robots-all Reference Manual

Generated by Doxygen 1.3.2

Wed Aug 20 15:55:11 2003

Contents

Chapter 1

robots-all Namespace Index

1.1 robots-all Namespace List

Here is a list of all namespaces with brief descriptions:

Chapter 2

robots-all Compound Index

2.1 robots-all Compound List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 3

robots-all File Index

3.1 robots-all File List

Here is a list of all files with brief descriptions:

Chapter 4

robots-all Page Index

4.1 robots-all Related Pages

Here is a list of all related documentation pages:

Chapter 5

robots-all Namespace Documentation

5.1 dolt Namespace Reference

5.2 std Namespace Reference

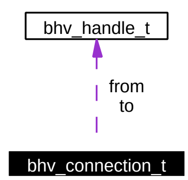
Chapter 6

robots-all Class Documentation

6.1 bhv_connection_t Struct Reference

`#include <seq.h>`

Collaboration diagram for bhv_connection_t:



Public Attributes

- **bhv_handle_t** ∗ **from**
- **bhv_handle_t** ∗ **to**
- uint8_t **from_key**
- uint8_t **to_key**

6.1.1 Member Data Documentation

6.1.1.1 bhv_handle_t∗ bhv_connection_t::from

behavior sending output

6.1.1.2 uint8_t bhv_connection_t::from_key

output key to send

6.1.1.3 bhv_handle_t∗ bhv_connection_t::to

behavior receiving input

6.1.1.4 uint8_t bhv_connection_t::to_key

input key to send to

The documentation for this struct was generated from the following file:

- include/robot/**seq.h**

6.2 bhv_data_t Struct Reference

`#include <seq.h>`

Public Attributes

- uint8_t **key**
- uint8_t **data** [ROBOT_MAX_BHV_DATA_SIZE-1]

6.2.1 Member Data Documentation

6.2.1.1 uint8_t bhv_data_t::data[ROBOT_MAX_BHV_DATA_SIZE - 1]

6.2.1.2 uint8_t bhv_data_t::key

The documentation for this struct was generated from the following file:

- include/robot/**seq.h**

6.3 bhv_handle_t Struct Reference

`#include <seq.h>`

Public Attributes

- pid_t **pid**
- int **qid**

6.3.1 Detailed Description

behavior handle

6.3.2 Member Data Documentation

6.3.2.1 pid_t bhv_handle_t::pid

behavior process id

6.3.2.2 int bhv_handle_t::qid

msg queue id for behavior

The documentation for this struct was generated from the following file:

- include/robot/**seq.h**

6.4 bhv_t Struct Reference

`#include <behavior.h>`

Public Attributes

- **bhv_cleanup_func_t cleanup**
- **bhv_inhibit_func_t on_inhibit**
- **bhv_uninhibit_func_t on_uninhibit**
- **bhv_main_func_t main**
- uint32_t **flags**

6.4.1 Detailed Description

filled in, for the most part, by the behavior itself in order to tell the sequencer how to communicate with it

6.4.2 Member Data Documentation

6.4.2.1 bhv_cleanup_func_t bhv_t::cleanup

6.4.2.2 uint32_t bhv_t::flags

flags for initialization and execution; can use bhv_flags_t flags as well as any flags sent to robot_init

6.4.2.3 bhv_main_func_t bhv_t::main

6.4.2.4 bhv_inhibit_func_t bhv_t::on_inhibit

6.4.2.5 bhv_uninhibit_func_t bhv_t::on_uninhibit

The documentation for this struct was generated from the following file:

- include/robot/**behavior.h**

6.5 BumpSensor Class Reference

`#include <bumpsensor.h>`

Public Member Functions

- **BumpSensor** ()
- **BumpSensor** (dolt::Polygon p, float x, float y, float theta)
- float **x** ()
- float **y** ()
- float **t** ()

6.5.1 Constructor & Destructor Documentation

6.5.1.1 BumpSensor::BumpSensor () `[inline]`

6.5.1.2 BumpSensor::BumpSensor (dolt::Polygon *p*, float *x*, float *y*, float *theta*) `[inline]`

6.5.2 Member Function Documentation

6.5.2.1 float BumpSensor::t () `[inline]`

6.5.2.2 float BumpSensor::x () `[inline]`

6.5.2.3 float BumpSensor::y () `[inline]`

The documentation for this class was generated from the following file:

- misc/simulator/**bumpsensor.h**

6.6 data_len_t Struct Reference

#include <interp.h>

Public Attributes

- uint8_t **from_dev**
- uint8_t **to_dev**

6.6.1 Detailed Description

specifies the length of data from/to each hw device see **data_lengths.c**

6.6.2 Member Data Documentation

6.6.2.1 uint8_t data_len_t::from_dev

6.6.2.2 uint8_t data_len_t::to_dev

The documentation for this struct was generated from the following file:

- interp/**interp.h**

6.7 devfs_set_t Struct Reference

`#include <devfs.h>`

Public Attributes

- uint8_t **hwid**
- int **stream**
- int **change**
- int **current**
- int **ctl**

6.7.1 Detailed Description

file descriptors for the /dev/robot stuff

6.7.2 Member Data Documentation

6.7.2.1 int devfs_set_t::change

6.7.2.2 int devfs_set_t::ctl

file descriptors

6.7.2.3 int devfs_set_t::current

6.7.2.4 uint8_t devfs_set_t::hwid

hardware id (**hwid.h**)

6.7.2.5 int devfs_set_t::stream

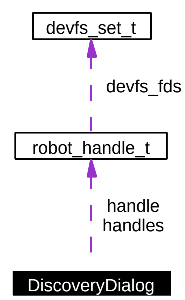
The documentation for this struct was generated from the following file:

- include/robot/**devfs.h**

6.8 DiscoveryDialog Class Reference

`#include <discoverydialog.h>`

Collaboration diagram for DiscoveryDialog:



Public Slots

- void **discover** ()
- void **selectionChanged** (int)

Public Member Functions

- **DiscoveryDialog** (QWidget *parent=0, const char *name=0, bool modal=FALSE, WFlags f=0)
- ~**DiscoveryDialog** ()
- **robot_handle_t** * **getSelection** ()

6.8.1 Constructor & Destructor Documentation

6.8.1.1 DiscoveryDialog::DiscoveryDialog (QWidget * *parent* = 0, const char * *name* = 0, bool *modal* = FALSE, WFlags *f* = 0)

6.8.1.2 DiscoveryDialog::~DiscoveryDialog ()

6.8.2 Member Function Documentation

6.8.2.1 void DiscoveryDialog::discover () `[slot]`

6.8.2.2 robot_handle_t * DiscoveryDialog::getSelection ()

6.8.2.3 void DiscoveryDialog::selectionChanged (int) `[slot]`

The documentation for this class was generated from the following files:

- pda/mom/**discoverydialog.h**
- pda/mom/**discoverydialog.cpp**

6.9 freq_req_val_t Struct Reference

```
#include <types.h>
```

Public Attributes

- **owner_val_t owner**
- **freq_val_t freq**

6.9.1 Member Data Documentation

6.9.1.1 freq_val_t freq_req_val_t::freq

6.9.1.2 owner_val_t freq_req_val_t::owner

The documentation for this struct was generated from the following file:

- include/robot/**types.h**

6.10 InfoDialog Class Reference

`#include <infodialog.h>`

Public Member Functions

- **InfoDialog** (**RobotInfo** *__robot__, **robot_handle_t** *handle, QWidget *parent=0, const char *name=0, bool modal=false, WFlags f=0)
- ~**InfoDialog** ()

6.10.1 Constructor & Destructor Documentation

6.10.1.1 InfoDialog::InfoDialog (RobotInfo * *robot*, robot_handle_t * *handle*, QWidget * *parent* = 0, const char * *name* = 0, bool *modal* = false, WFlags *f* = 0)

6.10.1.2 InfoDialog::~InfoDialog ()

The documentation for this class was generated from the following files:

- pda/mom/**infodialog.h**
- pda/mom/**infodialog.cpp**

6.11 IpInputDialog Class Reference

`#include <ipinputdialog.h>`

Public Member Functions

- **IpInputDialog** (QWidget *parent=0, const char *name=0, bool modal=FALSE, WFlags f=0)
- ~**IpInputDialog** ()
- const char * **get_ip** ()
- const char * **get_port** ()

Protected Slots

- void **accept** ()

6.11.1 Constructor & Destructor Documentation

6.11.1.1 IpInputDialog::IpInputDialog (QWidget * *parent* = 0, const char * *name* = 0, bool *modal* = FALSE, WFlags *f* = 0)

6.11.1.2 IpInputDialog::~IpInputDialog ()

6.11.2 Member Function Documentation

6.11.2.1 void IpInputDialog::accept () `[protected, slot]`

6.11.2.2 const char * IpInputDialog::get_ip ()

6.11.2.3 const char * IpInputDialog::get_port ()

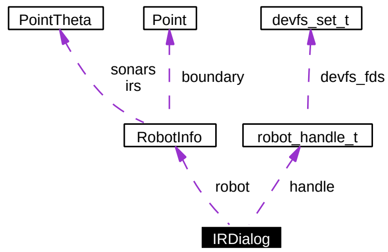
The documentation for this class was generated from the following files:

- pda/mom/**ipinputdialog.h**
- pda/mom/**ipinputdialog.cpp**

6.12 IRDialog Class Reference

`#include <irdialog.h>`

Collaboration diagram for IRDialog:



Public Slots

- void **getInfo** ()

Public Member Functions

- **IRDialog** (**RobotInfo** *r, **robot_handle_t** *h, QWidget *parent=0, const char *name=0, bool modal=TRUE, WFlags f=0)
- ~**IRDialog** ()

6.12.1 Constructor & Destructor Documentation

6.12.1.1 IRDialog::IRDialog (RobotInfo * *r*, robot_handle_t * *h*, QWidget * *parent* = 0, const char * *name* = 0, bool *modal* = TRUE, WFlags *f* = 0)

6.12.1.2 IRDialog::~IRDialog ()

6.12.2 Member Function Documentation

6.12.2.1 void IRDialog::getInfo () `[slot]`

The documentation for this class was generated from the following files:

- pda/mom/**irdialog.h**
- pda/mom/**irdialog.cpp**

6.13 log_writer_t Class Reference

`#include <writer.h>`

Public Member Functions

- **log_writer_t** (uint32_t rsz=ROBOT_DEFAULT_LOG_ROTATE_SIZE)

  Constructor.

- ~**log_writer_t** ()

  Destructor.

- bool **open** (const char *file)

  Open a log file for appending.

- void **close** ()

  Close file if open.

- uint32_t **size** ()
- bool **write** (log_entry_t ***entry**)

  Write a log entry to the log file.

6.13.1 Constructor & Destructor Documentation

6.13.1.1 log_writer_t::log_writer_t (uint32_t *rsz* = ROBOT_DEFAULT_LOG_ROTATE_SIZE)

Constructor.

Does not open any files!

See also:
open

6.13.1.2 log_writer_t::~log_writer_t ()

Destructor.

Closes file if open.

See also:
close

6.13.2 Member Function Documentation

6.13.2.1 void log_writer_t::close ()

Close file if open.

6.13.2.2 bool log_writer_t::open (const char * *file*)

Open a log file for appending.

Parameters:

file Path of log file to open

Returns:

true on success, false on failure or if file is currently locked by another writer

6.13.2.3 uint32_t log_writer_t::size ()

Returns:

Size, in bytes, of the log file; 0 if no file is open.

6.13.2.4 bool log_writer_t::write (log_entry_t * *entry*)

Write a log entry to the log file.

Parameters:

entry Pointer to a log entry to write

Returns:

true on success, false on failure

The documentation for this class was generated from the following files:

- misc/logger/**writer.h**
- misc/logger/**writer.cpp**

6.14 mc_lib_t Struct Reference

`#include <mclib.h>`

Public Attributes

- void * **handle**
- **mc_init_func_t mc_init**
- **mc_shutdown_func_t mc_shutdown**
- **mc_start_frame_func_t mc_start_frame**
- **mc_set_velocity_func_t mc_set_velocity**
- **mc_get_velocity_func_t mc_get_velocity**
- **mc_set_odometry_func_t mc_set_odometry**
- **mc_do_control_func_t mc_do_control**

6.14.1 Detailed Description

structure containing pointers to all library functions

6.14.2 Member Data Documentation

6.14.2.1 void* mc_lib_t::handle

dlopen handle

6.14.2.2 mc_do_control_func_t mc_lib_t::mc_do_control

6.14.2.3 mc_get_velocity_func_t mc_lib_t::mc_get_velocity

6.14.2.4 mc_init_func_t mc_lib_t::mc_init

6.14.2.5 mc_set_odometry_func_t mc_lib_t::mc_set_odometry

6.14.2.6 mc_set_velocity_func_t mc_lib_t::mc_set_velocity

6.14.2.7 mc_shutdown_func_t mc_lib_t::mc_shutdown

6.14.2.8 mc_start_frame_func_t mc_lib_t::mc_start_frame

The documentation for this struct was generated from the following file:

- include/robot/**mclib.h**

6.15 MomCanvasView Class Reference

`#include <momcanvasview.h>`

Public Slots

- void **contentsMouseMoveEvent** (QMouseEvent *event)
- void **contentsMouseReleaseEvent** (QMouseEvent *event)

Signals

- void **positionChanged** (int, int)

Public Member Functions

- **MomCanvasView** (QCanvas *c, QWidget *parent)
- **~MomCanvasView** ()

Static Public Attributes

- const int **xOffset** = 118
- const int **yOffset** = 160

6.15.1 Constructor & Destructor Documentation

6.15.1.1 MomCanvasView::MomCanvasView (QCanvas * *c*, QWidget * *parent*)

6.15.1.2 MomCanvasView::~MomCanvasView ()

6.15.2 Member Function Documentation

6.15.2.1 void MomCanvasView::contentsMouseMoveEvent (QMouseEvent * *event*) `[slot]`

6.15.2.2 void MomCanvasView::contentsMouseReleaseEvent (QMouseEvent * *event*) `[slot]`

6.15.2.3 void MomCanvasView::positionChanged (int, int) `[signal]`

6.15.3 Member Data Documentation

6.15.3.1 const int MomCanvasView::xOffset = 118 `[static]`

6.15.3.2 const int MomCanvasView::yOffset = 160 `[static]`

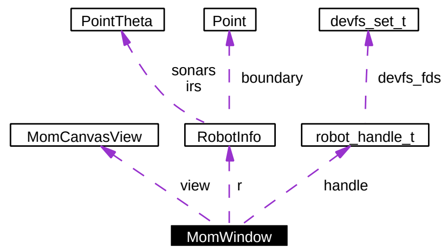
The documentation for this class was generated from the following files:

- pda/mom/**momcanvasview.h**
- pda/mom/**momcanvasview.cpp**

6.16 MomWindow Class Reference

`#include <momwindow.h>`

Collaboration diagram for MomWindow:



Public Slots

- void **about** ()
- void **updateStatus** (int x, int y)
- void **updateScreen** (int x, int y)
- void **ipWindow** ()
- void **discoveryWindow** ()
- void **disconnect** ()
- void **moveRobot** (int x, int y)
- void **haltRobot** ()
- void **robotStatus** ()
- void **sonarStatus** ()
- void **infraredStatus** ()

Public Member Functions

- **MomWindow** ()
- **RobotInfo** & **getRInfo** ()
- **robot_handle_t** * **getHandle** ()
- virtual ~**MomWindow** ()

6.16.1 Constructor & Destructor Documentation

6.16.1.1 MomWindow::MomWindow ()

6.16.1.2 MomWindow::~MomWindow () [virtual]

6.16.2 Member Function Documentation

6.16.2.1 void MomWindow::about () [slot]

6.16.2.2 void MomWindow::disconnect () [slot]

6.16.2.3 void MomWindow::discoveryWindow () [slot]

6.16.2.4 robot_handle_t* MomWindow::getHandle () [inline]

6.16.2.5 RobotInfo& MomWindow::getRInfo () [inline]

6.16.2.6 void MomWindow::haltRobot () [slot]

6.16.2.7 void MomWindow::infraredStatus () [slot]

6.16.2.8 void MomWindow::ipWindow () [slot]

6.16.2.9 void MomWindow::moveRobot (int *x*, int *y*) [slot]

6.16.2.10 void MomWindow::robotStatus () [slot]

6.16.2.11 void MomWindow::sonarStatus () [slot]

6.16.2.12 void MomWindow::updateScreen (int *x*, int *y*) [slot]

6.16.2.13 void MomWindow::updateStatus (int *x*, int *y*) [slot]

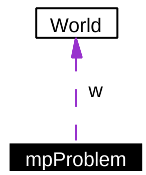
The documentation for this class was generated from the following files:

- pda/mom/**momwindow.h**
- pda/mom/**momwindow.cpp**

6.17 mpProblem Class Reference

`#include <world.h>`

Collaboration diagram for mpProblem:



Public Member Functions

- **mpProblem** (const char *fname, bool verbose=false)
- **SimRobot** * **getNextRobot** ()
- log_reader_t * **getNextLog** ()

Public Attributes

- char **problemName** [**MAX_PROBLEM_NAME_LEN**]
- **World** * **w**

6.17.1 Constructor & Destructor Documentation

6.17.1.1 mpProblem::mpProblem (const char * *fname*, bool *verbose* = false)

6.17.2 Member Function Documentation

6.17.2.1 log_reader_t * mpProblem::getNextLog ()

6.17.2.2 SimRobot * mpProblem::getNextRobot ()

6.17.3 Member Data Documentation

6.17.3.1 char mpProblem::problemName[MAX_PROBLEM_NAME_LEN]

6.17.3.2 World* mpProblem::w

The documentation for this class was generated from the following files:

- misc/simulator/**world.h**
- misc/simulator/**world.cpp**

6.18 Obstacle Class Reference

`#include <world.h>`

Public Member Functions

- **Obstacle** ()

Public Attributes

- string **name**

6.18.1 Constructor & Destructor Documentation

6.18.1.1 Obstacle::Obstacle () `[inline]`

6.18.2 Member Data Documentation

6.18.2.1 string Obstacle::name

The documentation for this class was generated from the following file:

- misc/simulator/**world.h**

6.19 Point Class Reference

`#include <robotinfo.h>`

Public Attributes

- float **x**
- float **y**

6.19.1 Member Data Documentation

6.19.1.1 float Point::x

6.19.1.2 float Point::y

The documentation for this class was generated from the following file:

- pda/mom/**robotinfo.h**

6.20 PointTheta Class Reference

`#include <robotinfo.h>`

Public Attributes

- float **x**
- float **y**
- float **t**

6.20.1 Member Data Documentation

6.20.1.1 float PointTheta::t

6.20.1.2 float PointTheta::x

6.20.1.3 float PointTheta::y

The documentation for this class was generated from the following file:

- pda/mom/**robotinfo.h**

6.21 robot_dev_t Struct Reference

`#include <robotdrv.h>`

Public Attributes

- uint8_t **type**
- uint8_t **data_size**
- devfs_handle_t **handle**
- uint8_t **wcnt**
- uint8_t **rcnt**
- semaphore **sem**
- uint8_t * **data**
- uint32_t **dcnt**
- wait_queue_head_t **readq**
- pid_t **lock_owner**
- uint32_t **lock_prio**

6.21.1 Detailed Description

our representation of a /dev/robot entry

6.21.2 Member Data Documentation

6.21.2.1 uint8_t* robot_dev_t::data

current data

6.21.2.2 uint8_t robot_dev_t::data_size

size of data

6.21.2.3 uint32_t robot_dev_t::dcnt

number of writes (wrap ok)

6.21.2.4 devfs_handle_t robot_dev_t::handle

devfs handle

6.21.2.5 pid_t robot_dev_t::lock_owner

owner of current lock (if any)

6.21.2.6 uint32_t robot_dev_t::lock_prio

priority of current lock

6.21.2.7 uint8_t robot_dev_t::rcnt

num current writers/readers

6.21.2.8 wait_queue_head_t robot_dev_t::readq

blocking/polling

6.21.2.9 struct semaphore robot_dev_t::sem

6.21.2.10 uint8_t robot_dev_t::type

device type

6.21.2.11 uint8_t robot_dev_t::wcnt

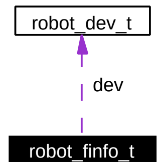
The documentation for this struct was generated from the following file:

- driver/**robotdrv.h**

6.22 robot_finfo_t Struct Reference

`#include <robotdrv.h>`

Collaboration diagram for robot_finfo_t:



Public Attributes

- uint32_t **dcnt**
- **robot_dev_t** * **dev**

6.22.1 Detailed Description

file information for each open file

6.22.2 Member Data Documentation

6.22.2.1 uint32_t robot_finfo_t::dcnt

the dcnt of dev when i last read

6.22.2.2 robot_dev_t* robot_finfo_t::dev

the device i have open

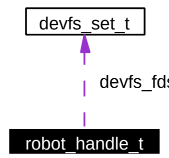
The documentation for this struct was generated from the following file:

- driver/**robotdrv.h**

6.23 robot_handle_t Struct Reference

`#include <handle.h>`

Collaboration diagram for robot_handle_t:



Public Attributes

- **devfs_set_t devfs_fds** [NUM_DEVICE_DIRS]
- **robot_id_t id**
- char **name** [ROBOT_MAX_NAME_LEN]
- uint8_t **init_complete**
- uint32_t **flags**
- uint32_t **devfs_flags**
- int **sock**
- sockaddr_in **sockaddr**
- uint32_t **timeout**

6.23.1 Detailed Description

handle for identifying which robot to talk to, and how to do the talking

6.23.2 Member Data Documentation

6.23.2.1 devfs_set_t robot_handle_t::devfs_fds[NUM_DEVICE_DIRS]

A list of structures with file descriptor information that is used to read from and write to each /dev/robot entry. Every hardware id has an associated stream, change and current entry, and optionally a ctl entry, in the /dev/robot filesystem.

When communicating with a robot over the network, all file descriptors will be the same as the network socket (sock).

6.23.2.2 uint32_t robot_handle_t::devfs_flags

passed to devfs_init

6.23.2.3 uint32_t robot_handle_t::flags

passed to robot_init

6.23.2.4 robot_id_t robot_handle_t::id

unique robot id number

6.23.2.5 uint8_t robot_handle_t::init_complete

has robot_init been called successfully?

6.23.2.6 char robot_handle_t::name[ROBOT_MAX_NAME_LEN]

robot name

6.23.2.7 int robot_handle_t::sock

network socket if necessary

6.23.2.8 struct sockaddr_in robot_handle_t::sockaddr

6.23.2.9 uint32_t robot_handle_t::timeout

network timeout

The documentation for this struct was generated from the following file:

- include/robot/**handle.h**

6.24 robot_net_msg_t Struct Reference

`#include <net.h>`

Public Attributes

- uint8_t **hwid**
- uint8_t **devfs_type**
- uint32_t **mid**
- uint32_t **count**
- uint8_t * **buf**

6.24.1 Member Data Documentation

6.24.1.1 uint8_t* robot_net_msg_t::buf

data buffer for message

6.24.1.2 uint32_t robot_net_msg_t::count

size of data in buf (bytes)

6.24.1.3 uint8_t robot_net_msg_t::devfs_type

device type (**devfs.h**)

6.24.1.4 uint8_t robot_net_msg_t::hwid

hardware id from **hwid.h**

6.24.1.5 uint32_t robot_net_msg_t::mid

managed internally

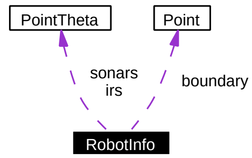
The documentation for this struct was generated from the following file:

- include/robot/**net.h**

6.25 RobotInfo Class Reference

`#include <robotinfo.h>`

Collaboration diagram for RobotInfo:



Public Member Functions

- **RobotInfo** ()
- ~**RobotInfo** ()
- QCanvasPolygon * **getBoundarySonar** (QCanvas *c)
- QCanvasPolygon * **getSonarPolygon** (QCanvas *c, int sensor, float dist)
- QCanvasPolygon * **getBoundaryIR** (QCanvas *c)
- QCanvasLine * **getIRLine** (QCanvas *c, int sensor, float dist)

6.25.1 Constructor & Destructor Documentation

6.25.1.1 RobotInfo::RobotInfo ()

6.25.1.2 RobotInfo::~RobotInfo ()

6.25.2 Member Function Documentation

6.25.2.1 QCanvasPolygon * RobotInfo::getBoundaryIR (QCanvas * *c*)

6.25.2.2 QCanvasPolygon * RobotInfo::getBoundarySonar (QCanvas * *c*)

6.25.2.3 QCanvasLine * RobotInfo::getIRLine (QCanvas * *c*, int *sensor*, float *dist*)

6.25.2.4 QCanvasPolygon * RobotInfo::getSonarPolygon (QCanvas * *c*, int *sensor*, float *dist*)

The documentation for this class was generated from the following files:

- pda/mom/**robotinfo.h**
- pda/mom/**robotinfo.cpp**

6.26 SensorInfo Class Reference

`#include <sensorinfo.h>`

Public Member Functions

- **SensorInfo** ()
- **SensorInfo** (float x, float y, float theta)
- float **t** ()

6.26.1 Constructor & Destructor Documentation

6.26.1.1 SensorInfo::SensorInfo () `[inline]`

6.26.1.2 SensorInfo::SensorInfo (float *x*, float *y*, float *theta*) `[inline]`

6.26.2 Member Function Documentation

6.26.2.1 float SensorInfo::t () `[inline]`

The documentation for this class was generated from the following file:

- misc/simulator/**sensorinfo.h**

6.27 seq_msgbuf_t Struct Reference

`#include <seq.h>`

Public Attributes

- long **mtype**
- uint8_t **cmd**
- uint8_t **data** [ROBOT_MAX_BHV_DATA_SIZE]

6.27.1 Detailed Description

message queue buffer

6.27.2 Member Data Documentation

6.27.2.1 uint8_t seq_msgbuf_t::cmd

command to send (see enum)

6.27.2.2 uint8_t seq_msgbuf_t::data[ROBOT_MAX_BHV_DATA_SIZE]

6.27.2.3 long seq_msgbuf_t::mtype

should always be pid of sender

The documentation for this struct was generated from the following file:

- include/robot/**seq.h**

6.28 serial_cmd_t Struct Reference

```
#include <interp.h>
```

Public Attributes

- uint8_t **hwid**
- uint8_t **data** [4]

6.28.1 Detailed Description

a command to send to or receive from a hardware device through serial

6.28.2 Member Data Documentation

6.28.2.1 uint8_t serial_cmd_t::data[4]

max amount is 4 bytes

6.28.2.2 uint8_t serial_cmd_t::hwid

a hardware id from **hwid.h**

The documentation for this struct was generated from the following file:

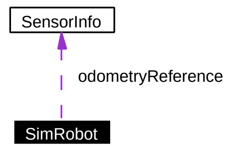
- interp/**interp.h**

6.29 SimRobot Class Reference

The SimRobot class is used to simulate a configurable differential drive robot.

`#include <simrobot.h>`

Collaboration diagram for SimRobot:



Public Member Functions

- **SimRobot** (const char ∗fname, int **port**, bool verbose=false)
- void **setV** (float velocity)

  Set the translational velocity of the robot.

- void **setW** (float velocity)

  Set the rotational velocity of the robot.

- void **get_all_sonar_data** (float ∗∗info, bool verbose=false)

  Get sonar data from all of sonar sensors on the robot.

- void **get_sonar_data** (float ∗info, int sensor, bool verbose=false)

  Get sonar data from a specific sonar sensor.

- void **get_all_ir_data** (float ∗∗info, bool verbose=false)

  Get infrared data from all of IR sensors on the robot.

- void **get_ir_data** (float ∗info, int sensor, bool verbose=false)

  Get infrared data from a specific IR sensor.

- void **getBumpData** (unsigned char ∗∗info)

  Get bump sensor data from all of the bump sensors on the robot.

- void **getBumpData** (unsigned char ∗info, int sensor)

  Get bump sensor data from a specific bump sensor on the robot.

- void **getOdometry** (float ∗x, float ∗y, float ∗theta)

  Get odometry data for the robot.

- void **setOdometry** (float x, float y, float theta)

  Set the robot's odometry so that the current odometry values are equal to those passed to the function.

- void **move** (float time)

  Tell the robot that a certain amount of time has passed.

- string & **getName** ()

  Get the name of this robot.

- drawablePoint * **get_true_cor** ()

  Get a visual representation of the robot's center of rotation.

- drawablePoint * **get_estimated_cor** ()

  Get a visual representation of the robot's estimated center of rotation.

- drawableLineStrip * **getSonarScan** ()

  Get a visual representation of the last sonar scan.

- drawableLineStrip * **getPath** ()

  Get a visual representation of the path that this robot has traveled.

- drawableLineStrip * **getEstimatedPath** ()

  Get a visual representation of the path that the robot thinks it has traveled.

- objectList & **getIRBeams** ()

  Get a visual representation of the last infrared scan.

- objectList & **getSonarObjects** ()

  Get a visual representation of the sonar sensors on this robot.

- objectList & **getIRObjects** ()

  Get a visual representation of the IR sensors on this robot.

- objectList & **getBumpObjects** ()

  Get a visual representation of the bump sensors on this robot.

- float **getV** ()

  Get the robot's current translational velocity.

- float **getTargetV** ()

  Get the robot's target translational velocity.

- float **getW** ()

  Get the robot's current rotational velocity.

- float **getTargetW** ()

  Get the robot's target rotational velocity.

- float **getA** ()

  Get the robot's current acceleration value.

- void **setA** (float **acceleration**)

  Set the robot's current acceleration value.

- unsigned int **getNumSonars** ()

Get the number of sonar sensors on the robot.

- unsigned int **getNumIRs** ()

  Get the number of infrared sensors on the robot.

- unsigned int **getNumBumps** ()

  Get the number of bump sensors on the robot.

- bool **odometryChanged** ()

  Check to see if the robot's odometry has changed.

- void **set_all_sonar_frequencies** (float frequency)

  Set the frequency of all of the sonar sensors.

- void **set_sonar_frequency** (int sensor, float frequency)

  Set a sonar sensor to fire at a certain frequency.

- void **set_all_ir_frequencies** (float frequency)

  Set the frequency of all of the ir sensors.

- void **set_ir_frequency** (int sensor, float frequency)

  Set an ir sensor to fire at a certain frequency.

6.29.1 Detailed Description

The SimRobot class is used to simulate a configurable differential drive robot.

6.29.2 Constructor & Destructor Documentation

6.29.2.1 SimRobot::SimRobot (const char * *fname*, int *port*, bool *verbose* = false)

6.29.3 Member Function Documentation

6.29.3.1 void SimRobot::get_all_ir_data (float ** *info*, bool *verbose* = false)

Get infrared data from all of IR sensors on the robot.

This function generates simulated infrared data based on the positions and orientations of the IR sensors on the robot.

Parameters:

info An unitialized pointer that will point to an array containing the IR data after the function returns. The user is not responsible for this memory and should not try to delete it!

verbose Specifies whether or not drawable versions of the IR beams should be generated.

6.29.3.2 void SimRobot::get_all_sonar_data (float ** *info*, bool *verbose* = false)

Get sonar data from all of sonar sensors on the robot.

This function generates simulated sonar data based on the positions and orientations of the sonar sensors on the robot. It is important to note that this function only accounts for readings that result from direct echos back to the robot and does not account for the possibilities of multiple reflections that may occur in real life.

Parameters:

info An unitialized pointer that will point to an array containing the sonar data after the function returns. The user is not responsible for this memory and should not try to delete it!

verbose Specifies whether or not drawable versions of the sonar cones should be generated.

6.29.3.3 drawablePoint* SimRobot::get_estimated_cor () `[inline]`

Get a visual representation of the robot's estimated center of rotation.

Returns:

Returns a pointer to a drawablePoint which defines this robot's estimated center of rotation. Useful for seeing how much odometry drift has occured.

6.29.3.4 void SimRobot::get_ir_data (float * *info*, int *sensor*, bool *verbose* = false)

Get infrared data from a specific IR sensor.

This function generates simulated infrared data based on the positions and orientations of the IR sensors on the robot.

Parameters:

info A valid pointer. The IR data will be placed here when the function returns.

sensor Specifies the IR sensor to get data from.

verbose Specifies whether or not a drawable version of the IR beam should be generated.

6.29.3.5 void SimRobot::get_sonar_data (float * *info*, int *sensor*, bool *verbose* = false)

Get sonar data from a specific sonar sensor.

This function generates simulated sonar data based on the positions and orientations of the sonar sensors on the robot. It is important to note that this function only accounts for readings that result from direct echos back to the robot and does not account for the possibilities of multiple reflections that may occur in real life.

Parameters:

info A valid pointer. The sonar data will be placed here when the function returns.

sensor Specifies the sonar sensor to get data from.

verbose Specifies whether or not a drawable version of the sonar cone should be generated.

6.29.3.6 drawablePoint* SimRobot::get_true_cor () [inline]

Get a visual representation of the robot's center of rotation.

Returns:
Returns a pointer to a drawablePoint which defines this robot's true center of rotation.

6.29.3.7 float SimRobot::getA () [inline]

Get the robot's current acceleration value.

Returns:
Returns the robot's current acceleration value.

6.29.3.8 void SimRobot::getBumpData (unsigned char * *info*, int *sensor*)

Get bump sensor data from a specific bump sensor on the robot.

This function generates simulated bump sensor data based on the positions and orientations of the IR sensors on the robot. A bump sensor "fires" if after a specified action the bump sensor would penetrate an object such as the world boundary or an obstacle.

Parameters:
info A valid pointer. The data from the bump sensor will be placed here when the function returns.

6.29.3.9 void SimRobot::getBumpData (unsigned char ** *info*)

Get bump sensor data from all of the bump sensors on the robot.

This function generates simulated bump sensor data based on the positions and orientations of the IR sensors on the robot. A bump sensor "fires" if after a specified action the bump sensor would penetrate an object such as the world boundary or an obstacle.

Parameters:
info An unitialized pointer that will point to an array containing the bump sensor data after the function returns. The user is not responsible for this memory and should not try to delete it!

6.29.3.10 objectList& SimRobot::getBumpObjects () [inline]

Get a visual representation of the bump sensors on this robot.

Returns:
Returns a reference to an objectList that contains drawablePolygons. These drawablePolygons define the positions and orientations of the bump sensors of the robot.

6.29.3.11 drawableLineStrip* SimRobot::getEstimatedPath () [inline]

Get a visual representation of the path that the robot thinks it has traveled.

Returns:
Returns a pointer to a drawableLineStrip that shows the path the robot thinks has taken during the simulation. This differs from the actual path because of odometry drift.

6.29.3.12 objectList& SimRobot::getIRBeams () [inline]

Get a visual representation of the last infrared scan.

Returns:
Returns a reference to an objectList that defines the infrared beams generated by the last infrared scan. When calling getIRData, verbose must be set to true.

6.29.3.13 objectList& SimRobot::getIRObjects () [inline]

Get a visual representation of the IR sensors on this robot.

Returns:
Returns a reference to an objectList that contains drawablePoints. These drawablePoints define the position of the IR sensors on the robot.

6.29.3.14 string& SimRobot::getName () [inline]

Get the name of this robot.

Returns:
Returns a string that contains the name of the robot.

6.29.3.15 unsigned int SimRobot::getNumBumps () [inline]

Get the number of bump sensors on the robot.

Returns:
Returns the number of bump sensors on the robot.

6.29.3.16 unsigned int SimRobot::getNumIRs () [inline]

Get the number of infrared sensors on the robot.

Returns:
Returns the number of sonar sensors on the robot.

6.29.3.17 unsigned int SimRobot::getNumSonars () `[inline]`

Get the number of sonar sensors on the robot.

Returns:
Returns the number of sonar sensors on the robot.

6.29.3.18 void SimRobot::getOdometry (float * *x*, float * *y*, float * *theta*)

Get odometry data for the robot.

Parameters:
x A valid pointer. The x component of the robot's odometry will be placed here.

y A valid pointer. The y component of the robot's odometry will be placed here.

theta A valid pointer. The theta component of the robot's odometry will be placed here.

6.29.3.19 drawableLineStrip* SimRobot::getPath () `[inline]`

Get a visual representation of the path that this robot has traveled.

Returns:
Returns a pointer to a drawableLineStrip that shows the path this robot has taken during the simulation.

6.29.3.20 objectList& SimRobot::getSonarObjects () `[inline]`

Get a visual representation of the sonar sensors on this robot.

Returns:
Returns a reference to an objectList that contains drawablePoints. These drawablePoints define the position of the sonar sensors on the robot.

6.29.3.21 drawableLineStrip* SimRobot::getSonarScan () `[inline]`

Get a visual representation of the last sonar scan.

Returns:
Returns a pointer to a drawableLineStrip that defines the sonar cones generated by the last sonar scan. When calling getSonarData, verbose must be set to true.

6.29.3.22 float SimRobot::getTargetV () `[inline]`

Get the robot's target translational velocity.

Returns:
Returns the robot's target translational velocity.

6.29.3.23 float SimRobot::getTargetW () [inline]

Get the robot's target rotational velocity.

Returns:
Returns the robot's target rotational velocity.

6.29.3.24 float SimRobot::getV () [inline]

Get the robot's current translational velocity.

Returns:
Returns the robot's current translational velocity.

6.29.3.25 float SimRobot::getW () [inline]

Get the robot's current rotational velocity.

Returns:
Returns the robot's current rotational velocity.

6.29.3.26 void SimRobot::move (float *time*)

Tell the robot that a certain amount of time has passed.

Based on the given discrete time value, the actions of the robot during this time will be approximated.

Parameters:
time The amount of time (in seconds) that the robot should simulate its actions for.

6.29.3.27 bool SimRobot::odometryChanged ()

Check to see if the robot's odometry has changed.

Returns:
Returns true if the robot has moved since the last time interval. Returns false if the robot has not moved since that time.

6.29.3.28 void SimRobot::set_all_ir_frequencies (float *frequency*)

Set the frequency of all of the ir sensors.

This function will set the frequency of the ir sensors so that frequency number of readings is taken by each sensor per second. This function staggers the firing times of the sensors evenly.

Parameters:
frequency The frequency in Hz.

6.29.3.29 void SimRobot::set_all_sonar_frequencies (float *frequency*)

Set the frequency of all of the sonar sensors.

This function will set the frequency of the sonar sensors so that frequency number of readings is taken by each sensor per second. This function staggers the firing times of the sensors evenly.

Parameters:

frequency The frequency in Hz.

6.29.3.30 void SimRobot::set_ir_frequency (int *sensor*, float *frequency*)

Set an ir sensor to fire at a certain frequency.

This function will set the frequency of a specified ir sensor so that frequency number of readings is taken by by that sensor per second. This

Parameters:

sensor The sensor that should have its frequency set

frequency The frequency in Hz.

6.29.3.31 void SimRobot::set_sonar_frequency (int *sensor*, float *frequency*)

Set a sonar sensor to fire at a certain frequency.

This function will set the frequency of a specified sonar sensor so that frequency number of readings is taken by by that sensor per second. This

Parameters:

sensor The sensor that should have its frequency set

frequency The frequency in Hz.

6.29.3.32 void SimRobot::setA (float *acceleration*) `[inline]`

Set the robot's current acceleration value.

Returns:

Returns the robot's current acceleration value.

6.29.3.33 void SimRobot::setOdometry (float *x*, float *y*, float *theta*)

Set the robot's odometry so that the current odometry values are equal to those passed to the function.

Parameters:

x What the x component of the odometry should be.

y What the y component of the odometry should be.

theta What the theta component of the odometry should be.

6.29.3.34 void SimRobot::setV (float *velocity*)

Set the translational velocity of the robot.

This does not guarentee that the robot will immediately travel at the specified velocity. The robot may have to accelerate to reach this value.

Parameters:

velocity The target velocity (in meters/second) at which the robot should travel.

6.29.3.35 void SimRobot::setW (float *velocity*)

Set the rotational velocity of the robot.

This does not guarentee that the robot will immediately travel at the specified velocity. The robot may have to accelerate to reach this value.

Parameters:

velocity The target velocity (in radians/second) at which the robot should travel.

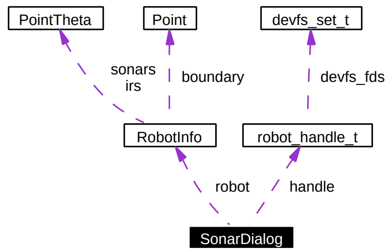
The documentation for this class was generated from the following files:

- misc/simulator/**simrobot.h**
- misc/simulator/**simrobot.cpp**

6.30 SonarDialog Class Reference

`#include <sonardialog.h>`

Collaboration diagram for SonarDialog:



Public Slots

- void **getInfo** ()

Public Member Functions

- **SonarDialog** (**RobotInfo** ∗**r**, **robot_handle_t** ∗h, QWidget ∗parent=0, const char ∗name=0, bool modal=TRUE, WFlags f=0)
- ∼**SonarDialog** ()

6.30.1 Constructor & Destructor Documentation

6.30.1.1 SonarDialog::SonarDialog (RobotInfo ∗ *r*, robot_handle_t ∗ *h*, QWidget ∗ *parent* = 0, const char ∗ *name* = 0, bool *modal* = TRUE, WFlags *f* = 0)

6.30.1.2 SonarDialog::∼SonarDialog ()

6.30.2 Member Function Documentation

6.30.2.1 void SonarDialog::getInfo () `[slot]`

The documentation for this class was generated from the following files:

- pda/mom/**sonardialog.h**
- pda/mom/**sonardialog.cpp**

6.31 World Class Reference

`#include <world.h>`

Public Member Functions

- **World** (const char *fname, bool verbose=false)

Public Attributes

- string **name**
- dolt::drawablePolygon * **boundary**
- std::list< **Obstacle** * > **obstacles**

6.31.1 Constructor & Destructor Documentation

6.31.1.1 World::World (const char * *fname*, bool *verbose* = false)

6.31.2 Member Data Documentation

6.31.2.1 dolt::drawablePolygon* World::boundary

6.31.2.2 string World::name

6.31.2.3 std::list<Obstacle*> World::obstacles

The documentation for this class was generated from the following files:

- misc/simulator/**world.h**
- misc/simulator/**world.cpp**

Chapter 7

robots-all File Documentation

7.1 arch/bhv/test.c File Reference

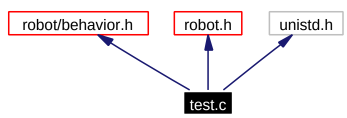
Test behavior.

`#include <robot/behavior.h>`

`#include <robot.h>`

`#include <unistd.h>`

Include dependency graph for test.c:



Functions

- void **test_cleanup** (void)
- void **test_inhibit** (void)
- void **test_uninhibit** (void)
- int **test_main** (void)
- int **test_ondata** (uint8_t key, const void *data, int size)
- int **bhv_init** (**bhv_t** *bhv)

  Entry point into the behavior.

7.1.1 Detailed Description

Test behavior.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

test.c,v 1.6 2003/08/19 18:42:45 beevek Exp

Doesn't really do anything, just prints stuff to a log file. Echoes data received on input directly to output.

7.1.2 Function Documentation

7.1.2.1 int bhv_init (bhv_t * *bhv*)

Entry point into the behavior.

All behaviors must define this function. It should fill in the values of bhv as appropriate, and perform any other initialization (such as starting sub-behaviors, etc).

Parameters:

bhv Pointer to a **bhv_t** struct to be initialized by the behavior

Returns:

< 0 on failure, >= 0 on success

7.1.2.2 void test_cleanup (void)

7.1.2.3 void test_inhibit (void)

7.1.2.4 int test_main (void)

7.1.2.5 int test_ondata (uint8_t *key*, const void * *data*, int *size*)

7.1.2.6 void test_uninhibit (void)

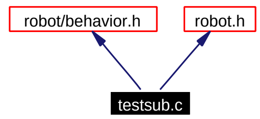
7.2 arch/bhv/testsub.c File Reference

Test behavior for loading sub-behaviors.

`#include <robot/behavior.h>`

`#include <robot.h>`

Include dependency graph for testsub.c:



Functions

- int **bhv_init** (**bhv_t** ∗bhv)

  Entry point into the behavior.

Variables

- **bhv_handle_t** ∗ **test**

7.2.1 Detailed Description

Test behavior for loading sub-behaviors.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

testsub.c,v 1.1 2003/08/19 18:44:13 beevek Exp

Loads a sub-behavior (test), nothing else.

7.2.2 Function Documentation

7.2.2.1 int bhv_init (bhv_t ∗ *bhv*)

Entry point into the behavior.

All behaviors must define this function. It should fill in the values of bhv as appropriate, and perform any other initialization (such as starting sub-behaviors, etc).

Parameters:

bhv Pointer to a **bhv_t** struct to be initialized by the behavior

Returns:

< 0 on failure, >= 0 on success

7.2.3 Variable Documentation

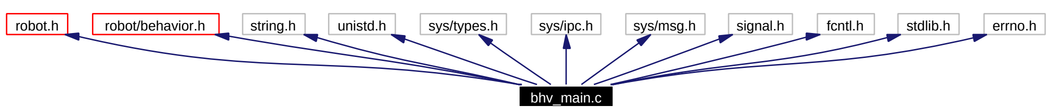
7.2.3.1 bhv_handle_t* test

7.3 arch/libbehavior/bhv_main.c File Reference

Provides a main program to behaviors, and handles communication with controlling programs (and the sequencer).

```
#include <robot.h>
#include <robot/behavior.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>
#include <signal.h>
#include <fcntl.h>
#include <stdlib.h>
#include <errno.h>
```

Include dependency graph for bhv_main.c:



Compounds

- struct **_input_t**
- struct **_inq_t**
- struct **_output_t**
- struct **inq_list_t**

Typedefs

- typedef _input_t **input_t**
- typedef _output_t **output_t**
- typedef _inq_t **inq_t**

Functions

- int **seq_init** (void)

  Internal use only.

- void **seq_cleanup** (void)

  Internal use only.

- int **net_init** (const char *__ip__, uint16_t **port**, **robot_handle_t** *handle)

Internal use only.

- int **bhv_add_input** (uint8_t key, **bhv_data_func_t** ondata)

  Add an input key to accept input from.

- int **bhv_output** (uint8_t key, const void *data, int size)

  Send output to all behaviors that we are connected to through the specified output key.

- int **bhv_input_pop** (uint8_t key, void *buf, int size)

  Extract input data from an input key's queue.

- void **bhv_shutdown** (int exitval)

  Shut down gracefully. Never call exit! Always call this instead!

- void **bhv_block_forever** (void)

  Block forever (handling EINTR).

- int **main** (int argc, char **argv)

Variables

- int **errno**
- int **seq_qid**
- int **my_qid**
- **robot_handle_t bhv_robot_handle**
- **bhv_handle_t bhv_self**
- const char * **bhv_name**
- **input_t** * **inputs** [256]
- **output_t** * **outputs** [256]
- inq_list_t **inqs** [256]

7.3.1 Detailed Description

Provides a main program to behaviors, and handles communication with controlling programs (and the sequencer).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

VersIdon:

bhv_main.c,v 1.17 2003/08/20 19:43:51 beevek Exp

7.3.2 Typedef Documentation

7.3.2.1 typedef struct _input_t input_t

7.3.2.2 typedef struct _inq_t inq_t

7.3.2.3 typedef struct _output_t output_t

7.3.3 Function Documentation

7.3.3.1 int bhv_add_input (uint8_t *key*, bhv_data_func_t *ondata*)

Add an input key to accept input from.

When data is sent to this behavior with a matching input key, call the ondata function with the data. Note that any number of ondata functions can be called for a single key. However, data will only be added to the internal queue once, no matter how many times you've called bhv_add_input with ondata as null.

Parameters:

key Input key to accept

ondata Function to call when data arrives for this input key. If null, the data will be stored in an internal queue and the behavior can access it by calling bhv_input_pop with the correct key.

Returns:

< 0 on failure, >= 0 on success

See also:

bhv_input_pop

7.3.3.2 void bhv_block_forever (void)

Block forever (handling EINTR).

Useful if you need to define a main behavior function that does a few things initially but then just wants to sleep quietly forever while data handlers are called.

Warning:

Never returns!

7.3.3.3 int bhv_input_pop (uint8_t *key*, void * *buf*, int *size*)

Extract input data from an input key's queue.

If data has been sent to our input labeled key, and if no ondata function was specified for key in the call to bhv_add_input, the data is placed in a queue for that input and is accessible through this function.

Parameters:

key Input key to check for queued data

buf Buffer in which to place data if found

size Size of buffer (in bytes); if waiting data is larger than size, an error is generated and ERANGE is set

Returns:

< 0 on failure, or the size of the data placed in buf on success; if no items are on the specified queue, -1 is returned and ENODATA is set

7.3.3.4 int bhv_output (uint8_t *key*, const void * *data*, int *size*)

Send output to all behaviors that we are connected to through the specified output key.

Searches for key in the internal connection table. Any behaviors that are registered to receive input from an output from this behavior with the matching key will be sent data.

Parameters:

key Output key to send to

data Data buffer to send

size Length of data (in bytes)

See also:

seq_connect

7.3.3.5 void bhv_shutdown (int *exitval*)

Shut down gracefully. Never call exit! Always call this instead!

Parameters:

exitval Value passed to exit

7.3.3.6 int main (int *argc*, char ** *argv*)

7.3.3.7 int net_init (const char * *ip*, uint16_t *port*, robot_handle_t * *handle*)

Internal use only.

Initialize a robot handle with ip address and port. Does not actually connect.

Parameters:

ip IP address string

port Remote port (usually ROBOT_DEFAULT_NET_PORT)

handle Pointer to handle to initialize

Returns:

< 0 on failure, >= 0 otherwise

7.3.3.8 void seq_cleanup (void)

Internal use only.

De-initialize message queue communication with the sequencer and any loaded behaviors.

7.3.3.9 int seq_init (void)

Internal use only.

Initialize message queue communication with the sequencer.

Returns:

< 0 on failure, $>= 0$ otherwise

7.3.4 Variable Documentation

7.3.4.1 const char* bhv_name

the name of this behavior

7.3.4.2 robot_handle_t bhv_robot_handle

7.3.4.3 bhv_handle_t bhv_self

handle referring to ourself

7.3.4.4 int errno

7.3.4.5 input_t* inputs[256]

7.3.4.6 inq_list_t inqs[256]

7.3.4.7 int my_qid ()

my msg queue id

7.3.4.8 output_t* outputs[256]

7.3.4.9 int seq_qid ()

msg queue id for talking to seq

7.4 arch/seq/bhvctl.cpp File Reference

Start, stop and get status of reactive behaviors.

`#include <robot.h>`

`#include <stdio.h>`

`#include <string.h>`

`#include <stdlib.h>`

`#include <unistd.h>`

`#include <sys/types.h>`

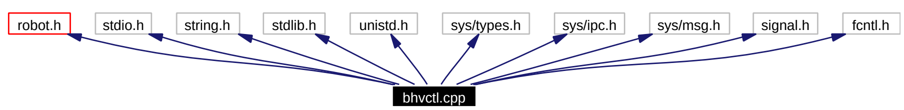
`#include <sys/ipc.h>`

`#include <sys/msg.h>`

`#include <signal.h>`

`#include <fcntl.h>`

Include dependency graph for bhvctl.cpp:



Defines

- #define **printf**(s...) do { printf(s); fflush(stdout); } while(0)
- #define **perror**(s) do { perror(s); fflush(stderr); } while(0)

Functions

- int **seq_init** (void)

  Internal use only.

- void **seq_cleanup** (void)

  Internal use only.

- void **print_bhv_info** (pid_t pid)

  Get/print info about a behavior based on its pid.

- void **show_bhvs** (void)

  Print a list of running behaviors and info about each.

- void **kill_bhv_pid** (int pid)

  Kill a behavior based on its pid.

- void **kill_bhv_name** (const char *name)

  Kill a behavior based on its name.

- void **start_bhv** (const char *name)

  Start a behavior (and leave it running).

- int **parse_command_line** (int argc, char **argv)

  Parse command line for bhvctl.

- int **main** (int argc, char **argv)

Variables

- int **seq_qid**
- int **my_qid**
- char * **bchelp**

7.4.1 Detailed Description

Start, stop and get status of reactive behaviors.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
bhvctl.cpp,v 1.4 2003/08/01 16:45:19 beevek Exp

For usage information, run bhvctl –help.

7.4.2 Define Documentation

7.4.2.1 #define perror(s) do { perror(s); fflush(stderr); } while(0)

7.4.2.2 #define printf(s...) do { printf(s); fflush(stdout); } while(0)

7.4.3 Function Documentation

7.4.3.1 void kill_bhv_name (const char * *name*)

Kill a behavior based on its name.

Parameters:
name Name of behavior to kill

7.4.3.2 void kill_bhv_pid (int *pid*)

Kill a behavior based on its pid.

Parameters:
pid Pid of behavior to kill

7.4.3.3 int main (int *argc*, char ** *argv*)

7.4.3.4 int parse_command_line (int *argc*, char ** *argv*)

Parse command line for bhvctl.

Returns:
< 0 on failure, >= 0 on success

7.4.3.5 void print_bhv_info (pid_t *pid*)

Get/print info about a behavior based on its pid.

7.4.3.6 void seq_cleanup (void)

Internal use only.

De-initialize message queue communication with the sequencer and any loaded behaviors.

7.4.3.7 int seq_init (void)

Internal use only.

Initialize message queue communication with the sequencer.

Returns:
< 0 on failure, >= 0 otherwise

7.4.3.8 void show_bhvs (void)

Print a list of running behaviors and info about each.

7.4.3.9 void start_bhv (const char * *name*)

Start a behavior (and leave it running).

Parameters:
name Name of behavior to start

7.4.4 Variable Documentation

7.4.4.1 char * bchelp

Initial value:

```
 "\n"
"Normally, reactive behaviors are started and stopped as\n"
"part of a larger process that remains \"attached\" to them,\n"
"and they are automatically killed when that process quits.\n"
"Sometimes it is useful to simply start a behavior with no\n"
```

```
"\"owner\" that sticks around to control them.  Similarly, it\n"
"may be convenient to kill behaviors outside of their owner\n"
"process (or if they were started in detached form).  This\n"
"program facilitates these actions.\n"
"\n"
"Beware that killing a behavior to which another process is\n"
"attached may cause unexpected consequences in the process,\n"
"since it will not be notified.  Also keep in mind that any\n"
"\"sub-behaviors\" started by the behavior you kill will be\n"
"stopped recursively.\n"
"\n"
"Commands:\n"
"\n"
"show         list information about running behaviors\n"
"kill <pid>   kill the behavior with pid <pid> (gracefully)\n"
"stop <name>  stop all behaviors called <name> (gracefully)\n"
"start <name> start the behavior called <name>\n"
```

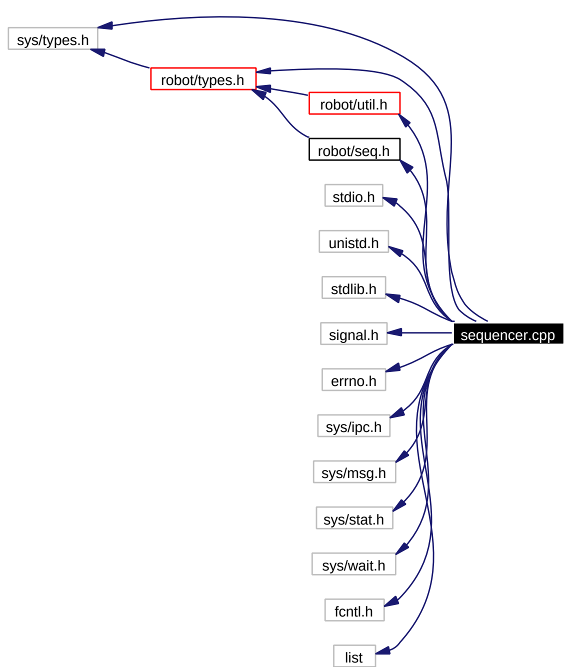
7.4.4.2 int my_qid

7.4.4.3 int seq_qid

7.5 arch/seq/sequencer.cpp File Reference

```
#include <robot/types.h>
#include <robot/util.h>
#include <robot/seq.h>
#include <stdio.h>
#include <unistd.h>
#include <stdlib.h>
#include <signal.h>
#include <errno.h>
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>
#include <sys/stat.h>
#include <sys/wait.h>
#include <fcntl.h>
#include <list>
```

Include dependency graph for sequencer.cpp:



Compounds

- struct **loaded_bhv_t**

Defines

- #define **printf**(s...) do { printf(s); fflush(stdout); } while(0)
- #define **ROBOT_DEFAULT_BHV_PATH** "../bhv"

  default behavior search paths

- #define **PREFIX** "[behavior]"

Enumerations

- enum { **OPT_RUN_BG** = (1 << 0), **OPT_HAVE_LOG** = (1 << 1) }

  command line options

Functions

- int **init_search_path** (char *path)

  Parse a path argument.

- int **parse_command_line** (int argc, char **argv)

  Parse the netrobotd command line.

- int **make_daemon** (void)

  Become a daemon.

- void **shutdown** (int sig)

  Signal handler, shutdown gracefully.

- const char * **find_behavior** (const char *name, const char *cwd)

  Search internal paths and cwd for a behavior called name.

- int **load_behavior** (const char *path, const char *name, int qid, uid_t uid, char *args)

  Actually start a new behavior if necessary.

- int **find_and_load** (const char *name, const char *cwd, pid_t pid, uid_t uid, char *args)

  Convenience; search for the behavior and then try to load it.

- void **send_err** (pid_t pid, uint8_t cmd)
- void **handle_load** (void)

  Load the requested behavior.

- void **handle_attach** (void)

  Give the requester a handle to an already-running behavior.

- void **handle_unload** (void)

  Unload the specified behavior.

- void **handle_list** (void)

  Send a list of pids of currently running behaviors back to the requester.

- void **zombie** (int sig)
- void **myalarm** (int sig)

  Handle SIGALRM.

- int **load_required_bhv** (void)

  Parse list of required behaviors and load them.

- int **init_queue** ()

  Initialize the sequencer message queue.

- int **main** (int argc, char **argv)

Variables

- int **errno**
- char * **seqhelp**
- std::list< loaded_bhv_t > **behaviors**

  currently running behaviors

- std::list< char * > **search_dirs**

  search paths

- char * **reqd_bhv** = 0

  required behaviors

- char * **ip** = 0

  ip address of robot

- char * **port** = 0

  port on robot to connect to

7.5.1 Define Documentation

7.5.1.1 #define PREFIX "[behavior]"

7.5.1.2 #define printf(s...) do { printf(s); fflush(stdout); } while(0)

7.5.1.3 #define ROBOT_DEFAULT_BHV_PATH "../bhv"

default behavior search paths

7.5.2 Enumeration Type Documentation

7.5.2.1 anonymous enum

command line options

Enumeration values:

OPT_RUN_BG

OPT_HAVE_LOG

7.5.3 Function Documentation

7.5.3.1 int find_and_load (const char * *name*, const char * *cwd*, pid_t *pid*, uid_t *uid*, char * *args*)

Convenience; search for the behavior and then try to load it.

Returns:

< 0 on failure, >= 0 otherwise

7.5.3.2 const char* find_behavior (const char * *name*, const char * *cwd*)

Search internal paths and cwd for a behavior called name.

Parameters:

name Name of the behavior

cwd Working directory of calling process, will also be searched

Returns:

Full path of behavior if found, null otherwise

7.5.3.3 void handle_attach (void)

Give the requester a handle to an already-running behavior.

On error, send back an error message with errno.

7.5.3.4 void handle_list (void)

Send a list of pids of currently running behaviors back to the requester.

7.5.3.5 void handle_load (void)

Load the requested behavior.

Send **bhv_handle_t** information back to the requesting process. On an error, send back an error message with errno.

7.5.3.6 void handle_unload (void)

Unload the specified behavior.

Send back SEQ_UNLOAD on success, and an errno on failure.

7.5.3.7 int init_queue ()

Initialize the sequencer message queue.

Create the message queue. If it already exists, fail. Set its permissions to 00777 (all read/write).

Returns:
< 0 on failure, >= 0 otherwise

7.5.3.8 int init_search_path (char * *path*)

Parse a path argument.

Parameters:
path The argument to -p

Returns:
< 0 on failure, number of paths to search otherwise

7.5.3.9 int load_behavior (const char * *path*, const char * *name*, int *qid*, uid_t *uid*, char * *args*)

Actually start a new behavior if necessary.

Parameters:
path Path to the behavior

name Name to pass to the behavior

qid Msg queue of requesting process to notify

uid Uid to run behavior as

args Argument string to pass to behavior; if this exists, do not pass ip/port from our own cmdline

Returns:
< 0 on failure, >= 0 otherwise

7.5.3.10 int load_required_bhv (void)

Parse list of required behaviors and load them.

Returns:
< 0 on failure, >= 0 on success

7.5.3.11 int main (int *argc*, char ** *argv*)

7.5.3.12 int make_daemon (void)

Become a daemon.

Close open files if necessary, or point them to some other place.

Returns:
< 0 on failure, >= 0 on success

7.5.3.13 void myalarm (int *sig*)

Handle SIGALRM.

Do nothing, we just want the interruption.

7.5.3.14 int parse_command_line (int *argc*, char ** *argv*)

Parse the netrobotd command line.

Print usage information if necessary.

Returns:
-1 on failure, 0 on success

Parameters:
argc main's argc

argv main's argv

7.5.3.15 void send_err (pid_t *pid*, uint8_t *cmd*) `[inline]`

7.5.3.16 void shutdown (int *sig*)

Signal handler, shutdown gracefully.

7.5.3.17 void zombie (int *sig*)

7.5.4 Variable Documentation

7.5.4.1 std::list<loaded_bhv_t> behaviors

currently running behaviors

7.5.4.2 int errno

7.5.4.3 char* ip = 0

ip address of robot

7.5.4.4 char* port = 0

port on robot to connect to

7.5.4.5 char* reqd_bhv = 0

required behaviors

7.5.4.6 std::list<char *> search_dirs

search paths

7.5.4.7 char * seqhelp

Initial value:

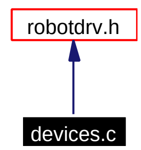
```
 "\n"
"-d          run as daemon\n"
"-p <path>   specify search path for behaviors; of the form:\n"
"                 /path/a:/path/b:/path/c:/etc\n"
"            by default, path is just " ROBOT_DEFAULT_BHV_PATH "\n"
"-b <bhvs>   specify a comma-separated list of behaviors to load\n"
"            automatically; they will not be stopped until the\n"
"            sequencer exits.  if any cannot be loaded, the sequencer\n"
"            will fail and quit.  e.g.:\n"
"                 emergency-stop,wall-follow,...\n"
"-i <ip>     remote ip address of robot for behaviors to connect to;\n"
"            this is completely optional, and if it is not specified,\n"
"            behaviors will assume they are running on the robot\n"
"-o <port>   port on remote robot to connect to (if ip is specified)\n"
"-l <file>   print to this file instead of stdout\n"
```

7.6 driver/devices.c File Reference

Device info for all the different robot devices.

`#include "robotdrv.h"`

Include dependency graph for devices.c:



Defines

- #define **NUM_DIRS** (1 + NUM_DEVICE_DIRS)
- #define **INIT_DIR**(n, c, ds, cs) if(init_single_dir(n, c, ds, cs) < 0) return -1

Functions

- int **init_devfs** (void)

  Initialize devfs /dev/robot filesystem entries.

- void **cleanup_devfs** (void)

  Destroy /dev/robot filesystem.

Variables

- **robot_dev_t robot_devices** [NUM_DEVICES]

7.6.1 Detailed Description

Device info for all the different robot devices.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

devices.c,v 1.12 2003/08/01 15:30:43 beevek Exp

A word on device types: The stream, change and current types are essentially just for applications to get data from. They may only be opened for writing by one process (which should be interp), but can be opened for reading by any number of processes. The stream and change types both act the same, but interp sends data to them differently (it sends everything to stream, and only sends data to change when the data is different from the previously sent data).

The ctl type, on the other hand, may be opened for writing by any number of processes. Data sent to this device will be read by interp and forwarded (sometimes after some transformation) to the hardware.

A read or write on any of these devices will fail if the size of the buffer being read to or written from is not exactly what the device expects. Look in the documentation for what these values are.

7.6.2 Define Documentation

7.6.2.1 #define INIT_DIR(n, c, ds, cs) if(init_single_dir(n, c, ds, cs) < 0) return -1

7.6.2.2 #define NUM_DIRS (1 + NUM_DEVICE_DIRS)

7.6.3 Function Documentation

7.6.3.1 void cleanup_devfs (void)

Destroy /dev/robot filesystem.

Clean up and call devfs_unregister on all /dev/robot entries

Precondition:
init_devfs must have been called

See also:
init_devfs

7.6.3.2 int init_devfs (void)

Initialize devfs /dev/robot filesystem entries.

This actually creates all of the /dev/robot files and registers our driver's system calls to handle data on them.

Returns:
< 0 on failure, >= 0 on success

See also:
cleanup_devfs

7.6.4 Variable Documentation

7.6.4.1 robot_dev_t robot_devices[NUM_DEVICES]

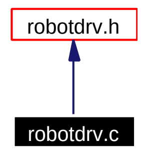
global list of device structures

7.7 driver/robotdrv.c File Reference

Robot kernel driver for /dev/robot.

`#include "robotdrv.h"`

Include dependency graph for robotdrv.c:



Functions

- **MODULE_AUTHOR** ("Kris Beevers(beevek @cs.rpi.edu)")
- **MODULE_DESCRIPTION** ("/dev/**robot** driver for RPI ARL **robots**")
- **MODULE_LICENSE** ("GPL")
- int **init_devfs** (void)

  Initialize devfs /dev/robot filesystem entries.

- void **cleanup_devfs** (void)

  Destroy /dev/robot filesystem.

- void **cleanup_module** (void)

  Called by the kernel on module unload.

- int **init_module** (void)

  Called by the kernel on module load; essentially just calls init_devfs and does nothing else.

7.7.1 Detailed Description

Robot kernel driver for /dev/robot.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

Id: **robotdrv.c**,v 1.8 2003/07/31 18:24:48 beevek Exp

Linux kernel driver to provide an interface for user-space programs to the robot sensor/motor hardware. Actually, just acts as a communication interface with interp.

It requires a recentish kernel (2.4.x or greater) because I'm not writing support for older kernels, since the robot uses a 2.4. It also requires devfs support in the kernel!

7.7.2 Function Documentation

7.7.2.1 void cleanup_devfs (void)

Destroy /dev/robot filesystem.

Clean up and call devfs_unregister on all /dev/robot entries

Precondition:
init_devfs must have been called

See also:
init_devfs

7.7.2.2 void cleanup_module (void)

Called by the kernel on module unload.

See also:
init_module

7.7.2.3 int init_devfs (void)

Initialize devfs /dev/robot filesystem entries.

This actually creates all of the /dev/robot files and registers our driver's system calls to handle data on them.

Returns:
< 0 on failure, >= 0 on success

See also:
cleanup_devfs

7.7.2.4 int init_module (void)

Called by the kernel on module load; essentially just calls init_devfs and does nothing else.

See also:
cleanup_module init_devfs

Returns:
-1 on failure, 0 on success

7.7.2.5 MODULE_AUTHOR ("Kris Beevers(beevek @cs.rpi.edu)")

7.7.2.6 MODULE_DESCRIPTION ("/dev/robot driver for RPI ARL robots")

7.7.2.7 MODULE_LICENSE ("GPL")

7.8 driver/robotdrv.h File Reference

Robot driver global include file.

`#include <robot/constants.h>`

`#include <robot/devfs.h>`

`#include <linux/config.h>`

`#include <linux/module.h>`

`#include <linux/version.h>`

`#include <linux/slab.h>`

`#include <linux/errno.h>`

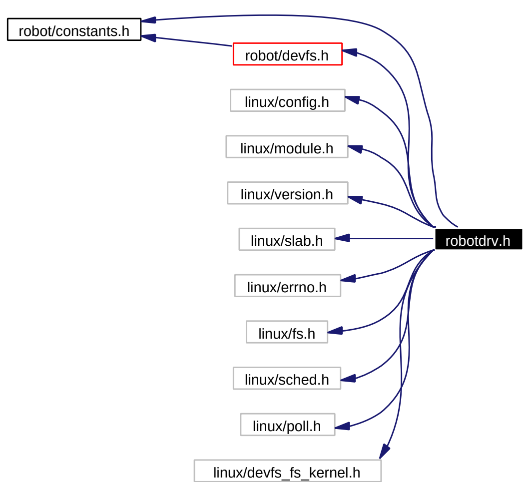
`#include <linux/fs.h>`

`#include <linux/sched.h>`

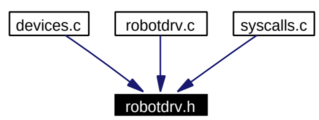
`#include <linux/poll.h>`

`#include <linux/devfs_fs_kernel.h>`

Include dependency graph for robotdrv.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **robot_dev_t**
- struct **robot_finfo_t**

Defines

- #define **STREAM** 0x00
- #define **CHANGE** 0x01
- #define **CURRENT** 0x02
- #define **CTL** 0x03
- #define **MAX_TYPE** 0x03

Variables

- **robot_dev_t robot_devices** []
- file_operations **robot_fops**

7.8.1 Detailed Description

Robot driver global include file.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id **robotdrv.h**,v 1.9 2003/07/31 22:30:03 beevek Exp

7.8.2 Define Documentation

7.8.2.1 #define CHANGE 0x01

7.8.2.2 #define CTL 0x03

7.8.2.3 #define CURRENT 0x02

7.8.2.4 #define MAX_TYPE 0x03

7.8.2.5 #define STREAM 0x00

7.8.3 Variable Documentation

7.8.3.1 robot_dev_t robot_devices[] ()

global list of device structures

7.8.3.2 struct file_operations robot_fops ()

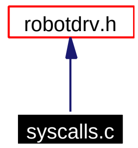
point to our system calls so the kernel knows what to use

7.9 driver/syscalls.c File Reference

System calls (common to all the device types).

`#include "robotdrv.h"`

Include dependency graph for syscalls.c:



Functions

- int **robot_open** (struct inode *inode, struct file *filp)

  Implementation of the open system call.

- int **robot_release** (struct inode *inode, struct file *filp)

  Implementation of the release (close) system call.

- ssize_t **robot_read** (struct file *filp, char *buf, size_t count, loff_t *f_pos)

  Implementation of the read system call.

- ssize_t **robot_write** (struct file *filp, const char *buf, size_t count, loff_t *f_pos)
- unsigned int **robot_poll** (struct file *filp, poll_table *wait)
- int **robot_ioctl** (struct inode *inode, struct file *filp, unsigned int cmd, unsigned long arg)

  Implementation of the ioctl system call.

Variables

- file_operations **robot_fops**

7.9.1 Detailed Description

System calls (common to all the device types).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

syscalls.c,v 1.7 2003/08/01 15:30:43 beevek Exp

We only implement the open, release (close), read, write, and poll system calls.

7.9.2 Function Documentation

7.9.2.1 int robot_ioctl (struct inode * *inode*, struct file * *filp*, unsigned int *cmd*, unsigned long *arg*)

Implementation of the ioctl system call.

The robot driver supports locking and unlocking of ctl-type files via this interface. "Locking" a file makes it so only the owner of the lock can write to it.

Parameters:

arg Should be set to the "priority" of the lock/unlock command. The larger the value, the lower the priority. If a file is locked but another lock attempt is made by a higher priority process, this attempt will be granted and the original lock owner will no longer own the file. Similarly, a higher- priority unlock request will release the lock of a lower-priority owner.

Returns:

< 0 on failure, >= 0 on success

7.9.2.2 int robot_open (struct inode * *inode*, struct file * *filp*)

Implementation of the open system call.

This call only allows one writer at a type for CTL-type devices.

Returns:

< 0 (a negative errno) on failure, 0 on success

7.9.2.3 unsigned int robot_poll (struct file * *filp*, poll_table * *wait*)

7.9.2.4 ssize_t robot_read (struct file * *filp*, char * *buf*, size_t *count*, loff_t * *f_pos*)

Implementation of the read system call.

This call blocks for STREAM, CHANGE and CTL types if no data is available, otherwise it returns immediately.

Parameters:

count must be exactly equal to the expected value!

Returns:

< 0 on failure, number of bytes read on success

7.9.2.5 int robot_release (struct inode * *inode*, struct file * *filp*)

Implementation of the release (close) system call.

Returns:

< 0 (a negative errno) on failure, 0 on success

7.9.2.6 ssize_t robot_write (struct file * *filp*, const char * *buf*, size_t *count*, loff_t * *f_pos*)

7.9.3 Variable Documentation

7.9.3.1 struct file_operations robot_fops

Initial value:

```
 {
  read:     robot_read,
  write:    robot_write,
  poll:     robot_poll,
  open:     robot_open,
  release:  robot_release,
  ioctl:    robot_ioctl,
}
```

point to our system calls so the kernel knows what to use

7.10 include/robot.h File Reference

Global librobot header file (all high-level robot programs should include this).

`#include <robot/config.h>`

`#include <robot/constants.h>`

`#include <robot/types.h>`

`#include <robot/handle.h>`

`#include <robot/sys.h>`

`#include <robot/time.h>`

`#include <robot/mclib.h>`

`#include <robot/hwid.h>`

`#include <robot/devfs.h>`

`#include <robot/net.h>`

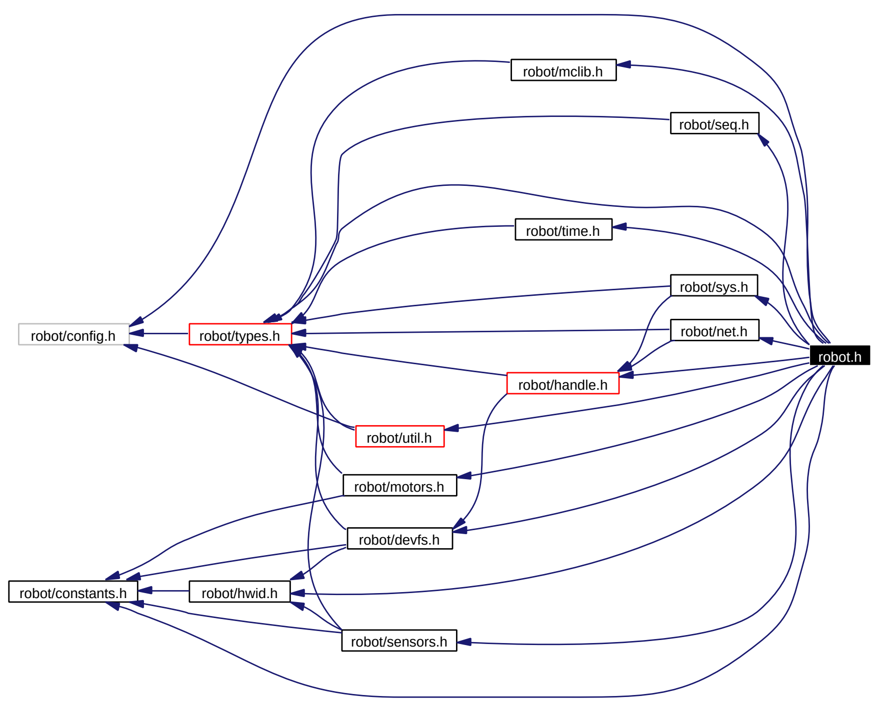
`#include <robot/motors.h>`

`#include <robot/sensors.h>`

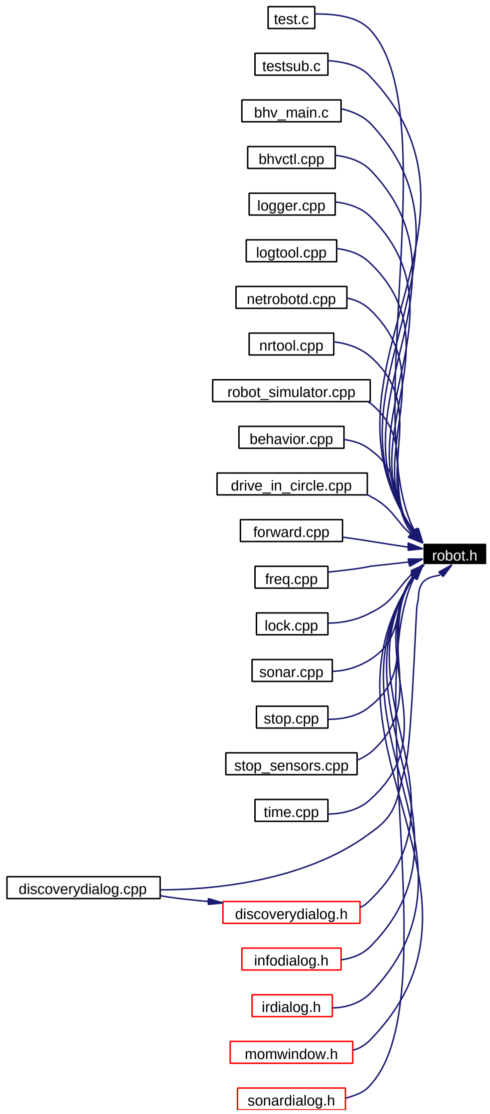
`#include <robot/util.h>`

`#include <robot/seq.h>`

Include dependency graph for robot.h:



This graph shows which files directly or indirectly include this file:



7.10.1 Detailed Description

Global librobot header file (all high-level robot programs should include this).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

VersIidon:

robot.h,v 1.15 2003/08/01 19:39:26 beevek Exp

7.11 include/robot/behavior.h File Reference

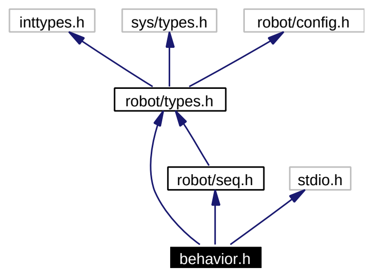
Definitions to be used in the creation of new reactive behaviors.

`#include <robot/types.h>`

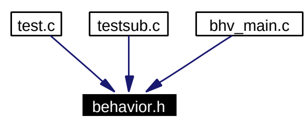
`#include <robot/seq.h>`

`#include <stdio.h>`

Include dependency graph for behavior.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **bhv_t**

Defines

- #define **bhv_printf**(s...)

  Print to sequencer's logfile with some nice formatting (our name, pid).

- #define **bhv_perror**(s)

  Print error message to sequencer's logfile with some nice formatting (our name, pid).

Typedefs

- typedef void(∗ **bhv_cleanup_func_t**)(void)

  Called on behavior cleanup.

- typedef int(∗ **bhv_data_func_t**)(uint8_t key, const void ∗data, int size)

  Called whenever new data has arrived from an outside process for one of the inputs of the behavior.

- typedef void(* **bhv_inhibit_func_t**)(void)

  Called whenever the behavior is about to be inhibited.

- typedef void(* **bhv_uninhibit_func_t**)(void)

  Called whenever the behavior is about to be uninhibited.

- typedef int(* **bhv_main_func_t**)(void)

  The main function of a behavior.

Enumerations

- enum **bhv_flags_t** { **NO_ROBOT_INIT** = (1 << 31), **QUEUE_WHEN_INHIBITED** = (1 << 30) }

Functions

- int **bhv_init** (**bhv_t** *bhv)

  Entry point into the behavior.

- int **bhv_add_input** (uint8_t key, **bhv_data_func_t** ondata)

  Add an input key to accept input from.

- int **bhv_output** (uint8_t key, const void *data, int size)

  Send output to all behaviors that we are connected to through the specified output key.

- int **bhv_input_pop** (uint8_t key, void *buf, int size)

  Extract input data from an input key's queue.

- void **bhv_shutdown** (int exitval)

  Shut down gracefully. Never call exit! Always call this instead!

- void **bhv_block_forever** (void)

  Block forever (handling EINTR).

Variables

- **bhv_handle_t bhv_self**
- const char * **bhv_name**

7.11.1 Detailed Description

Definitions to be used in the creation of new reactive behaviors.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:
behavior.h,v 1.7 2003/08/01 16:45:19 beevek Exp

Other programs should not include this file. It is part of libbehavior and should only be used by behaviors themselves in order to specify their interface.

7.11.2 Define Documentation

7.11.2.1 #define bhv_perror(s)

Value:

```
do { \
  fprintf(stderr, "<%s (%d)> Error: ", bhv_name, bhv_self.pid); \
  perror(s); \
  fflush(stderr); \
} while(0);
```

Print error message to sequencer's logfile with some nice formatting (our name, pid).

7.11.2.2 #define bhv_printf(s...)

Value:

```
do { \
  printf("<%s (%d)> ", bhv_name, bhv_self.pid); \
  printf(s); \
  fflush(stdout); \
} while(0);
```

Print to sequencer's logfile with some nice formatting (our name, pid).

7.11.3 Typedef Documentation

7.11.3.1 typedef void(* bhv_cleanup_func_t)(void)

Called on behavior cleanup.

Should perform any necessary de-initialization of the behavior.

7.11.3.2 typedef int(* bhv_data_func_t)(uint8_t key, const void *data, int size)

Called whenever new data has arrived from an outside process for one of the inputs of the behavior.

Should handle the data in whatever manner is necessary.

Use bhv_add_input to associate one of these functions with data arriving for a specific input key.

Parameters:
- ***key*** Input key of data
- ***data*** Pointer to data buffer
- ***size*** Size of data buffer (bytes)

Returns:
< 0 on failure, >= 0 on success

7.11.3.3 typedef void(* bhv_inhibit_func_t)(void)

Called whenever the behavior is about to be inhibited.

Note that the behavior is not responsible for inhibiting itself, this is taken care of by libbehavior after this function has been called.

7.11.3.4 typedef int(* bhv_main_func_t)(void)

The main function of a behavior.

This function should perform whatever behavior-related actions are necessary. In most cases it should loop forever. It does not need to worry about starting and stopping when the behavior is inhibited, this is done automatically by libbehavior.

If this function is executing, the behavior can assume it is not currently inhibited.

IMPORTANT: this function must be interruptible. In other words, it should check failed function calls to see whether errno is EINTR, and handle this situation gracefully. This is because the main function is interrupted by signals when data arrives or the behavior is inhibited.

Returns:
< 0 on failure, >= 0 on success.

7.11.3.5 typedef void(* bhv_uninhibit_func_t)(void)

Called whenever the behavior is about to be uninhibited.

Note that the behavior is not responsible for uninhibiting itself, this is taken care of by libbehavior after this function has been called.

7.11.4 Enumeration Type Documentation

7.11.4.1 enum bhv_flags_t

bhv_t flags

Enumeration values:

NO_ROBOT_INIT robot_{init,shutdown} not called

QUEUE_WHEN_INHIBITED queue incoming data when paused, and call ondata when unpaused for each queued item (if ondata is set)

7.11.5 Function Documentation

7.11.5.1 int bhv_add_input (uint8_t *key*, bhv_data_func_t *ondata*)

Add an input key to accept input from.

When data is sent to this behavior with a matching input key, call the ondata function with the data. Note that any number of ondata functions can be called for a single key. However, data will only be added to the internal queue once, no matter how many times you've called bhv_add_input with ondata as null.

Parameters:

key Input key to accept

ondata Function to call when data arrives for this input key. If null, the data will be stored in an internal queue and the behavior can access it by calling bhv_input_pop with the correct key.

Returns:

< 0 on failure, >= 0 on success

See also:

bhv_input_pop

7.11.5.2 void bhv_block_forever (void)

Block forever (handling EINTR).

Useful if you need to define a main behavior function that does a few things initially but then just wants to sleep quietly forever while data handlers are called.

Warning:

Never returns!

7.11.5.3 int bhv_init (bhv_t * *bhv*)

Entry point into the behavior.

All behaviors must define this function. It should fill in the values of bhv as appropriate, and perform any other initialization (such as starting sub-behaviors, etc).

Parameters:

bhv Pointer to a **bhv_t** struct to be initialized by the behavior

Returns:

< 0 on failure, >= 0 on success

7.11.5.4 int bhv_input_pop (uint8_t *key*, void * *buf*, int *size*)

Extract input data from an input key's queue.

If data has been sent to our input labeled key, and if no ondata function was specified for key in the call to bhv_add_input, the data is placed in a queue for that input and is accessible through this function.

Parameters:

key Input key to check for queued data

buf Buffer in which to place data if found

size Size of buffer (in bytes); if waiting data is larger than size, an error is generated and ERANGE is set

Returns:

< 0 on failure, or the size of the data placed in buf on success; if no items are on the specified queue, -1 is returned and ENODATA is set

7.11.5.5 int bhv_output (uint8_t *key*, const void * *data*, int *size*)

Send output to all behaviors that we are connected to through the specified output key.

Searches for key in the internal connection table. Any behaviors that are registered to receive input from an output from this behavior with the matching key will be sent data.

Parameters:

key Output key to send to

data Data buffer to send

size Length of data (in bytes)

See also:

seq_connect

7.11.5.6 void bhv_shutdown (int *exitval*)

Shut down gracefully. Never call exit! Always call this instead!

Parameters:

exitval Value passed to exit

7.11.6 Variable Documentation

7.11.6.1 const char* bhv_name

the name of this behavior

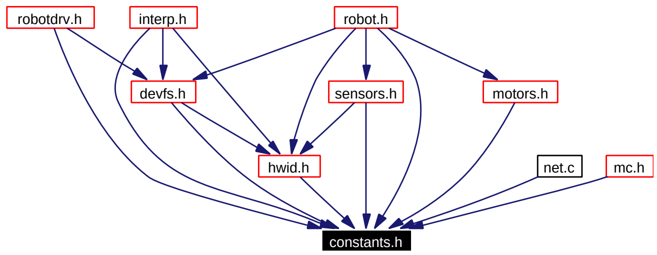
7.11.6.2 bhv_handle_t bhv_self

handle referring to ourself

7.12 include/robot/constants.h File Reference

Global constants for the robot, should be available to any and all robot software.

This graph shows which files directly or indirectly include this file:



Defines

- #define **ROBOT_NUM_SONAR** 10
- #define **ROBOT_NUM_IR** 10
- #define **ROBOT_NUM_BUMP** 6
- #define **ROBOT_WHEEL_RADIUS** 0.076
- #define **ROBOT_WHEEL_RADIUS_L** ROBOT_WHEEL_RADIUS
- #define **ROBOT_WHEEL_RADIUS_R** ROBOT_WHEEL_RADIUS
- #define **ROBOT_AXLE_WIDTH** 0.37
- #define **ROBOT_ENCODER_STEPS_PER_REV** 4096
- #define **ROBOT_SONAR_MULTIPLIER** 274.4e-6
- #define **ROBOT_IR_MULTIPLIER** 0
- #define **ROBOT_HW_TTY** ”/dev/tts/1”
- #define **ROBOT_THRESH_ODOM_X** 0.01
- #define **ROBOT_THRESH_ODOM_Y** 0.01
- #define **ROBOT_THRESH_ODOM_THETA** 0.01
- #define **ROBOT_THRESH_VEL_V** 0.001
- #define **ROBOT_THRESH_VEL_W** 0.001
- #define **ROBOT_THRESH_SONAR** 0.01
- #define **ROBOT_THRESH_IR** 0.01
- #define **ROBOT_THRESH_TRANSLATE** 0.03
- #define **ROBOT_THRESH_ROTATE** 0.03
- #define **ROBOT_DEFAULT_VEL_V** 0.2
- #define **ROBOT_DEFAULT_VEL_W** 0.4
- #define **ROBOT_MAX_VEL_V** 1.0
- #define **ROBOT_MAX_VEL_W** 3.14
- #define **ROBOT_DEFAULT_SONAR_FREQ** 4.0 /*! hertz */
- #define **ROBOT_DEFAULT_IR_FREQ** 4.0 /*! hertz */
- #define **ROBOT_MAX_NAME_LEN** 128
- #define **ROBOT_DEFAULT_NET_TIMEOUT** 2000
- #define **ROBOT_DEFAULT_NET_PORT** 10798

7.12.1 Detailed Description

Global constants for the robot, should be available to any and all robot software.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
constants.h,v 1.19 2003/07/24 20:53:13 beevek Exp

Todo
Most of these values need to be appropriately set.

7.12.2 Define Documentation

7.12.2.1 #define ROBOT_AXLE_WIDTH 0.37

7.12.2.2 #define ROBOT_DEFAULT_IR_FREQ 4.0 /*! hertz */

7.12.2.3 #define ROBOT_DEFAULT_NET_PORT 10798

7.12.2.4 #define ROBOT_DEFAULT_NET_TIMEOUT 2000

millisecs

7.12.2.5 #define ROBOT_DEFAULT_SONAR_FREQ 4.0 /*! hertz */

7.12.2.6 #define ROBOT_DEFAULT_VEL_V 0.2

m/s

7.12.2.7 #define ROBOT_DEFAULT_VEL_W 0.4

m/s

7.12.2.8 #define ROBOT_ENCODER_STEPS_PER_REV 4096

number of encoder steps in one wheel revolution

7.12.2.9 #define ROBOT_HW_TTY "/dev/tts/1"

7.12.2.10 #define ROBOT_IR_MULTIPLIER 0

7.12.2.11 #define ROBOT_MAX_NAME_LEN 128

7.12.2.12 #define ROBOT_MAX_VEL_V 1.0

m/s

7.12.2.13 #define ROBOT_MAX_VEL_W 3.14

m/s

7.12.2.14 #define ROBOT_NUM_BUMP 6

must be <= 8

7.12.2.15 #define ROBOT_NUM_IR 10

must be <= 16

7.12.2.16 #define ROBOT_NUM_SONAR 10

must be <= 16

7.12.2.17 #define ROBOT_SONAR_MULTIPLIER 274.4e-6

multiply sonar_time_val_t, ir_voltage_val_t by these to get dist in meters

7.12.2.18 #define ROBOT_THRESH_IR 0.01

hertz

7.12.2.19 #define ROBOT_THRESH_ODOM_THETA 0.01

meters

7.12.2.20 #define ROBOT_THRESH_ODOM_X 0.01

meters

7.12.2.21 #define ROBOT_THRESH_ODOM_Y 0.01

meters

7.12.2.22 #define ROBOT_THRESH_ROTATE 0.03

7.12.2.23 #define ROBOT_THRESH_SONAR 0.01

hertz

7.12.2.24 #define ROBOT_THRESH_TRANSLATE 0.03

7.12.2.25 #define ROBOT_THRESH_VEL_V 0.001

m/s

7.12.2.26 #define ROBOT_THRESH_VEL_W 0.001

m/s

7.12.2.27 #define ROBOT_WHEEL_RADIUS 0.076

7.12.2.28 #define ROBOT_WHEEL_RADIUS_L ROBOT_WHEEL_RADIUS

7.12.2.29 #define ROBOT_WHEEL_RADIUS_R ROBOT_WHEEL_RADIUS

7.13 include/robot/devfs.h File Reference

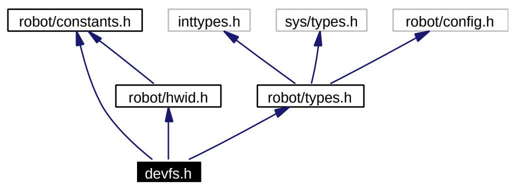
Device-related definitions for the /dev/robot device tree.

`#include <robot/constants.h>`

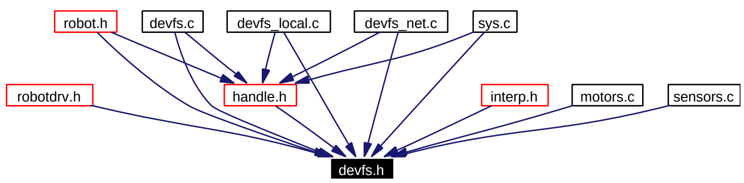
`#include <robot/types.h>`

`#include <robot/hwid.h>`

Include dependency graph for devfs.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **devfs_set_t**

Defines

- #define **NUM_DEVICE_DIRS** (7 + ROBOT_NUM_SONAR + ROBOT_NUM_IR + ROBOT_NUM_BUMP)
- #define **NUM_DEVICES** (26 + (ROBOT_NUM_SONAR * 4) + (ROBOT_NUM_IR * 4) + (ROBOT_NUM_BUMP * 3))
- #define **DEVFS_IOCLOCKCTL** 0xc301
- #define **DEVFS_IOCUNLOCKCTL** 0xc302
- #define **DEVFS_IOCGETLOCKOWNER** 0xc303
- #define **DATA_SIZE_ODOM** (3 * sizeof(**odom_val_t**))
- #define **CTL_SIZE_ODOM** (3 * sizeof(**odom_val_t**))
- #define **DATA_SIZE_VEL** (2 * sizeof(**vel_val_t**))
- #define **CTL_SIZE_VEL** (2 * sizeof(**vel_val_t**))
- #define **DATA_SIZE_ENCODER** (2 * sizeof(**encoder_val_t**))
- #define **CTL_SIZE_ENCODER** 0
- #define **DATA_SIZE_PWM** (2 * sizeof(**pwm_val_t**))
- #define **CTL_SIZE_PWM** 0
- #define **DATA_SIZE_SONAR** (sizeof(**sonar_val_t**))

- #define **CTL_SIZE_SONAR** (sizeof(**freq_req_val_t**))
- #define **DATA_SIZE_IR** (sizeof(**ir_val_t**))
- #define **CTL_SIZE_IR** (sizeof(**freq_req_val_t**))
- #define **DATA_SIZE_BUMP** (sizeof(**bump_val_t**))
- #define **CTL_SIZE_BUMP** 0
- #define **DEVFS_ROOT_STR** "robot"
- #define **DEVFS_ODOM_STR** "robot/**odom**"
- #define **DEVFS_VEL_STR** "robot/**vel**"
- #define **DEVFS_ENCODER_STR** "robot/encoder"
- #define **DEVFS_PWM_STR** "robot/**pwm**"
- #define **DEVFS_SONAR_STR** "robot/**sonar**"
- #define **DEVFS_IR_STR** "robot/**ir**"
- #define **DEVFS_BUMP_STR** "robot/**bump**"
- #define **DEV_TYPE_STREAM_STR** "stream"
- #define **DEV_TYPE_CHANGE_STR** "change"
- #define **DEV_TYPE_CURRENT_STR** "current"
- #define **DEV_TYPE_CTL_STR** "ctl"

Enumerations

- enum **devfs_dir_type_t** {
  DEVFS_ODOM = 0, **DEVFS_VEL**, **DEVFS_ENCODER**, **DEVFS_PWM**,
  DEVFS_SONAR, **DEVFS_SONAR_SINGLE**, **DEVFS_IR**, **DEVFS_IR_SINGLE**,
  DEVFS_BUMP, **DEVFS_BUMP_SINGLE** }
- enum **devfs_type_t** { **DEV_TYPE_STREAM** = 0, **DEV_TYPE_CHANGE**, **DEV_-TYPE_CURRENT**, **DEV_TYPE_CTL** }
- enum { **DEVFS_SERVER** = (1 << 0), **DEVFS_CLIENT** = (1 << 1), **DEVFS_-RDONLY** = (1 << 2) }
- enum {
  DEVFS_PRIO_SUPER = 0x00000000, **DEVFS_PRIO_CRITICAL** = 0x0000000f, **DEVFS_PRIO_HIGH** = 0x000000ff, **DEVFS_PRIO_NORMAL** = 0x0000ffff,
  DEVFS_PRIO_LOW = 0x00ffffff }

Functions

- int **devfs_init** (int flags)

  Initialize the devfs subsystem.

- void **devfs_cleanup** (void)

  De-initialize the devfs subsystem.

- **devfs_set_t** * **devfs_find** (uint8_t hwid)

  Find the **devfs_set_t** *for the specified hardware id in the current robot's devfs_fds list.*

- int **devfs_get_data_size** (uint8_t hwid, **devfs_type_t** type)

  Figure out the size of the data to read or write from the /dev/robot entry matching hwid and type.

- int **devfs_write** (**devfs_set_t** *set, const void *buf, int count)

    Write the data in buf to any of set's open file descriptors that are opened for writing.

- int **devfs_read** (**devfs_set_t** *set, **devfs_type_t** type, void *buf, int count)

    Read count bytes into buf from set's file descriptor matching the specified devfs_type_t.

- int **devfs_wait_for_change** (uint8_t ***hwids**, int count)

    Wait until new data arrives on the change device for one of the hardware ids in hwids.

- int **devfs_lock_ctl** (**devfs_set_t** *set, uint32_t prio)

    Lock the ctl entry for a hardware device.

- int **devfs_unlock_ctl** (**devfs_set_t** *set, uint32_t prio)

    Unlock the ctl entry for a hardware device.

- int **devfs_get_lock_owner** (**devfs_set_t** *set)

    Get the pid of the owner of the current lock on a devfs ctl entry, if one is set.

7.13.1 Detailed Description

Device-related definitions for the /dev/robot device tree.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

VersIdon:

devfs.h,v 1.11 2003/08/01 15:30:43 beevek Exp

7.13.2 Define Documentation

7.13.2.1 #define CTL_SIZE_BUMP 0

7.13.2.2 #define CTL_SIZE_ENCODER 0

7.13.2.3 #define CTL_SIZE_IR (sizeof(freq_req_val_t))

7.13.2.4 #define CTL_SIZE_ODOM (3 * sizeof(odom_val_t))

7.13.2.5 #define CTL_SIZE_PWM 0

7.13.2.6 #define CTL_SIZE_SONAR (sizeof(freq_req_val_t))

7.13.2.7 #define CTL_SIZE_VEL (2 * sizeof(vel_val_t))

7.13.2.8 #define DATA_SIZE_BUMP (sizeof(bump_val_t))

7.13.2.9 #define DATA_SIZE_ENCODER (2 * sizeof(encoder_val_t))

7.13.2.10 #define DATA_SIZE_IR (sizeof(ir_val_t))

7.13.2.11 #define DATA_SIZE_ODOM (3 * sizeof(odom_val_t))

7.13.2.12 #define DATA_SIZE_PWM (2 * sizeof(pwm_val_t))

7.13.2.13 #define DATA_SIZE_SONAR (sizeof(sonar_val_t))

7.13.2.14 #define DATA_SIZE_VEL (2 * sizeof(vel_val_t))

7.13.2.15 #define DEV_TYPE_CHANGE_STR "change"

7.13.2.16 #define DEV_TYPE_CTL_STR "ctl"

7.13.2.17 #define DEV_TYPE_CURRENT_STR "current"

7.13.2.18 #define DEV_TYPE_STREAM_STR "stream"

7.13.2.19 #define DEVFS_BUMP_STR "robot/bump"

7.13.2.20 #define DEVFS_ENCODER_STR "robot/encoder"

7.13.2.21 #define DEVFS_IOCGETLOCKOWNER 0xc303

7.13.2.22 #define DEVFS_IOCLOCKCTL 0xc301

ioctls for /dev/robot driver. Not really the proper way to do these but simplifies things significantly.

7.13.2.23 #define DEVFS_IOCUNLOCKCTL 0xc302

7.13.2.24 #define DEVFS_IR_STR "robot/ir"

7.13.2.25 #define DEVFS_ODOM_STR "robot/odom"

7.13.2.26 #define DEVFS_PWM_STR "robot/pwm"

7.13.2.27 #define DEVFS_ROOT_STR "robot"

7.13.2.28 #define DEVFS_SONAR_STR "robot/sonar"

7.13.2.29 #define DEVFS_VEL_STR "robot/vel"

7.13.2.30 #define NUM_DEVICE_DIRS (7 + ROBOT_NUM_SONAR + ROBOT_NUM_IR + ROBOT_NUM_BUMP)

Warning:
if new devices are added this MUST BE CHANGED

7.13.2.31 #define NUM_DEVICES (26 + (ROBOT_NUM_SONAR * 4) + (ROBOT_NUM_IR * 4) + (ROBOT_NUM_BUMP * 3))

Warning:
if new devices are added this MUST BE CHANGED

7.13.3 Enumeration Type Documentation

7.13.3.1 anonymous enum

devfs initialization options

Enumeration values:

DEVFS_SERVER

DEVFS_CLIENT

DEVFS_RDONLY

7.13.3.2 anonymous enum

priorities for devfs_lock_ctl and devfs_unlock_ctl

Enumeration values:

DEVFS_PRIO_SUPER

DEVFS_PRIO_CRITICAL

DEVFS_PRIO_HIGH

DEVFS_PRIO_NORMAL always use this!

DEVFS_PRIO_LOW

7.13.3.3 enum devfs_dir_type_t

some numbers to identify device "directory types" by

Enumeration values:

- **DEVFS_ODOM**
- **DEVFS_VEL**
- **DEVFS_ENCODER**
- **DEVFS_PWM**
- **DEVFS_SONAR** e.g. /dev/robot/sonar
- **DEVFS_SONAR_SINGLE** e.g. /dev/robot/sonar/0
- **DEVFS_IR**
- **DEVFS_IR_SINGLE**
- **DEVFS_BUMP**
- **DEVFS_BUMP_SINGLE**

7.13.3.4 enum devfs_type_t

device file types

Enumeration values:

- **DEV_TYPE_STREAM** /dev/robot/.../stream
- **DEV_TYPE_CHANGE** /dev/robot/.../change
- **DEV_TYPE_CURRENT** /dev/robot/.../current
- **DEV_TYPE_CTL** /dev/robot/.../ctl

7.13.4 Function Documentation

7.13.4.1 void devfs_cleanup (void)

De-initialize the devfs subsystem.

7.13.4.2 devfs_set_t* devfs_find (uint8_t *hwid*)

Find the **devfs_set_t** for the specified hardware id in the current robot's devfs_fds list.

Parameters:

hwid A hardware id from **hwid.h**

Returns:

A pointer to the **devfs_set_t** matching hwid from the current robot's devfs_fds list

7.13.4.3 int devfs_get_data_size (uint8_t *hwid*, devfs_type_t *type*)

Figure out the size of the data to read or write from the /dev/robot entry matching hwid and type.

Parameters:

hwid A hardware id from **hwid.h**

type The type of device

Returns:

Data size for the device, or zero on failure (no matching device exists)

7.13.4.4 int devfs_get_lock_owner (devfs_set_t * *set*)

Get the pid of the owner of the current lock on a devfs ctl entry, if one is set.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to get the lock owner of

Returns:

< 0 on failure or if no lock is set, and the pid of the process owning the lock otherwise

7.13.4.5 int devfs_init (int *flags*)

Initialize the devfs subsystem.

Parameters:

flags A bitfield of flags to control the initialization

Returns:

< 0 on failure, >= 0 on success

7.13.4.6 int devfs_lock_ctl (devfs_set_t * *set*, uint32_t *prio*)

Lock the ctl entry for a hardware device.

If the priority is higher than that for the current owner of a lock on the device, or if no lock currently exists, the requester is granted exclusive write access to the device and only a higher-priority lock or unlock request will be granted.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to set the lock on

prio The priority of the lock; the lower this value, the higher the lock priority. In general, DEVFS_PRIO_NORMAL should be used.

Returns:

< 0 on failure, >= 0 on success

7.13.4.7 int devfs_read (devfs_set_t * *set*, devfs_type_t *type*, void * *buf*, int *count*)

Read count bytes into buf from set's file descriptor matching the specified devfs_type_t.

You can only read data of exactly the correct size from a /dev/robot device, otherwise the read will fail.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to read from

type The device type from the set to read from

buf Buffer in which the data will be placed

count Number of bytes to read

Returns:

< 0 on failure, >= 0 on success

7.13.4.8 int devfs_unlock_ctl (devfs_set_t * *set*, uint32_t *prio*)

Unlock the ctl entry for a hardware device.

If the priority is higher than that for the current owner of a lock on the device, or the requester is the owner of the lock, then the lock is removed and any process can write to the device.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to unlock

prio The priority of the lock; the lower this value, the higher the lock priority. In general, DEVFS_PRIO_NORMAL should be used.

Returns:

< 0 on failure, >= 0 on success

7.13.4.9 int devfs_wait_for_change (uint8_t * *hwids*, int *count*)

Wait until new data arrives on the change device for one of the hardware ids in hwids.

This function will block until the /dev/robot/.../change entry for one of the specified hwids has data waiting to be read. Note that if you have never read data from the change device before, data will be waiting.

Parameters:

hwids An array of hardware ids from **hwid.h**

count The size of the hwids array (number of hwids)

Returns:

< 0 on failure, >= 0 on success

7.13.4.10 int devfs_write (devfs_set_t * *set*, const void * *buf*, int *count*)

Write the data in buf to any of set's open file descriptors that are opened for writing.

You can only write data of exactly the correct size to a /dev/robot device, otherwise the write will fail.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to write to

buf Buffer containing the data to write

count Number of bytes to write

Returns:

< 0 on failure, >= 0 on success

7.14 include/robot/handle.h File Reference

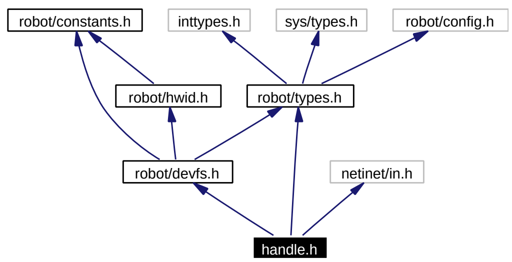
robot_handle_t and associated functionality

`#include <robot/types.h>`

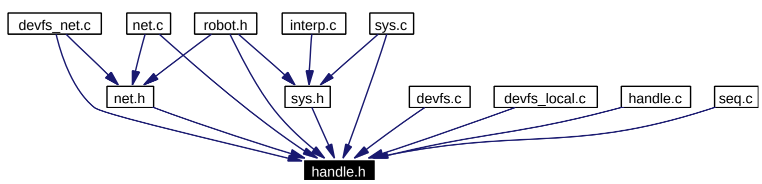
`#include <robot/devfs.h>`

`#include <netinet/in.h>`

Include dependency graph for handle.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **robot_handle_t**

Defines

- #define **handle_is_net**(h) ((h) → sock > 0 || (h) → sockaddr.sin_addr.s_addr)
- #define **handle_is_loc**(h) (!handle_is_net(h))
- #define **handle_is_connected**(h) (handle_is_net(h) && (h) → init_complete)

Functions

- int **robot_set_handle** (**robot_handle_t** ∗handle)

  Set the current handle for all robot operations.

Variables

- **robot_handle_t** ∗ **cur_robot**

7.14.1 Detailed Description

robot_handle_t and associated functionality

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
handle.h,v 1.4 2003/07/18 01:13:11 beevek Exp

robot_handle_t is used primarily for communicating with robots via the network. In particular, it allows one program to control multiple robots by switching between handles. In general, any program that runs directly on the robot will never need to worry about handles at all. In fact, any program that is meant to control only one robot (even over the network) will never have to use this functionality. Only programs that talk to multiple robots will make use of it.

7.14.2 Define Documentation

7.14.2.1 #define handle_is_connected(h) (handle_is_net(h) && (h) → init_complete)

Nonzero if the handle represents a robot somewhere else on the network, and we have successfully connected to it and initialized it. The h parameter must be a **robot_handle_t** *.

7.14.2.2 #define handle_is_loc(h) (!handle_is_net(h))

Nonzero if the handle represents a robot on this machine, zero if it is somewhere else on the network. The h parameter must be a **robot_handle_t** *.

7.14.2.3 #define handle_is_net(h) ((h) → sock > 0 || (h) → sockaddr.sin_addr.s_addr)

Nonzero if the handle represents a robot somewhere else on the network, zero if it is on this machine. The h parameter must be a **robot_handle_t** *.

7.14.3 Function Documentation

7.14.3.1 int robot_set_handle (robot_handle_t * *handle*)

Set the current handle for all robot operations.

Passing null will make all operations act on the local computer (i.e., the program must be running on the robot itself).

Parameters:
handle A valid **robot_handle_t**, or null for local robot

Returns:
< 0 on failure, >= 0 on success

7.14.4 Variable Documentation

7.14.4.1 robot_handle_t* cur_robot ()

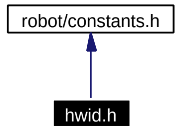
pointer to the handle for the robot librobot is currently controlling

7.15 include/robot/hwid.h File Reference

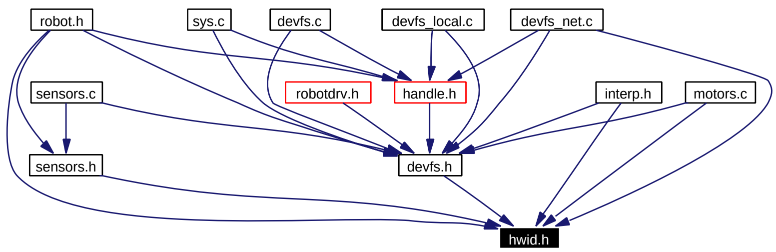
Id numbers for hardware devices talking through serial.

`#include <robot/constants.h>`

Include dependency graph for hwid.h:



This graph shows which files directly or indirectly include this file:



Defines

- #define **HW_IS_MC**(d) (d == HW_MC)
- #define **HW_IS_MOTORS**(d) (d == HW_MOTORS)
- #define **HW_IS_VEL**(d) (d == HW_VEL)
- #define **HW_IS_ODOM**(d) (d == HW_ODOM)
- #define **HW_IS_ENCODER**(d) (d == HW_ENCODER)
- #define **HW_IS_PWM**(d) (d == HW_PWM)
- #define **HW_IS_ALL_SONAR**(d) (d == HW_ALL_SONAR)
- #define **HW_IS_ALL_IR**(d) (d == HW_ALL_IR)
- #define **HW_IS_ALL_BUMP**(d) (d == HW_ALL_BUMP)
- #define **HW_IS_SONAR**(d) (d >= HW_SONAR01 && d <= HW_SONAR01 + ROBOT_NUM_SONAR)
- #define **HW_IS_IR**(d) (d >= HW_IR01 && d <= HW_IR01 + ROBOT_NUM_IR)
- #define **HW_IS_BUMP**(d) (d >= HW_BUMP01 && d <= HW_BUMP01 + ROBOT_NUM_BUMP)
- #define **HW_IS_VIRTUAL**(d)

Enumerations

- enum {
  HW_MC = 0x00, **HW_MOTORS** = 0x01, **HW_VEL** = 0x02, **HW_ODOM** = 0x03,
  HW_ENCODER = 0x04, **HW_PWM** = 0x05, **HW_ALL_SONAR** = 0x06, **HW_ALL_IR** = 0x07,

HW_ALL_BUMP = 0x08, **HW_SONAR01** = 0x10, **HW_SONAR02** = 0x11, **HW_-SONAR03** = 0x12,

HW_SONAR04 = 0x13, **HW_SONAR05** = 0x14, **HW_SONAR06** = 0x15, **HW_-SONAR07** = 0x16,

HW_SONAR08 = 0x17, **HW_SONAR09** = 0x18, **HW_SONAR10** = 0x19, **HW_-SONAR11** = 0x1a,

HW_SONAR12 = 0x1b, **HW_SONAR13** = 0x1c, **HW_SONAR14** = 0x1d, **HW_-SONAR15** = 0x1e,

HW_SONAR16 = 0x1f, **HW_IR01** = 0x20, **HW_IR02** = 0x21, **HW_IR03** = 0x22,

HW_IR04 = 0x23, **HW_IR05** = 0x24, **HW_IR06** = 0x25, **HW_IR07** = 0x26,

HW_IR08 = 0x27, **HW_IR09** = 0x28, **HW_IR10** = 0x29, **HW_IR11** = 0x2a,

HW_IR12 = 0x2b, **HW_IR13** = 0x2c, **HW_IR14** = 0x2d, **HW_IR15** = 0x2e,

HW_IR16 = 0x2f, **HW_BUMP01** = 0x30, **HW_BUMP02** = 0x31, **HW_BUMP03** = 0x32,

HW_BUMP04 = 0x33, **HW_BUMP05** = 0x34, **HW_BUMP06** = 0x35, **HW_-BUMP07** = 0x36,

HW_BUMP08 = 0x37, **HW_MIN** = 0x00, **HW_MAX** = 0x38 }

Hardware device ids.

7.15.1 Detailed Description

Id numbers for hardware devices talking through serial.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

hwid.h,v 1.7 2003/07/18 15:27:22 beevek Exp

Also used to identify hardware internally throughout librobot.

Defined here as well are a number of macros useful for determining the nature of a hardware id. These should be self-explanatory for the most part.

7.15.2 Define Documentation

7.15.2.1 #define HW_IS_ALL_BUMP(d) (d == HW_ALL_BUMP)

7.15.2.2 #define HW_IS_ALL_IR(d) (d == HW_ALL_IR)

7.15.2.3 #define HW_IS_ALL_SONAR(d) (d == HW_ALL_SONAR)

7.15.2.4 #define HW_IS_BUMP(d) (d >= HW_BUMP01 && d <= HW_BUMP01 + ROBOT_NUM_BUMP)

7.15.2.5 #define HW_IS_ENCODER(d) (d == HW_ENCODER)

7.15.2.6 #define HW_IS_IR(d) (d >= HW_IR01 && d <= HW_IR01 + ROBOT_NUM_IR)

7.15.2.7 #define HW_IS_MC(d) (d == HW_MC)

7.15.2.8 #define HW_IS_MOTORS(d) (d == HW_MOTORS)

7.15.2.9 #define HW_IS_ODOM(d) (d == HW_ODOM)

7.15.2.10 #define HW_IS_PWM(d) (d == HW_PWM)

7.15.2.11 #define HW_IS_SONAR(d) (d >= HW_SONAR01 && d <= HW_SONAR01 + ROBOT_NUM_SONAR)

7.15.2.12 #define HW_IS_VEL(d) (d == HW_VEL)

7.15.2.13 #define HW_IS_VIRTUAL(d)

Value:

```
(HW_IS_VEL(d) || HW_IS_ODOM(d) \
                         || HW_IS_ENCODER(d) || HW_IS_PWM(d) \
                         || HW_IS_ALL_SONAR(d) || HW_IS_ALL_IR(d) \
                         || HW_IS_BUMP(d))
```

Returns:

Nonzero only if d has NO matching real hardware device (i.e. it is completely handled in software).

7.15.3 Enumeration Type Documentation

7.15.3.1 anonymous enum

Hardware device ids.

These numbers have two uses: they act as device identifiers when talking to the microcontroller controlling the hardware, and they also are used throughout the system to identify the hardware for dev/robot entries. Thus, every devfs entry has a corresponding hardware device id, even if there is no "real" corresponding hardware device. These virtual HW devices are those that are marked "not sent from serial" below.

Enumeration values:

- **HW_MC**
- **HW_MOTORS**
- **HW_VEL** not sent from serial
- **HW_ODOM** not sent from serial
- **HW_ENCODER** not sent from serial
- **HW_PWM** not sent from serial
- **HW_ALL_SONAR** not sent from serial
- **HW_ALL_IR** not sent from serial
- **HW_ALL_BUMP**
- **HW_SONAR01**
- **HW_SONAR02**
- **HW_SONAR03**
- **HW_SONAR04**
- **HW_SONAR05**
- **HW_SONAR06**
- **HW_SONAR07**
- **HW_SONAR08**
- **HW_SONAR09**
- **HW_SONAR10**
- **HW_SONAR11**
- **HW_SONAR12**
- **HW_SONAR13**
- **HW_SONAR14**
- **HW_SONAR15**
- **HW_SONAR16**
- **HW_IR01**
- **HW_IR02**
- **HW_IR03**
- **HW_IR04**
- **HW_IR05**
- **HW_IR06**
- **HW_IR07**
- **HW_IR08**
- **HW_IR09**
- **HW_IR10**
- **HW_IR11**
- **HW_IR12**
- **HW_IR13**
- **HW_IR14**
- **HW_IR15**
- **HW_IR16**

HW_BUMP01 none of these are ever sent from serial

HW_BUMP02

HW_BUMP03

HW_BUMP04

HW_BUMP05

HW_BUMP06

HW_BUMP07

HW_BUMP08

HW_MIN

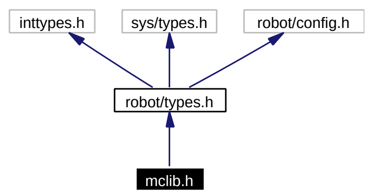
HW_MAX one greater than max

7.16 include/robot/mclib.h File Reference

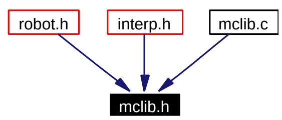
Definitions related to loading a motor control shared library.

`#include <robot/types.h>`

Include dependency graph for mclib.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **mc_lib_t**

Typedefs

- typedef int(∗ **mc_init_func_t**)(uint32_t)
- typedef void(∗ **mc_shutdown_func_t**)(void)
- typedef int(∗ **mc_start_frame_func_t**)(**encoder_val_t**, **encoder_val_t**)
- typedef int(∗ **mc_set_velocity_func_t**)(**vel_val_t**, **vel_val_t**)
- typedef void(∗ **mc_get_velocity_func_t**)(**vel_val_t** ∗, **vel_val_t** ∗)
- typedef void(∗ **mc_set_odometry_func_t**)(**odom_val_t** ∗, **odom_val_t** ∗, **odom_val_t** ∗)
- typedef int(∗ **mc_do_control_func_t**)(**pwm_val_t** ∗, **pwm_val_t** ∗)

Functions

- int **mc_lib_load** (const char ∗lib_file, **mc_lib_t** ∗lib)

  Load a motor control shared library and initialize lib to point to its functions.

- void **mc_lib_unload** (**mc_lib_t** ∗lib)

  Unload a motor control shared library.

7.16.1 Detailed Description

Definitions related to loading a motor control shared library.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
mclib.h,v 1.4 2003/07/18 01:13:11 beevek Exp

This is mostly used just by the interpreter; in general most user programs will not have to worry about this stuff.

Here we specify typedefs for functions that must be provided by any motor control library. For more information, see doc/motor_control_interface.txt and mc/mc.h.

7.16.2 Typedef Documentation

7.16.2.1 typedef int(* mc_do_control_func_t)(pwm_val_t *, pwm_val_t *)

7.16.2.2 typedef void(* mc_get_velocity_func_t)(vel_val_t *, vel_val_t *)

7.16.2.3 typedef int(* mc_init_func_t)(uint32_t)

7.16.2.4 typedef void(* mc_set_odometry_func_t)(odom_val_t *, odom_val_t *, odom_val_t *)

7.16.2.5 typedef int(* mc_set_velocity_func_t)(vel_val_t, vel_val_t)

7.16.2.6 typedef void(* mc_shutdown_func_t)(void)

7.16.2.7 typedef int(* mc_start_frame_func_t)(encoder_val_t, encoder_val_t)

7.16.3 Function Documentation

7.16.3.1 int mc_lib_load (const char * *lib_file*, mc_lib_t * *lib*)

Load a motor control shared library and initialize lib to point to its functions.

Parameters:
lib_file Path to the library shared object file
lib **mc_lib_t** to fill in with pointers to the library's functions

Returns:
< 0 on failure, >= 0 on success

7.16.3.2 void mc_lib_unload (mc_lib_t * *lib*)

Unload a motor control shared library.

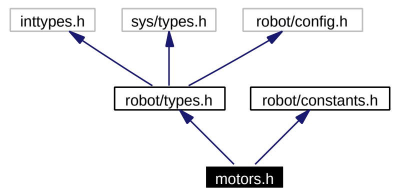
Parameters:
lib An **mc_lib_t** previously initialized with mc_lib_load

7.17 include/robot/motors.h File Reference

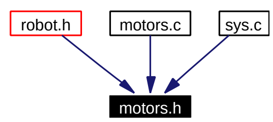
Send commands to the motors from high-level software, and read sensor data related to the motors.

```
#include <robot/types.h>
#include <robot/constants.h>
```

Include dependency graph for motors.h:



This graph shows which files directly or indirectly include this file:



Functions

- int **robot_set_velocity** (**vel_val_t** v, **vel_val_t** w)
  Set translational and rotational velocity of the robot.
- int **robot_translate** (float dist, **vel_val_t** v)
  Translate (straight forward or backward) dist meters at velocity v.
- int **robot_rotate** (float radians, **vel_val_t** w)
  Rotate the specified distance in radians at rotational velocity w.
- int **robot_set_odometry** (**odom_val_t** x, **odom_val_t** y, **odom_val_t** theta)
  Reset the robot's internal odometry counters to the specified values.
- int **robot_get_velocity** (**vel_val_t** *v, **vel_val_t** *w)
  Get the robot's current translational and rotational velocities.
- int **robot_get_odometry** (**odom_val_t** *x, **odom_val_t** *y, **odom_val_t** *theta)
  Get the robot's current odometry counter values.
- int **robot_lock_motors** (void)
  Lock velocity control of the motors to this process.
- int **robot_unlock_motors** (void)
  Unlock velocity control of the motors.

7.17.1 Detailed Description

Send commands to the motors from high-level software, and read sensor data related to the motors.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
motors.h,v 1.6 2003/08/01 15:30:43 beevek Exp

Todo
FIXME: acceleration?

7.17.2 Function Documentation

7.17.2.1 int robot_get_odometry (odom_val_t * *x*, odom_val_t * *y*, odom_val_t * *theta*)

Get the robot's current odometry counter values.

Parameters:
- ***x*** Pointer to location to store x-component
- ***y*** Pointer to location to store y-component
- ***theta*** Pointer to location to store theta-component (rotation)

Returns:
< 0 on failure, >= 0 on success

7.17.2.2 int robot_get_velocity (vel_val_t * *v*, vel_val_t * *w*)

Get the robot's current translational and rotational velocities.

Parameters:
- ***v*** Pointer to location to store the robot's translational velocity (meters/sec)
- ***w*** Pointer to location to store the robot's rotational velocity (radians/sec)

Returns:
< 0 on failure, >= 0 otherwise

7.17.2.3 int robot_lock_motors (void)

Lock velocity control of the motors to this process.

When a process has locked control of the motors, no other process can control them (unless it has a higher priority – e.g. the emergency-stop behavior).

Returns:
< 0 on failure, >= 0 on success

See also:
robot_unlock_motors

7.17.2.4 int robot_rotate (float *radians*, vel_val_t *w*)

Rotate the specified distance in radians at rotational velocity w.

This function quits if it detects that the robot is for some reason turning improperly.

Parameters:

radians Distance (in radians) to rotate; positive for counterclockwise rotation, negative for clockwise rotation

w Rotational velocity (radians/sec)

Returns:

< 0 on failure, >= 0 otherwise

7.17.2.5 int robot_set_odometry (odom_val_t *x*, odom_val_t *y*, odom_val_t *theta*)

Reset the robot's internal odometry counters to the specified values.

Parameters:

x x-component odometry value

y y-component odometry value

theta theta-component (rotation) odometry value

Returns:

< 0 on failure, >= 0 otherwise

7.17.2.6 int robot_set_velocity (vel_val_t *v*, vel_val_t *w*)

Set translational and rotational velocity of the robot.

Parameters:

v Translational velocity (in meters/second)

w Rotational velocity (in radians/second)

Returns:

< 0 on failure, >= 0 otherwise

7.17.2.7 int robot_translate (float *dist*, vel_val_t *v*)

Translate (straight forward or backward) dist meters at velocity v.

If for some reason the robot moves farther away from its goal during the course of this call, it fails and sets errno to ESPIPE (Illegal seek :)

Parameters:

dist Distance (in meters) to translate; positive to go forward, negative to go backward

v Translational velocity (meters/sec)

Returns:

< 0 on failure, >= 0 otherwise

7.17.2.8 int robot_unlock_motors (void)

Unlock velocity control of the motors.

In general, only call this after locking control of the motors with robot_lock_motors. If you do not call this before your program quits, robot_shutdown will take care of it for you.

Returns:

< 0 on failure, >= 0 on success

See also:

robot_lock_motors

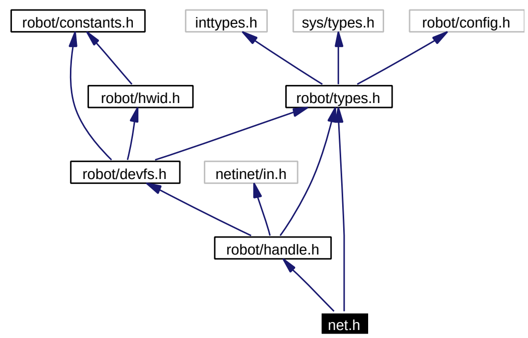
7.18 include/robot/net.h File Reference

Methods for setting up network control of robots.

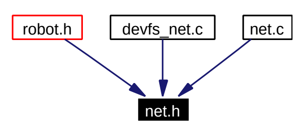
`#include <robot/types.h>`

`#include <robot/handle.h>`

Include dependency graph for net.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **robot_net_msg_t**

Enumerations

- enum {

  MSG_PING = 0xffffffff, **MSG_INIT** = 0x01, **MSG_SHUTDOWN** = 0x02, **MSG_-WAIT_FOR_CHANGE** = 0x03,

  MSG_LOCK_CTL = 0xff, **MSG_UNLOCK_CTL** = 0xfe, **MSG_GET_LOCK_-OWNER** = 0xfd, **MSG_ERROR** = 0x00 }

Functions

- int **robot_net_set_timeout** (**robot_handle_t** *handle, int32_t ms)

  Set the network timeout for the specified handle, in milliseconds.

- int **robot_net_find** (**robot_handle_t** **handles, uint32_t timeout_ms)

  Search for network-controllable robots on the local subnet.

- const char * **robot_get_ip_str** (const **robot_handle_t** *handle)

  Get a string containing the ip address of the robot pointed to by handle.

7.18.1 Detailed Description

Methods for setting up network control of robots.

Author:
Kris Beevers (beevek@cs.rpi.edu)

VersIdon:
net.h,v 1.7 2003/07/31 22:30:03 beevek Exp

In order to control a robot via the network, the netrobotd program must be running on it!

7.18.2 Enumeration Type Documentation

7.18.2.1 anonymous enum

special "devfs_types" that we send with hwid 0 to control netrobotd

Enumeration values:

MSG_PING udp only

MSG_INIT

MSG_SHUTDOWN

MSG_WAIT_FOR_CHANGE

MSG_LOCK_CTL

MSG_UNLOCK_CTL

MSG_GET_LOCK_OWNER

MSG_ERROR

7.18.3 Function Documentation

7.18.3.1 const char* robot_get_ip_str (const robot_handle_t * *handle*)

Get a string containing the ip address of the robot pointed to by handle.

Parameters:
handle A pointer to a network-controllable **robot_handle_t**

Returns:
Pointer to a STATICALLY allocated string containing the ip address. Do not attempt to deallocate this string. Note that it will be overwritten by subsequent calls.

7.18.3.2 int robot_net_find (robot_handle_t ** *handles*, uint32_t *timeout_ms*)

Search for network-controllable robots on the local subnet.

handles will be allocated and must be properly freed by the caller.

Note that after this call, robot_init must still be called with each handle to actually begin talking to the robot.

Parameters:

handles Pointer to a pointer that will be set the the memory location of an array of robot_-handle_t's that have been initialized with network information for discovered robots

timeout_ms The time to wait for robots to report after sending a discovery broadcast

Returns:

Number of discovered robots, zero if none are found; < 0 on failure.

7.18.3.3 int robot_net_set_timeout (robot_handle_t * *handle*, int32_t *ms*)

Set the network timeout for the specified handle, in milliseconds.

This will affect all read and write operations, as well as connection attempts.

Parameters:

handle Pointer to a robot handle

ms Time, in milliseconds, of timeout. If less than zero, the default timeout is used. If equal to zero, there is no timeout (operations will block forever). If greater than zero, exactly this value is used.

Returns:

< 0 on failure, >= 0 on success

7.19 include/robot/sensors.h File Reference

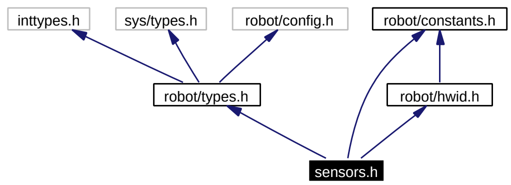
Send frequency commands to sensors and get sensor values (for sonar, ir, bump sensors).

`#include <robot/types.h>`

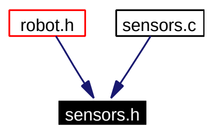
`#include <robot/constants.h>`

`#include <robot/hwid.h>`

Include dependency graph for sensors.h:



This graph shows which files directly or indirectly include this file:



Functions

- int **robot_force_reset_all_sensors** (void)

  Demand that all sensors stop firing regardless of what other processes have requested.

- int **robot_set_sensor_freq** (uint8_t hwid, **freq_val_t** freq)

  Generic method to set any sonar or ir sensor's frequency.

- int **robot_set_sonar_freq** (uint8_t hwid, **freq_val_t** freq)

  Set sonar firing frequency for the specified sonar hardware id.

- int **robot_set_all_sonar_freq** (**freq_val_t** freq)

  Set all sonar firing frequencies to the same value.

- int **robot_set_ir_freq** (uint8_t hwid, **freq_val_t** freq)

  Set infrared firing frequency for the specified ir hardware id.

- int **robot_set_all_ir_freq** (**freq_val_t** freq)

  Set all infrared firing frequencies to the same value.

- **sonar_val_t robot_get_sonar** (uint8_t hwid)

  Get current range value from a single sonar.

- int **robot_get_all_sonar** (**sonar_val_t** ranges[ROBOT_NUM_SONAR])

Place all current sonar ranges in a buffer.

- **ir_val_t robot_get_ir** (uint8_t hwid)

  Get current range value from a single ir sensor.

- int **robot_get_all_ir** (**ir_val_t** ranges[ROBOT_NUM_IR])

  Place all current infrared ranges in a buffer.

- **bump_val_t robot_get_bump** (uint8_t hwid)

  Get current bump toggle from a single bump sensor.

- int **robot_get_all_bump** (**bump_val_t** toggles[ROBOT_NUM_BUMP])

  Place all current bump toggle values in a buffer.

7.19.1 Detailed Description

Send frequency commands to sensors and get sensor values (for sonar, ir, bump sensors).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

sensors.h,v 1.4 2003/07/18 01:13:12 beevek Exp

Setting the frequency at which a sonar or ir sensor fires does not guarantee that the sensor will fire at exactly that frequency. Instead, it guarantees that the sensor will fire at AT LEAST that frequency. If the requested frequency is not possible, the sensor will fire as quickly as it is able.

To set the frequency of sonar number 3, for example, do: robot_set_sonar_freq(HW_SONAR03, frequency);

7.19.2 Function Documentation

7.19.2.1 int robot_force_reset_all_sensors (void)

Demand that all sensors stop firing regardless of what other processes have requested.

Returns:

< 0 on failure, >= 0 on success

7.19.2.2 int robot_get_all_bump (bump_val_t *toggles*[ROBOT_NUM_BUMP])

Place all current bump toggle values in a buffer.

Parameters:

toggles Array in which toggle values will be placed

Returns:

< 0 on failure, >= 0 otherwise

7.19.2.3 int robot_get_all_ir (ir_val_t *ranges*[ROBOT_NUM_IR])

Place all current infrared ranges in a buffer.

Parameters:
ranges Array in which range values will be placed

Returns:
<0 on failure, $>=0$ otherwise

7.19.2.4 int robot_get_all_sonar (sonar_val_t *ranges*[ROBOT_NUM_SONAR])

Place all current sonar ranges in a buffer.

Parameters:
ranges Array in which range values will be placed

Returns:
<0 on failure, $>=0$ otherwise

7.19.2.5 bump_val_t robot_get_bump (uint8_t *hwid*)

Get current bump toggle from a single bump sensor.

Parameters:
hwid A bump sensor hardware id from **hwid.h**

Returns:
Toggle value; 0 for off, nonzero for on

7.19.2.6 ir_val_t robot_get_ir (uint8_t *hwid*)

Get current range value from a single ir sensor.

Parameters:
hwid An ir hardware id from **hwid.h**

Returns:
An ir range; zero generally indicates a failure

7.19.2.7 sonar_val_t robot_get_sonar (uint8_t *hwid*)

Get current range value from a single sonar.

Parameters:
hwid A sonar hardware id from **hwid.h**

Returns:
A sonar range; zero generally indicates a failure

7.19.2.8 int robot_set_all_ir_freq (freq_val_t *freq*)

Set all infrared firing frequencies to the same value.

See also:
robot_set_sensor_freq

7.19.2.9 int robot_set_all_sonar_freq (freq_val_t *freq*)

Set all sonar firing frequencies to the same value.

See also:
robot_set_sensor_freq

7.19.2.10 int robot_set_ir_freq (uint8_t *hwid*, freq_val_t *freq*)

Set infrared firing frequency for the specified ir hardware id.

See also:
robot_set_sensor_freq

7.19.2.11 int robot_set_sensor_freq (uint8_t *hwid*, freq_val_t *freq*)

Generic method to set any sonar or ir sensor's frequency.

Parameters:
hwid A sonar or ir hardware id from **hwid.h**
freq A frequency in hertz

Returns:
< 0 on failure, >= 0 on success

7.19.2.12 int robot_set_sonar_freq (uint8_t *hwid*, freq_val_t *freq*)

Set sonar firing frequency for the specified sonar hardware id.

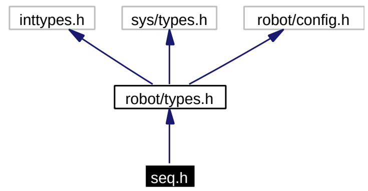
See also:
robot_set_sensor_freq

7.20 include/robot/seq.h File Reference

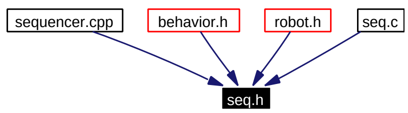
Remote control of reactive behaviors (through the sequencer).

`#include <robot/types.h>`

Include dependency graph for seq.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **bhv_connection_t**
- struct **bhv_data_t**
- struct **bhv_handle_t**
- struct **seq_msgbuf_t**

Defines

- #define **ROBOT_MAX_BHV_DATA_SIZE** 512
- #define **ROBOT_SEQ_QUEUE_KEY** 1
- #define **MSGBUF_BASE_SZ** (sizeof(uint8_t))

Enumerations

- enum {

  SEQ_LOAD = 0x00, **SEQ_ATTACH** = 0x01, **SEQ_UNLOAD** = 0x02, **SEQ_ERR** = 0x03,

  SEQ_LIST = 0x04, **BHV_INIT** = 0x10, **BHV_INHIBIT** = 0x11, **BHV_UNINHIBIT** = 0x12,

  BHV_CONNECT = 0x13, **BHV_DISCONNECT** = 0x14, **BHV_DATA** = 0x15 }

Functions

- **bhv_handle_t** * **seq_load** (const char *name)

  Load a reactive behavior and initialize it.

- **bhv_handle_t** * **seq_load_args** (const char *name, const char *args)

  Load a reactive behavior and pass it commandline arguments.

- **bhv_handle_t** * **seq_load_net** (const char *name, const char ***ip**, uint16_t **port**)

  Simple wrapper for seq_load_args that connects the behavior to a remote netrobotd.

- **bhv_handle_t** * **seq_attach** (const char *name)

  Get the handle of an already-running behavior.

- int **seq_unload** (**bhv_handle_t** *bhv)

  Unload a reactive behavior.

- int **seq_unload_all** (void)

  Unload all loaded behaviors.

- int **seq_inhibit** (**bhv_handle_t** *bhv)

  Inhibit ("pause") a behavior.

- int **seq_inhibit_all** (void)

  Inhibit all loaded behaviors.

- int **seq_uninhibit** (**bhv_handle_t** *bhv)

  Uninhibit ("unpause") a behavior.

- int **seq_uninhibit_all** (void)

  Uninhibit all loaded behaviors.

- int **seq_send** (**bhv_handle_t** *bhv, uint8_t key, const void *data, int size)

  Send (per-behavior) data directly to a behavior (without actually "connecting" to one of its inputs).

- int **seq_get** (uint8_t key, **bhv_data_t** *buf)

  Wait for a behavior to send data to us, with input key key.

- int **seq_connect** (const **bhv_connection_t** *conn)

  Connect an output of one behavior to an input of another.

- int **seq_disconnect** (const **bhv_connection_t** *conn)

  Disconnect an output of one behavior from an input of another.

- int **seq_get_my_handle** (**bhv_handle_t** *handle)

  Get a **bhv_handle_t** *representing the calling process, even if it isn't a behavior.*

7.20.1 Detailed Description

Remote control of reactive behaviors (through the sequencer).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

seq.h,v 1.10 2003/08/20 19:43:51 beevek Exp

7.20.2 Define Documentation

7.20.2.1 #define MSGBUF_BASE_SZ (sizeof(uint8_t))

7.20.2.2 #define ROBOT_MAX_BHV_DATA_SIZE 512

maximum size of data that can be read from or written to a behavior

7.20.2.3 #define ROBOT_SEQ_QUEUE_KEY 1

message queue key for sequencer

7.20.3 Enumeration Type Documentation

7.20.3.1 anonymous enum

commands to send as part of a **seq_msgbuf_t**

Enumeration values:

SEQ_LOAD

SEQ_ATTACH

SEQ_UNLOAD

SEQ_ERR

SEQ_LIST internal use only

BHV_INIT

BHV_INHIBIT

BHV_UNINHIBIT

BHV_CONNECT

BHV_DISCONNECT

BHV_DATA

7.20.4 Function Documentation

7.20.4.1 bhv_handle_t* seq_attach (const char * *name*)

Get the handle of an already-running behavior.

Looks for the oldest already-running behavior with the specified name. If the caller has sufficient permissions, returns a handle to the behavior.

Sets EACCES if caller does not have permission to control the previously loaded behavior.

Parameters:
name Name of the behavior to attach to

Returns:
Pointer to a behavior handle for the behavior, or null on failure

See also:
seq_load

7.20.4.2 int seq_connect (const bhv_connection_t * *conn*)

Connect an output of one behavior to an input of another.

If the specified output and input are valid, all data sent to the specified output by the behavior conn->from will be forwarded to the specified input of conn->to.

Parameters:
conn Pointer to a structure specifying the connection information

Returns:
< 0 on failure, >= 0 on success

7.20.4.3 int seq_disconnect (const bhv_connection_t * *conn*)

Disconnect an output of one behavior from an input of another.

If the specified output and input are valid, the behavior conn->from will no longer forward data from the specified output to the input of conn->to.

Parameters:
conn Pointer to a structure specifying the connection information

Returns:
< 0 on failure, >= 0 on success

7.20.4.4 int seq_get (uint8_t *key*, bhv_data_t * *buf*)

Wait for a behavior to send data to us, with input key key.

Used to get data in a non-behavior, from a behavior's output. This function will block until data arrives for the specified key. Note that no data will ever arrive unless seq_connect is called to connect a behavior to the caller (use seq_get_my_handle when setting this up).

Warning:
IMPORANT: Behaviors should not use this function, only external programs controlling behaviors!

Parameters:

key Input key of data

buf Data input buffer

Returns:

< 0 on failure, >= 0 on success

7.20.4.5 int seq_get_my_handle (bhv_handle_t * *handle*)

Get a **bhv_handle_t** representing the calling process, even if it isn't a behavior.

Useful for setting up a connection with a real behavior's outputs (see seq_get).

Parameters:

handle Pointer to a **bhv_handle_t** to be filled in

Returns:

< 0 on failure, >= 0 on success

7.20.4.6 int seq_inhibit (bhv_handle_t * *bhv*)

Inhibit ("pause") a behavior.

Tells a behavior to stop processing until it is told to "uninhibit" itself. When a behavior is inhibited, any data sent to its inputs is either queued or discarded, according to options set by the behavior itself.

Parameters:

bhv Behavior handle from seq_load

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_uninhibit

7.20.4.7 int seq_inhibit_all (void)

Inhibit all loaded behaviors.

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_inhibit

7.20.4.8 bhv_handle_t* seq_load (const char * *name*)

Load a reactive behavior and initialize it.

Sets the following errno's on failure:

EINVAL: unable to communicate with the sequencer

EBUSY: program has loaded the maximum number of allowed behaviors

ERANGE: the data being sent to the sequencer is too large (i.e. the cwd + name are too long)

If the calling program has performed a robot_init with a remote netrobotd, seq_load will connect the behavior to the same remote robot.

Parameters:

name Name of the behavior to load. The sequencer searches its internal path for a behavior of this name. If not found, the current working directory of the process that called seq_load is also searched. If still not found, the function fails.

Returns:

Pointer to a behavior handle for the behavior, or null on failure.

See also:

seq_unload seq_attach seq_load_args

7.20.4.9 bhv_handle_t* seq_load_args (const char * *name*, const char * *args*)

Load a reactive behavior and pass it commandline arguments.

Same as seq_load, but passes commandline arguments to the behavior. Note that all behaviors that use libbehavior will treat the first commandline argument as an ip address/dns name, and the second as a port, used to connect to a netrobotd. Using this to load a behavior causes the -i and -o arguements to the sequencer to NOT be sent to the behavior. Generally this function should not be used, unless you have a VERY GOOD REASON for passing arguments to your behavior (rather than sending them as an "input").

See also:

seq_load

7.20.4.10 bhv_handle_t* seq_load_net (const char * *name*, const char * *ip*, uint16_t *port*)

Simple wrapper for seq_load_args that connects the behavior to a remote netrobotd.

When you use this instead of seq_load, the -i and -o arguments to the sequencer are not passed to the behavior. This function can be used to connect the behavior to a different ip/port than the calling program is connected to.

Parameters:

name Name of the behavior to load (see seq_load)

ip IP address for the behavior to connect to

port Remote port for the behavior to connect to

See also:

seq_load seq_load_args

7.20.4.11 int seq_send (bhv_handle_t * *bhv*, uint8_t *key*, const void * *data*, int *size*)

Send (per-behavior) data directly to a behavior (without actually "connecting" to one of its inputs).

Generally this is some sort of structure defined in a header file for the specific behavior. The user is responsible for making sure this is the right kind of data to send to the behavior.

Sets ERANGE if the size of the data is larger than allowed.

Parameters:

bhv Behavior handle from seq_load

key Input key of bhv to send to

data Pointer to data buffer

size Size (in bytes) of data buffer

Returns:

< 0 on failure, >= 0 on success

7.20.4.12 int seq_uninhibit (bhv_handle_t * *bhv*)

Uninhibit ("unpause") a behavior.

Tells a behavior it may begin processing again if it is currently paused.

Parameters:

bhv Behavior handle from seq_load

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_inhibit

7.20.4.13 int seq_uninhibit_all (void)

Uninhibit all loaded behaviors.

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_uninhibit

7.20.4.14 int seq_unload (bhv_handle_t * *bhv*)

Unload a reactive behavior.

Basically just decrements a usage count for the behavior. When this count reaches zero, the behavior is completely unloaded from the system. Note that it is not strictly necessary to call this since usage counts for behaviors are automatically decremented when the calling program exits.

Parameters:

bhv Behavior handle from seq_load

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_load

7.20.4.15 int seq_unload_all (void)

Unload all loaded behaviors.

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_unload

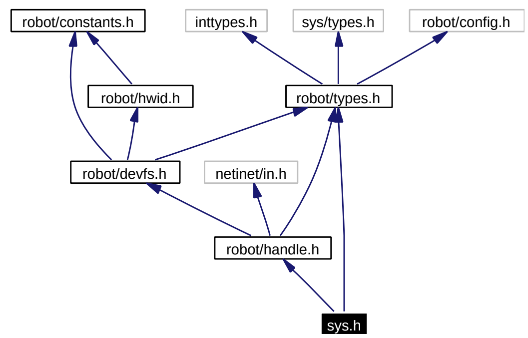
7.21 include/robot/sys.h File Reference

Robot system initialization and shutdown.

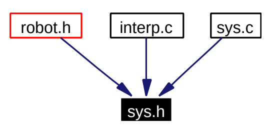
`#include <robot/types.h>`

`#include <robot/handle.h>`

Include dependency graph for sys.h:



This graph shows which files directly or indirectly include this file:



Defines

- #define **robot_init_local**(flags) robot_init(flags, 0, 0, 0)

  Initialize a local robot. Purely for convenience.

Enumerations

- enum **robot_init_flags_t** {

  RI_NO_SET_FREQS = (1 << 0), **RI_NO_HANDLE_SIGS** = (1 << 1), **RI_STOP_-ON_QUIT** = (1 << 2), **RI_DEVFS_READ_ALL** = (1 << 3),

  RI_USE_SEQUENCER = (1 << 4), **RI_NO_DEVFS** = (1 << 5), **RI_DEFAULT** = RI_STOP_ON_QUIT }

Functions

- int **robot_init** (uint32_t flags, **robot_handle_t** *handle, const char ***ip**, uint16_t **port**)

  Initialize the robot for use either locally or over a network.

- void **robot_shutdown** (void)

Shut down the robot currently in use.

- **robot_id_t robot_get_id** (void)

  Get the unique id number of the current robot.

- const char * **robot_get_name** (void)

  Get the name of the current robot.

7.21.1 Detailed Description

Robot system initialization and shutdown.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
Id: **sys.h**,v 1.9 2003/07/29 18:03:58 beevek Exp

7.21.2 Define Documentation

7.21.2.1 #define robot_init_local(flags) robot_init(flags, 0, 0, 0)

Initialize a local robot. Purely for convenience.

This just calls robot_init with null handle, ip and port arguments (i.e., it will only succeed if the program is running on the robot itself).

See also:
robot_init

7.21.3 Enumeration Type Documentation

7.21.3.1 enum robot_init_flags_t

flags to be passed to robot_init

Enumeration values:

RI_NO_SET_FREQS don't request default sonar/ir freqs

RI_NO_HANDLE_SIGS don't handle signals to shut down cleanly

RI_STOP_ON_QUIT set velocity to zero in robot_shutdown

RI_DEVFS_READ_ALL open all devfs entries with O_RDONLY

RI_USE_SEQUENCER enable loading/unloading of reactive behaviors

RI_NO_DEVFS do not initialize devfs entries

RI_DEFAULT default flags; most programs should use this

7.21.4 Function Documentation

7.21.4.1 robot_id_t robot_get_id (void)

Get the unique id number of the current robot.

Todo
FIXME implement

7.21.4.2 const char* robot_get_name (void)

Get the name of the current robot.

Todo
FIXME implement

7.21.4.3 int robot_init (uint32_t *flags*, robot_handle_t * *handle*, const char * *ip*, uint16_t *port*)

Initialize the robot for use either locally or over a network.

This function performs the following tasks:

If an ip address has been specified, or if ip information in the robot handle has already been filled in, initialize network communications

Set the current robot handle for all librobot functions to act on to be handle

If RI_NO_HANDLE_SIGS is not set, register signal handler for cleanly shutting down the robot on receipt of SIGINT, SIGQUIT, SIGTERM or SIGSEGV

Initialize the devfs subsystem (if RI_NO_DEVFS is not set)

Initialize sensors; if RI_NO_SET_FREQS is not set, request that all sensors fire at the default frequency

If RI_USE_SEQUENCER is set, initialize sequencer IPC

Parameters:

flags Initialization flags (robot_init_flags_t)

handle A handle to use in the initialization. This is only necessary if your program will be controlling more than one robot. The handle's values will be filled in by robot_init.

ip An ip address string telling us where to connect if the robot is to be controlled over the network. This should be null if the robot will be controlled locally, or if handle's network information has already been filled in elsewhere (such as robot_net_find).

port The remote port to connect to if ip is non-null (ignored otherwise). Usually, this should be ROBOT_DEFAULT_NET_PORT from **constants.h**.

7.21.4.4 void robot_shutdown (void)

Shut down the robot currently in use.

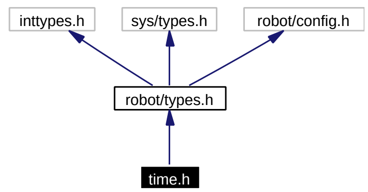
Uses the internal pointer to the current robot handle to decide which robot to shut down.

7.22 include/robot/time.h File Reference

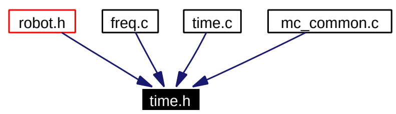
Precision timing methods for librobot.

`#include <robot/types.h>`

Include dependency graph for time.h:



This graph shows which files directly or indirectly include this file:



Defines

- #define **USEC_PER_SEC** 1000000
- #define **USEC_PER_MSEC** 1000
- #define **MSEC_PER_SEC** 1000
- #define **robot_time_to_float_sec**(rt) ((float)((double)(rt) / (double)USEC_PER_SEC))
- #define **robot_time_to_float_ms**(rt) ((float)((double)(rt) / (double)USEC_PER_MSEC))

Functions

- int **robot_get_time** (**robot_time_us_t** *time)

  Get the current time since the Unix epoch in microseconds.

- int **robot_sleep** (const **robot_time_us_t** *time)

  Sleep for the specified time (in microseconds).

- int **robot_alarm** (const **robot_time_us_t** *time)

  Set an alarm to go off after the specified time (in microseconds). Similar to alarm().

7.22.1 Detailed Description

Precision timing methods for librobot.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

time.h,v 1.4 2003/07/18 01:13:12 beevek Exp

It is useful to have very precise timing information for certain tasks on the robot. We'll do this timing using microseconds.

7.22.2 Define Documentation

7.22.2.1 #define MSEC_PER_SEC 1000

7.22.2.2 #define robot_time_to_float_ms(rt) ((float)((double)(rt) / (double)USEC_PER_MSEC))

convert robot time to a float representing milliseconds

7.22.2.3 #define robot_time_to_float_sec(rt) ((float)((double)(rt) / (double)USEC_PER_SEC))

convert robot time to a float representing seconds

7.22.2.4 #define USEC_PER_MSEC 1000

7.22.2.5 #define USEC_PER_SEC 1000000

7.22.3 Function Documentation

7.22.3.1 int robot_alarm (const robot_time_us_t * *time*)

Set an alarm to go off after the specified time (in microseconds). Similar to alarm().

Parameters:

time Pointer to a location with the time for the alarm

Returns:

< 0 on failure, >= 0 otherwise

7.22.3.2 int robot_get_time (robot_time_us_t * *time*)

Get the current time since the Unix epoch in microseconds.

Parameters:

time Pointer to a location to store the current time

Returns:

< 0 on failure, >= 0 otherwise

7.22.3.3 int robot_sleep (const robot_time_us_t * *time*)

Sleep for the specified time (in microseconds).

Parameters:

time Pointer to a location with the time to sleep

Returns:

< 0 on failure, >= 0 otherwise

7.23 include/robot/types.h File Reference

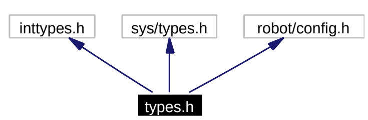
Global types and data sizes for robot software. Mostly for lower-level stuff.

`#include <inttypes.h>`

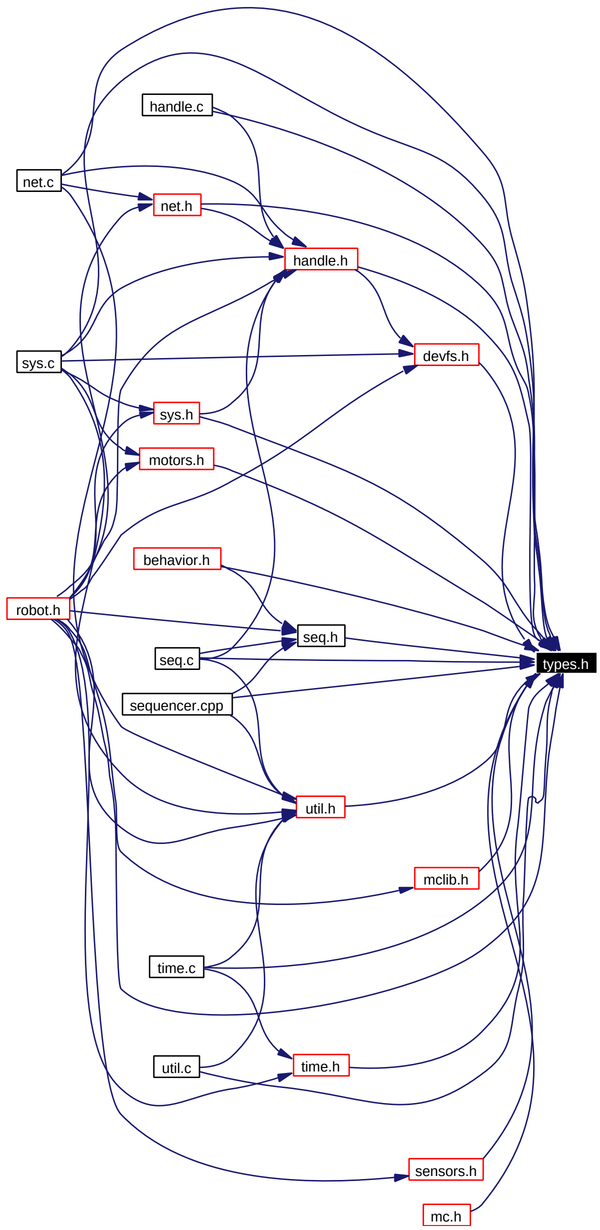
`#include <sys/types.h>`

`#include <robot/config.h>`

Include dependency graph for types.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **freq_req_val_t**

Defines

- #define **ROBOT_BYTE_ORDER** __BIG_ENDIAN

Typedefs

- typedef float **odom_val_t**
- typedef float **vel_val_t**
- typedef int16_t **encoder_val_t**
- typedef float **sonar_val_t**
- typedef float **ir_val_t**
- typedef uint8_t **bump_val_t**
- typedef float **freq_val_t**
- typedef int8_t **pwm_val_t**
- typedef uint16_t **sonar_time_val_t**
- typedef uint16_t **ir_voltage_val_t**
- typedef uint8_t **bump_bitfield_val_t**
- typedef uint8_t **hw_freq_val_t**
- typedef pid_t **owner_val_t**
- typedef uint64_t **robot_time_us_t**
- typedef uint32_t **robot_id_t**

7.23.1 Detailed Description

Global types and data sizes for robot software. Mostly for lower-level stuff.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version: Id:
types.h,v 1.16 2003/07/24 18:23:51 beevek Exp

7.23.2 Define Documentation

7.23.2.1 #define ROBOT_BYTE_ORDER __BIG_ENDIAN

powerpc

7.23.3 Typedef Documentation

7.23.3.1 typedef uint8_t bump_bitfield_val_t

7.23.3.2 typedef uint8_t bump_val_t

7.23.3.3 typedef int16_t encoder_val_t

7.23.3.4 typedef float freq_val_t

to ctl sonar/ir

7.23.3.5 typedef uint8_t hw_freq_val_t

freq sent to hw

7.23.3.6 typedef float ir_val_t

7.23.3.7 typedef uint16_t ir_voltage_val_t

7.23.3.8 typedef float odom_val_t

7.23.3.9 typedef pid_t owner_val_t

7.23.3.10 typedef int8_t pwm_val_t

7.23.3.11 typedef uint32_t robot_id_t

7.23.3.12 typedef uint64_t robot_time_us_t

7.23.3.13 typedef uint16_t sonar_time_val_t

7.23.3.14 typedef float sonar_val_t

7.23.3.15 typedef float vel_val_t

7.24 include/robot/util.h File Reference

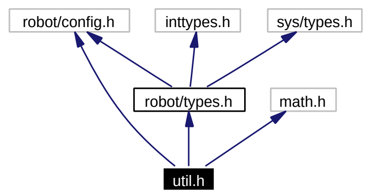
Miscellaneous utilities useful both internally to librobot and to external applications using it.

`#include <robot/config.h>`

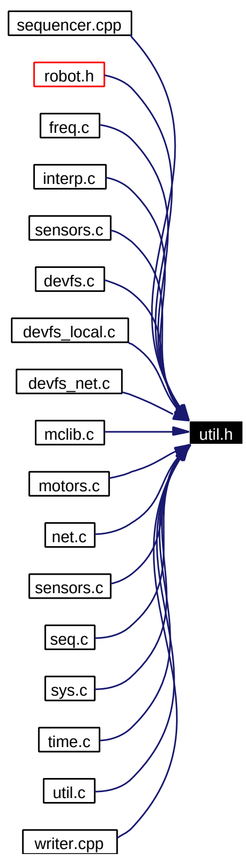
`#include <robot/types.h>`

`#include <math.h>`

Include dependency graph for util.h:



This graph shows which files directly or indirectly include this file:



Defines

- #define **robot_deg2rad**(a) ((a) $*$ M_PI / 180)

- #define **robot_rad2deg**(a) ((a) * 180 / M_PI)
- #define **robot_dprintf**(s...)
- #define **assert**(a)
- #define **robot_fix_byte_order**(buf, item_sz, n)

Functions

- **odom_val_t robot_sqdist** (**odom_val_t** x1, **odom_val_t** y1, **odom_val_t** x2, **odom_val_t** y2)

  Calculate squared distance between two points.

- **odom_val_t robot_dist** (**odom_val_t** x1, **odom_val_t** y1, **odom_val_t** x2, **odom_val_t** y2)

  Calculate distance between two points.

7.24.1 Detailed Description

Miscellaneous utilities useful both internally to librobot and to external applications using it.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

VersIdon:
util.h,v 1.9 2003/07/18 18:41:58 beevek Exp

7.24.2 Define Documentation

7.24.2.1 #define assert(a)

7.24.2.2 #define robot_deg2rad(a) ((a) * M_PI / 180)

degrees to radians

7.24.2.3 #define robot_dprintf(s...)

7.24.2.4 #define robot_fix_byte_order(buf, item_sz, n)

7.24.2.5 #define robot_rad2deg(a) ((a) * 180 / M_PI)

radians to degrees

7.24.3 Function Documentation

7.24.3.1 odom_val_t robot_dist (odom_val_t *x1*, odom_val_t *y1*, odom_val_t *x2*, odom_val_t *y2*)

Calculate distance between two points.

7.24.3.2 odom_val_t robot_sqdist (odom_val_t *x1*, odom_val_t *y1*, odom_val_t *x2*, odom_val_t *y2*)

Calculate squared distance between two points.

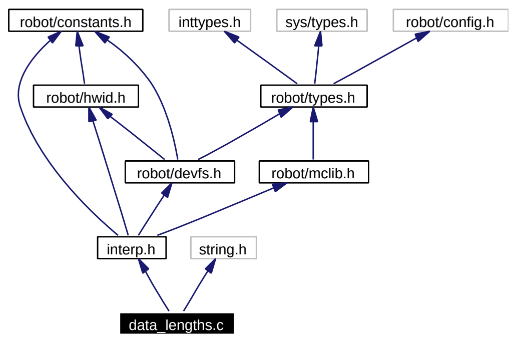
7.25 interp/data_lengths.c File Reference

Constants indicating the length of data to be sent/received from each type of device (through serial!).

`#include "interp.h"`

`#include <string.h>`

Include dependency graph for data_lengths.c:



Functions

- void **data_lengths_init** (void)

  Fill in the data_lengths array with proper values.

Variables

- **data_len_t data_lengths** [HW_MAX]

7.25.1 Detailed Description

Constants indicating the length of data to be sent/received from each type of device (through serial!).

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

Id: **data_lengths.c**,v 1.11 2003/07/18 15:27:22 beevek Exp

This assumes that every device only ever needs to send data of one type (length), and receive data of only one type (length).

7.25.2 Function Documentation

7.25.2.1 void data_lengths_init (void)

Fill in the data_lengths array with proper values.

7.25.3 Variable Documentation

7.25.3.1 data_len_t data_lengths[HW_MAX]

data sizes (in bytes) for sending/receiving from HW

7.26 interp/freq.c File Reference

Manage sensor "firing frequencies" according to requests by processes.

`#include "interp.h"`

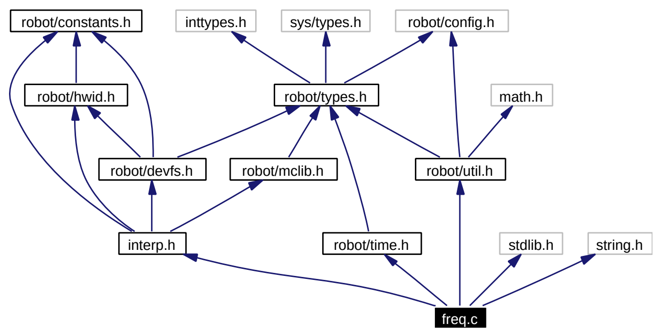
`#include <robot/util.h>`

`#include <robot/time.h>`

`#include <stdlib.h>`

`#include <string.h>`

Include dependency graph for freq.c:



Compounds

- struct **_freq_list_t**

Defines

- #define **freq_to_hw_freq**(f)

Typedefs

- typedef _freq_list_t **freq_list_t**

Functions

- int **freq_init** (void)

  Initialize our internal data related to maintaining proper frequencies.

- void **freq_cleanup** (void)

  Clean up the list of processes and their requested frequencies.

- int **freq_set** (uint8_t hwid, **freq_req_val_t** *req)

  Set the frequencies for a HWID based on a request from some robot-related process.

Variables

- **serial_cmd_t out_cmd**

7.26.1 Detailed Description

Manage sensor "firing frequencies" according to requests by processes.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
Id: **freq.c**,v 1.6 2003/07/31 22:30:03 beevek Exp

Here's how this works:

We have a linked list (freq_head) of structs that contain information about frequencies requested by each process that is currently running. Any process that requests the sensors to fire at a certain frequency gets added to this list, and is only removed when either:

1. the process with the same id requests frequencies of all zero 2. a process sending id 0 requests frequencies from any hwid. In this case the list is cleared and the frequencies from id 0 are used unconditionally. In general this should only be used to set all frequencies to zero.

This is kind of clunky but is what works best because of the /dev/robot interface.

Whenever the list or elements of it change, we re-examine it. If any of the requested frequencies are larger than those previously sent to the hardware, we send updates to the affected hardware. If the maximum frequency for a sensor is less than what the sensor is currently firing at, we send it.

This way, we are always firing sensors at the highest necessary frequency and no higher. This saves power while guaranteeing every process will get sensor readings as fast as it needs (or faster).

7.26.2 Define Documentation

7.26.2.1 #define freq_to_hw_freq(f)

Value:

```
(f) == 0 ? 0 : \
  (hw_freq_val_t)(100.0 / (f))
```

convert from a frequency in HZ to one that the hardware expects (basically a number indicating how many ms to wait between firing)

7.26.3 Typedef Documentation

7.26.3.1 typedef struct _freq_list_t freq_list_t

linked list containing frequency request information from each running robot process

7.26.4 Function Documentation

7.26.4.1 void freq_cleanup (void)

Clean up the list of processes and their requested frequencies.

This does not set any frequencies on the hardware.

7.26.4.2 int freq_init (void)

Initialize our internal data related to maintaining proper frequencies.

This does not actually set any frequencies on the hardware.

Returns:
-1 on failure, 0 on success

7.26.4.3 int freq_set (uint8_t *hwid*, freq_req_val_t * *req*)

Set the frequencies for a HWID based on a request from some robot-related process.

Returns:
< 0 on failure, >= 0 on success

Parameters:

hwid A hardware id from **hwid.h**

req A pointer to a frequency request.

7.26.5 Variable Documentation

7.26.5.1 serial_cmd_t out_cmd ()

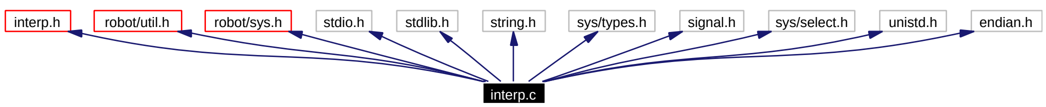
outgoing to serial

7.27 interp/interp.c File Reference

Interpreter: low-level communication interface between microcontrollers and higher-level software.

```
#include "interp.h"
#include <robot/util.h>
#include <robot/sys.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/types.h>
#include <signal.h>
#include <sys/select.h>
#include <unistd.h>
#include <endian.h>
```

Include dependency graph for interp.c:



Defines

- #define **printf**(s...) do { printf(s); fflush(stdout); } while(0)
- #define **MKUINT16**(a, b) (((uint16_t)a << 8) | (uint16_t)b)
- #define **read_or_fail**(buf)

Enumerations

- enum {

  OPT_RUN_BG = (1 << 0), **OPT_HIGH_PRIO** = (1 << 1), **OPT_DEVFS** = (1 << 2), **OPT_HW** = (1 << 3),

  OPT_HAVE_LOG = (1 << 4) }

Functions

- void **shutdown** (int sig)

  Signal handler, shut down gracefully.

- void **hw_dispatch** (void)

  Take a **serial_cmd_t** *from the hardware and handle it properly.*

- int **ctl_read_and_dispatch** (int fd, **devfs_set_t** ∗owner)
- void **loop_forever** (void)

Main program loop.

- int **parse_command_line** (int argc, char **argv)

  Parse the interp command line.

- int **make_daemon** (void)

  Become a daemon.

- int **main** (int argc, char **argv)

Variables

- char * **ihelp**
- **mc_lib_t mc_lib**
- **serial_cmd_t in_cmd**
- **serial_cmd_t out_cmd**

7.27.1 Detailed Description

Interpreter: low-level communication interface between microcontrollers and higher-level software.

Author:

Kris Beevers (beevek@cs.rpi.edu)

Version:

interp.c,v 1.32 2003/08/19 15:14:56 beevek Exp

7.27.2 Define Documentation

7.27.2.1 #define MKUINT16(a, b) (((uint16_t)a << 8) | (uint16_t)b)

for constructing uint16_t from 2 bytes sent by hw

7.27.2.2 #define printf(s...) do { printf(s); fflush(stdout); } while(0)

7.27.2.3 #define read_or_fail(buf)

Value:

```
do{ \
  if(read(fd, buf, sizeof(buf)) < 0) \
    return -1; \
  } while(0)
```

7.27.3 Enumeration Type Documentation

7.27.3.1 anonymous enum

cmd line options

Enumeration values:

OPT_RUN_BG run as a daemon

OPT_HIGH_PRIO attempt to run with nice -20

OPT_DEVFS talk to /dev/robot

OPT_HW talk to hardware

OPT_HAVE_LOG write somewhere other than stdout

7.27.4 Function Documentation

7.27.4.1 int ctl_read_and_dispatch (int *fd*, devfs_set_t * *owner*)

Determine which kind of command this is, read it, pack it up and send it to the right hw device (or do the right thing internally if it isn't meant for hw).

Returns:

< 0 on failure, >= 0 on success

Parameters:

fd file descriptor to read from

owner where in /dev/robot fd came from

7.27.4.2 void hw_dispatch (void)

Take a **serial_cmd_t** from the hardware and handle it properly.

IMPORTANT: the byte order on the microcontrollers is little endian and the byte order on powerpc is big endian. MKUINT16 handles this properly.

7.27.4.3 void loop_forever (void)

Main program loop.

Wait for data on hardware fds (serial) and /dev/robot fds, and handle it properly when it comes in. Never returns.

7.27.4.4 int main (int *argc*, char ** *argv*)

7.27.4.5 int make_daemon (void)

Become a daemon.

Close open files if necessary, or point them to some other place.

Returns:

< 0 on failure, >= 0 on success

7.27.4.6 int parse_command_line (int *argc*, char ** *argv*)

Parse the interp command line.

Print usage information if necessary.

Returns:
-1 on failure, 0 on success

Parameters:
argc main's argc
argv main's argv

7.27.4.7 void shutdown (int *sig*)

Signal handler, shut down gracefully.

7.27.5 Variable Documentation

7.27.5.1 char * ihelp

Initial value:

```
 "\n"
"-d          run as daemon\n"
"-p          high priority\n"
"-f          do not read/write from /dev/robot\n"
"-h          do not talk to hardware\n"
"-m <path>   use the specified motor control library (default ../mc/mc_pid.so)\n"
"-l <file>   print to this file instead of stdout\n"
```

Todo
FIXME: mc path

7.27.5.2 serial_cmd_t in_cmd

incoming from serial

7.27.5.3 mc_lib_t mc_lib

motor control library

7.27.5.4 serial_cmd_t out_cmd

outgoing to serial

7.28 interp/interp.h File Reference

Interpreter definitions.

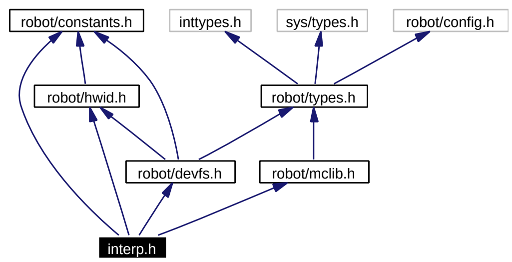
`#include <robot/constants.h>`

`#include <robot/hwid.h>`

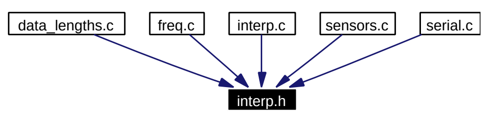
`#include <robot/devfs.h>`

`#include <robot/mclib.h>`

Include dependency graph for interp.h:



This graph shows which files directly or indirectly include this file:



Compounds

- struct **data_len_t**
- struct **serial_cmd_t**

Defines

- #define **HW_TIMEOUT** 2
- #define **DEFAULT_MC_LIB** "../mc/mc_pid.so"

Functions

- void **data_lengths_init** (void)

  Fill in the data_lengths array with proper values.

- int **serial_init** (const char *mc_tty)

  Initialize serial communications with hardware.

- int **serial_shutdown** (void)

  Shutdown the hardware communications and the serial device they go through.

- int **serial_read** (**serial_cmd_t** *cmd)

  Read a hardware data packet from the serial device.

- int **serial_write** (const **serial_cmd_t** *cmd)

  Write a data packet to the serial device.

- int **sens_init** (void)

  Initialize internal sensor data storage.

- void **sens_update_motors** (**encoder_val_t** enc_left, **encoder_val_t** enc_right, **pwm_val_t** pwm_left, **pwm_val_t** pwm_right)

  Send motor-related data to /dev/robot.

- void **sens_update_sonar** (uint8_t hwid, **sonar_time_val_t** time)

  Send sonar-related data to /dev/robot.

- void **sens_update_ir** (uint8_t hwid, **ir_voltage_val_t** voltage)

  Send ir-related data to /dev/robot.

- void **sens_update_bump** (**bump_bitfield_val_t** bits)

  Send bump-related data to /dev/robot.

- int **freq_init** (void)

  Initialize our internal data related to maintaining proper frequencies.

- void **freq_cleanup** (void)

  Clean up the list of processes and their requested frequencies.

- int **freq_set** (uint8_t hwid, **freq_req_val_t** *req)

  Set the frequencies for a HWID based on a request from some robot-related process.

Variables

- **mc_lib_t mc_lib**
- **data_len_t data_lengths** [HW_MAX]
- **odom_val_t odom** [3]

7.28.1 Detailed Description

Interpreter definitions.

Author:

Kris Beevers (beevek@cs.rpi.edu)

Version:

Id: **interp.h**,v 1.16 2003/07/18 01:13:12 beevek Exp

7.28.2 Define Documentation

7.28.2.1 #define DEFAULT_MC_LIB "../mc/mc_pid.so"

Todo

FIXME

7.28.2.2 #define HW_TIMEOUT 2

timeout for initializing and shutting down microcontroller (seconds)

7.28.3 Function Documentation

7.28.3.1 void data_lengths_init (void)

Fill in the data_lengths array with proper values.

7.28.3.2 void freq_cleanup (void)

Clean up the list of processes and their requested frequencies.

This does not set any frequencies on the hardware.

7.28.3.3 int freq_init (void)

Initialize our internal data related to maintaining proper frequencies.

This does not actually set any frequencies on the hardware.

Returns:

-1 on failure, 0 on success

7.28.3.4 int freq_set (uint8_t *hwid*, freq_req_val_t * *req*)

Set the frequencies for a HWID based on a request from some robot-related process.

Returns:

< 0 on failure, >= 0 on success

Parameters:

hwid A hardware id from **hwid.h**

req A pointer to a frequency request.

7.28.3.5 int sens_init (void)

Initialize internal sensor data storage.

Returns:

-1 on failure, 0 on success

7.28.3.6 void sens_update_bump (bump_bitfield_val_t *bits*)

Send bump-related data to /dev/robot.

Parameters:

bits A bitfield indicating which bump sensors are toggled

7.28.3.7 void sens_update_ir (uint8_t *hwid*, ir_voltage_val_t *voltage*)

Send ir-related data to /dev/robot.

Parameters:

hwid A ir hardware id from **hwid.h**

voltage Voltage sent by the hardware

7.28.3.8 void sens_update_motors (encoder_val_t *enc_left*, encoder_val_t *enc_right*, pwm_val_t *left_pwm*, pwm_val_t *right_pwm*)

Send motor-related data to /dev/robot.

This includes encoder, pwm, velocity and odometry data. This function calls motor control library functions to get the current values for velocity and odometry.

Parameters:

enc_left encoder count for left motor

enc_right encoder count for right motor

left_pwm pwm count for left motor

right_pwm pwm count for right motor

7.28.3.9 void sens_update_sonar (uint8_t *hwid*, sonar_time_val_t *time*)

Send sonar-related data to /dev/robot.

Parameters:

hwid A sonar hardware id from **hwid.h**

time Hardware-calculated time of a sonar ping

7.28.3.10 int serial_init (const char * *mc_tty*)

Initialize serial communications with hardware.

Opens the serial device and sends an initialize command to the hardware, and then waits for a proper response. Sets errno appropriately on failure; in particular, sets EPROTO if the serial device initialized properly but the hardware sent back improper data in response to the initialization command.

Returns:

< 0 on failure, >= 0 on success

Parameters:

mc_tty string path to the tty device to connect to

7.28.3.11 int serial_read (serial_cmd_t * *cmd*)

Read a hardware data packet from the serial device.

Sets errno appropriately; in particular, sets EBADF if the serial device has not been properly initialized, and sets ENODATA if the timeout expires before data is available on the serial port.

Returns:
< 0 on failure, >= 0 on success

Parameters:
cmd A pointer to a **serial_cmd_t** where the data will be placed

7.28.3.12 int serial_shutdown (void)

Shutdown the hardware communications and the serial device they go through.

Returns:
-1 on failure, 0 on success

7.28.3.13 int serial_write (const serial_cmd_t * *cmd*)

Write a data packet to the serial device.

Sets errno to EBADF if serial device not initialized.

Returns:
< 0 on failure, >= 0 on success

Parameters:
cmd A pointer to a **serial_cmd_t** containing the data to send

7.28.4 Variable Documentation

7.28.4.1 data_len_t data_lengths[HW_MAX] ()

data sizes (in bytes) for sending/receiving from HW

7.28.4.2 mc_lib_t mc_lib ()

motor control library

7.28.4.3 odom_val_t odom[3] ()

odometry information

7.29 interp/sensors.c File Reference

Sensor data management.

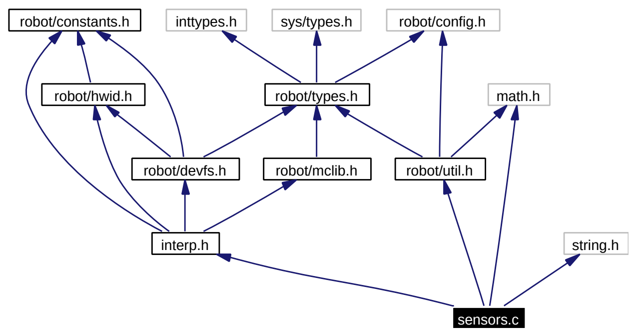
`#include "interp.h"`

`#include <robot/util.h>`

`#include <math.h>`

`#include <string.h>`

Include dependency graph for sensors.c:



Functions

- int **sens_init** (void)

  Initialize internal sensor data storage.

- void **sens_update_motors** (**encoder_val_t** enc_left, **encoder_val_t** enc_right, **pwm_val_t** left_pwm, **pwm_val_t** right_pwm)

  Send motor-related data to /dev/robot.

- void **sens_update_sonar** (uint8_t hwid, **sonar_time_val_t** time)

  Send sonar-related data to /dev/robot.

- void **sens_update_ir** (uint8_t hwid, **ir_voltage_val_t** voltage)

  Send ir-related data to /dev/robot.

- void **sens_update_bump** (**bump_bitfield_val_t** bits)

  Send bump-related data to /dev/robot.

Variables

- **encoder_val_t enc** [2]
- **pwm_val_t pwm** [2]
- **odom_val_t odom** [3]
- **vel_val_t vel** [2]
- **sonar_val_t sonar** [ROBOT_NUM_SONAR]

- **ir_val_t ir** [ROBOT_NUM_IR]
- **bump_val_t bump** [ROBOT_NUM_BUMP]

7.29.1 Detailed Description

Sensor data management.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
Id
sensors.c,v 1.15 2003/07/18 15:27:22 beevek Exp

Data from sensors, including: velocities/encoder counts, pwm counts, odometry, sonar, ir, bump; and methods for updating the data throughout the system.

7.29.2 Function Documentation

7.29.2.1 int sens_init (void)

Initialize internal sensor data storage.

Returns:
-1 on failure, 0 on success

7.29.2.2 void sens_update_bump (bump_bitfield_val_t *bits*)

Send bump-related data to /dev/robot.

Parameters:
bits A bitfield indicating which bump sensors are toggled

7.29.2.3 void sens_update_ir (uint8_t *hwid*, ir_voltage_val_t *voltage*)

Send ir-related data to /dev/robot.

Parameters:
hwid A ir hardware id from **hwid.h**
voltage Voltage sent by the hardware

7.29.2.4 void sens_update_motors (encoder_val_t *enc_left*, encoder_val_t *enc_right*, pwm_val_t *left_pwm*, pwm_val_t *right_pwm*)

Send motor-related data to /dev/robot.

This includes encoder, pwm, velocity and odometry data. This function calls motor control library functions to get the current values for velocity and odometry.

Parameters:
- ***enc_left*** encoder count for left motor
- ***enc_right*** encoder count for right motor
- ***left_pwm*** pwm count for left motor
- ***right_pwm*** pwm count for right motor

7.29.2.5 void sens_update_sonar (uint8_t *hwid*, sonar_time_val_t *time*)

Send sonar-related data to /dev/robot.

Parameters:
- ***hwid*** A sonar hardware id from **hwid.h**
- ***time*** Hardware-calculated time of a sonar ping

7.29.3 Variable Documentation

7.29.3.1 bump_val_t bump[ROBOT_NUM_BUMP]

bump sensor toggles

7.29.3.2 encoder_val_t enc[2]

encoder counts

7.29.3.3 ir_val_t ir[ROBOT_NUM_IR]

ir readings

7.29.3.4 odom_val_t odom[3]

odometry information

7.29.3.5 pwm_val_t pwm[2]

pwm counts

7.29.3.6 sonar_val_t sonar[ROBOT_NUM_SONAR]

sonar readings

7.29.3.7 vel_val_t vel[2]

velocity information

7.30 librobot/sensors.c File Reference

Implementation of methods from **sensors.h**.

`#include <robot/sensors.h>`

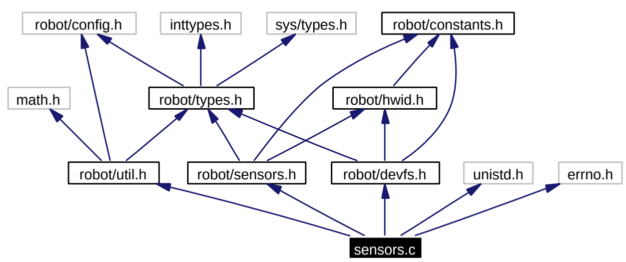
`#include <robot/devfs.h>`

`#include <robot/util.h>`

`#include <unistd.h>`

`#include <errno.h>`

Include dependency graph for sensors.c:



Functions

- int **sensors_init** (int set_default_freq)

  Internal use only.

- int **sensors_shutdown** (void)

  Internal use only.

- int **robot_force_reset_all_sensors** (void)

  Demand that all sensors stop firing regardless of what other processes have requested.

- int **robot_set_sensor_freq** (uint8_t hwid, **freq_val_t** freq)

  Generic method to set any sonar or ir sensor's frequency.

- int **robot_set_sonar_freq** (uint8_t hwid, **freq_val_t** freq)

  Set sonar firing frequency for the specified sonar hardware id.

- int **robot_set_all_sonar_freq** (**freq_val_t** freq)

  Set all sonar firing frequencies to the same value.

- int **robot_set_ir_freq** (uint8_t hwid, **freq_val_t** freq)

  Set infrared firing frequency for the specified ir hardware id.

- int **robot_set_all_ir_freq** (**freq_val_t** freq)

  Set all infrared firing frequencies to the same value.

- **sonar_val_t robot_get_sonar** (uint8_t hwid)

Get current range value from a single sonar.

- int **robot_get_all_sonar** (**sonar_val_t** ranges[ROBOT_NUM_SONAR])
  Place all current sonar ranges in a buffer.
- **ir_val_t robot_get_ir** (uint8_t hwid)
  Get current range value from a single ir sensor.
- int **robot_get_all_ir** (**ir_val_t** ranges[ROBOT_NUM_IR])
  Place all current infrared ranges in a buffer.
- **bump_val_t robot_get_bump** (uint8_t hwid)
  Get current bump toggle from a single bump sensor.
- int **robot_get_all_bump** (**bump_val_t** toggles[ROBOT_NUM_BUMP])
  Place all current bump toggle values in a buffer.

Variables

- int **errno**

7.30.1 Detailed Description

Implementation of methods from **sensors.h**.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id: sensors.c,v 1.13 2003/07/18 15:27:22 beevek Exp

7.30.2 Function Documentation

7.30.2.1 int robot_force_reset_all_sensors (void)

Demand that all sensors stop firing regardless of what other processes have requested.

Returns:
< 0 on failure, >= 0 on success

7.30.2.2 int robot_get_all_bump (bump_val_t *toggles*[ROBOT_NUM_BUMP])

Place all current bump toggle values in a buffer.

Parameters:
toggles Array in which toggle values will be placed

Returns:
< 0 on failure, >= 0 otherwise

7.30.2.3 int robot_get_all_ir (ir_val_t *ranges*[ROBOT_NUM_IR])

Place all current infrared ranges in a buffer.

Parameters:
ranges Array in which range values will be placed

Returns:
< 0 on failure, >= 0 otherwise

7.30.2.4 int robot_get_all_sonar (sonar_val_t *ranges*[ROBOT_NUM_SONAR])

Place all current sonar ranges in a buffer.

Parameters:
ranges Array in which range values will be placed

Returns:
< 0 on failure, >= 0 otherwise

7.30.2.5 bump_val_t robot_get_bump (uint8_t *hwid*)

Get current bump toggle from a single bump sensor.

Parameters:
hwid A bump sensor hardware id from **hwid.h**

Returns:
Toggle value; 0 for off, nonzero for on

7.30.2.6 ir_val_t robot_get_ir (uint8_t *hwid*)

Get current range value from a single ir sensor.

Parameters:
hwid An ir hardware id from **hwid.h**

Returns:
An ir range; zero generally indicates a failure

7.30.2.7 sonar_val_t robot_get_sonar (uint8_t *hwid*)

Get current range value from a single sonar.

Parameters:
hwid A sonar hardware id from **hwid.h**

Returns:
A sonar range; zero generally indicates a failure

7.30.2.8 int robot_set_all_ir_freq (freq_val_t *freq*)

Set all infrared firing frequencies to the same value.

See also:
robot_set_sensor_freq

7.30.2.9 int robot_set_all_sonar_freq (freq_val_t *freq*)

Set all sonar firing frequencies to the same value.

See also:
robot_set_sensor_freq

7.30.2.10 int robot_set_ir_freq (uint8_t *hwid*, freq_val_t *freq*)

Set infrared firing frequency for the specified ir hardware id.

See also:
robot_set_sensor_freq

7.30.2.11 int robot_set_sensor_freq (uint8_t *hwid*, freq_val_t *freq*)

Generic method to set any sonar or ir sensor's frequency.

Parameters:
hwid A sonar or ir hardware id from **hwid.h**
freq A frequency in hertz

Returns:
< 0 on failure, >= 0 on success

7.30.2.12 int robot_set_sonar_freq (uint8_t *hwid*, freq_val_t *freq*)

Set sonar firing frequency for the specified sonar hardware id.

See also:
robot_set_sensor_freq

7.30.2.13 int sensors_init (int *set_default_freq*)

Internal use only.

Initialize the sensor subsystem.

Parameters:
set_default_freq If nonzero, request default frequencies from all range sensors

Returns:
< 0 on failure, >= 0 otherwise

7.30.2.14 int sensors_shutdown (void)

Internal use only.

Shut down the sensor subsystem. Remove all frequency requests from this process.

Returns:

< 0 on failure, >= 0 otherwise

7.30.3 Variable Documentation

7.30.3.1 int errno

7.31 interp/serial.c File Reference

Serial communication with microcontrollers controlling sensor devices and motors.

`#include <sys/types.h>`

`#include <termios.h>`

`#include <fcntl.h>`

`#include <unistd.h>`

`#include <string.h>`

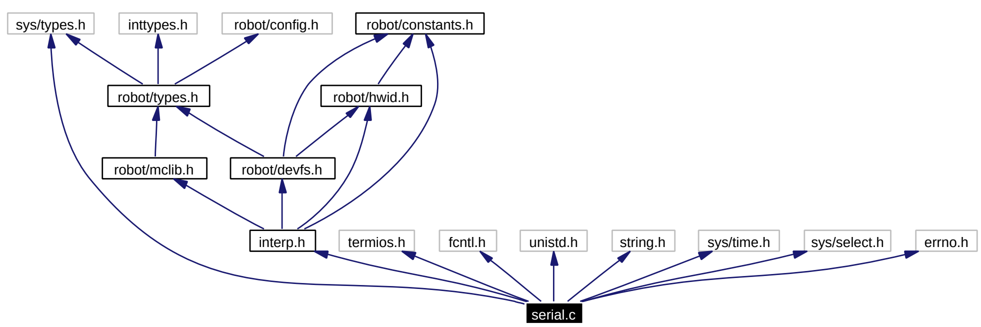
`#include <sys/time.h>`

`#include <sys/select.h>`

`#include <errno.h>`

`#include "interp.h"`

Include dependency graph for serial.c:



Functions

- int **serial_init** (const char *mc_tty)

  Initialize serial communications with hardware.

- int **serial_shutdown** (void)

  Shutdown the hardware communications and the serial device they go through.

- int **serial_read** (**serial_cmd_t** *cmd)

  Read a hardware data packet from the serial device.

- int **serial_write** (const **serial_cmd_t** *cmd)

  Write a data packet to the serial device.

7.31.1 Detailed Description

Serial communication with microcontrollers controlling sensor devices and motors.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
serial.c,v 1.12 2003/07/18 01:13:12 beevek Exp

This code assumes a baud rate of 115200.

7.31.2 Function Documentation

7.31.2.1 int serial_init (const char * *mc_tty*)

Initialize serial communications with hardware.

Opens the serial device and sends an initialize command to the hardware, and then waits for a proper response. Sets errno appropriately on failure; in particular, sets EPROTO if the serial device initialized properly but the hardware sent back improper data in response to the initialization command.

Returns:
< 0 on failure, >= 0 on success

Parameters:
mc_tty string path to the tty device to connect to

7.31.2.2 int serial_read (serial_cmd_t * *cmd*)

Read a hardware data packet from the serial device.

Sets errno appropriately; in particular, sets EBADF if the serial device has not been properly initialized, and sets ENODATA if the timeout expires before data is available on the serial port.

Returns:
< 0 on failure, >= 0 on success

Parameters:
cmd A pointer to a **serial_cmd_t** where the data will be placed

7.31.2.3 int serial_shutdown (void)

Shutdown the hardware communications and the serial device they go through.

Returns:
-1 on failure, 0 on success

7.31.2.4 int serial_write (const serial_cmd_t * *cmd*)

Write a data packet to the serial device.

Sets errno to EBADF if serial device not initialized.

Returns:

< 0 on failure, >= 0 on success

Parameters:

cmd A pointer to a **serial_cmd_t** containing the data to send

7.32 librobot/devfs.c File Reference

/dev/robot management and communication.

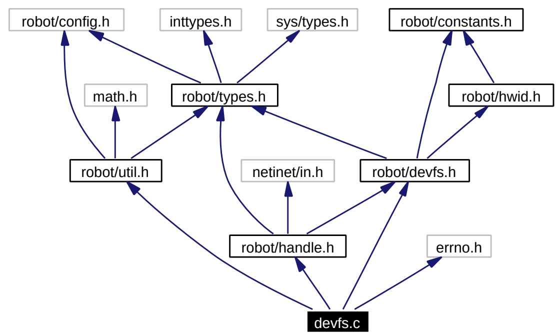
`#include <robot/devfs.h>`

`#include <robot/handle.h>`

`#include <robot/util.h>`

`#include <errno.h>`

Include dependency graph for devfs.c:



Functions

- int **devfs_loc_init** (int)
- void **devfs_loc_cleanup** (void)
- int **devfs_loc_write** (**devfs_set_t** *, const void *, int)
- int **devfs_loc_read** (**devfs_set_t** *, **devfs_type_t**, void *, int)
- int **devfs_loc_wait_for_change** (uint8_t *, int)
- int **devfs_loc_lock_ctl** (**devfs_set_t** *, uint32_t)
- int **devfs_loc_unlock_ctl** (**devfs_set_t** *, uint32_t)
- int **devfs_loc_get_lock_owner** (**devfs_set_t** *)
- int **devfs_net_init** (int)
- void **devfs_net_cleanup** (void)
- int **devfs_net_write** (**devfs_set_t** *, const void *, int)
- int **devfs_net_read** (**devfs_set_t** *, **devfs_type_t**, void *, int)
- int **devfs_net_wait_for_change** (uint8_t *, int)
- int **devfs_net_lock_ctl** (**devfs_set_t** *, uint32_t)
- int **devfs_net_unlock_ctl** (**devfs_set_t** *, uint32_t)
- int **devfs_net_get_lock_owner** (**devfs_set_t** *)
- int **devfs_init** (int flags)

  Initialize the devfs subsystem.

- void **devfs_cleanup** (void)

  De-initialize the devfs subsystem.

- int **devfs_write** (**devfs_set_t** *set, const void *buf, int count)

  Write the data in buf to any of set's open file descriptors that are opened for writing.

- int **devfs_read** (**devfs_set_t** *set, **devfs_type_t** type, void *buf, int count)

  Read count bytes into buf from set's file descriptor matching the specified devfs_type_t.

- int **devfs_wait_for_change** (uint8_t ***hwids**, int count)

  Wait until new data arrives on the change device for one of the hardware ids in hwids.

- int **devfs_lock_ctl** (**devfs_set_t** *set, uint32_t prio)

  Lock the ctl entry for a hardware device.

- int **devfs_unlock_ctl** (**devfs_set_t** *set, uint32_t prio)

  Unlock the ctl entry for a hardware device.

- int **devfs_get_lock_owner** (**devfs_set_t** *set)

  Get the pid of the owner of the current lock on a devfs ctl entry, if one is set.

- **devfs_set_t** * **devfs_find** (uint8_t hwid)

  Find the **devfs_set_t** *for the specified hardware id in the current robot's devfs_fds list.*

- int **devfs_get_data_size** (uint8_t hwid, **devfs_type_t** type)

  Figure out the size of the data to read or write from the /dev/robot entry matching hwid and type.

Variables

- int **errno**

7.32.1 Detailed Description

/dev/robot management and communication.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

Id:

devfs.c,v 1.15 2003/07/31 22:30:03 beevek Exp

Supports talking to the /dev/robot entries both locally and via the network; this file mostly just decides which "real" function (local or networked) to call.

Actually implements just devfs_get_data_size and devfs_find.

7.32.2 Function Documentation

7.32.2.1 void devfs_cleanup (void)

De-initialize the devfs subsystem.

7.32.2.2 devfs_set_t* devfs_find (uint8_t *hwid*)

Find the **devfs_set_t** for the specified hardware id in the current robot's devfs_fds list.

Parameters:

hwid A hardware id from **hwid.h**

Returns:

A pointer to the **devfs_set_t** matching hwid from the current robot's devfs_fds list

7.32.2.3 int devfs_get_data_size (uint8_t *hwid*, devfs_type_t *type*)

Figure out the size of the data to read or write from the /dev/robot entry matching hwid and type.

Parameters:

hwid A hardware id from **hwid.h**

type The type of device

Returns:

Data size for the device, or zero on failure (no matching device exists)

7.32.2.4 int devfs_get_lock_owner (devfs_set_t * *set*)

Get the pid of the owner of the current lock on a devfs ctl entry, if one is set.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to get the lock owner of

Returns:

<0 on failure or if no lock is set, and the pid of the process owning the lock otherwise

7.32.2.5 int devfs_init (int *flags*)

Initialize the devfs subsystem.

Parameters:

flags A bitfield of flags to control the initialization

Returns:

<0 on failure, $>=0$ on success

7.32.2.6 void devfs_loc_cleanup (void)

7.32.2.7 int devfs_loc_get_lock_owner (devfs_set_t *)

7.32.2.8 int devfs_loc_init (int)

7.32.2.9 int devfs_loc_lock_ctl (devfs_set_t *, uint32_t)

7.32.2.10 int devfs_loc_read (devfs_set_t *, devfs_type_t, void *, int)

7.32.2.11 int devfs_loc_unlock_ctl (devfs_set_t *, uint32_t)

7.32.2.12 int devfs_loc_wait_for_change (uint8_t *, int)

7.32.2.13 int devfs_loc_write (devfs_set_t *, const void *, int)

7.32.2.14 int devfs_lock_ctl (devfs_set_t * *set*, uint32_t *prio*)

Lock the ctl entry for a hardware device.

If the priority is higher than that for the current owner of a lock on the device, or if no lock currently exists, the requester is granted exclusive write access to the device and only a higher-priority lock or unlock request will be granted.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to set the lock on

prio The priority of the lock; the lower this value, the higher the lock priority. In general, DEVFS_PRIO_NORMAL should be used.

Returns:

< 0 on failure, >= 0 on success

7.32.2.15 void devfs_net_cleanup (void)

7.32.2.16 int devfs_net_get_lock_owner (devfs_set_t *)

7.32.2.17 int devfs_net_init (int)

7.32.2.18 int devfs_net_lock_ctl (devfs_set_t *, uint32_t)

7.32.2.19 int devfs_net_read (devfs_set_t *, devfs_type_t, void *, int)

7.32.2.20 int devfs_net_unlock_ctl (devfs_set_t *, uint32_t)

7.32.2.21 int devfs_net_wait_for_change (uint8_t *, int)

7.32.2.22 int devfs_net_write (devfs_set_t *, const void *, int)

7.32.2.23 int devfs_read (devfs_set_t * *set*, devfs_type_t *type*, void * *buf*, int *count*)

Read count bytes into buf from set's file descriptor matching the specified devfs_type_t.

You can only read data of exactly the correct size from a /dev/robot device, otherwise the read will fail.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to read from

type The device type from the set to read from

buf Buffer in which the data will be placed

count Number of bytes to read

Returns:

$<$ 0 on failure, $>=$ 0 on success

7.32.2.24 int devfs_unlock_ctl (devfs_set_t * *set*, uint32_t *prio*)

Unlock the ctl entry for a hardware device.

If the priority is higher than that for the current owner of a lock on the device, or the requester is the owner of the lock, then the lock is removed and any process can write to the device.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to unlock

prio The priority of the lock; the lower this value, the higher the lock priority. In general, DEVFS_PRIO_NORMAL should be used.

Returns:

$<$ 0 on failure, $>=$ 0 on success

7.32.2.25 int devfs_wait_for_change (uint8_t * *hwids*, int *count*)

Wait until new data arrives on the change device for one of the hardware ids in hwids.

This function will block until the /dev/robot/.../change entry for one of the specified hwids has data waiting to be read. Note that if you have never read data from the change device before, data will be waiting.

Parameters:

hwids An array of hardware ids from **hwid.h**

count The size of the hwids array (number of hwids)

Returns:

$<$ 0 on failure, $>=$ 0 on success

7.32.2.26 int devfs_write (devfs_set_t * *set*, const void * *buf*, int *count*)

Write the data in buf to any of set's open file descriptors that are opened for writing.

You can only write data of exactly the correct size to a /dev/robot device, otherwise the write will fail.

Parameters:

set The **devfs_set_t** from the current robot's devfs_fds list to write to

buf Buffer containing the data to write

count Number of bytes to write

Returns:

$<$ 0 on failure, $>=$ 0 on success

7.32.3 Variable Documentation

7.32.3.1 int errno

7.33 librobot/devfs_local.c File Reference

devfs_∗ functions for talking to a local /dev/robot filesystem.

`#include <robot/devfs.h>`

`#include <robot/handle.h>`

`#include <robot/util.h>`

`#include <stdio.h>`

`#include <string.h>`

`#include <fcntl.h>`

`#include <unistd.h>`

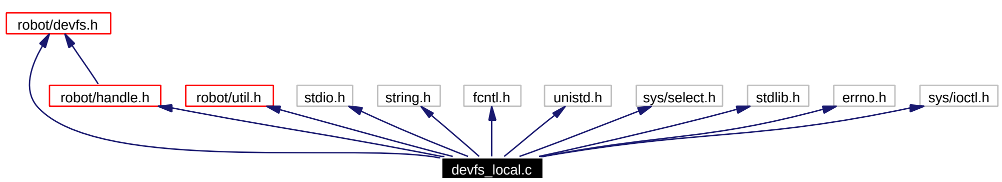
`#include <sys/select.h>`

`#include <stdlib.h>`

`#include <errno.h>`

`#include <sys/ioctl.h>`

Include dependency graph for devfs_local.c:



Defines

- #define **DNFMT** "/dev/%s/%s"
- #define **set_or_fail**(f, dir, type, flags)
- #define **init_dir_fail**(a, b, c, d)

Functions

- int **devfs_loc_init** (int flags)
- void **devfs_loc_cleanup** (void)
- int **devfs_loc_write** (**devfs_set_t** ∗set, const void ∗buf, int count)
- int **devfs_loc_read** (**devfs_set_t** ∗set, **devfs_type_t** type, void ∗buf, int count)
- int **devfs_loc_wait_for_change** (uint8_t ∗**hwids**, int count)
- int **devfs_loc_lock_ctl** (**devfs_set_t** ∗set, uint32_t prio)
- int **devfs_loc_unlock_ctl** (**devfs_set_t** ∗set, uint32_t prio)
- int **devfs_loc_get_lock_owner** (**devfs_set_t** ∗set)

Variables

- int **errno**

7.33.1 Detailed Description

devfs_* functions for talking to a local /dev/robot filesystem.

Author:

Kris Beevers (beevek@cs.rpi.edu)

Version:

devfs_local.c,v 1.7 2003/08/01 15:30:43 beevek Exp

In other words, reads/writes from/to /dev/robot on the same computer as the program.

7.33.2 Define Documentation

7.33.2.1 #define DNFMT "/dev/%s/%s"

7.33.2.2 #define init_dir_fail(a, b, c, d)

Value:

```
do { \
    if(devfs_init_dir(a,b,c,d,flags) < 0) { \
      robot_dprintf("failed initializing %s\n", c); \
      return -1; \
    } \
  } while(0)
```

7.33.2.3 #define set_or_fail(f, dir, type, flags)

Value:

```
do { \
  if((f = open_dev(dir, type, flags)) < 0) \
    return f; \
} while(0);
```

7.33.3 Function Documentation

7.33.3.1 void devfs_loc_cleanup (void)

7.33.3.2 int devfs_loc_get_lock_owner (devfs_set_t * *set*)

7.33.3.3 int devfs_loc_init (int *flags*)

7.33.3.4 int devfs_loc_lock_ctl (devfs_set_t * *set*, uint32_t *prio*)

7.33.3.5 int devfs_loc_read (devfs_set_t * *set*, devfs_type_t *type*, void * *buf*, int *count*)

7.33.3.6 int devfs_loc_unlock_ctl (devfs_set_t * *set*, uint32_t *prio*)

7.33.3.7 int devfs_loc_wait_for_change (uint8_t * *hwids*, int *count*)

7.33.3.8 int devfs_loc_write (devfs_set_t * *set*, const void * *buf*, int *count*)

7.33.4 Variable Documentation

7.33.4.1 int errno

7.34 librobot/devfs_net.c File Reference

devfs_* functions for talking to a remote /dev/robot (through netrobotd), via a network.

`#include <robot/devfs.h>`

`#include <robot/hwid.h>`

`#include <robot/handle.h>`

`#include <robot/util.h>`

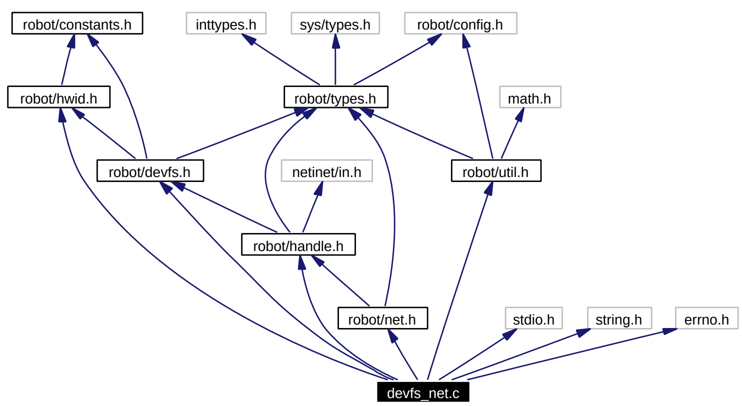
`#include <robot/net.h>`

`#include <stdio.h>`

`#include <string.h>`

`#include <errno.h>`

Include dependency graph for devfs_net.c:



Defines

- #define **add_hwid**(h) (**cur_robot** → devfs_fds[i++].hwid = (h))

Functions

- int **net_connect_tcp** (**robot_handle_t** *handle)

  Internal use only.

- int **net_write_msg** (int sock, **robot_net_msg_t** ***msg**)

  Internal use only.

- int **net_read_msg** (int sock, **robot_net_msg_t** ***msg**)

  Internal use only.

- int **devfs_net_init** (int flags)
- void **devfs_net_cleanup** (void)
- int **devfs_net_write** (**devfs_set_t** *set, const void *buf, int count)
- int **devfs_net_read** (**devfs_set_t** *set, **devfs_type_t** type, void *buf, int count)

- int **devfs_net_wait_for_change** (uint8_t *__hwids__, int count)
- int **devfs_net_lock_ctl** (**devfs_set_t** *set, uint32_t prio)
- int **devfs_net_unlock_ctl** (**devfs_set_t** *set, uint32_t prio)
- int **devfs_net_get_lock_owner** (**devfs_set_t** *set)

Variables

- int **errno**
- const **robot_net_msg_t msg_init**
- const **robot_net_msg_t msg_shutdown**
- const **robot_net_msg_t msg_wait_change**
- const **robot_net_msg_t msg_lock_ctl**
- const **robot_net_msg_t msg_unlock_ctl**
- const **robot_net_msg_t msg_get_lock_owner**

7.34.1 Detailed Description

devfs_* functions for talking to a remote /dev/robot (through netrobotd), via a network.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
devfs_net.c,v 1.8 2003/07/31 22:30:04 beevek Exp

7.34.2 Define Documentation

7.34.2.1 #define add_hwid(h) (cur_robot → devfs_fds[i++].hwid = (h))

7.34.3 Function Documentation

7.34.3.1 void devfs_net_cleanup (void)

7.34.3.2 int devfs_net_get_lock_owner (devfs_set_t * *set*)

7.34.3.3 int devfs_net_init (int *flags*)

7.34.3.4 int devfs_net_lock_ctl (devfs_set_t * *set*, uint32_t *prio*)

7.34.3.5 int devfs_net_read (devfs_set_t * *set*, devfs_type_t *type*, void * *buf*, int *count*)

7.34.3.6 int devfs_net_unlock_ctl (devfs_set_t * *set*, uint32_t *prio*)

7.34.3.7 int devfs_net_wait_for_change (uint8_t * *hwids*, int *count*)

7.34.3.8 int devfs_net_write (devfs_set_t * *set*, const void * *buf*, int *count*)

7.34.3.9 int net_connect_tcp (robot_handle_t * *handle*)

Internal use only.

Connect to a remote host using information stored in handle. Handle must have been properly initialized with net_init.

Parameters:
handle Pointer to handle with connection information

Returns:
< 0 on failure, >= 0 otherwise

7.34.3.10 int net_read_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Read a single robot message from the specified socket.

Parameters:
sock Socket file descriptor to read from
msg Pointer to message buffer to read into

Returns:
< 0 on failure, >= 0 on success

7.34.3.11 int net_write_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Write a single robot message to the specified socket.

Parameters:
sock Socket file descriptor to write to
msg Pointer to message to send

Returns:
< 0 on failure, >= 0 on success

7.34.4 Variable Documentation

7.34.4.1 int errno

7.34.4.2 const robot_net_msg_t msg_get_lock_owner

7.34.4.3 const robot_net_msg_t msg_init

7.34.4.4 const robot_net_msg_t msg_lock_ctl

7.34.4.5 const robot_net_msg_t msg_shutdown

7.34.4.6 const robot_net_msg_t msg_unlock_ctl

7.34.4.7 const robot_net_msg_t msg_wait_change

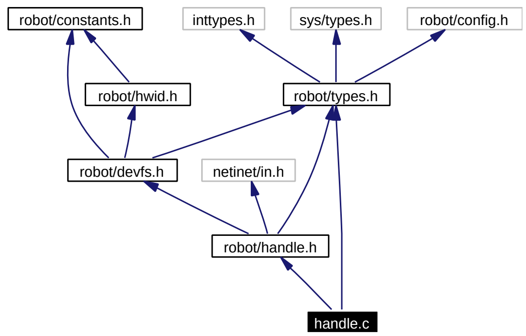
7.35 librobot/handle.c File Reference

robot_handle_t related methods, etc.

`#include <robot/types.h>`

`#include <robot/handle.h>`

Include dependency graph for handle.c:



Functions

- int **robot_set_handle** (**robot_handle_t** *handle)
  Set the current handle for all robot operations.

Variables

- **robot_handle_t local_robot**
- **robot_handle_t * cur_robot** = &**local_robot**

7.35.1 Detailed Description

robot_handle_t related methods, etc.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
handle.c,v 1.2 2003/07/18 07:08:40 beevek Exp

Also the location of cur_robot, the globally available pointer to the robot handle that librobot is currently controlling.

7.35.2 Function Documentation

7.35.2.1 int robot_set_handle (robot_handle_t * *handle*)

Set the current handle for all robot operations.

Passing null will make all operations act on the local computer (i.e., the program must be running on the robot itself).

Parameters:

handle A valid **robot_handle_t**, or null for local robot

Returns:

< 0 on failure, >= 0 on success

7.35.3 Variable Documentation

7.35.3.1 robot_handle_t* cur_robot = &local_robot

pointer to the handle for the robot librobot is currently controlling

7.35.3.2 robot_handle_t local_robot

internal robot handle for programs that talk only to a single robot

7.36 librobot/mclib.c File Reference

Load/unload motor control library and initialize and de-initialize it.

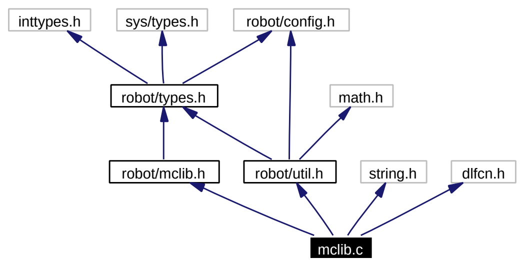
`#include <robot/mclib.h>`

`#include <robot/util.h>`

`#include <string.h>`

`#include <dlfcn.h>`

Include dependency graph for mclib.c:



Defines

- #define **load**(v, s)

Functions

- int **mc_lib_load** (const char *lib_file, **mc_lib_t** *lib)

  Load a motor control shared library and initialize lib to point to its functions.

- void **mc_lib_unload** (**mc_lib_t** *lib)

  Unload a motor control shared library.

7.36.1 Detailed Description

Load/unload motor control library and initialize and de-initialize it.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

mclib.c,v 1.4 2003/07/18 07:08:40 beevek Exp

7.36.2 Define Documentation

7.36.2.1 #define load(v, s)

Value:

```
do { \
  v = dlsym(lib->handle, s); \
  if(dlerror()) \
    return -1; \
} while(0)
```

load a single symbol from a shared library

7.36.3 Function Documentation

7.36.3.1 int mc_lib_load (const char * *lib_file*, mc_lib_t * *lib*)

Load a motor control shared library and initialize lib to point to its functions.

Parameters:

lib_file Path to the library shared object file

lib **mc_lib_t** to fill in with pointers to the library's functions

Returns:

< 0 on failure, >= 0 on success

7.36.3.2 void mc_lib_unload (mc_lib_t * *lib*)

Unload a motor control shared library.

Parameters:

lib An **mc_lib_t** previously initialized with mc_lib_load

7.37 librobot/motors.c File Reference

Implementation of methods from **motors.h**.

`#include <robot/motors.h>`

`#include <robot/devfs.h>`

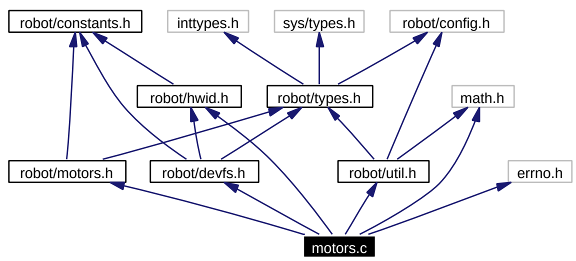
`#include <robot/hwid.h>`

`#include <robot/util.h>`

`#include <math.h>`

`#include <errno.h>`

Include dependency graph for motors.c:



Functions

- int **robot_set_velocity** (**vel_val_t** v, **vel_val_t** w)

  Set translational and rotational velocity of the robot.

- int **robot_translate** (float dist, **vel_val_t** v)

  Translate (straight forward or backward) dist meters at velocity v.

- int **robot_rotate** (float radians, **vel_val_t** w)

  Rotate the specified distance in radians at rotational velocity w.

- int **robot_set_odometry** (**odom_val_t** x, **odom_val_t** y, **odom_val_t** theta)

  Reset the robot's internal odometry counters to the specified values.

- int **robot_get_velocity** (**vel_val_t** ∗v, **vel_val_t** ∗w)

  Get the robot's current translational and rotational velocities.

- int **robot_get_odometry** (**odom_val_t** ∗x, **odom_val_t** ∗y, **odom_val_t** ∗theta)

  Get the robot's current odometry counter values.

- int **robot_lock_motors** (void)

  Lock velocity control of the motors to this process.

- int **robot_unlock_motors** (void)

  Unlock velocity control of the motors.

Variables

- int **errno**

7.37.1 Detailed Description

Implementation of methods from **motors.h**.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
motors.c,v 1.20 2003/08/01 15:30:43 beevek Exp

7.37.2 Function Documentation

7.37.2.1 int robot_get_odometry (odom_val_t * *x*, odom_val_t * *y*, odom_val_t * *theta*)

Get the robot's current odometry counter values.

Parameters:
x Pointer to location to store x-component
y Pointer to location to store y-component
theta Pointer to location to store theta-component (rotation)

Returns:
< 0 on failure, >= 0 on success

7.37.2.2 int robot_get_velocity (vel_val_t * *v*, vel_val_t * *w*)

Get the robot's current translational and rotational velocities.

Parameters:
v Pointer to location to store the robot's translational velocity (meters/sec)
w Pointer to location to store the robot's rotational velocity (radians/sec)

Returns:
< 0 on failure, >= 0 otherwise

7.37.2.3 int robot_lock_motors (void)

Lock velocity control of the motors to this process.

When a process has locked control of the motors, no other process can control them (unless it has a higher priority – e.g. the emergency-stop behavior).

Returns:
< 0 on failure, >= 0 on success

See also:
robot_unlock_motors

7.37.2.4 int robot_rotate (float *radians*, vel_val_t *w*)

Rotate the specified distance in radians at rotational velocity w.

This function quits if it detects that the robot is for some reason turning improperly.

Parameters:
- ***radians*** Distance (in radians) to rotate; positive for counterclockwise rotation, negative for clockwise rotation
- ***w*** Rotational velocity (radians/sec)

Returns:
< 0 on failure, >= 0 otherwise

7.37.2.5 int robot_set_odometry (odom_val_t *x*, odom_val_t *y*, odom_val_t *theta*)

Reset the robot's internal odometry counters to the specified values.

Parameters:
- ***x*** x-component odometry value
- ***y*** y-component odometry value
- ***theta*** theta-component (rotation) odometry value

Returns:
< 0 on failure, >= 0 otherwise

7.37.2.6 int robot_set_velocity (vel_val_t *v*, vel_val_t *w*)

Set translational and rotational velocity of the robot.

Parameters:
- ***v*** Translational velocity (in meters/second)
- ***w*** Rotational velocity (in radians/second)

Returns:
< 0 on failure, >= 0 otherwise

7.37.2.7 int robot_translate (float *dist*, vel_val_t *v*)

Translate (straight forward or backward) dist meters at velocity v.

If for some reason the robot moves farther away from its goal during the course of this call, it fails and sets errno to ESPIPE (Illegal seek :)

Parameters:
- ***dist*** Distance (in meters) to translate; positive to go forward, negative to go backward
- ***v*** Translational velocity (meters/sec)

Returns:
< 0 on failure, >= 0 otherwise

7.37.2.8 int robot_unlock_motors (void)

Unlock velocity control of the motors.

In general, only call this after locking control of the motors with robot_lock_motors. If you do not call this before your program quits, robot_shutdown will take care of it for you.

Returns:
< 0 on failure, >= 0 on success

See also:
robot_lock_motors

7.37.3 Variable Documentation

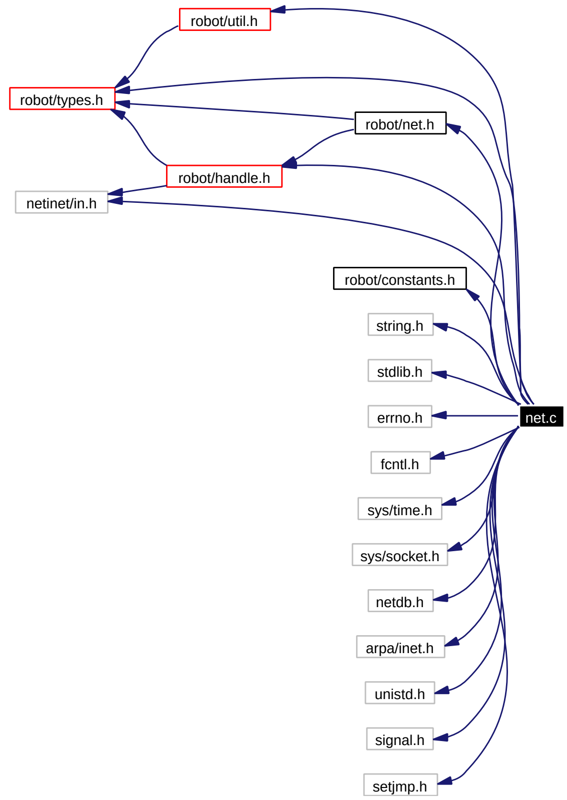
7.37.3.1 int errno

7.38 librobot/net.c File Reference

Methods for setting up network control of robots and sending and receiving data packets.

```
#include <robot/types.h>
#include <robot/constants.h>
#include <robot/net.h>
#include <robot/handle.h>
#include <robot/util.h>
#include <string.h>
#include <stdlib.h>
#include <errno.h>
#include <fcntl.h>
#include <sys/time.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <netdb.h>
#include <arpa/inet.h>
#include <unistd.h>
#include <signal.h>
#include <setjmp.h>
```

Include dependency graph for net.c:



Compounds

- struct **_find_list_t**

Typedefs

- typedef _find_list_t **find_list_t**

Functions

- int **net_init** (const char *__ip__, uint16_t **port**, **robot_handle_t** *handle)

  Internal use only.

- void **net_shutdown** (**robot_handle_t** *handle)

  Internal use only.

- int **net_connect_tcp** (**robot_handle_t** *handle)

  Internal use only.

- int **net_write_msg** (int sock, **robot_net_msg_t** ***msg**)

  Internal use only.

- int **net_read_msg** (int sock, **robot_net_msg_t** ***msg**)

  Internal use only.

- int **robot_net_set_timeout** (**robot_handle_t** *handle, int32_t ms)

  Set the network timeout for the specified handle, in milliseconds.

- const char * **robot_get_ip_str** (const **robot_handle_t** *handle)

  Get a string containing the ip address of the robot pointed to by handle.

- int **robot_net_find** (**robot_handle_t** **handles, uint32_t timeout_ms)

  Search for network-controllable robots on the local subnet.

Variables

- int **errno**
- const **robot_net_msg_t** **msg_init** = {0, MSG_INIT, 0, 0, 0}
- const **robot_net_msg_t** **msg_shutdown** = {0, MSG_SHUTDOWN, 0, 0, 0}
- const **robot_net_msg_t** **msg_wait_change** = {0, MSG_WAIT_FOR_CHANGE, 0, 0, 0}
- const **robot_net_msg_t** **msg_lock_ctl** = {0, MSG_LOCK_CTL, 0, 0, 0}
- const **robot_net_msg_t** **msg_unlock_ctl** = {0, MSG_UNLOCK_CTL, 0, 0, 0}
- const **robot_net_msg_t** **msg_get_lock_owner** = {0, MSG_GET_LOCK_OWNER, 0, 0, 0}
- const **robot_net_msg_t** **msg_error** = {0, MSG_ERROR, 0, 0, 0}
- const uint32_t **msg_ping** = MSG_PING

7.38.1 Detailed Description

Methods for setting up network control of robots and sending and receiving data packets.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

net.c,v 1.10 2003/07/31 22:30:04 beevek Exp

The netrobotd program should be running on the robot to be controlled over the network.

7.38.2 Typedef Documentation

7.38.2.1 typedef struct _find_list_t find_list_t

simple linked list of discovered robots

7.38.3 Function Documentation

7.38.3.1 int net_connect_tcp (robot_handle_t * *handle*)

Internal use only.

Connect to a remote host using information stored in handle. Handle must have been properly initialized with net_init.

Parameters:

handle Pointer to handle with connection information

Returns:

< 0 on failure, >= 0 otherwise

7.38.3.2 int net_init (const char * *ip*, uint16_t *port*, robot_handle_t * *handle*)

Internal use only.

Initialize a robot handle with ip address and port. Does not actually connect.

Parameters:

ip IP address string

port Remote port (usually ROBOT_DEFAULT_NET_PORT)

handle Pointer to handle to initialize

Returns:

< 0 on failure, >= 0 otherwise

7.38.3.3 int net_read_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Read a single robot message from the specified socket.

Parameters:

sock Socket file descriptor to read from

msg Pointer to message buffer to read into

Returns:

< 0 on failure, >= 0 on success

7.38.3.4 void net_shutdown (robot_handle_t * *handle*)

Internal use only.

Disconnect from the network and clean up network-related memory in handle.

Parameters:

handle Pointer to handle to clean up

7.38.3.5 int net_write_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Write a single robot message to the specified socket.

Parameters:

sock Socket file descriptor to write to *msg* Pointer to message to send

Returns:
< 0 on failure, >= 0 on success

7.38.3.6 const char* robot_get_ip_str (const robot_handle_t * *handle*)

Get a string containing the ip address of the robot pointed to by handle.

Parameters:
handle A pointer to a network-controllable **robot_handle_t**

Returns:
Pointer to a STATICALLY allocated string containing the ip address. Do not attempt to deallocate this string. Note that it will be overwritten by subsequent calls.

7.38.3.7 int robot_net_find (robot_handle_t ** *handles*, uint32_t *timeout_ms*)

Search for network-controllable robots on the local subnet.

handles will be allocated and must be properly freed by the caller.

Note that after this call, robot_init must still be called with each handle to actually begin talking to the robot.

Parameters:
handles Pointer to a pointer that will be set the the memory location of an array of robot_-handle_t's that have been initialized with network information for discovered robots

timeout_ms The time to wait for robots to report after sending a discovery broadcast

Returns:
Number of discovered robots, zero if none are found; < 0 on failure.

7.38.3.8 int robot_net_set_timeout (robot_handle_t * *handle*, int32_t *ms*)

Set the network timeout for the specified handle, in milliseconds.

This will affect all read and write operations, as well as connection attempts.

Parameters:
handle Pointer to a robot handle

ms Time, in milliseconds, of timeout. If less than zero, the default timeout is used. If equal to zero, there is no timeout (operations will block forever). If greater than zero, exactly this value is used.

Returns:
< 0 on failure, >= 0 on success

7.38.4 Variable Documentation

7.38.4.1 int errno

7.38.4.2 const robot_net_msg_t msg_error = {0, MSG_ERROR, 0, 0, 0}

7.38.4.3 const robot_net_msg_t msg_get_lock_owner = {0, MSG_GET_LOCK_OWNER, 0, 0, 0}

7.38.4.4 const robot_net_msg_t msg_init = {0, MSG_INIT, 0, 0, 0}

7.38.4.5 const robot_net_msg_t msg_lock_ctl = {0, MSG_LOCK_CTL, 0, 0, 0}

7.38.4.6 const uint32_t msg_ping = MSG_PING

7.38.4.7 const robot_net_msg_t msg_shutdown = {0, MSG_SHUTDOWN, 0, 0, 0}

7.38.4.8 const robot_net_msg_t msg_unlock_ctl = {0, MSG_UNLOCK_CTL, 0, 0, 0}

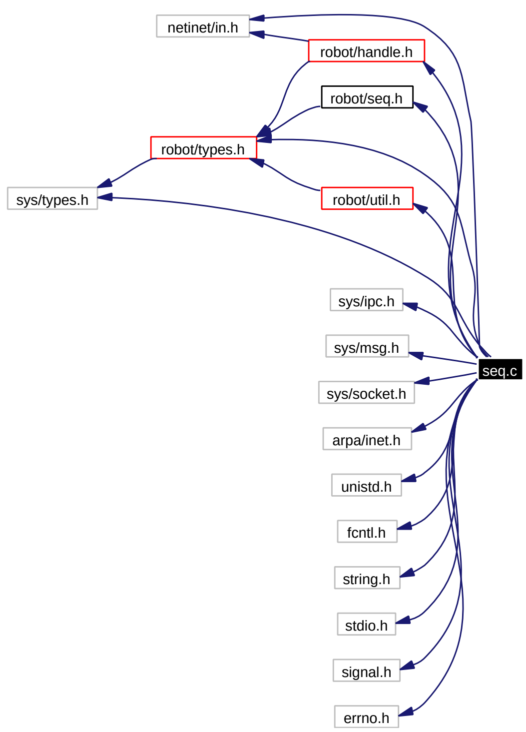
7.38.4.9 const robot_net_msg_t msg_wait_change = {0, MSG_WAIT_FOR_CHANGE, 0, 0, 0}

7.39 librobot/seq.c File Reference

Communication with the sequencer.

```
#include <robot/types.h>
#include <robot/util.h>
#include <robot/handle.h>
#include <robot/seq.h>
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <unistd.h>
#include <fcntl.h>
#include <string.h>
#include <stdio.h>
#include <signal.h>
#include <errno.h>
```

Include dependency graph for seq.c:



Defines

- #define **MAX_BHV** 32

Functions

- int **seq_init** (void)

  Internal use only.

- void **seq_cleanup** (void)

  Internal use only.

- **bhv_handle_t** * **seq_load_args** (const char *name, const char *args)

  Load a reactive behavior and pass it commandline arguments.

- **bhv_handle_t** * **seq_load** (const char *name)

  Load a reactive behavior and initialize it.

- **bhv_handle_t** * **seq_load_net** (const char *name, const char ***ip**, uint16_t **port**)

  Simple wrapper for seq_load_args that connects the behavior to a remote netrobotd.

- **bhv_handle_t** * **seq_attach** (const char *name)

  Get the handle of an already-running behavior.

- int **seq_unload** (**bhv_handle_t** *bhv)

  Unload a reactive behavior.

- int **seq_unload_all** (void)

  Unload all loaded behaviors.

- int **seq_inhibit** (**bhv_handle_t** *bhv)

  Inhibit ("pause") a behavior.

- int **seq_inhibit_all** (void)

  Inhibit all loaded behaviors.

- int **seq_uninhibit** (**bhv_handle_t** *bhv)

  Uninhibit ("unpause") a behavior.

- int **seq_uninhibit_all** (void)

  Uninhibit all loaded behaviors.

- int **seq_send** (**bhv_handle_t** *bhv, uint8_t key, const void *data, int size)

  Send (per-behavior) data directly to a behavior (without actually "connecting" to one of its inputs).

- int **seq_get** (uint8_t key, **bhv_data_t** *buf)

  Wait for a behavior to send data to us, with input key key.

- int **seq_connect** (const **bhv_connection_t** *conn)

Connect an output of one behavior to an input of another.

- int **seq_disconnect** (const **bhv_connection_t** *conn)
  Disconnect an output of one behavior from an input of another.
- int **seq_get_my_handle** (**bhv_handle_t** *handle)
  Get a **bhv_handle_t** *representing the calling process, even if it isn't a behavior.*

Variables

- int **errno**
- int **seq_qid** = -1
- int **my_qid** = -1

7.39.1 Detailed Description

Communication with the sequencer.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id:
seq.c,v 1.16 2003/08/20 19:43:51 beevek Exp

The seq program must be running on the robot in order for this interface to properly function. Also, these functions are only meant for use on the robot itself. They will not function over the network.

This portion of librobot is NOT EVEN REMOTELY THREAD SAFE.

7.39.2 Define Documentation

7.39.2.1 #define MAX_BHV 32

7.39.3 Function Documentation

7.39.3.1 bhv_handle_t* seq_attach (const char * *name*)

Get the handle of an already-running behavior.

Looks for the oldest already-running behavior with the specified name. If the caller has sufficient permissions, returns a handle to the behavior.

Sets EACCES if caller does not have permission to control the previously loaded behavior.

Parameters:
name Name of the behavior to attach to

Returns:
Pointer to a behavior handle for the behavior, or null on failure

See also:
seq_load

7.39.3.2 void seq_cleanup (void)

Internal use only.

De-initialize message queue communication with the sequencer and any loaded behaviors.

7.39.3.3 int seq_connect (const bhv_connection_t * *conn*)

Connect an output of one behavior to an input of another.

If the specified output and input are valid, all data sent to the specified output by the behavior conn->from will be forwarded to the specified input of conn->to.

Parameters:

conn Pointer to a structure specifying the connection information

Returns:

< 0 on failure, >= 0 on success

7.39.3.4 int seq_disconnect (const bhv_connection_t * *conn*)

Disconnect an output of one behavior from an input of another.

If the specified output and input are valid, the behavior conn->from will no longer forward data from the specified output to the input of conn->to.

Parameters:

conn Pointer to a structure specifying the connection information

Returns:

< 0 on failure, >= 0 on success

7.39.3.5 int seq_get (uint8_t *key*, bhv_data_t * *buf*)

Wait for a behavior to send data to us, with input key key.

Used to get data in a non-behavior, from a behavior's output. This function will block until data arrives for the specified key. Note that no data will ever arrive unless seq_connect is called to connect a behavior to the caller (use seq_get_my_handle when setting this up).

Warning:

IMPORANT: Behaviors should not use this function, only external programs controlling behaviors!

Parameters:

key Input key of data

buf Data input buffer

Returns:

< 0 on failure, >= 0 on success

7.39.3.6 int seq_get_my_handle (bhv_handle_t * *handle*)

Get a **bhv_handle_t** representing the calling process, even if it isn't a behavior.

Useful for setting up a connection with a real behavior's outputs (see seq_get).

Parameters:
handle Pointer to a **bhv_handle_t** to be filled in

Returns:
< 0 on failure, >= 0 on success

7.39.3.7 int seq_inhibit (bhv_handle_t * *bhv*)

Inhibit ("pause") a behavior.

Tells a behavior to stop processing until it is told to "uninhibit" itself. When a behavior is inhibited, any data sent to its inputs is either queued or discarded, according to options set by the behavior itself.

Parameters:
bhv Behavior handle from seq_load

Returns:
< 0 on failure, >= 0 otherwise

See also:
seq_uninhibit

7.39.3.8 int seq_inhibit_all (void)

Inhibit all loaded behaviors.

Returns:
< 0 on failure, >= 0 otherwise

See also:
seq_inhibit

7.39.3.9 int seq_init (void)

Internal use only.

Initialize message queue communication with the sequencer.

Returns:
< 0 on failure, >= 0 otherwise

7.39.3.10 bhv_handle_t* seq_load (const char * *name*)

Load a reactive behavior and initialize it.

Sets the following errno's on failure:

EINVAL: unable to communicate with the sequencer

EBUSY: program has loaded the maximum number of allowed behaviors

ERANGE: the data being sent to the sequencer is too large (i.e. the cwd + name are too long)

If the calling program has performed a robot_init with a remote netrobotd, seq_load will connect the behavior to the same remote robot.

Parameters:

name Name of the behavior to load. The sequencer searches its internal path for a behavior of this name. If not found, the current working directory of the process that called seq_load is also searched. If still not found, the function fails.

Returns:

Pointer to a behavior handle for the behavior, or null on failure.

See also:

seq_unload seq_attach seq_load_args

7.39.3.11 bhv_handle_t* seq_load_args (const char * *name*, const char * *args*)

Load a reactive behavior and pass it commandline arguments.

Same as seq_load, but passes commandline arguments to the behavior. Note that all behaviors that use libbehavior will treat the first commandline argument as an ip address/dns name, and the second as a port, used to connect to a netrobotd. Using this to load a behavior causes the -i and -o arguements to the sequencer to NOT be sent to the behavior. Generally this function should not be used, unless you have a VERY GOOD REASON for passing arguments to your behavior (rather than sending them as an "input").

See also:

seq_load

7.39.3.12 bhv_handle_t* seq_load_net (const char * *name*, const char * *ip*, uint16_t *port*)

Simple wrapper for seq_load_args that connects the behavior to a remote netrobotd.

When you use this instead of seq_load, the -i and -o arguments to the sequencer are not passed to the behavior. This function can be used to connect the behavior to a different ip/port than the calling program is connected to.

Parameters:

name Name of the behavior to load (see seq_load)

ip IP address for the behavior to connect to

port Remote port for the behavior to connect to

See also:

seq_load seq_load_args

7.39.3.13 int seq_send (bhv_handle_t * *bhv*, uint8_t *key*, const void * *data*, int *size*)

Send (per-behavior) data directly to a behavior (without actually "connecting" to one of its inputs).

Generally this is some sort of structure defined in a header file for the specific behavior. The user is responsible for making sure this is the right kind of data to send to the behavior.

Sets ERANGE if the size of the data is larger than allowed.

Parameters:

bhv Behavior handle from seq_load

key Input key of bhv to send to

data Pointer to data buffer

size Size (in bytes) of data buffer

Returns:

< 0 on failure, >= 0 on success

7.39.3.14 int seq_uninhibit (bhv_handle_t * *bhv*)

Uninhibit ("unpause") a behavior.

Tells a behavior it may begin processing again if it is currently paused.

Parameters:

bhv Behavior handle from seq_load

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_inhibit

7.39.3.15 int seq_uninhibit_all (void)

Uninhibit all loaded behaviors.

Returns:

< 0 on failure, >= 0 otherwise

See also:

seq_uninhibit

7.39.3.16 int seq_unload (bhv_handle_t * *bhv*)

Unload a reactive behavior.

Basically just decrements a usage count for the behavior. When this count reaches zero, the behavior is completely unloaded from the system. Note that it is not strictly necessary to call this since usage counts for behaviors are automatically decremented when the calling program exits.

Parameters:
bhv Behavior handle from seq_load

Returns:
< 0 on failure, $>= 0$ otherwise

See also:
seq_load

7.39.3.17 int seq_unload_all (void)

Unload all loaded behaviors.

Returns:
< 0 on failure, $>= 0$ otherwise

See also:
seq_unload

7.39.4 Variable Documentation

7.39.4.1 int errno

7.39.4.2 int my_qid = -1

my msg queue id

7.39.4.3 int seq_qid = -1

msg queue id for talking to seq

7.40 librobot/sys.c File Reference

System initialization and shutdown.

#include <robot/sys.h>

#include <robot/types.h>

#include <robot/handle.h>

#include <robot/devfs.h>

#include <robot/motors.h>

#include <robot/util.h>

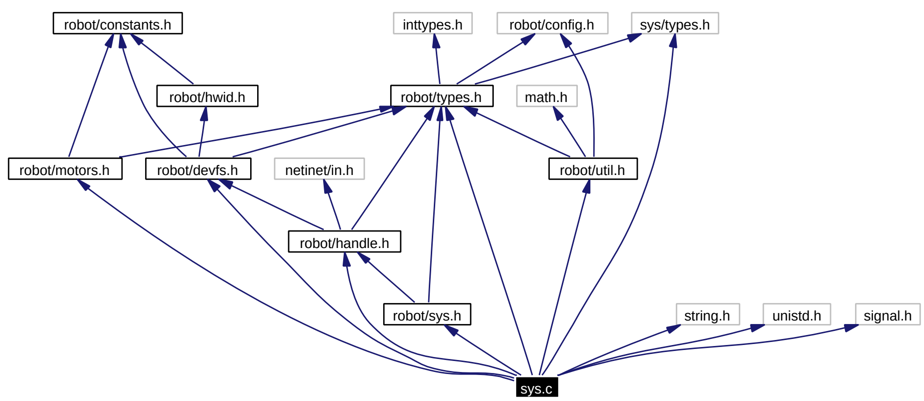
#include <sys/types.h>

#include <string.h>

#include <unistd.h>

#include <signal.h>

Include dependency graph for sys.c:



Functions

- int **sensors_init** (int)

  Internal use only.

- int **sensors_shutdown** (void)

  Internal use only.

- int **net_init** (const char ∗, uint16_t, **robot_handle_t** ∗)

  Internal use only.

- void **net_shutdown** (**robot_handle_t** ∗)

  Internal use only.

- int **seq_init** (void)

  Internal use only.

- void **seq_cleanup** (void)

  Internal use only.

- int **robot_init** (uint32_t flags, **robot_handle_t** *handle, const char ***ip**, uint16_t **port**)

  Initialize the robot for use either locally or over a network.

- void **robot_shutdown** (void)

  Shut down the robot currently in use.

- **robot_id_t** **robot_get_id** (void)

  Get the unique id number of the current robot.

- const char * **robot_get_name** (void)

  Get the name of the current robot.

Variables

- **robot_handle_t** **local_robot**

7.40.1 Detailed Description

System initialization and shutdown.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

sys.c,v 1.11 2003/08/19 15:14:56 beevek Exp

Also provides a default signal handler to shutdown properly on SIGINT, SIGQUIT, SIGTERM and SIGSEGV.

7.40.2 Function Documentation

7.40.2.1 int net_init (const char * *ip*, uint16_t *port*, robot_handle_t * *handle*)

Internal use only.

Initialize a robot handle with ip address and port. Does not actually connect.

Parameters:

ip IP address string

port Remote port (usually ROBOT_DEFAULT_NET_PORT)

handle Pointer to handle to initialize

Returns:

< 0 on failure, >= 0 otherwise

7.40.2.2 void net_shutdown (robot_handle_t * *handle*)

Internal use only.

Disconnect from the network and clean up network-related memory in handle.

Parameters:

handle Pointer to handle to clean up

7.40.2.3 robot_id_t robot_get_id (void)

Get the unique id number of the current robot.

Todo

FIXME implement

7.40.2.4 const char* robot_get_name (void)

Get the name of the current robot.

Todo

FIXME implement

7.40.2.5 int robot_init (uint32_t *flags*, robot_handle_t * *handle*, const char * *ip*, uint16_t *port*)

Initialize the robot for use either locally or over a network.

This function performs the following tasks:

If an ip address has been specified, or if ip information in the robot handle has already been filled in, initialize network communications

Set the current robot handle for all librobot functions to act on to be handle

If RI_NO_HANDLE_SIGS is not set, register signal handler for cleanly shutting down the robot on receipt of SIGINT, SIGQUIT, SIGTERM or SIGSEGV

Initialize the devfs subsystem (if RI_NO_DEVFS is not set)

Initialize sensors; if RI_NO_SET_FREQS is not set, request that all sensors fire at the default frequency

If RI_USE_SEQUENCER is set, initialize sequencer IPC

Parameters:

flags Initialization flags (robot_init_flags_t)

handle A handle to use in the initialization. This is only necessary if your program will be controlling more than one robot. The handle's values will be filled in by robot_init.

ip An ip address string telling us where to connect if the robot is to be controlled over the network. This should be null if the robot will be controlled locally, or if handle's network information has already been filled in elsewhere (such as robot_net_find).

port The remote port to connect to if ip is non-null (ignored otherwise). Usually, this should be ROBOT_DEFAULT_NET_PORT from **constants.h**.

7.40.2.6 void robot_shutdown (void)

Shut down the robot currently in use.

Uses the internal pointer to the current robot handle to decide which robot to shut down.

7.40.2.7 int sensors_init (int *set_default_freq*)

Internal use only.

Initialize the sensor subsystem.

Parameters:

set_default_freq If nonzero, request default frequencies from all range sensors

Returns:

< 0 on failure, >= 0 otherwise

7.40.2.8 int sensors_shutdown (void)

Internal use only.

Shut down the sensor subsystem. Remove all frequency requests from this process.

Returns:

< 0 on failure, >= 0 otherwise

7.40.2.9 void seq_cleanup (void)

Internal use only.

De-initialize message queue communication with the sequencer and any loaded behaviors.

7.40.2.10 int seq_init (void)

Internal use only.

Initialize message queue communication with the sequencer.

Returns:

< 0 on failure, >= 0 otherwise

7.40.3 Variable Documentation

7.40.3.1 robot_handle_t local_robot ()

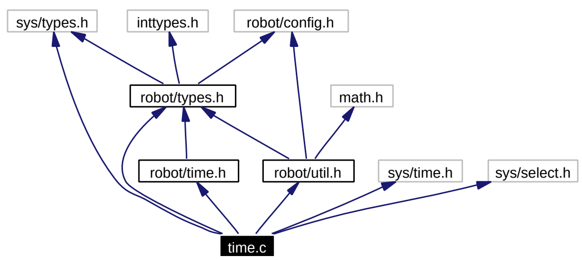
internal robot handle for programs that talk only to a single robot

7.41 librobot/time.c File Reference

us-precision timing functions for the robot. Implements stuff from **time.h**.

```
#include <robot/types.h>
#include <robot/time.h>
#include <robot/util.h>
#include <sys/time.h>
#include <sys/types.h>
#include <sys/select.h>
```

Include dependency graph for time.c:



Functions

- void **robot_time_to_timeval** (const **robot_time_us_t** ∗rt, struct timeval ∗**tv**)
- void **timeval_to_robot_time** (const struct timeval ∗**tv**, **robot_time_us_t** ∗rt)
- int **robot_get_time** (**robot_time_us_t** ∗time)

  Get the current time since the Unix epoch in microseconds.

- int **robot_sleep** (const **robot_time_us_t** ∗time)

  Sleep for the specified time (in microseconds).

- int **robot_alarm** (const **robot_time_us_t** ∗time)

  Set an alarm to go off after the specified time (in microseconds). Similar to alarm().

7.41.1 Detailed Description

us-precision timing functions for the robot. Implements stuff from **time.h**.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id
time.c,v 1.3 2003/07/18 07:08:41 beevek Exp

7.41.2 Function Documentation

7.41.2.1 int robot_alarm (const robot_time_us_t * *time*)

Set an alarm to go off after the specified time (in microseconds). Similar to alarm().

Parameters:
time Pointer to a location with the time for the alarm

Returns:
< 0 on failure, >= 0 otherwise

7.41.2.2 int robot_get_time (robot_time_us_t * *time*)

Get the current time since the Unix epoch in microseconds.

Parameters:
time Pointer to a location to store the current time

Returns:
< 0 on failure, >= 0 otherwise

7.41.2.3 int robot_sleep (const robot_time_us_t * *time*)

Sleep for the specified time (in microseconds).

Parameters:
time Pointer to a location with the time to sleep

Returns:
< 0 on failure, >= 0 otherwise

7.41.2.4 void robot_time_to_timeval (const robot_time_us_t * *rt*, struct timeval * *tv*) `[inline]`

7.41.2.5 void timeval_to_robot_time (const struct timeval * *tv*, robot_time_us_t * *rt*) `[inline]`

7.42 librobot/util.c File Reference

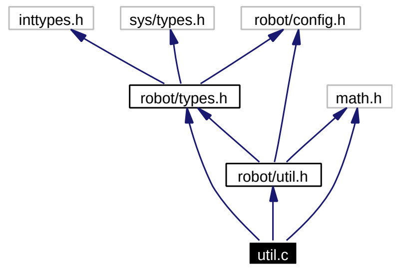
Utility functions.

`#include <robot/util.h>`

`#include <robot/types.h>`

`#include <math.h>`

Include dependency graph for util.c:



Functions

- **odom_val_t robot_sqdist** (**odom_val_t** x1, **odom_val_t** y1, **odom_val_t** x2, **odom_val_t** y2)

  Calculate squared distance between two points.

- **odom_val_t robot_dist** (**odom_val_t** x1, **odom_val_t** y1, **odom_val_t** x2, **odom_val_t** y2)

  Calculate distance between two points.

7.42.1 Detailed Description

Utility functions.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

util.c,v 1.4 2003/07/18 15:53:54 beevek Exp

7.42.2 Function Documentation

7.42.2.1 odom_val_t robot_dist (odom_val_t *x1*, odom_val_t *y1*, odom_val_t *x2*, odom_val_t *y2*)

Calculate distance between two points.

7.42.2.2 odom_val_t robot_sqdist (odom_val_t *x1*, odom_val_t *y1*, odom_val_t *x2*, odom_val_t *y2*)

Calculate squared distance between two points.

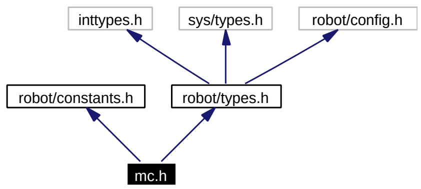
7.43 mc/mc.h File Reference

Motor control shared library interface and internals.

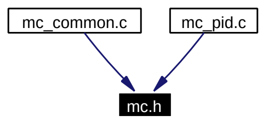
`#include <robot/constants.h>`

`#include <robot/types.h>`

Include dependency graph for mc.h:



This graph shows which files directly or indirectly include this file:



Enumerations

- enum { **LEFT** = 0, **RIGHT** = 1, **TRANS** = 0, **ROT** = 1 }

Functions

- int **mc_init** (uint32_t flags)

  Initialize the motor controller.

- void **mc_shutdown** (void)

  Shut down the controller and perform any necessary de-initialization.

- int **mc_start_frame** (**encoder_val_t** left, **encoder_val_t** right)

  Called at the start of each "motor control frame.".

- int **mc_set_velocity** (**vel_val_t** v, **vel_val_t** w)

  Set the target velocities for the motor controller.

- void **mc_get_velocity** (**vel_val_t** ∗v, **vel_val_t** ∗w)

  Get the current velocity (based on encoder counts for the current frame).

- void **mc_set_odometry** (**odom_val_t** ∗x, **odom_val_t** ∗y, **odom_val_t** ∗theta)

  Update the odometry values (passed as arguments) based on the current frame's encoder counts.

- int **mc_do_control** (**pwm_val_t** ∗left_pwm, **pwm_val_t** ∗right_pwm)

Calculate PWM counts to send to the motors based on internal state (target velocity and the encoder counts for the current frame).

- int **mc_init_common** (uint32_t flags)

  Perform internal initialization common to most motor controllers.

Variables

- **vel_val_t vel_correct** [2]
- **vel_val_t vel_current** [2]
- **vel_val_t vel_current_vw** [2]
- **encoder_val_t enc_correct** [2]
- **encoder_val_t enc_current** [2]
- **pwm_val_t pwm_current** [2]
- float **mc_dt**

7.43.1 Detailed Description

Motor control shared library interface and internals.

Author:
Christopher Chiaverini

Version:
Id:
mc.h,v 1.6 2003/08/01 19:39:26 beevek Exp

This file defines the motor control class proposed by Kris Beevers. This class will be used to set the speeds of the drive motors by taking encoder data as input and outputting a pwm count.

Motor controllers are built as shared libraries to be loaded by the interpreter. They must all provide the functions specified below.

See doc/motor_control_interface.txt for more information.

7.43.2 Enumeration Type Documentation

7.43.2.1 anonymous enum

Enumeration values:

LEFT

RIGHT

TRANS

ROT

7.43.3 Function Documentation

7.43.3.1 int mc_do_control (pwm_val_t * *left_pwm*, pwm_val_t * *right_pwm*)

Calculate PWM counts to send to the motors based on internal state (target velocity and the encoder counts for the current frame).

This is the primary function that will be re-implemented by new motor controllers.

Parameters:

left_pwm Pointer to location to store PWM count for the left motor

right_pwm Pointer to location to store PWM count for the right motor

Returns:

< 0 on failure, >= 0 on success

7.43.3.2 void mc_get_velocity (vel_val_t * *v*, vel_val_t * *w*)

Get the current velocity (based on encoder counts for the current frame).

This function should use internal state set by the mc_start_frame function to calculate current translational and rotational velocities.

Parameters:

v Pointer to a location to store the current translational velocity

w Pointer to a location to store the current rotational velocity

7.43.3.3 int mc_init (uint32_t *flags*)

Initialize the motor controller.

Parameters:

flags Currently unused

Returns:

< 0 on failure, >= 0 otherwise

7.43.3.4 int mc_init_common (uint32_t *flags*)

Perform internal initialization common to most motor controllers.

In general, motor controllers should call this at the top of their own mc_init function.

Parameters:

flags Currently ignored

Returns:

< 0 on failure, >= 0 on success

7.43.3.5 void mc_set_odometry (odom_val_t * *x*, odom_val_t * *y*, odom_val_t * *theta*)

Update the odometry values (passed as arguments) based on the current frame's encoder counts.

This function should ADD or SUBTRACT from the current values, but not overwrite them.

Parameters:

x Pointer to current x-component of odometry

y Pointer to current y-component of odometry

theta Pointer to current theta-component of odometry

7.43.3.6 int mc_set_velocity (vel_val_t *v*, vel_val_t *w*)

Set the target velocities for the motor controller.

Called whenever a high-level program sets the desired translational and rotational velocities for the robot. This should set internal variables as appropriate.

Parameters:

v Target translational velocity

w Target rotational velocity

Returns:

< 0 on failure, >= 0 otherwise

7.43.3.7 void mc_shutdown (void)

Shut down the controller and perform any necessary de-initialization.

7.43.3.8 int mc_start_frame (encoder_val_t *left*, encoder_val_t *right*)

Called at the start of each "motor control frame.".

In other words, this function is called before any other each time new encoder data becomes available. It should perform any per-frame calculations and store their results internally. Other functions (such as mc_do_control) use the state set by mc_start_frame to perform their computations.

Parameters:

left Left motor encoder count

right Right motor encoder count

Returns:

< 0 on failure, >= 0 otherwise

7.43.4 Variable Documentation

7.43.4.1 encoder_val_t enc_correct[2]

target encoder counts

7.43.4.2 encoder_val_t enc_current[2]

current encoder counts

7.43.4.3 float mc_dt

time since last frame

7.43.4.4 pwm_val_t pwm_current[2]

current pwm counts

7.43.4.5 vel_val_t vel_correct[2]

target velocities

7.43.4.6 vel_val_t vel_current[2]

current velocities

7.43.4.7 vel_val_t vel_current_vw[2]

current trans/rot velocities

7.44 mc/mc_common.c File Reference

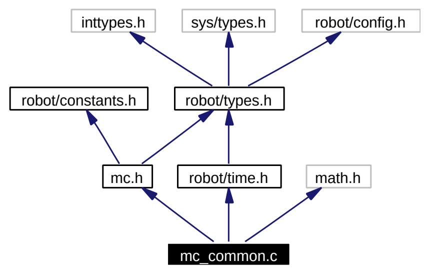
Immplements the functions defined in **mc.h** that are common to all motor controllers.

`#include "mc.h"`

`#include <robot/time.h>`

`#include <math.h>`

Include dependency graph for mc_common.c:



Defines

- #define **TWO_PI_R_L** (2 ∗ M_PI ∗ ROBOT_WHEEL_RADIUS_L)
- #define **TWO_PI_R_R** (2 ∗ M_PI ∗ ROBOT_WHEEL_RADIUS_R)
- #define **STEPS_MULT** (ROBOT_ENCODER_STEPS_PER_REV ∗ **mc_dt**)

Functions

- int **mc_start_frame** (**encoder_val_t** left, **encoder_val_t** right)

  Called at the start of each "motor control frame.".

- int **mc_init_common** (uint32_t flags)

  Perform internal initialization common to most motor controllers.

- void **mc_shutdown** (void)

  Shut down the controller and perform any necessary de-initialization.

- int **mc_set_velocity** (**vel_val_t** v, **vel_val_t** w)

  Set the target velocities for the motor controller.

- void **mc_get_velocity** (**vel_val_t** ∗v, **vel_val_t** ∗w)

  Get the current velocity (based on encoder counts for the current frame).

- void **mc_set_odometry** (**odom_val_t** ∗x, **odom_val_t** ∗y, **odom_val_t** ∗theta)

  Update the odometry values (passed as arguments) based on the current frame's encoder counts.

Variables

- **vel_val_t vel_correct** [2]
- **vel_val_t vel_current** [2]
- **vel_val_t vel_current_vw** [2]
- **encoder_val_t enc_correct** [2]
- **encoder_val_t enc_current** [2]
- **pwm_val_t pwm_current** [2]
- float **mc_dt**

7.44.1 Detailed Description

Immplements the functions defined in **mc.h** that are common to all motor controllers.

Author:
Christopher Chiaverini

Version: **Id:**
mc_common.c,v 1.8 2003/07/24 20:20:14 beevek Exp

7.44.2 Define Documentation

7.44.2.1 #define STEPS_MULT (ROBOT_ENCODER_STEPS_PER_REV * mc_dt)

7.44.2.2 #define TWO_PI_R_L (2 * M_PI * ROBOT_WHEEL_RADIUS_L)

7.44.2.3 #define TWO_PI_R_R (2 * M_PI * ROBOT_WHEEL_RADIUS_R)

7.44.3 Function Documentation

7.44.3.1 void mc_get_velocity (vel_val_t * *v*, vel_val_t * *w*)

Get the current velocity (based on encoder counts for the current frame).

This function should use internal state set by the mc_start_frame function to calculate current translational and rotational velocities.

Parameters:
v Pointer to a location to store the current translational velocity
w Pointer to a location to store the current rotational velocity

7.44.3.2 int mc_init_common (uint32_t *flags*)

Perform internal initialization common to most motor controllers.

In general, motor controllers should call this at the top of their own mc_init function.

Parameters:
flags Currently ignored

Returns:
< 0 on failure, >= 0 on success

7.44.3.3 void mc_set_odometry (odom_val_t * *x*, odom_val_t * *y*, odom_val_t * *theta*)

Update the odometry values (passed as arguments) based on the current frame's encoder counts.

This function should ADD or SUBTRACT from the current values, but not overwrite them.

Parameters:

x Pointer to current x-component of odometry

y Pointer to current y-component of odometry

theta Pointer to current theta-component of odometry

7.44.3.4 int mc_set_velocity (vel_val_t *v*, vel_val_t *w*)

Set the target velocities for the motor controller.

Called whenever a high-level program sets the desired translational and rotational velocities for the robot. This should set internal variables as appropriate.

Parameters:

v Target translational velocity

w Target rotational velocity

Returns:

< 0 on failure, >= 0 otherwise

7.44.3.5 void mc_shutdown (void)

Shut down the controller and perform any necessary de-initialization.

7.44.3.6 int mc_start_frame (encoder_val_t *left*, encoder_val_t *right*)

Called at the start of each "motor control frame.".

In other words, this function is called before any other each time new encoder data becomes available. It should perform any per-frame calculations and store their results internally. Other functions (such as mc_do_control) use the state set by mc_start_frame to perform their computations.

Parameters:

left Left motor encoder count

right Right motor encoder count

Returns:

< 0 on failure, >= 0 otherwise

7.44.4 Variable Documentation

7.44.4.1 encoder_val_t enc_correct[2]

target encoder counts

7.44.4.2 encoder_val_t enc_current[2]

current encoder counts

7.44.4.3 float mc_dt

time since last frame

7.44.4.4 pwm_val_t pwm_current[2]

current pwm counts

7.44.4.5 vel_val_t vel_correct[2]

target velocities

7.44.4.6 vel_val_t vel_current[2]

current velocities

7.44.4.7 vel_val_t vel_current_vw[2]

current trans/rot velocities

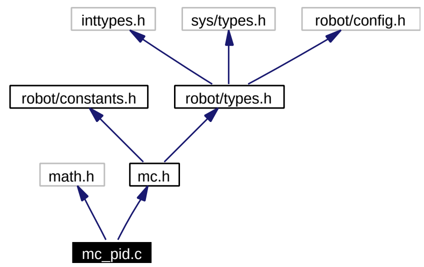
7.45 mc/mc_pid.c File Reference

Implements the mc_do_control and mc_init functions for a PID type controller.

`#include <math.h>`

`#include "mc.h"`

Include dependency graph for mc_pid.c:



Defines

- #define **NUM_SAMPLES** 25
- #define **clamp**(v, i, a)

Functions

- void **mc_get_left_kp** (float *k)
- void **mc_get_left_ki** (float *k)
- void **mc_get_left_kd** (float *k)
- void **mc_get_right_kp** (float *k)
- void **mc_get_right_ki** (float *k)
- void **mc_get_right_kd** (float *k)
- void **mc_set_left_kp** (float k)
- void **mc_set_left_ki** (float k)
- void **mc_set_left_kd** (float k)
- void **mc_set_right_kp** (float k)
- void **mc_set_right_ki** (float k)
- void **mc_set_right_kd** (float k)
- int **mc_init** (uint32_t flags)

  Initialize the motor controller.

- int **mc_do_control** (**pwm_val_t** *left_pwm, **pwm_val_t** *right_pwm)

  Calculate PWM counts to send to the motors based on internal state (target velocity and the encoder counts for the current frame).

7.45.1 Detailed Description

Implements the mc_do_control and mc_init functions for a PID type controller.

Author:

Christopher Chiaverini

Version:

Id **mc_pid.c**,v 1.6 2003/07/18 07:08:45 beevek Exp

Todo

FIXME: remove functions to get/set gains

7.45.2 Define Documentation

7.45.2.1 #define clamp(v, i, a)

Value:

```
do { \
  if(v < i) \
    v = i; \
  else if(v > a) \
    v = a; \
} while(0)
```

7.45.2.2 #define NUM_SAMPLES 25

number of integration steps to store

7.45.3 Function Documentation

7.45.3.1 int mc_do_control (pwm_val_t * *left_pwm*, pwm_val_t * *right_pwm*)

Calculate PWM counts to send to the motors based on internal state (target velocity and the encoder counts for the current frame).

This is the primary function that will be re-implemented by new motor controllers.

Parameters:

left_pwm Pointer to location to store PWM count for the left motor

right_pwm Pointer to location to store PWM count for the right motor

Returns:

< 0 on failure, >= 0 on success

7.45.3.2 void mc_get_left_kd (float * *k*)

7.45.3.3 void mc_get_left_ki (float * *k*)

7.45.3.4 void mc_get_left_kp (float * *k*)

7.45.3.5 void mc_get_right_kd (float * *k*)

7.45.3.6 void mc_get_right_ki (float * *k*)

7.45.3.7 void mc_get_right_kp (float * *k*)

7.45.3.8 int mc_init (uint32_t *flags*)

Initialize the motor controller.

Parameters:

flags Currently unused

Returns:

< 0 on failure, >= 0 otherwise

7.45.3.9 void mc_set_left_kd (float *k*)

7.45.3.10 void mc_set_left_ki (float *k*)

7.45.3.11 void mc_set_left_kp (float *k*)

7.45.3.12 void mc_set_right_kd (float *k*)

7.45.3.13 void mc_set_right_ki (float *k*)

7.45.3.14 void mc_set_right_kp (float *k*)

7.46 misc/logger/logger.cpp File Reference

Log data from /dev/robot entries, extensively.

#include <robot.h>

#include <stdio.h>

#include <string.h>

#include <unistd.h>

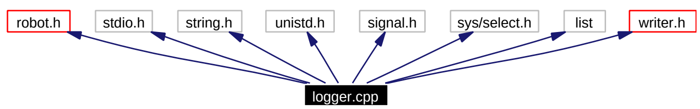
#include <signal.h>

#include <sys/select.h>

#include <list>

#include "writer.h"

Include dependency graph for logger.cpp:



Enumerations

- enum { **OPT_TYPE_STREAM** = (1 << 0), **OPT_TYPE_CHANGE** = (1 << 1), **OPT_TYPE_CTL** = (1 << 2), **OPT_RUN_BG** = (1 << 3) }

  command line options

Functions

- int **parse_hwid_list** (char *arg, std::list< uint8_t > ***hwids**)
- void **quit** (int **q**)

  Properly handle signals and exit.

- int **parse_command_line** (int argc, char **argv)

  Parse the logger command line.

- void **add_dir** (**devfs_set_t** *s, fd_set *fds, int *max)
- void **add_ctl** (**devfs_set_t** *s, fd_set *fds, int *max)
- void **init_poll_list** (fd_set *fds, int *max)

  Initialize the list of file descriptors to read from and log.

- void **read_and_log** (**devfs_set_t** *set, **devfs_type_t** type)

  Read from a file with waiting data and log it.

- void **log_forever** (void)

  Loop forever, reading data and logging it when it becomes available.

- int **main** (int argc, char **argv)

Variables

- char * **lhelp**
- **log_writer_t robot_log**

  output log

- log_entry_t **entry**

  buffer for log entries

- char * **filename** = 0
- int **opt** = 0
- std::list< uint8_t > **hwids**

  hwids we will log from

7.46.1 Detailed Description

Log data from /dev/robot entries, extensively.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id: **logger.cpp**,v 1.10 2003/08/19 15:14:57 beevek Exp

7.46.2 Enumeration Type Documentation

7.46.2.1 anonymous enum

command line options

Enumeration values:

OPT_TYPE_STREAM

OPT_TYPE_CHANGE

OPT_TYPE_CTL

OPT_RUN_BG

7.46.3 Function Documentation

7.46.3.1 void add_ctl (devfs_set_t * *s*, fd_set * *fds*, int * *max*) `[inline]`

7.46.3.2 void add_dir (devfs_set_t * *s*, fd_set * *fds*, int * *max*) `[inline]`

7.46.3.3 void init_poll_list (fd_set * *fds*, int * *max*)

Initialize the list of file descriptors to read from and log.

Parameters:

fds A pointer to an fd_set to fill in

max Will be set to the maximum valued file descriptor added to fds

7.46.3.4 void log_forever (void)

Loop forever, reading data and logging it when it becomes available.

This function never returns.

7.46.3.5 int main (int *argc*, char ** *argv*)

7.46.3.6 int parse_command_line (int *argc*, char ** *argv*)

Parse the logger command line.

Print usage information if necessary.

Returns:
-1 on failure, 0 on success

Parameters:
argc main's argc
argv main's argv

7.46.3.7 int parse_hwid_list (char * *arg*, std::list< uint8_t > * *hwids*)

Simple routine for parsing a string of the form blah,blah,blah,blah... and extracting hwids from it. Used as part of logger and logtool.

Returns:
-1 on failure, 0 on success

Parameters:
arg string to parse
hwids pointer to an STL list of hardware ids from **hwid.h** that will be filled in with the requested ids

7.46.3.8 void quit (int *q*)

Properly handle signals and exit.

7.46.3.9 void read_and_log (devfs_set_t * *set*, devfs_type_t *type*)

Read from a file with waiting data and log it.

Parameters:
set A **devfs_set_t** from devfs_fds for the current robot
type Which DEV_TYPE_* has waiting data

7.46.4 Variable Documentation

7.46.4.1 log_entry_t entry

buffer for log entries

7.46.4.2 char* filename = 0

7.46.4.3 std::list<uint8_t> hwids

hwids we will log from

7.46.4.4 char * lhelp

Initial value:

```
 "\n"
"-d          run as a daemon\n"
"\n"
"-s          log DEV_TYPE_STREAM entries\n"
"-c          log DEV_TYPE_CHANGE entries\n"
"-t          log DEV_TYPE_CTL entries\n"
"            if none of the above are specified, -ct is used by default\n"
"\n"
"-l <file>   log to <file> (default " ROBOT_DEFAULT_LOG_FILE ")\n"
"\n"
"-h <list>   log only the data for the specified HWIDs, comma separated (no spaces)\n"
"            valid arguments for this are:\n"
"\n"
"                sonar           all sonar readings and ctl\n"
"                ir              all ir readings and ctl\n"
"                bump            all bump readings\n"
"                vel             all velocity readings and ctl\n"
"                odom            all odometry updates and ctl\n"
"                encoder         all encoder counts\n"
"                pwm             all pwm counts\n"
"                {0-HW_MAX}      (digits): specified HWID\n"
"\n"
"             by default all data is logged\n"
```

7.46.4.5 int opt = 0

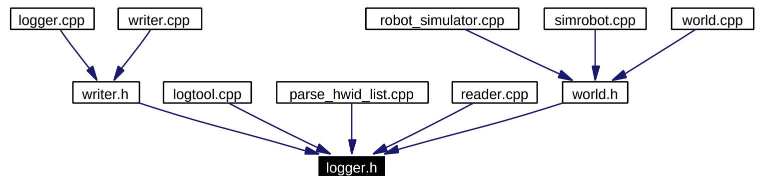
7.46.4.6 log_writer_t robot_log

output log

7.47 misc/logger/logger.h File Reference

Interface for reading from robot log files.

This graph shows which files directly or indirectly include this file:



7.47.1 Detailed Description

Interface for reading from robot log files.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

VersIdon:

logger.h,v 1.7 2003/07/18 07:08:45 beevek Exp

7.48 misc/logger/logtool.cpp File Reference

Tool for printing information from robot log files.

`#include <robot.h>`

`#include <stdio.h>`

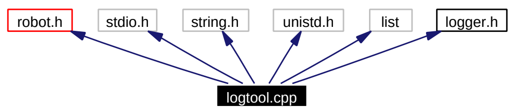
`#include <string.h>`

`#include <unistd.h>`

`#include <list>`

`#include "logger.h"`

Include dependency graph for logtool.cpp:



Enumerations

- enum { **OPT_TYPE_STREAM** = (1 << 0), **OPT_TYPE_CHANGE** = (1 << 1), **OPT_TYPE_CTL** = (1 << 2) }

  command line options

Functions

- int **parse_hwid_list** (char ∗arg, std::list< uint8_t > ∗**hwids**)
- int **parse_command_line** (int argc, char ∗∗argv)

  Parse the logtool command line.

- void **print_entry_common** (void)
- void **print_ctl_entry** (void)

  Print stuff specific to a CTL-type entry.

- void **print_data_entry** (void)

  Print stuff specific to a non-CTL-type entry (i.e. a STREAM or CHANGE entry).

- void **quit** (int **q**)

  Handle signals gracefully and exit.

- int **main** (int argc, char ∗∗argv)

Variables

- char ∗ **lthelp**
- log_reader_t **robot_log**

  log file to read from

- log_entry_t **entry**

  log entry buffer

- char * **filename** = 0
- **robot_time_us_t begin** = 0
- **robot_time_us_t end** = UINT64_MAX
- int **opt** = 0
- std::list< uint8_t > **hwids**

7.48.1 Detailed Description

Tool for printing information from robot log files.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id: **logtool.cpp**,v 1.6 2003/07/18 07:08:45 beevek Exp

7.48.2 Enumeration Type Documentation

7.48.2.1 anonymous enum

command line options

Enumeration values:
OPT_TYPE_STREAM
OPT_TYPE_CHANGE
OPT_TYPE_CTL

7.48.3 Function Documentation

7.48.3.1 int main (int *argc*, char ** *argv*)

7.48.3.2 int parse_command_line (int *argc*, char ** *argv*)

Parse the logtool command line.

Print usage information if necessary.

Returns:
-1 on failure, 0 on success

Parameters:
argc main's argc
argv main's argv

7.48.3.3 int parse_hwid_list (char * *arg*, std::list< uint8_t > * *hwids*)

Simple routine for parsing a string of the form blah,blah,blah,blah... and extracting hwids from it. Used as part of logger and logtool.

Returns:
-1 on failure, 0 on success

Parameters:
arg string to parse
hwids pointer to an STL list of hardware ids from **hwid.h** that will be filled in with the requested ids

7.48.3.4 void print_ctl_entry (void)

Print stuff specific to a CTL-type entry.

7.48.3.5 void print_data_entry (void)

Print stuff specific to a non-CTL-type entry (i.e. a STREAM or CHANGE entry).

7.48.3.6 void print_entry_common (void)

7.48.3.7 void quit (int *q*)

Handle signals gracefully and exit.

7.48.4 Variable Documentation

7.48.4.1 robot_time_us_t begin = 0

7.48.4.2 robot_time_us_t end = UINT64_MAX

7.48.4.3 log_entry_t entry

log entry buffer

7.48.4.4 char* filename = 0

7.48.4.5 std::list<uint8_t> hwids

7.48.4.6 char * lthelp

Initial value:

```
 "\n"
" -s          show DEV_TYPE_STREAM entries\n"
" -c          show DEV_TYPE_CHANGE entries\n"
" -t          show DEV_TYPE_CTL entries\n"
"             if none of the above is specified, -sct is used by default\n"
```

```
"\n"
" -l <file>   open <file> as the log file (default " ROBOT_DEFAULT_LOG_FILE ")\n"
"\n"
" -b <time>   begin printing at <time> (microseconds since epoch)\n"
" -e <time>   end printing at <time>\n"
"\n"
" -h <list>   print only the data for the specified HWIDs, comma separated (no spaces)\n"
"             valid arguments for this are:\n"
"\n"
"                sonar           all sonar readings and ctl\n"
"                ir              all ir readings and ctl\n"
"                bump            all bump readings\n"
"                vel             all velocity readings and ctl\n"
"                odom            all odometry updates and ctl\n"
"                encoder         all encoder counts\n"
"                pwm             all pwm counts\n"
"                {0-HW_MAX}      (digits): specified HWID\n"
"\n"
"             by default all data is printed\n"
```

7.48.4.7 int opt = 0

7.48.4.8 log_reader_t robot_log

log file to read from

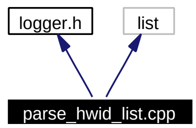
7.49 misc/logger/parse_hwid_list.cpp File Reference

Parse a string of the form a,b,c,d.

`#include "logger.h"`

`#include <list>`

Include dependency graph for parse_hwid_list.cpp:



Functions

- int **parse_hwid_list** (char *arg, std::list< uint8_t > ***hwids**)

7.49.1 Detailed Description

Parse a string of the form a,b,c,d.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

parse_hwid_list.cpp,v 1.3 2003/07/18 15:27:23 beevek Exp

7.49.2 Function Documentation

7.49.2.1 int parse_hwid_list (char * *arg*, std::list< uint8_t > * *hwids*)

Simple routine for parsing a string of the form blah,blah,blah,blah... and extracting hwids from it. Used as part of logger and logtool.

Returns:

-1 on failure, 0 on success

Parameters:

arg string to parse

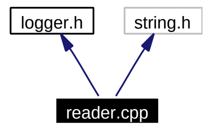
hwids pointer to an STL list of hardware ids from **hwid.h** that will be filled in with the requested ids

7.50 misc/logger/reader.cpp File Reference

Implementation of the log_reader_t class.

```
#include "logger.h"
#include <string.h>
```

Include dependency graph for reader.cpp:



7.50.1 Detailed Description

Implementation of the log_reader_t class.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

reader.cpp,v 1.5 2003/07/18 01:13:13 beevek Exp

7.51 misc/logger/writer.cpp File Reference

Implementation of **log_writer_t** class.

`#include <robot/util.h>`

`#include <string.h>`

`#include <sys/file.h>`

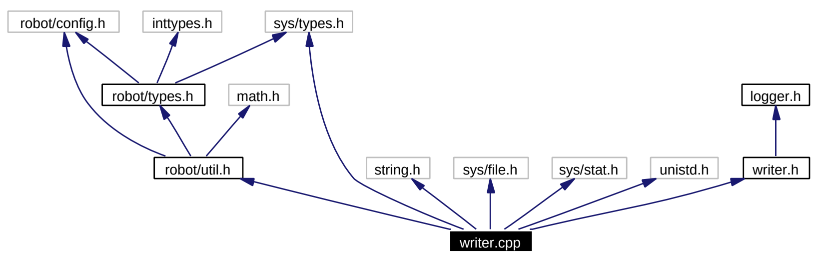
`#include <sys/types.h>`

`#include <sys/stat.h>`

`#include <unistd.h>`

`#include "writer.h"`

Include dependency graph for writer.cpp:



7.51.1 Detailed Description

Implementation of **log_writer_t** class.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

Id:

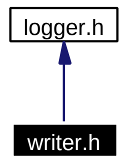
writer.cpp,v 1.6 2003/07/18 16:35:47 beevek Exp

7.52 misc/logger/writer.h File Reference

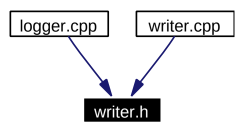
Interface for log writer class (only used internally).

`#include "logger.h"`

Include dependency graph for writer.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **log_writer_t**

7.52.1 Detailed Description

Interface for log writer class (only used internally).

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

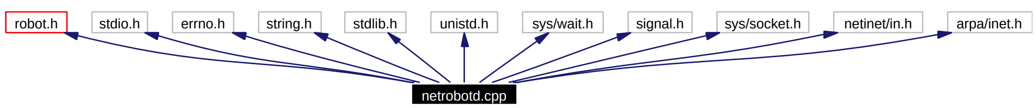
Version:
writer.h,v 1.3 2003/07/18 16:35:47 beevek Exp

7.53 misc/netrobot/netrobotd.cpp File Reference

Remote-control server to be run on the robot.

```
#include <robot.h>
#include <stdio.h>
#include <errno.h>
#include <string.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/wait.h>
#include <signal.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
```

Include dependency graph for netrobotd.cpp:



Defines

- #define **printf**(s...) do { printf(s); fflush(stdout); } while(0)

Enumerations

- enum { **OPT_RUN_BG** = (1 << 0), **OPT_NO_UDP** = (1 << 1), **OPT_HAVE_LOG** = (1 << 2) }

  command line options

Functions

- int **net_write_msg** (int sock, **robot_net_msg_t** ∗**msg**)

  Internal use only.

- int **net_read_msg** (int sock, **robot_net_msg_t** ∗**msg**)

  Internal use only.

- int **parse_command_line** (int argc, char ∗∗argv)

  Parse the netrobotd command line.

- int **make_daemon** (void)

Become a daemon.

- void **setup_sockaddr** (struct sockaddr_in *sa)
- int **listen_init** (void)

  Initialize listening sockets.

- int **do_robot_init** (void)
- int **net_write_error** (int err)
- int **tcp_handle_msg** (void)
- int **tcp_handle** (void)
- int **udp_handle** (void)
- void **zombie** (int sig)
- int **main** (int argc, char **argv)

Variables

- int **errno**
- const **robot_net_msg_t msg_error**
- **robot_id_t robot_id**

  id of local robot

- const char * **robot_name**

  name of local robot

- int **robot_name_len**
- char * **nrdhelp**
- int **client**

  socket of connected client

- uint8_t **msg_buf** [256]

  data buffer for msg

- **robot_net_msg_t msg**

  global message buffer

7.53.1 Detailed Description

Remote-control server to be run on the robot.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
netrobotd.cpp,v 1.14 2003/07/31 22:30:04 beevek Exp

Server that runs on the robot accepting commands from remote devices. Translates their commands into devfs_reads and devfs_writes locally. Must be running for the network functionality in librobot to work properly.

7.53.2 Define Documentation

7.53.2.1 #define printf(s...) do { printf(s); fflush(stdout); } while(0)

7.53.3 Enumeration Type Documentation

7.53.3.1 anonymous enum

command line options

Enumeration values:
- **OPT_RUN_BG**
- **OPT_NO_UDP**
- **OPT_HAVE_LOG**

7.53.4 Function Documentation

7.53.4.1 int do_robot_init (void)

7.53.4.2 int listen_init (void)

Initialize listening sockets.

Creates and initializes both a TCP listening socket and a UDP one.

Returns:
< 0 on failure, >= 0 on success

7.53.4.3 int main (int *argc*, char ** *argv*)

7.53.4.4 int make_daemon (void)

Become a daemon.

Close open files if necessary, or point them to some other place.

Returns:
< 0 on failure, >= 0 on success

7.53.4.5 int net_read_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Read a single robot message from the specified socket.

Parameters:
- ***sock*** Socket file descriptor to read from
- ***msg*** Pointer to message buffer to read into

Returns:
< 0 on failure, >= 0 on success

7.53.4.6 int net_write_error (int *err*)

7.53.4.7 int net_write_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Write a single robot message to the specified socket.

Parameters:

sock Socket file descriptor to write to

msg Pointer to message to send

Returns:

< 0 on failure, >= 0 on success

7.53.4.8 int parse_command_line (int *argc*, char ** *argv*)

Parse the netrobotd command line.

Print usage information if necessary.

Returns:

-1 on failure, 0 on success

Parameters:

argc main's argc

argv main's argv

7.53.4.9 void setup_sockaddr (struct sockaddr_in * *sa*) [inline]

7.53.4.10 int tcp_handle (void)

7.53.4.11 int tcp_handle_msg (void)

7.53.4.12 int udp_handle (void)

7.53.4.13 void zombie (int *sig*)

7.53.5 Variable Documentation

7.53.5.1 int client

socket of connected client

7.53.5.2 int errno

7.53.5.3 robot_net_msg_t msg

global message buffer

7.53.5.4 uint8_t msg_buf[256]

data buffer for msg

7.53.5.5 const robot_net_msg_t msg_error

7.53.5.6 char * nrdhelp

Initial value:

```
 "\n"
"-d          run as daemon\n"
"-p <port>   listen on <port> (both udp and tcp)\n"
"-u          do not listen on udp (for \"find\" requests)\n"
"-l <file>   print to this file instead of stdout\n"
```

7.53.5.7 robot_id_t robot_id

id of local robot

7.53.5.8 const char* robot_name

name of local robot

7.53.5.9 int robot_name_len

7.54 misc/netrobot/nrtool.cpp File Reference

A utility for controlling robots over the network.

`#include <robot.h>`

`#include <stdio.h>`

`#include <string.h>`

`#include <stdarg.h>`

`#include <list>`

`#include <unistd.h>`

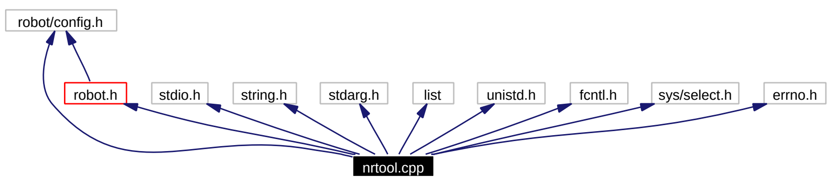
`#include <fcntl.h>`

`#include <sys/select.h>`

`#include <errno.h>`

`#include <robot/config.h>`

Include dependency graph for nrtool.cpp:



Compounds

- struct **handler_t**

  specify which function to call when a command is run

Functions

- int **setup_robot** ()

  initialize a remote robot

- int **cleanup_robot** ()

  shutdown a remote robot and free local memory

- **robot_handle_t** ∗ **find_robot** (const char ∗name)

  find a robot with the specified name in the robots array

- int **h_find** (int argc, char ∗∗argv)
- int **h_unset** (int argc, char ∗∗argv)
- int **h_name** (int argc, char ∗∗argv)
- int **h_ip** (int argc, char ∗∗argv)
- int **h_sasf** (int argc, char ∗∗argv)

- int **h_ssf** (int argc, char **argv)
- int **h_saif** (int argc, char **argv)
- int **h_sif** (int argc, char **argv)
- int **h_stop** (int argc, char **argv)
- int **h_sv** (int argc, char **argv)
- int **h_stv** (int argc, char **argv)
- int **h_srv** (int argc, char **argv)
- int **h_translate** (int argc, char **argv)
- int **h_rotate** (int argc, char **argv)
- int **h_so** (int argc, char **argv)
- int **h_gv** (int argc, char **argv)
- int **h_go** (int argc, char **argv)
- int **h_gs** (int argc, char **argv)
- int **h_gi** (int argc, char **argv)
- int **h_gb** (int argc, char **argv)
- int **h_status** (int argc, char **argv)
- void **remove_comments** (char *cmd)

  strip the comments from a command line

- int **run** (char *cmd)

  Actually can run a series of commands separated by ;'s.

- void **console** (void)

  Repeatedly read commands and execute them.

- int **main** (int argc, char **argv)

Variables

- int **errno**
- char * **nrhelp**
- const char * **version** = "Id: nrtool.cpp,v 1.9 2003/07/18 15:27:23 beevek Exp $"
- char * **rip** = 0
- **robot_handle_t** * **robot**

  current robot handle

- **robot_handle_t** * **robots**

  available robots reported by h_find

- int **nrobots** = 0

  size of robots array

- char * **err_args** = "error: wrong arguments"
- char * **err_robot** = "error: no **robot** to talk to (use 'name' or '**ip**')\n"
- handler_t **handlers** []

  list of handlers for commands

7.54.1 Detailed Description

A utility for controlling robots over the network.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
Id: **nrtool.cpp**,v 1.11 2003/08/11 21:21:46 beevek Exp

Run "nrtool -h" for usage information.

The h_* functions are handlers for each command.

7.54.2 Function Documentation

7.54.2.1 int cleanup_robot ()

shutdown a remote robot and free local memory

7.54.2.2 void console (void)

Repeatedly read commands and execute them.

This function doesn't exit until the user types quit or exit, or does ctrl-c.

7.54.2.3 robot_handle_t* find_robot (const char * *name*)

find a robot with the specified name in the robots array

7.54.2.4 int h_find (int *argc*, char ** *argv*)

7.54.2.5 int h_gb (int *argc*, char ** *argv*)

7.54.2.6 int h_gi (int *argc*, char ** *argv*)

7.54.2.7 int h_go (int *argc*, char ** *argv*)

7.54.2.8 int h_gs (int *argc*, char ** *argv*)

7.54.2.9 int h_gv (int *argc*, char ** *argv*)

7.54.2.10 int h_ip (int *argc*, char ** *argv*)

7.54.2.11 int h_name (int *argc*, char ** *argv*)

7.54.2.12 int h_rotate (int *argc*, char ** *argv*)

7.54.2.13 int h_saif (int *argc*, char ** *argv*)

7.54.2.14 int h_sasf (int *argc*, char ** *argv*)

7.54.2.15 int h_sif (int *argc*, char ** *argv*)

7.54.2.16 int h_so (int *argc*, char ** *argv*)

7.54.2.17 int h_srv (int *argc*, char ** *argv*)

7.54.2.18 int h_ssf (int *argc*, char ** *argv*)

7.54.2.19 int h_status (int *argc*, char ** *argv*)

7.54.2.20 int h_stop (int *argc*, char ** *argv*)

7.54.2.21 int h_stv (int *argc*, char ** *argv*)

7.54.2.22 int h_sv (int *argc*, char ** *argv*)

7.54.2.23 int h_translate (int *argc*, char ** *argv*)

7.54.2.24 int h_unset (int *argc*, char ** *argv*)

7.54.2.25 int main (int *argc*, char ** *argv*)

7.54.2.26 void remove_comments (char * *cmd*)

strip the comments from a command line

7.54.2.27 int run (char * *cmd*)

Actually can run a series of commands separated by ;'s.

Strips comments from the end of the line. Separating commands with semicolons makes it so you can (essentially) script nrtool.

Returns:
< 0 on failure (cmd not found), >= 0 on success

7.54.2.28 int setup_robot ()

initialize a remote robot

7.54.3 Variable Documentation

7.54.3.1 char* err_args = "error: wrong arguments"

7.54.3.2 char* err_robot = "error: no robot to talk to (use 'name' or 'ip')\n"

7.54.3.3 int errno

7.54.3.4 handler_t handlers[]

list of handlers for commands

7.54.3.5 char * nrhelp

7.54.3.6 int nrobots = 0

size of robots array

7.54.3.7 char* rip = 0

7.54.3.8 robot_handle_t* robot

current robot handle

7.54.3.9 robot_handle_t* robots

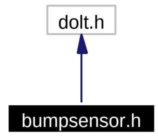
available robots reported by h_find

7.54.3.10 const char* version = "Id: nrtool.cpp,v 1.9 2003/07/18 15:27:23 beevek Exp $"

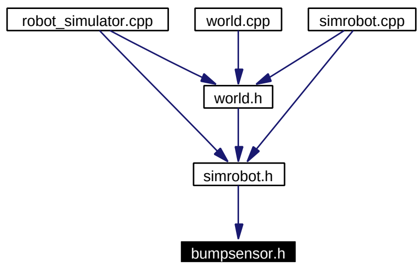
7.55 misc/simulator/bumpsensor.h File Reference

`#include <dolt.h>`

Include dependency graph for bumpsensor.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **BumpSensor**

7.56 misc/simulator/robot_simulator.cpp File Reference

#include <robot.h>

#include <stdio.h>

#include <errno.h>

#include <string.h>

#include <stdlib.h>

#include <unistd.h>

#include <sys/wait.h>

#include <signal.h>

#include <sys/socket.h>

#include <netinet/in.h>

#include <arpa/inet.h>

#include <sys/time.h>

#include <iostream>

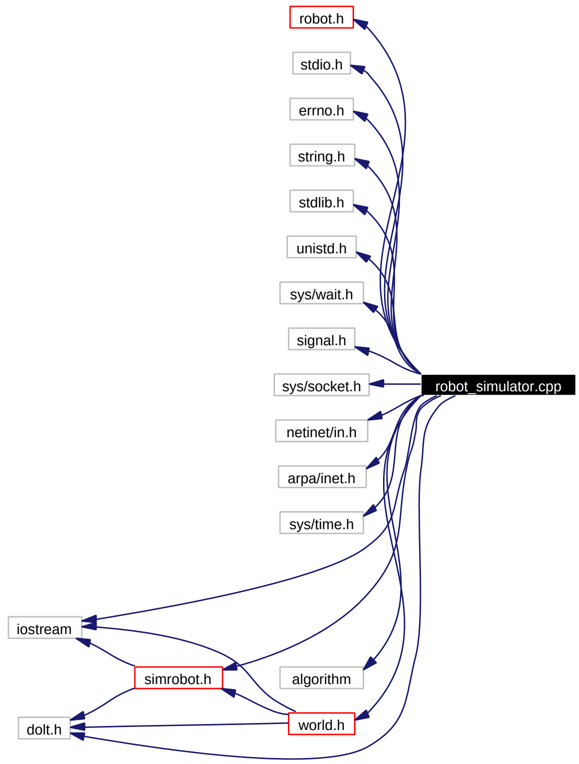
#include <dolt.h>

#include <algorithm>

#include "world.h"

#include "simrobot.h"

Include dependency graph for robot_simulator.cpp:



Namespaces

- namespace **dolt**

Compounds

- struct **clientInfo**

Defines

- #define **printf**(s...) do { printf(s); fflush(stdout); } while(0)

Typedefs

- typedef list< pair< clientInfo, **SimRobot** * > > **RobotList**

Enumerations

- enum { **OPT_RUN_BG** = (1 << 0), **OPT_NO_UDP** = (1 << 1), **OPT_HAVE_LOG** = (1 << 2) }

Functions

- int **net_write_msg** (int sock, **robot_net_msg_t** *msg)

  Internal use only.
- int **net_read_msg** (int sock, **robot_net_msg_t** *msg)

  Internal use only.
- void **setup_sockaddr** (struct sockaddr_in *sa)
- int **listen_init** (void)
- int **net_write_error** (RobotList::iterator i, int err)
- int **set_velocity** (RobotList::iterator i)
- int **get_velocity** (RobotList::iterator i)
- int **set_odometry** (RobotList::iterator i)
- int **get_odometry** (RobotList::iterator i)
- int **set_all_sonar_frequencies** (RobotList::iterator i)
- int **get_all_sonar** (RobotList::iterator i)
- int **set_sonar_frequency** (RobotList::iterator i, int sensor)
- int **get_sonar** (RobotList::iterator i, int sensor)
- int **set_all_ir_frequencies** (RobotList::iterator i)
- int **get_all_ir** (RobotList::iterator i)
- int **set_ir_frequency** (RobotList::iterator i, int sensor)
- int **get_ir** (RobotList::iterator i, int sensor)
- int **get_all_bump** (RobotList::iterator i)
- int **get_bump** (RobotList::iterator i, int sensor)
- int **tcp_handle_msg** (RobotList::iterator **robot**)
- void **look_for_change** (RobotList::iterator **robot**)
- int **tcp_handle** (int sock, **SimRobot** *rob)
- void **do_physics** ()
- void **keyboardHandler** (unsigned char key)
- int **main** (int argc, char **argv)

Variables

- int **errno**
- const **robot_net_msg_t msg_error**
- **robot_id_t robot_id**
- const char * **robot_name**
- int **robot_name_len**
- uint8_t **msg_buf** [256]
- timeval last present **tv**
- double **elapsed**
- double **total_elapsed**
- Graphics **G**
- **mpProblem** * **P**
- objectList **workspace**
- float **acceleration**
- bool **displayPaths**
- bool **displaySonars**
- bool **displayIRs**

- bool **displayBumps**
- bool **waitForChange**
- **RobotList robots**
- list< RobotList::iterator > **toDelete**
- list< pair< int, **SimRobot** * > > **socks**

7.56.1 Define Documentation

7.56.1.1 #define printf(s...) do { printf(s); fflush(stdout); } while(0)

7.56.2 Typedef Documentation

7.56.2.1 typedef list< pair<clientInfo, SimRobot *> > RobotList

7.56.3 Enumeration Type Documentation

7.56.3.1 anonymous enum

Enumeration values:

OPT_RUN_BG

OPT_NO_UDP

OPT_HAVE_LOG

7.56.4 Function Documentation

7.56.4.1 void do_physics ()

7.56.4.2 int get_all_bump (RobotList::iterator *i*)

7.56.4.3 int get_all_ir (RobotList::iterator *i*)

7.56.4.4 int get_all_sonar (RobotList::iterator *i*)

7.56.4.5 int get_bump (RobotList::iterator *i*, int *sensor*)

7.56.4.6 int get_ir (RobotList::iterator *i*, int *sensor*)

7.56.4.7 int get_odometry (RobotList::iterator *i*)

7.56.4.8 int get_sonar (RobotList::iterator *i*, int *sensor*)

7.56.4.9 int get_velocity (RobotList::iterator *i*)

7.56.4.10 void keyboardHandler (unsigned char *key*)

7.56.4.11 int listen_init (void)

7.56.4.12 void look_for_change (RobotList::iterator *robot*)

7.56.4.13 int main (int *argc*, char ** *argv*)

7.56.4.14 int net_read_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Read a single robot message from the specified socket.

Parameters:

sock Socket file descriptor to read from

msg Pointer to message buffer to read into

Returns:

< 0 on failure, >= 0 on success

7.56.4.15 int net_write_error (RobotList::iterator *i*, int *err*)

7.56.4.16 int net_write_msg (int *sock*, robot_net_msg_t * *msg*)

Internal use only.

Write a single robot message to the specified socket.

Parameters:

sock Socket file descriptor to write to

msg Pointer to message to send

Returns:

< 0 on failure, >= 0 on success

7.56.4.17 int set_all_ir_frequencies (RobotList::iterator *i*)

7.56.4.18 int set_all_sonar_frequencies (RobotList::iterator *i*)

7.56.4.19 int set_ir_frequency (RobotList::iterator *i*, int *sensor*)

7.56.4.20 int set_odometry (RobotList::iterator *i*)

7.56.4.21 int set_sonar_frequency (RobotList::iterator *i*, int *sensor*)

7.56.4.22 int set_velocity (RobotList::iterator *i*)

7.56.4.23 void setup_sockaddr (struct sockaddr_in * *sa*) `[inline]`

7.56.4.24 int tcp_handle (int *sock*, SimRobot * *rob*)

7.56.4.25 int tcp_handle_msg (RobotList::iterator *robot*)

7.56.5 Variable Documentation

7.56.5.1 float acceleration

7.56.5.2 bool displayBumps

7.56.5.3 bool displayIRs

7.56.5.4 bool displayPaths

7.56.5.5 bool displaySonars

7.56.5.6 double elapsed

7.56.5.7 int errno

7.56.5.8 Graphics G

7.56.5.9 uint8_t msg_buf[256]

7.56.5.10 const robot_net_msg_t msg_error

7.56.5.11 mpProblem* P

7.56.5.12 robot_id_t robot_id

7.56.5.13 const char* robot_name

7.56.5.14 int robot_name_len

7.56.5.15 RobotList robots

7.56.5.16 list< pair<int, SimRobot *> > socks

7.56.5.17 list<RobotList::iterator> toDelete

7.56.5.18 double total_elapsed

7.56.5.19 struct timeval last present tv

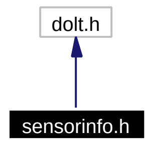
7.56.5.20 bool waitForChange

7.56.5.21 objectList workspace

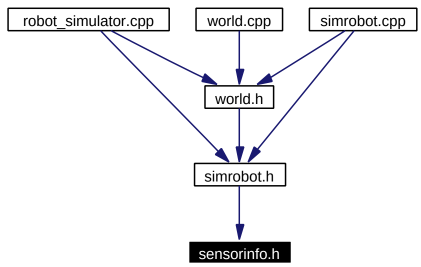
7.57 misc/simulator/sensorinfo.h File Reference

`#include <dolt.h>`

Include dependency graph for sensorinfo.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **SensorInfo**

7.58 misc/simulator/simrobot.cpp File Reference

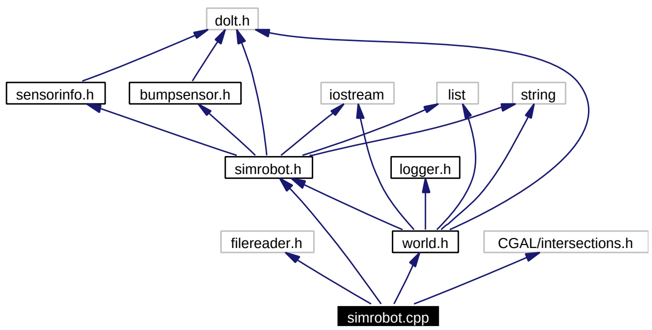
`#include <filereader.h>`

`#include "world.h"`

`#include "simrobot.h"`

`#include <CGAL/intersections.h>`

Include dependency graph for simrobot.cpp:



Namespaces

- namespace **std**

Functions

- double **dist** (const **Point** &p, const **Point** &**q**)

Variables

- **mpProblem** ∗ **P**
- const long **defaultSeed** = 18846224
- long **pmRandGenSeed** = **defaultSeed**
- const long **alpha** = 16807
- const long **m** = 2147483647
- const long **q** = **m**/**alpha**
- const long **r** = **m** % **alpha**
- const long **pmRandMax** = **m**

7.58.1 Function Documentation

7.58.1.1 double dist (const Point & *p*, const Point & *q*) [inline]

7.58.2 Variable Documentation

7.58.2.1 const long alpha = 16807

7.58.2.2 const long defaultSeed = 18846224

7.58.2.3 const long m = 2147483647

7.58.2.4 mpProblem* P

7.58.2.5 long pmRandGenSeed = defaultSeed

7.58.2.6 const long pmRandMax = m

7.58.2.7 const long q = m/alpha

7.58.2.8 const long r = m % alpha

7.59 misc/simulator/simrobot.h File Reference

This file defines the Simrobot class.

`#include <list>`

`#include <string>`

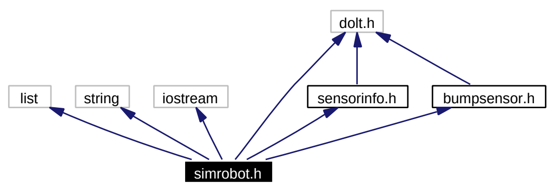
`#include <iostream>`

`#include <dolt.h>`

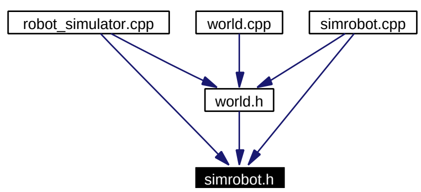
`#include "sensorinfo.h"`

`#include "bumpsensor.h"`

Include dependency graph for simrobot.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **SimRobot**

  The SimRobot class is used to simulate a configurable differential drive robot.

7.59.1 Detailed Description

This file defines the Simrobot class.

Author:

Christopher Chiaverini (`chiavc@cs.rpi.edu`)

Version:

simrobot.h,v 1.24 2003/08/06 15:36:00 chiavc Exp

7.60 misc/simulator/world.cpp File Reference

`#include "world.h"`

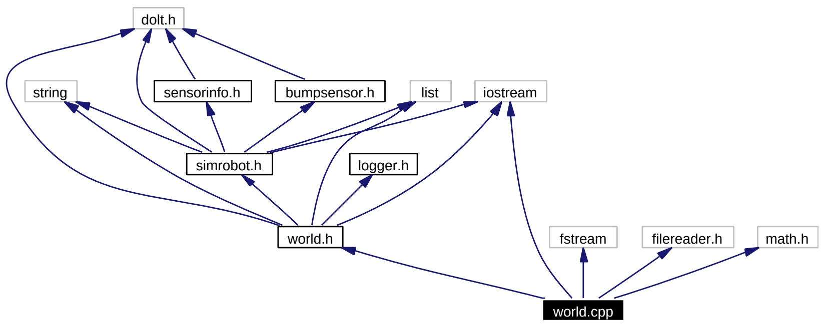
`#include <iostream>`

`#include <fstream>`

`#include <filereader.h>`

`#include <math.h>`

Include dependency graph for world.cpp:



Functions

- istream & **operator>>** (istream &in, **Obstacle** &obst)

7.60.1 Function Documentation

7.60.1.1 istream& operator>> (istream & *in*, Obstacle & *obst*)

7.61 misc/simulator/world.h File Reference

`#include <list>`

`#include <string>`

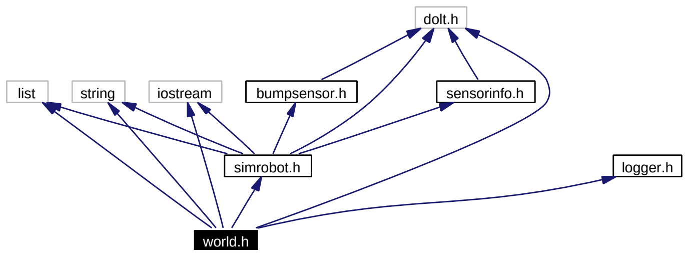
`#include <iostream>`

`#include <dolt.h>`

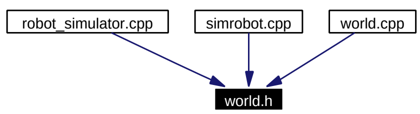
`#include "simrobot.h"`

`#include "logger.h"`

Include dependency graph for world.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **mpProblem**
- class **Obstacle**
- class **World**

Variables

- const unsigned int **MAX_PROBLEM_NAME_LEN** = 100

7.61.1 Variable Documentation

7.61.1.1 const unsigned int MAX_PROBLEM_NAME_LEN = 100

7.62 misc/tests/behavior.cpp File Reference

Test of the behavioral subsystem.

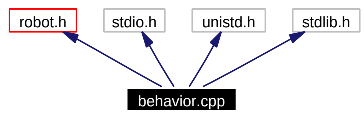
`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

`#include <stdlib.h>`

Include dependency graph for behavior.cpp:



Functions

- int **main** (int argc, char **argv)

7.62.1 Detailed Description

Test of the behavioral subsystem.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id **behavior.cpp**,v 1.5 2003/08/20 18:28:27 beevek Exp

Load a behavior, sit around for a while and then quit (should automatically unload behavior).

7.62.2 Function Documentation

7.62.2.1 int main (int *argc*, char ** *argv*)

7.63 misc/tests/drive_in_circle.cpp File Reference

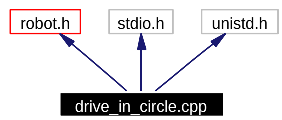
Simple test to make the robot drive in a circle.

`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

Include dependency graph for drive_in_circle.cpp:



Functions

- int **main** (int argc, char **argv)

7.63.1 Detailed Description

Simple test to make the robot drive in a circle.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id
drive_in_circle.cpp,v 1.5 2003/07/18 07:08:45 beevek Exp

7.63.2 Function Documentation

7.63.2.1 int main (int *argc*, char ** *argv*)

7.64 misc/tests/forward.cpp File Reference

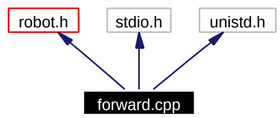
Simple test to make the robot drive forward.

`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

Include dependency graph for forward.cpp:



Functions

- int **main** (int argc, char **argv)

7.64.1 Detailed Description

Simple test to make the robot drive forward.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

forward.cpp,v 1.4 2003/07/18 07:08:45 beevek Exp

7.64.2 Function Documentation

7.64.2.1 int main (int *argc*, char ** *argv*)

7.65 misc/tests/freq.cpp File Reference

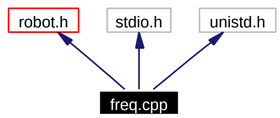
Test setting sensor frequencies.

`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

Include dependency graph for freq.cpp:



Functions

- int **main** (int argc, char **argv)

7.65.1 Detailed Description

Test setting sensor frequencies.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version: Id:

freq.cpp,v 1.4 2003/07/18 07:08:45 beevek Exp

7.65.2 Function Documentation

7.65.2.1 int main (int *argc*, char ** *argv*)

7.66 misc/tests/lock.cpp File Reference

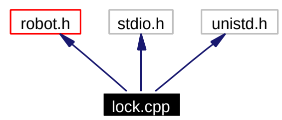
Test the locking of hardware device control.

#include <robot.h>

#include <stdio.h>

#include <unistd.h>

Include dependency graph for lock.cpp:



Functions

- int **main** (int argc, char **argv)

7.66.1 Detailed Description

Test the locking of hardware device control.

Author:
Kris Beevers (beevek@cs.rpi.edu)

Version:
lock.cpp,v 1.1 2003/08/01 15:30:43 beevek Exp

7.66.2 Function Documentation

7.66.2.1 int main (int *argc*, char ** *argv*)

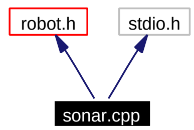
7.67 misc/tests/sonar.cpp File Reference

Test sonar sensors.

`#include <robot.h>`

`#include <stdio.h>`

Include dependency graph for sonar.cpp:



Functions

- int **main** (int argc, char **argv)

7.67.1 Detailed Description

Test sonar sensors.

Author:

Kris Beevers (`beevek@cs.rpi.edu`)

Version:

Id **sonar.cpp**,v 1.4 2003/07/24 18:23:51 beevek Exp

7.67.2 Function Documentation

7.67.2.1 int main (int *argc*, char ** *argv*)

7.68 misc/tests/stop.cpp File Reference

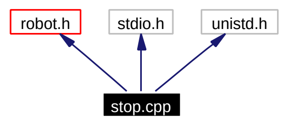
Make the robot's motors stop.

`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

Include dependency graph for stop.cpp:



Functions

- int **main** (int argc, char $**$argv)

7.68.1 Detailed Description

Make the robot's motors stop.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
Id:
stop.cpp,v 1.4 2003/07/18 07:08:46 beevek Exp

7.68.2 Function Documentation

7.68.2.1 int main (int *argc*, char $**$ *argv*)

7.69 misc/tests/stop_sensors.cpp File Reference

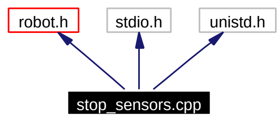
Make the robot's sensors stop firing.

#include <robot.h>

#include <stdio.h>

#include <unistd.h>

Include dependency graph for stop_sensors.cpp:



Functions

- int **main** (int argc, char **argv)

7.69.1 Detailed Description

Make the robot's sensors stop firing.

Author:

Kris Beevers (beevek@cs.rpi.edu)

Version:

stop_sensors.cpp,v 1.3 2003/07/18 07:08:46 beevek Exp

7.69.2 Function Documentation

7.69.2.1 int main (int *argc*, char ** *argv*)

7.70 misc/tests/time.cpp File Reference

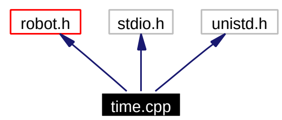
Test robot_time_us_t.

`#include <robot.h>`

`#include <stdio.h>`

`#include <unistd.h>`

Include dependency graph for time.cpp:



Functions

- int **main** (int argc, char **argv)

7.70.1 Detailed Description

Test robot_time_us_t.

Author:
Kris Beevers (`beevek@cs.rpi.edu`)

Version:
time.cpp,v 1.2 2003/07/18 07:08:46 beevek Exp

7.70.2 Function Documentation

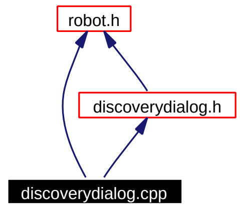
7.70.2.1 int main (int *argc*, char ** *argv*)

7.71 pda/mom/discoverydialog.cpp File Reference

`#include "robot.h"`

`#include "discoverydialog.h"`

Include dependency graph for discoverydialog.cpp:



7.72 pda/mom/discoverydialog.h File Reference

`#include <list>`

`#include <qvbox.h>`

`#include <qlabel.h>`

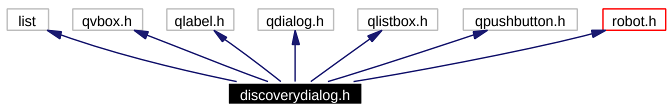
`#include <qdialog.h>`

`#include <qlistbox.h>`

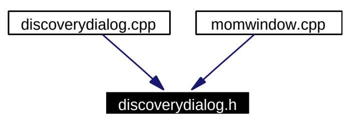
`#include <qpushbutton.h>`

`#include "robot.h"`

Include dependency graph for discoverydialog.h:



This graph shows which files directly or indirectly include this file:



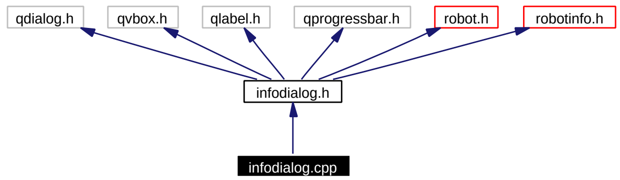
Compounds

- class **DiscoveryDialog**

7.73 pda/mom/infodialog.cpp File Reference

`#include "infodialog.h"`

Include dependency graph for infodialog.cpp:



7.74 pda/mom/infodialog.h File Reference

`#include <qdialog.h>`

`#include <qvbox.h>`

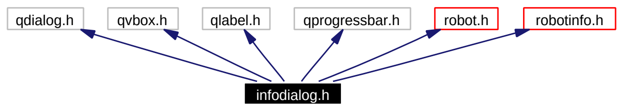
`#include <qlabel.h>`

`#include <qprogressbar.h>`

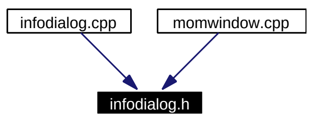
`#include "robot.h"`

`#include "robotinfo.h"`

Include dependency graph for infodialog.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **InfoDialog**

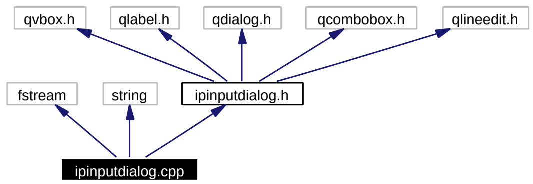
7.75 pda/mom/ipinputdialog.cpp File Reference

`#include <fstream>`

`#include <string>`

`#include "ipinputdialog.h"`

Include dependency graph for ipinputdialog.cpp:



7.76 pda/mom/ipinputdialog.h File Reference

`#include <qvbox.h>`

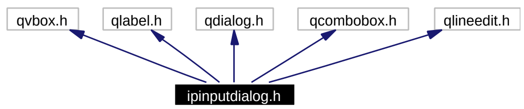
`#include <qlabel.h>`

`#include <qdialog.h>`

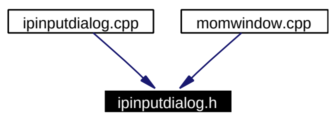
`#include <qcombobox.h>`

`#include <qlineedit.h>`

Include dependency graph for ipinputdialog.h:



This graph shows which files directly or indirectly include this file:



Compounds

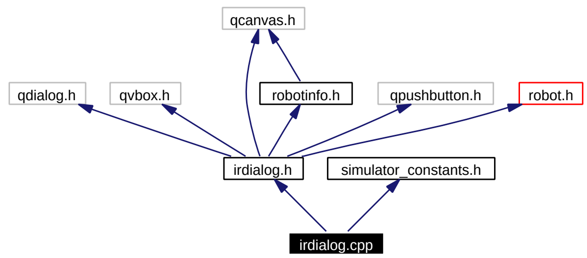
- class **IpInputDialog**

7.77 pda/mom/irdialog.cpp File Reference

`#include "irdialog.h"`

`#include "simulator_constants.h"`

Include dependency graph for irdialog.cpp:



7.78 pda/mom/irdialog.h File Reference

`#include <qdialog.h>`

`#include <qvbox.h>`

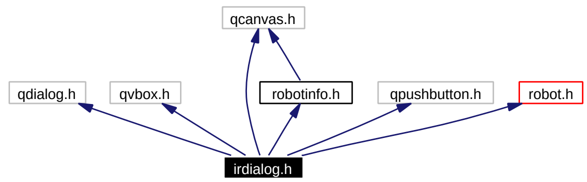
`#include <qcanvas.h>`

`#include <qpushbutton.h>`

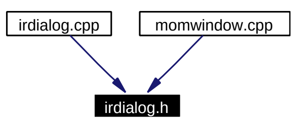
`#include "robot.h"`

`#include "robotinfo.h"`

Include dependency graph for irdialog.h:



This graph shows which files directly or indirectly include this file:



Compounds

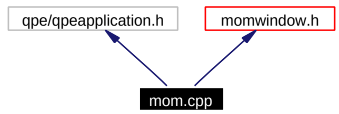
- class **IRDialog**

7.79 pda/mom/mom.cpp File Reference

`#include <qpe/qpeapplication.h>`

`#include "momwindow.h"`

Include dependency graph for mom.cpp:



Functions

- int **main** (int argc, char **argv)

7.79.1 Function Documentation

7.79.1.1 int main (int *argc*, char ** *argv*)

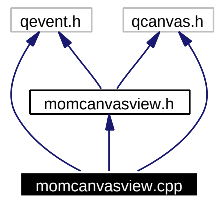
7.80 pda/mom/momcanvasview.cpp File Reference

`#include <qevent.h>`

`#include <qcanvas.h>`

`#include "momcanvasview.h"`

Include dependency graph for momcanvasview.cpp:

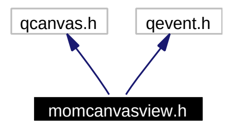


7.81 pda/mom/momcanvasview.h File Reference

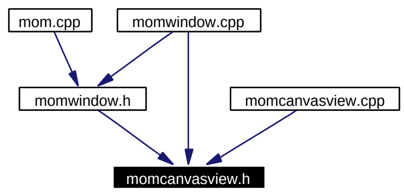
`#include <qcanvas.h>`

`#include <qevent.h>`

Include dependency graph for momcanvasview.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **MomCanvasView**

7.82 pda/mom/momwindow.cpp File Reference

#include <stdlib.h>

#include <string>

#include <iostream>

#include <fstream>

#include <qmainwindow.h>

#include <qapplication.h>

#include <qmessagebox.h>

#include <qevent.h>

#include <qcanvas.h>

#include <qcolor.h>

#include <qmenubar.h>

#include <qvbox.h>

#include <qhbox.h>

#include <qstring.h>

#include <qpen.h>

#include "momwindow.h"

#include "momcanvasview.h"

#include "ipinputdialog.h"

#include "discoverydialog.h"

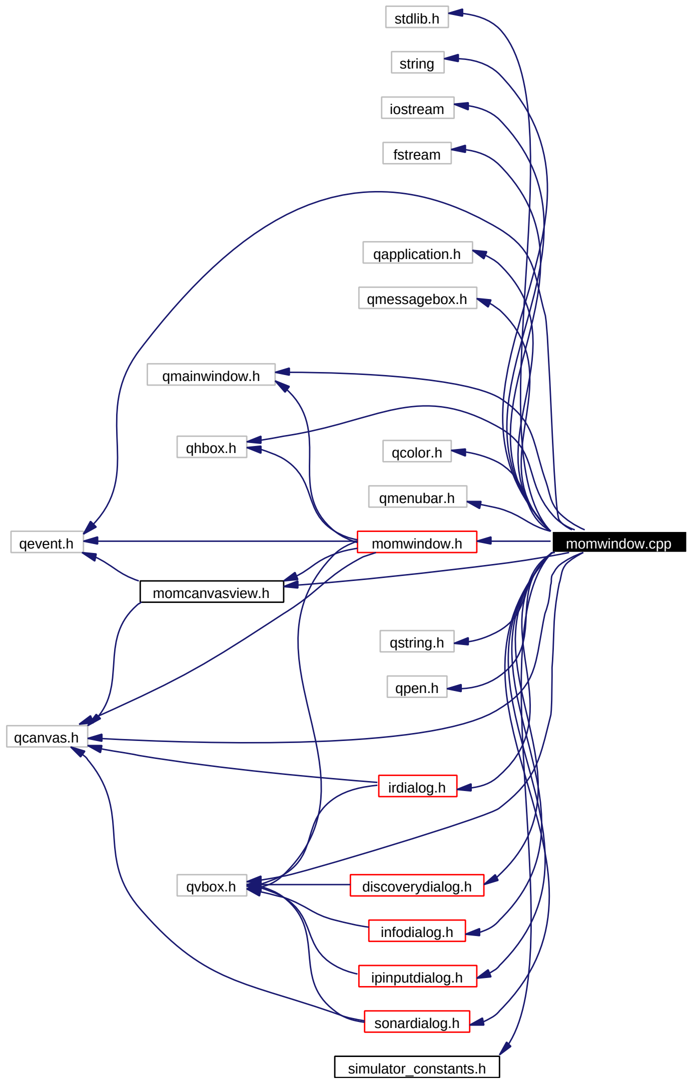
#include "sonardialog.h"

#include "irdialog.h"

#include "infodialog.h"

#include "simulator_constants.h"

Include dependency graph for momwindow.cpp:


stdlib.h
string
iostream
fstream
qapplication.h
qmessagebox.h
qmainwindow.h
qhbox.h
qcolor.h
qmenubar.h
qevent.h
momwindow.h
momwindow.cpp
momcanvasview.h
qstring.h
qpen.h
qcanvas.h
irdialog.h
qvbox.h
discoverydialog.h
infodialog.h
ipinputdialog.h
sonardialog.h
simulator_constants.h

7.83 pda/mom/momwindow.h File Reference

`#include <qmainwindow.h>`

`#include <qpopupmenu.h>`

`#include <qevent.h>`

`#include <qcanvas.h>`

`#include <qlabel.h>`

`#include <qvbox.h>`

`#include <qhbox.h>`

`#include <qtimer.h>`

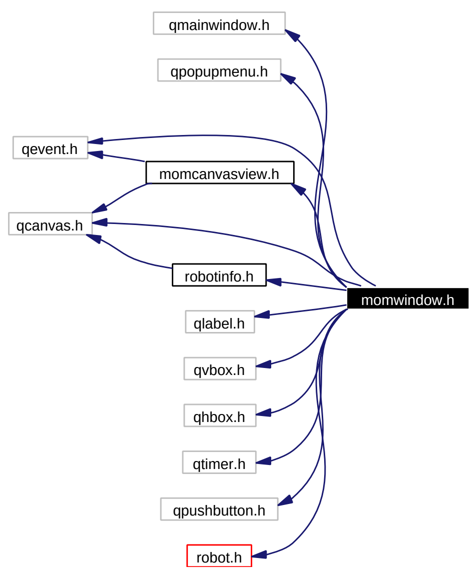
`#include <qpushbutton.h>`

`#include "momcanvasview.h"`

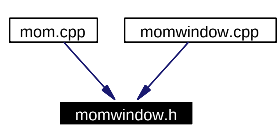
`#include "robotinfo.h"`

`#include "robot.h"`

Include dependency graph for momwindow.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **MomWindow**

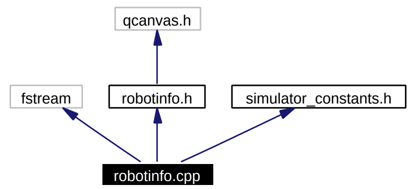
7.84 pda/mom/robotinfo.cpp File Reference

`#include "fstream"`

`#include "robotinfo.h"`

`#include "simulator_constants.h"`

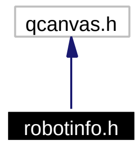
Include dependency graph for robotinfo.cpp:



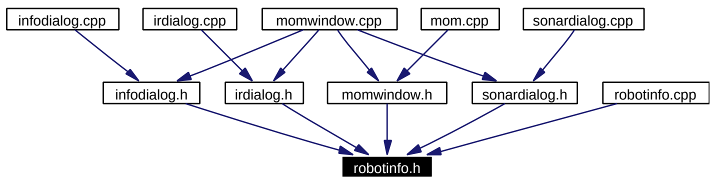
7.85 pda/mom/robotinfo.h File Reference

`#include <qcanvas.h>`

Include dependency graph for robotinfo.h:



This graph shows which files directly or indirectly include this file:

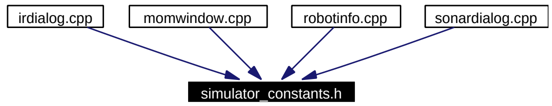


Compounds

- class **Point**
- class **PointTheta**
- class **RobotInfo**

7.86 pda/mom/simulator_constants.h File Reference

This graph shows which files directly or indirectly include this file:



Defines

- #define **xCenter** 118
- #define **yCenter** 118
- #define **HEIGHT** 236
- #define **WIDTH** 236

7.86.1 Define Documentation

7.86.1.1 #define HEIGHT 236

7.86.1.2 #define WIDTH 236

7.86.1.3 #define xCenter 118

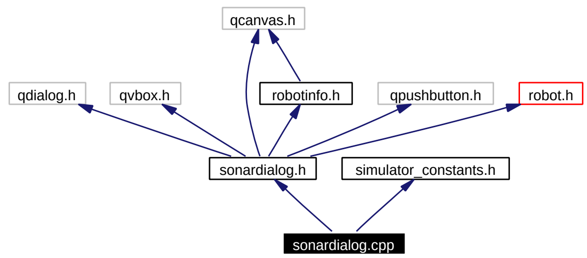
7.86.1.4 #define yCenter 118

7.87 pda/mom/sonardialog.cpp File Reference

`#include "sonardialog.h"`

`#include "simulator_constants.h"`

Include dependency graph for sonardialog.cpp:



7.88 pda/mom/sonardialog.h File Reference

`#include <qdialog.h>`

`#include <qvbox.h>`

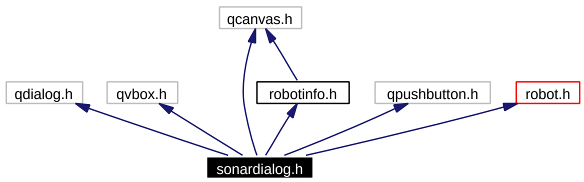
`#include <qcanvas.h>`

`#include <qpushbutton.h>`

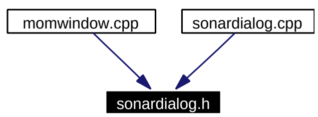
`#include "robot.h"`

`#include "robotinfo.h"`

Include dependency graph for sonardialog.h:



This graph shows which files directly or indirectly include this file:



Compounds

- class **SonarDialog**

Chapter 8

robots-all Page Documentation

8.1 Libbehavior Extra Documentation

```
Kris Beevers (beevek@cs.rpi.edu)
API documentation for libbehavior.
$Id: libbehavior_api.txt,v 1.1 2003/08/01 18:17:31 beevek Exp $

For source-level API documentation see behavior.h, or the doxygen
documentation for behavior.h.

Libbehavior is a library for writing reactive behaviors that:

  * are started and stopped by the sequencer (see sequencer.txt)
  * can take inputs from other behaviors (or deliberative programs)
  * can send outputs to other behaviors
  * can be inhibited (paused) and uninhibited at any time
  * can interact with the robot's hardware using librobot (see
    librobot_api.txt)

Behaviors written using libbehavior are mostly event-driven.  They
provide a set of functions to be called when certain events take
place.  All of these functions are optional (if a behavior provides
none of them, it will just start and sleep forever, doing nothing).
Behaviors can also provide one function that is run only once, after
initialization, that acts as a "main program."  Unlike the other
functions in a behavior, this one is not event driven and is only
called once.  Usually, it should loop forever, almost always while
blocking and waiting for some sort of input or occurrence in each loop
iteration.

All of the "administrative" work for writing a behavior is taken care
of by libbehavior.  In particular, it takes care of

  * starting up properly and notifying the sequencer of successful
    initialization
  * calling robot_init; the behavior itself should never call
    robot_init or robot_shutdown (see the discussion of bhv_init
    below)
  * shutting down properly, either when told to by the sequencer or
    when the behavior's main function exits for some reason
  * pausing when told to inhibit itself
  * queuing data arriving on inputs while inhibited, if requested
  * unpausing when told to uninhibit itself
  * sending output data to the right recipients
  * getting input data and notifying the behavior, or queuing the data
    if requested
  * doing nothing forever if the behavior does not provide its own
```

```
    main function

A behavior written using libbehavior must:

  * provide a bhv_init function corresponding to the prototype in
    behavior.h
  * provide any other functions from bhv_t in behavior.h that it
    requires

The bhv_init function is libbehavior's "entry point" into the
behavior-specific functionality.  This function is called when the
behavior first starts.  It should:

  * fill in function pointers in the bhv argument; if you will not be
    providing one of the functions, do not set its pointer to anything
  * fill in robot_init flags and flags from bhv_flags_t in the
    bhv->flags variable as appropriate
  * start any necessary sub-behaviors (and connect their
    inputs/outputs as necessary)
  * return < 0 on failure, or >= 0 otherwise

bhv_init should not do anything intensive itself.  Save this for the
main function.

Functions that can be specified by the behavior to be called by
libbehavior are:

  * cleanup (called when the behavior is shutting down)
  * on_inhibit (called just before the behavior is inhibited)
  * on_uninhibit (called just after the behavior is uninhibited)
  * bhv_main (if specified, called after initialization is complete;
    the behavior will exit as soon as this function exits)

In addition, the behavior can specify functions to be called when data
arrives on one of its inputs (as many functions as desired for a
single input).  See the documentation for bhv_add_input for more
information.

Libbehavior will also queue incoming data from inputs if requested.
The program can access this data with bhv_input_pop.

Finally, behaviors should use libbehavior's bhv_printf and bhv_perror
functions in place of their normal counterparts, to print extra
information to the sequencer's log file.  printf and perror will send
their output to the same file, but bhv_printf and bhv_perror
differentiate a behavior's output from that of the sequencer and other
behaviors.

The best way to figure out how to write a behavior is to look at some
that are already written.  In the source tree, look in the arch/bhv
directory for examples.
```

8.2 Sequencer Internals Documentation

```
Kris Beevers (beevek@cs.rpi.edu)
Discussion of the sequencer internals.
$Id: sequencer.txt,v 1.1 2003/08/01 18:17:31 beevek Exp $

The sequencer is the central program in the reactive layer of our
robot software "architecture."  It is responsible mostly for loading
and unloading behaviors that make use of libbehavior.

The sequencer is really a very simple program.  It itself does not
control robot hardware in any way (in fact, it does not even call
librobot's robot_init).  All it does is start and stop other programs
(behaviors) that act in a specified way according to requests by
separate processes.

IPC between other processes and the sequencer is done using Linux's
kernel message queues (sys/ipc.h and sys/msg.h).  This is a very
simple mechanism for delivering distinct messages to a process and
requires a lot less parsing than socket communication in most cases.
Message queues reside within the Linux kernel and are accessible from
anywhere in the system via a special key/queue id.  The sequencer's
message queue key is specified in seq.h (ROBOT_SEQ_QUEUE_KEY).  It is
the only pre-specified key in the reactive layer.

The sequencer has internal search paths that dictate where it will
look for behaviors to run.  If a requested behavior isn't found in
these directories, or the cwd of the requesting process, no behavior
will be loaded.

Any process talking to the sequencer must have its own message queue,
whose key is its pid.  This works because all communication is
initiated by client processes talking to the sequencer (which make
their pids available to it).  For non-behaviors, this is handled by
robot_init when the RI_USE_SEQUENCER flag is passed to it.  For
behaviors, this is handled internally by libbehavior.

If the sequencer is told to launch a behavior and it finds the
behavior in its search paths, it launches the behavior by forking and
calling execve with the behavior's path.  It then waits for the
behavior to send a special message to the sequencer's message queue
indicating a successful initialization.  If the behavior's process
exits before sending this message, or if the message isn't received
within one second, the loading of the behavior is determined to have
failed and the requesting process is notified.  If the message is
received, a "behavior handle" is sent to the requesting process for
use in talking directly to the behavior's message queue.  This
behavior handle is also used to tell the sequencer to unload
behaviors.  Note that, because the behavior must send this message to
the sequencer's message queue, normal programs (i.e. those not written
using libbehavior) cannot be launched by the sequencer.

The sequencer also provides functionality for "attaching" to an
already-running behavior (started by some other process), given proper
permissions.  Most normal programs won't need to do this, but it can
occasionally be useful for starting a behavior without the calling
process continuing to run, and then stopping it again later.  The
bhvctl program does this.

Also in seq.h is functionality for talking directly to behaviors (once
they have been loaded by the sequencer).  Specifically, the following
actions can be performed on behaviors:

  * inhibit (pause) a behavior
  * uninhibit a behavior
  * send data to one of a behavior's inputs
  * get data from one of a behavior's outputs
```

```
  * connect one behavior's outputs to another's inputs
  * disconnect one behavior's outputs from another's inputs

For more informations on how these actions affect behaviors, see
libbehavior_api.txt.
```

8.3 Compilation Instructions

```
Robot source compilation/installation howto
Kris Beevers (beevek@cs.rpi.edu)
$Id: compiling.txt,v 1.5 2003/08/01 18:17:31 beevek Exp $
----------------------------------------------------------------------

Compilation of the software for the robot is managed by a combination
of global makefiles and local ones for each software module.

The simple method for compiling all of the robot code is:

  Robot control code (everything but PDA, simulator)
  --------------------------------------------------------------------
  $ cd <robot source dir>
  $ ./configure --prefix=<installdir>
  $ make
  $ make install

      this will compile all of the robot code and install it in a
      directory tree whose root is <installdir> (/usr/local by
      default).  additionally, a SysV init script will be put at
      /etc/init.d/robot and linked to in /etc/rc{234}.d.  This script
      will load the robot driver and start several services.  Edit
      options within the script to change what/how different services
      are run.

  For debugging code to be compiled in, you must instead do
  $ ./configure --enable-debug

      mostly, this will just print out lots of debugging information
      to stdout.  there are a few minor other things that it does; to
      see them, do 'grep -r ROBOT_DEBUG *' in the source tree.

  On-PDA code
  --------------------------------------------------------------------
  $ cd <robot source dir>
  $ ./configure --enable-pda
  $ make

  You'll have to install this yourself for now, scripts might be
  provided eventually.

  Simulator
  --------------------------------------------------------------------
  $ cd <robot source dir>
  $ ./configure --enable-sim
  $ make
  $ make install (FIXME not yet working)

  Doxygen Documentation
  --------------------------------------------------------------------
  $ cd <robot source dir>
  $ ./configure --enable-doc
  $ make

  Now all of the documentation is in the doc/ directory; this
  generates both documentation for the entire tree, and a smaller set
  of documentation just for the librobot api.

  Other configure options
  --------------------------------------------------------------------
  Running configure with the --enable-librobot option builds only
  librobot itself and the tests in misc/tests.  This is particularly
  useful for programs that are running somewhere other than the
  robot.  Running configure with --enable-init-script=no (or just
  --disable-init-script) will cause the SysV init script for the robot
```

```
  not to be installed during a make install.

All of the modules can be compiled individually as well.  For example,

  $ cd <robot source dir>
  $ ./configure
  $ cd librobot
  $ make

will build the librobot module.  However, in order for any of the
modules to compile, configure must be run first, in order to create
the Rules.make file.

Most modules provide an uninstall target as well.  Just run make
uninstall in the source tree's root directory to uninstall everything
recursively.

All new Makefiles should

  a) set the TOPDIR variable based on their relative paths
  b) include $(TOPDIR)/Rules.make

See some of the already-written makefiles for examples of doing this.
```

8.4 Librobot Extra Documentation

```
Kris Beevers (beevek@cs.rpi.edu)
API documentation for librobot.
$Id: librobot_api.txt,v 1.2 2003/08/01 18:17:31 beevek Exp $

The librobot API is extensively documented via doxygen.  To compile
the doxygen documentation, you must

  * have doxygen
  * have latex if you want ps/pdf documentation (not just html)

Simply run configure with the --enable-doc option, and then make.
I.e., in the source tree root directory, do:

  $ ./configure --enable-doc
  $ make

Now, librobot documentation is available in doc/librobot-api (html)
and doc/librobot-api.{ps,pdf}.

In order to use librobot, programs need to link with it.  Ideally, all
robot programs should include the robot's Rules.make file and use its
definitions in their own Makefile.  To do so, in their Makefiles they
should:

  include $(ROBOT_INSTALL_DIR)/make/Rules.make
  LDFLAGS += $(LIBROBOT_FLAGS)
  LDLIBS += $(LIBROBOT)

This will ensure that programs use the proper libraries and flags for
compiling with librobot.

In general, most programs should just use

  #include <robot.h>

rather than including individual header files.

In general, librobot is not thread safe.  In particular, the sequencer
functionality (seq.h) makes use of static variables.  It is not
recommended that threaded programs make use of librobot.
```

8.5 General Robot Software Specifications

```
Kris Beevers (beevek@cs.rpi.edu)
General software specification document for the robot software, from
the lowest to highest levels.
$Id: soft_specs.txt,v 1.3 2003/08/01 18:17:31 beevek Exp $

This document has largely been turned into an index for more focused
documents that talk about different components in the robot's software
system.

All of the robot's software that runs on its computer is available
from the CVS repository on the CS filesystem, at /projects/arl/CVS.
Almost all of the software will compile on any Linux machine, but most
of it is meant to be compiled and used on the robot itself.  For
information on properly building and installing the robot software,
see doc/compiling.txt.

The robot's core software consists of a number of components; ordered
from lowest "level" (with respect to the hardware), they are:

  * interp        (interpreter daemon)
  * mc_*          (motor controllers)
  * robot.o       (/dev/robot driver)
  * librobot      (software interface for user-level programs)
  * netrobotd     (daemon for controlling robot over network)
  * logger        (daemon for logging sensor/etc data)
  * sequencer     (manages reactive layer/behaviors)
  * libbehavior   (used in the creation of reactive behaviors)

There are also a number of "peripheral" tools/programs, as follows:

  * nrtool        (console interface for controlling robot over the
                   network)
  * logtool       (examine log files produced by logger)
  * bhvctl        (cmdline tool for talking to sequencer)
  * misc/tests/*  (a number of example/test programs for librobot)
  * simulator     (simulator providing a librobot api)
  * mom           (pda interface to robot)
  * robot.sh      (sysv init script to start core services)

Detailed information on the interpreter, motor controllers and robot.o
is in low_level_data_flow.txt and motor_control_interface.txt.
Information on librobot and netrobotd is in librobot_api.txt.
Information on data logging provided by logger is in data_logging.txt.
Information on the sequencer is in sequencer.txt.  Information on
libbehavior is in libbehavior_api.txt.

Note that most of the programs (e.g. interp, netrobotd, logger,
sequencer, nrtool, logtool, bhvctl) take command line options.  For
usage information, run them with --help.

Here is an (extremely) high-level overview of "how the system works":

Most important hardware in the system, such as motors and sensors, is
controlled by a series of microcontrollers.  These controllers speak
(currently through a serial interface) to the main CPU, where all of
the above software resides.  The interpreter reads and writes from the
serial device and is the sole channel for talking to the hardware.
Motor control is performed inside the interpreter, via shared motor
control libraries.  All sensor data from the hardware is forwarded to
the /dev/robot interface provided by robot.o.  In addition, the
interpreter reads from "ctl"-type device files and sends commands to
the hardware based on the data.

The librobot library provides a simple, clean interface and for the
most part just reads from and writes to the /dev/robot files
```

```
(communicating with the interpreter).  However, it also transparently
provides a network-based (tcp/udp) version of /dev/robot for talking
to a netrobotd remotely.  All netrobotd really does is forward data
between the network and a local /dev/robot, and vice versa.  So, a
program compiled with librobot can be run either locally on the robot
itself, or remotely on another computer (as long as the robot is
accessible via the network, and is running netrobotd).

Worthy of note is that we have dropped the RTOS requirement that we
originally had for the system.  No RTOS is installed.  Generally,
interp is run as a high-priority process and so far this has been more
than sufficient to ensure adequate control over the robot's hardware.

On top of librobot, normal user programs can run and control the
robot.  In addition, we provide the functionality of a "reactive"
layer, in which a number of (generally small) "behaviors" run
concurrently, interacting with each other and the hardware as
appropriate.  This is done via the "sequencer," which is basically
just a launching and control point for behavior programs.  In our
system, every behavior is a separate process (including sub-behaviors
launched by a higher-level behavior).

Eventually bindings for librobot might be provided in several
languages (other than C/C++); Perl, Python, Lisp and Scheme are
candidates.

And now some notes about what still needs to be done in terms of
software in the system.

Low Level
----------------------------------------------------------------------
  * USB; the LCD panel, on-robot UI switches, and all proprioceptive
    sensors (power status, internal temperature, and tilt?) will be
    interfaced through a USB port.  the sensors and UI switches will
    definitely go through a microcontroller; possibly the LCD will
    too.  in all probability, interp will be updated to talk to these
    devices as well.

  * Firewire/Camera; drivers and support for extracting images must be
    provided.  it is questionable whether interp should handle this or
    whether it should instead be part of librobot (if it is part of
    librobot, image data will not be available from /dev/robot/camera,
    though this is probably ok).

  * Wireless ethernet; drivers for a PCMCIA ethernet card need to be
    installed.

  * Complete testing of PID motor controller.

  * Implementation of other motor controllers.

  * Communication "service" for inter-robot communication.

Reactive Layer
----------------------------------------------------------------------
Here are a few of the behaviors we may want to implement; we currently
have no real behaviors, just the facilities for implementing them:

  * Emergency stop: stop on toggling of bump sensors (any other
    criteria?)
  * Preemptive stop: stop when infrared sensors return some minimum
    value
  * Move-to: move to a specified configuration while avoiding
    obstacles (e.g. using a bug algorithm)
  * Wall-following: find a wall and then follow it
  * Exploration: wander according to some rules (perhaps based on data
    from a mapping/localization service?)
```

```
  * Follow: follow a person (probably based on vision) or another
    robot
  * Flee: avoid any approaching object
  * Meet: approach other robots (or people?) to within some threshold
    distance (perhaps while talking to the other robots?)
  * What else?

Deliberative Components
----------------------------------------------------------------------
FIXME (asynchronous planning, should be able to change the goals being
worked on by the sequencer at any time, i.e. interrupting whatever is
currently being worked on.  pass series of ``actions'' to the
sequencer?  in this case, are what we have in the reactive layer right
now the ``actions'' and behaviors should be lower level?)

Other Services
----------------------------------------------------------------------
FIXME (e.g. communication; data requests/responses, what else?, want
to use 802.11b in adhoc mode, should handle multihop routing for us)
```

8.6 Low Level Data Flow

```
Kris Beevers (beevek@cs.rpi.edu)
Some discussion of the low-level data flow/managment on the CPU end of
the robot stuff.
$Id: low_level_data_flow.txt,v 1.4 2003/08/01 18:17:31 beevek Exp $

Microcontrollers controlling the motors and sensors will (at least for
now) be speaking through the serial port to the cpu.  Sitting on and
reading from the serial port will be a high-priority process, the
"interpreter," whose responsibility is mainly to read data from the
serial device and pass it on to the rest of the system, and to take
data from the rest of the system and write it to the serial device.

Data from the microcontrollers to the computer will be of the format:

    [hwid (1 byte)][data (1 to 4 bytes)]

and data from the computer back to the microcontrollers will follow
the same format.  The "hardware id" (hwid) will refer to a specific
"hardware device" controlled by the microcontrollers (e.g. motors,
individual sensors, etc).  See hwid.h for the set of valid hwids.  The
"data" is device-specific and will be handled by the interpreter.
Some hwids that are available to high-level components in the system
are completely "virtual" and are handled internally by the
interpreter.

The interpreter is responsible for performing fast motor control in
response to encoder counts sent by the microcontrollers.  It does this
by loading a motor control shared library.  For details on the library
interface, see motor_control_interface.txt, mclib.h and the mc/
directory.  A PID control shared library is provided as the default
controller.  All motor controllers generate PWM counts in response to
encoder counts, which are sent back to the motors through the
interpreter (as well as forwarded to the rest of the system as data).

All data (including encoder/pwm data) coming from the microcontrollers
is written by the interpreter to a set of special character devices in
the /dev/robot filesystem.  These files are created by the robot.o
kernel module (see the driver/ directory).  In general, each component
provides several methods of access from user-level programs through
/dev/robot, each with different characteristics:

    stream     any time data is written to the /dev/robot/.../stream
               entry, this device reports new data as being available
               for reading.  in other words, every bit of data that
               the interpreter writes to /dev/robot for a particular
               component can be read from its stream device file.

    change     this file acts similarly to stream.  however, new data
               is only written to it if the data is different than the
               previous data that was written.  for values like
               sonar/ir readings, this is based on a threshold
               difference (see constants.h).

    current    whenever data is written to stream files, it is also
               written to the corresponding current file.  however,
               current never blocks on a read.  it always returns
               whatever the current value of the data for its
               component is.

    ctl        this device file is special.  user-level programs can
               write to it (rather than just read).  the interpreter
               reads from it, and data sent to it is used to control
               the robot's hardware.

All of these files require the data buffers being read or written
```

```
(through the read/write system calls) to be of exactly the size they
expect (e.g., setting the velocity requires exactly two floats).  In
general, user-level programs will use the librobot api rather than
accessing the /dev/robot files directly, and will not need to worry
about this.  See the file devfs.h for data sizes for different
/dev/robot entries.

Currently, device files supported by robot.o are as follows; for type
information, see types.h and for constants (e.g. ROBOT_NUM_*) see
constants.h:

    /dev/robot/vel/{stream,change,current,ctl}
       get/set robot's translational and rotational velocity
       read:        two vel_val_t
       write (ctl): two vel_val_t

    /dev/robot/odom/{stream,change,current,ctl}
       get/set robot's odometric information (x, y, theta)
       read:        three odom_val_t
       write (ctl): three odom_val_t

    /dev/robot/encoder/{stream,change,current}
       get robot's motor encoder counts (left, right)
       read:        two encoder_val_t
       write (ctl): not available

    /dev/robot/pwm/{stream,change,current}
       get motor controller's pwm counts (left, right)
       read:        two pwm_val_t
       write (ctl): not available

    /dev/robot/sonar/{stream,change,current,ctl}
       get sonar range information for all sonars at once, or set
       firing frequencies for all sonars at once
       read:        sonar_val_t * ROBOT_NUM_SONAR
       write (ctl): freq_req_val_t * ROBOT_NUM_SONAR

    /dev/robot/sonar/{0-ROBOT_NUM_SONAR}/{stream,change,current,ctl}
       get sonar range information or set firing frequency for an
       individual sonar sensor
       read:        sonar_val_t
       write (ctl): freq_req_val_t

    /dev/robot/ir/{stream,change,current,ctl}
       get ir range information for all ir sensors at once, or set
       firing frequencies for all ir sensors at once
       read:        ir_val_t * ROBOT_NUM_IR
       write (ctl): freq_req_val_t * ROBOT_NUM_IR

    /dev/robot/ir/{0-ROBOT_NUM_IR}/{stream,change,current,ctl}
       get ir range information or set firing frequency for an
       individual ir sensor
       read:        ir_val_t
       write (ctl): freq_req_val_t

    /dev/robot/bump/{stream,change,current}
       get bump sensor toggle information for all bump sensors at once
       read:        bump_val_t
       write (ctl): not available

    /dev/robot/bump/{0-ROBOT_NUM_BUMP}
       get bump sensor toggle information for an individual sensor
       read:        bump_val_t
       write (ctl): not available

The robot.o driver also provides special locking capabilities, only
for ctl-type device files.  This is through an ioctl call.  The
```

```
locking is based on a priority mechanism.  If no lock is currently
held on a ctl file, any lock request will be granted and no other
process will be able to write to the file.  If a lock is currently
held, a lock request will be granted ONLY if the priority of the
request is HIGHER than that of the currently held lock.  Any process
with a higher priority than the currently held lock (or the process
that holds the lock) can unlock the ctl file as well.  For more
information on this, the the documentation for the functions
devfs_lock_ctl and devfs_unlock_ctl from devfs.h.
```

8.7 Motor Controller Interface

```
Kris Beevers (beevek@cs.rpi.edu)
Some initial motor controller thoughts/specs:
$Id: motor_control_interface.txt,v 1.5 2003/06/27 14:25:40 beevek Exp $

The motor controller workings have been almost completely overhauled
since the original version of this document.  The interface they
present remains mostly similar, but internally they have been
restructured significantly.

Motor controllers are shared libraries that provide a strict set of
functionality to whoever loads them, via an interface described in
include/robot/mclib.h.  Programs use librobot's mclib functions to
load a motor control library and call its functions.  Note that in
general, only the interpreter will be doing this but it is possible
for any program on the robot to load and call the functions of a motor
control shared library (this is particularly useful in debugging, or,
say, simulation).

The rest of this document assumes the motor controllers have been
loaded into the interpreter.

The interpreter speaks directly to the hardware for the robots (via
serial).  At some fixed frequency (currently 100hz), the motors send
it encoder counts; it must call the current motor controller's methods
as appropriate and return pwm counts to the motors.  The interpreter
is also responsible for keeping track of odometry information and
sends this, along with current velocity information and encoder counts
(as well as information from other sensors) to the robot's /dev/robot
filesystem for use by higher-level programs.

Because motor control needs to happen at such a fast rate, the motor
control library's functions (in particular, mc_do_control) need to be
very efficient.

Motor controllers cannot assume a fixed rate (i.e. they should not
#define FREQUENCY 100 or something of the sort) because the
interpreter runs in user space.  Instead the mc_start_frame function
is called at the start of every "frame" of data to update timer
information and calculate the amount of time that has passed since the
last motor control update.  This function is implemented in
mc_common.c, though a particular motor controller may re-implement it
if necessary.

Higher-level software in the system will tell set the motor
controller's desired velocity (via the interpreter's /dev/robot
interface).  The motor controller is responsible for converting a <v,
w> pair into a <v_l, v_r> pair.  Generally, the functionality provided
by mc_set_velocity in mc_common.c should be able to handle this
without changes.

The interface to be provided by motor controllers has changed to
reflect the fact that the motor controller should store state
information internally.  In particular, only mc_start_frame actually
takes encoder counts as arguments (these should be stored internally
by that function for the rest of the frame -- this is done in the
default implementation).  Storing state information internally leads
to a much cleaner interface and reduced computation (especially for
functions like mc_set_odometry and mc_get_velocity).

Following is the interface to be provided by motor controllers (i.e.,
they must implement the following functions).  Most of the types
involved are defined in include/robot/types.h.  Constants useful in
motor control (e.g. wheel radii, axle width, etc.) are defined in
include/robot/constants.h.
```

```
int mc_init(uint32_t flags);

    Perform any necessary initialization.  flags is currently unused
    but might eventually be used to pass some sort of options.  A
    common initialization function is provided in mc_common.c as
    mc_init_common.  In general, most controller-specific mc_init
    functions should call mc_init_common at the top of their function.

    Return < 0 on failure, >= 0 otherwise.

void mc_shutdown(void);

    Shut down the motor controller.  Free any used memory and do any
    necessary de-initialization of anything else internal to the
    controller.  A common version of this function is provided in
    mc_common.c.

int mc_start_frame(encoder_val_t left, encoder_val_t right);

    Must be called at the beginning of each "data frame" to set
    internal variables containing current encoder counts.  This will
    be called before mc_get_velocity, mc_set_odometry and
    mc_do_control.  It should also calculte the change in time since
    the last frame and use this in its calculations, rather than
    assume a fixed frequency.  A common version of this function is
    provided in mc_common.c and should work fine for most controllers.

    Return < 0 on failure, >= 0 otherwise.

int mc_set_velocity(vel_val_t v, vel_val_t w);

    Set the desired translational and rotational velocities.  The
    controller should handle converting these values into values for
    the velocities of the left and right motors, and store these
    internally.  Either of these velocities can be negative (to
    indicate "reverse").  A common version of this function is
    provided in mc_common.c.

    Return < 0 on failure, >= 0 otherwise.

void mc_get_velocity(vel_val_t *v, vel_val_t *w);

    Use the encoder values for the current frame to calculate the
    current translational (v) and rotational (w) velocities, and fill
    in the arguments.  A common version of this function is provided
    in mc_common.c.

void mc_set_odometry(odom_val_t *x, odom_val_t *y, odom_val_t *theta);

    Use the encoder values for the current frame to update the
    previous odometry values stored in x, y and theta.  This method
    should modify the odometry values (add to them), not replace them
    starting from zero.  A common version of this function is provided
    in mc_common.c.

    Return < 0 on failure, >= 0 otherwise.

int mc_do_control(pwm_val_t *left_pwm, pwm_val_t *right_pwm);

    Use the encoder values for the current frame to calculate pwm
    counts to send to the motor (also using internally stored
    "correct" encoder counts set in mc_start_frame based on desired
    velocities set by mc_set_velocity).  This function is definitely
    always specific to each type of motor controller.

    Return < 0 on failure, >= 0 otherwise.
```

8.8 Data Logging

```
Kris Beevers (beevek@cs.rpi.edu)
Discussion of data logging mechanism for the robot
$Id: data_logging.txt,v 1.4 2003/07/16 21:15:47 beevek Exp $

Often it will be convenient to have access to data generated by the
robot's hardware and software during the course of an experiment.
We'd like to have a logging mechanism that can record such data so
that we can "play it back" later, i.e. either just by looking at it
manually or by running commands through a simulator.

Conveniently, we have the /dev/robot interface, a virtual filesystem
through which almost all of the data we would be interested in
passes.  Consequently, we can just log data by reading these files as
appropriate.  A simple "logging daemon" that just opens all of the
files for reading and writes to the log when new data is available
will suffice.

There are a couple of issues.  First, we want accurate timing
information for each event.  Internally, the robot uses 64-bit
microsecond values for timing.  We will make use of this mechanism.
The time of each event will just be the number of microseconds since
the Unix epoch (see time(2)).

Second, the robot will be generating a huge amount of data.  In
particular, encoder counts will be coming from the motors at up to 100
times per second, and pwm counts will be going back out at the same
rate.  Pwm counts are separate from encoder counts in /dev/robot, so
they will be treated as separate events.  So too will velocity and
odometry updates.  So, assuming a 64-bit timestamp, this is a minimum
of:

  64+16+16 + 64+8+8 + 64+32+32 + 64+32+32+32 = 464 bits = 58 bytes

at a rate of 100 per second, i.e. 5800 bytes per second.  This seems
bad at first, but consider that with 3600 seconds in an hour, this is
only 20880000 bytes per hour (20.88 MB).  Other data will be produced
at a much less significant rate and will not significantly change
this.

Still, the logger will rotate logs after they reach a certain size.
A script should be run periodically on the robot to destroy
out-of-date log files.

For the sake of simplicity, all data will be logged to one file
(rather than, say, separate files for each type of data).  The
/dev/robot structure lends itself well to this.  Every "event" in the
log file will follow this format:

  [HWID] [DEV_TYPE] [timestamp] [data]
    1b       1b         8b        nb

HWID is a hardware id number from hwid.h.  DEV_TYPE is from
devfs_type_t in devfs.h.  timestamp is just a robot_time_us_t from
types.h.  data is specific to HWID and is known by the logger.  Note
that no data from DEV_TYPE_CURRENT will ever be logged.  In general,
only data from DEV_TYPE_CHANGE and DEV_TYPE_CTL will be logged, but
the logger will optionally log data from DEV_TYPE_STREAM.  Also, only
data from HW_ALL_{SONAR,IR,BUMP} will be logged (rather than from
every individual hardware device).  No data is lost by doing this.
However, all frequency requests for each HW_{SONAR,IR} will be logged.

So, for example, all velocity control from a user will be written to
the log with entries like:

  [HW_VEL] [DEV_TYPE_CTL] [<time>] [v] [w]
```

```
In order to make it easier to read from to these logfiles, liblogger
provides class log_reader_t (see logger.h).  A tool, logtool, is
provided that simply reads all entries from a logfile and prints them
out in a human-readable form (that is also convenient for grepping).

Both the logger and logtool have a number of command-line options.
Run them with --help to print these out.
```

8.9 Simulator Interface

```
Christopher Chiaverini (chiavc@cs.rpi.edu)
Simulator usage instructions:
$Id: simulator_interface.txt,v 1.2 2003/08/05 20:56:41 chiavc Exp $

The simulator is designed to simulate differential-drive robots of any size
and shape in a configurable environment.  The simulator can currently simulate
SONAR, infrared, and bump sensors to allow the robots to determine information
about their environment.

In order to set up the environment for a simulation at least 3 files are
needed:

1) A file that describes the world
2) One or more files that describe the robots to be used in the simulation
3) A problem file that identifies the world file as well as any robot files

The format of each of these files is as follows:

The World Definition File -- A world definition must give a name for the
world,and defines the boundary, and any number of obstacles (including none)
within the boundary.  All distances are in meters!

A typical World file is as follows (minus the header and the footer):

    ------------- Begin World File --------------

    #comment
    (A single word that names the world)

    #comment
    (The number of world boundary points)
    (The boundary points defined in Clockwise order)

    #comment
    (The name of the obstacle)
    (The number of obstacle boundary points)
    (The boundary points defined in Counter-Clockwise order)

    (any additional obstacle definitions go here...)

    -------------- End World File ---------------


The Robot Defintion File(s) -- A robot definition file must give a name for
the robot, define the robot's starting position/center of rotation, the
radial distance between the wheels and the center of rotation, the initial
orientation of the robot, and the boundary of the robot.  Any number of SONAR,
infrared, and bump sensors is optional.  All distances are in meters!

The robot definition is meant to be as customizable as possible, but please
take note of these things:

    The COR should define the point that the robot rotates around when spinning
    in place, and should be the point along the axis of the wheels that is
    exactly in the center.

    The center of rotation defines the starting point of the robot when the
    simulation is run.

    All points on the robot should be defined relative to the COR.  The points
    should define the robot at an orientation of 0 radians.  The robot
    boundary should not be defined in absolute terms!

    The simulator assumes that at an orientation of 0 radians, the forward
    direction of the robot lies along the x-axis.
```

```
    All angles must be defined in radians, defining them in degrees will cause
    undesirable effects.

    The definitions and orientations of all sensors should be defined as if
    the robot is at an orientation of 0 radians.

    The definitions of all sensors should be defined in numerical order.  It
    does not matter if this is clockwise, counter-clockwise, or in any
    arbitrary order.

    The boundary of the bump sensors should be defined as if the sensor is at
    an orientation of 0 radians, is centered along the x-axis, and has its
    back edge aligned with the y-axis.

    The defining point of a bump sensor is the origin above and bump sensors
    should be placed on the robot according to this point.

A typical Robot file is as follows (minus the header and the footer):

    ------------- Begin Robot File --------------

    #comment
    (A single word that names the robot)

    #comment
    (A point that defines the COR of the robot)

    #comment
    (The radial distance from the COR to one of the wheels)

    #comment
    (The initial orientation of the robot)

    #comment
    (the acceleration of the robot)

    #comment
    (The number of robot boundary points)
    (The boundary points defined in Counter-Clockwise order)

    #comment
    (The amount of noise in translational motion)

    #comment
    (The amount of noise in rotational motion)

    #comment
    (The number of SONAR sensors)
    (A point that describes the placement of this sensor)
    (The orientation of this sensor)
    (any additional SONAR sensor defintions go here...)

    #comment
    (The angular width of the SONAR beam)

    #comment
    (The maximum distance of SONAR data)

    #comment
    (The amount of noise in SONAR measurements)

    #comment
    (The number of IR sensors)
    (A point that describes the placement of this sensor)
    (The orientation of this sensor)
    (any additional IR sensor defintions go here...)
```

```
    #comment
    (The maximum distance of ir data)

    #comment
    (The amount of noise in infrared measurements)

    #comment
    (The number of boundary points for a bump sensor)
    (The boundary points defined in Counter-Clockwise order)

    #comment
    (The number of bump sensors)
    (A point that describes the placement of this sensor)
    (The orientation of this sensor)
    (any additional bump sensor defintions go here...)

    -------------- End Robot File ---------------

The Problem File -- The problem file is given on the command line, and defines
the name of the world file and robot files to use for the simulation.  It also
defines whether or not log playback should occur.

A typical Problem file is as follows (minus the header and the footer):

    ------------ Begin Problem File -------------

    #comment
    (The name of the world file)

    #comment
    (The number of robots in the simulation)

    #comment
    (The name of the robot defintion file)
    (any additional robot definition files go here...)

    #comment
    (The number of log files that should be read from)

    #comment
    (The name of the log file to read from)
    (Any additional log files)

    ------------- End Problem File --------------

The simulator now uses the same api as the robots do.  Programs can be tested
with the simulator, then run on the robot with no code changes or recompilation
necessary.  See the documentation on the robot interface for more information
on the api.


New Features:
-------------

Robots do not appear in the environment until a client connects to it.  At this
point, the robot will appear at the starting point specified in the log file.
When a program finishes and robot_shutdown is called, the robot will disappear
from the environment.

As a result of the above change, programs will not be able to use the "search"
functionality to connect to the simulator.  All simulator connections must be
made by manually giving an ip address.  The simulator will not respond to ping
commands.

The acceleration of the robot is now specifiable.
```

```
Infrared range is now supported.  This allows the infrared sensors to double as
laser rangefinders if so desired.

SONAR and infrared frequencies are now supported, and as a result this
information will no longer be generated on the fly.  In order to better
simulate real robots, the values of these sensors will be generated in the
order they are specified, at the frequency specified by the user.  This means
that immediate changes in distance may not be available (ie passing a doorway)
and depending on the sensor frequency specified, they may not be noticed at
all.

Sensor noise and odometry noise has been impletemented.  The amount of noise
can be specified in the description file for each robot.  If no noise is
wanted, these should be set to 0.

Robot actions can be played back from a log file generated by the robot.  The
log file is simulated from beginning to end.  It is suggested that the user
extract the portion of the log file that is of interest.
```

8.10 Todo List

File constants.h Most of these values need to be appropriately set.

File motors.h FIXME: acceleration?

Member robot_get_id(void) FIXME implement

Member robot_get_name(void) FIXME implement

Member ihelp FIXME: mc path

Member DEFAULT_MC_LIB FIXME

File mc_pid.c FIXME: remove functions to get/set gains

Index