

roneos

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Chapter 1

Main Page

1.1 Overview:

The r-one robots are designed by the Multi-Robotic Systems Lab at Rice University

<http://mrsl.rice.edu/>

1.1.1 Software stack

The code base is designed to be extensible, with a three-layer software stack:

- [Applications (i.e. `SensorTest`, `SuperDemo`)]
- [`roneolib` (basic behaviors that will be used to make other code)]
- [`roneos` (hardware, sensors, actuators, system-level code)]

1.2 Included in roneos:

- `Audio:`
- `InputOutput:`
- `NeighborListOps:`

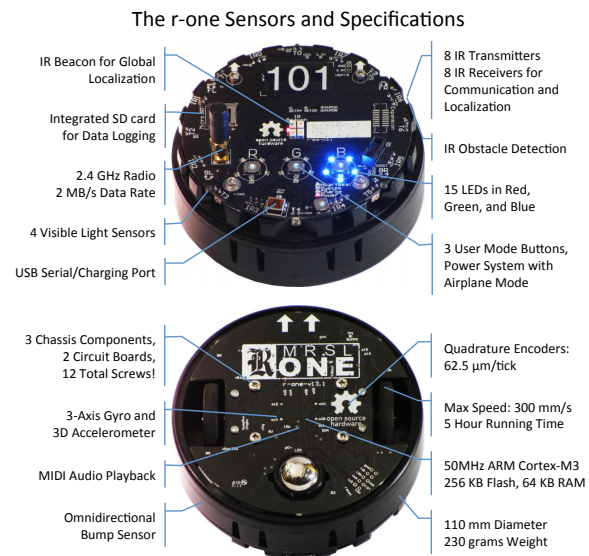


Figure 1.1: r-one robot specifications

Chapter 2

Module Index

2.1 Modules

Here is a list of all modules:

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Chapter 3

Data Structure Index

3.1 Data Structures

Here are the data structures with brief descriptions:

errorMsg	Error message includes information to track error	27
guiCmdData	Commands from the GUI	27
ir_comms_message	Message received over IR ring (contains the sending transmitter ID and receiving ID	27
IRRangeData	Data from IR signal	28
MIDITrackStruct	Represents a MIDI track. Should be generated by the tool MIDIToC, not created by hand . . .	28
motorVelocityData	Information on the robot's state used for smooth motor control	28
MSP430_PROGRAM_SECTION	28
Nbr	Information stored on a network neighbor	29
NbrData	Array containing data on all the network neighbors	29
NbrList	Array containing data on all the network neighbors??	29
NbrMsgField	Linked list of data on messages	30
NbrMsgRadio	Linked list a neighbor's messages	30
NbrMsgRadioNbrData	IR message a neighbor has	30
Pose	The pose of a robot, it's position and orientation	30
radio_message	Single radio message and metrics	31
RadioCmd	A radio command is a linked list of the radio commands received	31
robotName	Robot has a name and a numeric ID	32
SerialCmd	Serial commands are a linked list of commands containing the message and name	32
warningMessage	Warning message includes information to track warning	32

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File Index

4.1 File List

Here is a list of all documented files with brief descriptions:

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Audio/ VS1053_PatchTable.h	??
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InputOutput/ blinky_led.c	
Functions that control the blinky_led {heartbeat, System, Charge, Power}	33
InputOutput/ blinky_led.h	??
InputOutput/ buttons.c	
Functions for 3 buttons on the top of the robot (R,G,B) that can be programmed by the user	35
InputOutput/ buttons.h	??
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System/ msp430Bootloader.c	
Boot loader functions on MSP430	79
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System/ pwm.c	
This is a PWM module which was originally created for the IR beacon. It is meant to control some PWM setup, but mostly for setting and changing PWM on the 8962 pins. PWM outputs are used for things like single LEDs and the power adjustment on the IR beacons	81
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Chapter 5

Module Documentation

5.1 nRF24L01 Register definitions

Macros

- #define NRF_ENAA_ENAA_P5 5
- #define NRF_ENAA_ENAA_P4 4
- #define NRF_ENAA_ENAA_P3 3
- #define NRF_ENAA_ENAA_P2 2
- #define NRF_ENAA_ENAA_P1 1
- #define NRF_ENAA_ENAA_P0 0
- #define NRF_DYNPD_DPL_P5 5
- #define NRF_DYNPD_DPL_P4 4
- #define NRF_DYNPD_DPL_P3 3
- #define NRF_DYNPD_DPL_P2 2
- #define NRF_DYNPD_DPL_P1 1
- #define NRF_DYNPD_DPL_P0 0
- #define NRF_FEATURE_EN_DPL 2
- #define NRF_FEATURE_EN_ACK_PAY 1
- #define NRF_FEATURE_EN_DYN_ACK 0

- Instruction Set -

- #define NRF_R_REGISTER 0x00
- #define NRF_W_REGISTER 0x20
- #define REGISTER_MASK 0x1F
- #define NRF_R_RX_PAYLOAD 0x61
- #define NRF_W_TX_PAYLOAD 0xA0
- #define NRF_FLUSH_TX 0xE1
- #define NRF_FLUSH_RX 0xE2
- #define NRF_REUSE_TX_PL 0xE3
- #define NRF_R_RX_PAYLOAD_WID 0x60
- #define NRF_W_ACK_PAYLOAD 0xA8
- #define NRF_W_TX_PAYLOAD_NOACK 0xB0
- #define NRF_NOP 0xFF
- #define NRF_LOCK_UNLOCK 0x50

- Register Memory Map -

- #define NRF_CONFIG 0x00
- #define NRF_EN_AA 0x01
- #define NRF_EN_RXADDR 0x02
- #define NRF_SETUP_AW 0x03
- #define NRF_SETUP_RETR 0x04
- #define NRF_RF_CH 0x05
- #define NRF_RF_SETUP 0x06
- #define NRF_STATUS 0x07
- #define NRF_OBSERVE_TX 0x08
- #define NRF_RPD 0x09
- #define NRF_RX_ADDR_P0 0x0A
- #define NRF_RX_ADDR_P1 0x0B
- #define NRF_RX_ADDR_P2 0x0C
- #define NRF_RX_ADDR_P3 0x0D
- #define NRF_RX_ADDR_P4 0x0E
- #define NRF_RX_ADDR_P5 0x0F
- #define NRF_TX_ADDR 0x10
- #define NRF_RX_PW_P0 0x11
- #define NRF_RX_PW_P1 0x12
- #define NRF_RX_PW_P2 0x13
- #define NRF_RX_PW_P3 0x14
- #define NRF_RX_PW_P4 0x15
- #define NRF_RX_PW_P5 0x16
- #define NRF_FIFO_STATUS 0x17
- #define NRF_DYNPD 0x1C
- #define NRF_FEATURE 0x1D

CONFIG register bit definitions

* Bit Mnemonics */

- #define NRF_CONFIG_MASK_RX_DR 6
- #define NRF_CONFIG_MASK_TX_DS 5
- #define NRF_CONFIG_MASK_MAX_RT 4
- #define NRF_CONFIG_EN_CRC 3
- #define NRF_CONFIG_CRCO 2
- #define NRF_CONFIG_PWR_UP 1
- #define NRF_CONFIG_PRIM_RX 0

RF_SETUP register bit definitions

- #define NRF_SETUP_PLL_LOCK 4
- #define NRF_SETUP_RF_DR 3
- #define NRF_SETUP_RF_PWR1 2
- #define NRF_SETUP_RF_PWR0 1
- #define NRF_SETUP_LNA_HCURR 0

STATUS register bit definitions

- #define NRF_STATUS_RX_DR 6
- #define NRF_STATUS_TX_DS 5
- #define NRF_STATUS_MAX_RT 4
- #define NRF_STATUS_TX_FULL 0

FIFO_STATUS register bit definitions

- `#define NRF_FIFOSTATUS_TX_REUSE 6`
- `#define NRF_FIFOSTATUS_TX_FIFO_FULL 5`
- `#define NRF_FIFOSTATUS_TX_EMPTY 4`
- `#define NRF_FIFOSTATUS_RX_FULL 1`
- `#define NRF_FIFOSTATUS_RX_EMPTY 0`

5.1.1 Detailed Description

Header file defining register mapping with bit definitions. This file is radio-chip dependent, and are included with the `hal_nrf.h`

5.1.2 Macro Definition Documentation

5.1.2.1 `#define NRF_CONFIG 0x00`

nRF24L01 config register

5.1.2.2 `#define NRF_CONFIG_CRCO 2`

CONFIG register bit 2

5.1.2.3 `#define NRF_CONFIG_EN_CRC 3`

CONFIG register bit 3

5.1.2.4 `#define NRF_CONFIG_MASK_MAX_RT 4`

CONFIG register bit 4

5.1.2.5 `#define NRF_CONFIG_MASK_RX_DR 6`

CONFIG register bit 6

5.1.2.6 `#define NRF_CONFIG_MASK_TX_DS 5`

CONFIG register bit 5

5.1.2.7 `#define NRF_CONFIG_PRIM_RX 0`

CONFIG register bit 0

5.1.2.8 `#define NRF_CONFIG_PWR_UP 1`

CONFIG register bit 1

5.1.2.9 `#define NRF_DYNPD 0x1C`

nRF24L01 Dynamic payload setup

5.1.2.10 `#define NRF_DYNPD_DPL_P0 0`

dynamic payload enable

5.1.2.11 `#define NRF_DYNPD_DPL_P1 1`

dynamic payload enable

5.1.2.12 `#define NRF_DYNPD_DPL_P2 2`

dynamic payload enable

5.1.2.13 `#define NRF_DYNPD_DPL_P3 3`

dynamic payload enable

5.1.2.14 `#define NRF_DYNPD_DPL_P4 4`

dynamic payload enable

5.1.2.15 `#define NRF_DYNPD_DPL_P5 5`

dynamic payload enable

5.1.2.16 `#define NRF_EN_AA 0x01`

nRF24L01 enable Auto-Acknowledge register

5.1.2.17 `#define NRF_EN_RXADDR 0x02`

nRF24L01 enable RX addresses register

5.1.2.18 `#define NRF_ENAA_ENAA_P0 0`

dynamic payload enable

5.1.2.19 `#define NRF_ENAA_ENAA_P1 1`

dynamic payload enable

5.1.2.20 `#define NRF_ENAA_ENAA_P2 2`

dynamic payload enable

5.1.2.21 `#define NRF_ENAA_ENAA_P3 3`

dynamic payload enable

5.1.2.22 `#define NRF_ENAA_ENAA_P4 4`

dynamic payload enable

5.1.2.23 `#define NRF_ENAA_ENAA_P5 5`

dynamic payload enable

5.1.2.24 `#define NRF_FEATURE_0x1D`

nRF24L01 Exclusive feature setup

5.1.2.25 `#define NRF_FEATURE_EN_ACK_PAY 1`

dynamic payload enable

5.1.2.26 `#define NRF_FEATURE_EN_DPL 2`

dynamic payload enable

5.1.2.27 `#define NRF_FEATURE_EN_DYN_ACK 0`

dynamic payload enable

5.1.2.28 `#define NRF_FIFO_STATUS 0x17`

nRF24L01 FIFO status register

5.1.2.29 `#define NRF_FIFOSTATUS_RX_EMPTY 0`

FIFO_STATUS register bit 0

5.1.2.30 `#define NRF_FIFOSTATUS_RX_FULL 1`

FIFO_STATUS register bit 1

5.1.2.31 `#define NRF_FIFOSTATUS_TX_EMPTY 4`

FIFO_STATUS register bit 4

5.1.2.32 `#define NRF_FIFOSTATUS_TX_FIFO_FULL 5`

FIFO_STATUS register bit 5

5.1.2.33 `#define NRF_FIFOSTATUS_TX_REUSE 6`

FIFO_STATUS register bit 6

5.1.2.34 #define NRF_FLUSH_RX 0xE2

Flush RX register command

5.1.2.35 #define NRF_FLUSH_TX 0xE1

Flush TX register command

5.1.2.36 #define NRF_LOCK_UNLOCK 0x50

Lock/unlock exclusive features

5.1.2.37 #define NRF_NOP 0xFF

No Operation command, used for reading status register

5.1.2.38 #define NRF_OBSERVE_TX 0x08

nRF24L01 transmit observe register

5.1.2.39 #define NRF_R_REGISTER 0x00

Register read command

5.1.2.40 #define NRF_R_RX_PAYLOAD 0x61

Read RX payload command

5.1.2.41 #define NRF_R_RX_PAYLOAD_WID 0x60

Read RX payload command

5.1.2.42 #define NRF_REUSE_TX_PL 0xE3

Reuse TX payload command

5.1.2.43 #define NRF_RF_CH 0x05

nRF24L01 RF channel register

5.1.2.44 #define NRF_RF_SETUP 0x06

nRF24L01 RF setup register

5.1.2.45 #define NRF_RPD 0x09

nRF24L01 receive power detect register

5.1.2.46 `#define NRF_RX_ADDR_P0 0x0A`

nRF24L01 receive address data pipe0

5.1.2.47 `#define NRF_RX_ADDR_P1 0x0B`

nRF24L01 receive address data pipe1

5.1.2.48 `#define NRF_RX_ADDR_P2 0x0C`

nRF24L01 receive address data pipe2

5.1.2.49 `#define NRF_RX_ADDR_P3 0x0D`

nRF24L01 receive address data pipe3

5.1.2.50 `#define NRF_RX_ADDR_P4 0x0E`

nRF24L01 receive address data pipe4

5.1.2.51 `#define NRF_RX_ADDR_P5 0x0F`

nRF24L01 receive address data pipe5

5.1.2.52 `#define NRF_RX_PW_P0 0x11`

nRF24L01 # of bytes in rx payload for pipe0

5.1.2.53 `#define NRF_RX_PW_P1 0x12`

nRF24L01 # of bytes in rx payload for pipe1

5.1.2.54 `#define NRF_RX_PW_P2 0x13`

nRF24L01 # of bytes in rx payload for pipe2

5.1.2.55 `#define NRF_RX_PW_P3 0x14`

nRF24L01 # of bytes in rx payload for pipe3

5.1.2.56 `#define NRF_RX_PW_P4 0x15`

nRF24L01 # of bytes in rx payload for pipe4

5.1.2.57 `#define NRF_RX_PW_P5 0x16`

nRF24L01 # of bytes in rx payload for pipe5

5.1.2.58 `#define NRF_SETUP_AW 0x03`

nRF24L01 setup of address width register

5.1.2.59 `#define NRF_SETUP_LNA_HCURR 0`

RF_SETUP register bit 0

5.1.2.60 `#define NRF_SETUP_PLL_LOCK 4`

RF_SETUP register bit 4

5.1.2.61 `#define NRF_SETUP_RETR 0x04`

nRF24L01 setup of automatic retransmission register

5.1.2.62 `#define NRF_SETUP_RF_DR 3`

RF_SETUP register bit 3

5.1.2.63 `#define NRF_SETUP_RF_PWR0 1`

RF_SETUP register bit 1

5.1.2.64 `#define NRF_SETUP_RF_PWR1 2`

RF_SETUP register bit 2

5.1.2.65 `#define NRF_STATUS 0x07`

nRF24L01 status register

5.1.2.66 `#define NRF_STATUS_MAX_RT 4`

STATUS register bit 4

5.1.2.67 `#define NRF_STATUS_RX_DR 6`

STATUS register bit 6

5.1.2.68 `#define NRF_STATUS_TX_DS 5`

STATUS register bit 5

5.1.2.69 `#define NRF_STATUS_TX_FULL 0`

STATUS register bit 0

5.1.2.70 `#define NRF_TX_ADDR 0x10`

nRF24L01 transmit address

5.1.2.71 `#define NRF_W_ACK_PAYLOAD 0xA8`

Write ACK payload command

5.1.2.72 `#define NRF_W_REGISTER 0x20`

Register write command

5.1.2.73 `#define NRF_W_TX_PAYLOAD 0xA0`

Write TX payload command

5.1.2.74 `#define NRF_W_TX_PAYLOAD_NOACK 0xB0`

Write ACK payload command

5.2 System >

Functions

- void `neighborsDisable` (void)
Disable neighbor xmit/recv.
- void `neighborsXmitEnable` (boolean neighbor_xmit_enable_arg)
Enable neighbor to transmit messages.
- void `neighborsInit` (uint32 neighbor_period_arg)
Initialize neighbors and start neighbors task.
- void `neighborsSetPeriod` (uint32 neighbor_period_arg)
Set neighbor period, neighbor timeout, and obstacle timeout proportional to argument.
- void `neighborsIgnore` (uint8 neighborID)
Tries add neighborID to list of neighbors to ignore.
- uint32 `neighborsGetPeriod` (void)
Get neighbor period.
- void `nbrPrint` (Nbr *nbrPtr)
Print information on neighbor (and information of neighbor's neighbors).
- void `obstaclePrint` (uint8 bits)
Print the obstacle data from the IR sensors.
- void `nbrPrintData` (Nbr *nbrPtr, uint32 round)
Print header and neighbor data.
- uint8 `irObstaclesGetBits` (void)
Get IR obstacle bits.
- void `neighborsGetMutex` (void)
Get neighbors mutex.
- void `neighborsPutMutex` (void)
Put neighbors mutex.
- void `neighborsTask` (void *parameters)
The neighbor update system task.
- uint32 `neighborsGetRound` (void)
Get neighbor round from neighbor data.
- boolean `neighborsNewRoundCheck` (uint32 *roundOldPtr)
Check to see if there is a new neighbor round. Updates the variable at the pointer.
- boolean `nbrIsBeacon` (Nbr *nbrPtr)
Returns true if this neighbor is a beacon.
- uint8 `nbrGetID` (Nbr *nbrPtr)
Get neighbor ID.
- uint32 `nbrGetBearing` (Nbr *nbrPtr)
Get neighbor bearing.
- uint32 `nbrGetOrientation` (Nbr *nbrPtr)
Get neighbor orientation.
- boolean `nbrGetOrientationValid` (Nbr *nbrPtr)
Get neighbor orientation valid.
- uint8 `nbrGetRangeBits` (Nbr *nbrPtr)
Get neighbor range bits.
- uint8 `nbrGetReceiverBits` (Nbr *nbrPtr)
Get neighbor receiver bits.
- uint8 `nbrGetTransmitterBits` (Nbr *nbrPtr)
Get neighbor transmitter bits.
- uint32 `nbrGetUpdateTime` (Nbr *nbrPtr)
Get neighbor update time.

5.2.1 Detailed Description

Neighbor system allows a robot to communicate with its neighbors.\nFunction neighborsTask is performed constantly at every WHAT.\n

}@

5.2.2 Function Documentation

5.2.2.1 uint8 irObstaclesGetBits (void)

Get IR obstacle bits.

Returns

IR obstacle bits

5.2.2.2 uint32 nbrGetBearing (Nbr * nbrPtr)

Get neighbor bearing.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

bearing

5.2.2.3 uint8 nbrGetID (Nbr * nbrPtr)

Get neighbor ID.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

ID

5.2.2.4 uint32 nbrGetOrientation (Nbr * nbrPtr)

Get neighbor orientation.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

orientation

5.2.2.5 boolean nbrGetOrientationValid (Nbr * nbrPtr)

Get neighbor orientation valid.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

whether orientation is valid

5.2.2.6 uint8 nbrGetRangeBits (Nbr * nbrPtr)

Get neighbor range bits.

Range bits are receiverBitCount + orientationBitCount

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

range bits

5.2.2.7 uint8 nbrGetReceiverBits (Nbr * nbrPtr)

Get neighbor receiver bits.

Receiver bits are the actual receivers the message was received on

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

receiver bits

5.2.2.8 uint8 nbrGetTransmitterBits (Nbr * nbrPtr)

Get neighbor transmitter bits.

Receiver bits are the actual transmitter the message was received from

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

transmitter bits

5.2.2.9 uint32 nbrGetUpdateTime (Nbr * nbrPtr)

Get neighbor update time.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

update time

5.2.2.10 boolean nbrIsBeacon (Nbr * nbrPtr)

Returns true if this neighbor is a beacon.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

true if the neighbor is a IR beacon

5.2.2.11 void nbrPrint (Nbr * nbrPtr)

Print information on neighbor (and information of neighbor's neighbors).

Print roneID and neighbor's ID, bear, orientation, orientation valid Print name and value of each neighbor message.

Parameters

<i>nbrPtr</i>	neighbor pointer
---------------	------------------

Returns

void

5.2.2.12 void nbrPrintData (Nbr * nbrPtr, uint32 round)

Print header and neighbor data.

Print header once. Print id, time, round; neighbor's ID, bearing, update time; neighbor's neighbor's ID, bearing, update time.

Parameters

<i>nbrPtr</i>	neighbor pointer
<i>round</i>	the round number

Returns

void

5.2.2.13 void neighborsDisable (void)

Disable neighbor xmit/recv.

Returns

void

5.2.2.14 void neighborsGetMutex (void)

Get neighbors mutex.

Returns

void

5.2.2.15 uint32 neighborsGetPeriod (void)

Get neighbor period.

Returns

void

5.2.2.16 uint32 neighborsGetRound (void)

Get neighbor round from neighbor data.

Returns

neighbor round

5.2.2.17 void neighborsIgnore (uint8 neighborID)

Tries add neighborID to list of neighbors to ignore.

Parameters

<i>neighborID</i>	the neighbor we want to ignore (no longer monitor)
-------------------	--

Returns

void

5.2.2.18 void neighborsInit (uint32 neighbor_period_arg)

Initialize neighbors and start neighbors task.

Initializes neighbor period, neighbor timeout, obstacle timeout. Initialize neighborData Sets message length. Puts 7-bit roneID in message. Semaphore implementing neighborsMutex created.

Parameters

<i>neighbor_period_arg</i>	the neighbor period in rounds
----------------------------	-------------------------------

Returns

void

5.2.2.19 `boolean neighborsNewRoundCheck (uint32 * roundOldPtr)`

Check to see if there is a new neighbor round. Updates the variable at the pointer.

Returns

TRUE if the neighbor round has changed

5.2.2.20 `void neighborsPutMutex (void)`

Put neighbors mutex.

Returns

void

5.2.2.21 `void neighborsSetPeriod (uint32 neighbor_period_arg)`

Set neighbor period, neighbor timeout, and obstacle timeout proportional to argument.

Parameters

<i>neighbor_period_arg</i>	the neighbor period length in rounds
----------------------------	--------------------------------------

Returns

void

5.2.2.22 `void neighborsTask (void * parameters)`

The neighbor update system task.

Returns

void

5.2.2.23 `void neighborsXmitEnable (boolean neighbor_xmit_enable_arg)`

Enable neighbor to transmit messages.

Parameters

<i>neighbor_xmit_enable_arg</i>	a boolean that allows enable or not
---------------------------------	-------------------------------------

Returns

void

5.2.2.24 void obstaclePrint (uint8 *bits*)

Print the obstacle data from the IR sensors.

Returns

void

Chapter 6

Data Structure Documentation

6.1 errorMsg Struct Reference

Error message includes information to track error.

6.1.1 Detailed Description

Error message includes information to track error.

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

- System/[system.c](#)

6.2 guiCmdData Struct Reference

Commands from the GUI.

6.2.1 Detailed Description

Commands from the GUI.

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

- SerialIO/[systemCommands.c](#)

6.3 ir_comms_message Struct Reference

message received over IR ring (contains the sending transmitter ID and receiving ID

```
#include <ir_comms.h>
```

6.3.1 Detailed Description

message received over IR ring (contains the sending transmitter ID and receiving ID

NOTE! If you are using the neighbor system, you have 7 less bits than this says.

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

- IComms/ir_comms.h
- IComms/ir_comms_jsm.h

6.4 IRRangeData Struct Reference

Data from IR signal.

```
#include <neighbors.h>
```

6.4.1 Detailed Description

Data from IR signal.

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

- IComms/neighbors.h

6.5 MIDITrackStruct Struct Reference

Represents a MIDI track. Should be generated by the tool MIDIToC, not created by hand.

```
#include <Midi.h>
```

6.5.1 Detailed Description

Represents a MIDI track. Should be generated by the tool MIDIToC, not created by hand.

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

- Audio/Midi.h

6.6 motorVelocityData Struct Reference

contains information on the robot's state used for smooth motor control

6.6.1 Detailed Description

contains information on the robot's state used for smooth motor control

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

- Motors/[motor.c](#)

6.7 MSP430_PROGRAM_SECTION Struct Reference

```
#include <msp430ProgramData.h>
```


6.7.1 Detailed Description

Header Containing Section Structure

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

- System/msp430ProgramData.h

6.8 Nbr Struct Reference

information stored on a network neighbor

```
#include <neighbors.h>
```

6.8.1 Detailed Description

information stored on a network neighbor

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

- IComms/neighbors.h

6.9 NbrData Struct Reference

Array containing data on all the network neighbors.

```
#include <neighbors.h>
```

6.9.1 Detailed Description

Array containing data on all the network neighbors.

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

- IComms/neighbors.h

6.10 NbrList Struct Reference

Array containing data on all the network neighbors??

```
#include <neighbors.h>
```

6.10.1 Detailed Description

Array containing data on all the network neighbors??

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

- IComms/neighbors.h

6.11 NbrMsgField Struct Reference

linked list of data on messages

```
#include <neighbors.h>
```

6.11.1 Detailed Description

linked list of data on messages

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

- IComms/neighbors.h

6.12 NbrMsgRadio Struct Reference

linked list a neighbor's messages

```
#include <neighbors.h>
```

6.12.1 Detailed Description

linked list a neighbor's messages

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

- IComms/neighbors.h

6.13 NbrMsgRadioNbrData Struct Reference

IR message a neighbor has.

```
#include <neighbors.h>
```

6.13.1 Detailed Description

IR message a neighbor has.

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

- IComms/neighbors.h

6.14 Pose Struct Reference

The pose of a robot, it's position and orientation.

```
#include <intMath.h>
```

Data Fields

- int32 [y](#)
- int32 [theta](#)
- uint32 [odometer](#)

6.14.1 Detailed Description

The pose of a robot, it's position and orientation.

6.14.2 Field Documentation

6.14.2.1 uint32 Pose::odometer

typically in milli-radians

6.14.2.2 int32 Pose::theta

typically in milli-meters

6.14.2.3 int32 Pose::y

typically in milli-meters

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

- System/intMath.h

6.15 radio_message Struct Reference

single radio message and metrics

```
#include <radio.h>
```

6.15.1 Detailed Description

single radio message and metrics

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

- InputOutput/radio.h

6.16 RadioCmd Struct Reference

A radio command is a linked list of the radio commands received.

```
#include <radioCommand.h>
```

6.16.1 Detailed Description

A radio command is a linked list of the radio commands received.

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

- InputOutput/radioCommand.h

6.17 robotName Struct Reference

robot has a name and a numeric ID

6.17.1 Detailed Description

robot has a name and a numeric ID

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

- System/robot_names.c

6.18 SerialCmd Struct Reference

Serial commands are a linked list of commands containing the message and name.

```
#include <serialCommand.h>
```

6.18.1 Detailed Description

Serial commands are a linked list of commands containing the message and name.

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

- SerialIO/serialCommand.h

6.19 warningMessage Struct Reference

Warning message includes information to track warning.

6.19.1 Detailed Description

Warning message includes information to track warning.

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

- System/[system.c](#)

Chapter 7

File Documentation

7.1 Audio/Midi.c File Reference

functions for playing MIDI files on the robot

7.1.1 Detailed Description

functions for playing MIDI files on the robot

Since

Jul 20, 2011

Author

Sunny Kim

Warning

Many functions are not commented

7.2 Audio/MIDIFilesOS.h File Reference

```
#include "roneos.h"
```

7.3 InputOutput/blinky_led.c File Reference

Functions that control the blinky_led {heartbeat, System, Charge, Power}.

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

Functions

- void `blinky_led_init` (void)
Initializes blinky.
- void `blinkyLedSet` (uint32 state)
Sets the blinky on or off.
- void `blinky_led_flash` (uint32 delay)
Flashes the blinky once with delay.
- void `blinkyUpdate` (void)
Updates the blinky.
- void `blinkySystemBuildMessage` (uint8 *msg)
Build message for blinky.
- void `blinkySystemUpdate` (void)
Update blinky system.

7.3.1 Detailed Description

Functions that control the `blinky_led` {heartbeat, System, Charge, Power}.

7.3.2 Function Documentation

7.3.2.1 void `blinky_led_flash` (uint32 *delay*)

Flashes the blinky once with delay.

Flashes the blinky once (turns it on and then off) with a specified delay in between).

Parameters

<i>delay</i>	determines how long the delay is
--------------	----------------------------------

Returns

void

7.3.2.2 void `blinky_led_init` (void)

Initializes blinky.

Initializes blinky with port B, pin 6 as output. Blinky is turned off with initialization.

Returns

void

7.3.2.3 void `blinkyLedSet` (uint32 *state*)

Sets the blinky on or off.

Parameters

<i>state</i>	determines whether the pin should be on or off (send 1 to turn on, 0 to turn off)
--------------	---

Returns

void

7.3.2.4 void blinkySystemBuildMessage (uint8 * msg)

Build message for blinky.

Initializes message to specific brightness.

Returns

void

7.3.2.5 void blinkySystemUpdate (void)

Update blinky system.

Update both the blinky system timer and the brightness.

Returns

void

7.3.2.6 void blinkyUpdate (void)

Updates the blinky.

Updates the blinky timer and turns blinky on or off depending on the timer.

Returns

void

7.4 InputOutput/buttons.c File Reference

functions for 3 buttons on the top of the robot (R,G,B) that can be programmed by the user.

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

Functions

- void [buttons_init](#) (void)
Initializes the buttons.
- uint32 [buttons_get](#) (uint32 button)
Gets the state of the specified button.
- void [buttonsBuildMessage](#) (uint8 *msg)
Build a message containing the states of each button.

7.4.1 Detailed Description

functions for 3 buttons on the top of the robot (R,G,B) that can be programmed by the user.

Since

Jul 21, 2010

Author

jamesm

7.4.2 Function Documentation

7.4.2.1 uint32 buttons_get (uint32 *button*)

Gets the state of the specified button.

Tells you whether the specified button is on or off

Parameters

<i>button</i>	specifies which button to check (BUTTON_RED, BUTTON_BLUE, or BUTTON_GREEN)
---------------	--

Returns

void

7.4.2.2 void buttons_init (void)

Initializes the buttons.

Initializes the red, green, and blue buttons as input.

Returns

void

7.4.2.3 void buttonsBuildMessage (uint8 * *msg*)

Build a message containing the states of each button.

3 bits of message used. Blue, green, red.

Parameters

<i>msg</i>	the address where we place the message
------------	--

Returns

void

7.5 InputOutput/hal_nrf_reg.h File Reference

Register definitions for the nRF HAL module.

Macros

- #define NRF_ENAA_ENAA_P5 5
- #define NRF_ENAA_ENAA_P4 4
- #define NRF_ENAA_ENAA_P3 3
- #define NRF_ENAA_ENAA_P2 2
- #define NRF_ENAA_ENAA_P1 1
- #define NRF_ENAA_ENAA_P0 0
- #define NRF_DYNPD_DPL_P5 5
- #define NRF_DYNPD_DPL_P4 4
- #define NRF_DYNPD_DPL_P3 3
- #define NRF_DYNPD_DPL_P2 2
- #define NRF_DYNPD_DPL_P1 1
- #define NRF_DYNPD_DPL_P0 0
- #define NRF_FEATURE_EN_DPL 2
- #define NRF_FEATURE_EN_ACK_PAY 1
- #define NRF_FEATURE_EN_DYN_ACK 0

- Instruction Set -

- #define NRF_R_REGISTER 0x00
- #define NRF_W_REGISTER 0x20
- #define REGISTER_MASK 0x1F
- #define NRF_R_RX_PAYLOAD 0x61
- #define NRF_W_TX_PAYLOAD 0xA0
- #define NRF_FLUSH_TX 0xE1
- #define NRF_FLUSH_RX 0xE2
- #define NRF_REUSE_TX_PL 0xE3
- #define NRF_R_RX_PAYLOAD_WID 0x60
- #define NRF_W_ACK_PAYLOAD 0xA8
- #define NRF_W_TX_PAYLOAD_NOACK 0xB0
- #define NRF_NOP 0xFF
- #define NRF_LOCK_UNLOCK 0x50

- Register Memory Map -

- #define NRF_CONFIG 0x00
- #define NRF_EN_AA 0x01
- #define NRF_EN_RXADDR 0x02
- #define NRF_SETUP_AW 0x03
- #define NRF_SETUP_RETR 0x04
- #define NRF_RF_CH 0x05
- #define NRF_RF_SETUP 0x06
- #define NRF_STATUS 0x07
- #define NRF_OBSERVE_TX 0x08
- #define NRF_RPD 0x09
- #define NRF_RX_ADDR_P0 0x0A
- #define NRF_RX_ADDR_P1 0x0B
- #define NRF_RX_ADDR_P2 0x0C
- #define NRF_RX_ADDR_P3 0x0D
- #define NRF_RX_ADDR_P4 0x0E
- #define NRF_RX_ADDR_P5 0x0F
- #define NRF_TX_ADDR 0x10
- #define NRF_RX_PW_P0 0x11
- #define NRF_RX_PW_P1 0x12
- #define NRF_RX_PW_P2 0x13
- #define NRF_RX_PW_P3 0x14
- #define NRF_RX_PW_P4 0x15
- #define NRF_RX_PW_P5 0x16
- #define NRF_FIFO_STATUS 0x17
- #define NRF_DYNPD 0x1C

- `#define NRF_FEATURE 0x1D`

CONFIG register bit definitions

- *Bit Mnemonics */*
- `#define NRF_CONFIG_MASK_RX_DR 6`
- `#define NRF_CONFIG_MASK_TX_DS 5`
- `#define NRF_CONFIG_MASK_MAX_RT 4`
- `#define NRF_CONFIG_EN_CRC 3`
- `#define NRF_CONFIG_CRCO 2`
- `#define NRF_CONFIG_PWR_UP 1`
- `#define NRF_CONFIG_PRIM_RX 0`

RF_SETUP register bit definitions

- `#define NRF_SETUP_PLL_LOCK 4`
- `#define NRF_SETUP_RF_DR 3`
- `#define NRF_SETUP_RF_PWR1 2`
- `#define NRF_SETUP_RF_PWR0 1`
- `#define NRF_SETUP_LNA_HCURR 0`

STATUS register bit definitions

- `#define NRF_STATUS_RX_DR 6`
- `#define NRF_STATUS_TX_DS 5`
- `#define NRF_STATUS_MAX_RT 4`
- `#define NRF_STATUS_TX_FULL 0`

FIFO_STATUS register bit definitions

- `#define NRF_FIFOSTATUS_TX_REUSE 6`
- `#define NRF_FIFOSTATUS_TX_FIFO_FULL 5`
- `#define NRF_FIFOSTATUS_TX_EMPTY 4`
- `#define NRF_FIFOSTATUS_RX_FULL 1`
- `#define NRF_FIFOSTATUS_RX_EMPTY 0`

7.5.1 Detailed Description

Register definitions for the nRF HAL module.

7.6 InputOutput/ir_beacon.c File Reference

This code controls the 4 IR LEDS on the top center of the rone robot (these are the IR_beacons, and an IR sensitive camera can use these to track the robots).

```
#include <string.h>
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/timer.h"
#include "driverlib/interrupt.h"
#include "driverlib/debug.h"
#include "driverlib/pwm.h"
#include "roneos.h"
#include "swarmCamLookupTable.h"
```

Functions

- void [IRBeaconPreinit](#) (void)
Initializes IRBeacon.
- void [IRBeaconInit](#) (void)
Initializes IRBeacon interrupt.
- void [IRBeaconIntEnable](#) ()
Enables ir_beacon clock.
- void [IRBeaconIntDisable](#) ()
Disables ir_beacon clock.
- void [IRBeaconSetData](#) (uint32 data)
Sets the data in IRBeacon.
- void [IRBeaconDisable](#) (void)
Disables IRBeacon.

7.6.1 Detailed Description

This code controls the 4 IR LEDS on the top center of the rone robot (these are the IR_beacons, and an IR sensitive camera can use these to track the robots). The init and preinit functions are typically called by functions in [system.c](#)

TODO: list the functions (and the calling order) that must be included in any main file in order to use the IRbeacons.

Since

Jul 22, 2010

Author

jamesm

7.6.2 Function Documentation

7.6.2.1 void IRBeaconDisable (void)

Disables IRBeacon.

Turns off IRBeacon LED and sets the timer to 0.

Returns

void

7.6.2.2 void IRBeaconInit (void)

Initializes IRBeacon interrupt.

Enables the 60hz IRBeacon interrupt.

Returns

void

7.6.2.3 void IRBeaconIntDisable ()

Disables ir_beacon clock.

Returns

void

Currently unused

7.6.2.4 void IRBeaconIntEnable ()

Enables ir_beacon clock.

Returns

void

Currently unused

7.6.2.5 void IRBeaconPreinit (void)

Initializes IRBeacon.

Enables the IRBeacon pin as an output. Turns IRBeacon off in the process.

Returns

void

7.6.2.6 void IRBeaconSetData (uint32 data)

Sets the data in IRBeacon.

Sets what the IRBeacon is going to output; also sets the timer for IRBeacon to 60.

This function, when called "IRBeaconSetData(roneID);" gives each robot a unique ID. TODO: this function should be called every second to get continuous localization?

Parameters

<i>data</i>	the output data (32 bit unsigned int)
-------------	---------------------------------------

Returns

void

7.7 InputOutput/leds.c File Reference

interface functions for LEDs on robot

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "roneos.h"
```

7.7.1 Detailed Description

interface functions for LEDs on robot

7.8 InputOutput/Logger/diskio.c File Reference

Interfaces the FatFS file-system SD card function calls to the SD card implementation for roneos.

```
#include "roneos.h"
```

Functions

- DSTATUS [disk_initialize](#) (BYTE drive)
Initialized the disk drive (the SD Card).
- DSTATUS [disk_status](#) (BYTE drive)
Gets the current status of the disk (SD card).
- DWORD [get_fattime](#) (void)

7.8.1 Detailed Description

Interfaces the FatFS file-system SD card function calls to the SD card implementation for roneos.

Author

Jeremy Hunt

7.8.2 Function Documentation

7.8.2.1 DSTATUS disk_initialize (BYTE drive)

Initialized the disk drive (the SD Card).

Parameters

<i>drive</i>	The drive which is to be initialized (Must be 0).
--------------	---

Returns

DSTATUS The status of the drive as flags.

7.8.2.2 DSTATUS disk_status (BYTE drive)

Gets the current status of the disk (SD card).

Parameters

<i>drive</i>	The drive which is to be read (Must be 0).
--------------	--

Returns

DSTATUS The status of the drive as flags

7.8.2.3 DWORD get_fatime (void)

Returns the current time (currently a fake time) as a packed 32 bit value. Used in the FatFs File system.

7.9 InputOutput/Logger/sd_card.c File Reference

Functions that control the SD card.

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "inc/hw_qei.h"
#include "driverlib/flash.h"
#include "driverlib/gpio.h"
#include "driverlib/pwm.h"
#include "driverlib/qei.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/systick.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "roneos.h"
```

7.9.1 Detailed Description

Functions that control the SD card.

Authors

Jeremy Hunt and Nathan Alison

7.10 InputOutput/radio.c File Reference

turns WiFi radio on or off, sends and receives radio messages, radio interrupts

```
#include <stdio.h>
#include <string.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "inc/hw_qei.h"
#include "driverlib/flash.h"
#include "driverlib/gpio.h"
#include "driverlib/pwm.h"
#include "driverlib/qei.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/systick.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "hal_nrf_reg.h"
#include "roneos.h"
```

Macros

- #define [RADIO_IRQ_PORT](#) GPIO_PORTC_BASE

Functions

- void [radioIntEnable](#) (void)
Enables radio interrupt.
- void [radioIntDisable](#) (void)
Disables radio interrupt.
- boolean [radio_get_error](#) (void)
Gets whether there is a radio error.
- void [radio_int_handler](#) (void)
Handles radio interrupt.
- void [radio_init](#) (void)
Initializes the radio.
- void [radio_send_message](#) ([radio_message](#) *messagePtr)
Sends a message through the radio.
- void [radio_get_message_blocking](#) ([radio_message](#) *messagePtr)
Checks whether there is a message with blocking.

7.10.1 Detailed Description

turns WiFi radio on or off, sends and receives radio messages, radio interrupts

Since

Jul 9, 2010

Authors

sjb2, edited by lyncas

7.10.2 Macro Definition Documentation

7.10.2.1 #define RADIO_IRQ_PORT GPIO_PORTC_BASE

V6 Pin Definitions - Radio SS=PA7, SLP_TR=PA6, RST=PG0 , IRQ=PC5 V11 Pin Definitions - Radio SS=PA7, SLP_TR=PA6, RST=PG0 , IRQ=PC5

7.10.3 Function Documentation

7.10.3.1 boolean radio_get_error (void)

Gets whether there is a radio error.

Returns

TRUE or FALSE depending on whether there is an error

7.10.3.2 void radio_get_message_blocking (radio_message * messagePtr)

Checks whether there is a message with blocking.

Parameters

<i>messagePtr</i>	pointer to the message to be checked
-------------------	--------------------------------------

Returns

void

7.10.3.3 void radio_init (void)

Initializes the radio.

Returns

void

7.10.3.4 void radio_int_handler (void)

Handles radio interrupt.

Returns

void

7.10.3.5 void radio_send_message (radio_message * messagePtr)

Sends a message through the radio.

Parameters

<i>messagePtr</i>	pointer to the message to be sent
-------------------	-----------------------------------

Can't call this function from within an ISR

7.10.3.6 void radiolntDisable (void)

Disables radio interrupt.

Returns

void

7.10.3.7 void radiolntEnable (void)

Enables radio interrupt.

Returns

void

7.11 IRComms/ir_comms.c File Reference

handles IR communication between robots using the ring of IR transmitters/receivers

```
#include <string.h>
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/timer.h"
#include "driverlib/interrupt.h"
#include "driverlib/debug.h"
#include "driverlib/pwm.h"
#include "roneos.h"
```

Functions

- uint16 [crc_update](#) (uint16 crc, const unsigned char *data, unsigned int data_len)
Updates the given crc.
- uint16 [CRCcalculate](#) (uint8 msg[])
Calculates the CRC for the message.
- void [orientation_xmit_latch](#) (void)
Latches the orientation data. Forces IR_CLK to clock.
- void [orientation_xmit_set_output_pins](#) (uint8 data)
Transmits the orientation data using the shift register.

- void [clearMsgBitsVariableBuffer](#) (uint32 *bitBufferPtr, uint8 bufferSize)
Clears the first two bits (buffer) of the message.
- void [shiftBitIntoVariableBuffer](#) (uint32 *bitBufferPtr, uint32 data, uint8 bufferSize)
Shifts one bit of data into buffer of variable length.
- void [shiftBitsIntoVariableBuffer](#) (uint32 *bitBufferPtr, uint32 data, uint8 bitCount, uint8 bufferSize)
Shifts a specified number of bits of the data into buffer of variable length.
- void [ir_comms_int_enable](#) ()
Enables ir_comms interrupt.
- void [ir_comms_int_disable](#) ()
Disables ir_comms.
- void [irCommsSetSize](#) (uint8 size)
Sets all of the IR comms size data.
- boolean [ir_comms_send_message](#) ([ir_comms_message](#) *irMessagePtr)
Sends out a message through IR transmitters if RC mode isn't active. Message is 1-5 bytes of data, first byte is robot ID.
- boolean [ir_comms_get_message](#) ([ir_comms_message](#) *irMessagePtr)
Gets a message through IR transmitters if RC mode not engaged.
- void [irSizeInit](#) (void)
initializes all of the size variables.
- void [ir_comms_init](#) (void)
Initializes IRComms.
- void [ir_comms_transmit_handler](#) (void)
Handles ir_comms transmission. Called every 800us in the interrupt.
- void [ir_comms_irq_handler](#) (void)
Handles interrupt requests generated by the IR comms.

7.11.1 Detailed Description

handles IR communication between robots using the ring of IR transmitters/receivers

Since

Jul 22, 2010

Author

jamesm

Created on: Jul 22, 2010 Author: jamesm

7.11.2 Function Documentation

7.11.2.1 void [clearMsgBitsVariableBuffer](#) (uint32 * *bitBufferPtr*, uint8 *bufferSize*)

Clears the first two bits (buffer) of the message.

Parameters

<i>bitBufferPtr</i>	The buffer to clear the first two bits of.
---------------------	--

Returns

void Clears the buffer

Parameters

<i>bitBufferPtr</i>	The buffer to clear
<i>bufferSize</i>	The size of the buffer to clear

Returns

void

7.11.2.2 uint16 crc_update (uint16 *crc*, const unsigned char * *data*, unsigned int *data_len*)

Updates the given crc.

Parameters

<i>crc</i>	The current crc
<i>data</i>	the data to update the crc from
<i>data_len</i>	the length of the data

Returns

The updated crc

7.11.2.3 uint16 CRCcalculate (uint8 *msg[]*)

Calculates the CRC for the message.

Parameters

<i>msg[]</i>	the message to be calculated
--------------	------------------------------

Returns

the CRC for the message

7.11.2.4 boolean ir_comms_get_message (ir_comms_message * *irMessagePtr*)

Gets a message through IR transmitters if RC mode not engaged.

Parameters

<i>irMessagePtr</i>	pointer to the ir_comms_message struct that contains receiver information
---------------------	---

Returns

TRUE if there is a message, FALSE if not

7.11.2.5 void ir_comms_init (void)

Initializes IREComms.

Creates the OS message queues. Initializes IR port for GPIO and set it as input. Sets PWM pins; computes and sets pwm period based on system clock. Enables PWM generators and output state. Enables a 1250hz (800us) interrupt.

Returns

void

7.11.2.6 void ir_comms_int_disable ()

Disables ir_comms.

Returns

void

7.11.2.7 void ir_comms_int_enable ()

Enables ir_comms interrupt.

Returns

void

7.11.2.8 void ir_comms_irq_handler (void)

Handles interrupt requests generated by the IR comms.

Clears IRQ line for next interrupt, transmit, receive, return to idle mode after message processed.

Returns

void

7.11.2.9 boolean ir_comms_send_message (ir_comms_message * irMessagePtr)

Sends out a message through IR transmitters if RC mode isn't active. Message is 1-5 bytes of data, first byte is robot ID.

Parameters

<i>irMessagePtr</i>	pointer to the ir_comms_message struct that contains the message to be sent
---------------------	---

Returns

whether the message is sent (TRUE/FALSE)

7.11.2.10 void irCommsSetSize (uint8 size)

Sets all of the IR comms size data.

**

Parameters

<i>size</i>	the size of the data portion of the ir message.
-------------	---

7.11.2.11 void irSizeInit (void)

initializes all of the size variables.

Returns

void

7.11.2.12 void orientation_xmit_latch (void)

Latches the orientation data. Forces IR_CLK to clock.

Returns

void

7.11.2.13 void orientation_xmit_set_output_pins (uint8 data)

Transmits the orientation data using the shift register.

Parameters

<i>data</i>	byte of data to be shifted into the shift register
-------------	--

Returns

void

7.11.2.14 void shiftBitIntoVariableBuffer (uint32 * bitBufferPtr, uint32 data, uint8 bufferSize)

Shifts one bit of data into buffer of variable length.

**

Parameters

<i>bitBufferPtr</i>	pointer to the buffer to be shifted into
<i>data</i>	the data to be inserted
<i>bufferSize</i>	how many 32-bit segments makes up bitBufferPtr

Returns

void

7.11.2.15 void shiftBitsIntoVariableBuffer (uint32 * bitBufferPtr, uint32 data, uint8 bitCount, uint8 bufferSize)

Shifts a specified number of bits of the data into buffer of variable length.

Parameters

<i>bitBufferPtr</i>	pointer to the buffer to be shifted into
<i>data</i>	the data whose bits are shifted
<i>bitCount</i>	how many bits should be shifted
<i>bufferSize</i>	how many 32-bit segments makes up bitBufferPtr

Returns

void

7.12 IRComms/neighbors.c File Reference

used to maintain information about network neighbors, sets up data storage and callbacks

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "roneos.h"
#include "neighborsInternal.h"
```

Functions

- void [neighborsDisable](#) (void)
Disable neighbor xmit/recv.
- void [neighborsXmitEnable](#) (boolean neighbor_xmit_enable_arg)
Enable neighbor to transmit messages.
- void [neighborsInit](#) (uint32 neighbor_period_arg)
Initialize neighbors and start neighbors task.
- void [neighborsSetPeriod](#) (uint32 neighbor_period_arg)
Set neighbor period, neighbor timeout, and obstacle timeout proportional to argument.
- void [neighborsIgnore](#) (uint8 neighborID)
Tries add neighborID to list of neighbors to ignore.
- uint32 [neighborsGetPeriod](#) (void)
Get neighbor period.
- void [nbrPrint](#) (Nbr *nbrPtr)
Print information on neighbor (and information of neighbor's neighbors).
- void [obstaclePrint](#) (uint8 bits)
Print the obstacle data from the IR sensors.
- void [nbrPrintData](#) (Nbr *nbrPtr, uint32 round)
Print header and neighbor data.
- uint8 [irObstaclesGetBits](#) (void)
Get IR obstacle bits.
- void [neighborsGetMutex](#) (void)
Get neighbors mutex.
- void [neighborsPutMutex](#) (void)
Put neighbors mutex.
- void [neighborsTask](#) (void *parameters)
The neighbor update system task.
- uint32 [neighborsGetRound](#) (void)
Get neighbor round from neighbor data.
- boolean [neighborsNewRoundCheck](#) (uint32 *roundOldPtr)

- *Check to see if there is a new neighbor round. Updates the variable at the pointer.*
- boolean `nbrIsBeacon` (`Nbr *nbrPtr`)
Returns true if this neighbor is a beacon.
- uint8 `nbrGetID` (`Nbr *nbrPtr`)
Get neighbor ID.
- uint32 `nbrGetBearing` (`Nbr *nbrPtr`)
Get neighbor bearing.
- uint32 `nbrGetOrientation` (`Nbr *nbrPtr`)
Get neighbor orientation.
- boolean `nbrGetOrientationValid` (`Nbr *nbrPtr`)
Get neighbor orientation valid.
- uint8 `nbrGetRangeBits` (`Nbr *nbrPtr`)
Get neighbor range bits.
- uint8 `nbrGetReceiverBits` (`Nbr *nbrPtr`)
Get neighbor receiver bits.
- uint8 `nbrGetTransmitterBits` (`Nbr *nbrPtr`)
Get neighbor transmitter bits.
- uint32 `nbrGetUpdateTime` (`Nbr *nbrPtr`)
Get neighbor update time.

7.12.1 Detailed Description

used to maintain information about network neighbors, sets up data storage and callbacks

Since

Mar 2, 2011

Author

: jamesm

7.13 Motors/encoder.c File Reference

functions for wheel encoders

```
#include <stdlib.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_qei.h"
#include "driverlib/gpio.h"
#include "driverlib/pwm.h"
#include "driverlib/qei.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

Macros

- #define `VEL_CAP_F` 10

Functions

- void `encoder_init` (void)
Initializes the encoder.
- int32 `encoder_get_ticks` (uint32 enc)
Gets the current ticks of the specified encoder.
- int32 `encoder_delta_ticks` (uint32 new, uint32 old)
Gets the difference between the two input ticks.
- int32 `encoder_get_direction` (uint32 enc)
Gets the current rotating direction of the encoder.
- int32 `encoder_get_velocity` (uint32 enc)
Gets the current velocity of the specified encoder.
- void `encoder_pose_update` (void)
Updates the encoder's pose.
- void `encoder_pose_clear` (void)
Clears the x, y, and theta values of the encoder.
- void `encoder_get_pose` (Pose *posePtr)
Gets the pose of the encoder and stores it in variables (x, y, theta) of where posePtr points to.
- void `encoder_set_pose` (Pose *posePtr)
Sets the pose of the encoder as variables of where posePtr points to.

7.13.1 Detailed Description

functions for wheel encoders

Since

Mar 2, 2011

Author

: jamesm

7.13.2 Macro Definition Documentation

7.13.2.1 #define VEL_CAP_F 10

Defines

7.13.3 Function Documentation

7.13.3.1 int32 encoder_delta_ticks (uint32 new, uint32 old)

Gets the difference between the two input ticks.

Parameters

<i>new</i>	is the new encoder position
<i>old</i>	is the old encoder position

Returns

the difference between old and new position with rollover protection

7.13.3.2 int32 encoder_get_direction (uint32 *enc*)

Gets the current rotating direction of the encoder.

Parameters

<i>enc</i>	specifies which encoder (right or left) to look up
------------	--

Returns

the current rotating direction

7.13.3.3 void encoder_get_pose (Pose * *posePtr*)

Gets the pose of the encoder and stores it in variables (x, y, theta) of where *posePtr* points to.

Parameters

<i>posePtr</i>	points to a Pose structure
----------------	--

Returns

void

7.13.3.4 int32 encoder_get_ticks (uint32 *enc*)

Gets the current ticks of the specified encoder.

Ticks can then be converted to a measurement of distance.

Parameters

<i>enc</i>	specifies which encoder's ticks you want
------------	--

Returns

the current position of the specified encoder; returns 0 if it's unavailable

7.13.3.5 int32 encoder_get_velocity (uint32 *enc*)

Gets the current velocity of the specified encoder.

Parameters

<i>enc</i>	specifies which encoder (right or left) to look up
------------	--

Returns

the current velocity

7.13.3.6 void encoder_init (void)

Initializes the encoder.

Enables the peripherals. Sets the state of the odometer to 0,0,0.

Returns

void

7.13.3.7 void encoder_pose_clear (void)

Clears the x, y, and theta values of the encoder.

Returns

void

7.13.3.8 void encoder_pose_update (void)

Updates the encoder's pose.

There is an assumption that this function will be called on a regular basis in to ensure accuracy. Keep updating in micrometers. The encoders have a resolution of 0.0625mm. That is, each tick represents a change of 0.0625 mm. Our pose is stored in micrometers and microradians. Each tick corresponds to 62.5 micrometers. Rounding to 63.

Returns

void

7.13.3.9 void encoder_set_pose (Pose * posePtr)

Sets the pose of the encoder as variables of where posePtr points to.

Parameters

<i>posePtr</i>	points to a Pose structure
----------------	--

Returns

void

7.14 Motors/motor.c File Reference

functions dealing with the two motors on the rone

```
#include <stdlib.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_qei.h"
#include "driverlib/gpio.h"
#include "driverlib/pwm.h"
#include "driverlib/qei.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

Data Structures

- struct [motorVelocityData](#)
contains information on the robot's state used for smooth motor control

Typedefs

- typedef struct [motorVelocityData](#) [motorVelocityData](#)
contains information on the robot's state used for smooth motor control

Functions

- void [motorInit](#) ()
Initializes motor.
- void [motorSetPWM](#) (uint32 motor, int32 dutyCycle)
Sets PWM duty cycle for the specified motor if remote control mode is off.
- void [motorBrake](#) (uint32 motor, int32 dutyCycle)
Brakes one motor with the specified duty cycle.
- void [motorCommandTimerUpdate](#) (void)
Updates the motor command timer.
- void [motorSetVelocity_NonCmd](#) (uint32 motor, int32 velocity)
Sets the current velocity of the specified motor.
- void [motorSetVelocity](#) (uint32 motor, int32 velocity)
Sets the velocity of the specified motor if remote control mode is off.
- int32 [motorGetVelocity](#) (uint32 motor)
Gets the current velocity of the specified motor.
- void [motorSetTVRV_NonCmd](#) (int32 tv, int32 rv)
Sets the translational and radial velocity of the motor.
- void [motorSetTVRV](#) (int32 tv, int32 rv)
Sets the translation and radial velocity of the motors if remote control mode is off.
- void [motorGetTVRV](#) (int32 *tvPtr, int32 *rvPtr)
Gets the translational and radial velocity of the motor.
- boolean [waypointMoveDone](#) (void)
Returns whether current waypoint has been reached.
- void [waypointMove](#) ([Pose](#) *posePtr, int32 speed)
MotorCommandMode set so that waypoint behavior with absolute coordinates is done.
- void [waypointMoveOffset](#) ([Pose](#) *posePtr, int32 speed)
MotorCommandMode set so that waypoint behavior with offset coordinates is done.

- void `waypointMoveTheta` (`Pose *posePtr`, int32 speed)
MotorCommandMode set so that waypoint behavior with absolute coordinates is done.
- void `waypointMoveThetaOffset` (`Pose *posePtr`, int32 speed)
MotorCommandMode set so that waypoint behavior with offset coordinates is done.
- void `motorVelocityUpdate` (void)
Updates the velocity data for both motors.

7.14.1 Detailed Description

functions dealing with the two motors on the rone

Since

Mar 2, 2011

Author

: jamesm

7.14.2 Function Documentation

7.14.2.1 void `motorBrake` (uint32 *motor*, int32 *dutyCycle*)

Brakes one motor with the specified duty cycle.

Parameters

<i>motor</i>	(left or right)
<i>dutyCycle</i>	duty cycle of PWM

7.14.2.2 void `motorCommandTimerUpdate` (void)

Updates the motor command timer.

If no motor command has been received, timeout and enables the charger. This function should be called at 10 hz.

Returns

void

7.14.2.3 void `motorGetTVRV` (int32 * *tvPtr*, int32 * *rvPtr*)

Gets the translational and radial velocity of the motor.

Parameters

<i>tvPtr</i>	pointer to the desired translational velocity
<i>rvPtr</i>	pointer to the desired rotational velocity

Returns

void

7.14.2.4 int32 motorGetVelocity (uint32 motor)

Gets the current velocity of the specified motor.

Parameters

<i>motor</i>	left or right motor
--------------	---------------------

Returns

the current velocity; 0 if the input parameter is not recognized

7.14.2.5 void motorInit (void)

Initializes motor.

Enables PWM and initializes the [motorVelocityData](#) struct for both left and right motor. Also sets the command timer to 0

Returns

void

7.14.2.6 void motorSetPWM (uint32 motor, int32 dutyCycle)

Sets PWM duty cycle for the specified motor if remote control mode is off.

Sets PWM duty cycle for the specified motor for both reverse and forward signals.

Parameters

<i>motor</i>	left or right motor
<i>dutyCycle</i>	duty cycle of PWM

Returns

void

7.14.2.7 void motorSetTVRV (int32 tv, int32 rv)

Sets the translation and radial velocity of the motors if remote control mode is off.

Parameters

<i>tv</i>	the translational velocity
<i>rv</i>	the rotational velocity

Returns

void

7.14.2.8 void motorSetTVRV_NonCmd (int32 tv, int32 rv)

Sets the translational and radial velocity of the motor.

Returns

void

7.14.2.9 void motorSetVelocity (uint32 *motor*, int32 *velocity*)

Sets the velocity of the specified motor if remote control mode is off.

Parameters

<i>motor</i>	left or right motor
<i>velocity</i>	motor velocity to be set in mm/s

Returns

void

7.14.2.10 void motorSetVelocity_NonCmd (uint32 *motor*, int32 *velocity*)

Sets the current velocity of the specified motor.

Parameters

<i>motor</i>	left or right motor
<i>velocity</i>	motor velocity to be set in mm/s

Returns

void

7.14.2.11 void motorVelocityUpdate (void)

Updates the velocity data for both motors.

Returns

void

7.14.2.12 void waypointMove (Pose * *posePtr*, int32 *speed*)

MotorCommandMode set so that waypoint behavior with absolute coordinates is done.

Returns

void

7.14.2.13 boolean waypointMoveDone (void)

Returns whether current waypoint has been reached.

Returns

waypointDone boolean that keeps track of whether the current waypoint has been reached or not

7.14.2.14 void waypointMoveOffset (Pose * *posePtr*, int32 *speed*)

MotorCommandMode set so that waypoint behavior with offset coordinates is done.

Returns

void

7.14.2.15 void waypointMoveTheta (Pose * *posePtr*, int32 *speed*)

MotorCommandMode set so that waypoint behavior with absolute coordinates is done.

Returns

void

7.14.2.16 void waypointMoveThetaOffset (Pose * *posePtr*, int32 *speed*)

MotorCommandMode set so that waypoint behavior with offset coordinates is done.

Returns

void

7.15 Sensors/accelerometer.c File Reference

interface functions for 3D accelerometer in the robot

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "roneos.h"
```

7.15.1 Detailed Description

interface functions for 3D accelerometer in the robot

Since

Jul 22, 2010

Author

jamesm

7.16 Sensors/accelerometer.h File Reference

Functions

- int16 [accelerometerGetValue](#) (uint32 axis)

Gets the accelerometer value.

7.16.1 Detailed Description

Created on: Mar 19, 2011 Author: jamesm

7.16.2 Function Documentation

7.16.2.1 int16 accelerometerGetValue (uint32 axis)

Gets the accelerometer value.

Parameters

<i>axis</i>	uint32 of the axis to get the value of.
-------------	---

Returns

int16 value of accelerometer.

7.17 Sensors/bump_sensor.c File Reference

reads bump sensor information, helper functions for this data

```
#include "roneos.h"
#include "bump_sensor.h"
```

Functions

- uint8 [bumpSensorsGetBits](#) ()
Get bump sensor bits.
- int16 [bumpSensorsGetBearing](#) ()
Get bump sensor bearing.

7.17.1 Detailed Description

reads bump sensor information, helper functions for this data

Since

Jul 22, 2010

Author

jamesm

7.17.2 Function Documentation

7.17.2.1 int16 bumpSensorsGetBearing ()

Get bump sensor bearing.

Returns

the bump sensor bearing

7.17.2.2 uint8 bumpSensorsGetBits ()

Get bump sensor bits.

Returns

the bump sensor bits

7.18 Sensors/gyro.c File Reference

interface to initialize and read 3D gyro

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_qei.h"
#include "driverlib/gpio.h"
#include "driverlib/adc.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

7.18.1 Detailed Description

interface to initialize and read 3D gyro

Since

Jul 22, 2010

Author

jamesm

7.19 Sensors/light_sensor.c File Reference

interface to initialize and read light sensor ring on robot

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_qei.h"
#include "driverlib/gpio.h"
#include "driverlib/adc.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

7.19.1 Detailed Description

interface to initialize and read light sensor ring on robot

Since

Jul 22, 2010

Author

jamesm

7.20 SerialIO/basicPrinting.c File Reference

print methods for converting data into strings with different formats

```
#include <stdio.h>
#include "roneos.h"
```

Functions

- char * [bitString8](#) (char *string, uint8 val)
Function that allows us to print binary.
- void [posePrint](#) ([Pose](#) *posePtr)
Print a pose structure.
- uint8 [ctoi_hex4](#) (char c)
Convert single character to an integer.
- uint8 [atoi_hex8](#) (char *string)
Convert 8-bit hex string to an integer.
- uint16 [atoi_hex16](#) (char *string)
Convert 16-bit hex string to an integer.
- uint32 [atoi_hex32](#) (char *string)
Convert 32-bit hex string to an integer.

7.20.1 Detailed Description

print methods for converting data into strings with different formats

Since

Mar 24, 2012

Author

: jamesm

7.20.2 Function Documentation

7.20.2.1 uint16 atoi_hex16 (char * *string*)

Convert 16-bit hex string to an integer.

Parameters

<i>string</i>	16-bit hex string to be converted
---------------	-----------------------------------

Returns

hex integer version of input

7.20.2.2 uint32 atoi_hex32 (char * *string*)

Convert 32-bit hex string to an integer.

Parameters

<i>string</i>	32-bit hex string to be converted
---------------	-----------------------------------

Returns

hex integer version of input

7.20.2.3 uint8 atoi_hex8 (char * *string*)

Convert 8-bit hex string to an integer.

Parameters

<i>string</i>	8-bit hex string to be converted
---------------	----------------------------------

Returns

hex integer version of input

7.20.2.4 char* bitString8 (char * *string*, uint8 *val*)

Function that allows us to print binary.

Creates a binary version of the input character in the space given by string.

Parameters

<i>*string</i>	is the char pointer that will point to the binary bitstring of val
<i>val</i>	is the value to be converted to binary

Returns

a pointer to the binary string converted from val

7.20.2.5 uint8 ctoi_hex4 (char c)

Convert single character to an integer.

Converts a single character that represents a unicode number (hex) to a unicode number(integer)

Parameters

<i>c</i>	is the character to be converted
----------	----------------------------------

Returns

val is the integer value

7.20.2.6 void posePrint (Pose * posePtr)

Print a pose structure.

Print a pose structure. Prints in braces to be fancy.

Parameters

<i>posePtr</i>	is a pointer to a pose.
----------------	-------------------------

7.21 SerialIO/cfprintf.c File Reference

light-weight formatted printing to a remote print buffer (routed through the robot network)

```
#include <ctype.h>
#include <stdarg.h>
#include <string.h>
#include "roneos.h"
#include "snprintf.h"
```

Functions

- void [cprintf](#) (char *format,...)
Serves the same purpose as formatted output string for the robot.
- void [cfprintfInit](#) (void)
Initializes cprintf and the remote print buffer.

7.21.1 Detailed Description

light-weight formatted printing to a remote print buffer (routed through the robot network)

Since

2001

Author

: James McLurkin

Copyright

iRobot 2001

7.21.2 Function Documentation**7.21.2.1 void cprintfInit (void)**

Initializes cprintf and the remote print buffer.

Returns

void

7.21.2.2 void cprintf (char * *format*, ...)

Serves the same purpose as formatted output string for the robot.

Processes the input string into an output string rone understands. If the input string is too large, cprintfOverRun-Error is set to TRUE.

Returns

void

7.22 SerialIO/serial.c File Reference

serial UART communication functions

```
#include <stdio.h>
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "roneos.h"
```

Functions

- void [sputchar](#) (char c)

- Sends out a character. (DEPRICATED - has hard to solve race condition problems, and is not used by cprintf)*
- void [sputcharFlush](#) (void)
Flushes the buffer and starts the serial xmit.
- int [sgetchar](#) (void)
Gets a character from serial receive buffer.
- void [uartIRQHandler](#) (void)
Interrupt that handles bytes coming through serial port.
- void [serial_init](#) ()
Initializes serial I/O.

7.22.1 Detailed Description

serial UART communication functions

Since

Jul 21, 2010

Author

sjb2

7.22.2 Function Documentation

7.22.2.1 void serial_init (void)

Initializes serial I/O.

Enable the peripherals used by this example. Enable processor interrupts. Set GPIO A0 and A1 as UART pins. Configure the UART for 115,200, 8-N-1 operation. Enable the UART interrupt.

Returns

void

7.22.2.2 int sgetchar (void)

Gets a character from serial receive buffer.

Returns

first character from serial receive buffer.

7.22.2.3 void sputchar (char c)

Sends out a character. (DEPRICATED - has hard to solve race condition problems, and is not used by cprintf)

Sends the character c to the transmit FIFO for the port specified by UART0_BASE (base address).

Parameters

<code>c</code>	is the character to be transmitted
----------------	------------------------------------

Returns

void Buffers a character on the serial output buffer.

Sends the character `c` to the transmit FIFO for the port specified by `UART0_BASE` (base address).

Parameters

<code>c</code>	is the character to be transmitted
----------------	------------------------------------

Returns

void

7.22.2.4 void sputcharFlush (void)

Flushes the buffer and starts the serial xmit.

loads the UART fifo from the RAM buffer. This starts a xmit.

Returns

void

7.22.2.5 void uartIRQHandler (void)

Interrupt that handles bytes coming through serial port.

Returns

void

7.23 SerialIO/serialCommand.c File Reference

processes serial commands and links them with desired function

```
#include <string.h>
#include "roneos.h"
```

Functions

- void [serialCommandAdd](#) ([SerialCmd](#) *serialCmdPtr, char *name, void(*funcPtr)(char *message))
Add serial command to linked list.
- void [serialCommandInit](#) ()
Initializes serial command processing.

7.23.1 Detailed Description

processes serial commands and links them with desired function

Since

Mar 17, 2012

Author

Sunny Kim

Warning

only partially commented

7.23.2 Function Documentation**7.23.2.1 void serialCommandAdd (SerialCmd * serialCmdPtr, char * name, void(*) (char *message) funcPtr)**

Add serial command to linked list.

Parameters

<i>serialCmdPtr</i>	pointer to serial command to be added
<i>name</i>	name of serial command
<i>funcPtr</i>	function pointer to function that will be executed when command is sent to serial port

Returns

void

7.23.2.2 void serialCommandInit ()

Initializes serial command processing.

Returns

void

7.24 SerialIO/systemCommands.c File Reference

parses char strings that are system commands

```
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
#include "roneos.h"
```

Data Structures

- struct [guiCmdData](#)
Commands from the GUI.

Functions

- void [systemCommandsInit](#) ()
Initialize system commands.

7.24.1 Detailed Description

parses char strings that are system commands

Since

Apr 2, 2012

Author

jamesm

7.24.2 Function Documentation

7.24.2.1 void systemCommandsInit (void)

Initialize system commands.

Returns

void

7.25 System/charger.c File Reference

initializes/enables/disables battery charger

```
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "roneos.h"
```

7.25.1 Detailed Description

initializes/enables/disables battery charger

Since

Apr 2, 2012

Author

jamesm

7.26 System/intMath.c File Reference

fast integer math (no floating point processor on rone)

```
#include <math.h>
#include <stdlib.h>
#include "roneos.h"
#include "intMathTrigLookup.c"
```

Functions

- uint32 [decToZero](#) (uint32 val)
Continually decrements the input value by one until it is closest to zero.
- int32 [average](#) (int32 val1, int32 val2)
Average two values.
- uint32 [circularInc](#) (uint32 index, uint32 maxIndex)
Circularly increments the index by 1.
- uint32 [circularDec](#) (uint32 index, uint32 maxIndex)
Circularly decrements the index by 1.
- uint32 [sqrtInt](#) (uint32 val)
Compute the integer square root of a number.
- void [pack32](#) (uint8 *arrayPtr, uint32 dataWord)
Pack a 32-bit dataWord into 8-bit, pointed to by char pointer arrayPtr.
- void [pack24](#) (uint8 *arrayPtr, uint32 dataWord)
Pack a 24-bit dataWord into 8-bit, pointed to by char pointer arrayPtr.
- void [pack16](#) (uint8 *arrayPtr, uint32 dataWord)
Pack a 16-bit dataWord into 8-bit, pointed to by pointer arrayPtr.
- uint16 [unpack16](#) (uint8 *arrayPtr)
Unpacks an 8-bit data into 16-bit.
- uint32 [unpack24](#) (uint8 *arrayPtr)
Unpacks an 8-bit data into 24-bit.
- uint32 [unpack32](#) (uint8 *arrayPtr)
Unpacks an 8-bit data into 32 bit.
- int16 [normalizeAngleMilliRad](#) (int16 angle)
Normalizes the angle.
- int16 [normalizeAngleMilliRad2](#) (int16 angle)
Normalizes the angle.
- int16 [normalizeAngleMilliRad3](#) (int16 angle)
Normalizes the angle.
- int32 [normalizeAngleMicroRad](#) (int32 angle)
Normalizes the angle.
- int16 [sinMilliRad](#) (int16 angle)
Interprets the angle as milli-radian of sine.
- int16 [cosMilliRad](#) (int16 angle)
- int16 [smallestAngleDifference](#) (int16 thetaGoal, int16 theta)
Calculates the smallest angle difference between the two input angles.
- int32 [poseAngleDiff](#) ([Pose](#) *poseGoalPtr, [Pose](#) *posePtr)
Calculates the smallestAngleDifference between two poses.
- void [poseAdd](#) ([Pose](#) *poseResPtr, [Pose](#) *pose1Ptr, [Pose](#) *pose2Ptr)
Adds two Poses and places result in a [Pose](#).
- int32 [poseDistance](#) ([Pose](#) *pose1Ptr, [Pose](#) *pose2Ptr)
Calculates distance between two poses.
- int32 [boundAbs](#) (int32 val, int32 [bound](#))
Bounds the value with one specified bound as both lower and upper bound.
- int32 [min](#) (int32 x, int32 y)
Finds the min of the two arguments.
- int32 [max](#) (int32 x, int32 y)
Finds the min of the two arguments.
- int32 [bound](#) (int32 val, int32 lowerBound, int32 upperBound)
Bounds the value with specified lower and upper bound.

- uint8 [countBits](#) (uint32 val)
Counts how many bits the value has.
- int16 [atan2MilliRad](#) (int32 y, int32 x)
Gets atan2 approximation in milliradians.
- int32 [averageAnglesMicroRad](#) (int32 theta1, int32 theta2)
Calculates the average of the two angles in microrad.
- int16 [averageAngles](#) (int16 angle1, int16 angle2)
Calculates the average of the two angles in millirad.
- int16 [averageArrayAngle](#) (int16 angleArray[], int32 size)
Calculates the average of the angles in the array.
- int16 [angleFromBits](#) (uint8 bitVector)
Calculates the resultant angle from the bit vector. This assumes that bit0 = 0 rad.
- int16 [angleFromBitsOffset](#) (uint8 bitVector)
Calculates the resultant angle from the bit vector. This assumes that bit0 = 0 rad.

7.26.1 Detailed Description

fast integer math (no floating point processor on rone)

Since

Apr 2, 2012

Author

jamesm

7.26.2 Function Documentation

7.26.2.1 int16 angleFromBits (uint8 *bitVector*)

Calculates the resultant angle from the bit vector. This assumes that bit0 = 0 rad.

Parameters

<i>bitVector</i>	is the vector of bits
------------------	-----------------------

Returns

the average angle

7.26.2.2 int16 angleFromBitsOffset (uint8 *bitVector*)

Calculates the resultant angle from the bit vector. This assumes that bit0 = 0 rad.

Parameters

<i>bitVector</i>	is the vector of bits
------------------	-----------------------

Returns

the average angle

7.26.2.3 int16 atan2MilliRad (int32 y, int32 x)

Gets atan2 approximation in milliradians.

Originally developed by John Aspinal at iRobot. It is quite good.

Parameters

<i>y</i>	y-coordinate of the point to be calculated
<i>x</i>	x-coordinate of the point to be calculated

Returns

atan2 approximation of the input point, specified by (x,y) coordinate

7.26.2.4 int32 average (int32 val1, int32 val2)

Average two values.

Parameters

<i>val1</i>	is the first value
<i>val2</i>	is the second value

Returns

the average of val1 and val2

7.26.2.5 int16 averageAngles (int16 angle1, int16 angle2)

Calculates the average of the two angles in millirad.

Parameters

<i>angle1</i>	is the first angle to be averaged
<i>angle2</i>	is the second angle to be averaged

Returns

the average angle

7.26.2.6 int32 averageAnglesMicroRad (int32 theta1, int32 theta2)

Calculates the average of the two angles in microrad.

Parameters

<i>theta1</i>	is the first angle to be averaged
<i>theta2</i>	is the second angle to be averaged

Returns

the average angle

7.26.2.7 int16 averageArrayAngle (int16 *angleArray*[], int32 *size*)

Calculates the average of the angles in the array.

Calculates the average of the first "size (a number)" of angles in *angleArray*.

Parameters

<i>angleArray</i> []	is the array of angles to be averaged
<i>size</i>	specifies how many elements in the array (starting from the first) should be averaged

Returns

the average of the angles in the array (returns 0 if given a nonpositive size)

7.26.2.8 int32 bound (int32 *val*, int32 *lowerBound*, int32 *upperBound*)

Bounds the value with specified lower and upper bound.

Bounds the value so that it stays within the range of $\text{lowerBound} \leq \text{value} \leq \text{upperBound}$. If it exceeds the bound, set it to the lower/upper bound.

Parameters

<i>val</i>	is the value to be bounded
<i>lowerBound</i>	is the lower bound
<i>upperBound</i>	is the upper bound

Returns

the bounded value

7.26.2.9 int32 boundAbs (int32 *val*, int32 *bound*)

Bounds the value with one specified bound as both lower and upper bound.

Bounds the input value so that it stays within the range of $-\text{bound} \leq \text{value} \leq \text{bound}$. If it exceeds the bound, set it to the bound.

Parameters

<i>val</i>	is the value to be bounded
<i>bound</i>	is the lower and upper bound

Returns

the bounded value

7.26.2.10 uint32 circularDec (uint32 *index*, uint32 *maxIndex*)

Circularly decrements the index by 1.

Decrement the index by 1. If the index reaches 0, resets it to maximum index. Circular meaning it goes back to maximum index.

Parameters

<i>index</i>	the index to be decremented
<i>maxIndex</i>	the maximum index

Returns

the decremented circular index

7.26.2.11 `uint32 circularInc (uint32 index, uint32 maxIndex)`

Circularly increments the index by 1.

Increments the index by 1. Resets index to 0 if it exceeds the maximum index Circular meaning it goes back to 0.

Parameters

<i>index</i>	is the index to be incremented
<i>maxIndex</i>	is the maximum index

Returns

the incremented circular index

7.26.2.12 `int16 cosMilliRad (int16 angle)`

Interprets the angle as milli-radian of cosine.

Parameters

<i>angle</i>	the angle to be interpreted
--------------	-----------------------------

Returns

angle as milli-radian of cosine

7.26.2.13 `uint8 countBits (uint32 val)`

Counts how many bits the value has.

Ignores leading zeros.

Parameters

<i>val</i>	is the value to be counted
------------	----------------------------

Returns

the number of bits of the input value

7.26.2.14 `uint32 decToZero (uint32 val)`

Continually decrements the input value by one until it is closest to zero.

Parameters

<i>val</i>	the value to be decremented
------------	-----------------------------

Returns

the decremented value (within the range of $0 \leq \text{val} < 1$)

7.26.2.15 int32 max (int32 *x*, int32 *y*)

Finds the min of the two arguments.

Finds the min of two arguments.

Parameters

<i>x,y</i>	is the value to be compared
------------	-----------------------------

Returns

the min value

7.26.2.16 int32 min (int32 *x*, int32 *y*)

Finds the min of the two arguments.

Finds the min of two arguments.

Parameters

<i>x,y</i>	is the value to be compared
------------	-----------------------------

Returns

the min value

7.26.2.17 int32 normalizeAngleMicroRad (int32 *angle*)

Normalizes the angle.

Normalizes the angle to make it stay in the range of $0 \leq \text{angle} < \text{microrad_2Pi}$.

Parameters

<i>angle</i>	the angle to be normalized
--------------	----------------------------

Returns

the normalized angle

7.26.2.18 int16 normalizeAngleMilliRad (int16 *angle*)

Normalizes the angle.

Normalizes the angle to make it stay in the range of $0 \leq \text{angle} < \text{millirad_2Pi}$

Parameters

<i>angle</i>	the angle to be normalized
--------------	----------------------------

Returns

the normalized angle

7.26.2.19 int16 normalizeAngleMilliRad2 (int16 *angle*)

Normalizes the angle.

Normalizes the angle to make it stay in the range of $-\text{millirad_PI} \leq \text{angle} < \text{millirad_PI}$.

Parameters

<i>angle</i>	the angle to be normalized
--------------	----------------------------

Returns

the normalized angle

7.26.2.20 int16 normalizeAngleMilliRad3 (int16 *angle*)

Normalizes the angle.

Normalizes the angle to make it stay in the range of $0 \leq \text{angle} < \text{millirad_PI}$.

Parameters

<i>angle</i>	the angle to be normalized
--------------	----------------------------

Returns

the normalized angle

7.26.2.21 void pack16 (uint8 * *arrayPtr*, uint32 *dataWord*)

Pack a 16-bit *dataWord* into 8-bit, pointed to by pointer *arrayPtr*.

Parameters

<i>arrayPtr</i>	points to the packed 8-bit <i>dataWord</i>
<i>dataWord</i>	16-bit data to be packed

Returns

void

7.26.2.22 void pack24 (uint8 * *arrayPtr*, uint32 *dataWord*)

Pack a 24-bit *dataWord* into 8-bit, pointed to by char pointer *arrayPtr*.

Parameters

<i>arrayPtr</i>	points to the packed 8-bit dataWord
<i>dataWord</i>	24-bit data to be packed

Returns

void

7.26.2.23 void pack32 (uint8 * *arrayPtr*, uint32 *dataWord*)

Pack a 32-bit dataWord into 8-bit, pointed to by char pointer arrayPtr.

Parameters

<i>arrayPtr</i>	points to the packed 8-bit dataWord
<i>dataWord</i>	32-bit data to be packed

Returns

void

7.26.2.24 void poseAdd (Pose * *poseResPtr*, Pose * *pose1Ptr*, Pose * *pose2Ptr*)

Adds two Poses and places result in a [Pose](#).

Parameters

<i>poseResPtr</i>	pointer to Pose to hold result
<i>pose1Ptr</i>	pointer to first Pose
<i>pose2Ptr</i>	pointer to second Pose

Returns

void

7.26.2.25 int32 poseAngleDiff (Pose * *poseGoalPtr*, Pose * *posePtr*)

Calculates the smallestAngleDifference between two poses.

Parameters

<i>poseGoalPtr</i>	pointer to goal pose
<i>posePtr</i>	pointer to a pose

Returns

smallest angle difference between two poses

7.26.2.26 int32 poseDistance (Pose * *pose1Ptr*, Pose * *pose2Ptr*)

Calculates distance between two poses.

Parameters

<i>pose1Ptr</i>	pointer to first Pose
<i>pose2Ptr</i>	pointer to second Pose

Returns

distance

7.26.2.27 int16 sinMilliRad (int16 *angle*)

Interprets the angle as milli-radian of sine.

Parameters

<i>angle</i>	the angle to be interpreted
--------------	-----------------------------

Returns

if angle is greater than pi/4, angle as milli-radian of sine. else, 0.

7.26.2.28 int16 smallestAngleDifference (int16 *thetaGoal*, int16 *theta*)

Calculates the smallest angle difference between the two input angles.

The difference will be within the range of -MILLIRAD_PI <- difference <= MILLIRAD_PI.

Parameters

<i>thetaGoal</i>	is first angle
<i>theta</i>	is second angle

Returns

the difference between thetaGoal and theta

7.26.2.29 uint32 sqrtInt (uint32 *val*)

Compute the integer square root of a number.

Based on Microchip app note TB040. Can't take the root of numbers higher than MAX_INT32.

Parameters

<i>val</i>	is the number to be computed
------------	------------------------------

Returns

the computed integer square root

7.26.2.30 uint16 unpack16 (uint8 * *arrayPtr*)

Unpacks an 8-bit data into 16-bit.

Parameters

<i>arrayPtr</i>	points to data with 8-bit wordlength
-----------------	--------------------------------------

Returns

unpacked input data with 16-bit wordlength

7.26.2.31 uint32 unpack24 (uint8 * arrayPtr)

Unpacks an 8-bit data into 24-bit.

Parameters

<i>arrayPtr</i>	points to data with 8-bit wordlength
-----------------	--------------------------------------

Returns

unpacked input data with 24-bit wordlength

7.26.2.32 uint32 unpack32 (uint8 * arrayPtr)

Unpacks an 8-bit data into 32 bit.

Parameters

<i>arrayPtr</i>	points to data with 8-bit wordlength
-----------------	--------------------------------------

Returns

unpacked input data with 32-bit wordlength

7.27 System/msp430Bootloader.c File Reference

boot loader functions on MSP430

```
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "inc/hw_nvic.h"
#include "inc/hw_sysctl.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/systick.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "driverlib/timer.h"
#include "driverlib/flash.h"
#include "roneos.h"
#include "system.h"
#include "msp430Bootloader.h"
#include "msp430ProgramData.h"
```

Functions

- uint16 [calcMessageChecksum](#) (const uint8 *buffer, int start, int length)

This method is a 16-bit, weighted checksum on x-mitted data.

- void [msp430BSLInit](#) (void)

This method is used to initialize the MSP430 and interrupts for the BSL.

- void [msp430BSLHandler](#) ()

MSP430 Boot Loader Handler.

7.27.1 Detailed Description

boot loader functions on MSP430

Since

Jul 31, 2012

Author

mrdouglass

7.27.2 Function Documentation

7.27.2.1 uint16 calcMessageChecksum (const uint8 * buffer, int start, int length)

This method is a 16-bit, weighted checksum on x-mitted data.

Returns

uint16

7.27.2.2 void msp430BSLHandler (void)

MSP430 Boot Loader Handler.

This method sends bytes periodically to the MSP430 to handle the boot loader function It transmits bytes about every 32us, which is about as fast as the MSP430 can Handle

Returns

void

7.27.2.3 void msp430BSLInit (void)

This method is used to initialize the MSP430 and interrupts for the BSL.

Returns

void

7.28 System/pwm.c File Reference

This is a PWM module which was originally created for the IR beacon. It is meant to control some PWM setup, but mostly for setting and changing PWM on the 8962 pins. PWM outputs are used for things like single LEDs and the power adjustment on the IR beacons.

```
#include "inc/lm3s8962.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/sysctl.h"
#include "driverlib/pwm.h"
#include "roneos.h"
```

7.28.1 Detailed Description

This is a PWM module which was originally created for the IR beacon. It is meant to control some PWM setup, but mostly for setting and changing PWM on the 8962 pins. PWM outputs are used for things like single LEDs and the power adjustment on the IR beacons.

Since

Jun 1, 2012

Author

Lindsay

7.29 System/spi_message.c File Reference

SPI commands for the MSP430.

```
#include <string.h>
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "inc/hw_nvic.h"
#include "inc/hw_sysctl.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/systick.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "driverlib/timer.h"
#include "driverlib/flash.h"
#include "roneos.h"
```

7.29.1 Detailed Description

SPI commands for the MSP430.

Since

Apr 2, 2012

Author

jamesm

7.30 System/system.c File Reference

System-level code: initialize and shutdown the robot, monitor power, set delays, etc.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#include "msp430Bootloader.h"
#include "inc/hw_memmap.h"
#include "inc/hw_types.h"
#include "inc/hw_ints.h"
#include "inc/hw_nvic.h"
#include "inc/hw_sysctl.h"
#include "driverlib/gpio.h"
#include "driverlib/rom.h"
#include "driverlib/rom_map.h"
#include "driverlib/systick.h"
#include "driverlib/sysctl.h"
#include "driverlib/uart.h"
#include "driverlib/ssi.h"
#include "driverlib/interrupt.h"
#include "driverlib/timer.h"
#include "driverlib/flash.h"
#include "roneos.h"
```

Data Structures

- struct [errorMsg](#)
Error message includes information to track error.
- struct [warningMessage](#)
Warning message includes information to track warning.

Typedefs

- typedef struct [errorMsg](#) [errorMsg](#)
Error message includes information to track error.
- typedef struct [warningMessage](#) [warningMessage](#)
Warning message includes information to track warning.

Functions

- void [systemHeartbeatTask](#) (void *parameters)
Background tasks performed during each heartbeat.
- void [systemPreInit](#) (void)

- Pre-initializes rone by starting the core hardware.*
- void `systemInit` (void)
Initializes the rest of rone after the pre-initialization.
- char * `sysGetFilenameFromPath` (char *filepathString)
Gets the file name from path.
- void `systemIDInit` (void)
Gets the robot ID.
- void `systemPrintMemUsage` (void)
Print the heap and stack usage.

7.30.1 Detailed Description

System-level code: initialize and shutdown the robot, monitor power, set delays, etc.

Since

Jul 26, 2010

7.30.2 Function Documentation

7.30.2.1 char* sysGetFilenameFromPath (char * filepathString)

Gets the file name from path.

Parameters

<i>filepathString</i>	the file path
-----------------------	---------------

Returns

a pointer that points to the file name

7.30.2.2 void systemHeartbeatTask (void * parameters)

Background tasks performed during each heartbeat.

Each heartbeat = every 16 milliseconds. Updates blinky, IRBeacon, leds, accelerometer, motor velocity, pose, and motor command timer.

Returns

void

7.30.2.3 void systemIDInit (void)

Gets the robot ID.

roneID is assigned robot ID. If robot is uninitialized, roneID is DEFAULT_RONEID.

Returns

void

7.30.2.4 void systemInit (void)

Initializes the rest of rone after the pre-initialization.

Initializes encoder, light sensor, motor, gyro, accelerometer, IR_comms, radio, ad cfprintf, sd card. Prints out the date, time, and roneID after everything is initialized. Rone starts heartbeat after this initialization.

Returns

void

7.30.2.5 void systemPreInit (void)

Pre-initializes rone by starting the core hardware.

Initializes roneID, charger, blinky, buttons, IRBeacon, SPI, LED, and serial. Rone blinks three times after the initializations are done.

Returns

void

7.30.2.6 void systemPrintMemUsage (void)

Print the heap and stack usage.

Returns

void

7.31 System/system.h File Reference

Functions

- void [systemPreInit](#) (void)
Pre-initializes rone by starting the core hardware.
- void [systemInit](#) (void)
Initializes the rest of rone after the pre-initialization.
- void [systemHeartbeatTask](#) (void *parameters)
Background tasks performed during each heartbeat.
- void [systemPrintMemUsage](#) (void)
Print the heap and stack usage.
- uint32 [systemUSBConnected](#) (void)
Check USBlevel.
- void [systemIDInit](#) (void)
Gets the robot ID.

7.31.1 Detailed Description

Since

Mar 26, 2011

Author

jamesm

7.31.2 Function Documentation

7.31.2.1 void systemHeartbeatTask (void * *parameters*)

Background tasks performed during each heartbeat.

Each heartbeat = every 16 milliseconds. Updates blinky, IRBeacon, leds, accelerometer, motor velocity, pose, and motor command timer.

Returns

void

7.31.2.2 void systemIDInit (void)

Gets the robot ID.

roneID is assigned robot ID. If robot is uninitialized, roneID is DEFAULT_RONEID.

Returns

void

7.31.2.3 void systemInit (void)

Initializes the rest of rone after the pre-initialization.

Initializes encoder, light sensor, motor, gyro, accelerometer, IR_comms, radio, ad cfprintf, sd card. Prints out the date, time, and roneID after everything is initialized. Rone starts heartbeat after this initialization.

Returns

void

7.31.2.4 void systemPreInit (void)

Pre-initializes rone by starting the core hardware.

Initializes roneID, charger, blinky, buttons, IRBeacon, SPI, LED, and serial. Rone blinks three times after the initializations are done.

Returns

void

7.31.2.5 void systemPrintMemUsage (void)

Print the heap and stack usage.

Returns

void

7.31.2.6 uint32 systemUSBConnected (void)

Check USBlevel.

Unfinished, and returns FALSE unconditionally.

Returns

FALSE

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