ARM Task Diagram

UART Physical Device (WiFly Module)



Area & Navigation

Thread

Conductor Thread

LCD Interrupt Handler

toLCD Device Queue

toUART Device Queue

toLCD Queue

LCD Physical Device

LCD Thread

toWeb Queue

Webserver Thread

toCommand Queue

toArea Queue

toConductor Queue

toUART Queue

Command/Request

Thread

UART Thread

UART Interrupt Handler

Threads:

* UART Thread: This thread accepts messages from the UART Interrupt Handler to take data measurements to the Conductor thread.
* Conductor Thread: Formats measurement data received with type and sends them to either the Area Thread or the Navigation Thread. Data is received from IR, Laser, or the IMU which is then formatted in this thread.
* Area & Navigation Thread: This thread takes measurement data from the Conductor Thread and does area or navigation calculation then forwards the data to the LCD Thread and Webserver Thread. Further, it can also make measurement requests using the Command/Request Thread.
* Webserver Thread: This thread takes area data from the Area & Navigation Thread for display on the arm website.
* LCD Thread: This thread accepts data from the Area & Navigation Thread and forwards it to the LCD.
* Command/Request Thread: This thread gets sensor requests from the Area & Navigation Thread and sends them to the pic using the UART Interrupt Handler.

Interrupt Handlers:

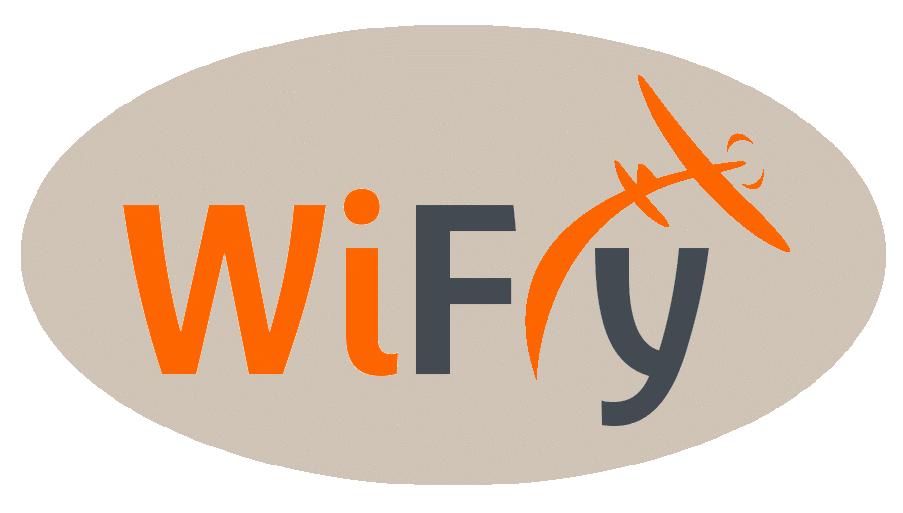
* UART Interrupt Handler: Interrupts whenever the UART interface is ready to send or receive a message. It communicates with the WiFly which in turn communicates with the PIC.
* LCD Interrupt Handler: Interrupts whenever the Area & Navigation thread sends a message to be printed. This communicates with the LCD on the ARM.

Physical Devices

* WiFly: as per documentation

Message Queues

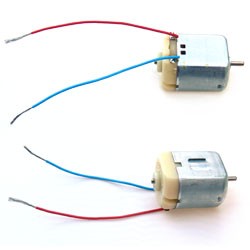
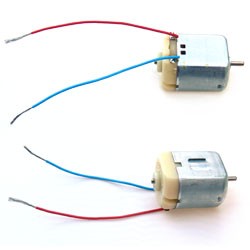
* toUART Queue: Handles incoming data from the WiFly module (unsigned int 3 bytes with type as first byte and data in next 2 bytes).
* toConductor Queue: Handles incoming data from the UART Thread to be sent to the conductor Thread(unsigned int 3 bytes with type as first byte and data in next 2 bytes).
* toArea Queue: Receives formatted data from the Conductor Thread to be sent to the Area & Navigation Thread (unsigned int 3 bytes with type as first byte and data in next 2).
* toCommand Queue: Handles incoming sensor data requests from the Area & Navigation Thread to be sent to the Command/Request Thread (unsigned int 3 bytes with type as first byte and data in next 2 bytes).
* toWeb Queue: Handles incoming data from the Area & Navigation Thread to be sent to the Webserver thread(unsigned int 3 bytes with type as first byte and data in next 2 bytes).
* toLCD Queue: Handles incoming data from the Area & Navigation Thread to be sent



UART Physical Device (WiFly Module)

To ARM

Master PIC



FromMainLow Queue

UART Thread

FromMainHigh Queue

UART Interrupt Handler

To PIC 1

I2C Interrupt Handler

IMU Device

PIC Internal Signals

I2C Physical Device

IMU Thread

ToMainLow Queue

ToMainHigh Queue

Motor Controller

Motor Control Thread

Main [distributes messages]



To PIC 2

I2C Interrupt Handler

Slave Pic

ADC Thread

FromMainLow Queue

Main [distributes messages]

ToMainLow Queue

ToMainHigh Queue

Subroutine Call

UART Threads 1 & 2

PIC Internal Signals

PIC Internal Signals

Timer1 Interrupt Handler

Timer1 Physical Device

I2C Physical Device

Subroutine Call



UART Interrupt Handlers

ADC Interrupt Handler

FromMainHigh

Queue

UART Physical Devices (2 Laser Sensors)

ADC Physical Device  
(Infrared or Ultrasonic)

Threads:

* UART Threads (PIC 1): These threads accept messages from the toMainHigh Queue to take data measurements whenever timer1 interrupts. It sends two messages into the fromMainHighQueue with type UART1\_READ and UART2\_READ.
* UART Thread (PIC 2): Handles the communication with the WiFy via UART
* ADC Thread: These threads accept messages from the toMainLowQueue to take data measurements when it is requested by the ARM. It sends a message to the fromMainHigh Queue with type ADC\_READ.
* Main: Handles the message passing between the toMainlow and toMainHigh Queues, as well as the initiation of all devices, threads, and interrupt handlers.
* IMU Thread: Accept messages from toMainHigh to take data when requested from the ARM
* Motor Control Thread: Talks to the motor controller when requested from the ARM

Interrupt Handlers:

* UART Interrupt Handlers: Interrupts whenever the UART interface is ready to send a message, or receives a message. These communicate with the 2 laser sensors, and the WiFly.
* ADC Interrupt Handler: Interrupts whenever the ADC is ready to initiate an ADC read or receives ADC data. This communicates with the infrared or ultrasonic sensor.
* Timer1 Interrupt Handler: This interrupts at recurring time period when we want to take laser sensor data via UART.
* I2C Interrupt Handler: interrupts whenever PIC is ready to send I2C data or receive I2C data.

Physical Devices

* UART Physical Devices: Talks to Laser Sensors
* ADC Physical Device: Reads Ultrasonic or Infrared Sensors
* I2C Physical Device: as per PIC documentation
* Timer1 Device: as per PIC documentation
* Motor Controller: as per documentation
* IMU Device: Uses I2C to get orientation data
* WiFly: as per documentation

Message Queues

* FromMainHighQueue: Handles ADC and UART data on PIC 1, Handles UART data on PIC 2 (unsigned int 3 bytes with type as first byte and data in next 2 bytes)
* FromMainLow Queue: Handles outgoing I2C messages on PIC 1, Handles outgoing I2C messages and IMU data on PIC 2 (unsigned int 3 bytes with type as first byte and data in next 2 bytes)
* ToMainHigh Queue: Handles Timer1 and ADC messages on PIC 1, Handles incoming UART messages from the ARM on PIC2 (unsigned int 3 bytes with type as first byte and data in next 2)
* ToMainLow Queue: Handles incoming I2C on PIC 1 and PIC2 (unsigned int 3 bytes with type as first byte and data in next 2 bytes)

References

[PIC 18F45J10 Documentation](http://ww1.microchip.com/downloads/en/DeviceDoc/39636d.pdf)

[WiFly](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&ved=0CDUQFjAC&url=http%3A%2F%2Fdlnmh9ip6v2uc.cloudfront.net%2Fdatasheets%2FWireless%2FWiFi%2FWiFly-RN-UM.pdf&ei=eP0wUtSjAZHK4AP1ioD4Dw&usg=AFQjCNGONOxcfX2wSF-mkHEZnIN427vspw&sig2=Ktjb9fI1dGeXZRqOf3Rigw&bvm=bv.52109249,d.dmg)

[IMU](http://www.sparkfun.com/datasheets/Sensors/Gyro/PS-ITG-3200-00-01.4.pdf)