

Threads:

- “Eyes” Thread: This thread accepts messages from the EyesQueue receiving a 4-bit input signifying direction of the other rover. This will send a message to the B1WiFlyQueue telling the rover with the emitter that it has seen the other rover.
- Maze Exploring Thread: This thread accepts messages from the ControlQueue which provides information about its current location. This information includes, if it is at the current goal and if it is at an intersection and will apply Tremaux’s algorithm to decide on its next move. This will send a binary value to the B1WiFlyQueue translating to the rovers next move (left, right, straight, back or stop).
- Motor Thread: This thread accepts messages from the MotorQueue which provides information regarding readjustment and direction. This sends a desired voltage for the right and left motor to ensure the rover is moving smoothly in the proper direction. It will also send information to the B2WiFlyQueue to go to the ControlQueue about its current location.
- Line Sensing Thread: This thread accepts information from the LineQueue that provides the what the line sensor is seeing. For example, the line sensor may detect an intersection, up to 4 ways, or a dead end. This will then send a message to the MotorQueue containing information regarding readjustment and direction options.

Interrupt Handlers:

- IR Interrupt Handler: Anytime a IR timer goes off, this interrupt handler is triggered. It reads the data concerning which detector(s) received the signal and sends this information to the EyesQueue to tell the other rover it has seen this one.
- Timer Interrupt Handler: Anytime the timer is set off, this interrupt is triggered. It reads from the line sensor and writes to the LineQueue providing information about the maze lines.
- Motor Interrupt Handler: Anytime the timer goes off, this interrupt is triggered. It will read data from the MotorQueue and change the voltage going to each of the motors accordingly.

Physical Devices and Interfaces:

- IR Sensor: A simple array of 4 IR receivers will be situated on top of the Rovers to allow them to know when they are “seen” by the other rover. Several IR LEDs on the front of each rover will act as their “eyes.” An interrupt will read the analog values and convert them to binary values. These receivers operate within 2.5V-5.5V with the analog output within 0.3V of the supply.
- Line Sensor: The line follower array will retrieve IR data from the ground in front of the rover and communicate an 8-bit value back to the PIC32 using I2C. These values will be used to coordinate movement with the motor control thread by informing it of deviation from the line. Also the motor control thread will inform the control thread of movement in case a turn decision needs to be made.

- **Rover Motors:** Two motors on each board will be control by an interrupt based on values placed in the queue by motor control threads. These devices operate based on the corresponding information in supplied documentation.
- **WiFly and Raspberry Pi:** These two devices will work together with the PIC32s in order to facilitate communication between the four boards. All operational information for these devices can be found in their documentation.
- **HW Timers:** The devices will be configured using Harmony in a manner that allows devices to act intermittently by triggering interrupts.

Message Queues:

- **MotorQueue:** This queue contains the commands received from the local WiFly board containing general movement commands from the control thread. Also, it will contain messages from the line sensing thread with more specific data allowing it to correct movement to stay on track.
- **LineQueue:** This queue contains 8-bit messages from the Line Sensor interrupt in order to determine where the line is in front of the rover. These values will be parsed and allow the line sensing thread to inform the motor control thread of changes in direction.
- **EyesQueue:** This contains 4-bit binary messages that contains the data read in the IR Interrupt Handler. Each bit will denote a IR detector (one for the front, right, left and back of the rover) to determine where the other rover spotted it from.
- **ControlQueue:** This contains unsigned char messages provided by the WiFly (the origin of the message is from the B2WiFlyQueue) containing information about the current location and the Eyes Thread, showing whether or not the rover has been seen. It will send this information to the Maze Exploring Thread to provide it with the information needed to determine which direction to move in.
- **B1WiflyQueue:** This contains unsigned char messages provided by the Maze Exploring Queue. This message will be sent to the WiFly containing the rovers next move.
- **B2WiflyQueue:** This contains unsigned char messages provided by the Motor Thread. It will send a message to the Wifly, to eventually make its way to the ControlQueue containing information about the rover's current location.

