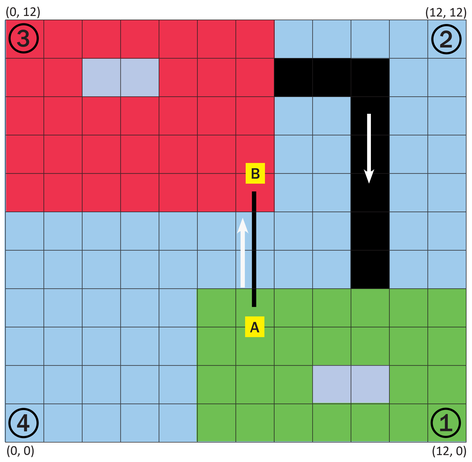
# McGill

# Dumb Piece of Metal

Team 06 - Fall 2017

## Objective




The goal is to design a robot that is capable of autonomously playing a one-on-one game of capture the flag. The robot must navigate to the opponent's zone, find the appropriately coloured flag, then return to the starting corner.

### Green Team

1. Receive game parameters
2. Localize to (11, 1)
3. Navigate to point A and relocalize
4. Mount, cross, and dismount zipline
5. Relocalize to point B
6. Navigate to red search zone and find flag
7. Return to corner 1 via the bridge

### Red Team

1. Receive game parameters
2. Localize to (1, 11)
3. Navigate to green search zone via bridge, find flag
4. Navigate to point A and relocalize
5. Mount, cross, and dismount zipline
6. Relocalize to point B
7. Return to corner 3

### Requirements of Play

- localization clock: 30 seconds
- game clock: 5 minutes
- no contact with ground during zipline crossing
- beep three times upon finding the opponent's flag
- after capture, return to the starting corner
- cross the zipline and bridge in the required order

## Hardware Design

3x Colour Sensor

- line detecton: 2 ground-facing sensors
- flag colour detection: 1 rotating sensor

1x EV3 Brick

- houses the processor, memory, and storage
- hub to connect sensors and motors

3x Large Motor

- driving the robot: 2 wheels on the ground
- zipline crossing: one pulley wheel

1x Sensor Motor

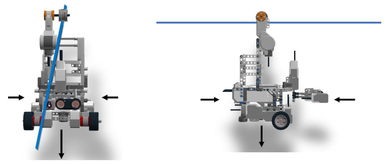
- rotates the ultrasonic sensor and one colour sensor to face flags

1x Ultrasonic Sensor

- detects flags and obstacles

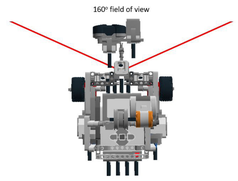
### Zipline Stability

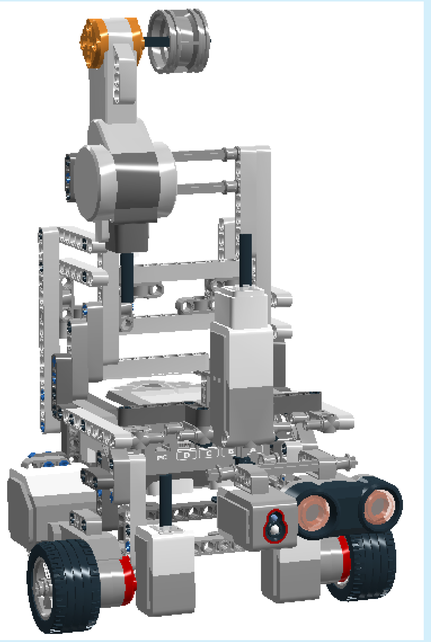
The robot is balanced such that it hangs vertically when traversing the zipline.



### Sensor Range of Motion

The forward-facing sensors have a 60° range of motion, used to detect obstacles and flags.

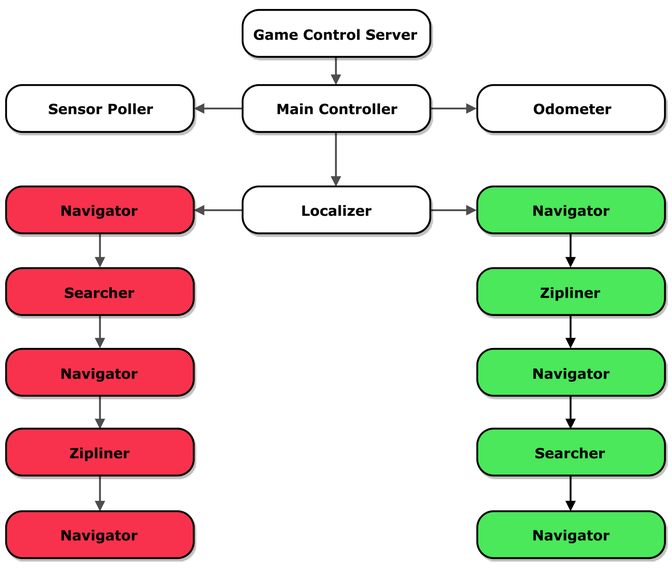


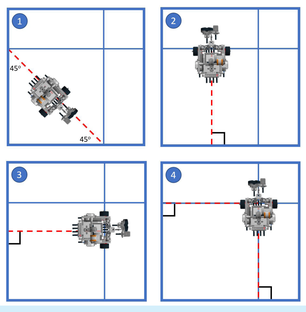
## Testing

| | |
|---|---|
| Week 1 - 2 | • sensor/motor characterization and selection<br>• ensure hardware stability on the ground<br>• determine centre of gravity on the zip line |
| Week 3 - 4 | • find and adjust for robot navigation and localization accuracy<br>• evaluate performance during long periods of operation<br>  • ensure that battery depletion is not a limiting factor<br>• separately confirm performance and reliability of individual software components |
| Week 5 - 6 | • full-game testing:<br>  • identify the weakest components of the run<br>  • develop methods to improve or circumvent weaknesses<br>• time limit testing<br>• extreme case testing:<br>  • encountering opponents, unexpected starting conditions |

## Software Design




### Localization



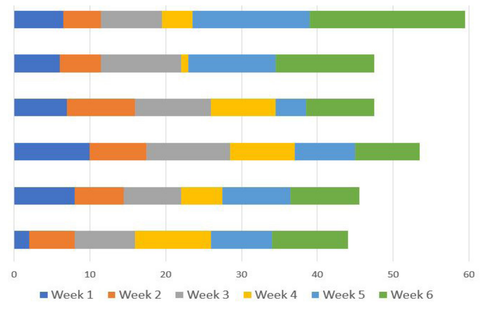

Localization runs in between each of the other components of the state machine. It is the most important process that the robot performs.

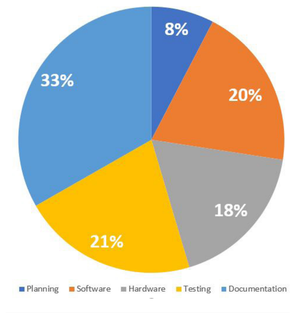
## Tools

## Team Management

| | |
|---|---|
| Project Manager | *Josh Inscoe* |
| Documentation Manager | *Alex Hale* |
| Hardware Team Leader | *Frederic Cyr* |
| Testing Team Leader | *Xu Hai* |
| Testing Engineer | *Xianyi Zhan* |
| Software Team Leader | *Justin Tremblay* |

84.8% used




Expenditure per Area