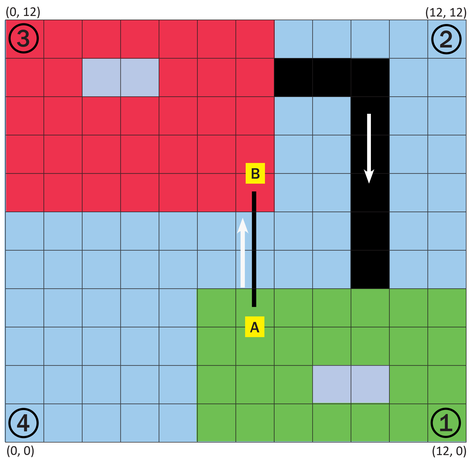
McGill

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

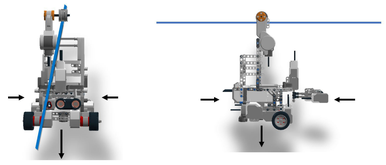
- rotates the ultrasonic sensor and one colour sensor to face flags

1x Ultrasonic Sensor

- detects flags and obstacles

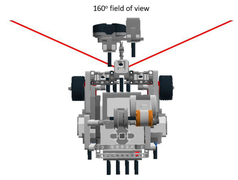
Zipline Stability

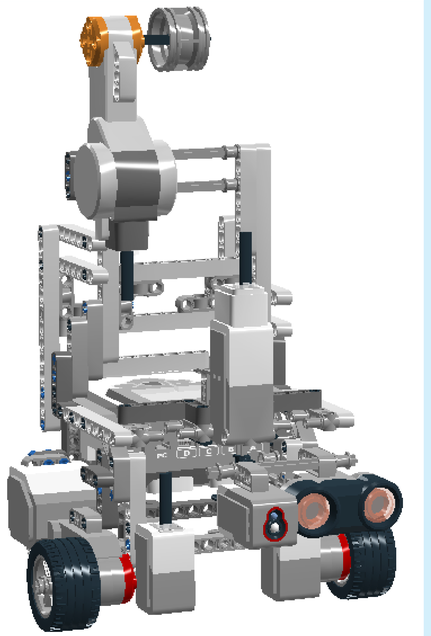
The robot is balanced such that it hangs vertically when traversing the zipline.



Sensor Range of Motion

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



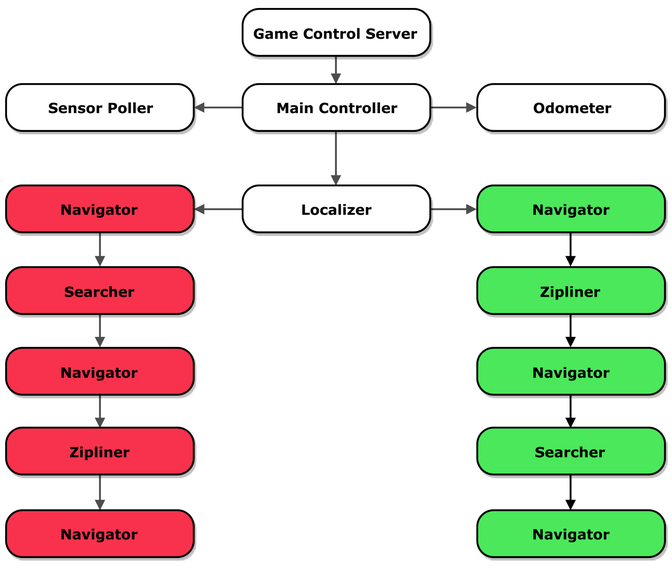


Testing

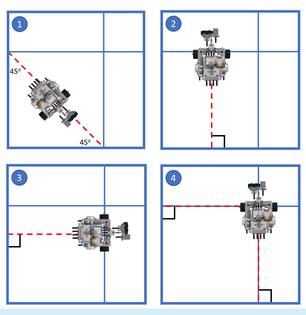
Week 1 - 2	• sensor/motor characterization and selection • ensure hardware stability on the ground • determine centre of gravity on the zip line
Week 3 - 4	• find and adjust for robot navigation and localization accuracy • evaluate performance during long periods of operation • ensure that battery depletion is not a limiting factor • separately confirm performance and reliability of individual software components

Week 5 - 6	• full-game testing:
	  • identify the weakest components of the run
	  • develop methods to improve or circumvent weaknesses
	• time limit testing
	• extreme case testing:
	  • encountering opponents, unexpected starting conditions

Software Design



Localization



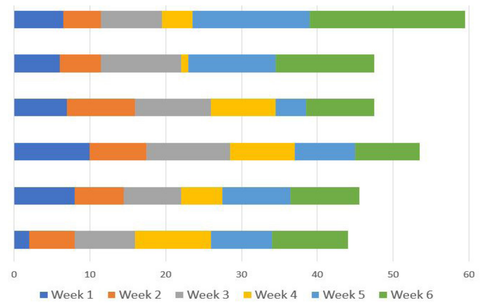
Localization runs in between each of the other components of the state machine. It is the most important process that the robot performs.

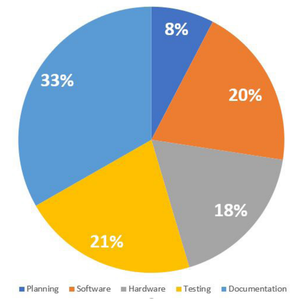
Tools

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