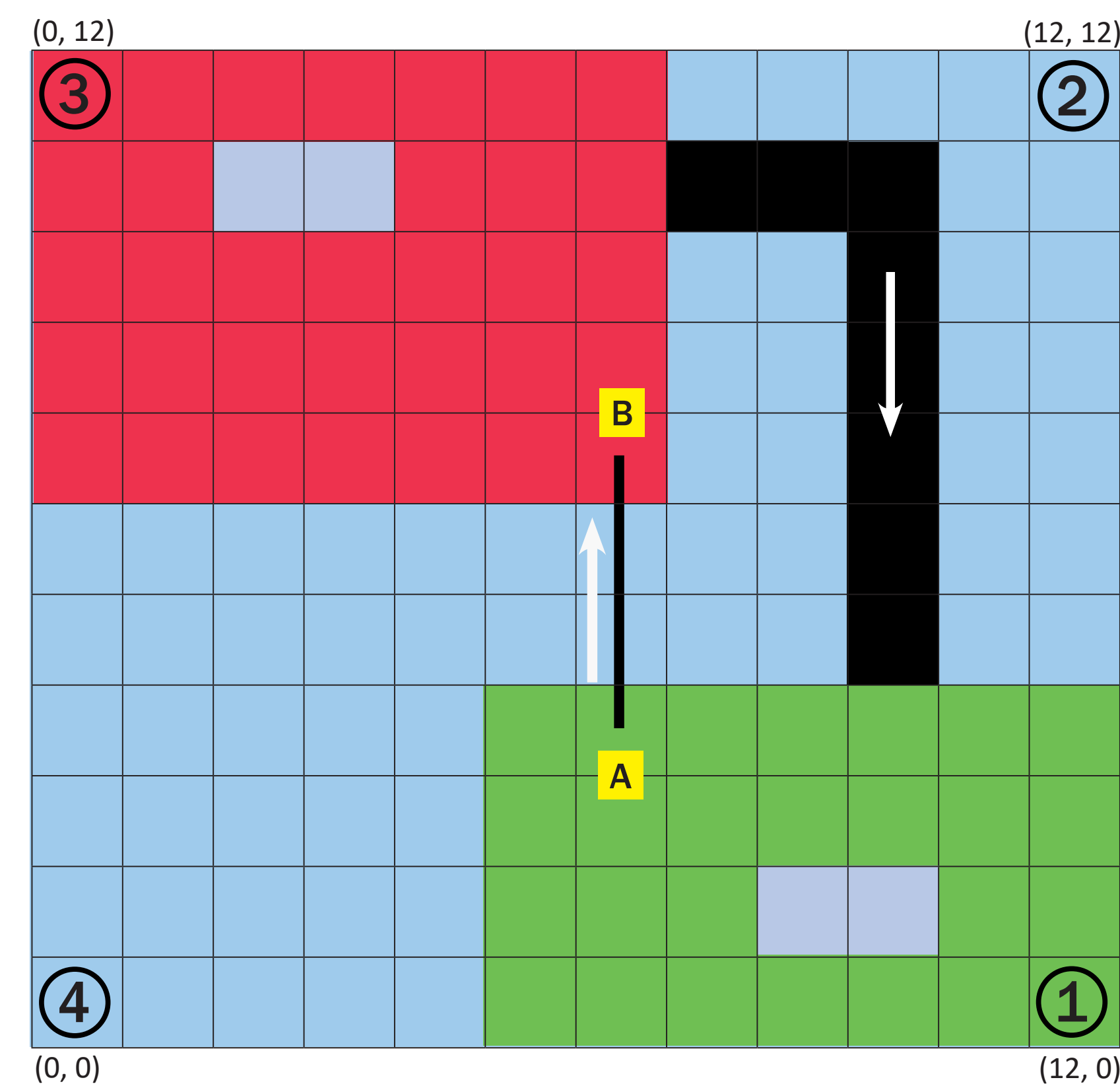


## Objective



The goal is to design a robot that is capable of autonomously playing a one-on-one game of capture the flag. At the start of play, the robot must receive the game parameters that describe the position of each element of the playing field. The robot must then navigate to the opponent's zone, find the appropriately coloured flag, and return to its starting zone.

### 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

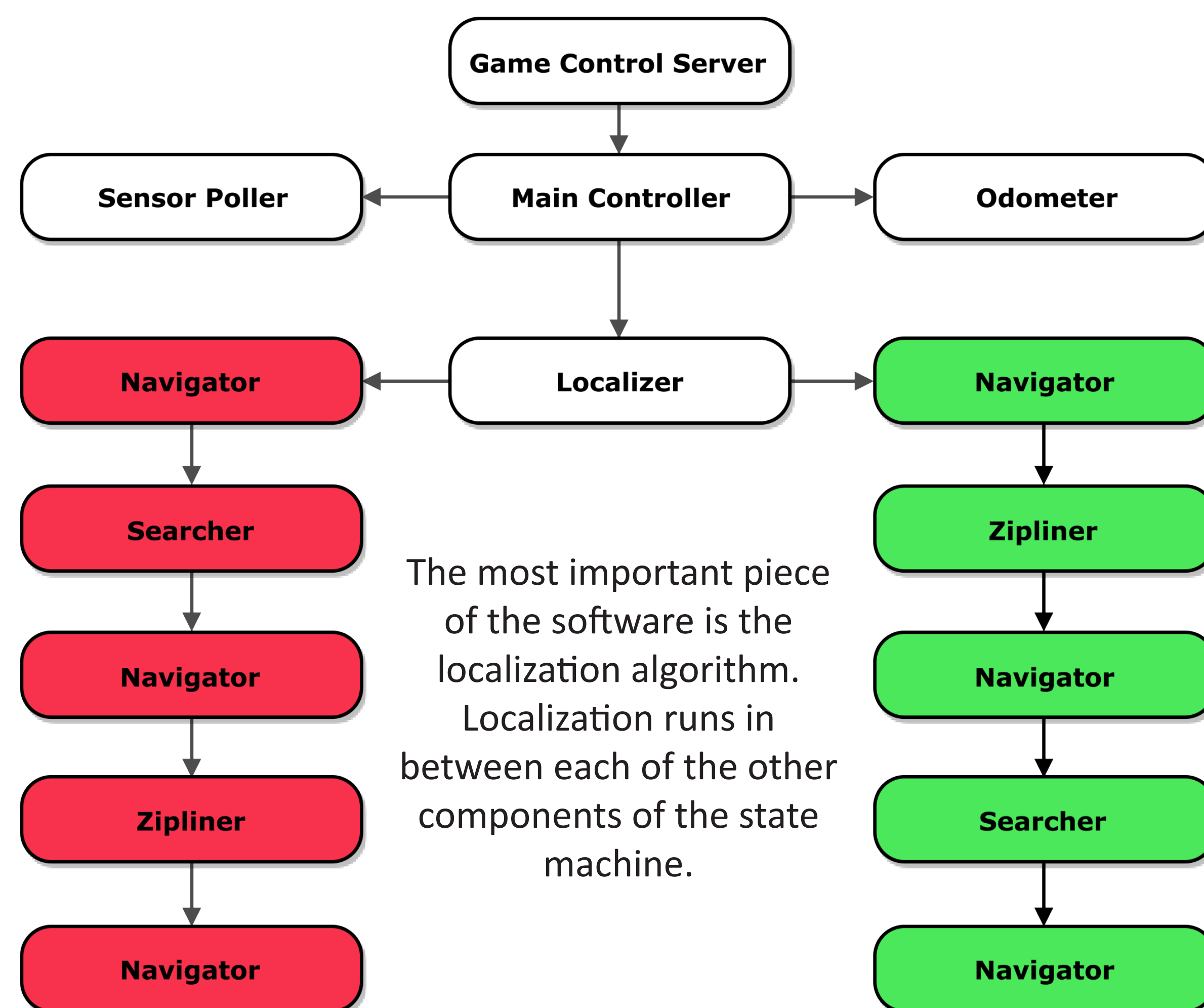
### Requirements of Play

- 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

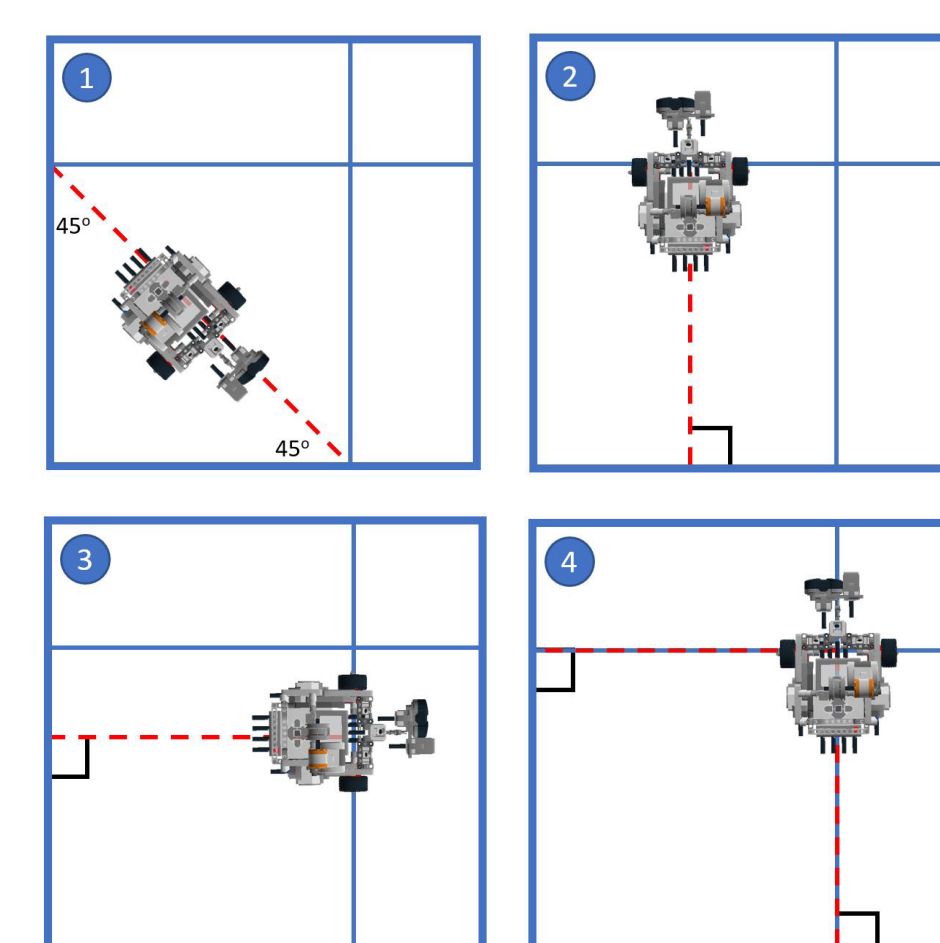
### Red Team

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

## Software Design



### Localization



## Hardware Design

3x



### Colour Sensor

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

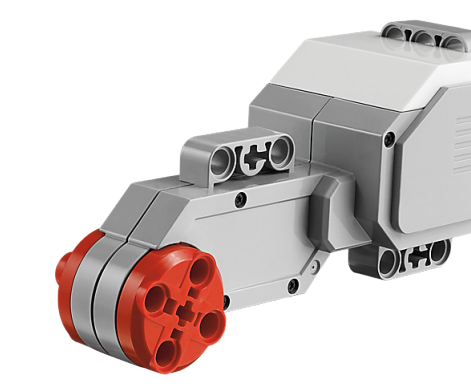
1x



### 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

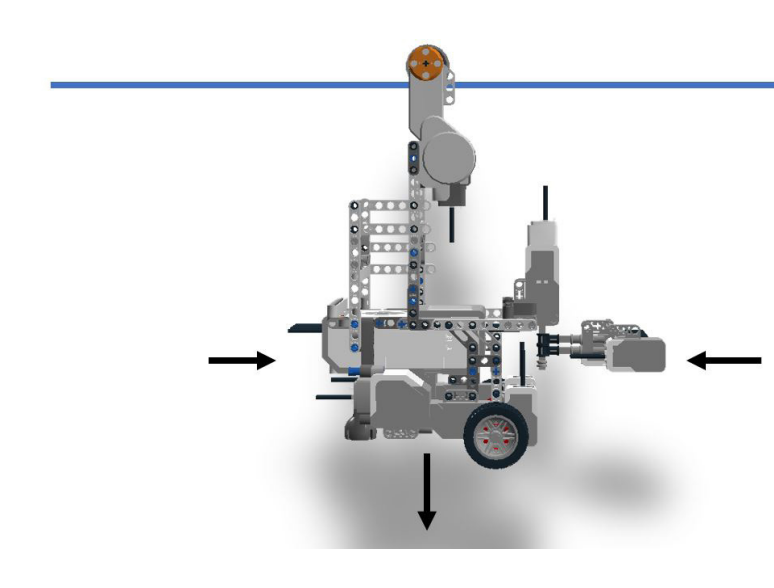
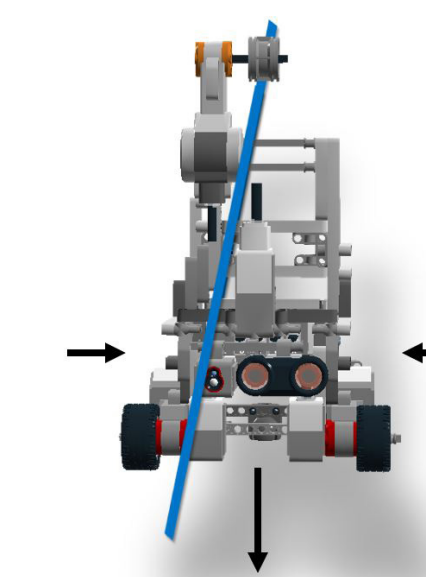


### Ultrasonic Sensor

- detects flags and obstacles

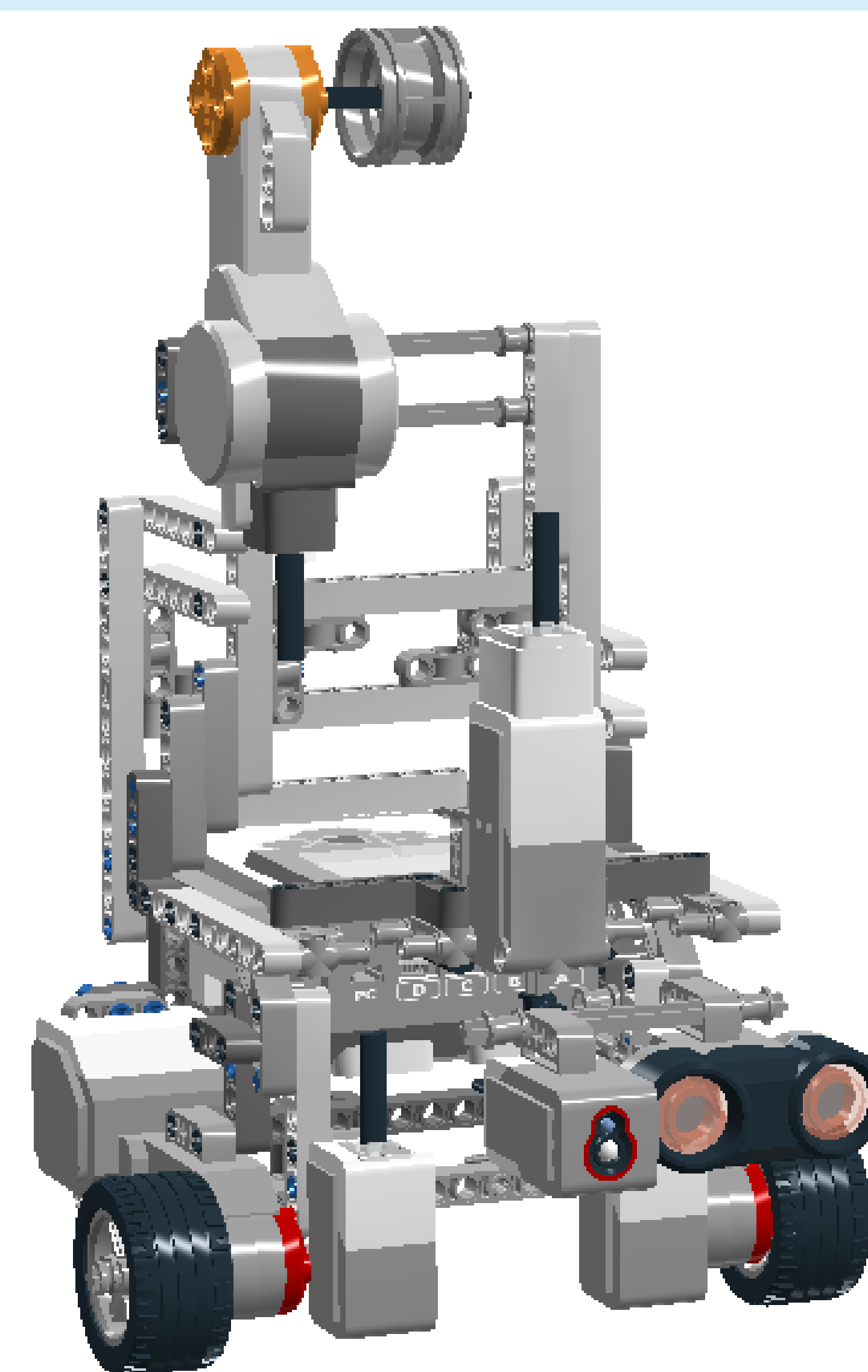
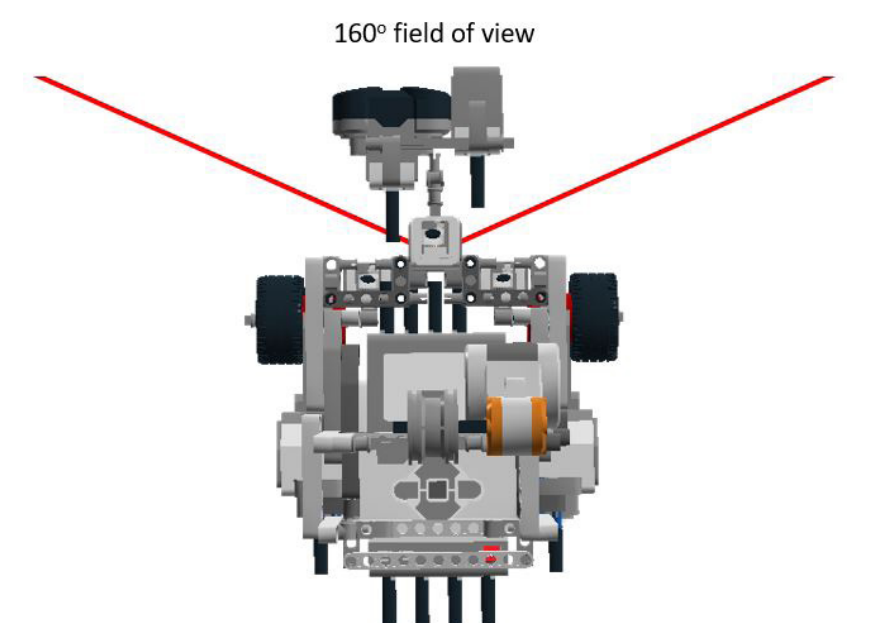
### Zipline Stability

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: localize in 30 seconds, full game in 5 minutes
- extreme case testing:
  - encountering opponents, unexpected starting conditions, other extreme cases

## Team Management

Project Manager

Josh Incoe

Documentation Manager

Alex Hale

Hardware Team Leader

Frederic Cyr

Testing Team Leader

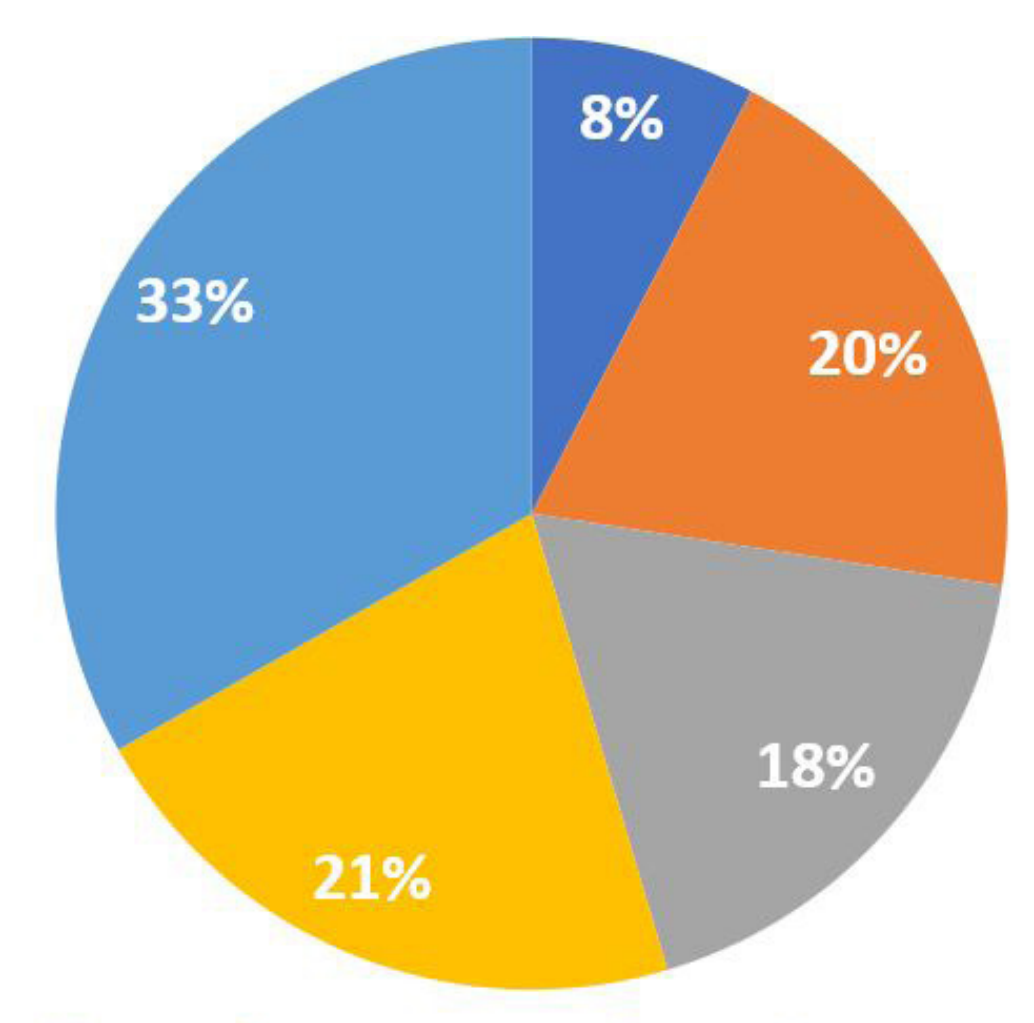
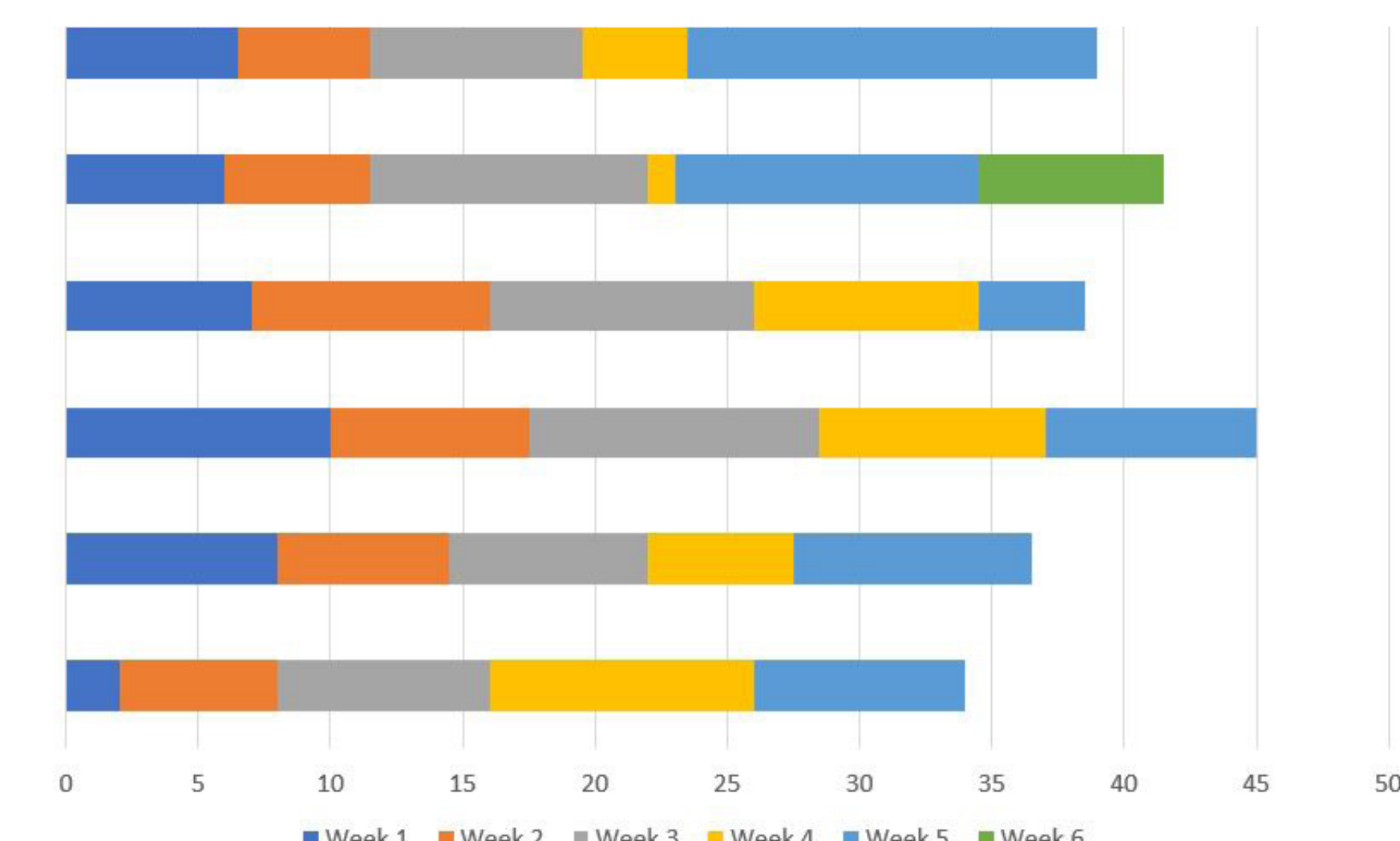
Xu Hai

Testing Engineer

Xianyi Zhan

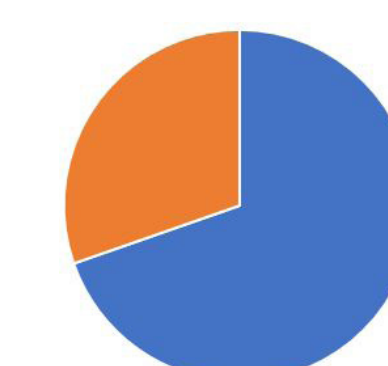
Software Team Leader

Justin Tremblay



Expenditure per Area

## Tools



70.3% used