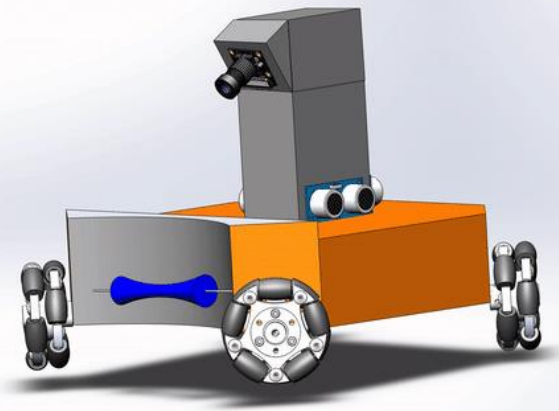
Overview

- Company Profile
- Problem Statement
- Objectives
- Overall System
- Solution Approaches
- Deliverables

PORO INC.

PORO INC.

POROBOT

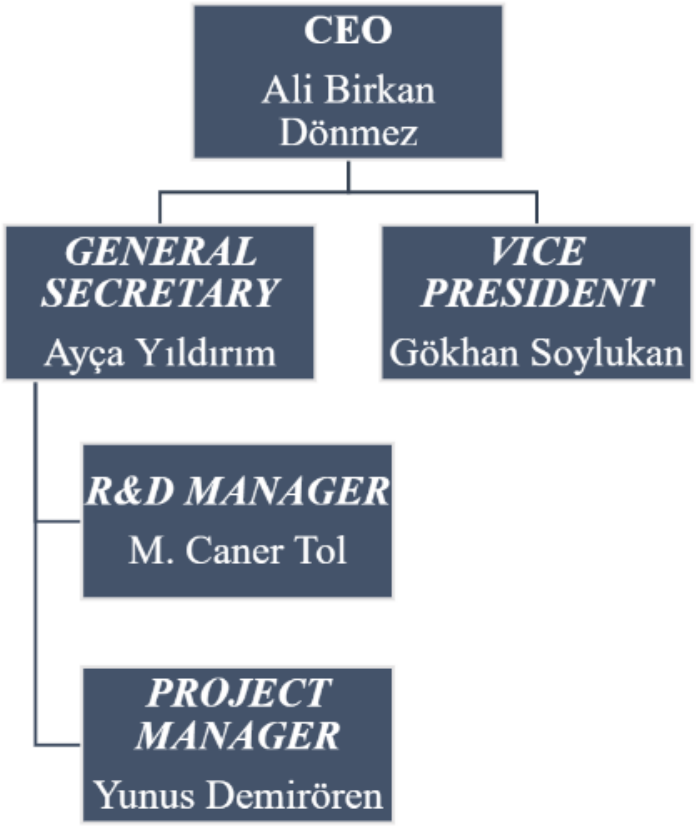


Gökhan Soylukan

Vice President

PORO INC.

Company Profile



Our mission is to manufacture innovative, efficient, eco-friendly, high-technology unique engineering products.

Our vision is to become one of the leading robotics companies with systematic research and development activities.

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Problem Statement

Adopted from http://capstone.eee.metu.edu.tr/projects/

-Remotely controlling the robot from at least 30 meters.

-Allowed time is 20 seconds for sending the ball to the counter side.

-Grasping, scooping and carrying are forbidden actions.

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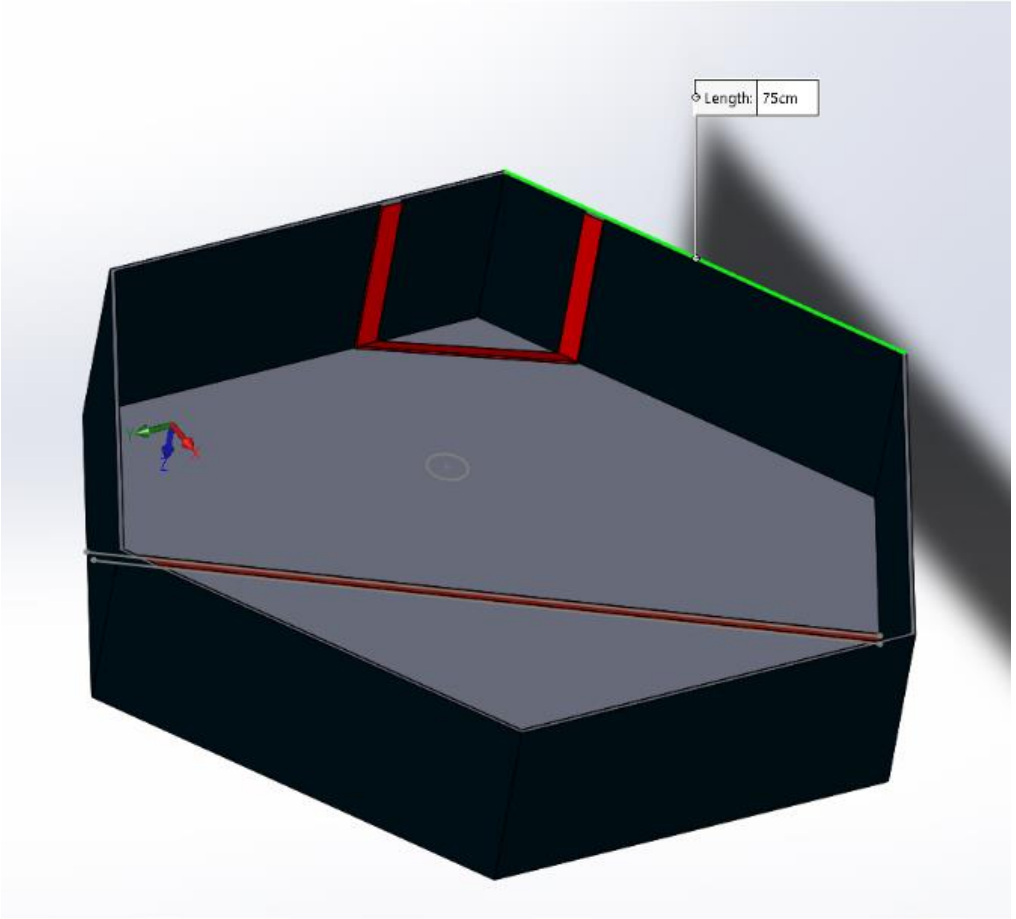
Problem Statement



Goal width must be at least twice of the width of the robot

Scoring two goals more than the opponent wins the game.

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Objectives

Streaming Delay

- Delay in the real-time applications like in our case should be as small as possible.

- Criterion (in seconds)

    Perfect: <100ms

    Good: 100ms-500ms

    Poor: >500ms

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Objectives

Response Time

- The robot should send the ball to the opponent’s goal as soon as possible when the ball is in our side. Allowed maximum time for this operation is 20 seconds.
- Criterion (in seconds)

    Perfect: <5s

    Good: 5s-15s

    Poor: 15s-20s

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Objectives

Horizontal angle of view

-View angle of the camera should be wide enough to be able to see the game field clearly.

-Criterion (in degrees)

Perfect: >150°

Good: 60°-150°

Poor: <60°

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Objectives

Budget

-The final price of POROBOT can be maximum $200.

-Criterion (in dollars)

Perfect: <$120

Good: $120-$200

Poor: >$200

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M. Caner Tol

R&D Manager

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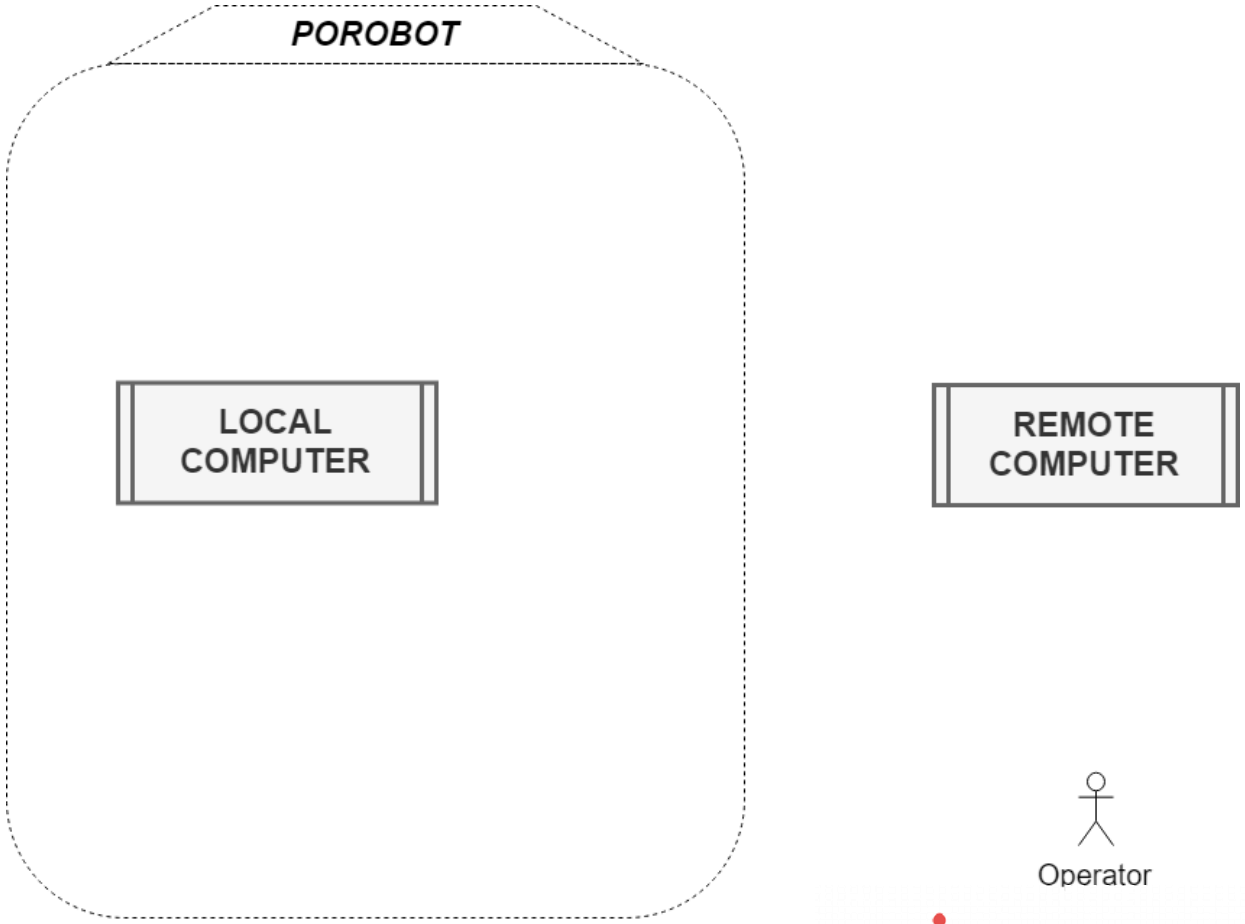
Overall System

- POROBOT
- Human Operator
- Remote Computer

  with Internet connection



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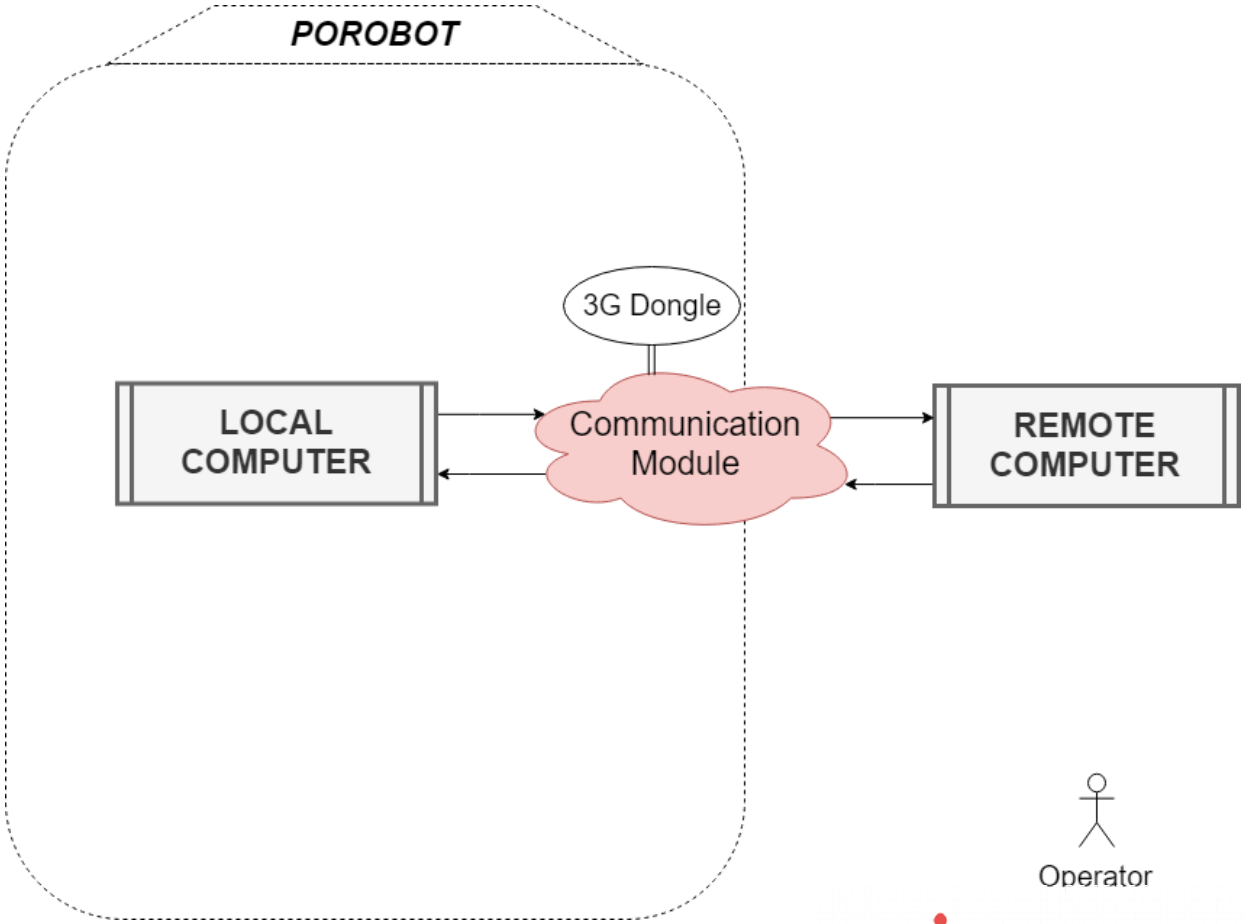
Subsystems

- Communication module



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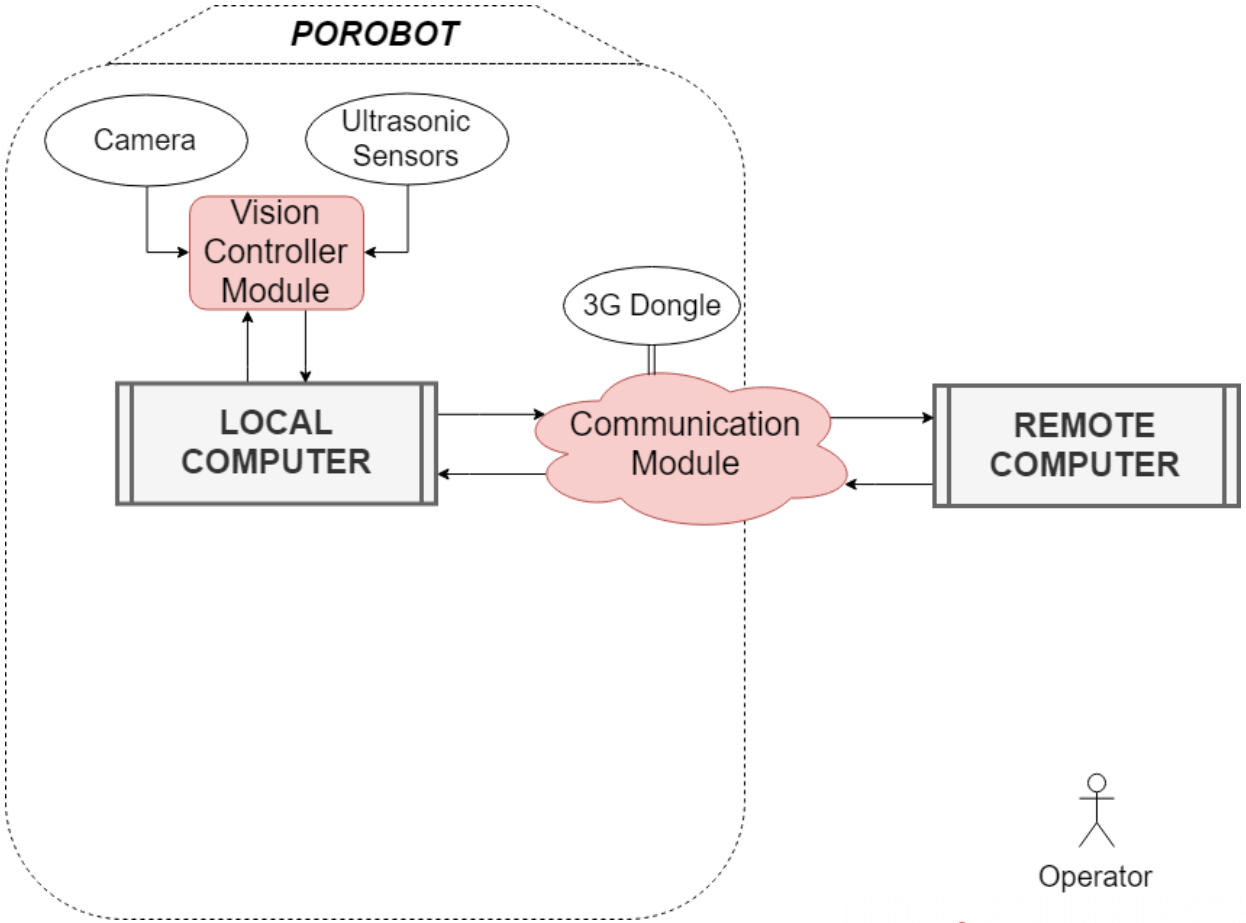
Subsystems

- Communication module
- Vision Controller module
  - Spatial information



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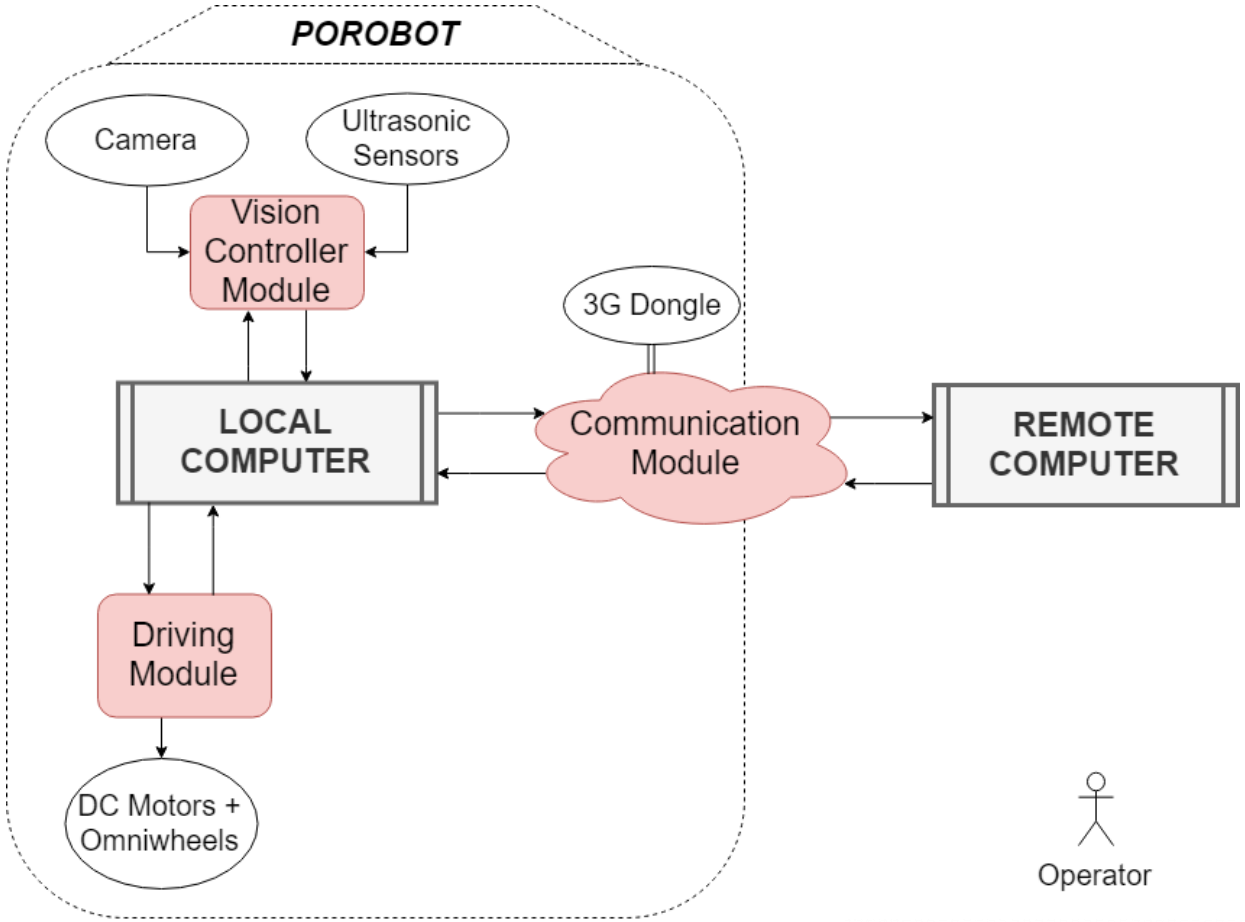
Subsystems

- Communication module
- Vision Controller module
- Driving module



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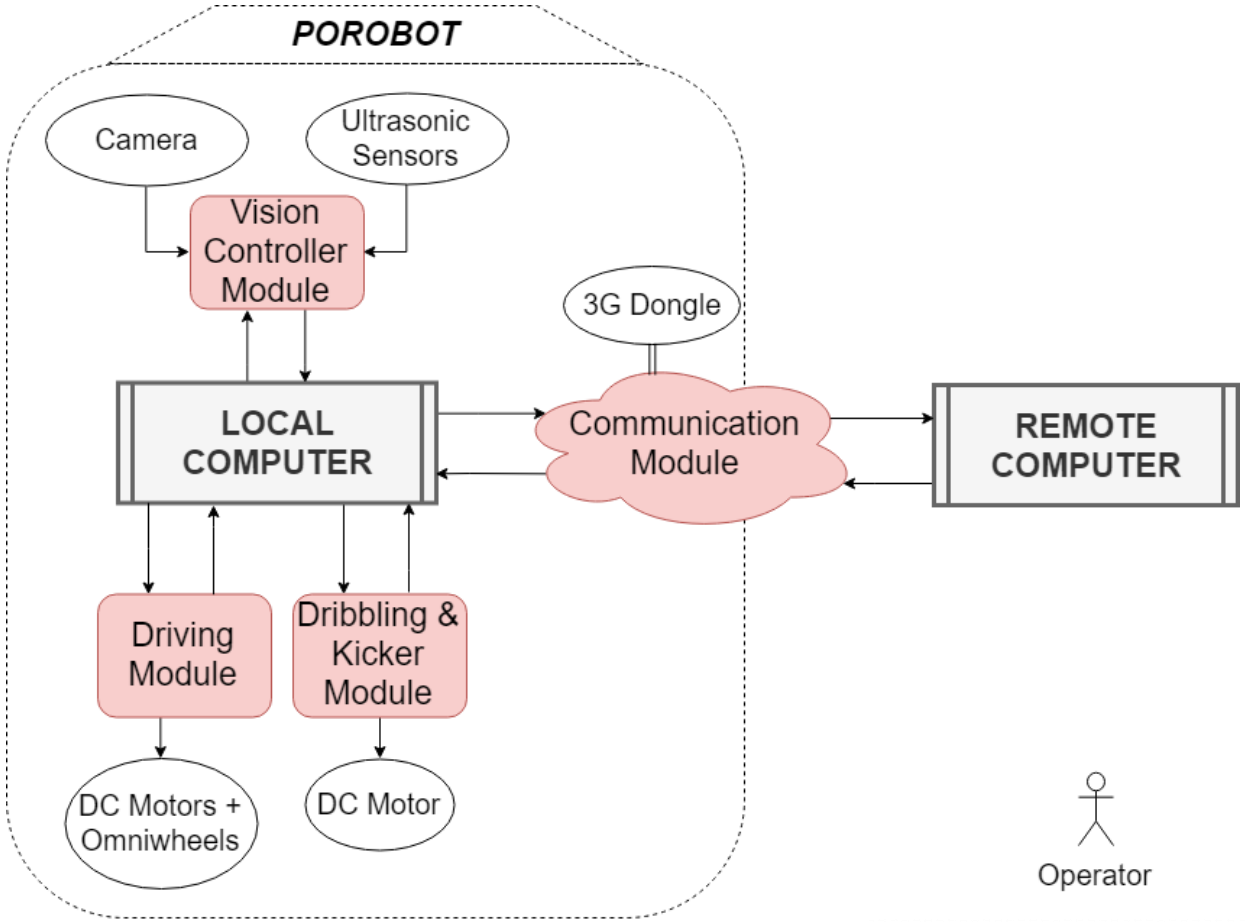
Subsystems

- Communication module
- Vision Controller module
- Driving module
- Dribbling & Kicker module



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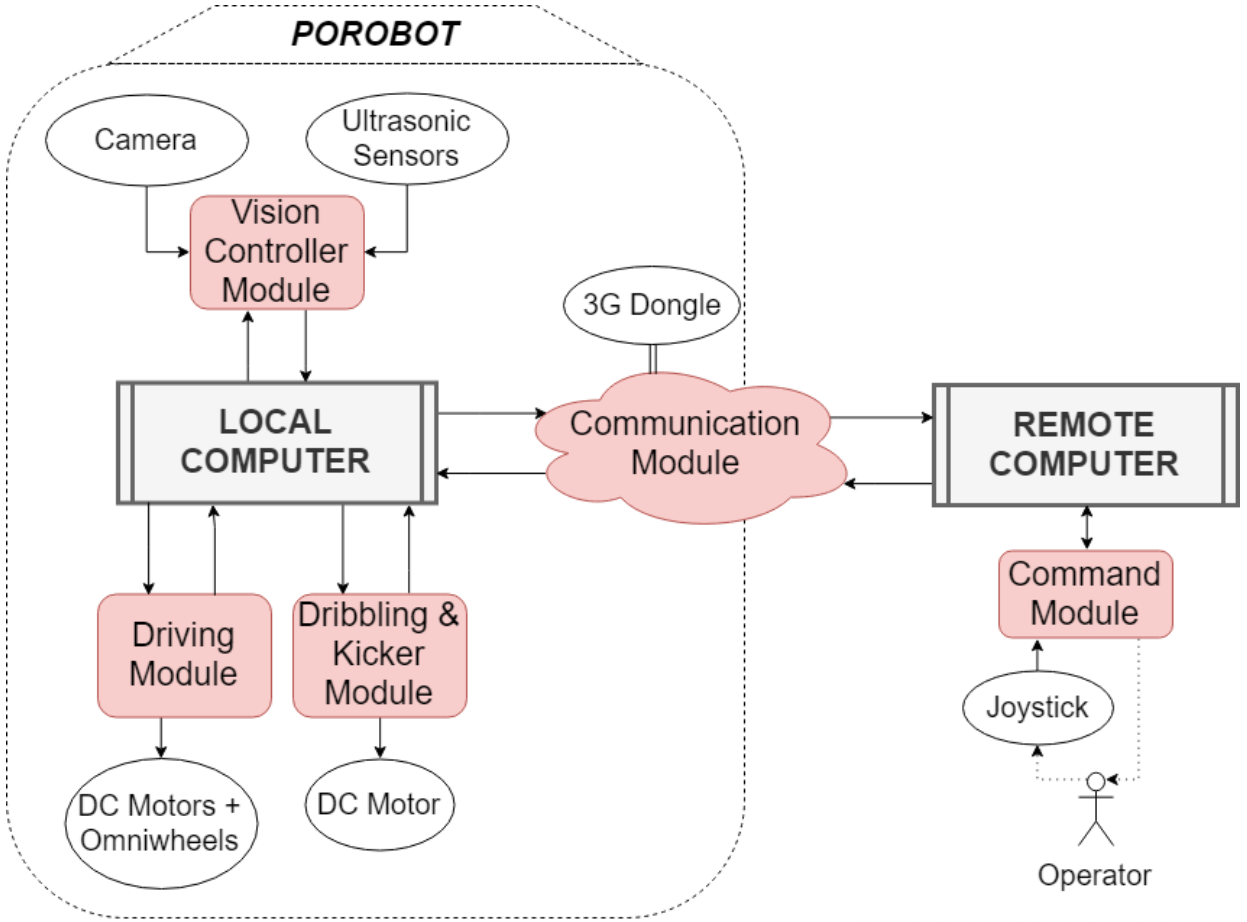
Subsystems

- Communication module
- Vision Controller module
- Driving module
- Dribbling & Kicker module
- Command module



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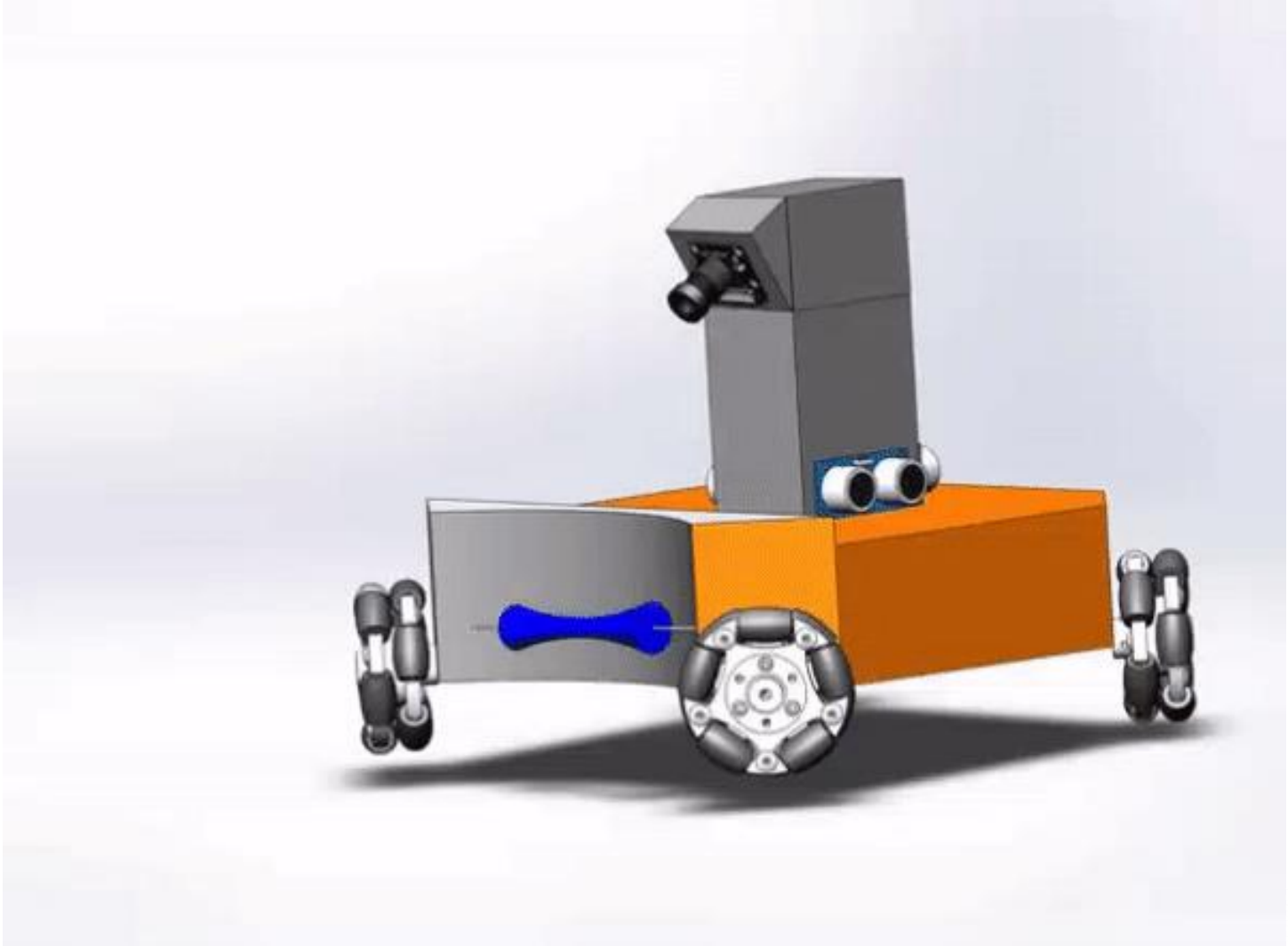
Design



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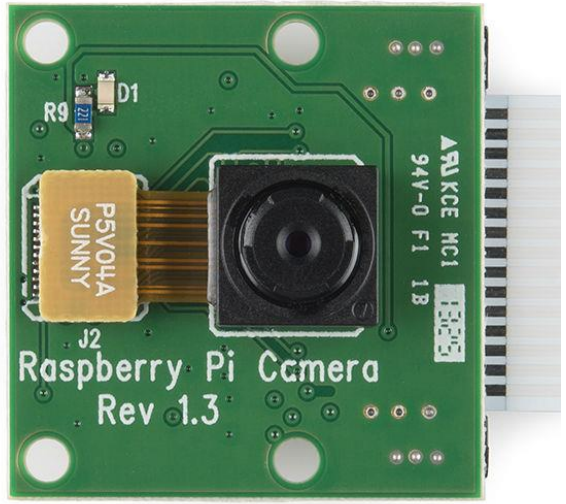
Vision Controller Module

- Camera
  - Raspberry Pi Camera v1.3
- Ultrasonic sensors
  - HC-SR04
  - ~54 % of the time is wasted while trying to understand the current state of the robot (Casper, 2002)
  - Telepresence



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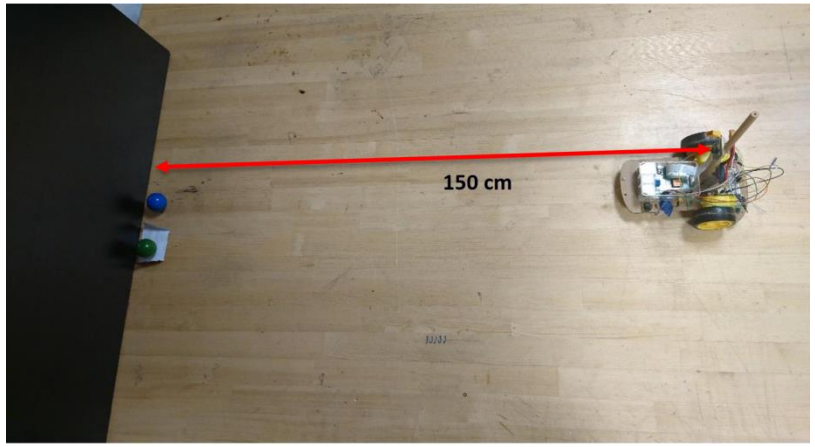
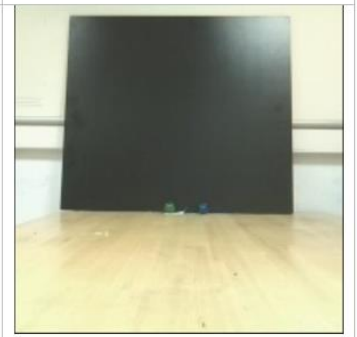
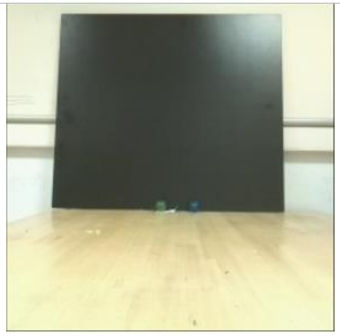
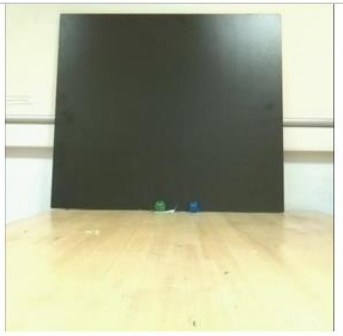
Vision Controller Module

- Camera Resolution tests
- 200x200 resolution



40x40	80x80	160x160	200x200
			
240x240	320x320	480x480	720x720
			

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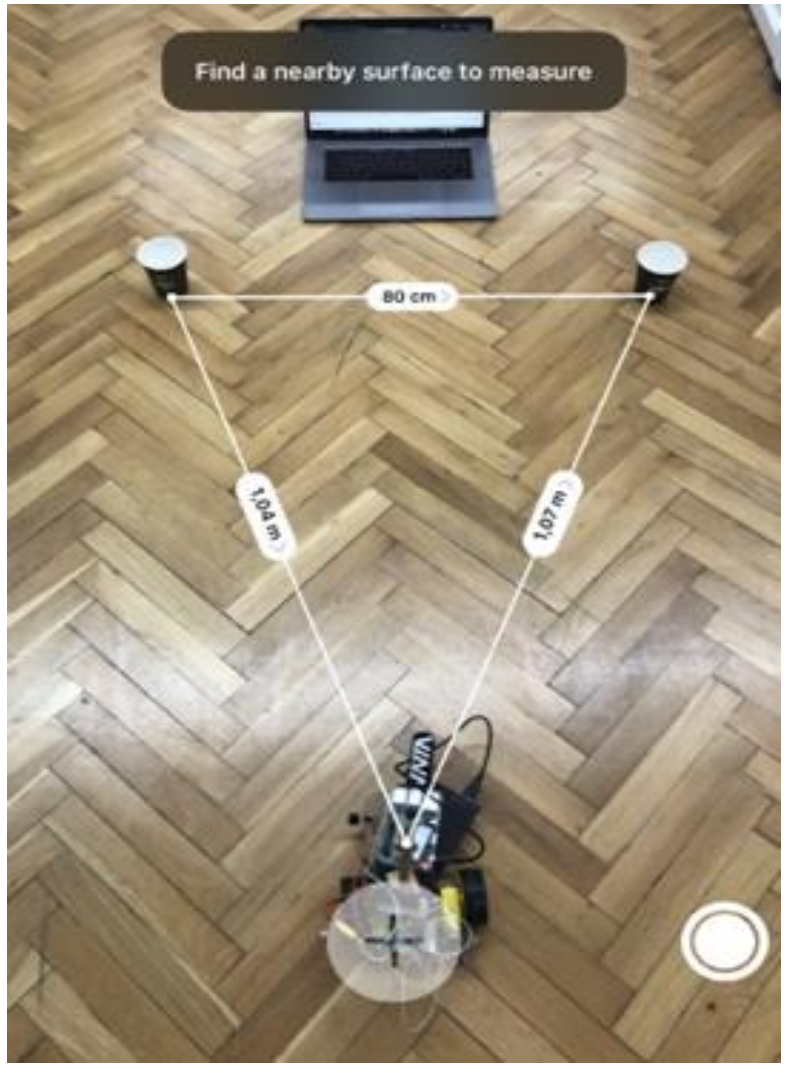
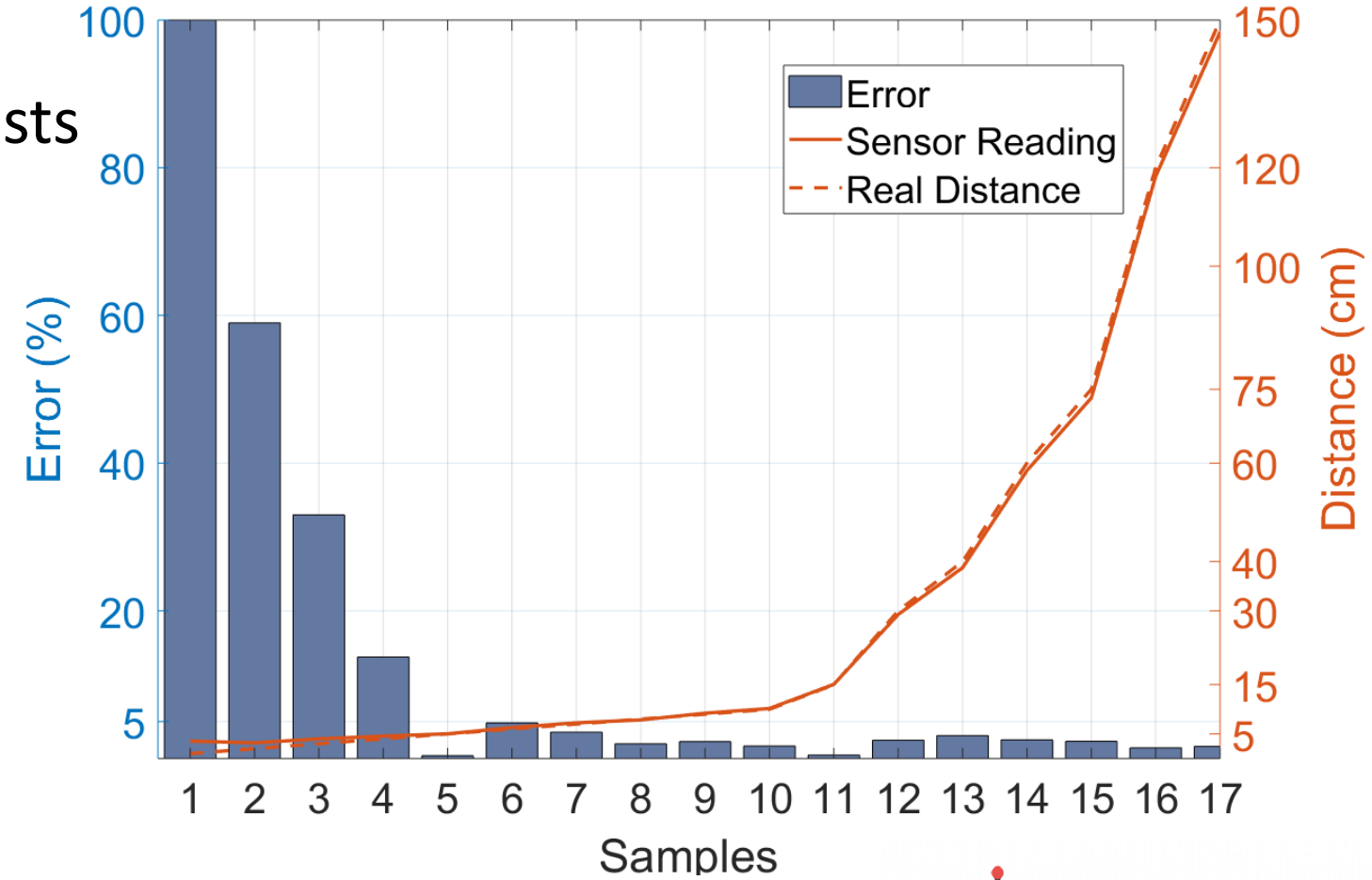
Vision Controller Module

- Angle of View (AOV) tests
- 44.5° horizontal angle
- Solution:
  - External lenses



Vision Controller Module

- Distance Measurement tests
- Error < 5 % after 5 cm



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Ayça Yıldırım

General Secretary

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Communication Module

- 3G dongle modem and SIM card
  - Sakis3G
- Dataplicity Agent
  - Porthole
  - Wormhole
- MJPEG Streamer

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Communication Module

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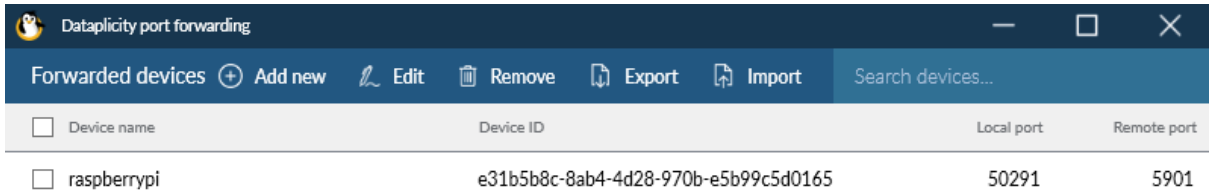

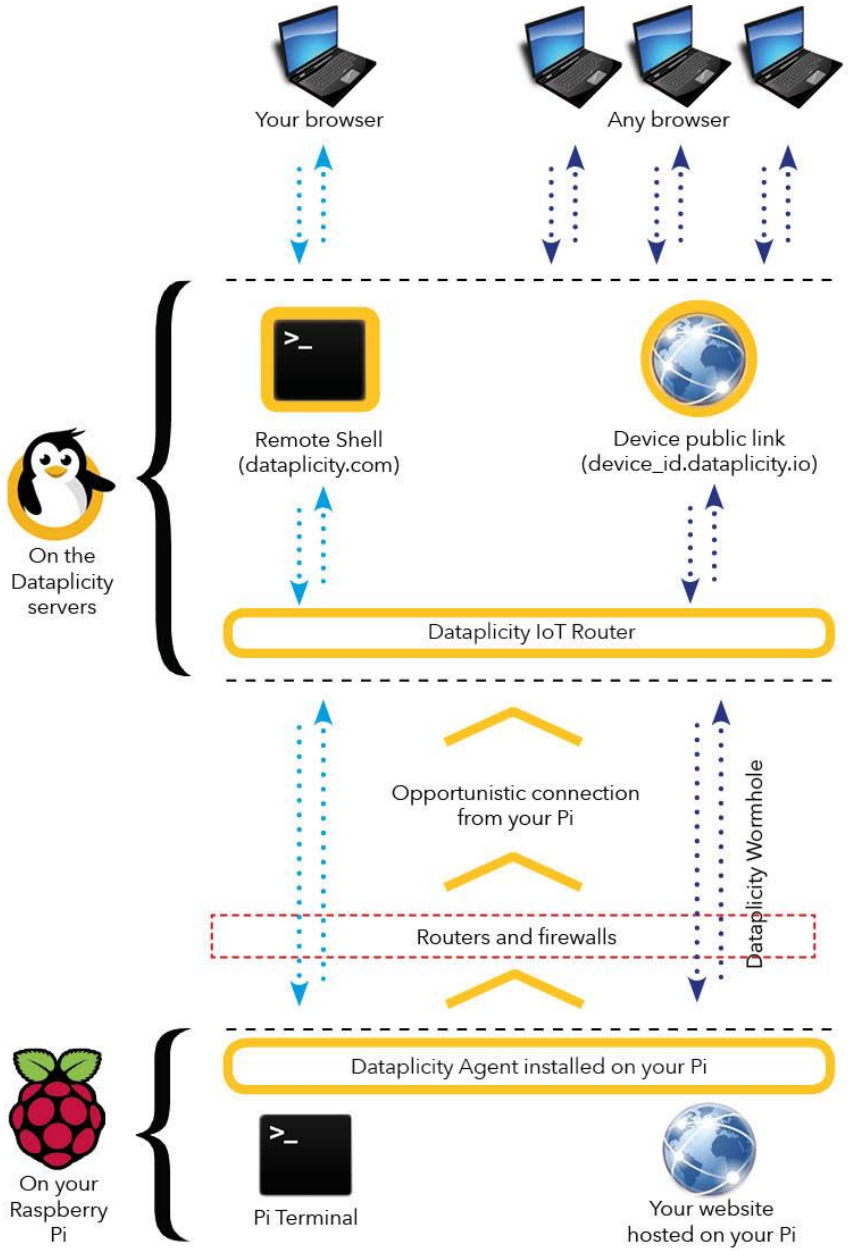

Communication Module

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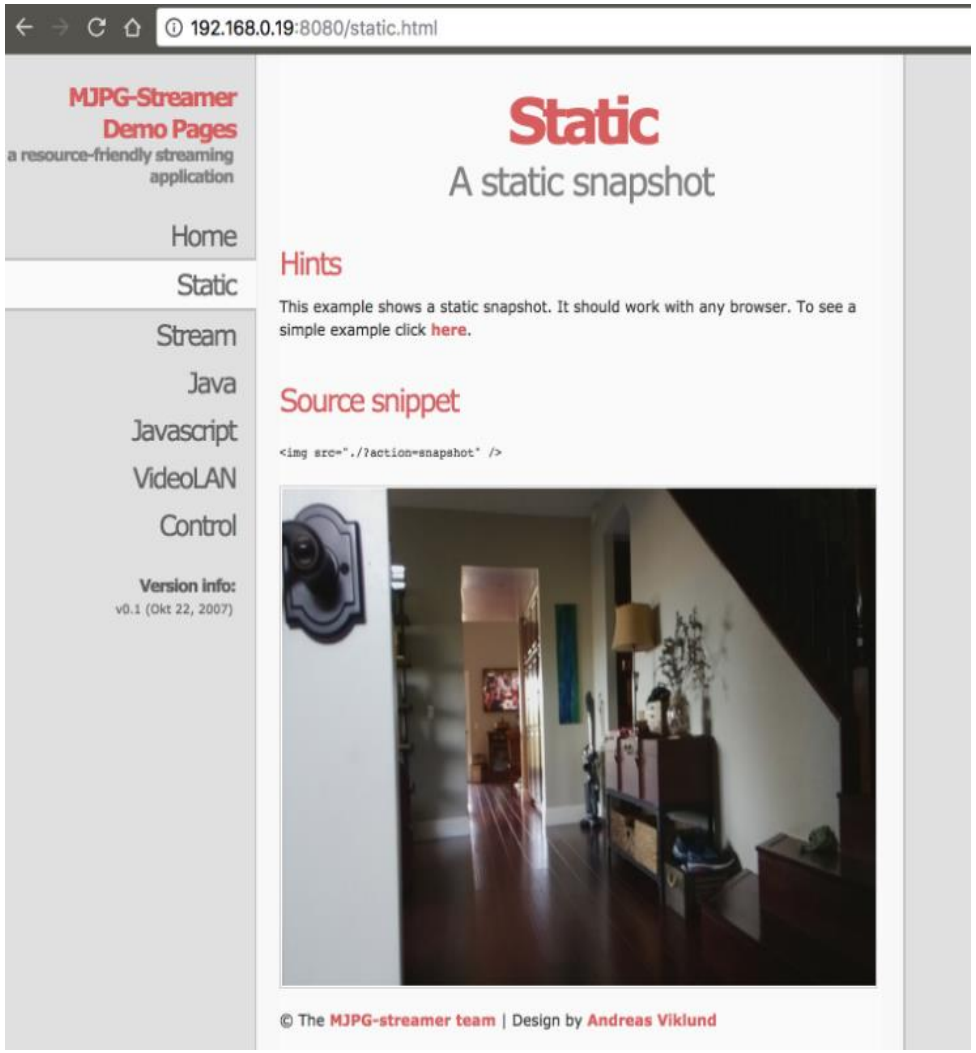

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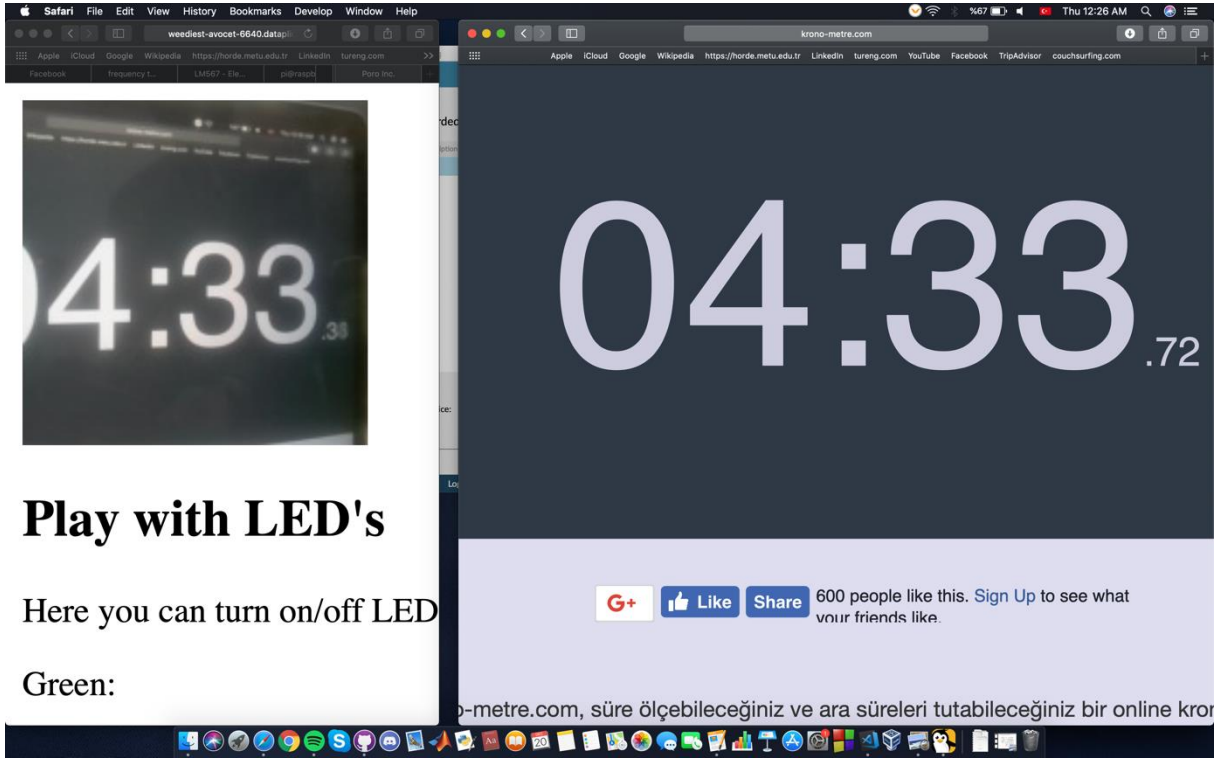
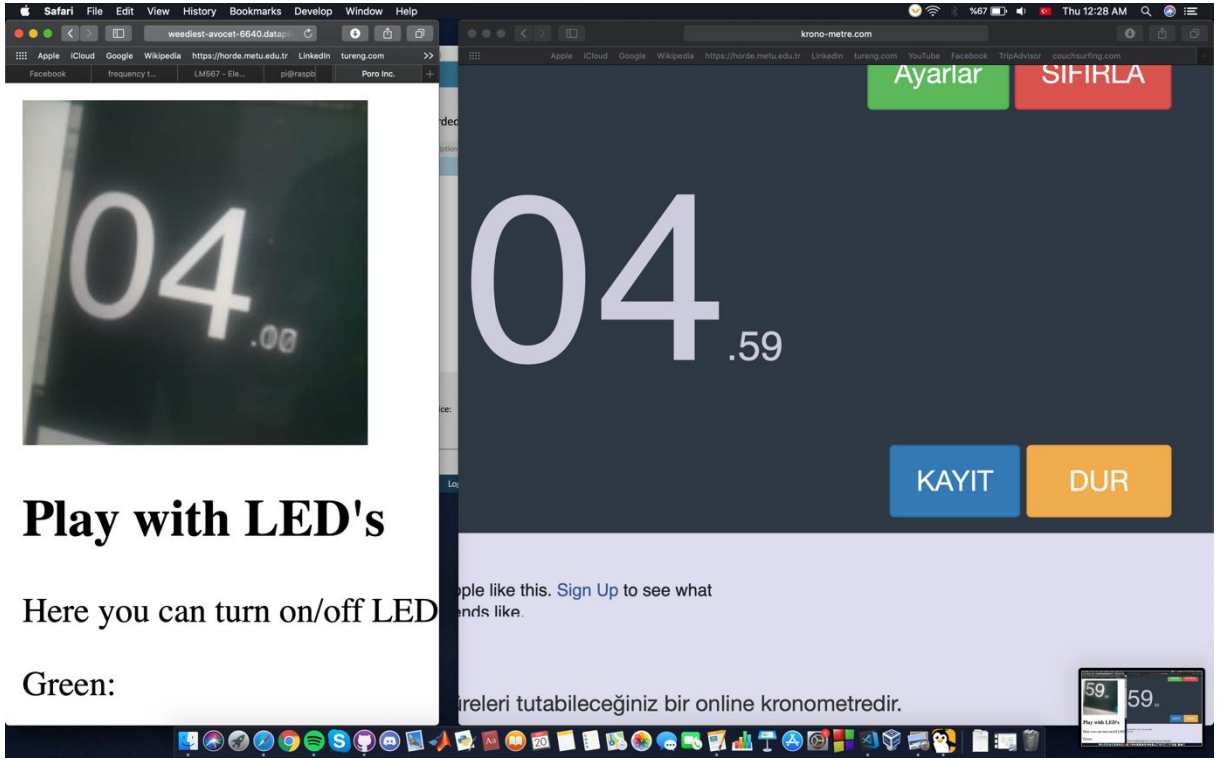
Communication Module

Stream delay tests



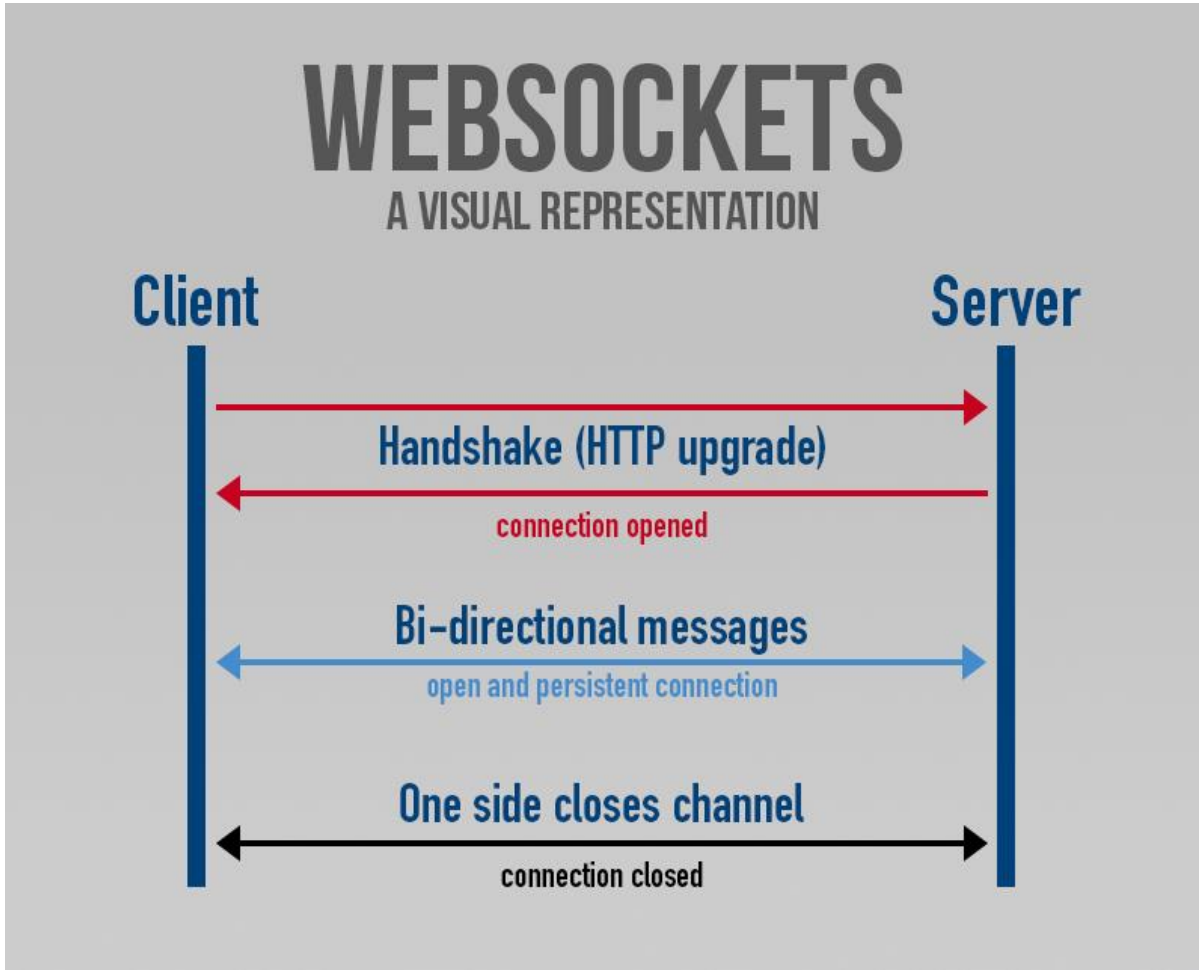
Best delay (around 400 ms)



Worst delay (around 590 ms)

Command Module

- WebSocket protocol
  - Full-duplex communication
  - Suitable for real time applications
- Tornado web server module
  - Non-blocking
  - Asynchronous
- Joystick
  - Controlling omni-wheels with stick
  - Activating dribbling and kicker mechanisms with buttons



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Command Module

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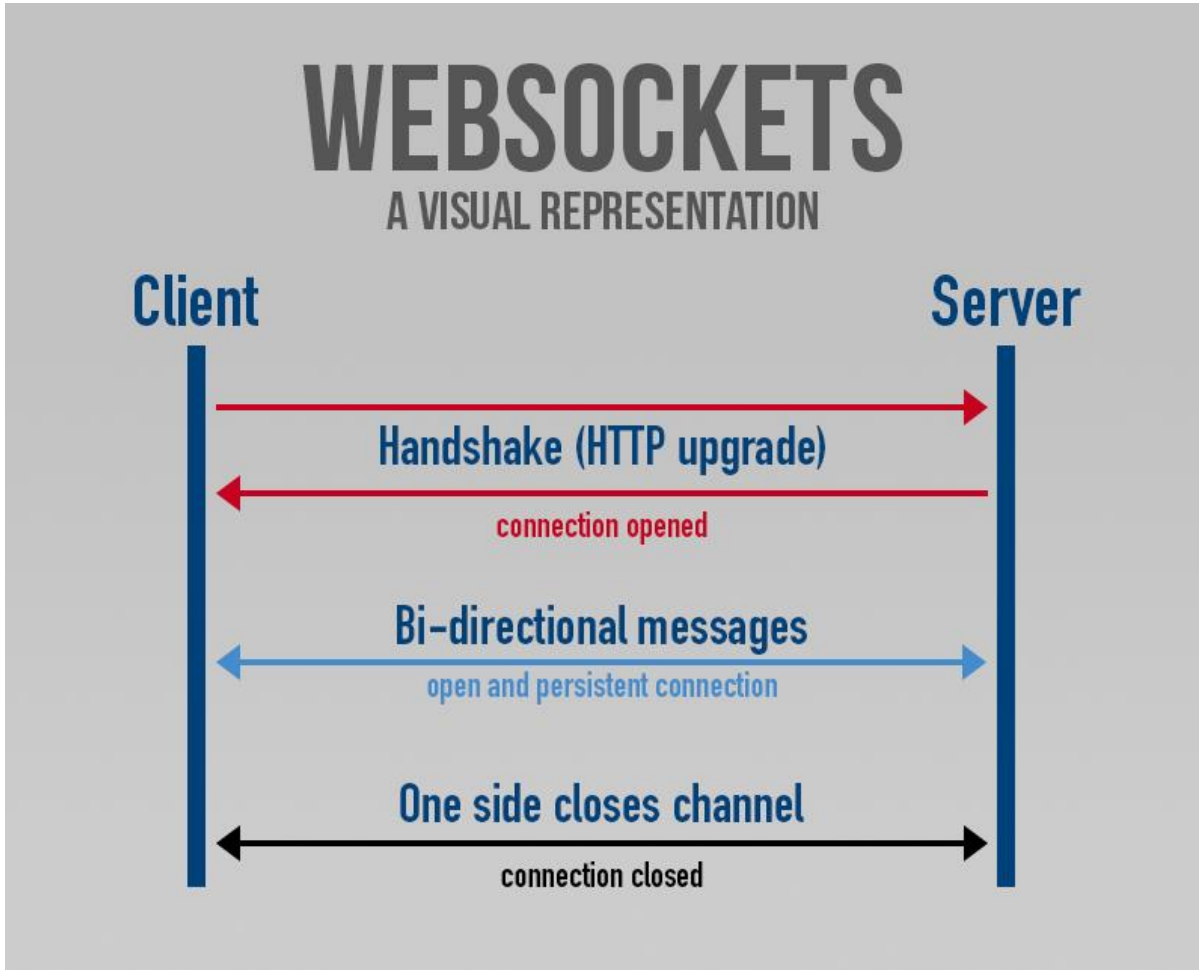

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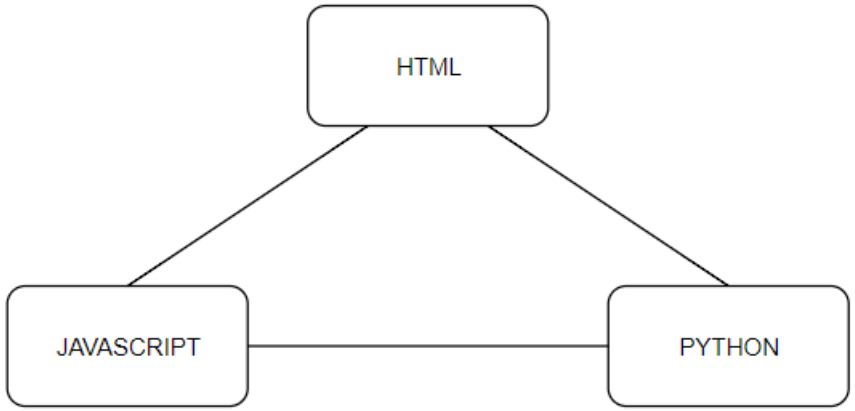

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```
var gamepadAPI = {
  controller: {},
  turbo: false,
  connect: function() {},
  disconnect: function() {},
  update: function() {},
  buttonPressed: function() {},
  buttons: [],
  buttonsCache: [],
  buttonsStatus: [],
  axesStatus: []
};
```

Ali Birkan Dönmez

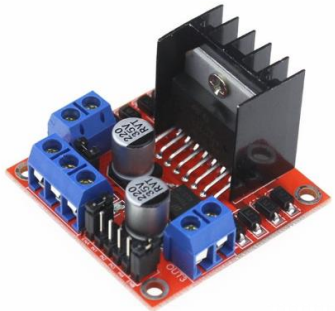
CEO

PORO INC.

Driving Module

Speed @ 6V	Stall Torque @ 6V	Gear Ratio
210 RPM	3.75 kg-cm	150:1

-38 mm Aluminum Omni Wheel
-Load capacity: 2kg (expected robot weight is 850g)
-Provides 360° movement with rotational and sideways maneuverability



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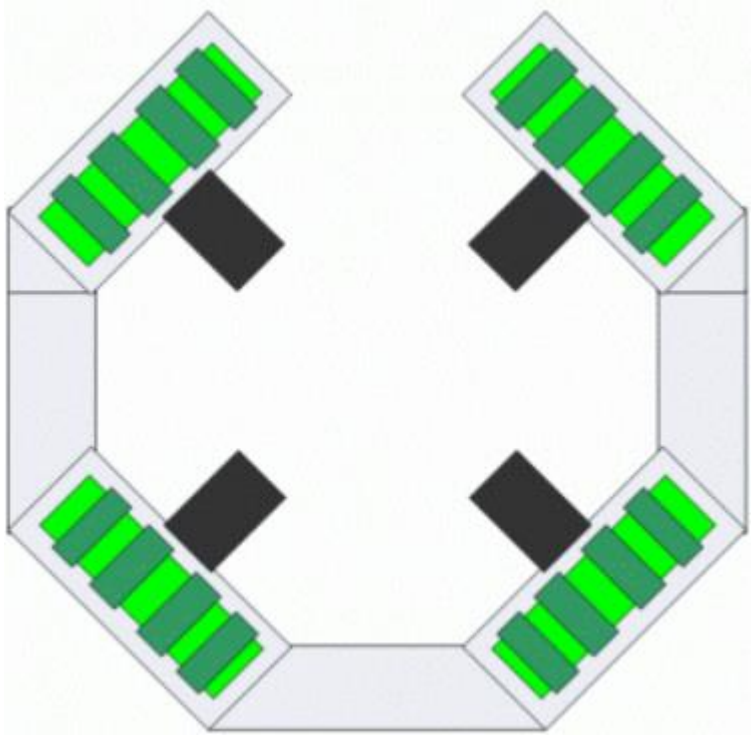
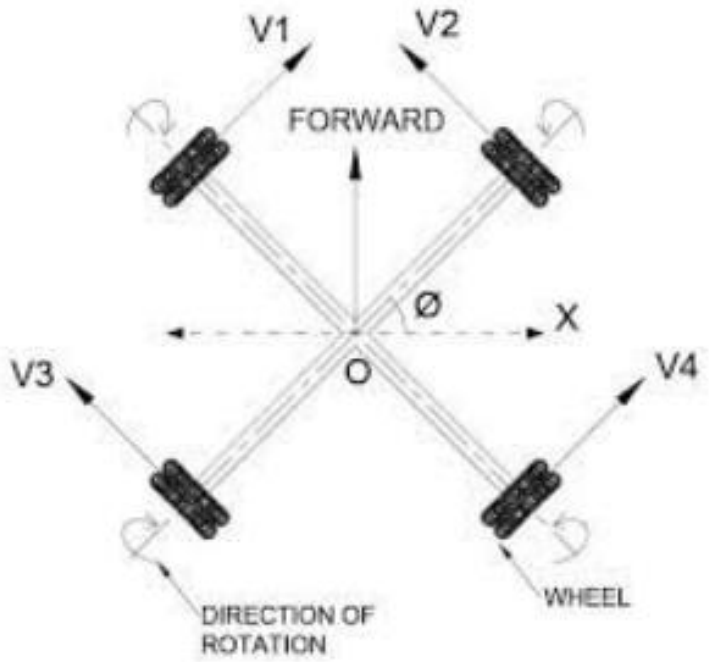
Driving Module





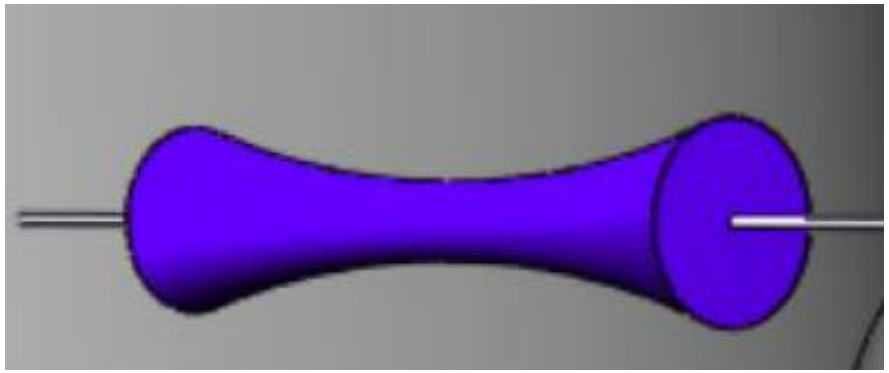
Four Omni directional wheels on chasis

Dribbling and Kicker Mechanism Module

Tasks:

-Controlling the ball

-Kicking the ball



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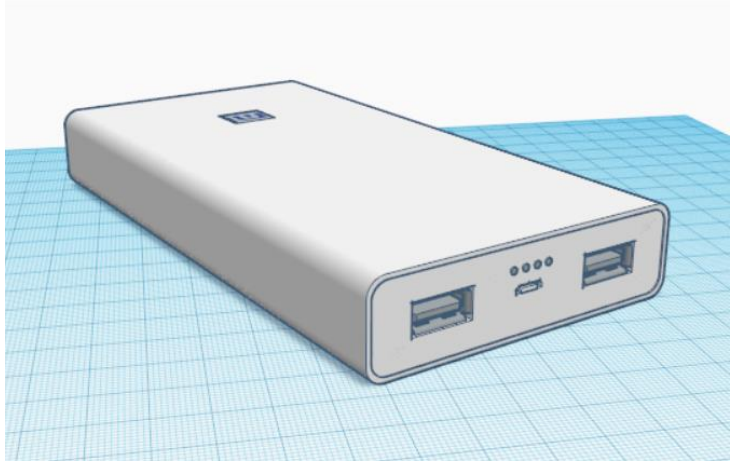
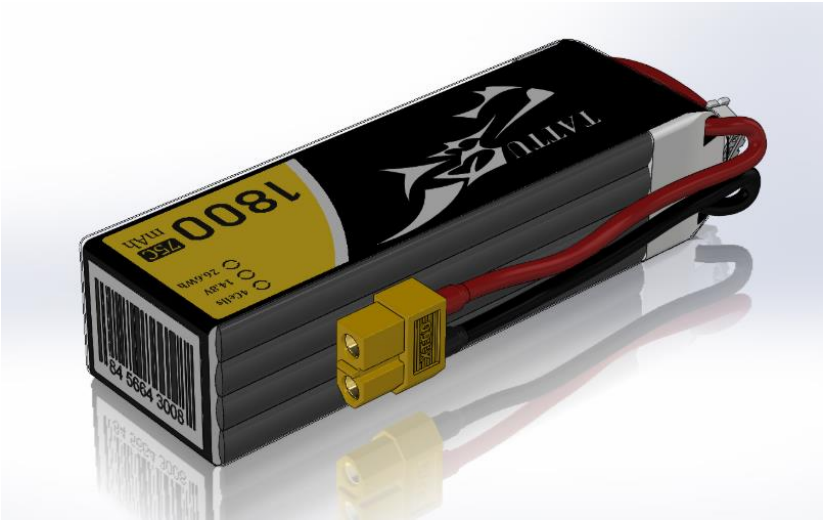
Power Supplies of POROBOT



Power Banks for
Raspberry Pi and
Arduino

Li-Po
Batteries for
DC motors



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Power Analysis

Equipment	Quantity	Power
Raspberry Pi 3B + RaspiCam v1.3 + MF667 3G Dongle	1	10W
Arduino UNO	1	2.5W
HC-SR04 Ultrasonic Sensors	3	75mW
Carbon Brushed DC Motor	5	45W
	TOTAL	57.575W

Yunus Demirören

Project Manager

PORO INC.

- Deliverables
- Time Management & Gantt Chart
- Cost analysis (Financial Management)
- Conclusion

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Deliverables

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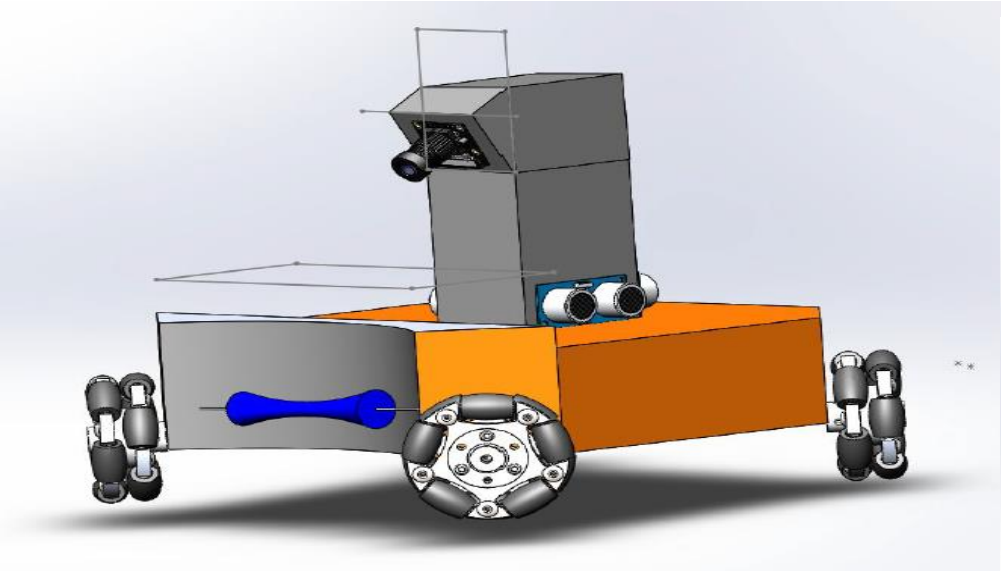
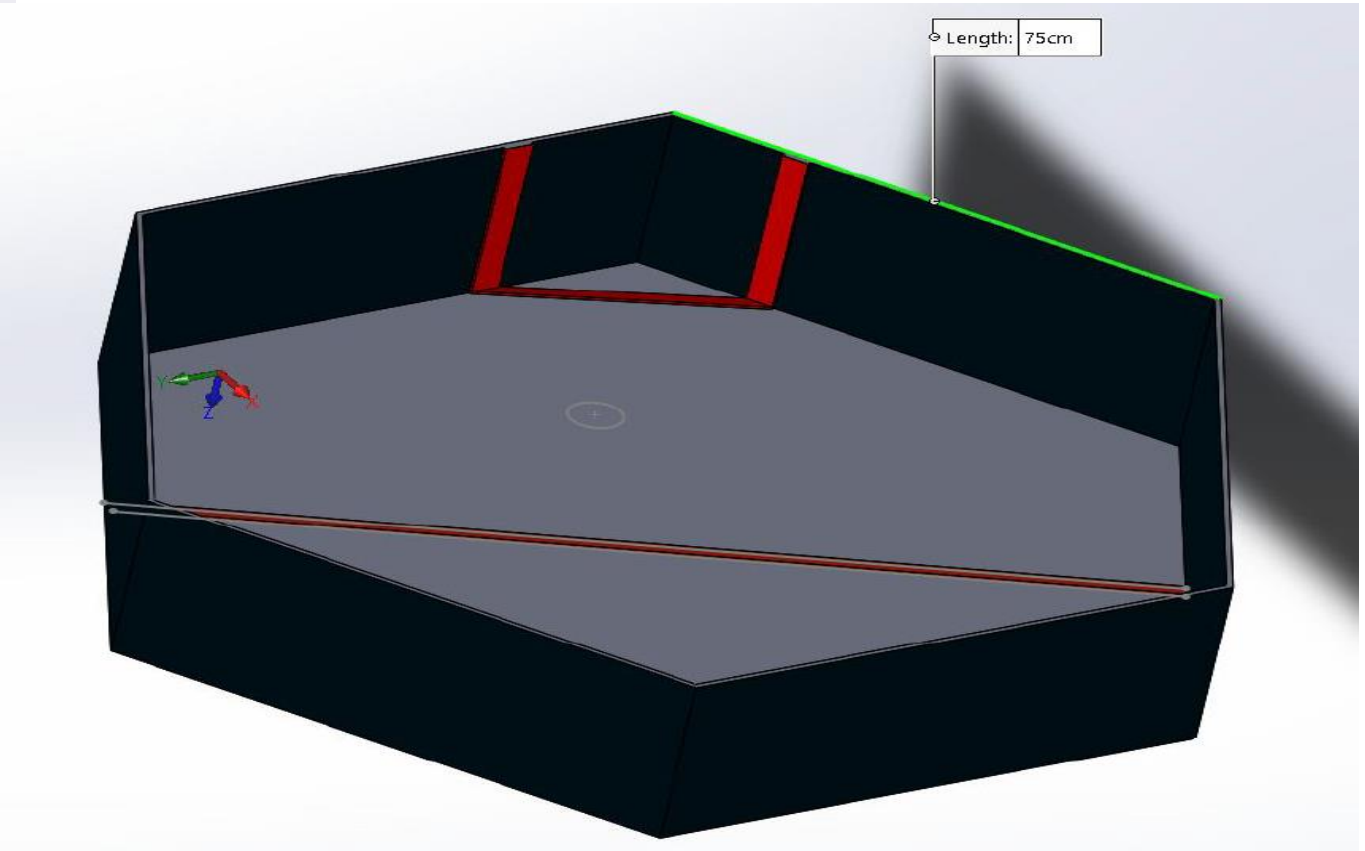
- Robot, Game Field and Game Ball





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•Power Supplies

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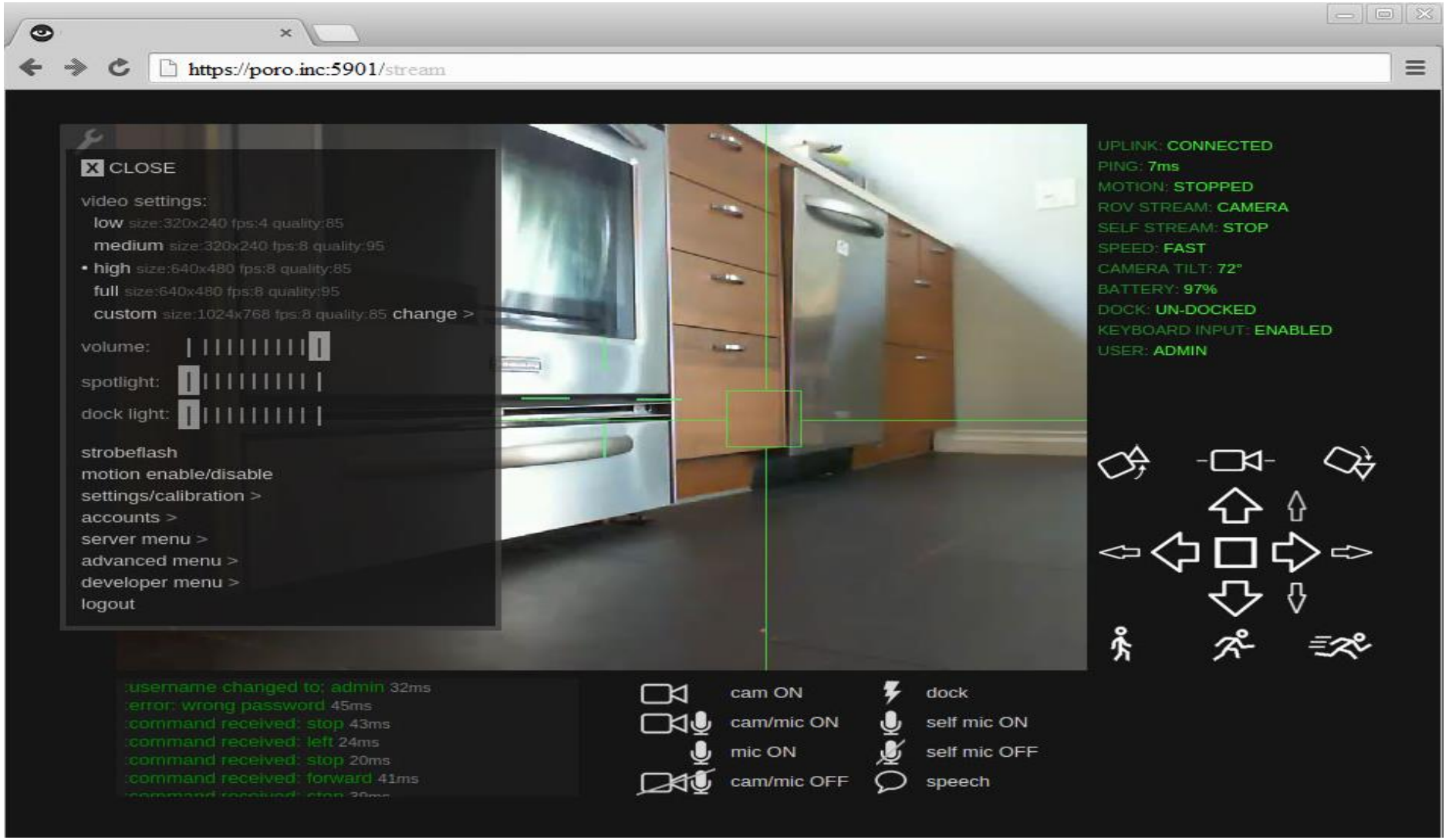
•GUI Application



- User Manual

PORO INC.

- Customer Service and Warranty

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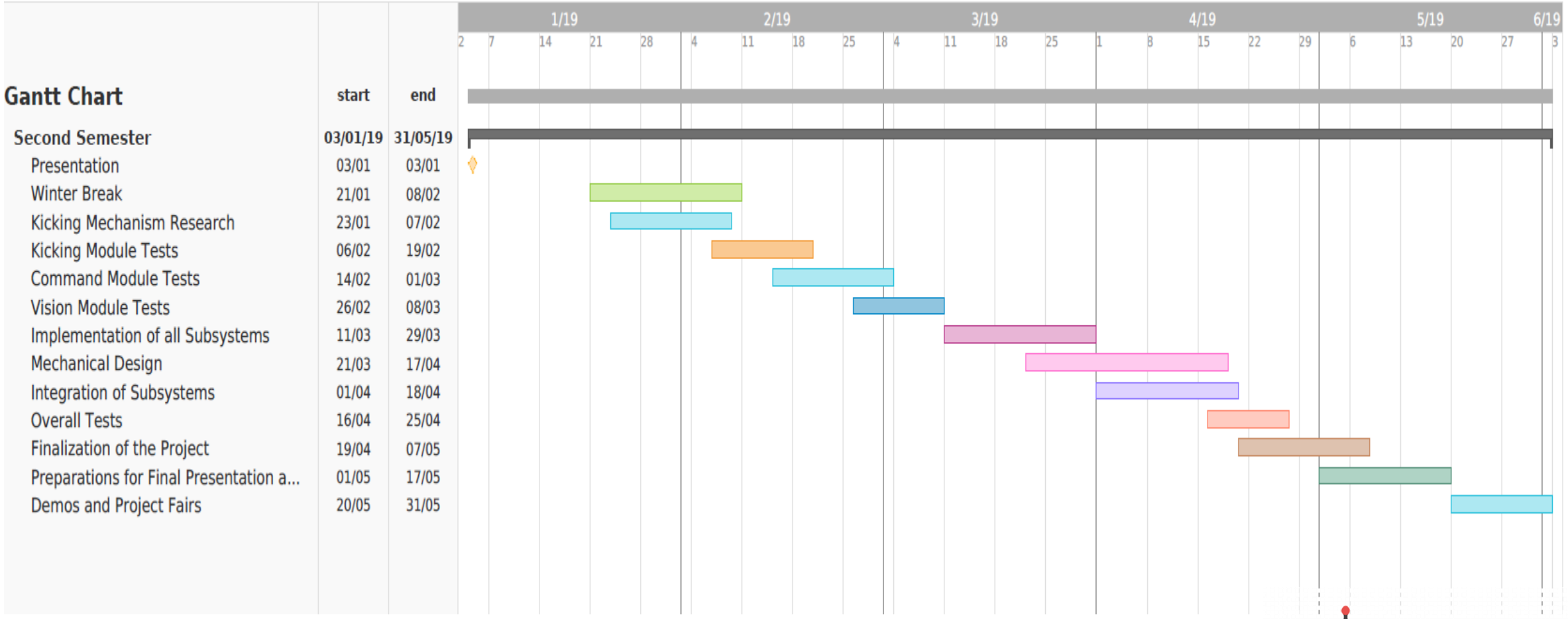
Time Management & Gantt Chart



Gantt Chart	start	end
Second Semester	03/01/19	31/05/19
Presentation	03/01	03/01
Winter Break	21/01	08/02
Kicking Mechanism Research	23/01	07/02
Kicking Module Tests	06/02	19/02
Command Module Tests	14/02	01/03
Vision Module Tests	26/02	08/03
Implementation of all Subsystems	11/03	29/03
Mechanical Design	21/03	17/04
Integration of Subsystems	01/04	18/04
Overall Tests	16/04	25/04
Finalization of the Project	19/04	07/05
Preparations for Final Presentation a...	01/05	17/05
Demos and Project Fairs	20/05	31/05

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Financial Management

Components	Quantity	Cost
Raspberry Pi	1	$37
Arduino UNO	1	$15
Raspberry Pi Camera	1	$5
Ultrasonic Sensor HC-SR04	3	$4.5
Brushed DC Motor	5	$37.5
L298N Dual H-Bridge Motor Controller	2	$6
3G Dongle USB Modem	1	$9.5
SIM Card	1	$14.5
Chassis	1	$10
11.1V Li-Po Battery 1350 mAh	1	$20
Omni Wheels	4	$22
Design Material	-	$10
	Total	**$191**

CONCLUSION

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THANK YOU

References

- 50 of the most important Raspberry Pi Sensors and Components. (n.d.). Retrieved from https://tutorials-raspberrypi.com/raspberry-pi-sensors-overview-50-important-components/
- Casper, J., & Murphy, R. R. (2003). Human-robot interactions during the robot-assisted urban search and rescue response at the world trade center. IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics), 33(3), 367-385.
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