Prince Mohammad University
Department of Electrical Engineering

Smart Electrical Car

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Outline

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- Project Specifications
- Design Constraints & Standards
- Project Architecture
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Project definition

Design a smart electric car that will be able to takes right dissections, detect the obstacles, interacts with traffic lights.

Project Objectives

- Simulate the latest advanced technology of the actual self-driving cars
- Reduce the need for the human control interference
- Expand the local content of smart systems inventions to be competitive with the global race
- Increase the duration cycle of the preventive maintenance
- Minimize gas emission

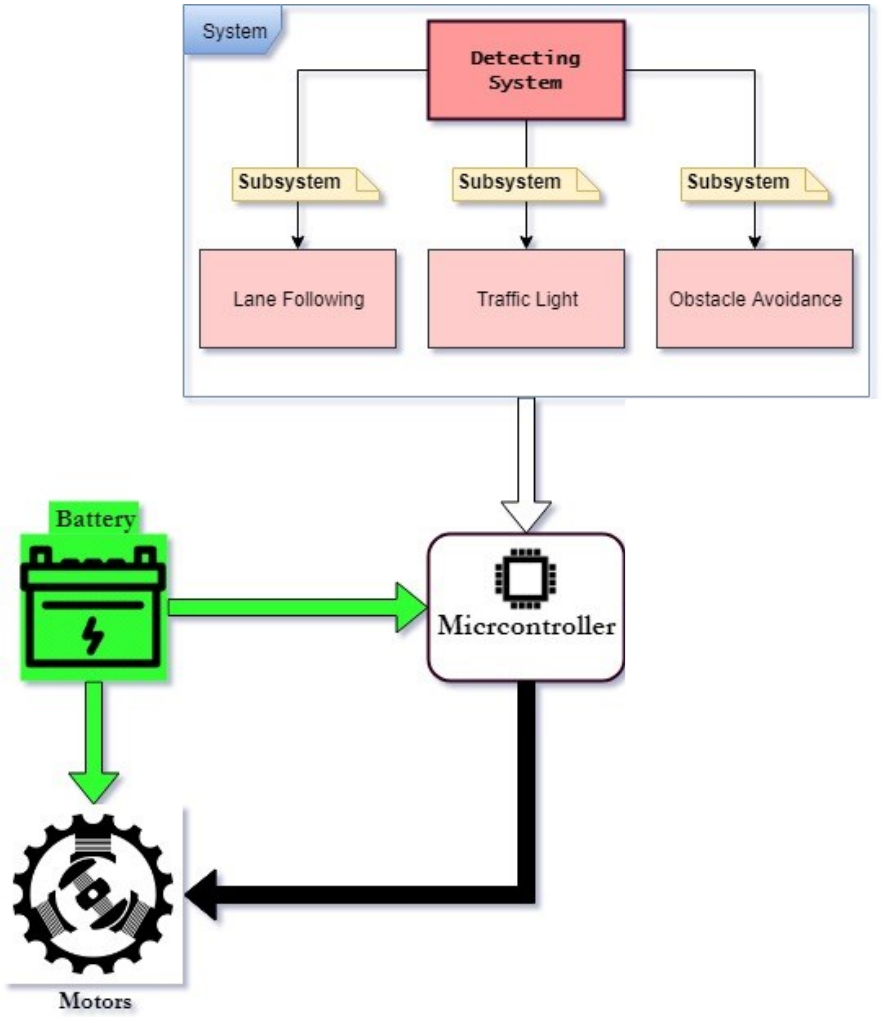
Project Specifications

- Runs on rechargeable battery for one hour
- Size approximately: length 50 cm, width 30 cm and height 35 cm
- Detects lane borders, turns and drives near lane center
- Recognizes obstacles
- Recognizes and follows traffic lights

Design Constraints & Standards

- High Cost
- Safety
- Environment

Project Architecture



Background: Problem

- Gas Emission

Background Problem

- Handicapped

Background: Smart Electrical Car

- Google self driving car (Waymo)
  - Started in 2009
  - First self driving car
  - First prototype reviled 2014

Smart Electrical Car Advantage

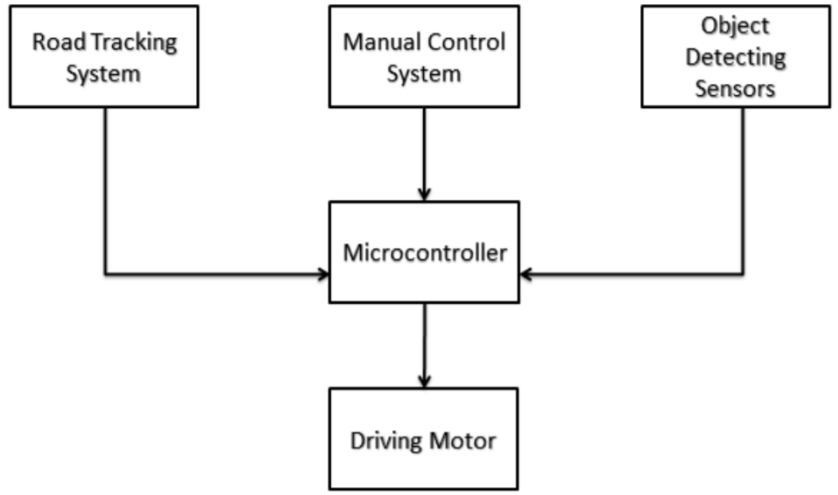
Gas Car	Smart Electrical Car
Gas powered	Electrically powered
More maintenance	Less maintenance
Pollution	Eco friendly
Need human interfere	No human interfere

Previous Projects (1)

Self-Driving Car, Prince Mohammed Bin Fahd University, Spring Semester 2017-2018

- Design self driving car that can drive between two predetermined locations by following a line track

- Design a manual control mode via a smart phone application in emergency



Previous Projects (2)

Self-driving car TOY model, University of Vermont July, 2015 (Bogdan Djukic)

- Designing a robotic operating system running with obstacle avoidance system

- Design to run between multiple locations

Previous Projects Summary

Projects	1	2	Our Project
Obstacles avoidance	✓	✓	✓
Drives near lane center	X	✓	✓
Recognizes traffic lights	X	X	✓

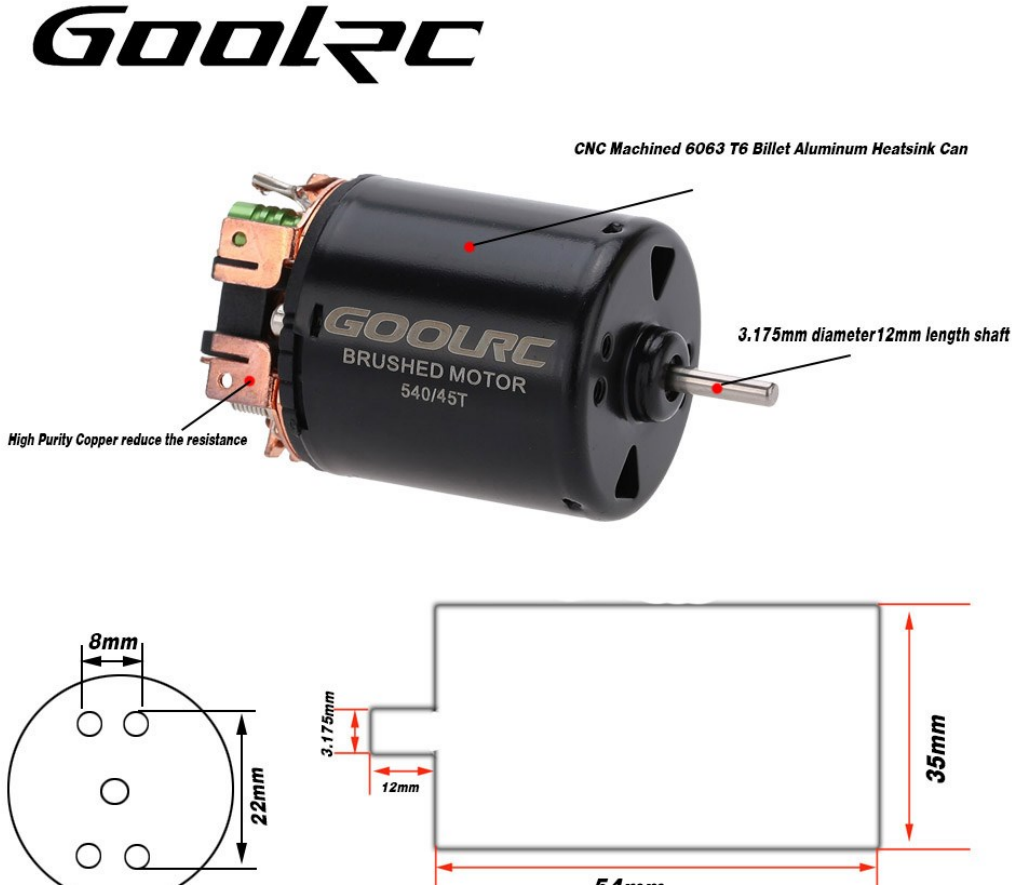
Design: Structure Options

Build from the zero

RC Car

Car Motor

- 7.4 Volt
- Max current: 1.82A
- 16500 RPM
- Shaft length: 12mm



Electronic Speed Controller(ESC)

Hobbywing Brushed Waterproof ESC

- Maximum continuous current: 40A
- Input: 1 or 2 LiPO Batteries
- Dimensions: 46.5*34*28.5mm
- Resistance: Forward 0.002ohm, Reverse 0.004ohm

Servo

- Metal Gear
- Dual Ball Bearing
- Size 40x20x30 mm
- Torque 10.2 kg/cm at 6 Volt

Transmitter

HPI TF-20E 2.4GHz TRANSMITTER (2ch)

Receiver

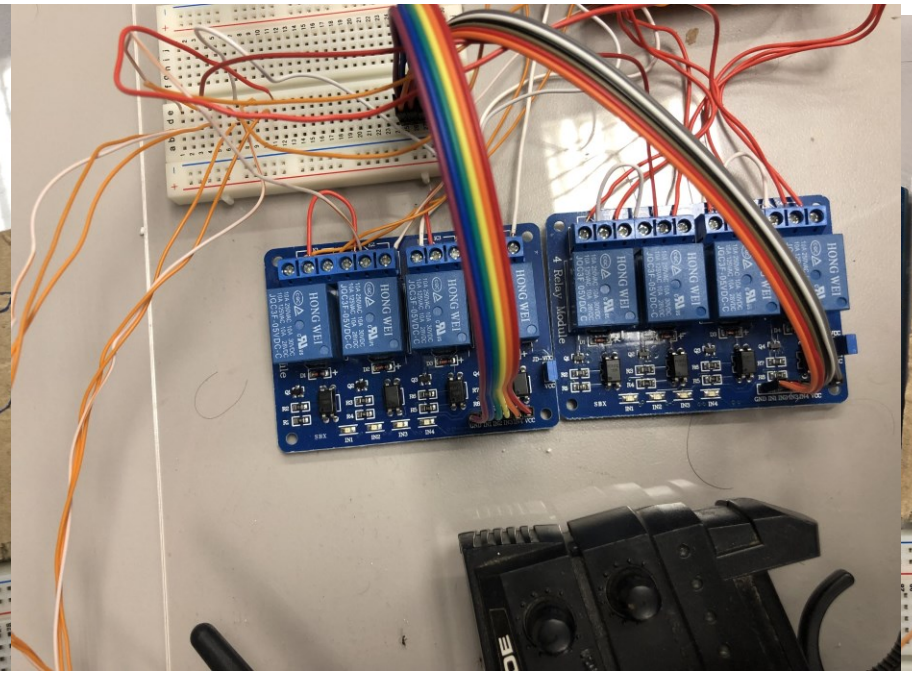
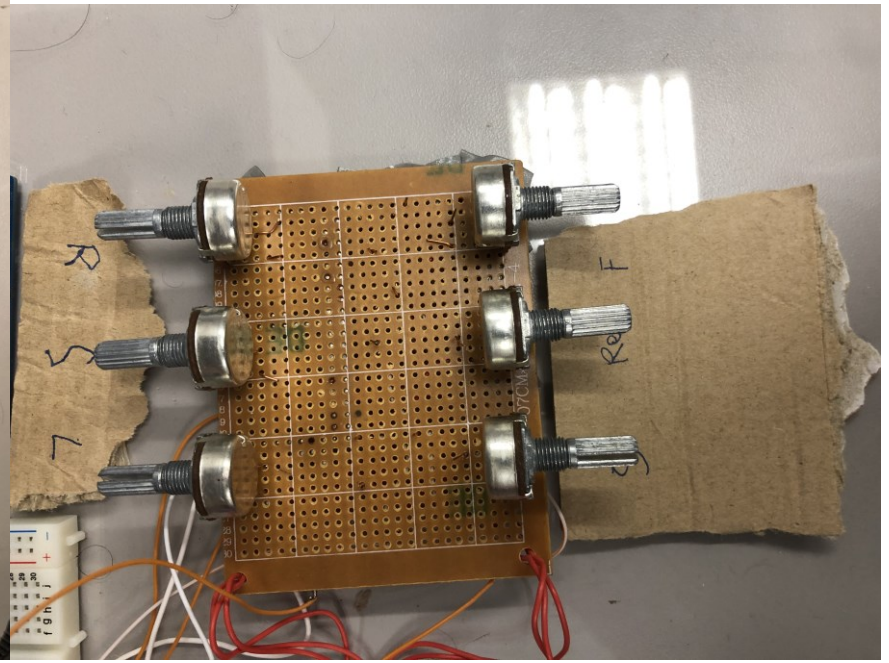
Hpi-racing 2 channel

- 2.4GHz high frequency reception
- 50 to 150 meter range
- Failsafe system if radio reception is lost
- Low voltage cut-off to prevent runaways

Batteries

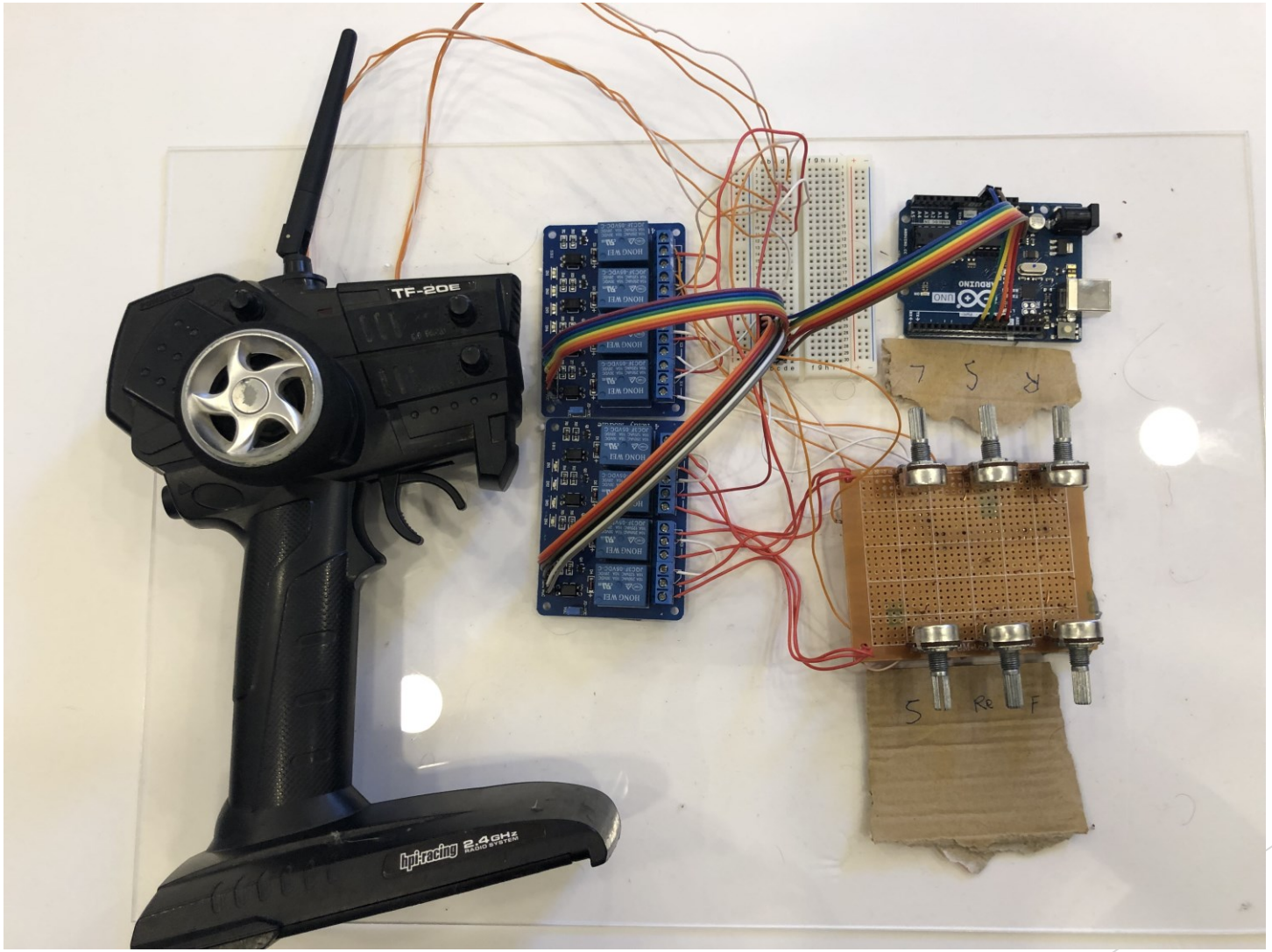
- Lithium polymer battery (*LiPo)*
- 7.4 Volts
- 3000 mah

Transmitter Modifications

Transmitter Modifications

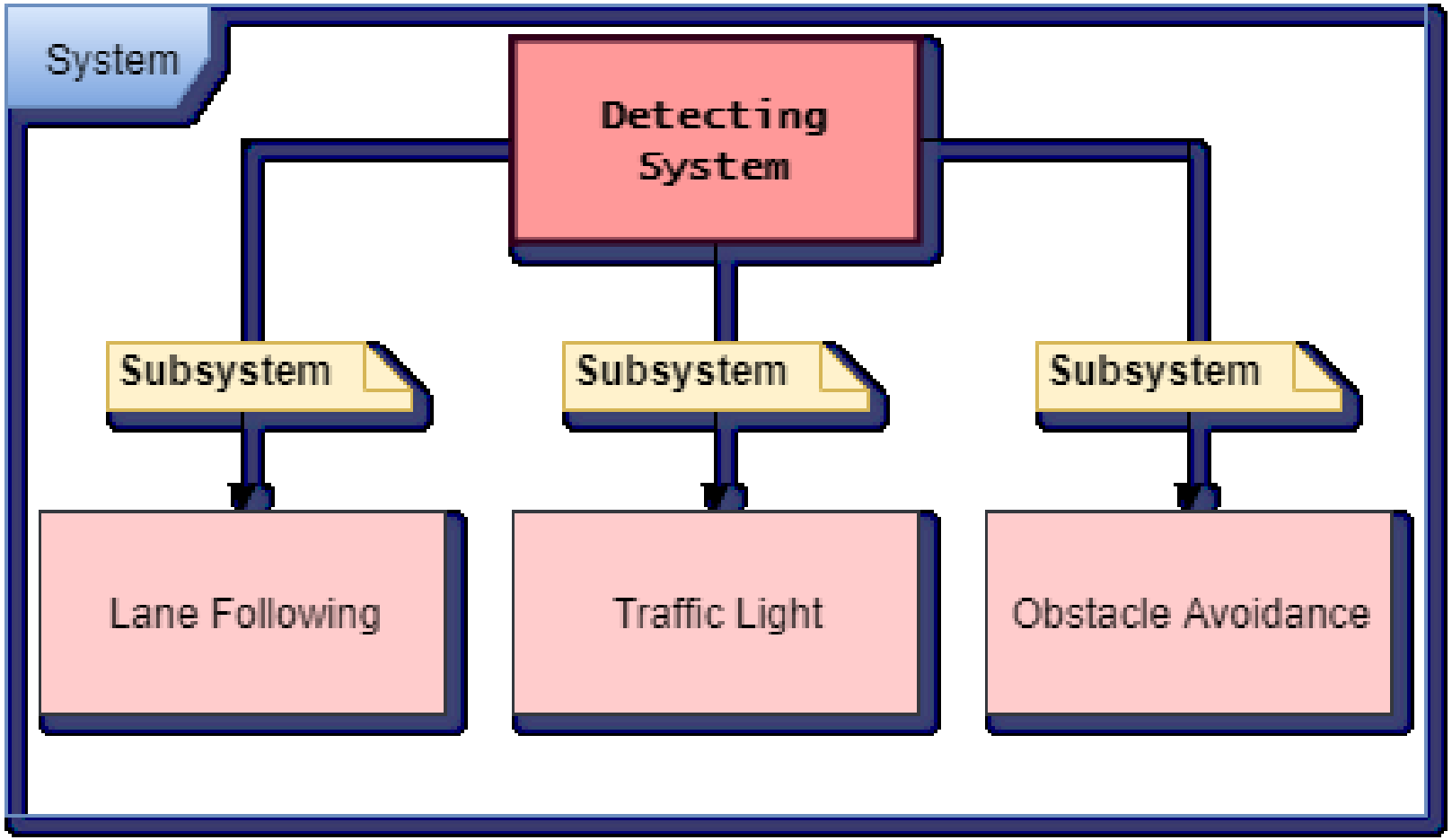
Transmitter Modifications



Design: Detecting system

- Detect Lane Boarders
- Detect traffic lights
- Detect stop signs
- Detect obstacles
- Drive in Lane Center

Project Architecture



Design: Image Transfer Options

Raspberry Pi
1.2GHz
Build in Wi-Fi
Single Board Computer

Pi Camera

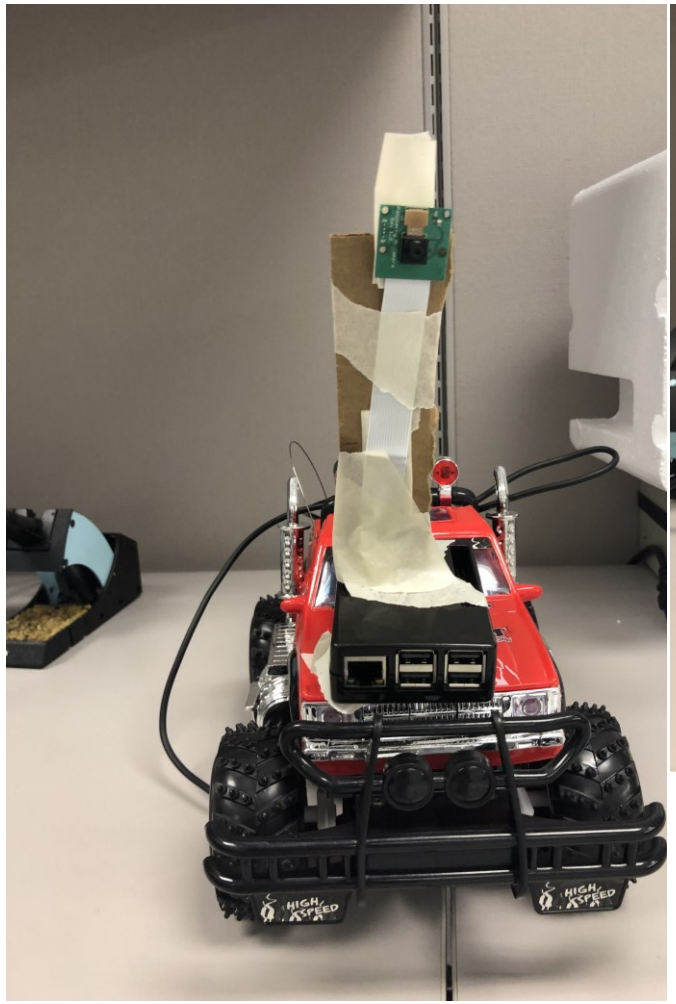
Pi Camera
Resolution: 8 Megapixels, 1080p
Compatible
Relatively cheap

OpenCV & Neural Network

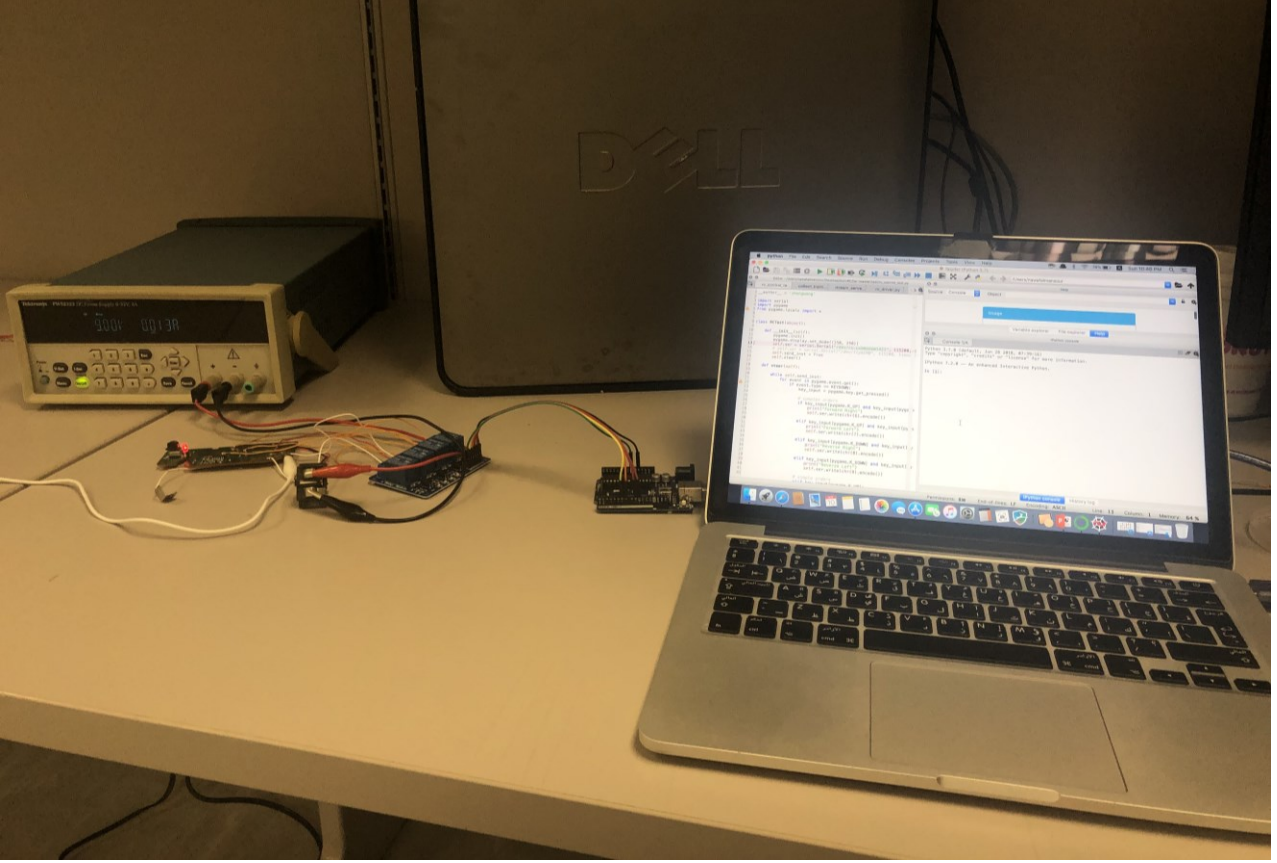
- OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision.

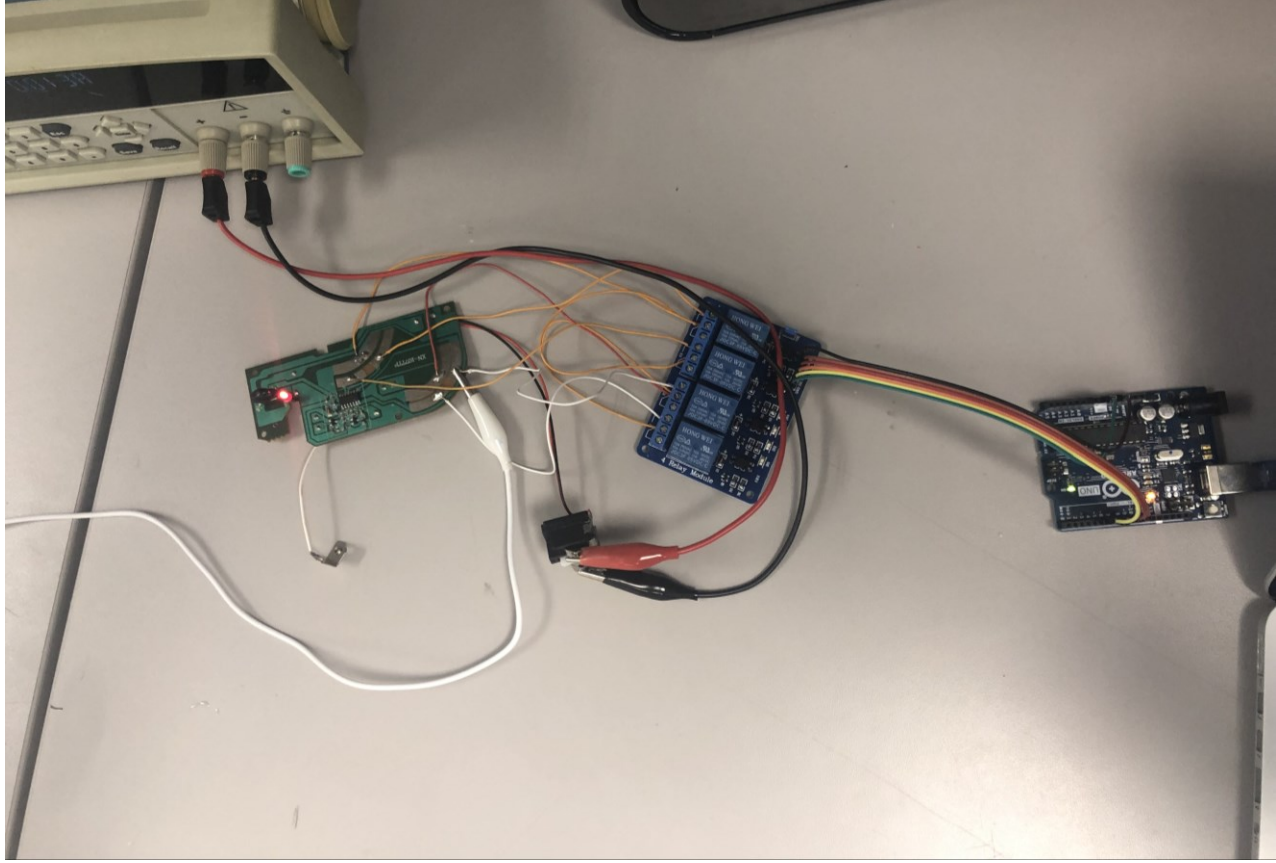
- OpenCV provides a trainer as well as detector.

Testing



Testing





Testing

Testing


image
Green
49.0cm
(x=244, y=226) ~ R:109 G:129 B:78
image
62.5cm
(x=244, y=226) ~ R:112 G:125 B:79

Testing

Testing

Console 1/A

```
Distance: 67.7 cm
Distance: 67.3 cm
Distance: 67.7 cm
Distance: 66.8 cm
Distance: 66.8 cm
Distance: 67.0 cm
Distance: 66.8 cm
Distance: 66.9 cm
Distance: 67.3 cm
Distance: 66.8 cm
Distance: 67.3 cm
Distance: 66.8 cm
Distance: 67.6 cm
Distance: 66.8 cm
Distance: 66.7 cm
Distance: 67.3 cm
Distance: 67.3 cm
Distance: 66.9 cm
Distance: 66.9 cm
Distance: 67.3 cm
Distance: 67.3 cm
Distance: 67.1 cm
Distance: 68.1 cm
Distance: 68.2 cm
Distance: 67.7 cm
Distance: 66.9 cm
Distance: 66.8 cm
Distance: 67.7 cm
Distance: 66.8 cm
Distance: 67.3 cm
Distance: 67.3 cm
Distance: 67.8 cm
Distance: 67.7 cm
Distance: 66.9 cm
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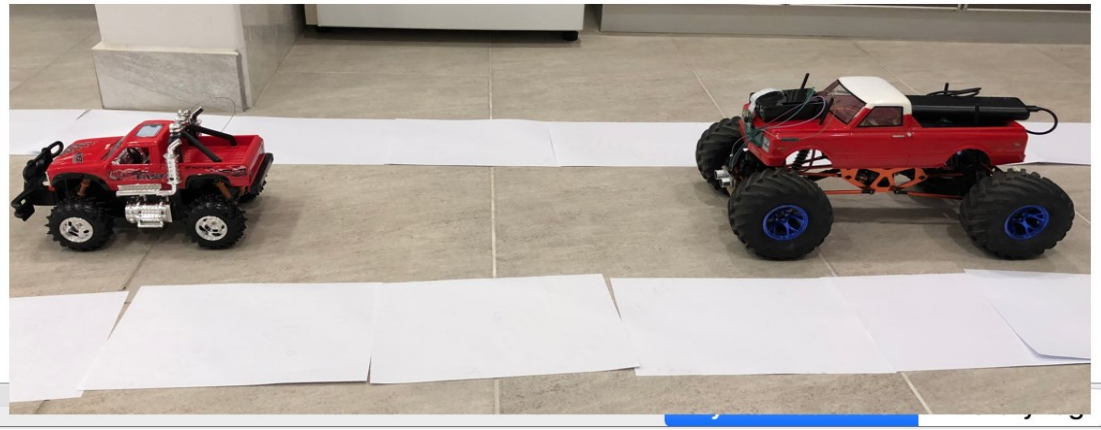
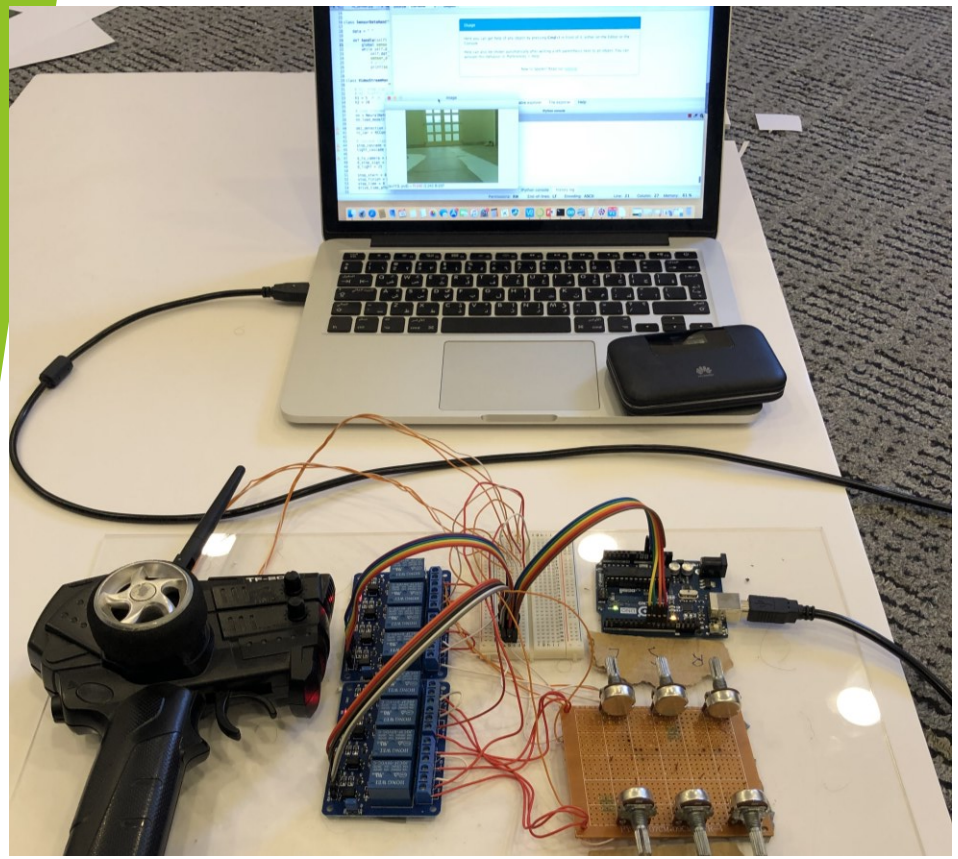
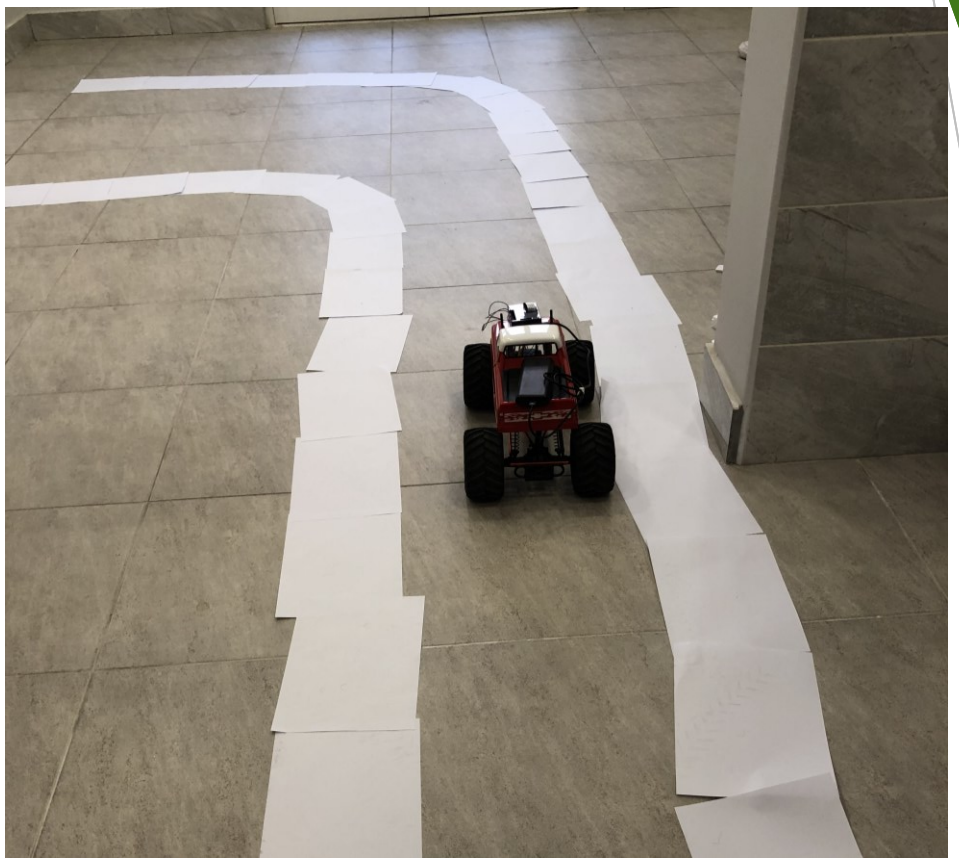


IPython console

image

(x=101, y=0) ~ R:163 G:175 B:89





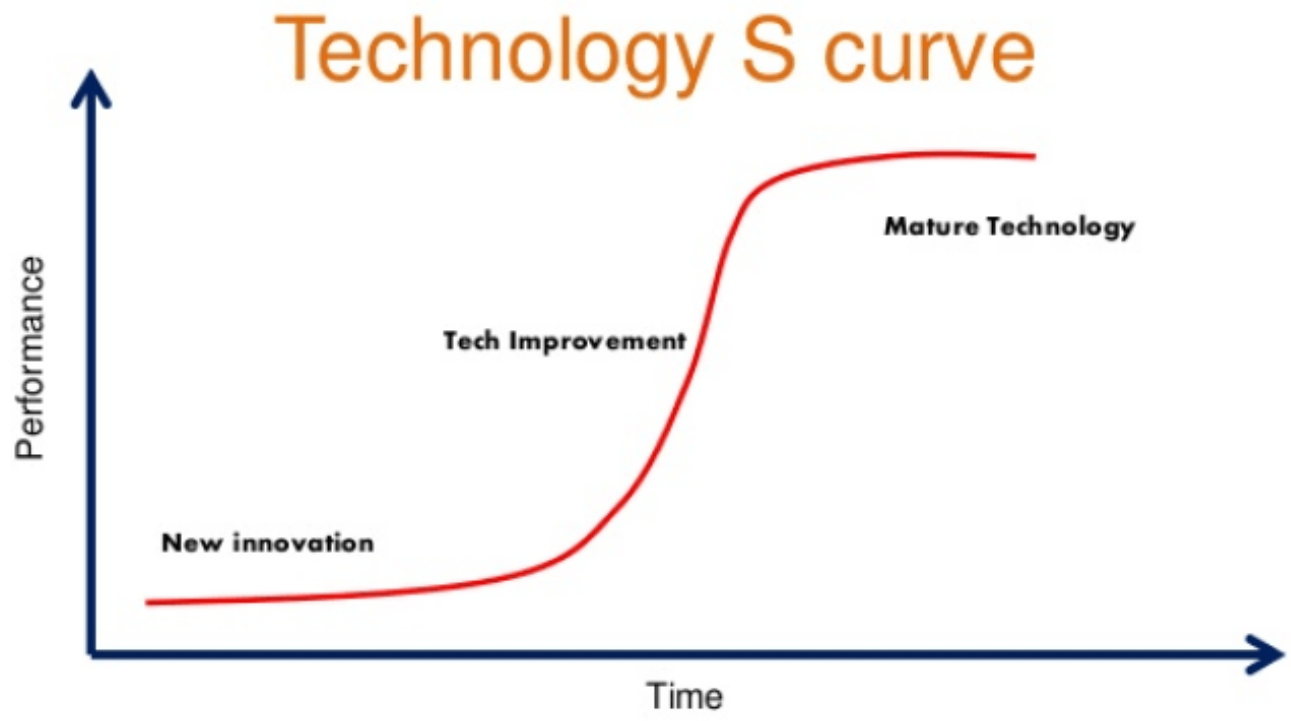
Testing

Team Work

Budget Estimate

Item	Quantity	Unit Cost (SR)	Subtotal
Microcontroller	2	200	400
Pi Camera	1	90	90
DC Battery	2	75	150
DC Motor	1	170	170
Chassis	1	240	240
ESC	1	250	250
Transmitter & Receiver	1	450	450
Servo	1	120	120
		Total	1870

Conclusions



References

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