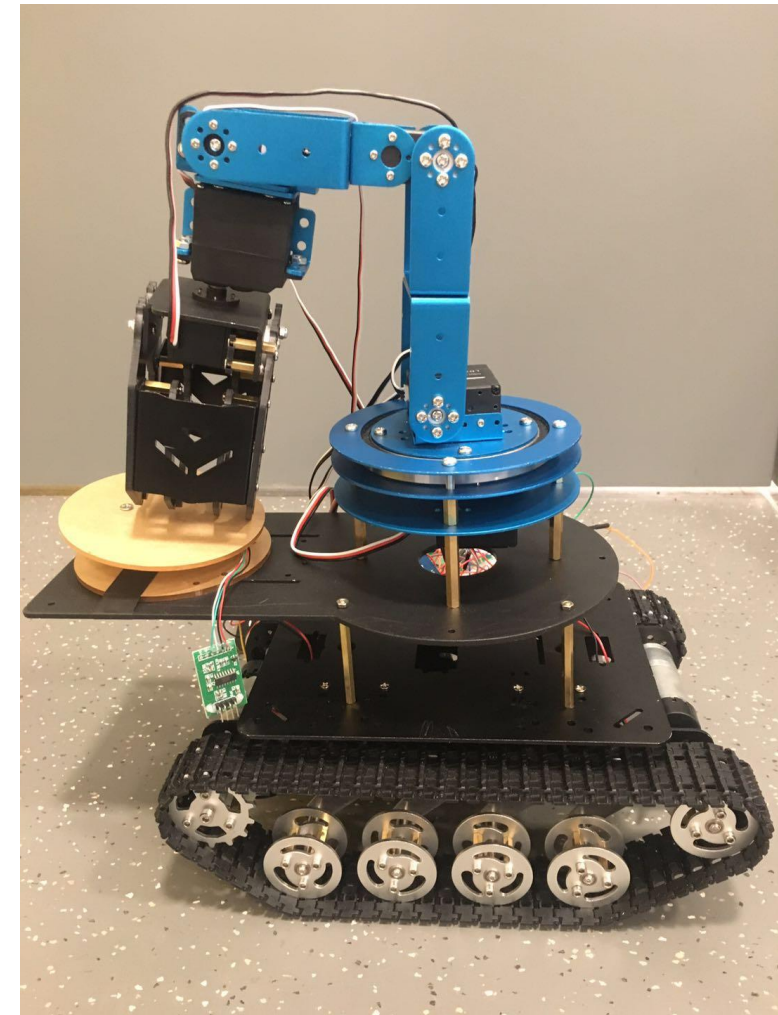


# ECE445 Project: Shoe Sorting Robot



**I ILLINOIS**

Electrical & Computer Engineering

COLLEGE OF ENGINEERING

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# Inspiration



# Objective

- Build an automatic robot that helps you pick up shoes in your doorway.
- The robot can “see” the randomly located shoe, moves right next to the shoe, picks it up, and then places it on shelf.

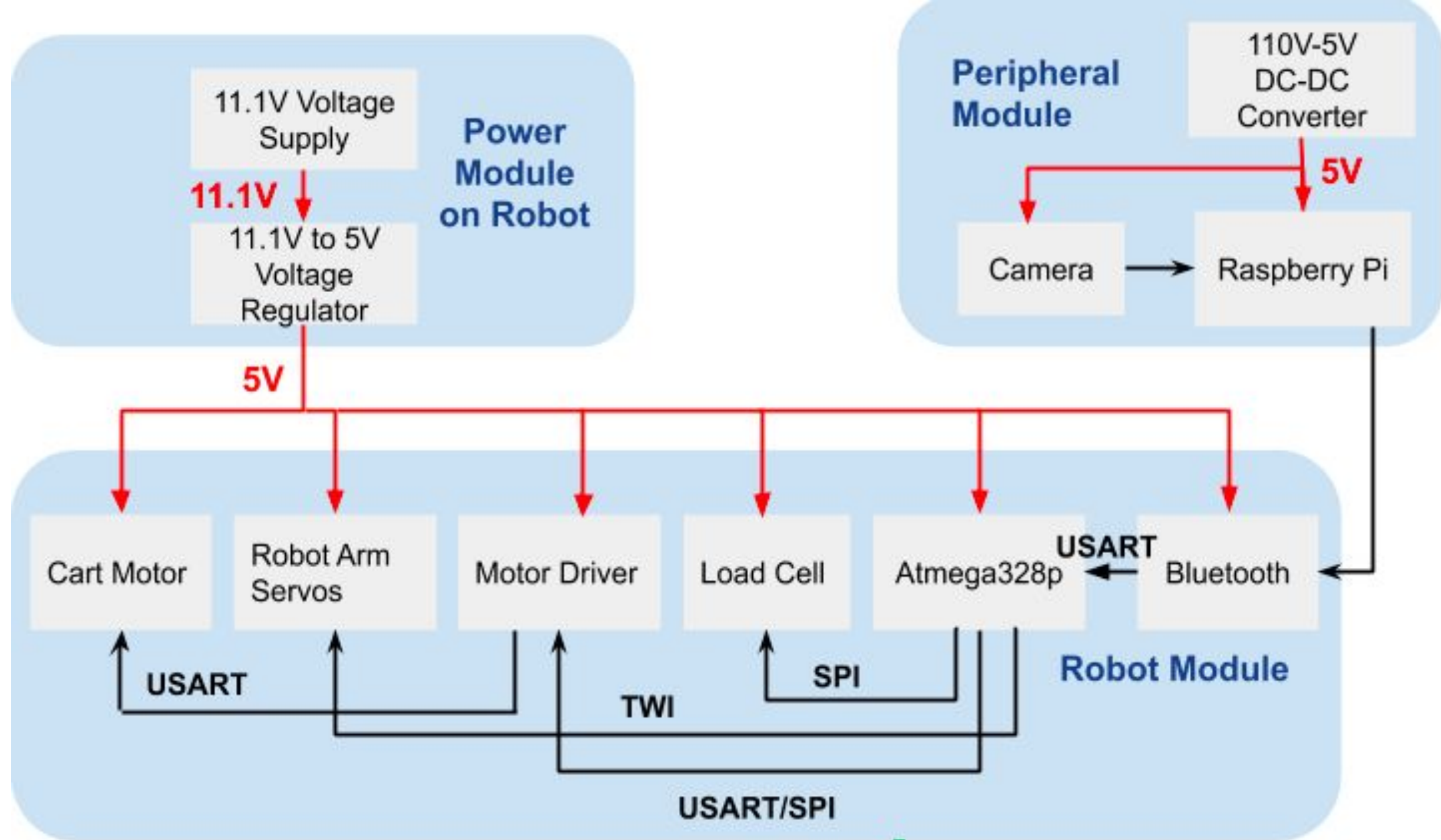
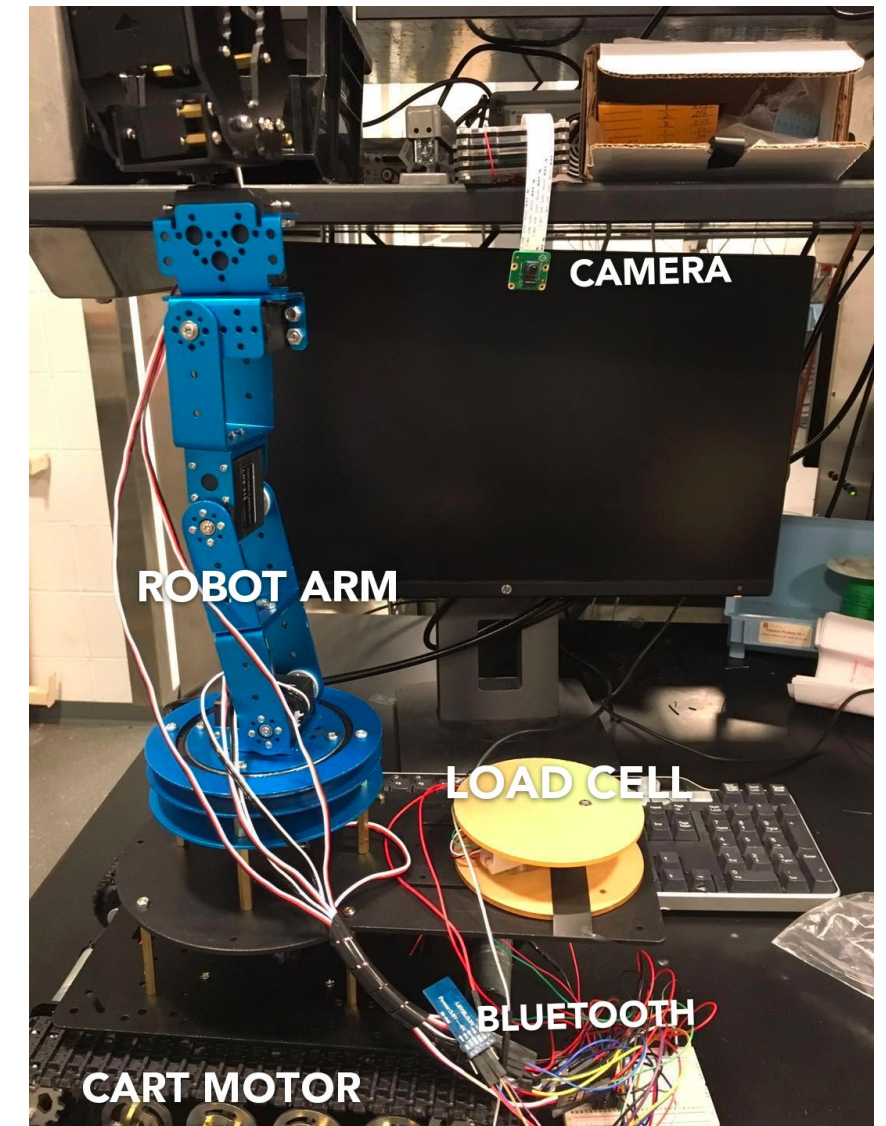


Figure 1. Block Diagram



# System Overview

- Hardware:
  - Power Supply
  - Bluetooth
  - Cart Motor
  - Microcontroller
  - Load Cell
  - Six Servos of Robot Arm
  - Raspberry Pi Camera

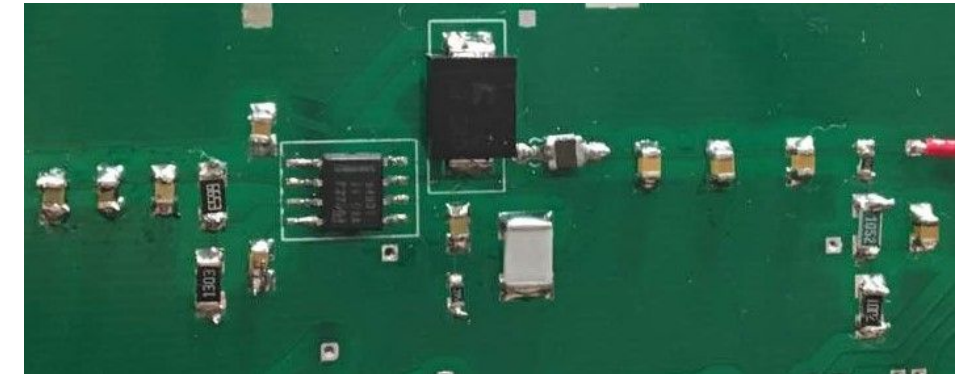
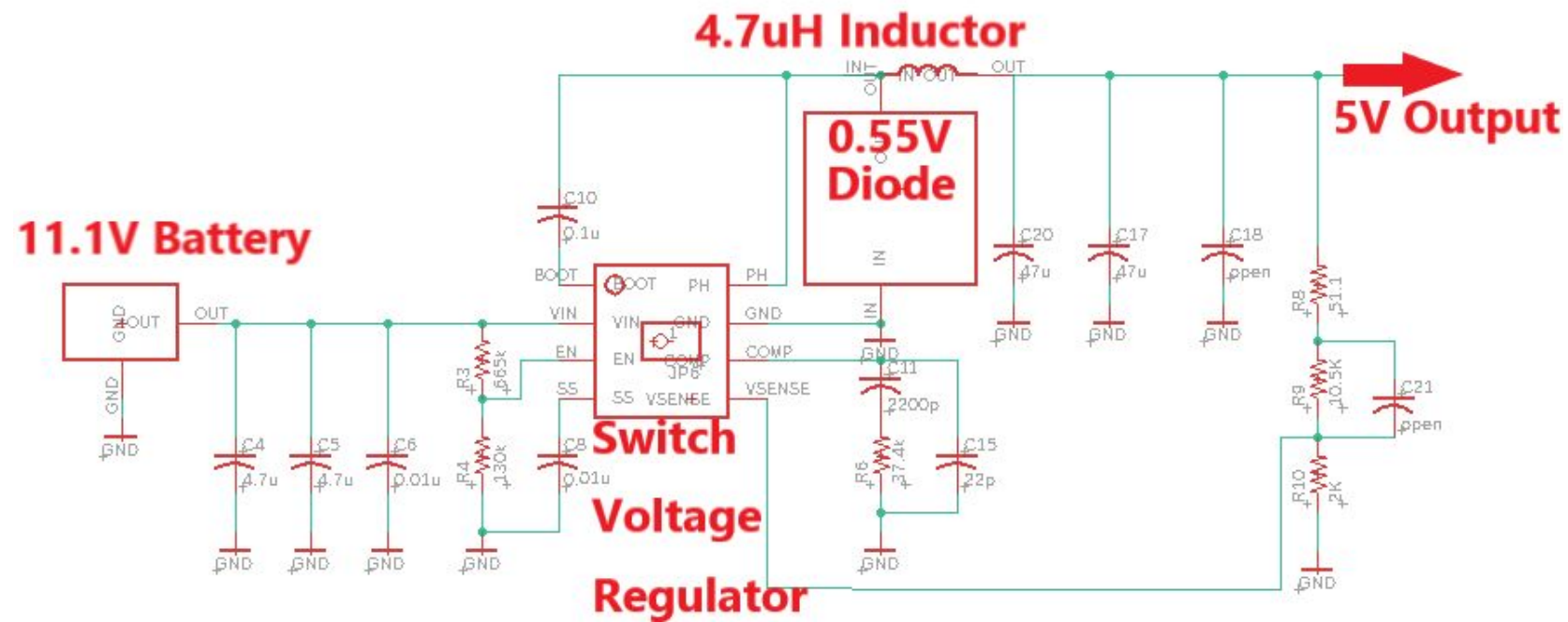


# Power Supply

- 11.1V Rechargeable Lipo Battery
- XT60 connectors
- 35C 1500mAh



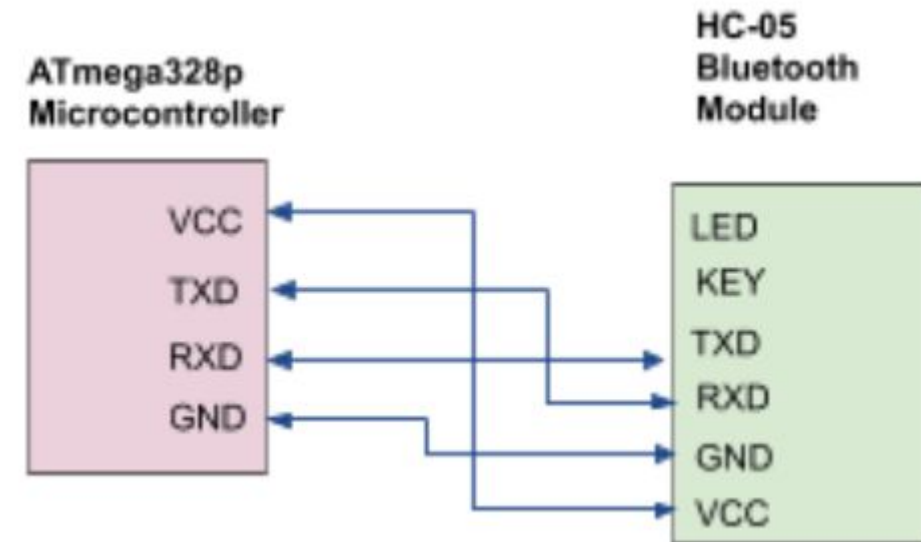
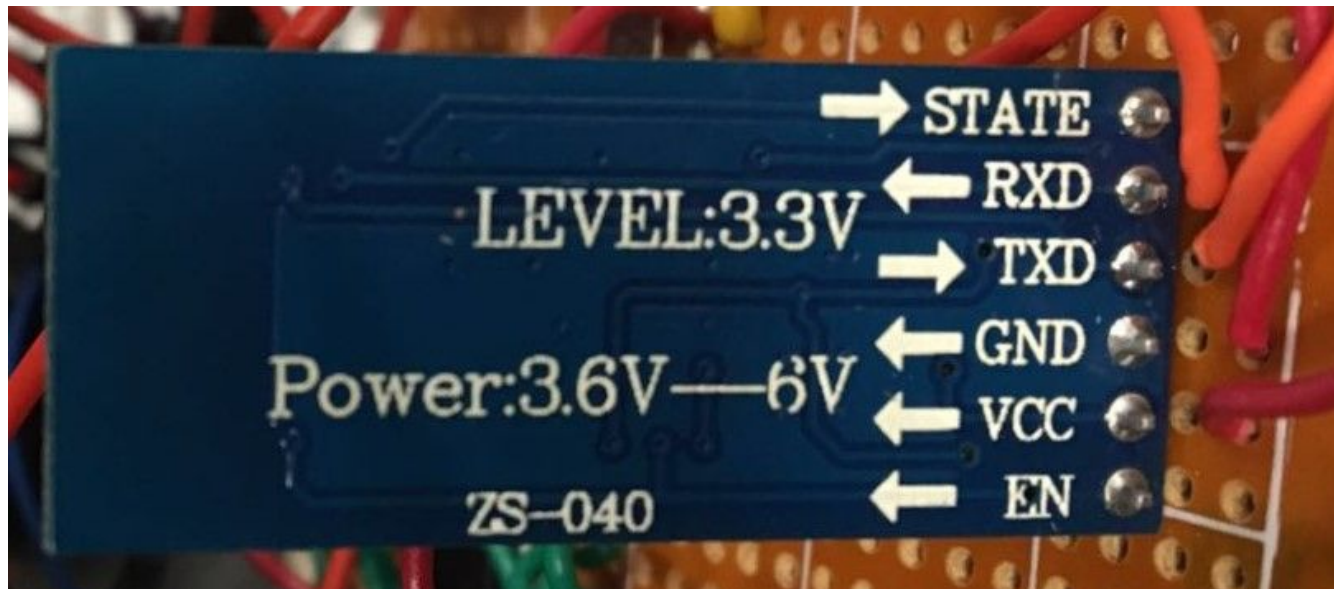
# Switch Voltage Regulator





# Bluetooth Unit HC-05

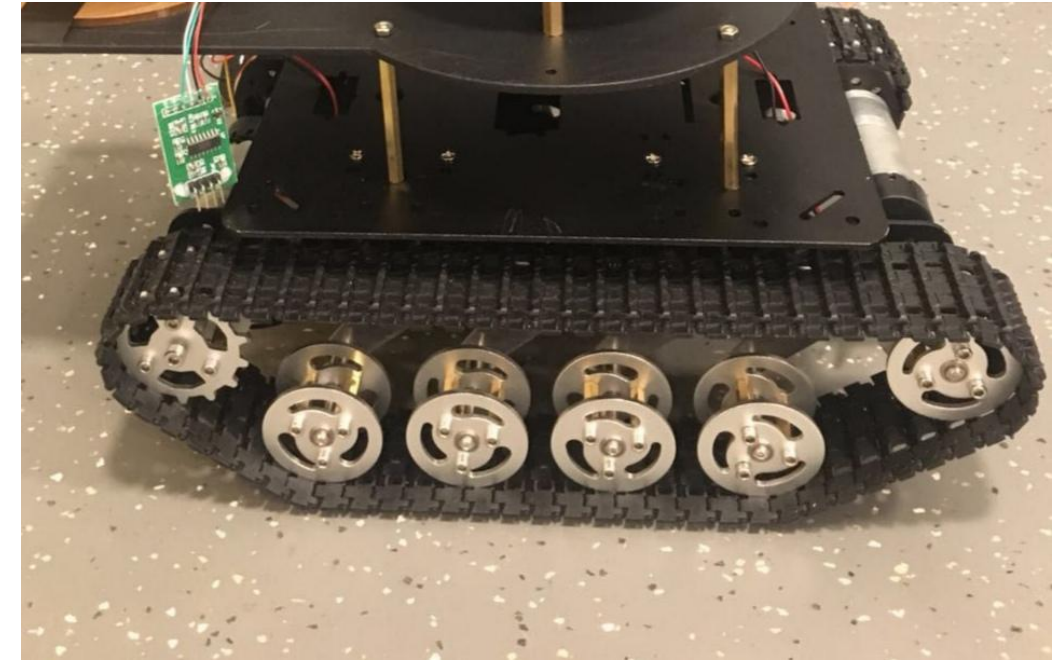
- Connected to ATmega328p
- Paired with Raspberry Pi
- Receive “Result.txt” file from Raspberry Pi Bluetooth Module





# Cart Motor with Driver

- Two 9V DC motors
- Motor driver TB6612FNG to control its forward and backward movement
- Speed and stability of cart motor



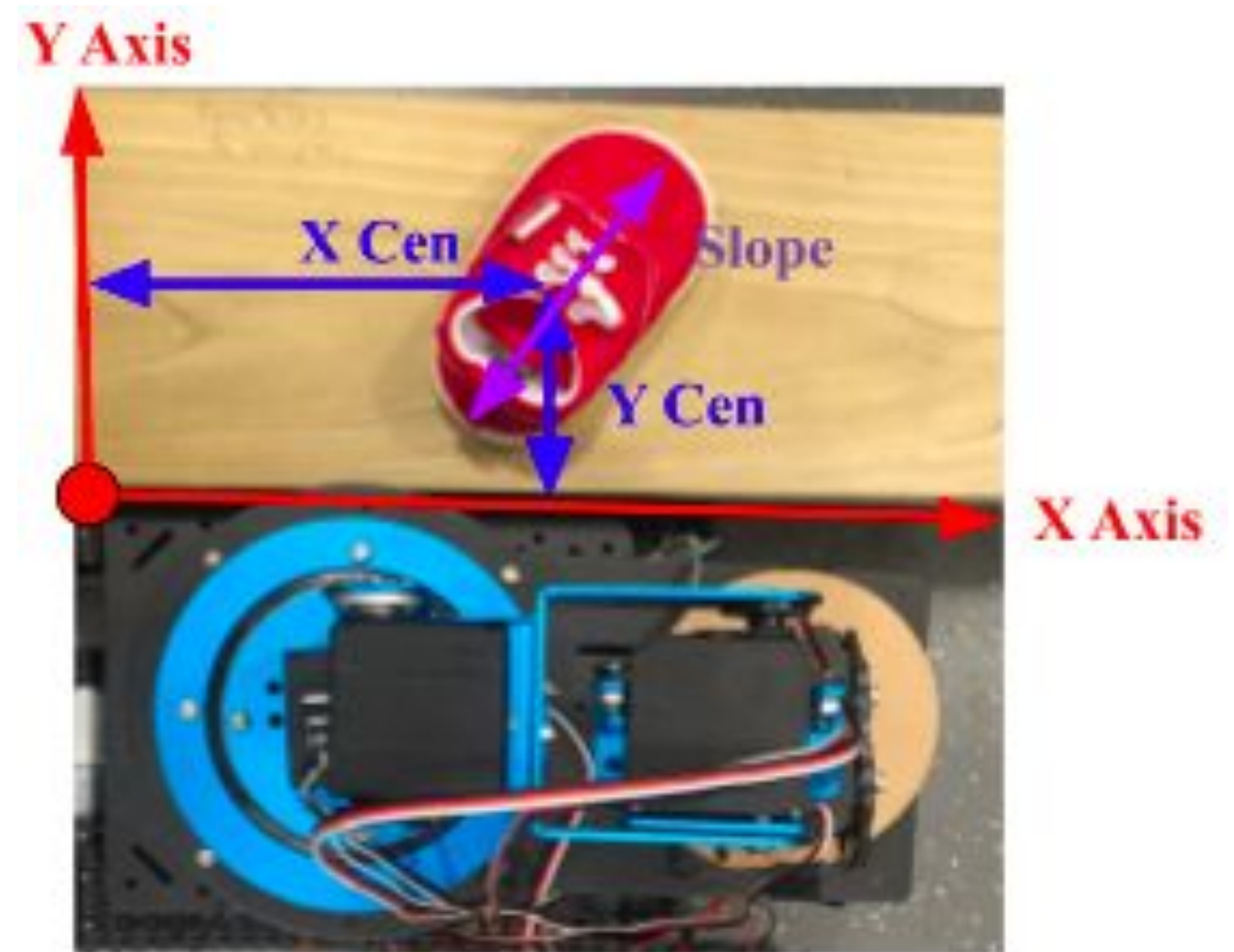
# Six Servos of Robot Arm

- Servo 1: 0-90 degree  
Servo 2-6: 0-180 degree
- Connected to Analog pins in ATmega328p
- Initializations: 90 degree
- Rotation



# Microcontroller

- Receives data
- Sends signal to motor
- Calculates six servo angles
- Records weight of shoes
- Places shoes on shelf



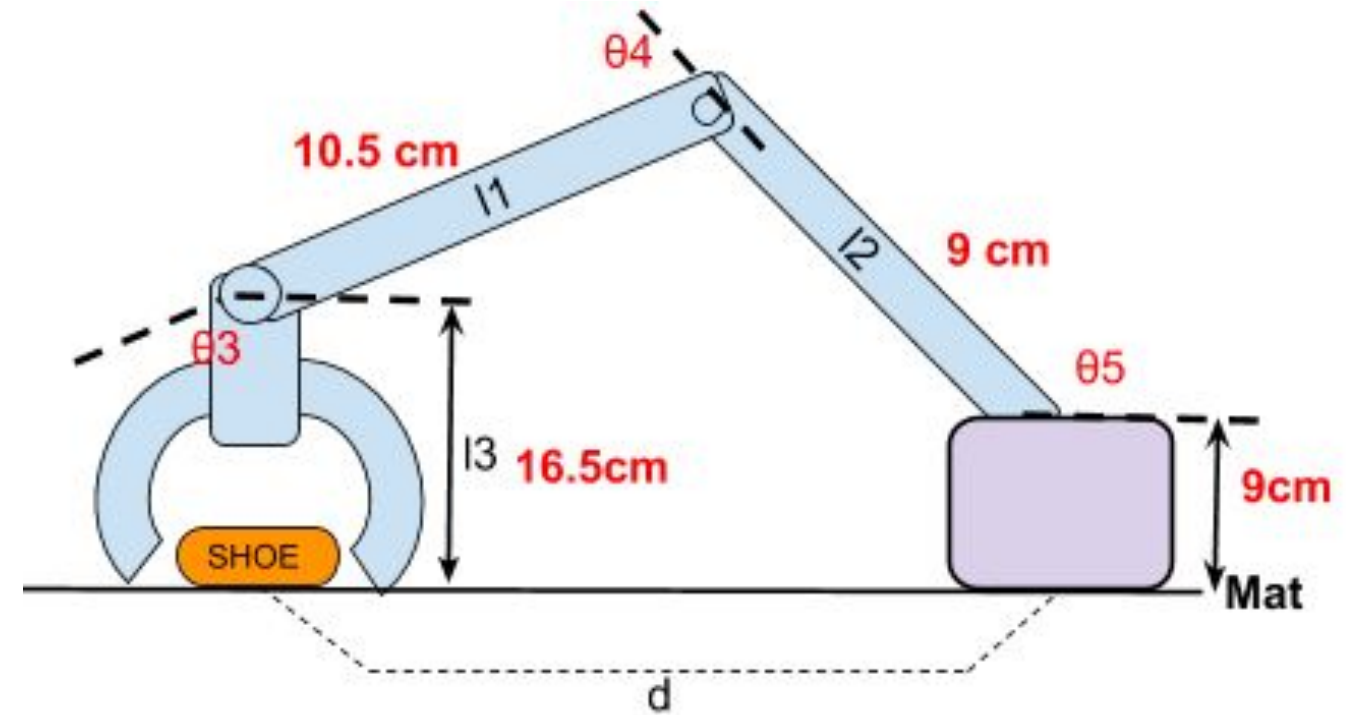
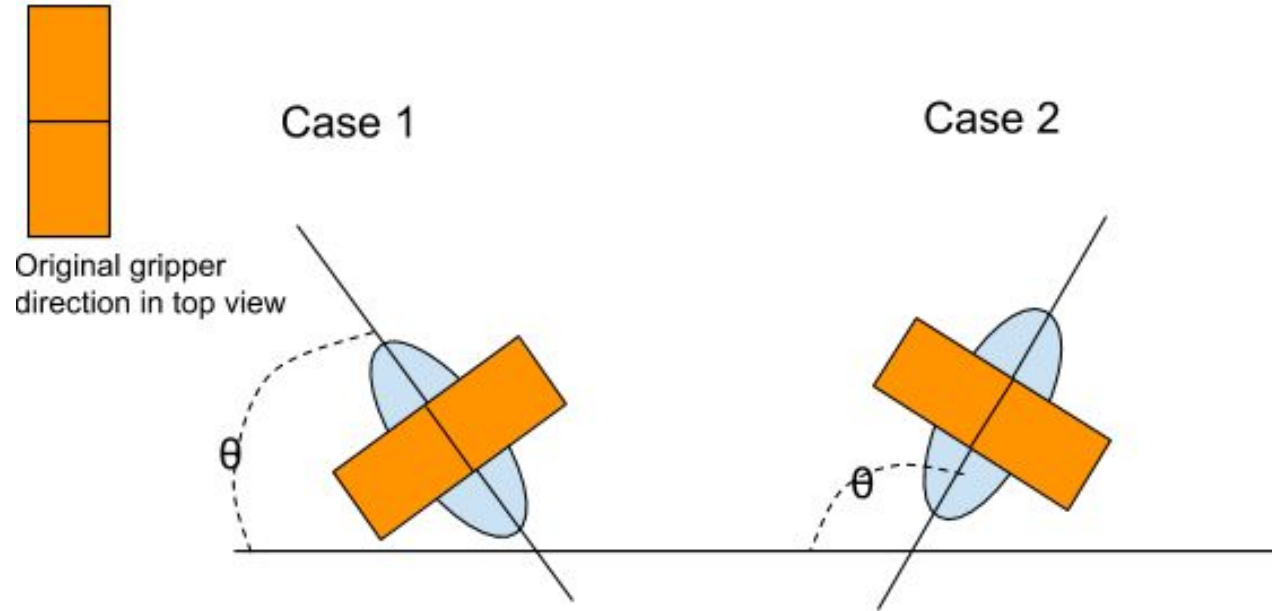
Top View



# Software

- Calculation in Microcontroller
- Image Processing by Raspberry Pi

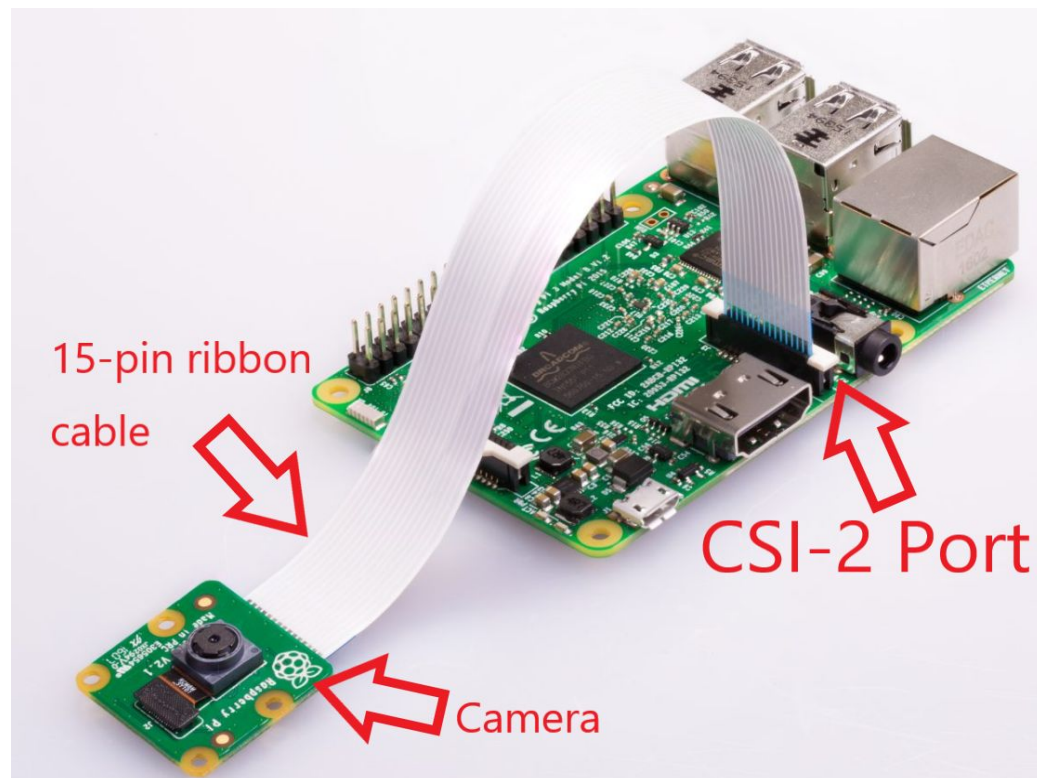
# Calculation By Microcontroller



Object number: order of shoe picking  
Xcen: motor movement distance  
Ycen: angles for servo 3,4 and 5  
Slope: rotation of servo 2 (2 cases)

# Image Processing

## Raspberry Pi Camera



### Output from program

object	coordinate	slope	color
1	(514, 153)	8.69	0
2	(362, 170)	1.36	0
3	(434, 74)	-0.75	1
4	(121, 99)	-2.28	1
5	(267, 66)	200	2
6	(227, 184)	1.12	2

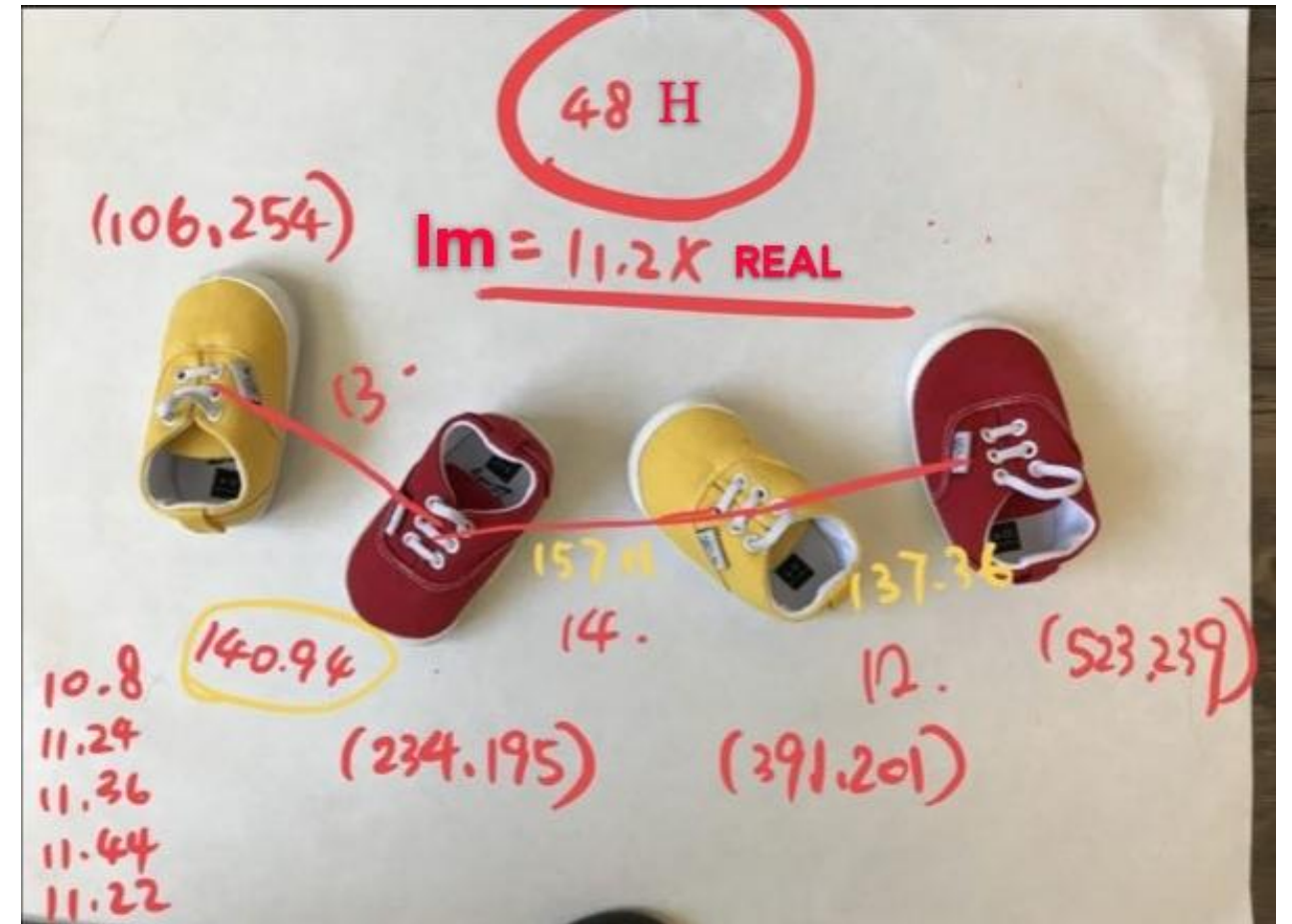


# Other Tests

- Size of end effector(compare of three)
- Physical limitation

# Test Results

- Image Processing:  
Offset between captured image  
and real life setting



# Test Results

gh Bluetooth

object	coordinate	slope	color
1	(514, 153)	8.69	0
2	(362, 170)	1.36	0

Result.txt in Raspberry Pi

```
c is:
1
x is:
514
y is:
153
slope is:
8.69
color is:
0
c is:
2
x is:
362
y is:
170
slope is:
1.36
color is:
0
```

Data received in Serial Port



# Test Results

- Servo stability
- Motor control

# Test Accuracy

Image Processing	80%
Shoe Picking	60%
Load Cell	90%
Motor Movement	90%
Servo 1 Rotation	95%
Servo 2 Rotation	100%
Servo 3 Rotation	95%
Servo 4 Rotation	95%
Servo 5 Rotation	95%
Servo 6 Rotation	90%
Bluetooth	100%

# Further Work

- Feedback loop to track shoes and robot
- Improvement of image processing
- Variability of working path



Thank you for listening! :)