Smart Garden Inc.

Auto Watering System

Outline

- Team members
- Video
- Introduction
- Schedule
- Finance
- Overview of system
- Hardware design
- Firmware design
- Encloser design
- Web design
- Future plan
- Conclusion

Team Members

Kwok Sum Yue, Timmy (CEO)

Weidi Zhai

Bo Sun

Siyan Chen

Tianguang Zhang

Duling Lai

Video

IMG_2354.MOV

Why do we have to do that??

Wake up in the morning for a plant???

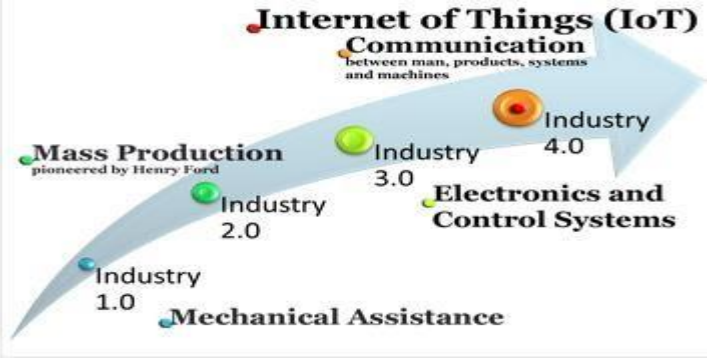
Video (2)

IMG_2355.MOV

Let’s do it~~!
Save your Time

Introduction

Where are we?



An area for Industry 4.0

Contemporary automation
Data exchange
Manufacturing technologies

Introduction(Continuous)

Typical Products for Today

- Google glass

- Amazon Prime Air

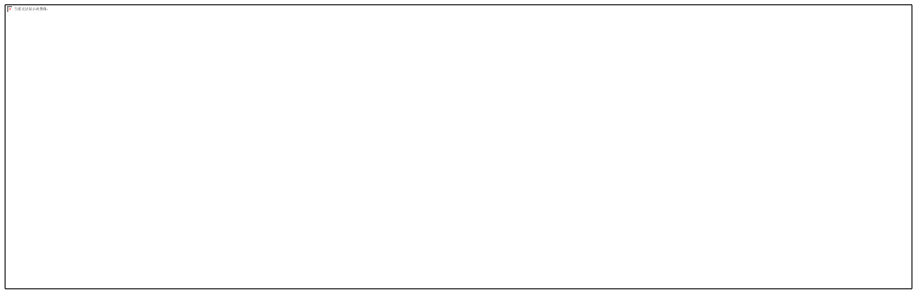
Intelligent + Customaries = Today

Introduction(Continuous)

Project idea: aimed to bring the best convenience to maintaining garden

- ✓ Solving a housework problem
- ✓ Internet of Things
- ✓ Data exchange *(future plan)*

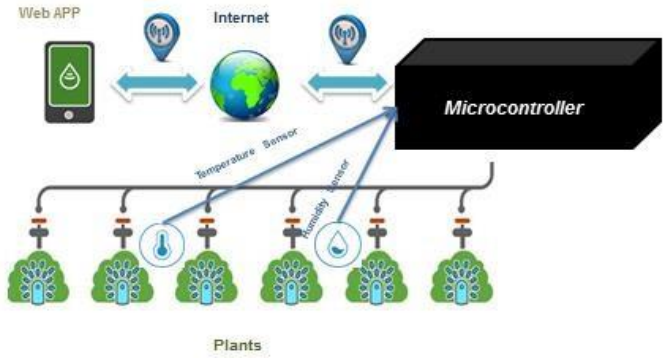
Home Automation



Introduction(Continuous)

E-Garden components:

- **Software**
  - User owned Database
  - Web app
- **Microcontroller**
  - Raspberry Pi *(future plan)*
- **Hardware**
  - Sensors (Moisture and Temperature)
  - Servo Motor



Marketing

Features	Standard Controller	Our E-garden controller
Control irrigation system with reporting from anywhere worldwide		
wireless enable		
Save water (when Rainning)		
Simple to install with no extra hardware required		
No smart phone required		

Schedule

Task	Initial schedule date	Actual schedule date
Research-Watering	September 26, 2015	September 30, 2015
Project proposal report	September 28, 2015	September 28, 2015
Functional specification report	October 20, 2015	October 20, 2015
Ordering and have all Materials	October 31, 2015	October 23, 2015
Application programming	October 31, 2015	October 31, 2015
Oral Progress presentation	October 27, 2015	October 27, 2015
Design Specification Report	November 18, 2015	November 15, 2015
Hardware Design and Development	November 20, 2015	November 20, 2015
Firmware Design and Development	November 20, 2015	November 20, 2015
Testing & Combining all parts	November 31, 2015	December 11,2015
Written progress	November 29, 2015	November 29, 2015

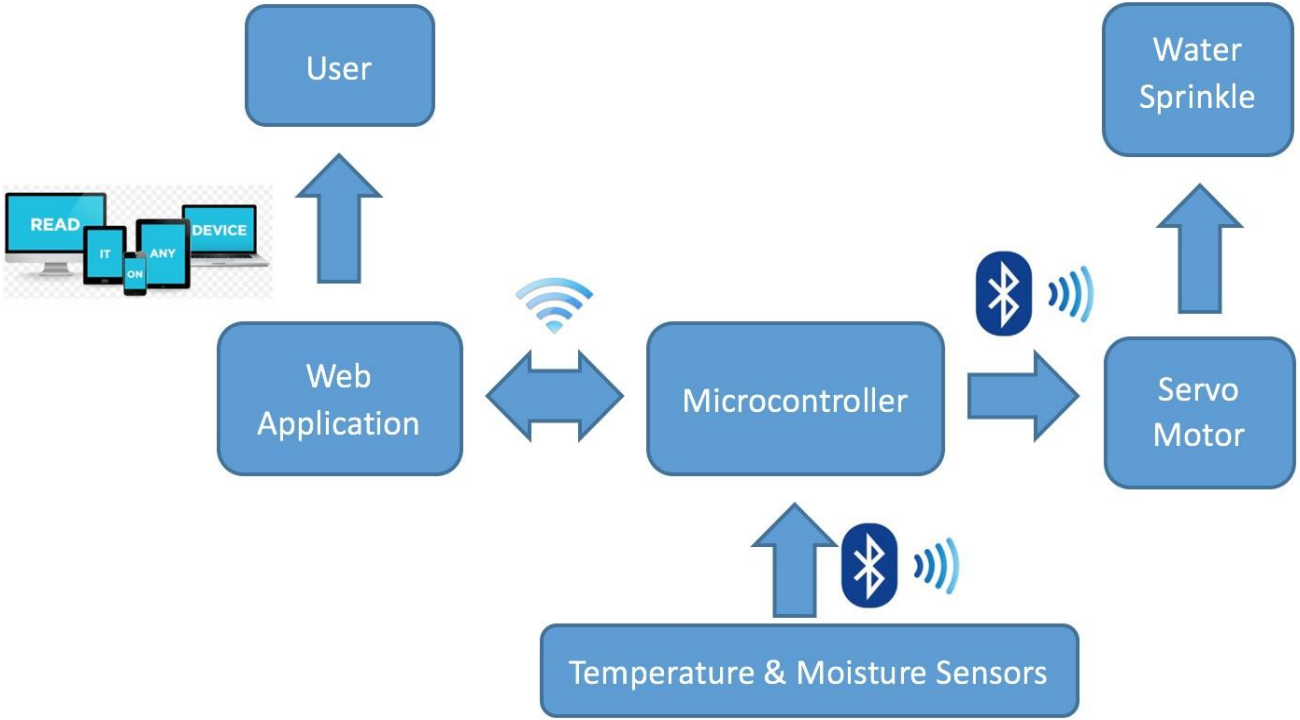
Finance

Item	Estimated Cost	Actual Cost	Difference
Raspberry Pi 2	65.99	$123.14	-$57.15
Soil moisture sensor	$14x2	$7.5	+$20.5
Temperature sensor	$4.99x2	$7.5	+$2.5
LCD display	$23.99x2	-	+$47.98
Micro Servo Motor	$14.99x2	$14.99	+$14.99
Plant water Sprinkler	$5x4	-	+$20
Small water pump	$21.45x2	-	+$42.9

Finance (Continuous)

Wi-Fi USB Adapter		**$9.99**	**$7.99**	**+$2**
SD card		$9.99	-	+$9.99
Amazon web Sever fee		$0	$10	-$10
Arduino		-	$33x2	-$66
Bluetooth		-	$35x3	-$105
3D-Printing Encloser		-	$36	-$36
Battery		-	$10	-$18
Other Cost		$60	$20	+$30
Shipping		$50	-	+$50
Totals		$374.83	$408.12	-$41.29

Overview of system



Watering System

In order to complete the entire irragation system, an approprate Watering system is definitely needed.

The ideal watering system should be efficient, low cost, smart.

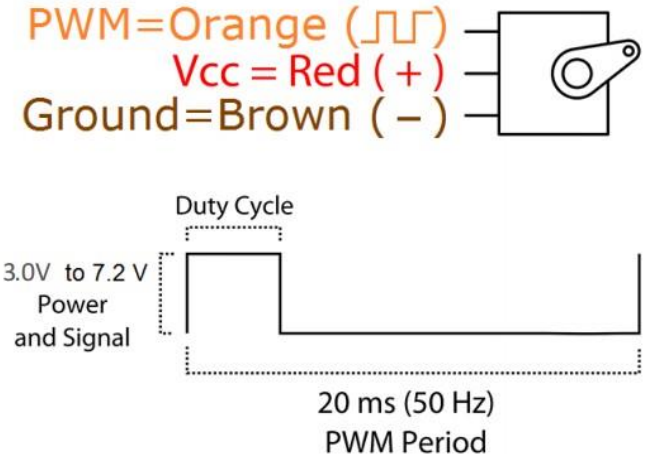
Servo Motor

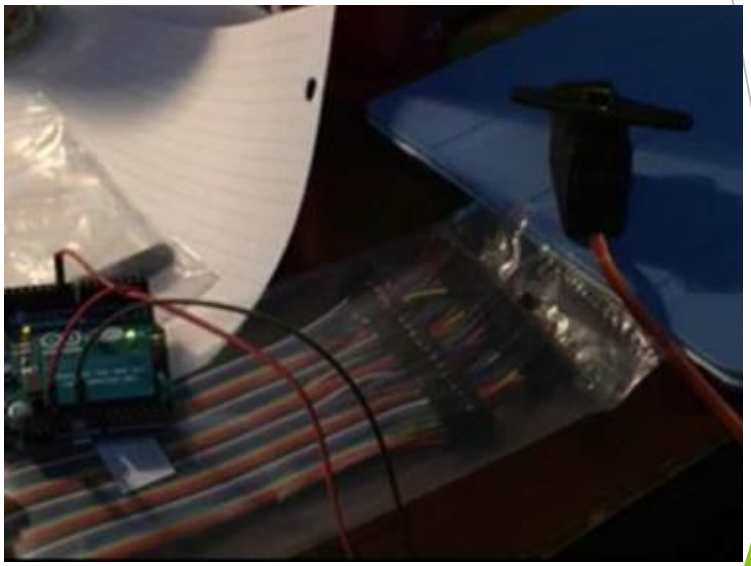
MG 995 servo motor

Operating voltage :3.0Volt - 7.2 Volt

Torque: 3.5Volt - 6.405 kg-cm

Speed: 0.36sec/60degree


PWM=Orange
Vcc = Red (+)
Ground=Brown (–)
Duty Cycle
3.0V to 7.2 V
Power
and Signal
20 ms (50 Hz)
PWM Period



Problems !?

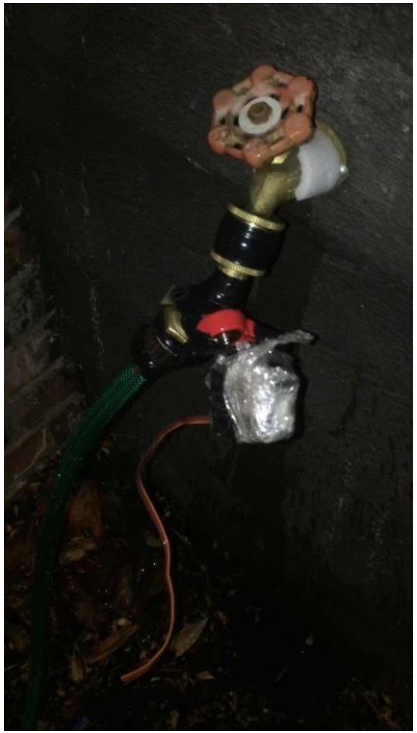
How to design the watering system?

How to connect servo motor with the valves?

How to make the watering system efficient?

How to use servo motor to control the valves in garden?

Servo Motor Valve



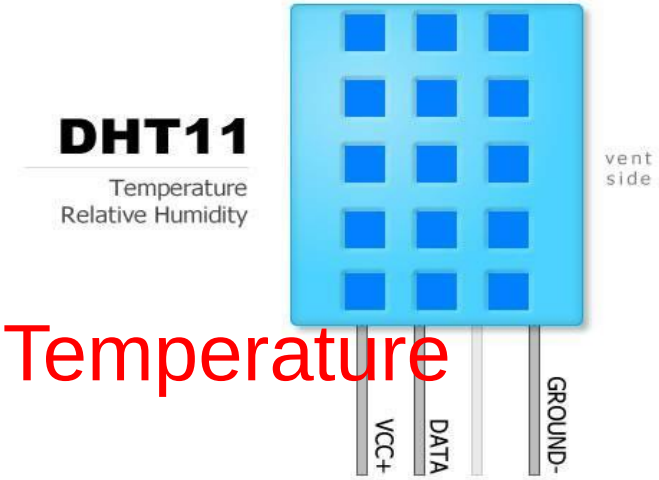
- Connect the servo motor with the valves switch. Servo's rotation will trurn on/off the valves.
- Water amount will depend on humudity level of the environment.
- The relationship between time and water amount is critical.
- Once the servo motor recieve the signal, it will make a 90 degree rotation and the rotation affect the valves.

According to the data we collected and by using the valves in our video(Radius=2.51cm), water amount will be(shown below). Therefore, in our video, with the high humudity level(after raining), it only need to irragate 10 second.

Time (s)	Amount of water (mL)
1	98.7
2	191.4
3	296.2
4	398.3
5	501.8

Sensors

Temperature



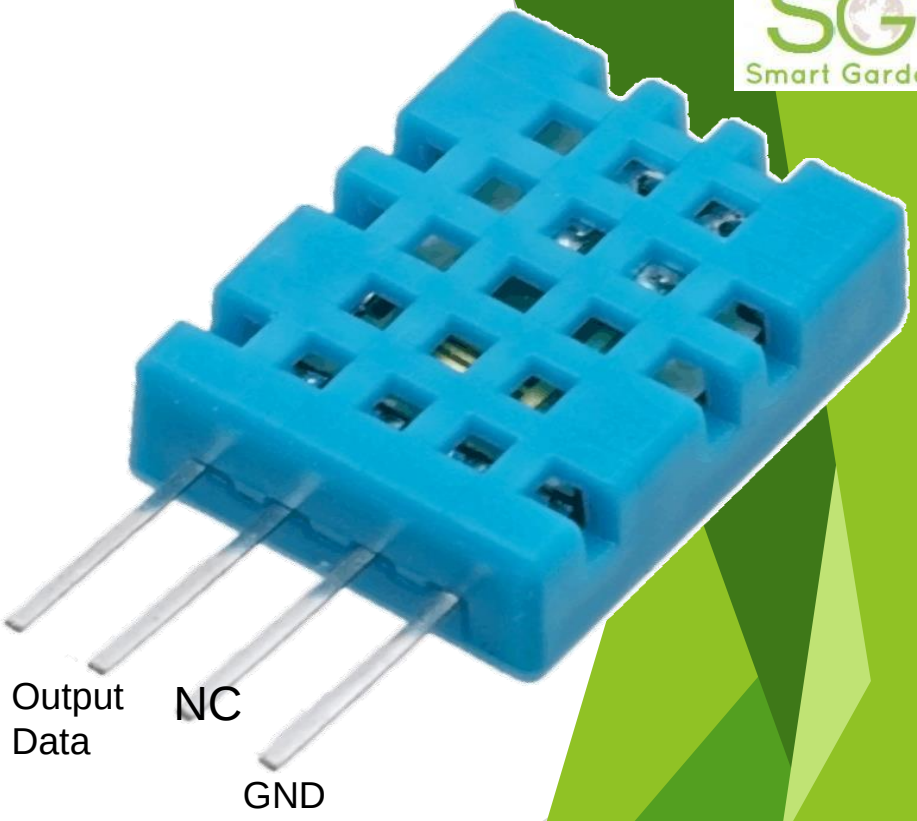
DHT11 Sensor

Soil Moisture

YL-69 Sensor

DHT11 Sensor

- Measure Range: 0℃ ~50℃
- Input Voltage: 3.3V (DC)
- Input Curremt: 1mA (DC)
- NC: no connection



Why do we choice DHT11?

Digital Signal

8 bit integral data + 8 bit decimal data + check sum data

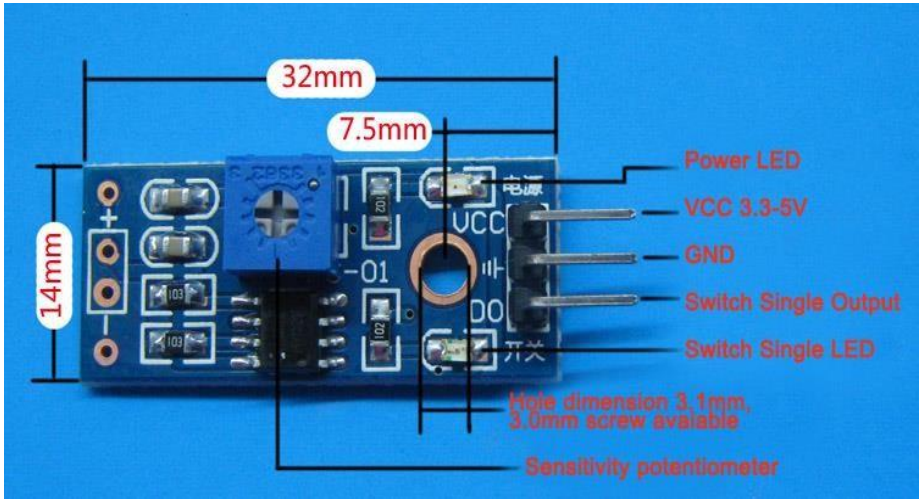
http://www.greenhousesensation.co.uk/click-drip-for-water-butt.html

About YL-69

Probes

Comparator Chip

About YL-69



Pins of YL-69

Input Voltage: 3.3V

Input Current: 35mA

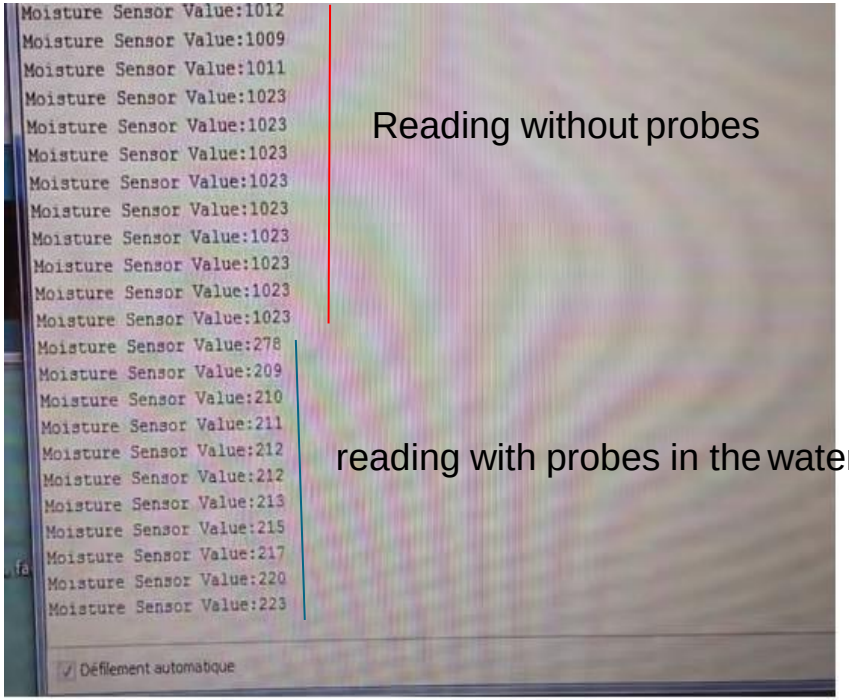
Two output pins:

- Digital Output Pin
- Analog Output Pin

The Analog Output is more accurate!

from:http://smart-prototyping.com/Soil-Hygrometer-Detection-Module-Soil-Moisture-Sensor-For-Arduino.html

About YL-69



Reading without probes

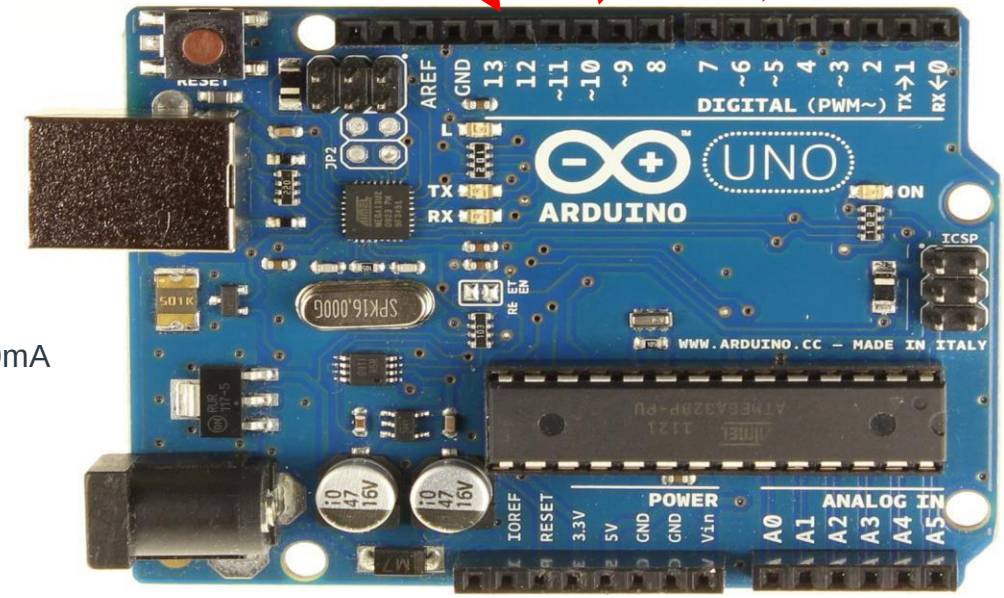
reading with probes in the water

(1023-reading)/10 = the real humidity in %

Arduino Uno

Bluetooh DHT11 Servo Motor

digital pin



input voltage: 7~12V

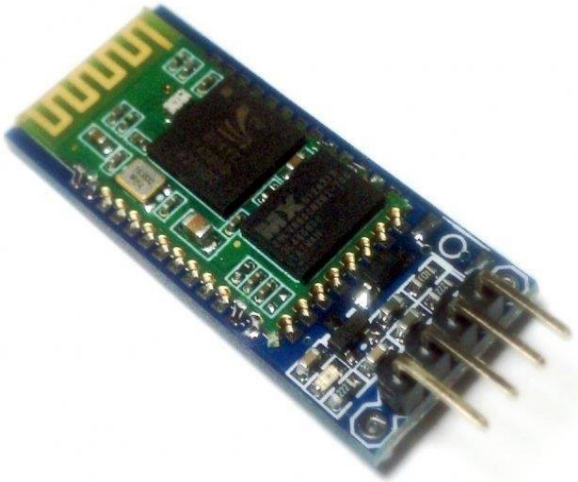
DC current for 3.3V pin: 50mA

power supply

analog pin

YL-69

Bluetooth Module



HC-05 Bluetooth Module

3.5V ~5V with 35mA

SPP (Serial Port Profile)：no format limit

Lower Power Consumption:
sending data at the rate of 75 bytes per second over Wi-Fi requires approximately 80 milliwatts of electrical power. Sending data at the same rate over Bluetooth consumes only 2 milliwatts.

Firmware Design

Raspberry pi will be the bridge to communicate with other device and webserver

WiFi - CanaKit regular Wi Fi receiver which able to connect to the internet(come with the raspberry pi)

Bluetooth - HC-05/ HM-10

HME-0 is not able to connect(Frequencyproblem)

HC-05 is able to use it on Arduino

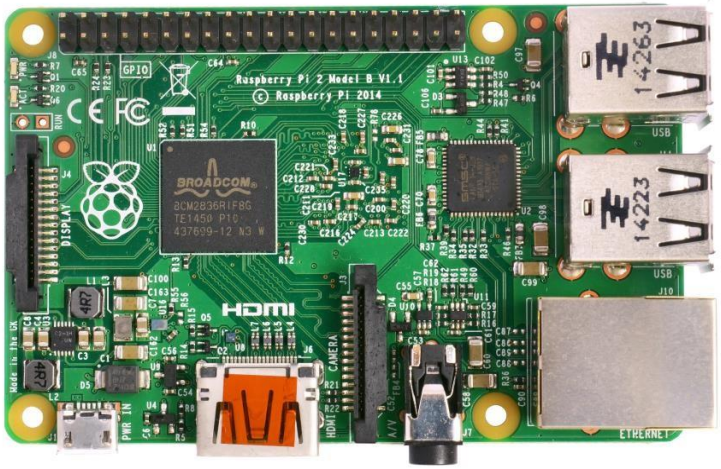
Distance: 9 meters

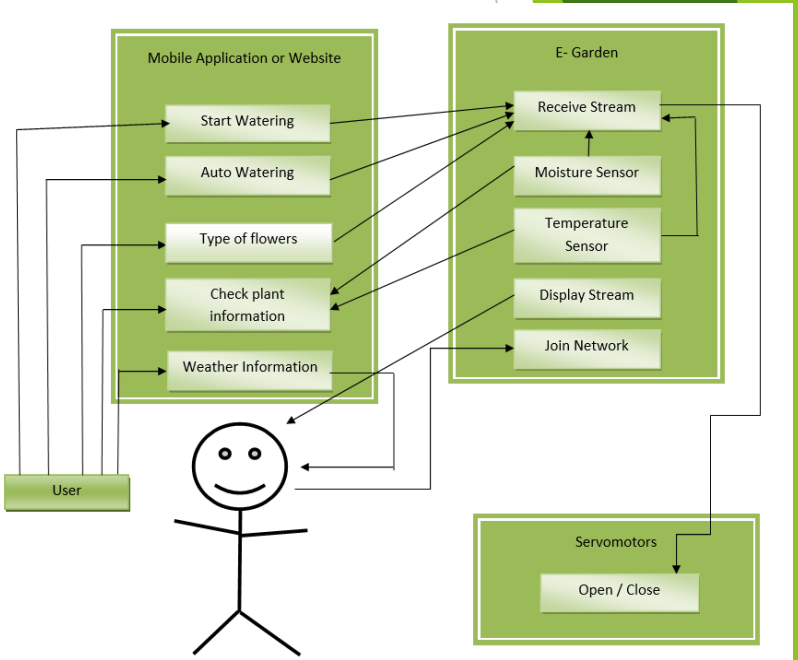
Availabe to receive number value

5V to 3.3V Regulator power

Firmware Design

- Raspberry Pi
  - Power has to keep on when the system is on
  - A communication bridge between device and webserver
  - Operation System (Windows and Linux)
  - Easy to setup Wi-Fi and Bluetooth adapter





Firmware Design

Wi-Fi adapter

CanaKit regular Wi Fi receiver which able to connect to the internet(come with the raspberry pi)

Stable and do not have to spend extra money

Firmware Design

- Bluetooth - HC-05/ HM-10
  - HM-10 is not able to connect to Arduino Board (Frequency problem)
  - HC-05 is able to use it on Arduino
    - Distance: 9 meters
    - Available to receive and send out number value
    - 5V to 3.3V Regulator power

Firmware Design

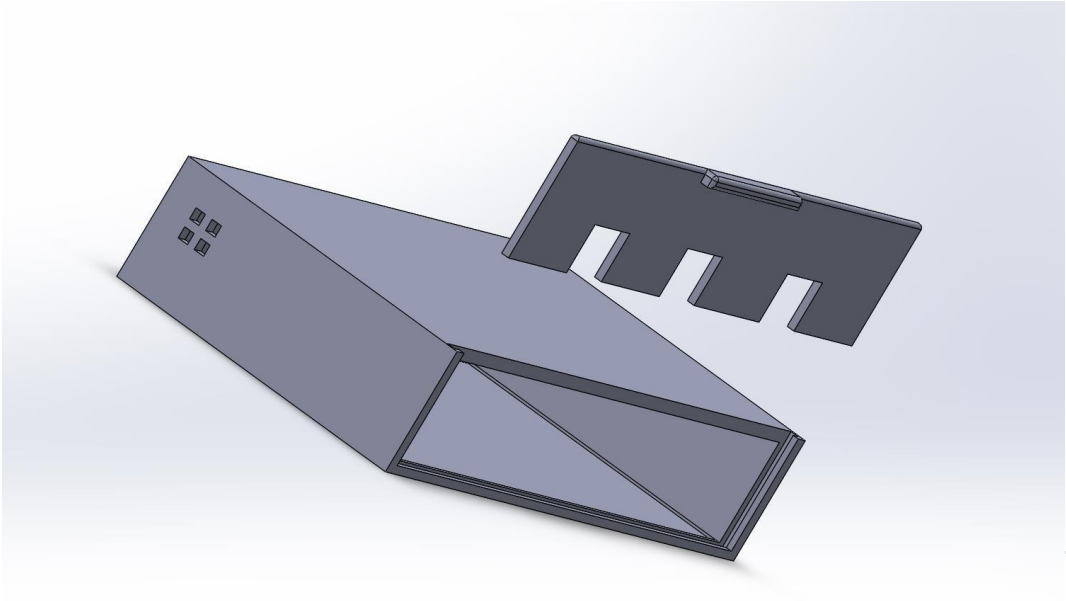
CSR V4.0

- Bluetooth receiver adapter for raspberry pi
- Able to setup in Raspberry Pi in terminal
- Bluetooth Version is V4.0 able to receive data that lower than 4.0
- Bluetooth Wireless Range is 20m and 0.024kg
- Highest version for Bluetooth Receiver

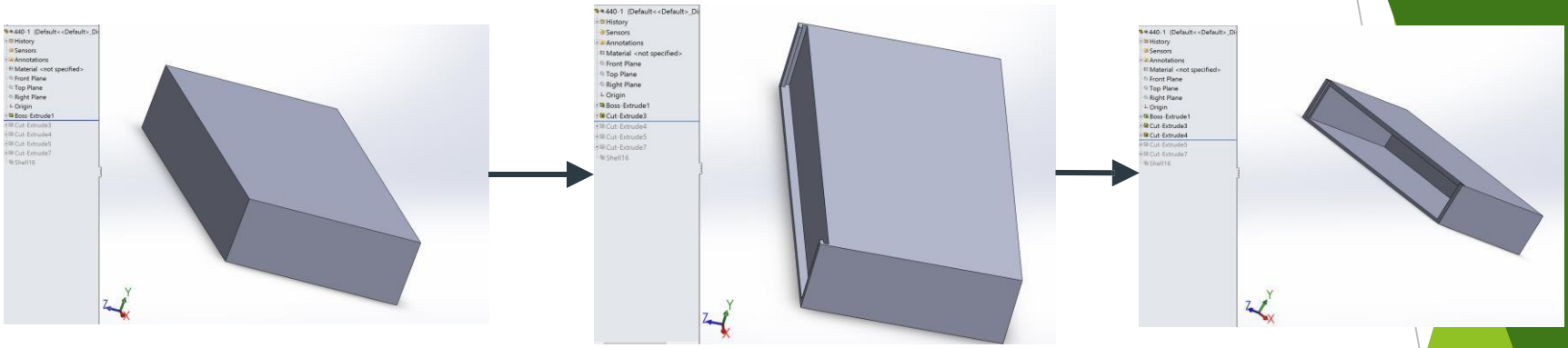
Firmware Design

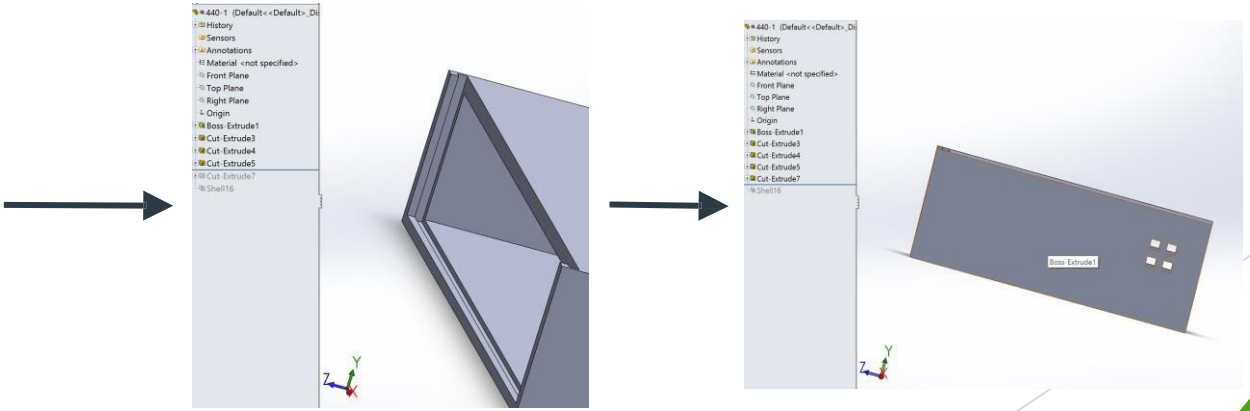
We have use python on the raspberry pi and C code for the Arduino
Python is able to code to connect MySQL database and receive Bluetooth Data
Receive a string data from Arduino Board
Change string into float number on the code in order to write if code

Encloser Design

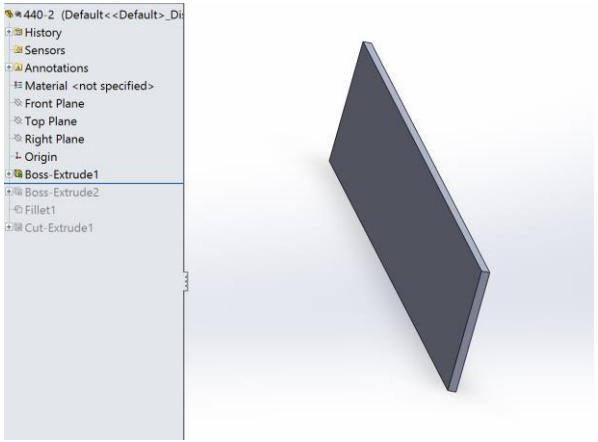


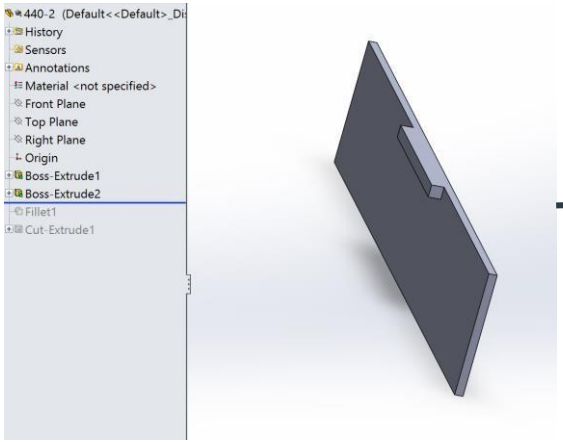
Encloser Design - Part 1

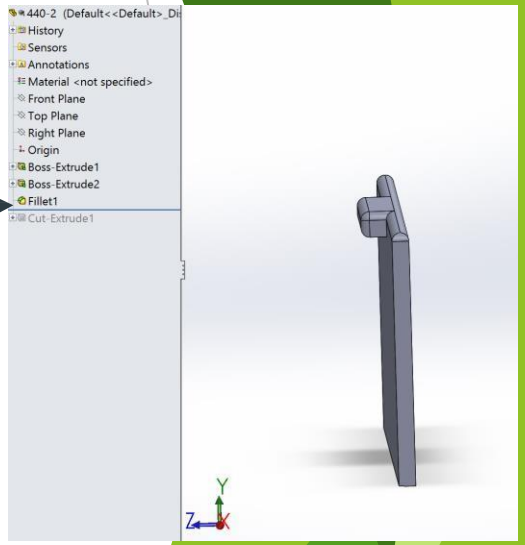


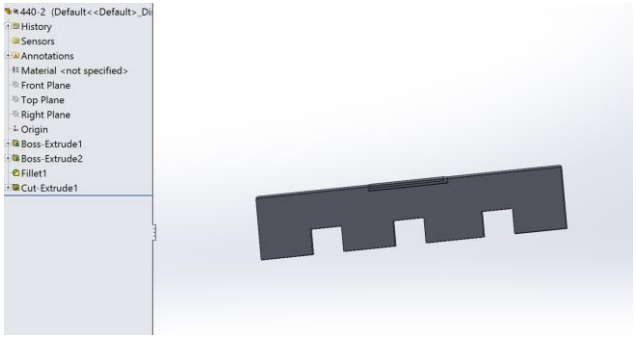


Encloser Design - Part 2



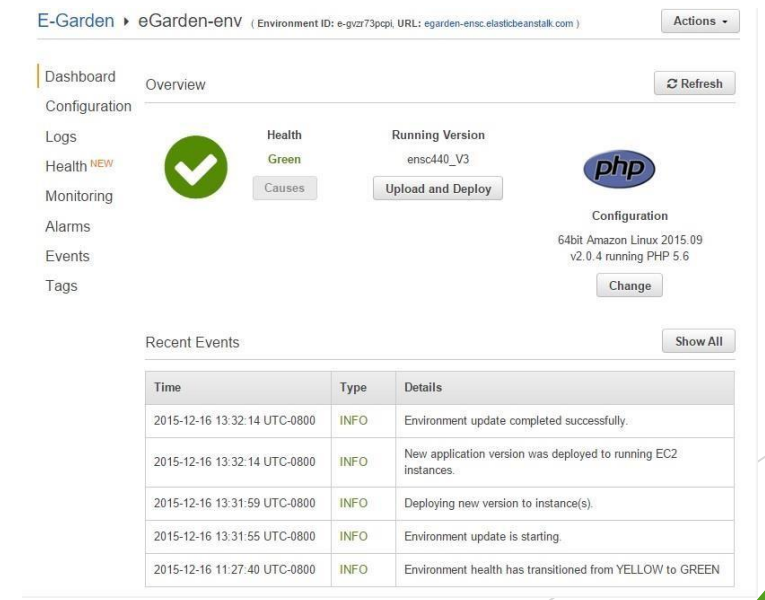






Web Application

- AWS
  - Data Analysis
- Elastic Beanstalk
  - Capacity Provision
  - Load Scaling
  - App health monitor
- RDS (EC2)
  - MySQL database



Web Page Layout

Registration Form

Name

Email

UserName

Password

Confirm Password

Sign-Up

Sign

E-Garden

Username

Password

Log In

New User? Register Here!

Login

E-Garden: Plant 1

27.0 °c

Temperature

40.0 %

Moisture Level

Auto Watering: OFF

Click Here To Water Plant Now!

Log out

Go To Plant 2 >>

Plant 1 History Data

Homepage

E-Garden: Plant 2

Time	Temp	Moisture Level
2015-12-17	13.0°C	62.0%
2015-12-17	5.0°C	64.0%

History Data

Future Plan

Data Analysis

Plant Community

Plant Library

Conclusion

Great improvement on Hard skills

- Software
- Hardware
- Firmware

- Soft skills *(most wanted skills from Employers)*
  - Communication
  - Team work

Demo

FullSizeRender.mov