

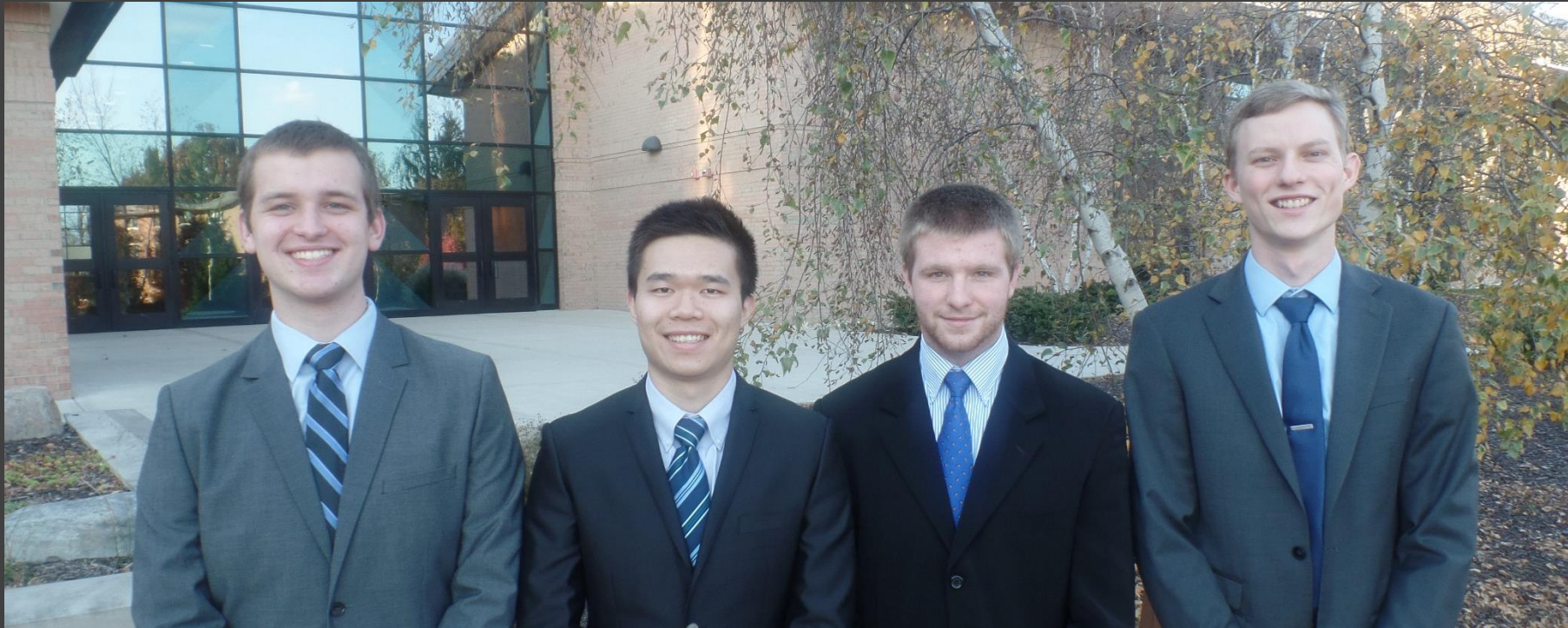
Garde*Net*

TEAM 16

JOHN CONNELL, ANTHONY JIN, CHARLES KINGSTON, AND KEVIN KREDIT



The Team



John Connell | Anthony Jin | Charles Kingston | Kevin Kredit

Overview

- ❑ The Project
- ❑ Design Decisions
- ❑ Project Highlights
- ❑ Reflections

The Project

The Problem

- ❑ Watering is a labor intensive venture
- ❑ Community gardens often have difficulties to get consistent volunteer help

Our Solution

- ❑ Automate the watering process via
 - ❑ 3G cellular network
 - ❑ Internet-of-Things (IoT)

Target Market

- ❑ Urban farms to community and home gardens
- ❑ Our main client is Caledonia Community Garden



Caledonia Community Garden

<https://lintvwotv.files.wordpress.com/2014/06/maranda-caledonia-community-garden.jpg?w=650>

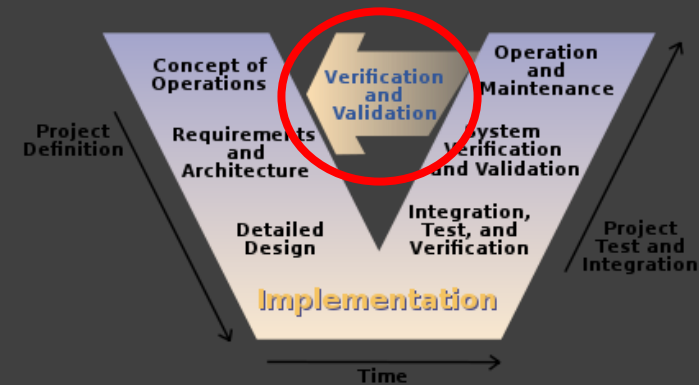
Design Norms

□ Integrity

□ Trust

□ Humility

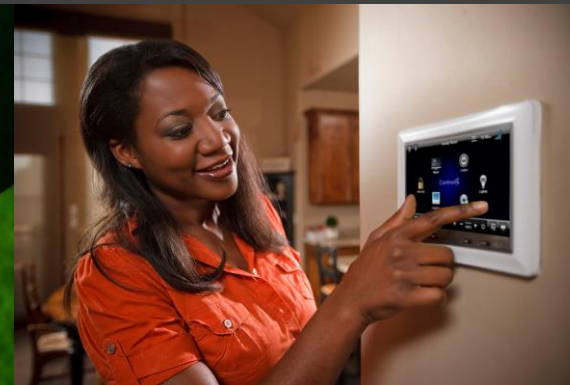
□ Stewardship



https://upload.wikimedia.org/wikipedia/commons/thumb/e/e8/Systems_Engineering_Process_II.svg/420px-Systems_Engineering_Process_II.svg.png



http://www.profitguide.com/wp-content/uploads/2014/03/outside_handshake_deal.jpg



<http://audiodimensions.net/wp-content/uploads/2011/10/Control-4-lady-with-touch-screen.jpg>



<http://g4.img-dpreview.com/384DA42DD7B54A149394C67164F2AD16.jpg>

The Team

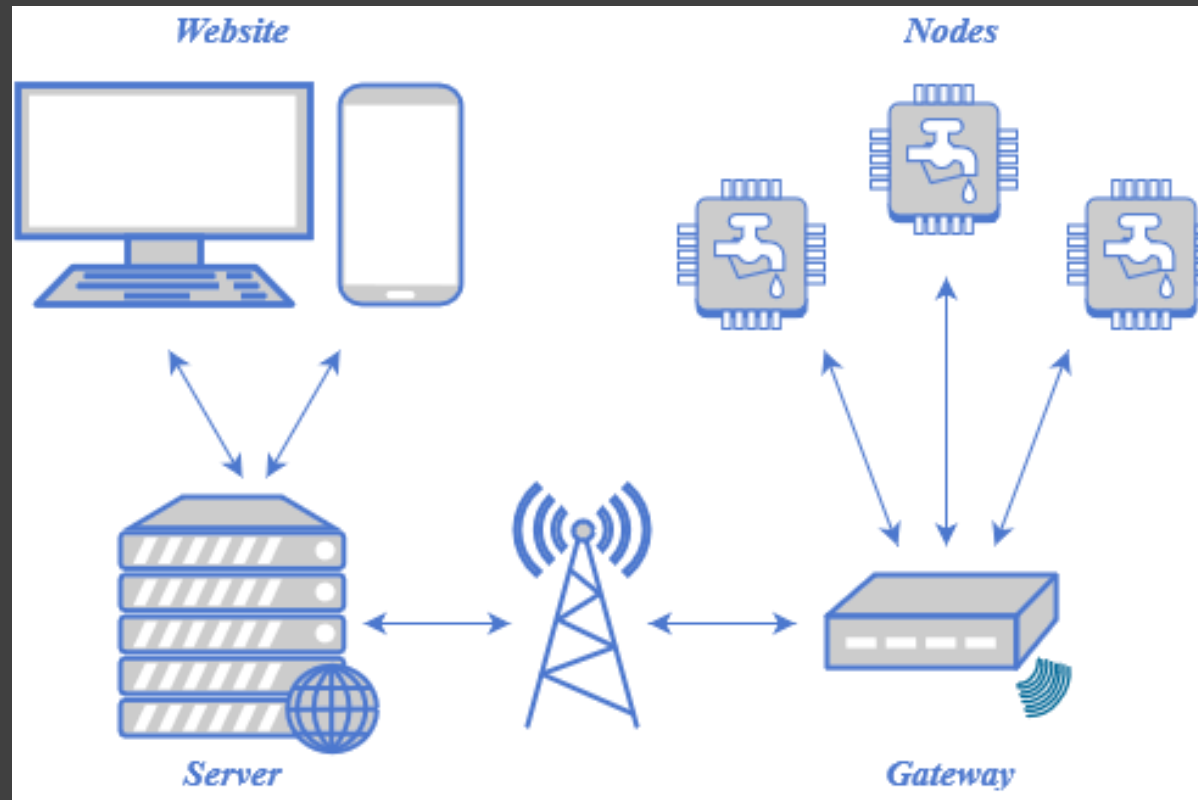
The Project

Design
Decisions

Project
Highlights

Reflections

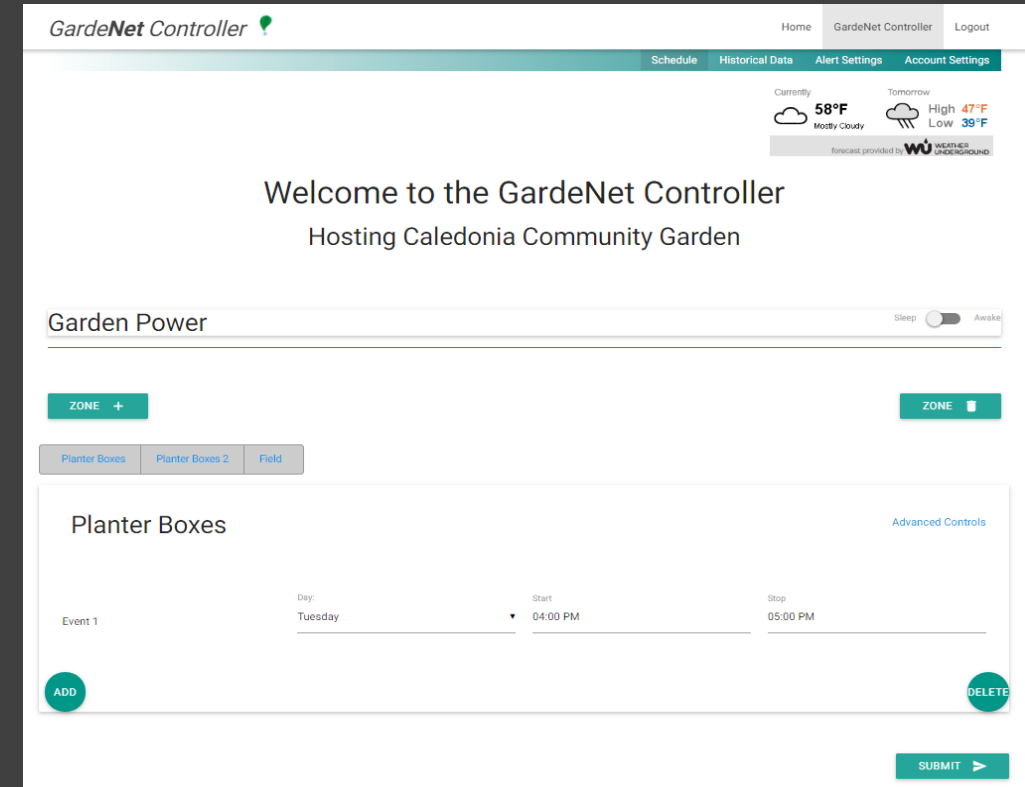
Our Design



Simplified GardeNet System Architecture

Website

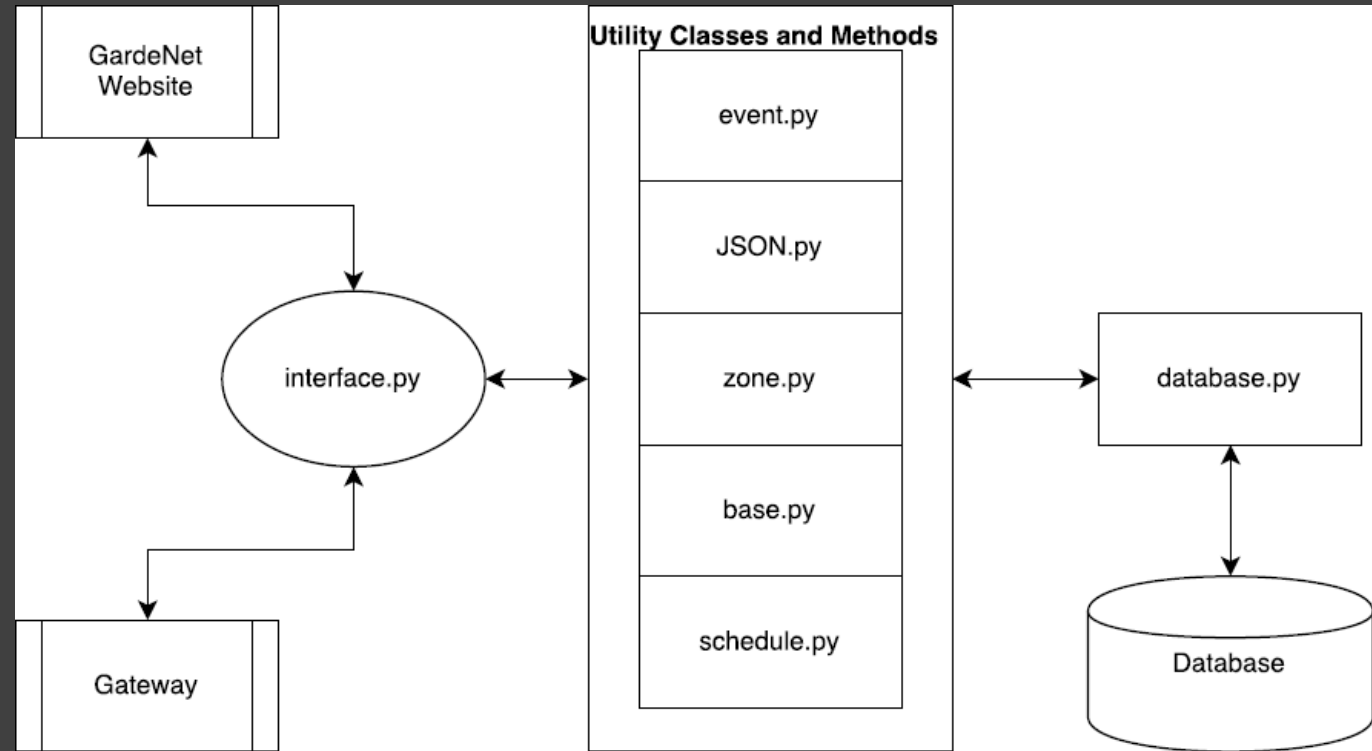
- ❑ Platform: Apache web server on Raspberry Pi
- ❑ Features
 - ❑ Dynamic scheduling
 - ❑ Set weather sensitivity per zone
 - ❑ “Public” and password protected “Admin” views
 - ❑ View historical data
 - ❑ Modify alert and account settings



GardeNet Website

Server

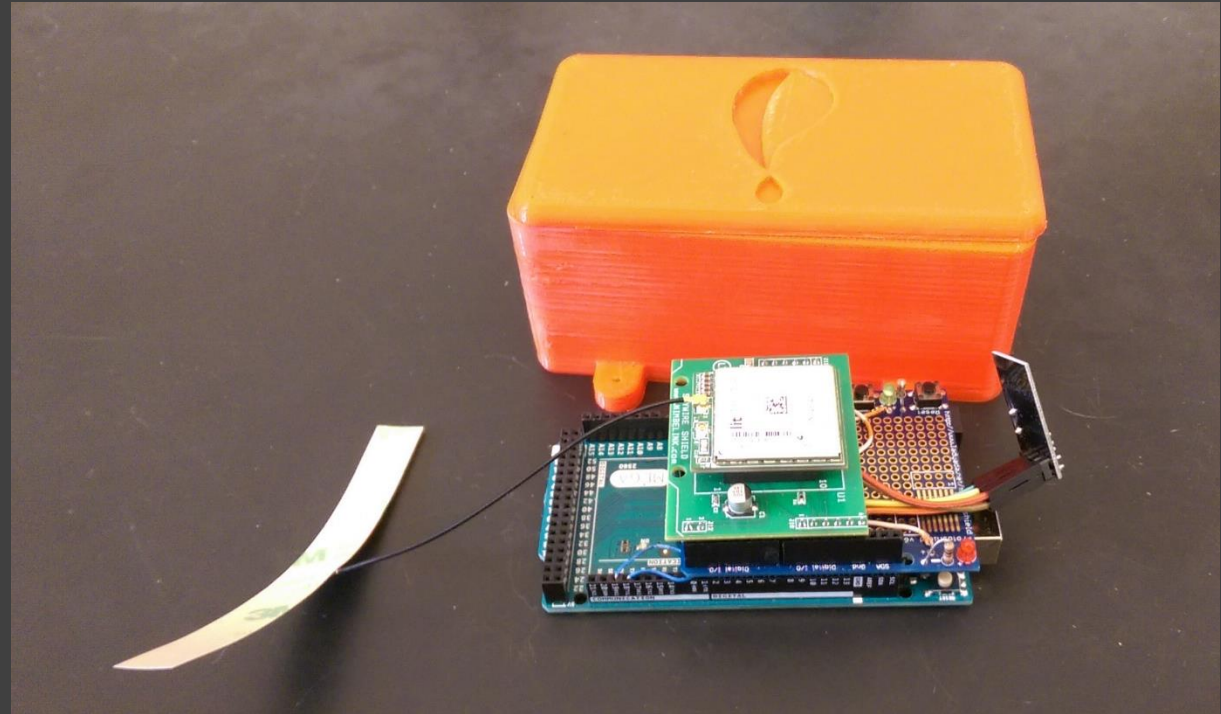
- ❑ Platform: Python server on Raspberry Pi
- ❑ Communication: Internet sockets
- ❑ Controls
 - ❑ Communication between the website and the gateway
 - ❑ Historical data
- ❑ Monitors
 - ❑ Weather
 - ❑ Garden status, sends alerts



GardeNet Server Architecture

Gateway

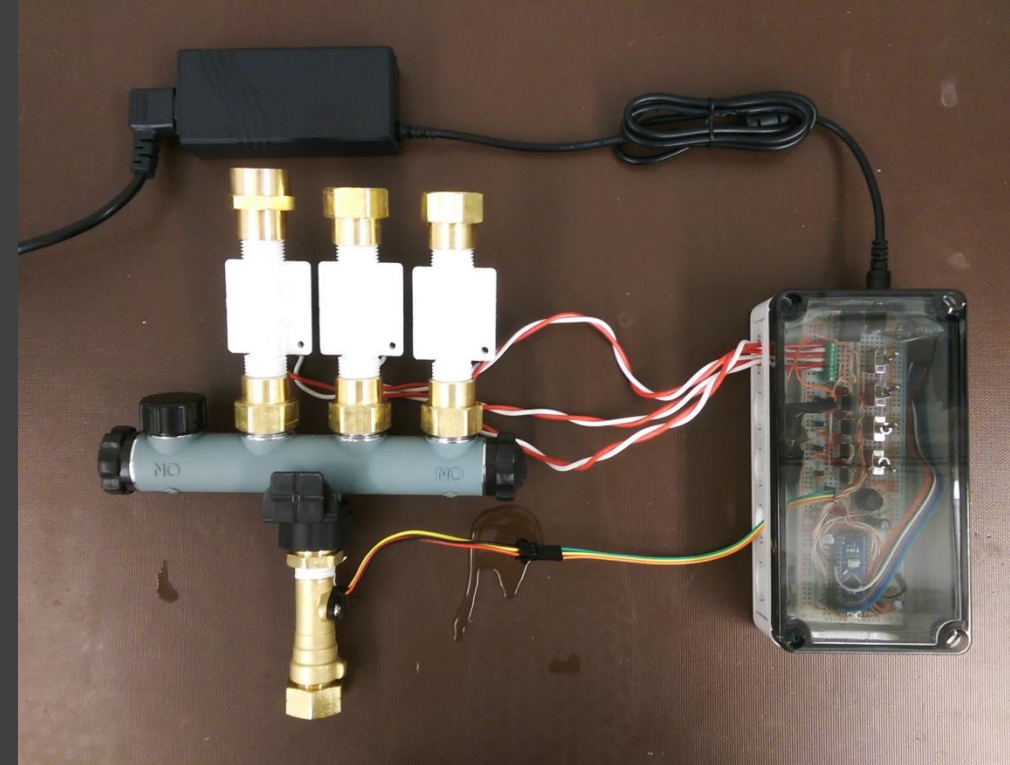
- ❑ Platform: Arduino Leonardo / MEGA 2560
- ❑ Communication
 - ❑ 3G Modem
 - ❑ RF24 radio
- ❑ Controls
 - ❑ Nodes
 - ❑ Alerts
- ❑ Monitors
 - ❑ System feedback data



The Gateway

Node

- ❑ Platform: Arduino Nano
- ❑ Communication: RF24 radio
- ❑ Controls
 - ❑ 4 valves
 - ❑ 1 flow rate meter
- ❑ Monitors
 - ❑ Input voltage level
 - ❑ Flow states
 - ❑ Communication link
- ❑ Modular
 - ❑ Up to 16 nodes
 - ❑ All programmed with same code



The Node

```

Input voltage : 12.92 V : good
Valve 1 is : closed : on for 0.50 minutes today
Valve 2 is : closed : on for 0.42 minutes today
Valve 3 is : closed : on for 0.42 minutes today
Current flow rate : 0.00 GPM : good
Accumulated flow : 15.32 gal

```

[Received T type message from node 0]

41

```

Time awake : 100.00%
Time connected : 100.00%
Node ID, address : 1, 5 : good
Input voltage : 12.92 V : good
Valve 1 is : closed : on for 0.50 minutes today
Valve 2 is : closed : on for 0.42 minutes today
Valve 3 is : closed : on for 0.42 minutes today
Current flow rate : 0.00 GPM : good
Accumulated flow : 15.32 gal

```

[Received T type message from node 0]

☒ Autoscroll

No line ending

9600 baud

```

Closed demo1 socket
Sending: DEMO1%1%0%0
Successfully sent!
Got a connection from the demo1
Closed demo1 socket
Sending: DEMO1%1%1%0
Successfully sent!
Got a connection from the demo1
Closed demo1 socket
Sending: DEMO1%1%1%1
Successfully sent!
Got a connection from the demo1
Closed demo1 socket
Sending: DEMO1%0%1%1
Successfully sent!
Got a connection from the demo1
Closed demo1 socket
Sending: DEMO1%0%0%1
Successfully sent!
Got a connection from the demo1
Closed demo1 socket
Sending: DEMO1%0%0%0
Successfully sent!

```



```

14:13:36
Friday, 5/6/2016
Demo 1 mode
Time Awake : 100.00%
Mesh status : 1/1 : good
Mesh uptime : 100.00%
3G status : connected (1) : good
3G uptime : 100.00%
Node states : no issues : good

```

[Send of type T to node 1 success]

```

14:13:41
Friday, 5/6/2016
Demo 1 mode
Time Awake : 100.00%
Mesh status : 1/1 : good
Mesh uptime : 100.00%
3G status : connected (1) : good
3G uptime : 100.00%
Node states : no issues : good

```



```

Today is Friday
Found 3 Events today.
{"start_time": "13.55", "stop_time": "13.56", "day": "Everyday", "zone_ID": "1", "valve_num": "1" }
{"start_time": "13.56", "stop_time": "13.57", "day": "Everyday", "zone_ID": "1", "valve_num": "2" }
{"start_time": "13.57", "stop_time": "13.58", "day": "Everyday", "zone_ID": "1", "valve_num": "3" }
Sending the BOT message: START3
Successfully sent!
Sending: {"start_time": "13.57", "stop_time": "13.58", "day": "Everyday", "zone_ID": "1", "valve_num": "3" }
The length of the event list is: 2
Successfully sent!
Sending: {"start_time": "13.56", "stop_time": "13.57", "day": "Everyday", "zone_ID": "1", "valve_num": "2" }
The length of the event list is: 1
Successfully sent!
Sending: {"start_time": "13.55", "stop_time": "13.56", "day": "Everyday", "zone_ID": "1", "valve_num": "1" }
The length of the event list is: 0
Successfully sent!
Sending the EOT message
Successfully sent!
Received: STATE?
Sending the current state!
Sending: true .....
Successfully sent the state!
03ceived: IP:100.125.45.7

```

Terminal

```

13:54:39
Friday, 5/6/2016
Time Awake : 100.00%
Mesh status : 1/1 : good
Mesh uptime : 100.00%
3G status : connected (1) : good
3G uptime : 100.00%
Node states : no issues : good

```

[Send of type T to node 1 success]

```

13:54:44
Friday, 5/6/2016
Time Awake : 100.00%
Mesh status : 1/1 : good
Mesh uptime : 100.00%
3G status : connected (1) : good
3G uptime : 100.00%
Node states : no issues : good

```



```

Valve 3 is : closed
Current flow rate : 0.00 GPM : good
Accumulated flow : 3.04 gal

```

[Received T type message from node 0]

```

7
Time awake : 100.00%
Time connected : 100.00%
Node ID, address : 1, 5 : good
Input voltage : 12.92 V : good
Valve 1 is : closed
Valve 2 is : closed
Valve 3 is : closed
Current flow rate : 0.00 GPM : good
Accumulated flow : 3.04 gal

```

[Received T type message from node 0]

☒ Autoscroll

No line

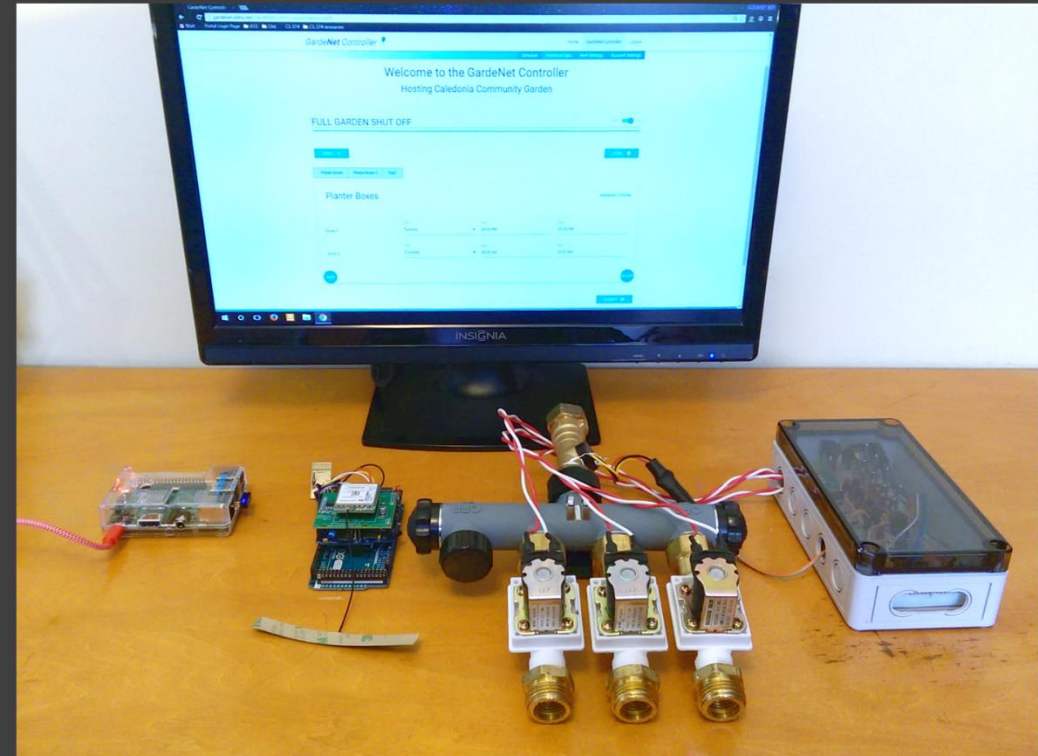
Project Highlights

Challenges

- ❑ Seven programming languages
- ❑ Exosite vs. GardeNet server
- ❑ Reliability
- ❑ Budget and time constraints

Opportunities

- ❑ Advice from experts
- ❑ Learning curve



The Complete System

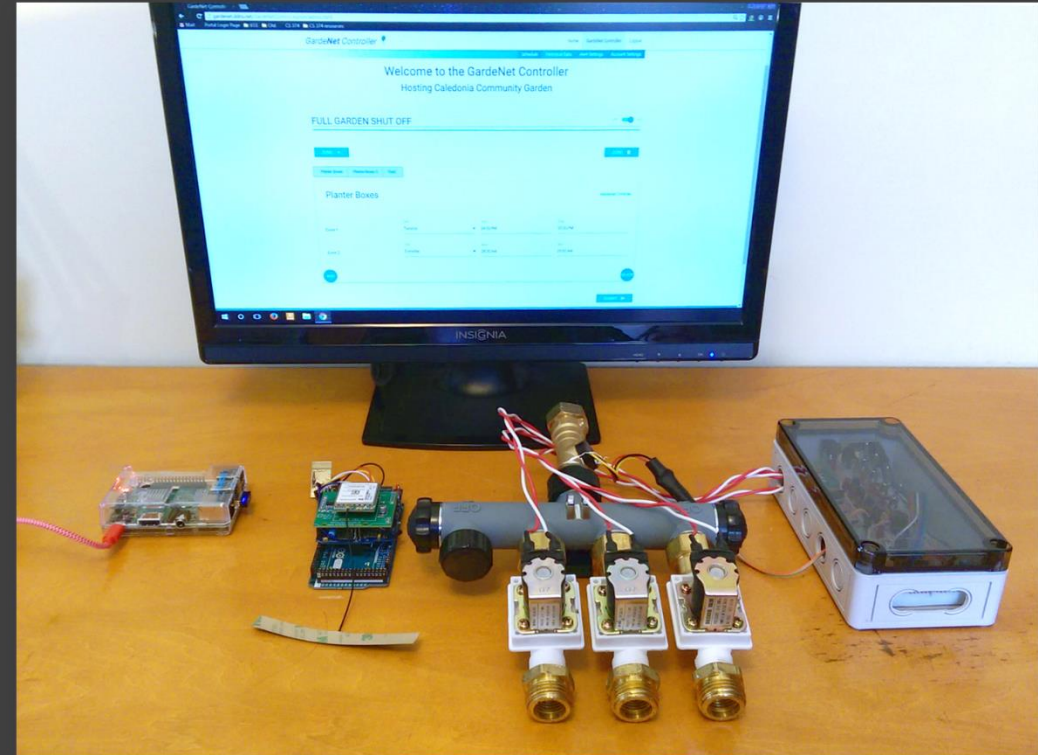
Assessment

What We Learned

- ☐ Systems design
- ☐ Web development
- ☐ Networking

Future Work

- ☐ Better onsite control
- ☐ Onsite weather monitoring
- ☐ Control lights, outlets
- ☐ Dedicated mobile app
- ☐ Support multiple customers



The Complete System

Thanks

Engineering Advisors

- ❑ Professor Mark Michmerhuizen
- ❑ Mentor Kurt Dykema
- ❑ Consultant Eric Walstra

Networking Advisors

- ❑ Professor Victor Norman
- ❑ Lab Administrator Chris Wieringa

Garden Managers

- ❑ David Benjamin of CCG
- ❑ Kyle Van Eerden of EDF

Engineering Support

- ❑ Bob DeKraker
- ❑ Phil Jasperse

Questions
