Team 6 sGreen
Final Presentation

Team Members:

Jacqueline Vital, Andrew Mirabile, Brandon Donohue, Morgan Simmons, Jared Delapasse

Agenda

- Introduction
- Alternative Solutions
- System Design Description
- Design Validation Approach
- Project Management
- Team Management
- Environmental, Social, Safety, Ethical Concerns
- Results

Introduction

- Background

  - There are areas that cannot normally grow their own food, or that have a climate that makes farming more difficult.

- Need

  - A low-maintenance, technologically advanced, and environmentally smart way for people to grow their own plants.

- Goal

  -Prototype for a “smart” greenhouse: scalable, grows plants, senses and actuates environment, minimal user interaction.

- Objectives:

  -Automatic, manage plants, easy to use, accessible anywhere

Design Alternatives and Final Decision

Alternatives:

- “natural process” environmental control
- “Farmbot Genesis” robotic planting system
- Solar powered greenhouse
- Web scraper plant database
- Hydroponic plant system

Final Decision:

- Initially proposed design

System Description

Distributed Sensors

- Detect and report internal environment

Distributed Actuators

- Fine tune environmental growth factors

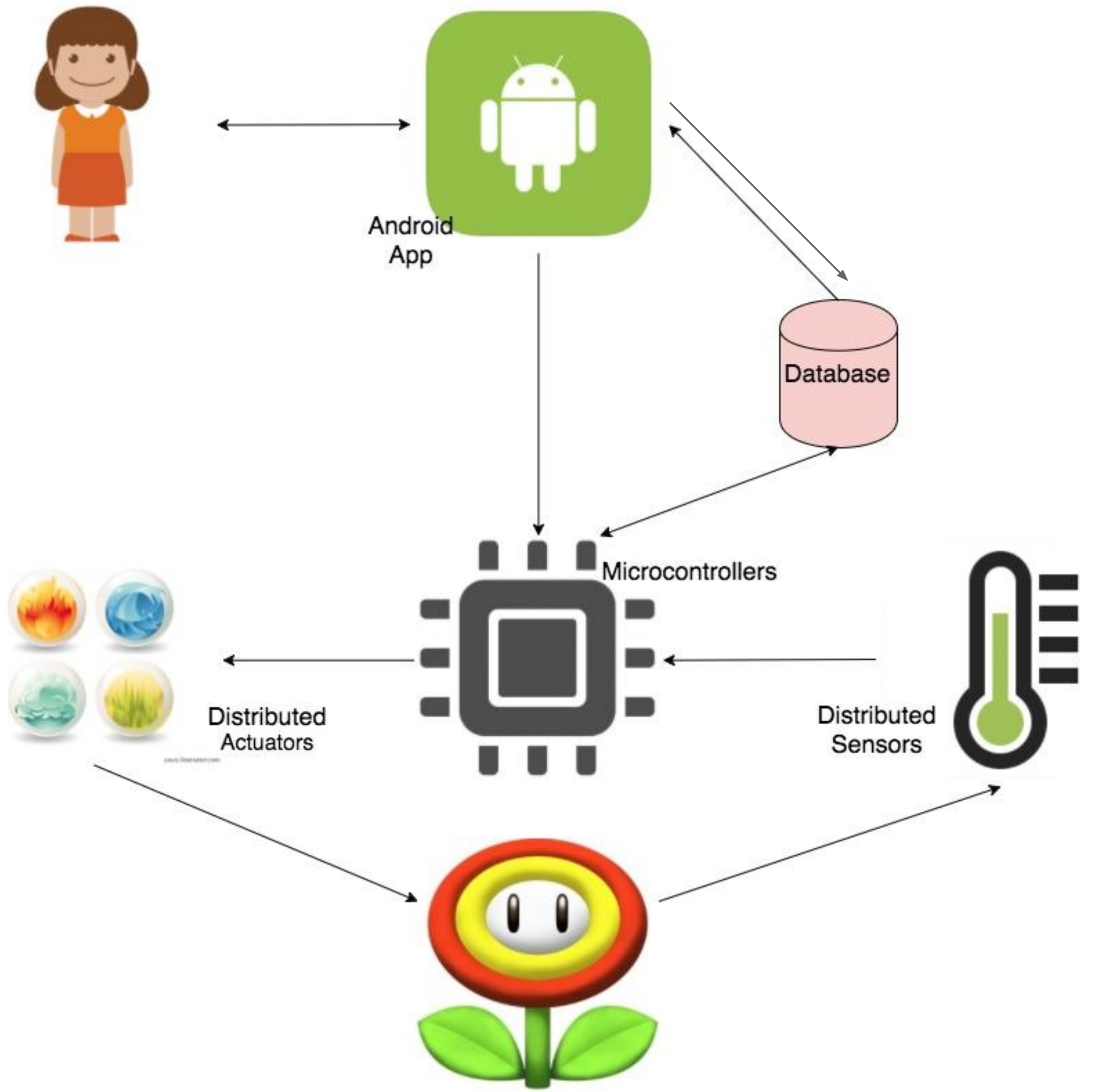
Microcontrollers

- Control actuators and sensors, report data to app

User App, Server/Database

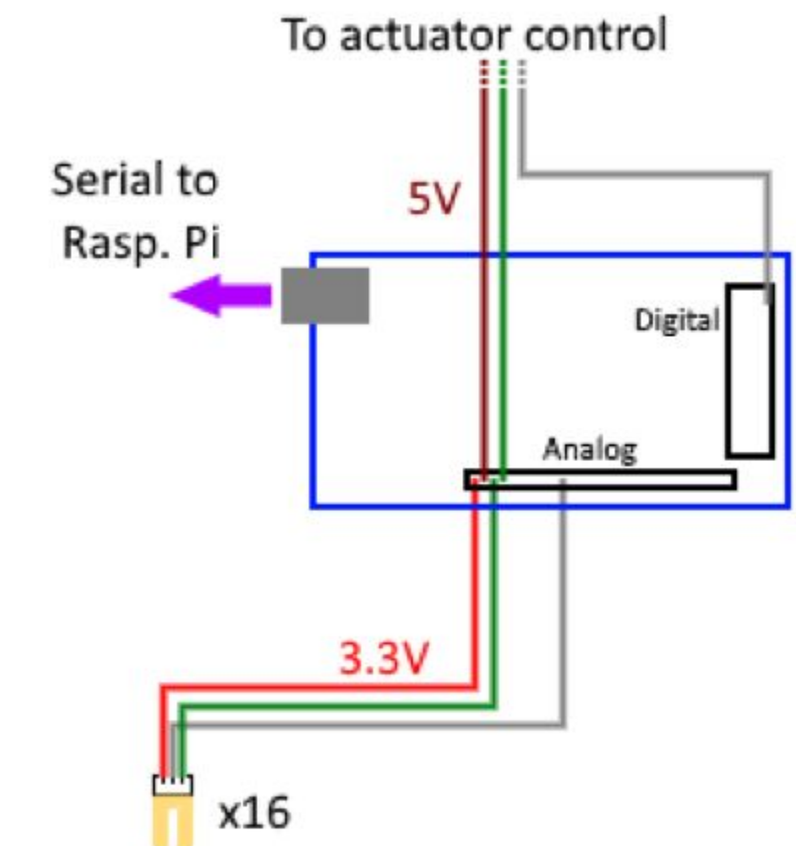
- Customize threshold values, store and view current state

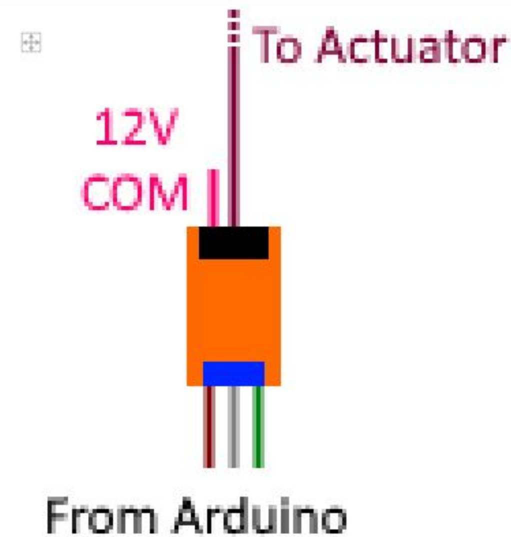
Overall Design



System Design

Arduino - Sensors, Actuator Control





System Design

Sensors:

- 16 Soil Moisture Sensors
- Temperature/Humidity Sensor

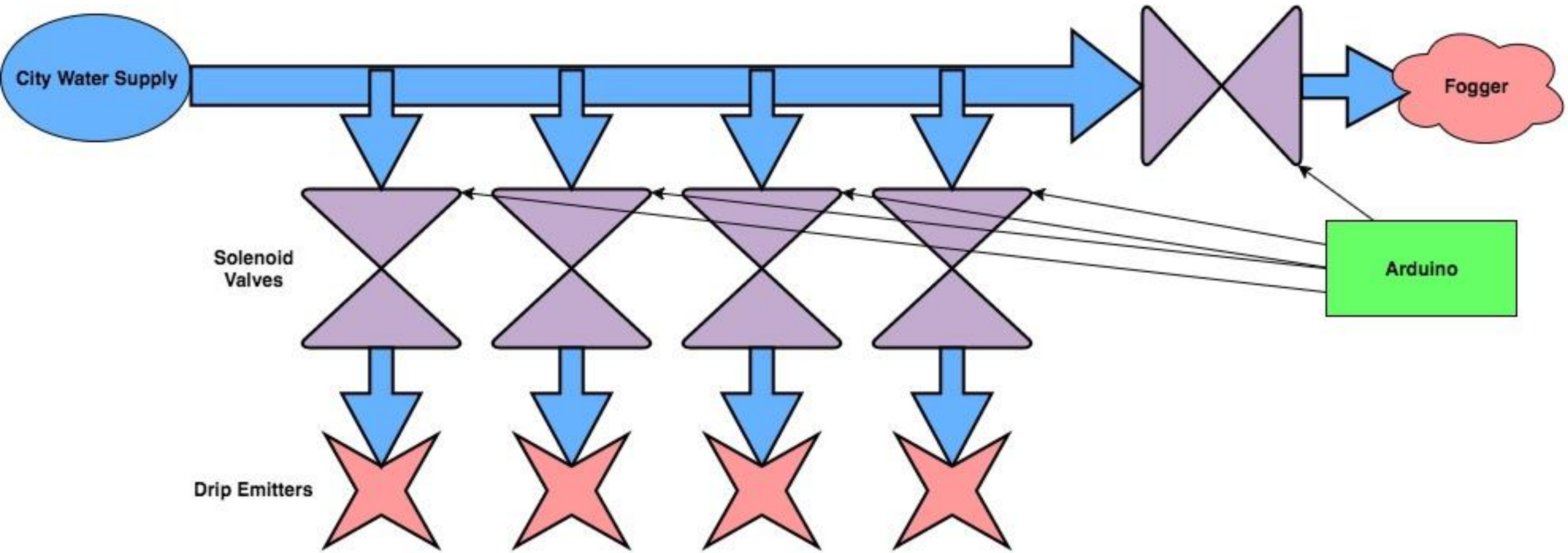
Actuators:

- Linear Actuator
- 4 Solenoid Valves
- 2 LED Grow Lights

Arduino pinout

Component	**Arduino Pin(s)**
soil moisture sensors	Analog 0-15
temperature sensor	Digital 22,24
light relay	Digital 31
vent actuator	Digital 33,35
irrigation relays	Digital 47,49,51,53
open for fan control	Digital 34,36,38,40

Irrigation System Design

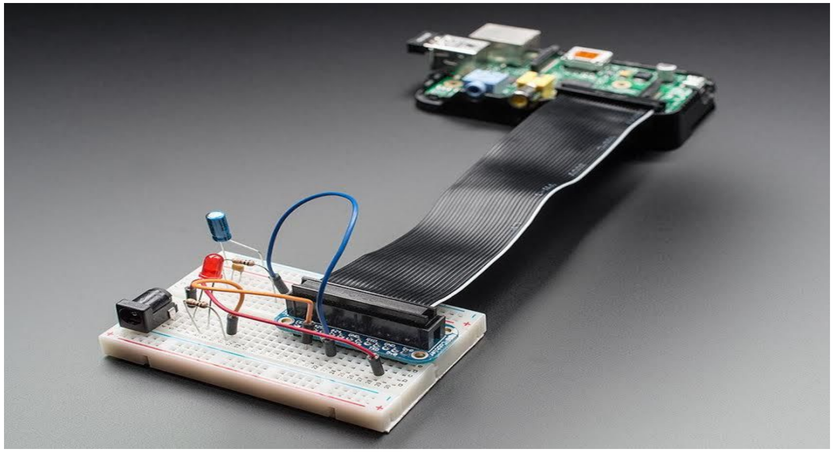


System Design

Arduino-Raspberry Pi Communication

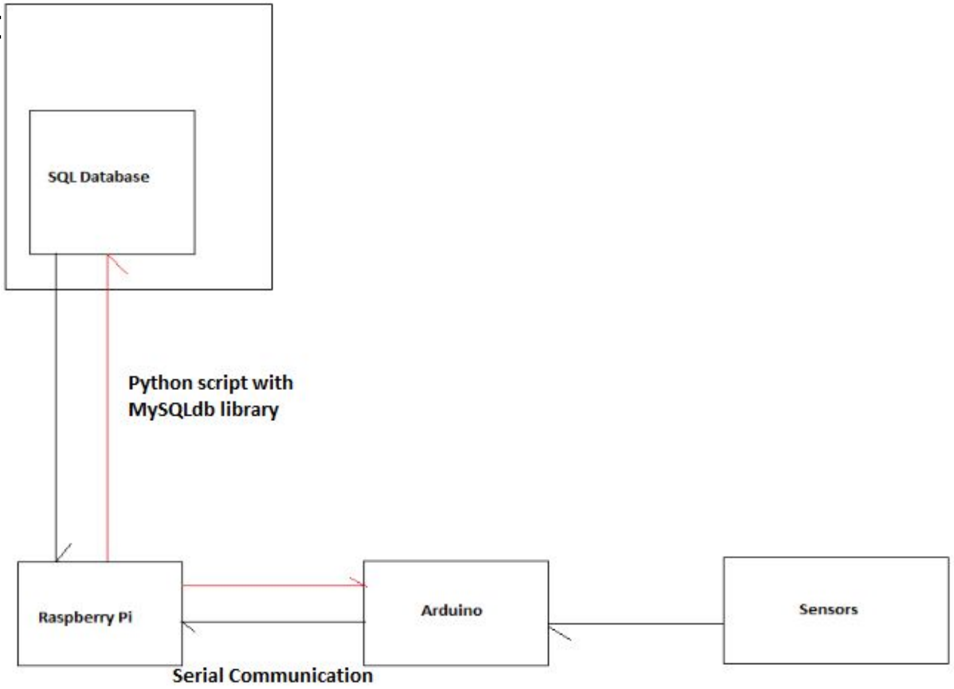
- Original plan was to use a Pi Cobbler for communication.

- Since we only have to send single values at a time, serial port communication was good enough for the task. Values were sent and received one byte at a time.

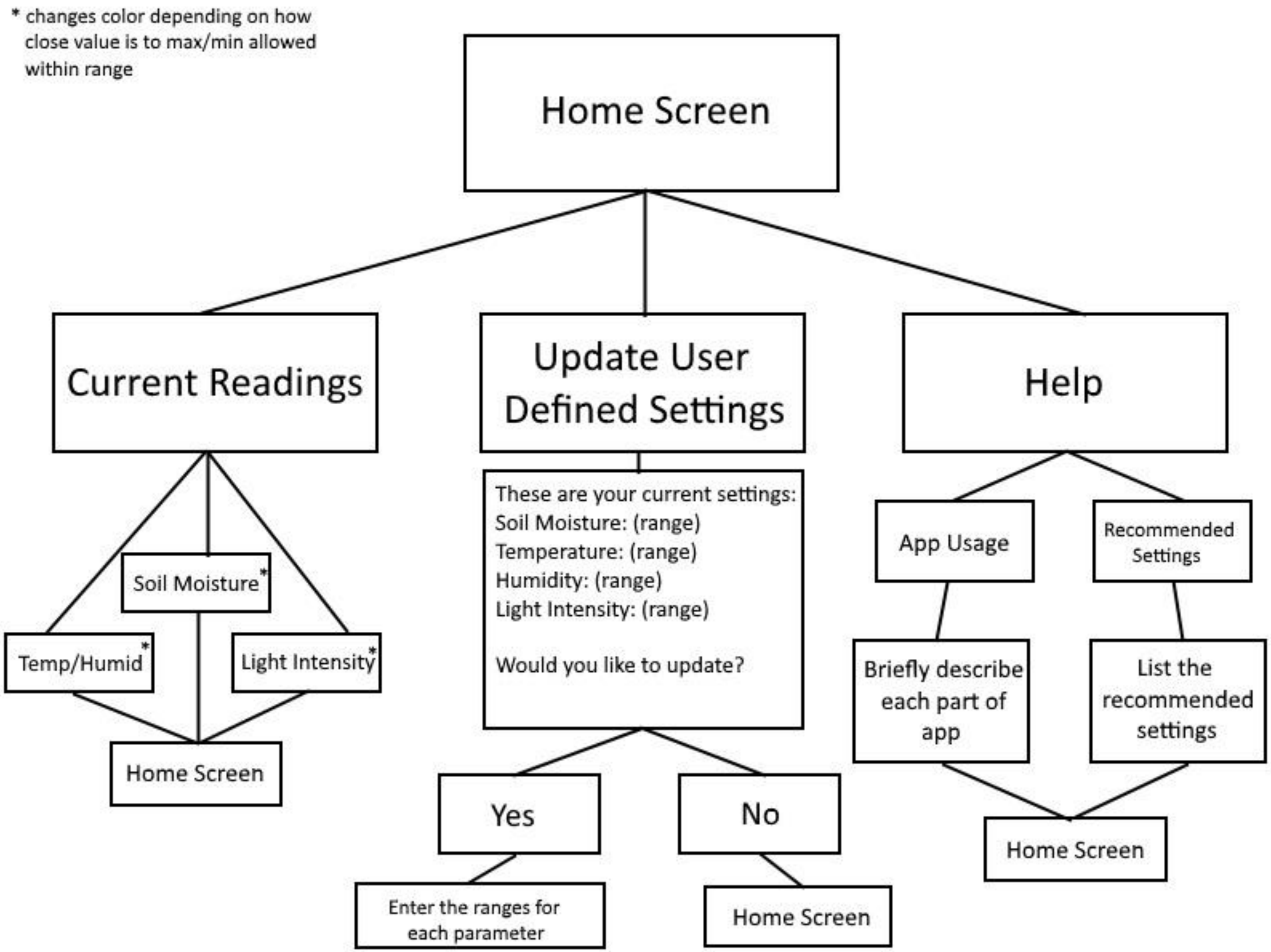


Raspberry Pi-Server Communication

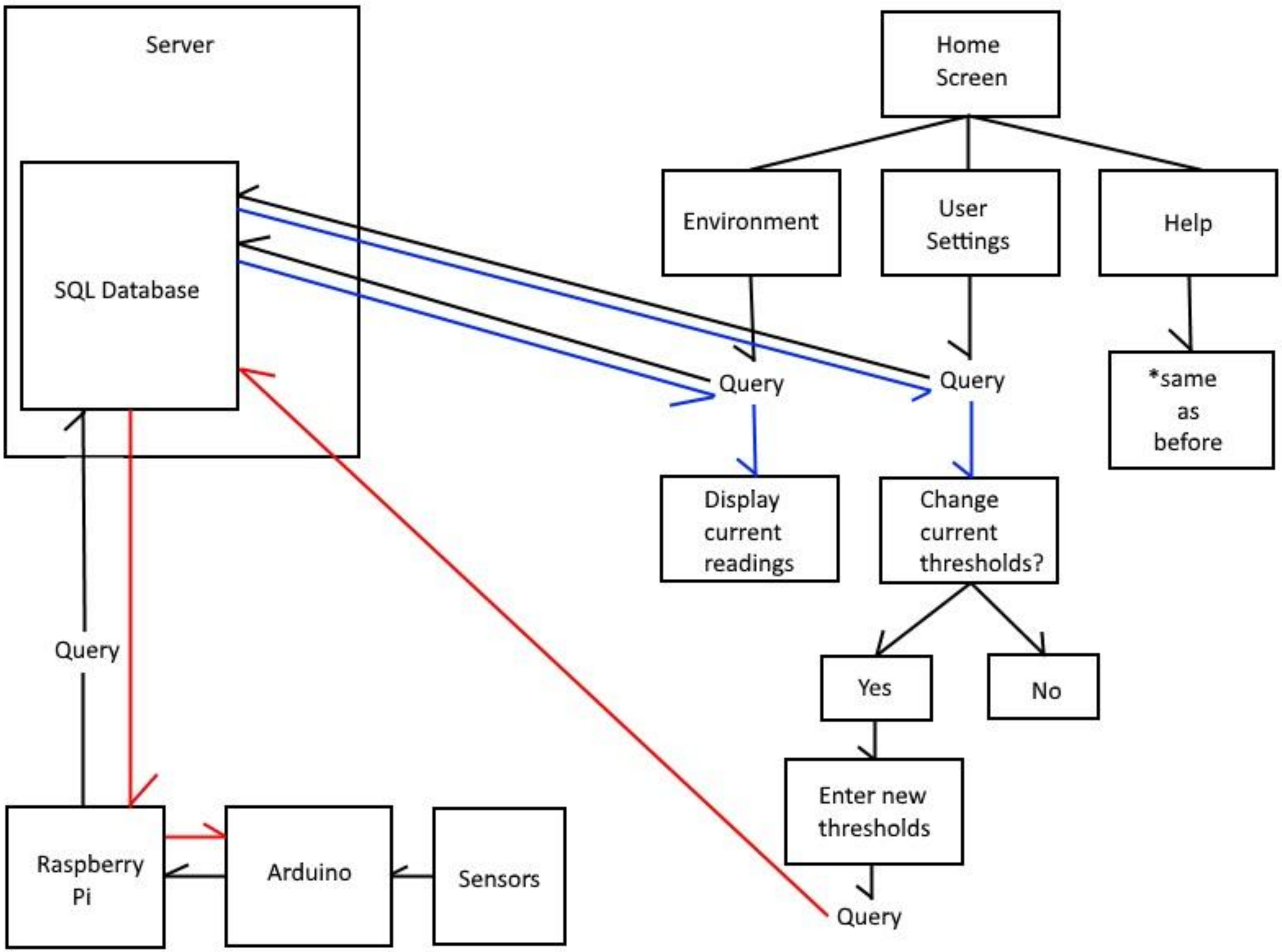
- Communication between Raspberry Pi and server using python's MySQLdb library.
  - Raspberry Pi can directly send mySQL queries to the database to update the values in the ActualValues table in the database
  - Updating the values in the table allows the app to pull accurate information to display to the user. The python script also pulls data from the TargetValues table and relays this information to the Arduino via the serial port



App System Design



App System Design



Design Validation Approach

- Conduct unit testing at various stages of development
- Calibrate and test all sensors
- System testing for actuator functionality
- Test wireless network system reliability
- Test user input and system interaction
- Test data transfer between Android, Raspberry Pi, and database
- Test mobile app functionality

Economic Analysis and Finalized Parts

- **Budget (Simplified):**
  - Sensors $125.17
  - Actuators $233.55
  - Microcontrollers $91.35
  - Various Misc. Materials $146.04
  - **Total: $730.39**
- **Economic Analysis**
  - Target audience: standard greenhouse audience
  - Parts used for prototype are common
  - Environment can be adjusted according to user
  - Sustainable

Team Roles

Team Member:	Project Area:
Jacqueline Vital	Team Leader, Finances, Actuator Control/Power Design
Morgan Simmons	Irrigation System Design and Implementation, Construction
Andrew Mirabile	Hardware Design & Implementation, Sensor Control
Brandon Donohue	App Design and Implementation, Hardware/Physical Construction
Jared Delapasse	Arduino-Raspberry Pi-Server Integration, Database Mgmt

Team Management

The team worked very well together.

Team management methods:

- Weekly tasks were assigned to each member.
- Each team member chose a project area to be responsible for.
- Communication through email and GroupMe.
- Many opportunities for team building when working together on the greenhouse.

Environmental, Social, Safety, Ethical Concerns

Societal Impact

- provides access to reliable plant growth in inhospitable climates
- teaches plant life cycles
- scalable for large communities

Safety Considerations

- water and electrical lines in close proximity

Environmental Impact

- small risk of local flooding due to ruptured water storage

Ethical Concerns

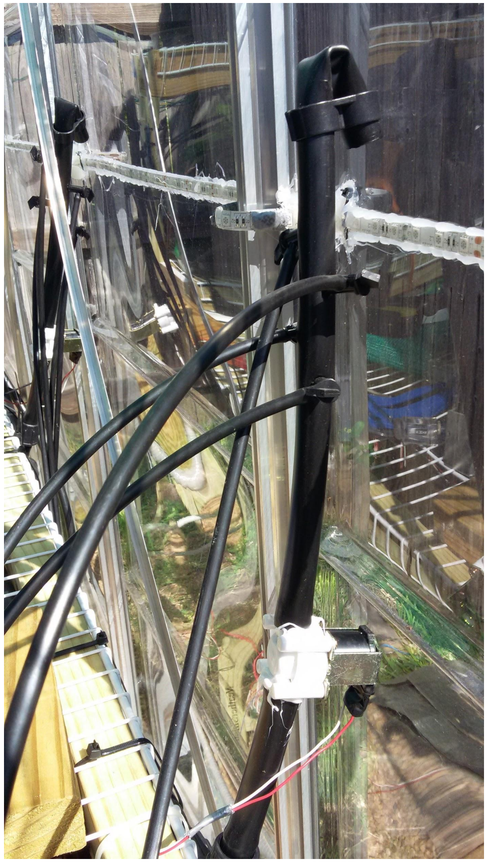
- privacy of user information, privacy of server

Results

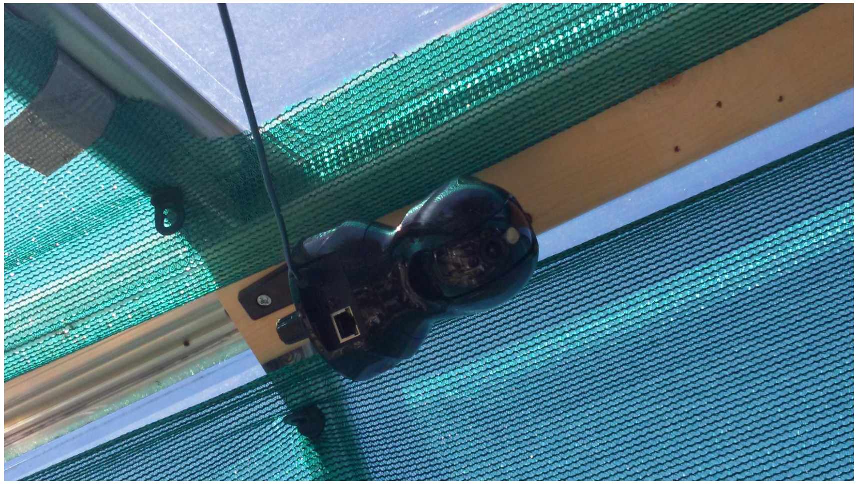
- Simplistic design
  - Low maintenance
  - Easily scalable
  - Low learning curve

- Future work:
  - Wire reduction
  - Data science/machine learning

Results




UNIFUN




Assembling the greenhouse!

Questions?