

Smart Health System For Plants

ECE 445- Fall 2022

Team 13

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Problem



- There are many families that have plants sitting at home but cannot take care of them due to various commitments
 - Plants wait for water and sunlight to be provided
- Many plants can die out hence owners either purchase a new plant or throw out the old one completely
- This is not only a problem of neglect, but also sustainability on a broader scope



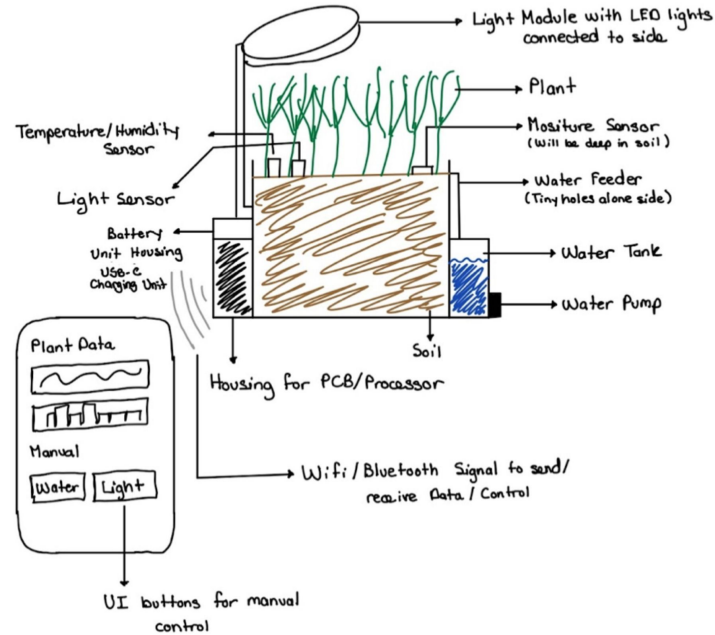
Solution



- Self sufficient plant stand, Smart Health System, and Phone App
- Different sensors used to measure values to determine exactly how much water/sunlight the plant will need
- Water pumped from our water reservoir straight to the roots while the light is above the plant and can provide different intensity when needed



Visual Aid

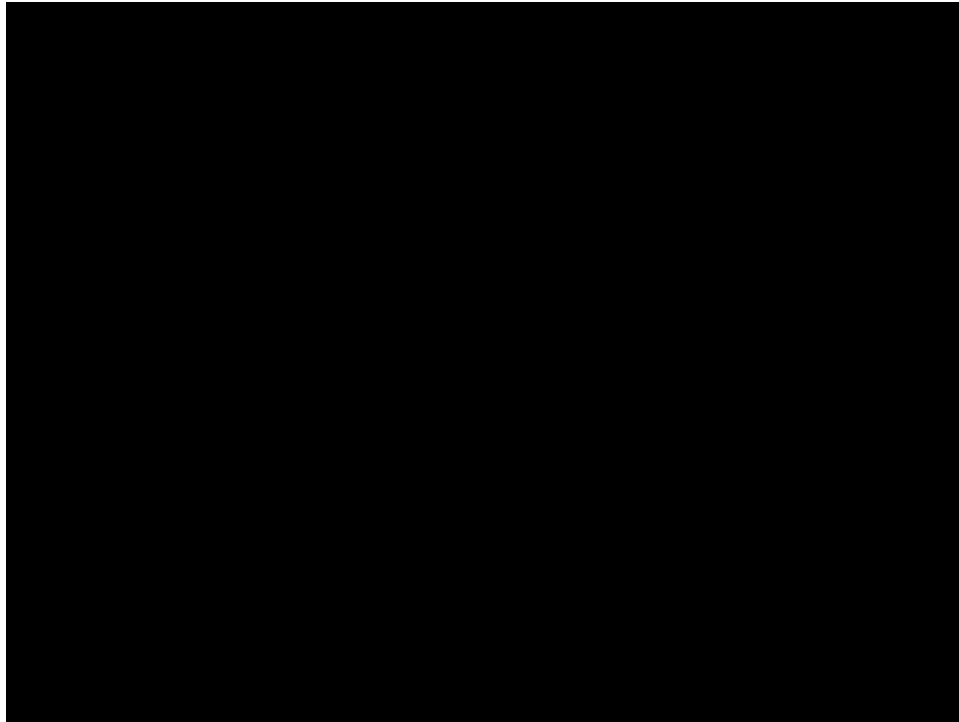


High Level Requirements



- The system should provide appropriate amount of water when required by the MCU/Microprocessor to do so using our created algorithm
- The system should provide appropriate amount of light when required by the MCU/Microprocessor to do so using our created algorithm
- MCU/Microprocessor is able to communicate with a central system that the phone app can poll from every few minutes and aggregate plant information and metrics to display to the user

Project Video



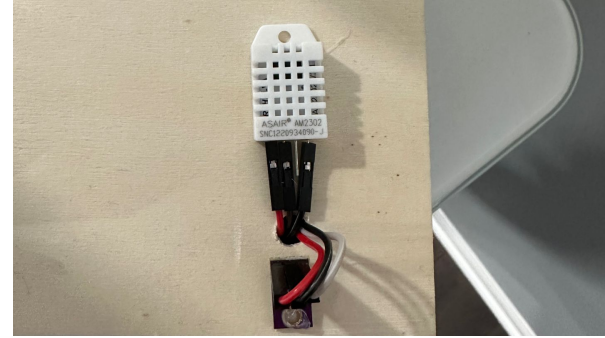
Project Images



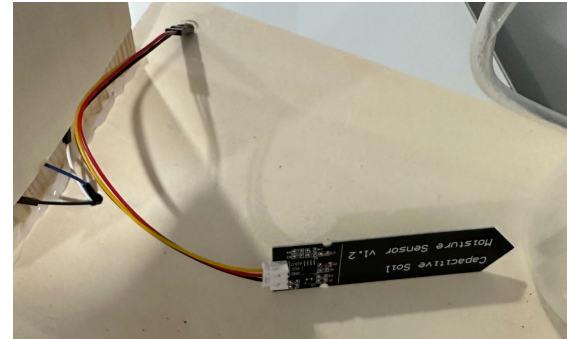
Full System



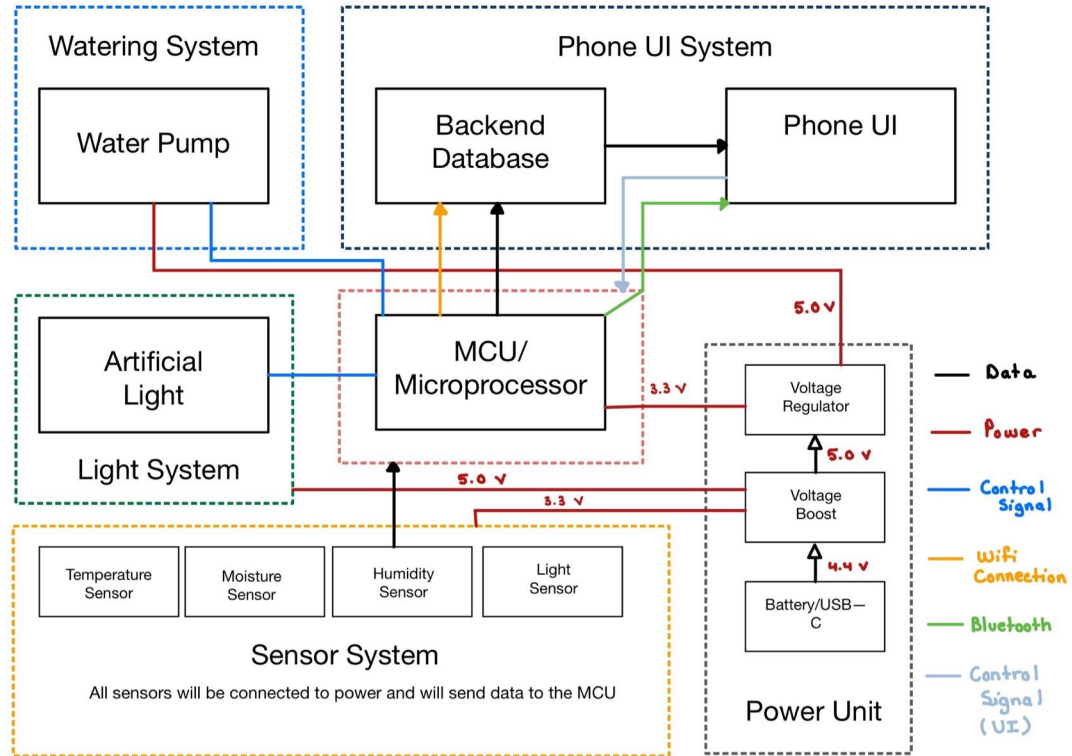
Water System



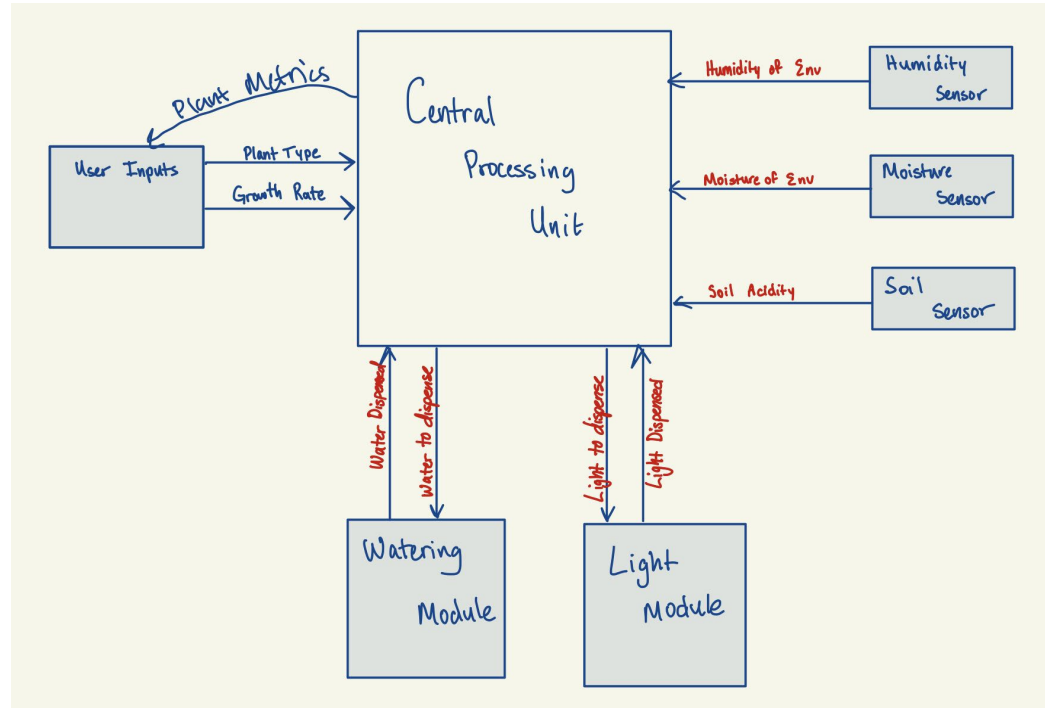
Sensor System



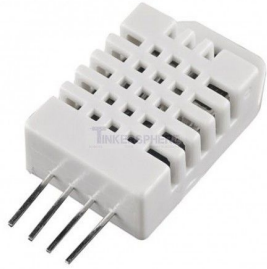
Block Diagram



System Overview



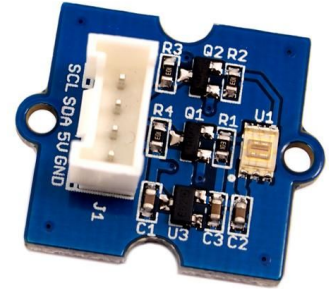
Sensors



Humidity & Temperature



Soil Moisture



Light

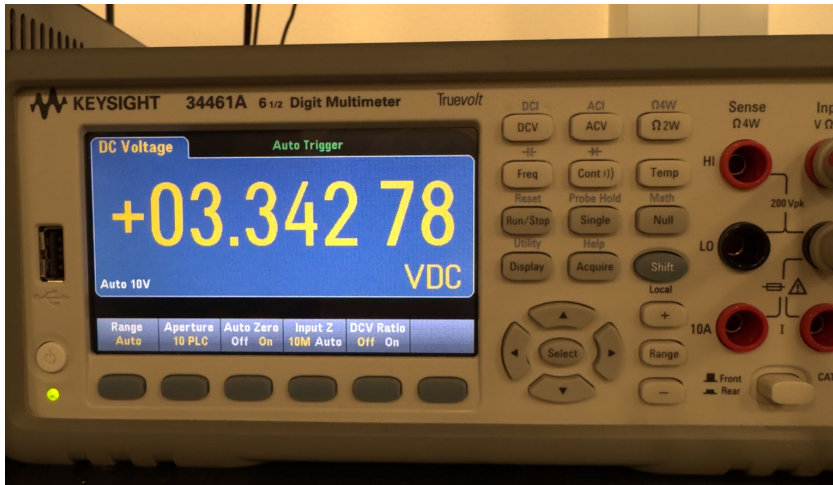
Microprocessor Results



- Get sensor readings every 2 minutes
- Send data to remote database every 2 minutes
- Poll for manual signals from the user



Power System Results



Voltage Regulator



Voltage Boost

Sensor Results



```
/dev/cu.SLAB_USBtoUART
Send

ets Jun  8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x17 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3ffff0018,len:4
load:0x3ffff001c,len:1044
load:0x40078000,len:10124
load:0x40080000,len:5856
entry 0x40080000
DHT22 Temp Sensor:
73.3 °F
DS18B20 Temp Sensor:
73.7 °F

☒ Autocroll ☐ Show timestamp Newline ☒ 115200 baud ☒ Clear output
```

Temperature Reading

```
/dev/cu.SLAB_USBtoUART
Send

configisp: 0, SPIWets Jun  8 2016 fets Jun  8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x17 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3ffff0018,len:4
load:0x3ffff001c,len:1044
load:0x40078000,len:10124
load:0x40080000,len:5856
entry 0x40080000
DHT22 Humidity Sensor:
34.6 %
DHT11 Humidity Sensor:
33.5 %

☒ Autocroll ☐ Show timestamp Newline ☒ 115200 baud ☒ Clear output
```

Humidity Reading

```
/dev/cu.SLAB_USBtoUART
Send

clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3ffff0018,len:4
load:0x3ffff001c,len:1044
load:0x40078000,len:10124
load:0x40080000,len:5856
entry 0x40080000
Capacitive Soil Moisture without Water:
0 %
Capacitive Soil Moisture with Water:
99.5 %
Resistive Soil Moisture Sensor without Water:
3.2 %
Resistive Soil Moisture Sensor with Water:
95.4 %

☒ Autocroll ☐ Show timestamp Newline ☒ 115200 baud ☒ Clear output
```

Soil Moisture Reading

```
/dev/cu.SLAB_USBtoUART
Send

clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3ffff0018,len:4
load:0x3ffff001c,len:1044
load:0x40078000,len:10124
load:0x40080000,len:5856
entry 0x40080000
TGMT6000 Ambient Light Sensor in Dark Room:
50 Lux
TGMT6000 Ambient Light Sensor in Bright Room:
4567 Lux
BH1750 Ambient Light Sensor in Dark Room:
0 Lux
BH1750 Ambient Light Sensor in Bright Room:
4890 Lux

☒ Autocroll ☐ Show timestamp Newline ☒ 115200 baud ☒ Clear output
```

Light Sensor Reading

Database Results



HumiditySensorDataHistory	d0
+ Add document	+ Start collection
d0	+ Add field
d10	sensorValue: 38.1
d11	time: 0
d12	timestamp: "November 23 2022 01:32"
d13	
d14	
d15	
d16	
d17	
d18	
d2	
d3	
d4	
d5	

Data Collection History

HumiditySensorDataCurrent	d0
+ Add document	+ Start collection
d0	+ Add field
	sensorValue: 37.7
	timestamp: "November 23 2022 01:51"

Current Data Collection

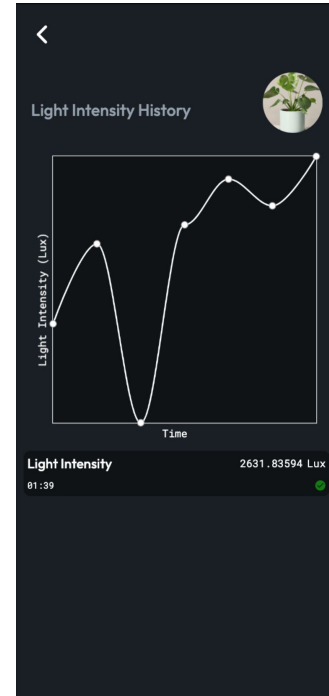
manualLight	lightSignal
+ Add document	+ Start collection
lightSignal	+ Add field
	signal: 0

Manual Light Signal

Phone App Results



Home Page

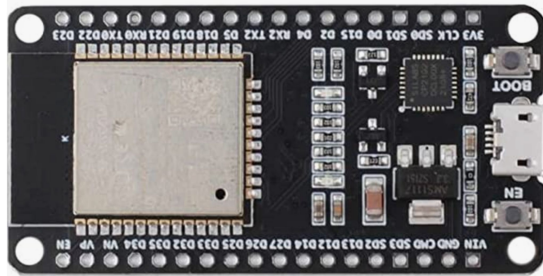


Light Intensity Chart

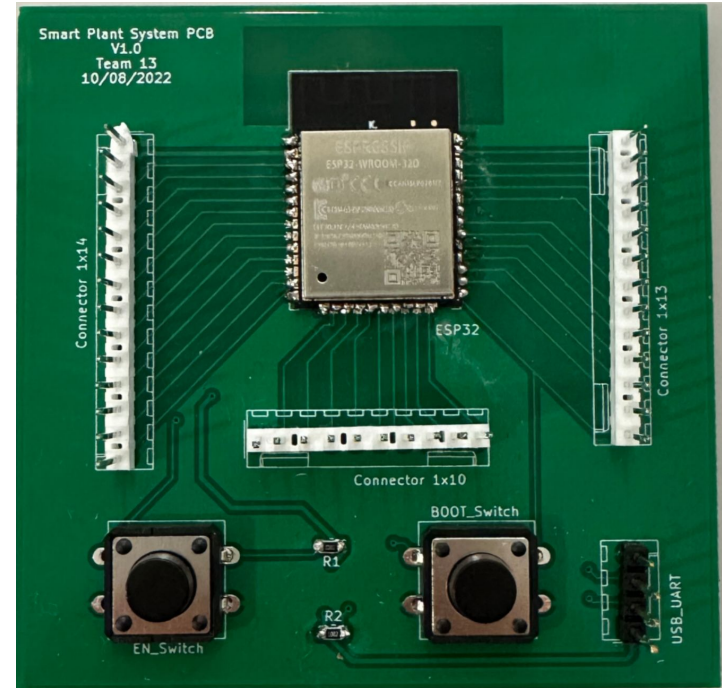
Challenges-PCB



- Difficulties lied in soldering the ESP32 chip onto the PCB
- Buttons were connected suboptimally
- Used ESP32 DevKit instead for functionality



ESP32 DevKit



PCB after soldering on chip and other parts

Successes



- Full System Integration from Hardware to Software
- System able to make decisions from plant metics
- User is able to see plant metics in phone UI and send signal to system

Plans for Future Work



- Implement a second light sensor directly under the light source to obtain a more accurate reading
- Increase App Functionality for User
- Scale up the design to accommodate for multiple plants or a row of plants
 - Greater number of light sensors to ensure each plant is receiving adequate light
 - Larger water reservoir with multiple pumps for each plant



Thank you!