Herb Chamber

SDP 21 Team 28
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Problem Statement

Many people are thinking about becoming more self-sufficient and growing some of their own herbs at home but are stopped at the starting point due to many requirements they need to care for the plants. Even without a green thumb, the Herb Chamber can monitor every factor that is needed to grow a garden successfully and take care of it for you, such as soil moisture, air temperature, air humidity, lighting duration and more. Herb Chamber can send you a reminder when it is time to harvest and will allow you to see your home garden from anywhere in the world. This allows you to cross the threshold without needing to do much work yourself.

System Specifications

1. Compact indoor form that fits on most tables
   a. 4 Soil containers
   b. Compact tent enclosure 23” x 23” x 42”
2. Power supply
   a. Low cost, low power system that delivers 50W
3. IP65 water and dust resistance rating
4. Water system
   a. 1x 12V DC pump with ½ inch tubing
   b. 4x 12V DC solenoid controlled watering channel with ½ inch tubing
5. Light System
   a. Indoor grow light
6. Sensor System
   a. humidity/temperature module
   b. moisture sensor
7. Product app interface
   a. Connected with a wifi module allowing remote access
   b. Displays various measured parameters
   c. Default plant directory for optimal growth

Duoc’s FDR Deliverables

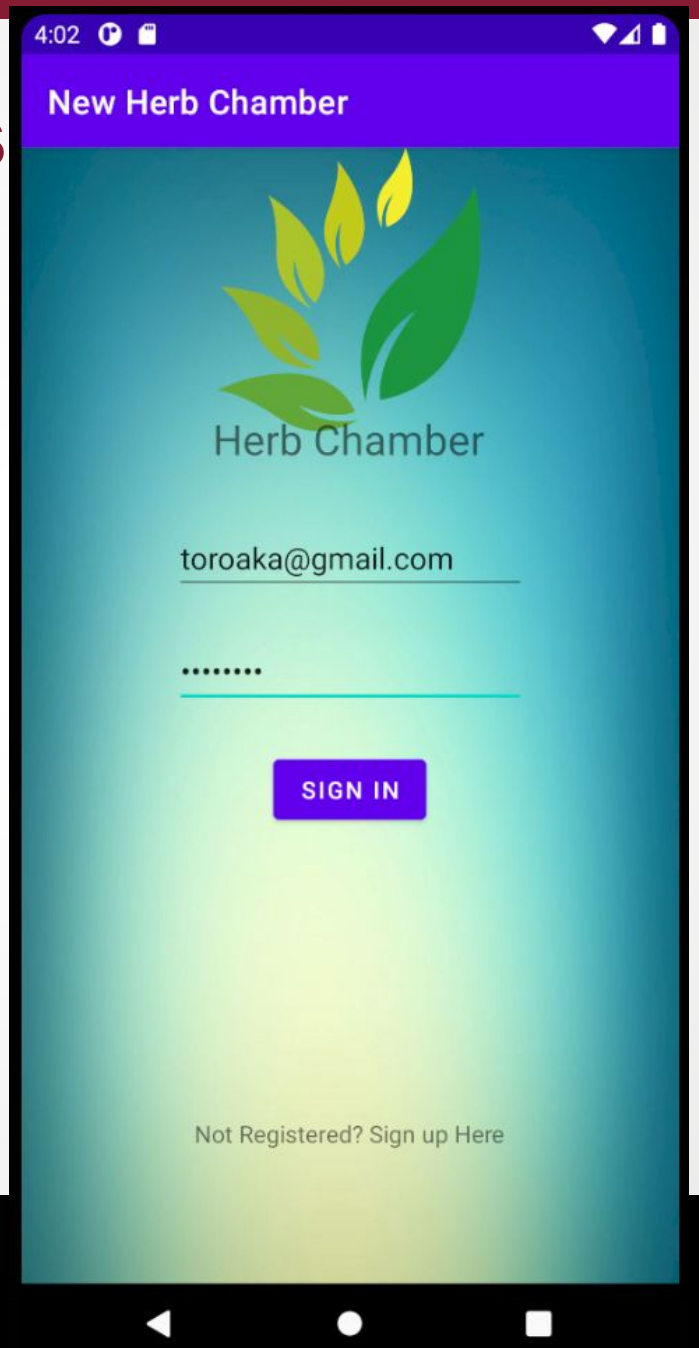
Worked with:

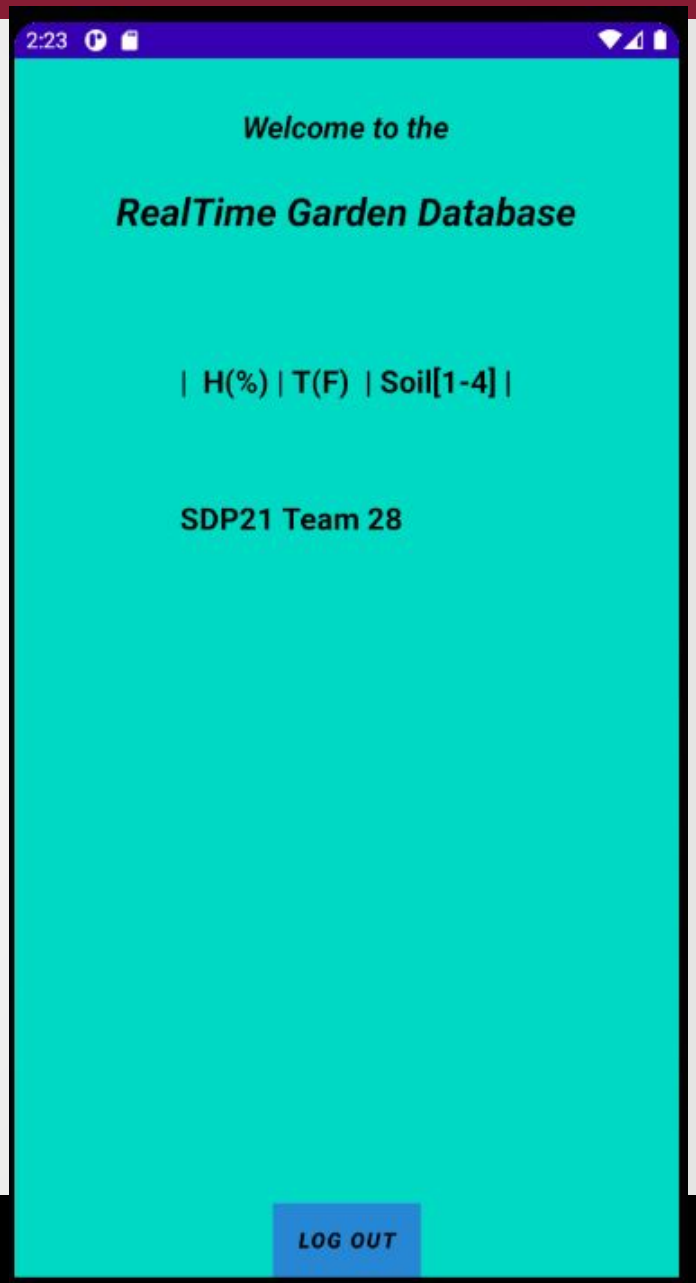
- DHT11 humidity and temperature Sensor
- Capacitive soil sensor
- ESP8266/WROOM-02

Using what I was working with for CDR, I created an app with similar uses to the one shown during the CDR demo.

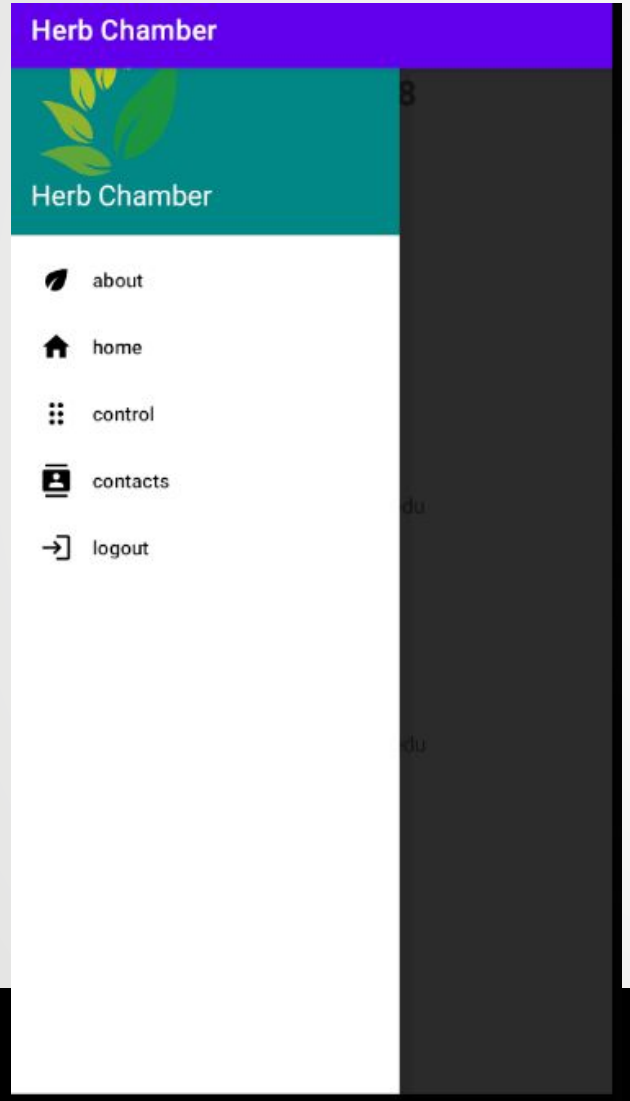
Duoc's CDR Deliverables

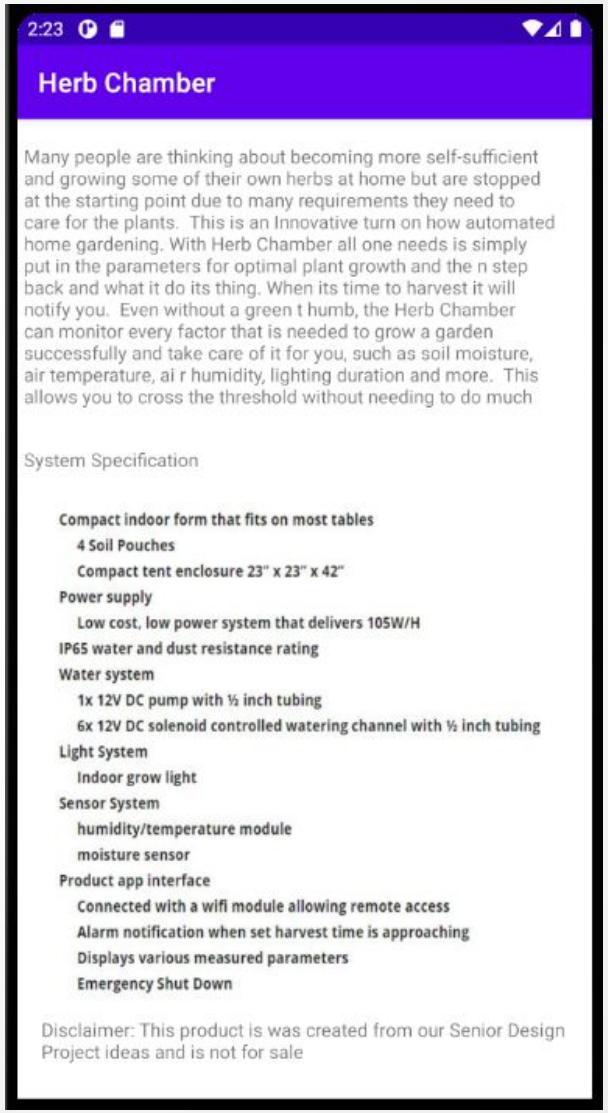
Using Android Studio with Java to create a standalone application for our project: Herb Chamber

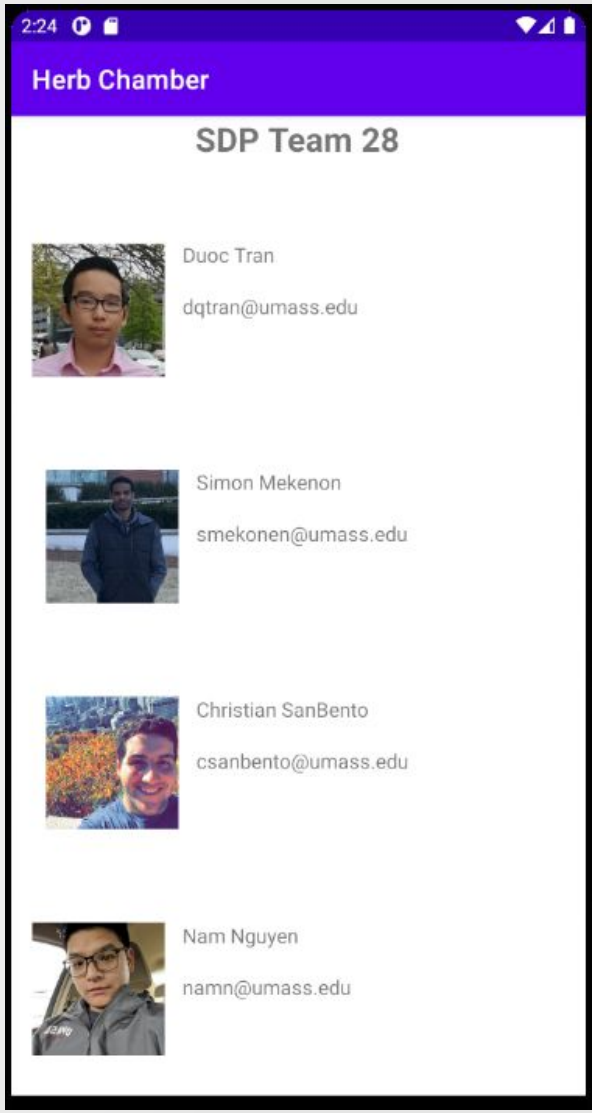




Duoc's FDR Deliverables







Simon's FPR Deliverables

- Convert Arduino code into C code to run on the ESP8266
- Adjust design to use ESP8266 as the main processor
  - Analog multiplexer for sensors
  - Removing serial connection

GPIO Implementation

7.1.1. PIN-Related Macros

The following macros are used to control the GPIO pins' status.

`PIN_PULLUP_DIS(PIN_NAME)`	Disable pin pull-up.	Example:
		`// Use MTDI pin as GPIO12.`
		`PIN_FUNC_SELECT(PERIPHS_IO_MUX_MTDI_U, FUNC_GPIO12);`

`PIN_PULLUP_EN(PIN_NAME)`	Enable pin pull up.	
`PIN_FUNC_SELECT(PIN_NAME, FUNC)`	Select pin function.	

7.1.2. gpio_output_set

Function	Set GPIO property.

Prototype	`void gpio_output_set(`
	`  uint32 set_mask,`
	`  uint32 clear_mask,`
	`  uint32 enable_mask,`
	`  uint32 disable_mask`
	`)`

Parameter	`uint32 set_mask`: set high output; 1: high output; 0: no status change; `uint32 clear_mask`: set low output; 1: low output; 0: no status change; `uint32 enable_mask`: enable output bit; `uint32 disable_mask`: enable input bit.
Return	none
Example	`gpio_output_set(BIT12, 0, BIT12, 0)`: Set GPIO12 as high-level output. `gpio_output_set(0, BIT12, BIT12, 0)`: Set GPIO12 as low-level output. `gpio_output_set(BIT12, BIT13, BIT12|BIT13, 0)`: Set GPIO12 as high-level output, and GPIO13 as low-level output. `gpio_output_set(0, 0, 0, BIT12)`: Set GPIO12 as input.

```
void digitalWrite2(uint8_t pin, uint8_t val){
  if(val) gpio_output_set((1 << pin), 0, 0, 0);
  else gpio_output_set(0, (1 << pin), 0, 0);
}


int analogRead2(){
  return system_adc_read();
}

void delay2(int msec){
  int ms = 1000*msec;
  int endTime = system_get_time() + ms;

  while (system_get_time() < endTime){
    ESP.wdtFeed();
  }
}


int map2(int x, int min1, int max1, int min2, int max2)
{
  return (x - min1)*(max2 - min2)/(max1 - min1) + min2;
}
```

Sample code - Timer setup

```
static os_timer_t main_timer;
static os_timer_t delay_timer;

static void main_timer_handler(void *prv);
static void delay_timer_handler(void *prv);
```

```
os_timer_setfn(&main_timer, (os_timer_func_t *)main_timer_handler, NULL);
os_timer_arm(&main_timer, inputProcessInterval, 0);
```

```
void delay2(int msec){
  int ms = 1000*msec;
  int endTime = system_get_time() + ms;

  while (system_get_time() < endTime){
    ESP.wdtFeed();
  }
}
```

Analog multiplexor

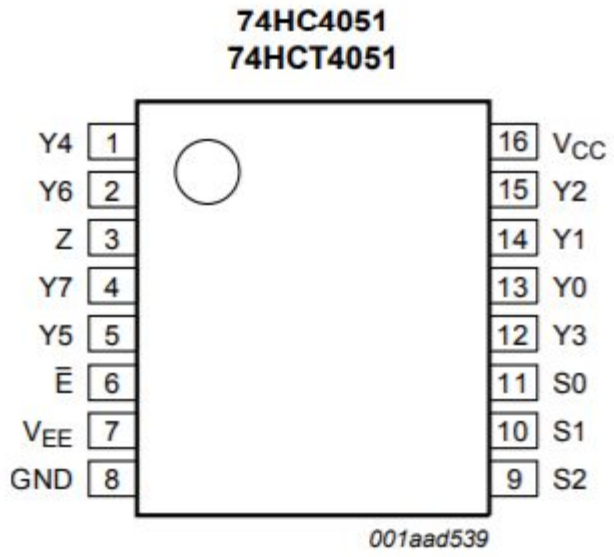


Figure 5. Pin configuration SO16, and (T)SSOP16

Table 2. Pin description

Symbol	Pin	Description
$\overline{E}$	6	enable input (active LOW)
V_{EE}	7	supply voltage
GND	8	ground supply voltage
S0, S1, S2	11, 10, 9	select input
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7	13, 14, 15, 12, 1, 5, 2, 4	independent input or output
Z	3	common output or input
V_{CC}	16	supply voltage

Christian’s FPR Deliverables

My Deliverables include:

- Learning to Solder
- Finish Populating the PCB

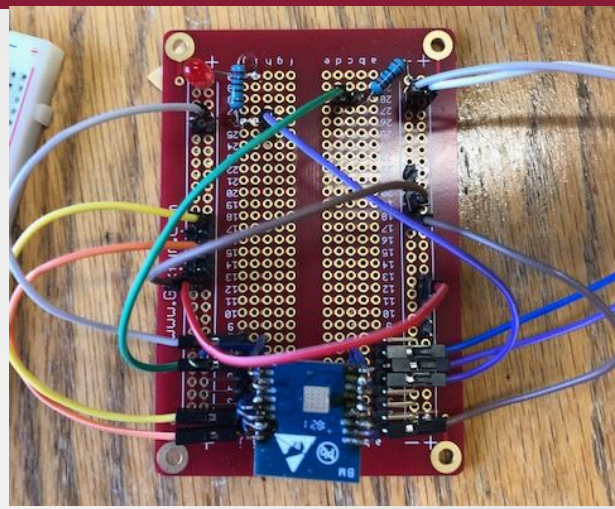
I will primarily be focusing on the PCB design, going through youtube videos to figure out the best way to solder the several parts that we needed and getting the parts that we have ordered onto the board as neatly as possible.

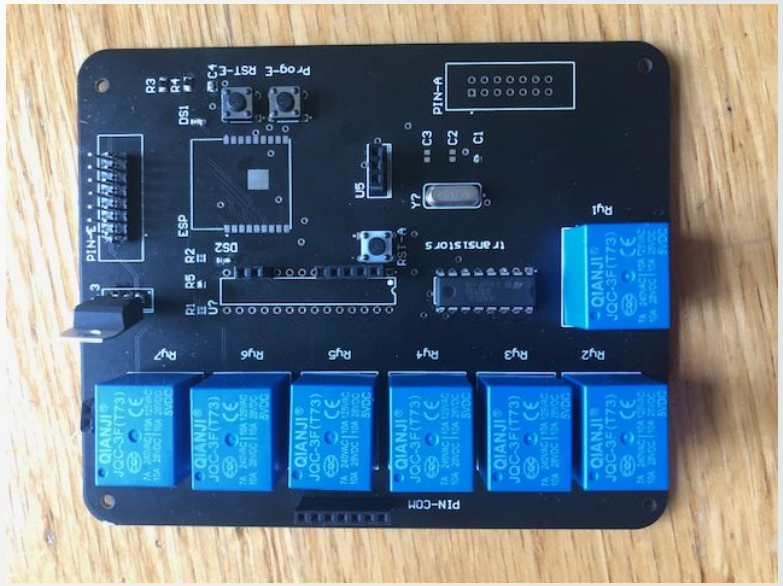
Christian’s part with the PCB

- Some research to learn how to Solder parts onto the PCB
  - youtube clips
  - Difficult at first, got easier the more i did

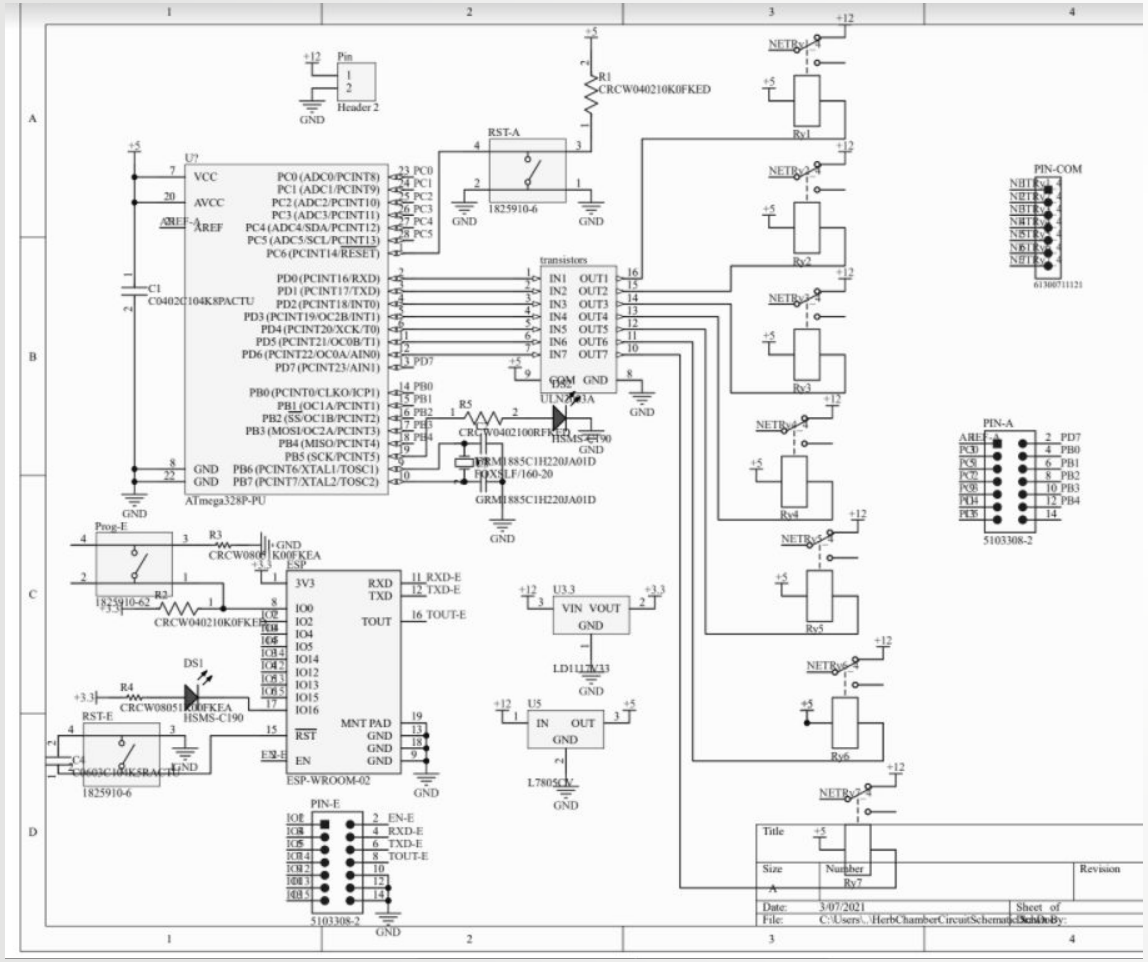
- PCB design
  - most parts on board
  - issue with ESP on board
  - Didn’t realize how small parts were
  - Two parts didn’t arrive

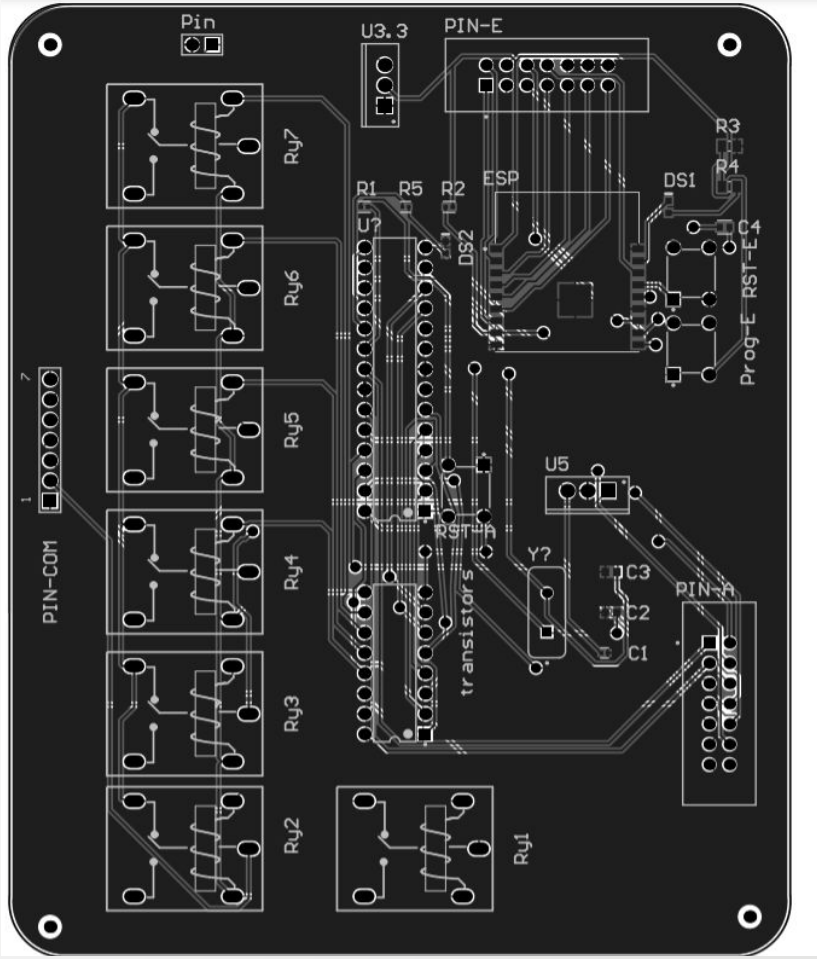
- Redesign
  - Taking out the Atmega, only using ESP
  - did not have time to order new PCB





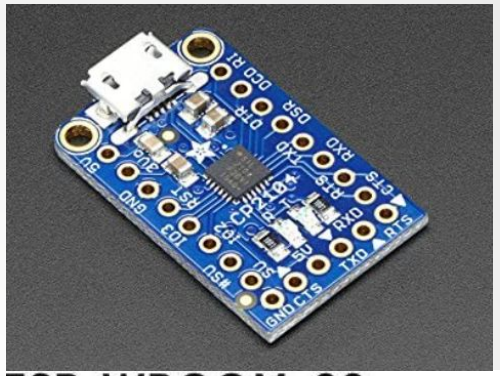
PCB Schematic and Board layout



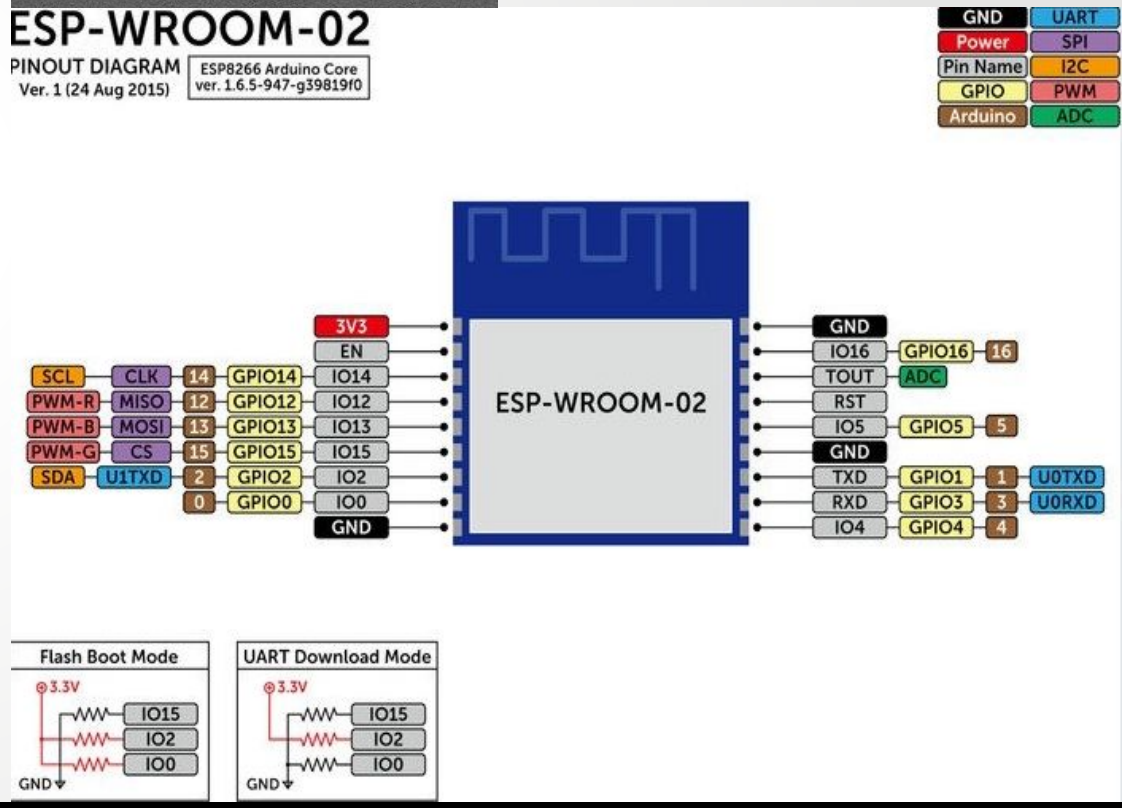


Nam's FPR Deliverables

- **Research on how to upload and run program to ESP-WROOM-02**
  - To communicate with the esp, we need a usb to serial converter



  - UART Download Mode: Pull up IO2, pull down IO15 and IO0



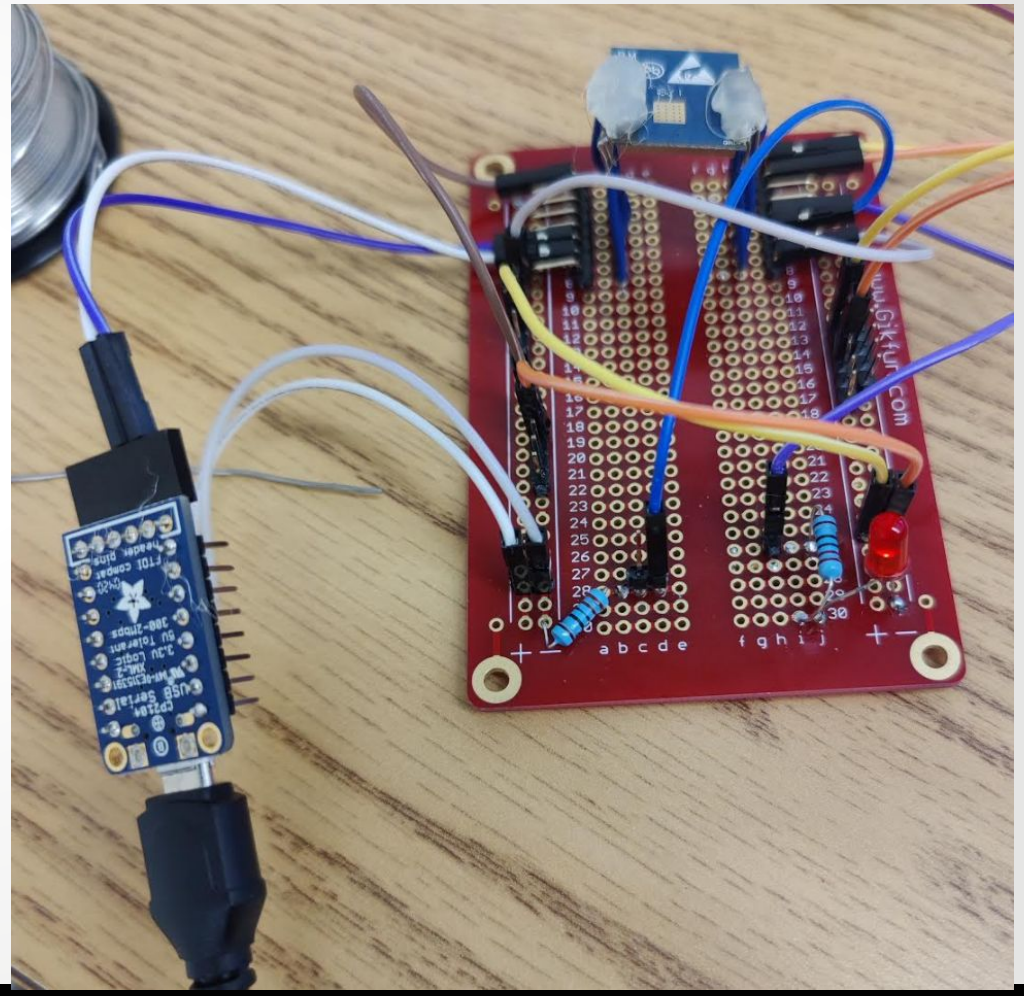
  - Flash Boot Mode: Pull up IO2, IO0, and pull down IO15

Debugging ESP-WROOM-02

- Our esp-wroom-02 does not work with our custom PCB

  Solution: we have to attach it to a protoboard

- At of the moment, the vroom is still not fully configured and debugged



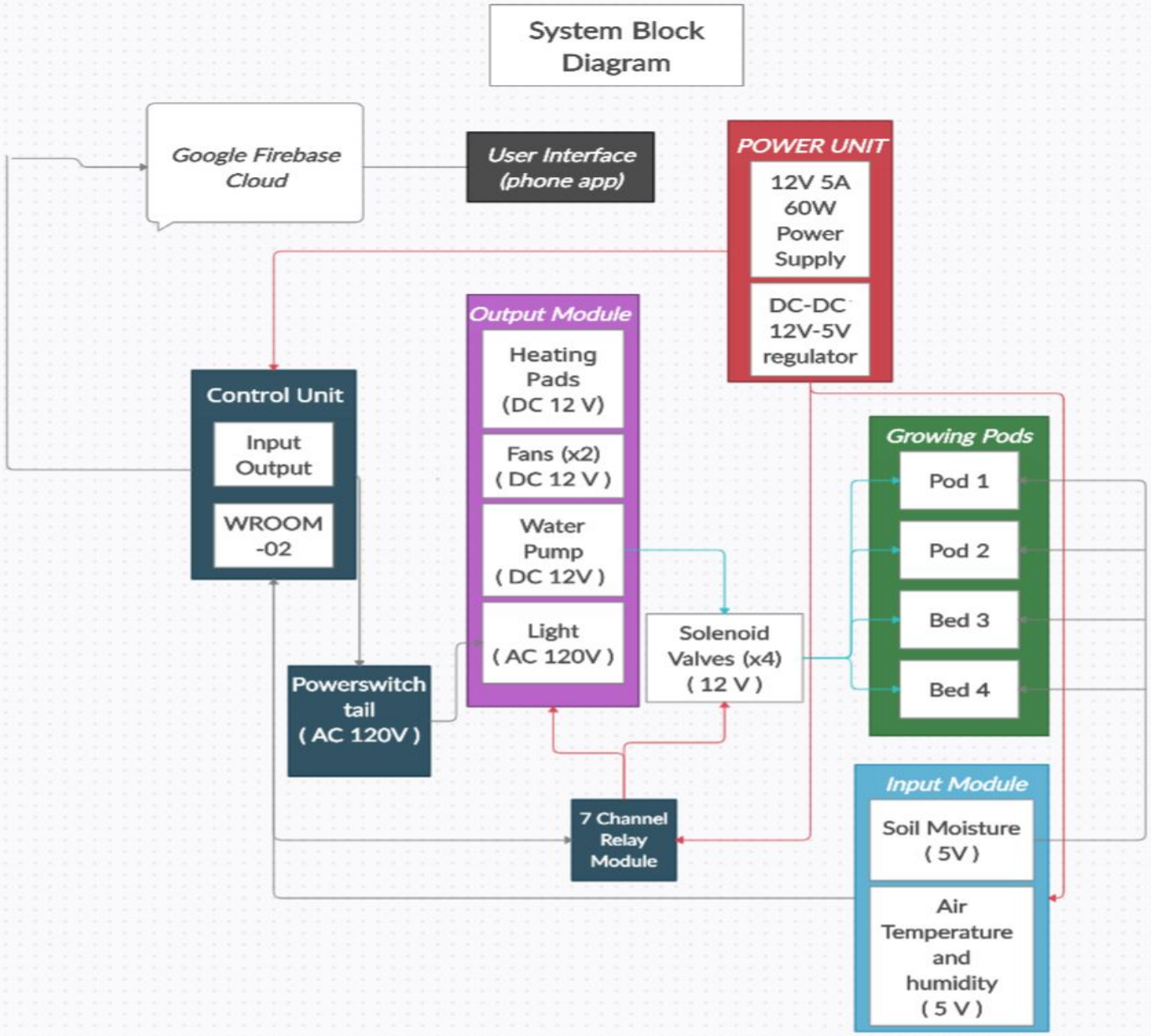
Hardware Diagram

Power Unit: 12V, 5A

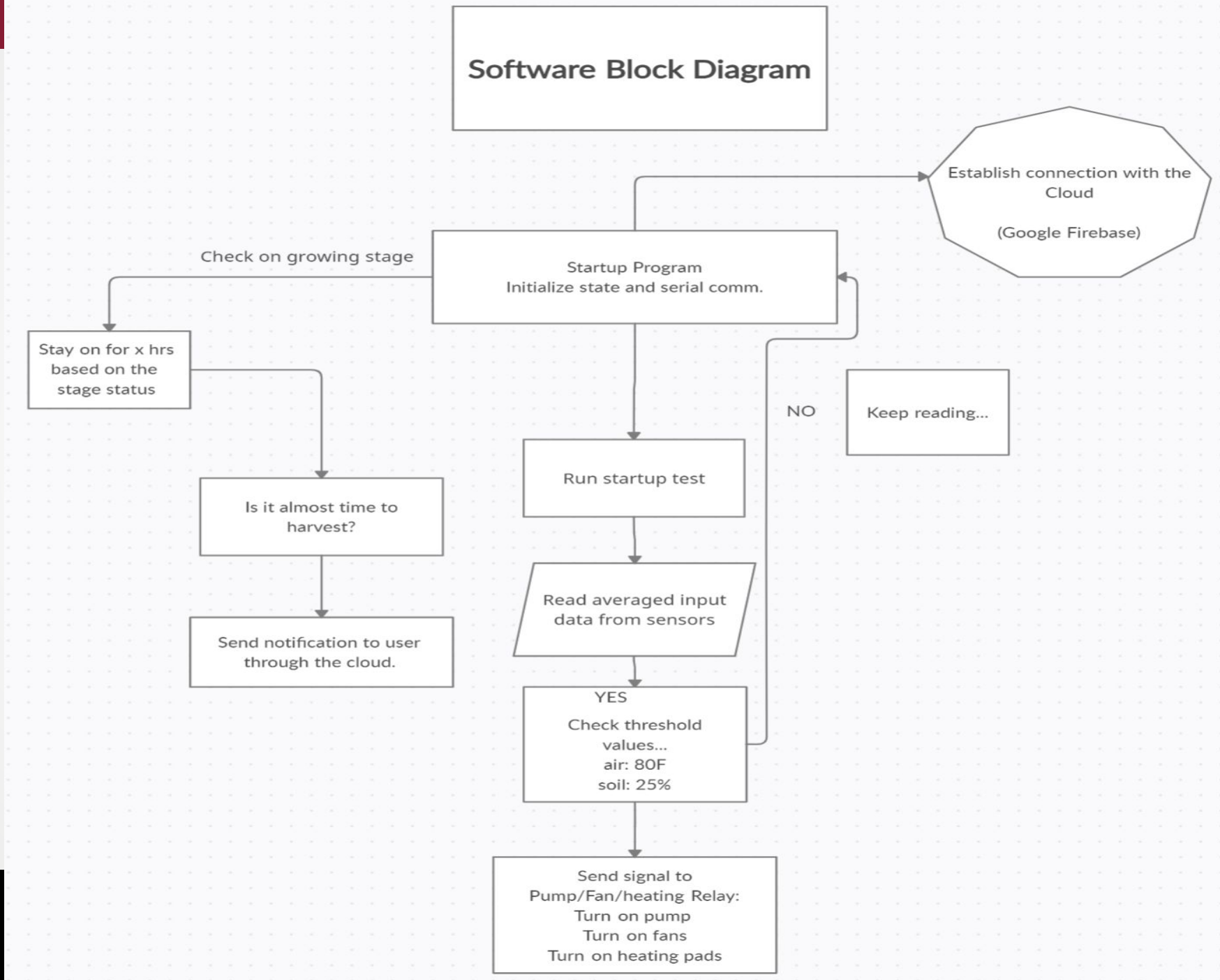
Control and Cloud unit: ESP-WROOM-02

Sensors:
Capacitive Soil Moisture
DHT11 Air Temperature and Humidity

Relay Unit: Controlling fans, heating pads, light, and pump solenoids



Software Diagram



Current Project Expenditure

2	**Team Number**	28		**Order Total:**	$460.56
3	**Team Member Contact Name**				
4	**Date**	11/17/2020			
5					
6					
7	Item Description	Link	Unit Price	Qty	Line Total
8	Relays	https://www.amazon.com/ELEGOO-Channel-Opto	$10.00	1	$10.00
9	Solenoid valves (x3)	https://www.amazon.com/Ximimark-Electric-Solen	$11.00	3	$33.00
10	Moisture sensors (x2)	https://www.amazon.com/Gikfun-Capacitive-Corro	$8.50	2	$17.00
11	Growth tent	https://www.amazon.com/VIVOSUN-Hydroponic-C	$65.00	1	$65.00
12	Growth light	https://www.amazon.com/Growing-Spectrum-Hydr	$27.00	1	$27.00
13	120mm fans	https://www.amazon.com/Antec-F12-Performance	$25.00	1	$25.00
14	Garden Soil	https://www.homedepot.com/p/Miracle-Gro-Moistu	$8.50	1	$8.50
15	Tubing 1/2"	https://www.amazon.com/pond-boss-8719800121	$9.00	2	$18.00
16	Water pumps	https://www.amazon.com/dp/B07W59D21M/ref=sy	$11.00	1	$11.00
17	Relays (x10)	https://www.amazon.com/gp/product/B07MQVQPI	$10.00	1	$10.00
18	Heating pad	https://www.amazon.com/Antec-F12-Performance	$16.00	1	$16.00
19	Solenoid valves (x2)	https://www.amazon.com/Ximimark-Electric-Solen	$11.00	1	$10.00
20					
21	Humidity sensor	https://www.amazon.com/KeeYees-Temperature-H	$14.00	1	$14.00
22	Liquid Nutrients	https://www.homedepot.com/p/AeroGarden-1-Lite	$28.50	1	$28.50
23	Irrigation Fittings Kit	https://www.amazon.com/Habitech-Irrigation-Fittin	$12.00	1	$12.00
24	Fabric Grow Bags	https://www.amazon.com/VIVOSUN-5-Pack-Thick	$16.00	1	$16.00
25	DC Water Pump	https://www.amazon.com/dp/B07W59D21M/ref=sy	$19.00	1	$19.00
26					
27	PCB (x10)	https://www.amazon.com/gp/product/B00J3MHRN	$55.00	1	$55.00
28	DC converter	https://www.amazon.com/gp/product/B00J3MHRN	$9.00	1	$9.00
29	ESP-WROOM-02	https://www.amazon.com/HiLetgo-ESP-WROOM-	$16.90	1	$16.00
30	Arduino Nano	https://www.amazon.com/gp/product/B07G99NNX	$14.00	1	$14.00
31	ATMEGA328P	https://www.amazon.com/gp/product/B07PZWYW	$8.00	1	$8.00
32	Transistor chip	https://www.amazon.com/gp/product/B00MMZ8K>	$3.00	1	$3.00
33	parts for PCB		$15.56	1	$15.56

Demo

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Question and Answer
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