Herb Chamber

SDP 21 Team 28
Simon, Nam, Duoc, Christian
Advisor: Prof. Siqueira

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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. Alarm notification when set harvest time is approaching
    c. Displays various measured parameters
    d. Adjustable water/light given to plants
    e. Default plant directory for optimal growth

Duoc's CDR Deliverables

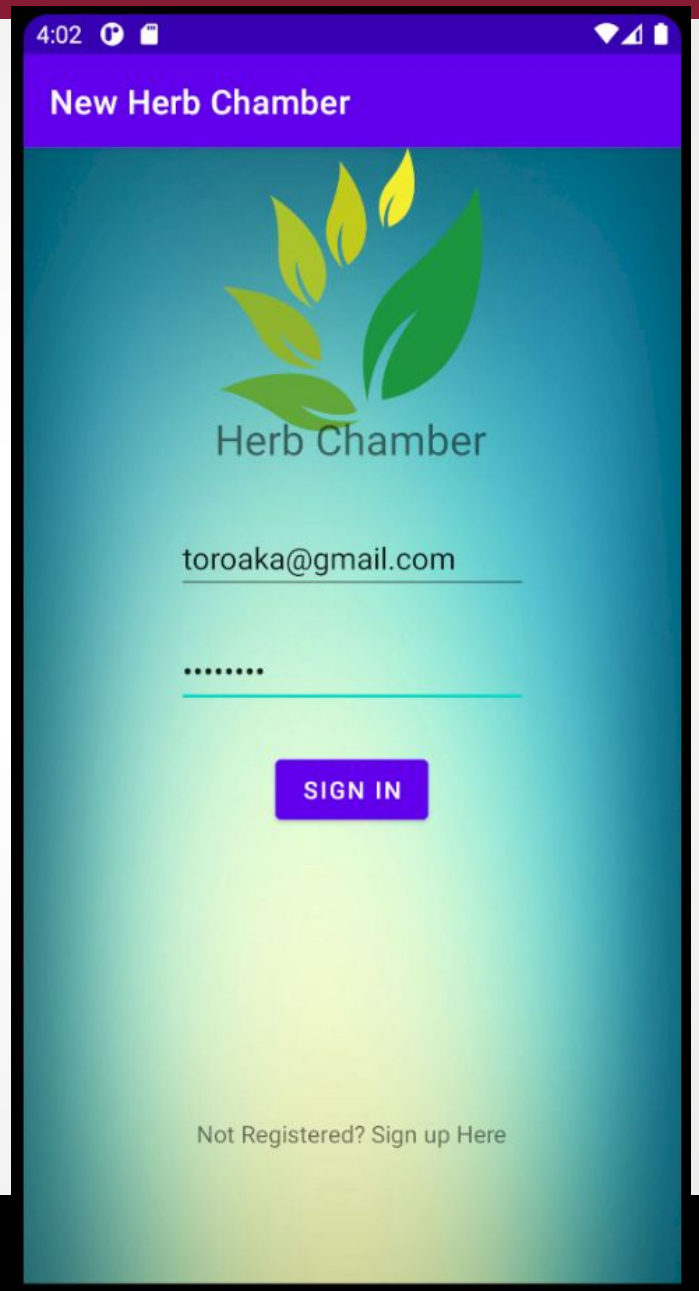
Worked with:

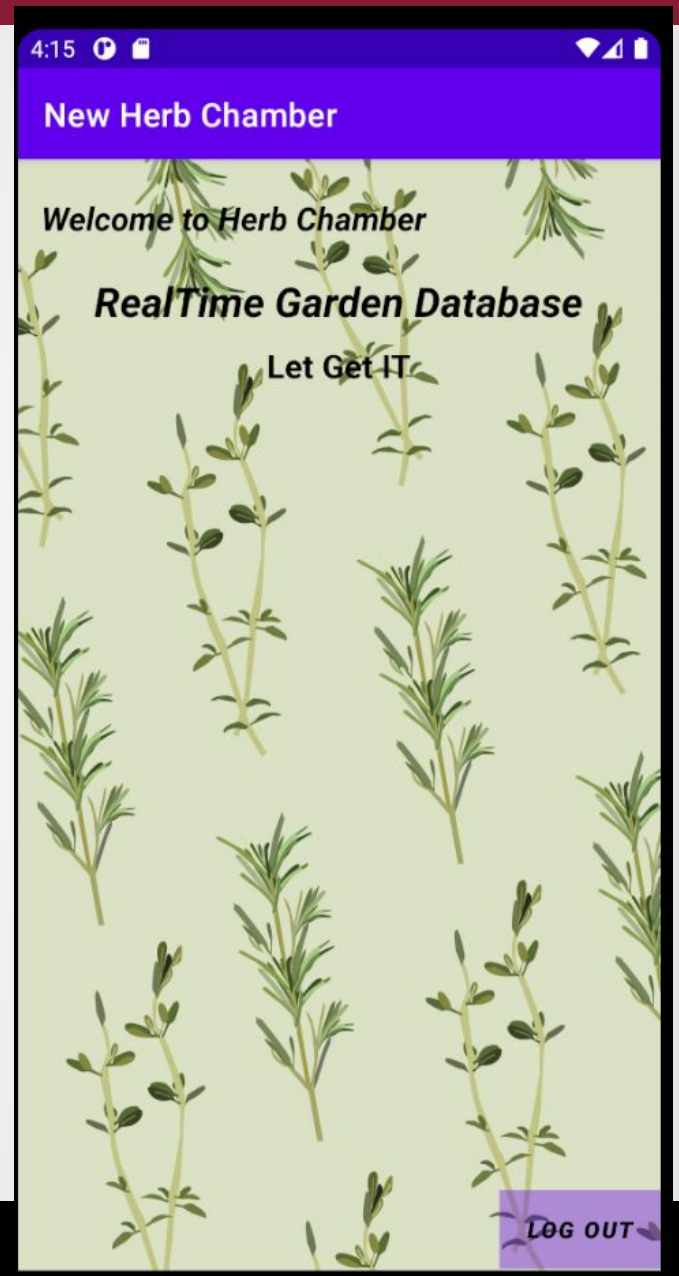
- DHT11 humidity and temperature Sensor
- Capacitive soil sensor
- ESP8266
- Arduino NANO

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

Duoc's CDR Deliverables

Using Android Studio with Java



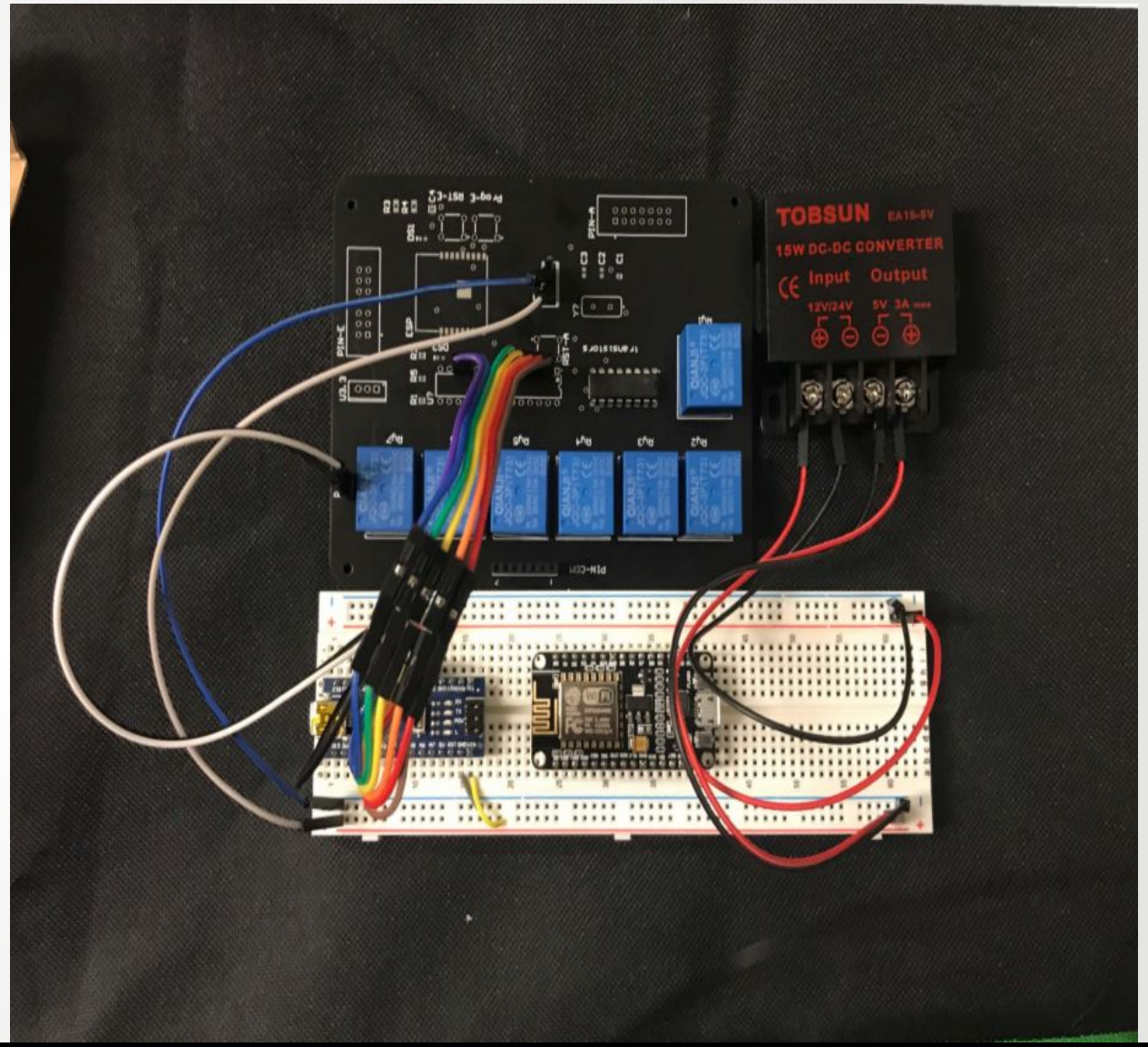


Simon's CDR Deliverables

- Integrating the code from the other subsystems and ensuring they work together.
- Implementing the PCB functionality on breadboard
- Arduino code to C code that can run on the ATMEGA328P chip.

Integrated System

1. Arduino and sensors
2. PCB and relays
3. ESP and Firebase realtime data
4. User's app



Christian's CDR Deliverables

My Deliverables include:

- Altium Research
- PCB

I will primarily be focusing on the PCB design, making sure I incorporate all the necessary components needed for our system and making sure it looks nice and clean. I will need to do a major amount of research to gain a better understanding of Altium and how I will be able to use it in our project

Christian's part with the PCB

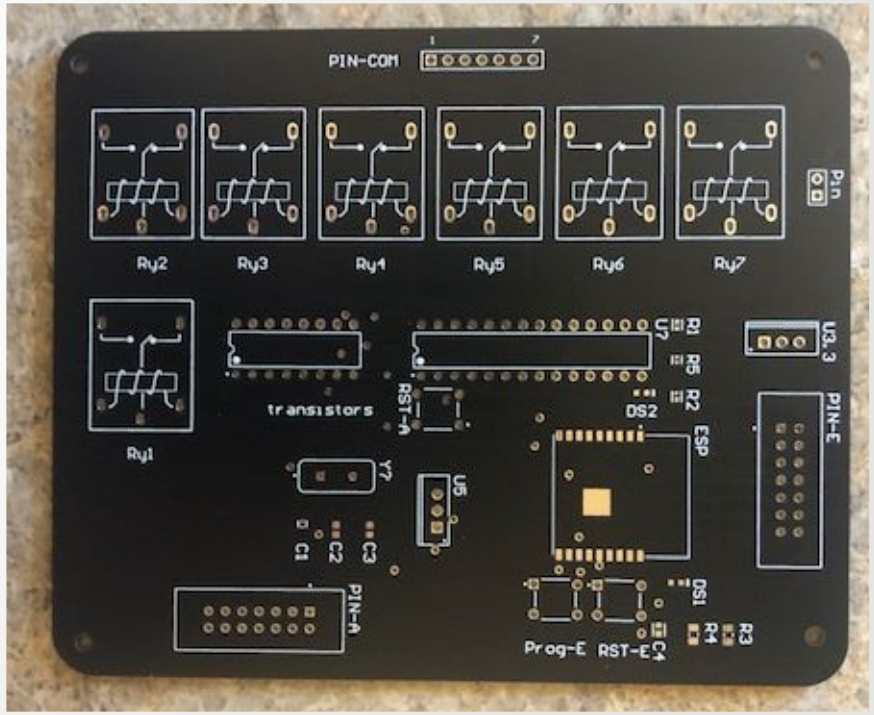
ALTIUM DESIGNER

- A lot of research to learn how to use Altium and how to navigate through it.
  - went through the M5 youtube series
  - went to the altium review sessions
  - google very helpful

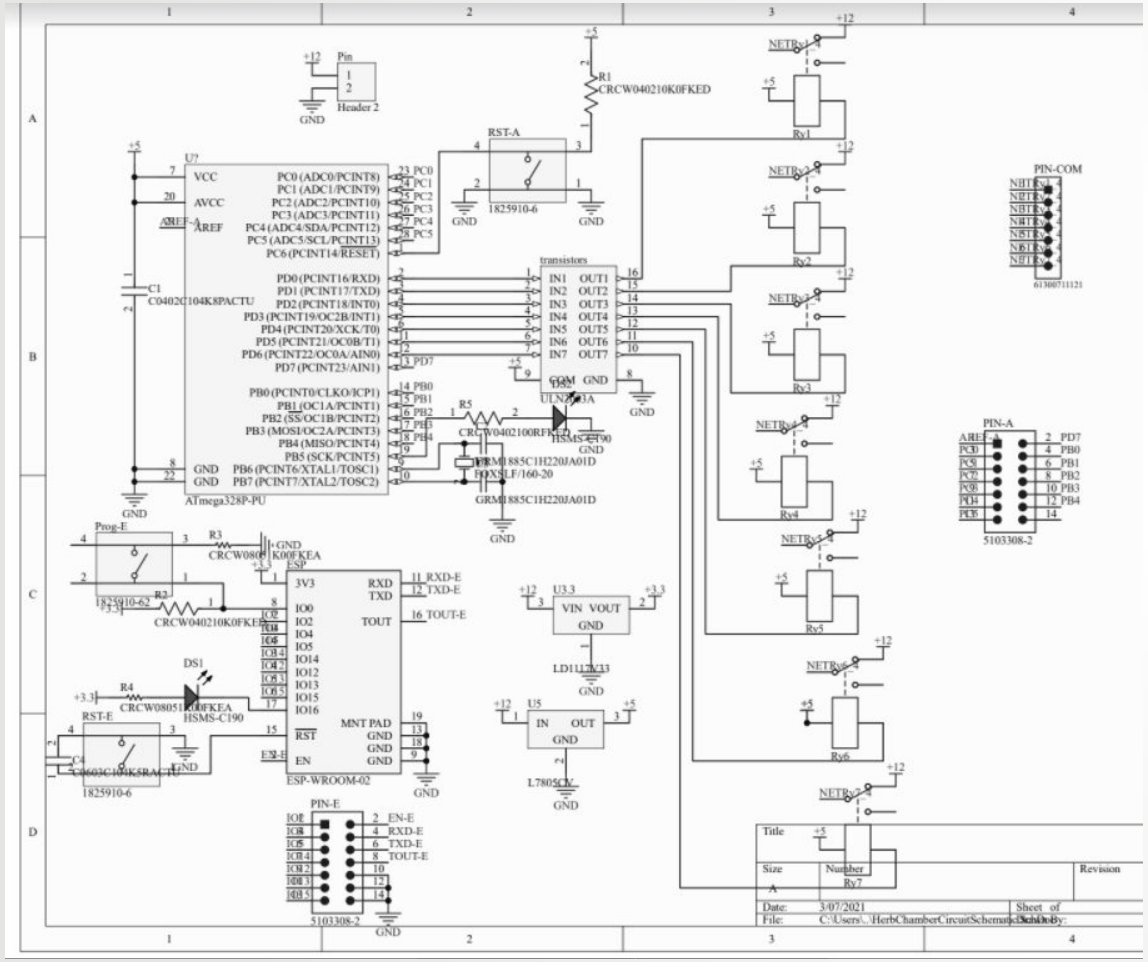
- PCB Schematic
  - finding all the components
  - wiring everything together
  - correct values for resistors and capacitors

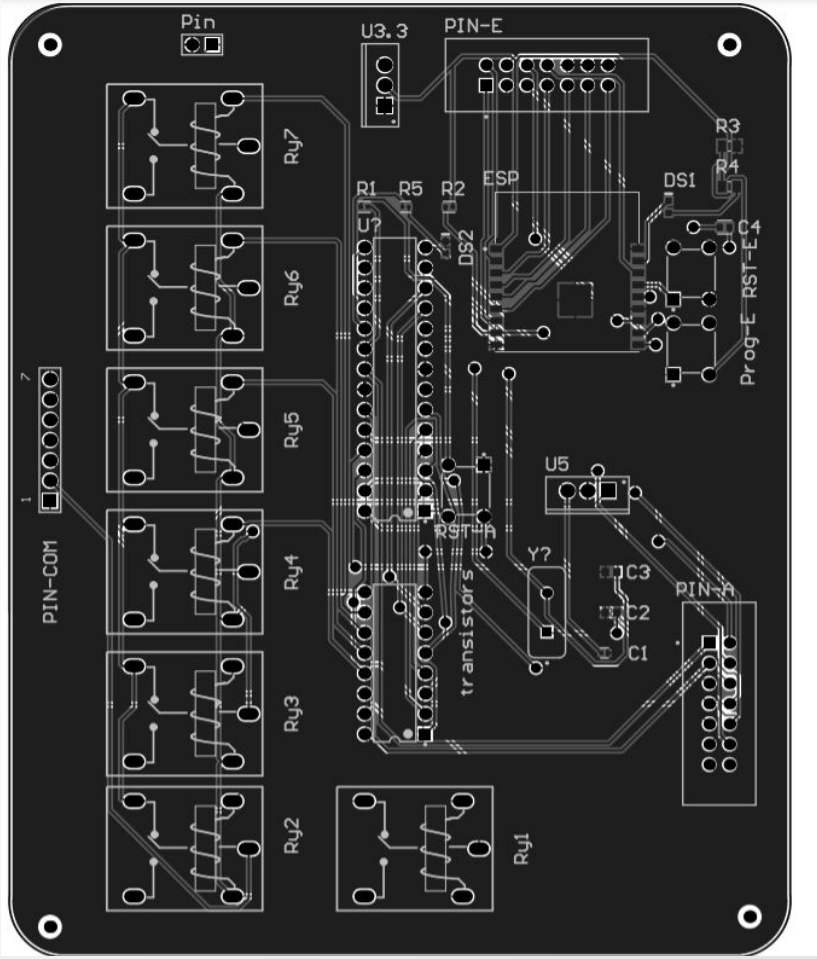
- PCB design
  - creating initial board
  - placement of parts
  - looks nice and clean in my opinion

will show in hand during presentation



PCB Schematic and Board layout





Nam’s CDR Deliverables

- **Stable power supply source**
  Added a 5V DC to DC converter
  Added diodes between power and ground channel of the solenoids

- **Arduino and ESP8266**
  Finalized the serial communication between the Arduino and ESP8266
  Successfully sending data to the cloud from the ESP through
  baud rate of 115200

- **DHT 11 humidity, temperature, and soil moisture sensors**

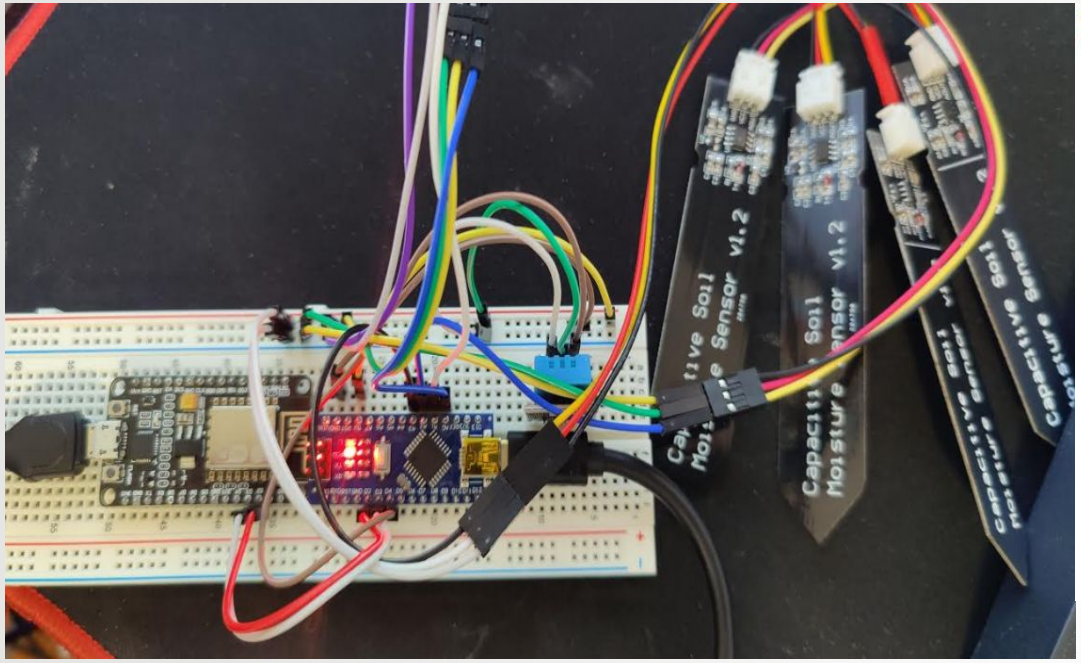
  Calibrated the sensors output and display to the cloud with a better format so they are easier to read.

- **Extra work**

  Assisted Christian with PCB Schematic and PCB layout population

  Participated in the debugging process of the working prototype

Google Firebase Cloud connection

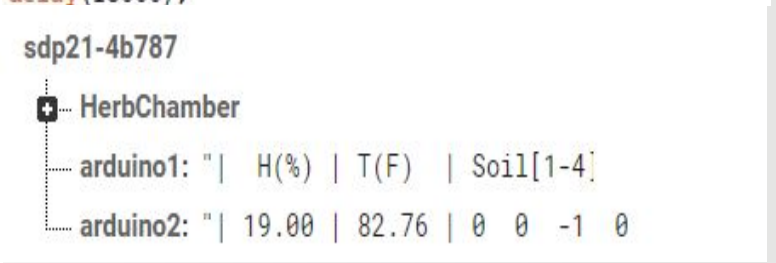


```
SoftwareSerial s(D3,D2);
void setup() {

  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");
  while (WiFi.status() != WL_CONNECTED)
  {
    Serial.print(".");
    delay(300);
  }
  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);

  Serial.begin(9600);
  s.begin(115200); //Establish the baud rate with Arduino
  while (!Serial) continue;
}
```

```
String data;
String data2 = "|  H(%) | T(F)  | Soil[1-4]% |";
if(s.available()) {
  data = s.readString();
  }
Serial.println(data);
Firebase.setString(firebaseData,"/arduino2", data);
Firebase.setString(firebaseData,"/arduino1", data2);
delay(15000);
```



- Sensors data are read from the Arduino and transmitted to ESP8266
- Firebase cloud connection is then established in the ESP code
- Sensors values are then converted into strings and get pushed to the cloud by Firebase.setString

Hardware Diagram

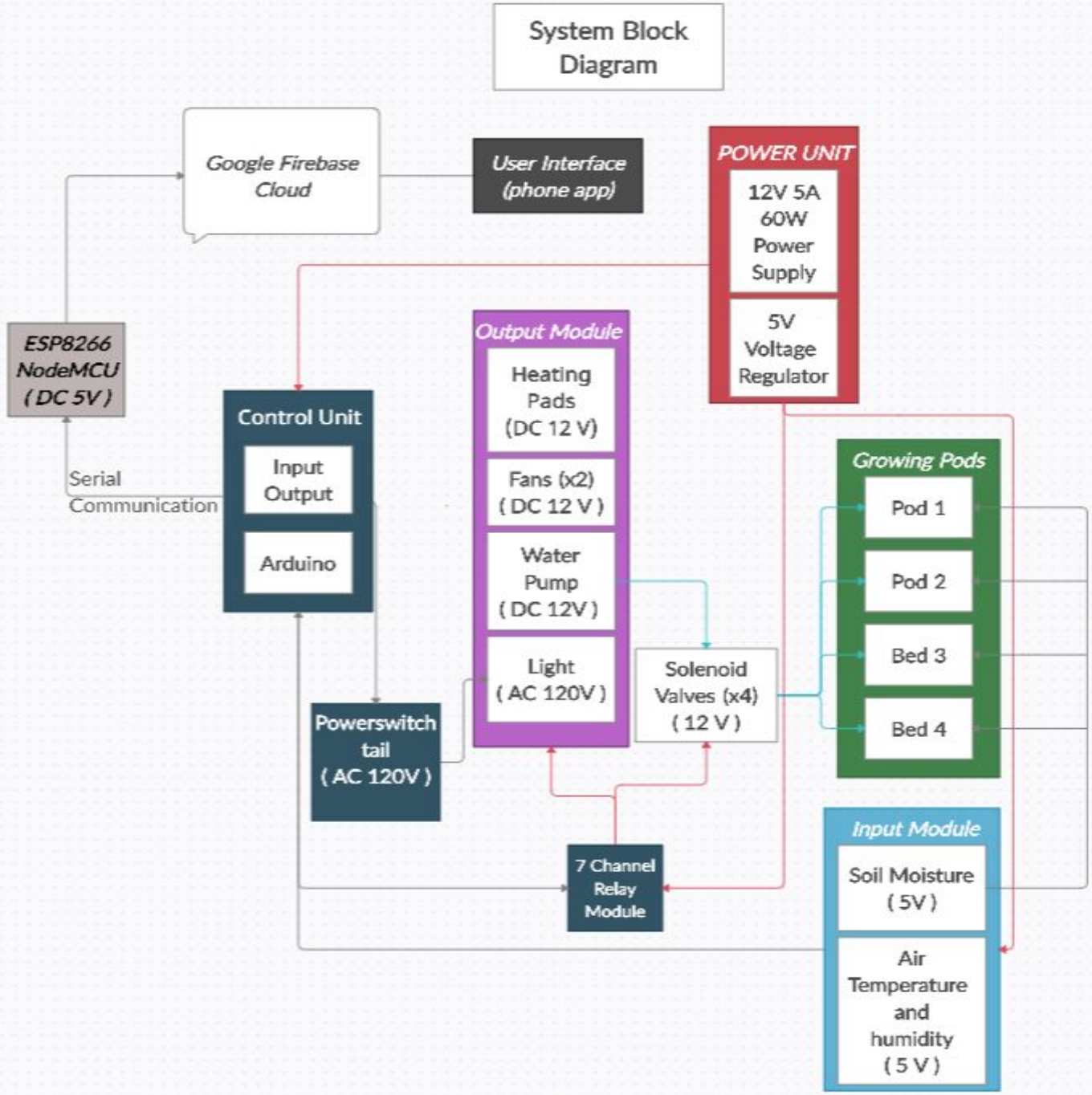
Power Unit: 12V, 5A

Control Unit: Arduino

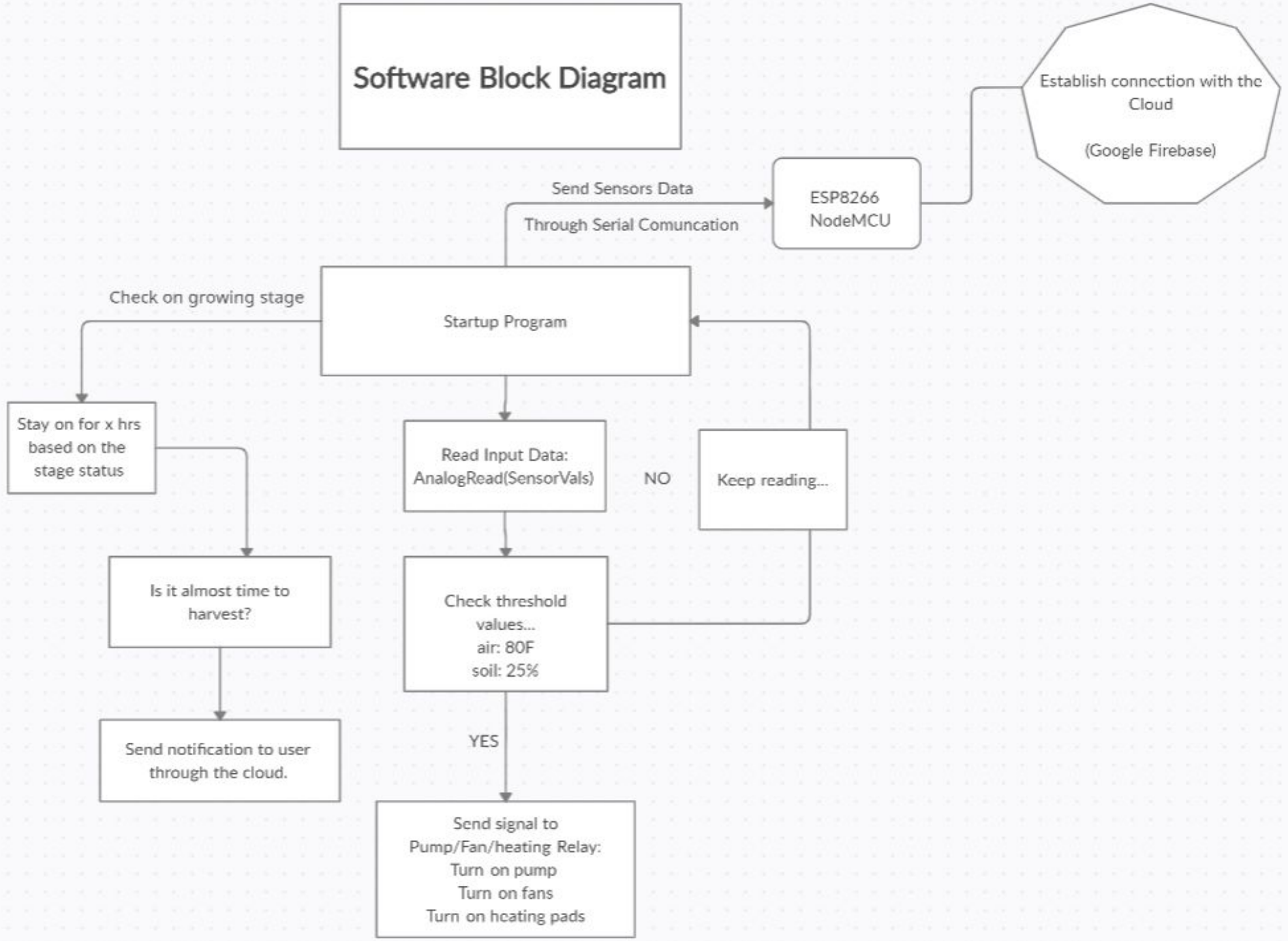
Cloud Unit: ESP8266

Sensors:
Capacitive Soil Moisture
DHT11 Air Temperature and Humidity

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



Software Diagram



Current Project Expenditure

Team Number	28		Order Total:	$445.00
Team Member Contact Name				
Date	11/17/2020			

Item Description	Link	Unit Price	Qty	Line Total
Relays	https://www.amazon.com/ELEGOO-Channel-Optc	$10.00	1	$10.00
Solenoid valves (x3)	https://www.amazon.com/Ximimark-Electric-Solen	$11.00	3	$33.00
Moisture sensors (x2)	https://www.amazon.com/Gikfun-Capacitive-Corro	$8.50	2	$17.00
Growth tent	https://www.amazon.com/VIVOSUN-Hydroponic-C	$65.00	1	$65.00
Growth light	https://www.amazon.com/Growing-Spectrum-Hydr	$27.00	1	$27.00
120mm fans	https://www.amazon.com/Antec-F12-Performance	$25.00	1	$25.00
Garden Soil	https://www.homedepot.com/p/Miracle-Gro-Moistu	$8.50	1	$8.50
Tubing 1/2"	https://www.amazon.com/pond-boss-8719800121	$9.00	2	$18.00
Water pumps	https://www.amazon.com/dp/B07W59D21M/ref=sy	$11.00	1	$11.00
Relays (x10)	https://www.amazon.com/gp/product/B07MQVQPI	$10.00	1	$10.00
Heating pad	https://www.amazon.com/Antec-F12-Performance	$16.00	1	$16.00
Solenoid valves (x2)	https://www.amazon.com/Ximimark-Electric-Solen	$11.00	1	$10.00
Humidity sensor	https://www.amazon.com/KeeYees-Temperature-H	$14.00	1	$14.00
Liquid Nutrients	https://www.homedepot.com/p/AeroGarden-1-Lite	$28.50	1	$28.50
Irrigation Fittings Kit	https://www.amazon.com/Habitech-Irrigation-Fittin	$12.00	1	$12.00
Fabric Grow Bags	https://www.amazon.com/VIVOSUN-5-Pack-Thick	$16.00	1	$16.00
DC Water Pump	https://www.amazon.com/dp/B07W59D21M/ref=sy	$19.00	1	$19.00
PCB (x10)	https://www.amazon.com/gp/product/B00J3MHRN	$55.00	1	$55.00
DC converter	https://www.amazon.com/gp/product/B00J3MHRN	$9.00	1	$9.00
ESP-WROOM-02	https://www.amazon.com/HiLetgo-ESP-WROOM-	$16.90	1	$16.00
Arduino Nano	https://www.amazon.com/gp/product/B07G99NNX	$14.00	1	$14.00
ATMEGA328P	https://www.amazon.com/gp/product/B07PZWYW	$8.00	1	$8.00
Transistor chip	https://www.amazon.com/gp/product/B00MMZ8KX	$3.00	1	$3.00

Demo

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FPR Plan

Full Integration of both hardware and software
Consolidation of User APK
Conversion of Arduino Code to C
Fail Safe System
Finalized PCB that is populated

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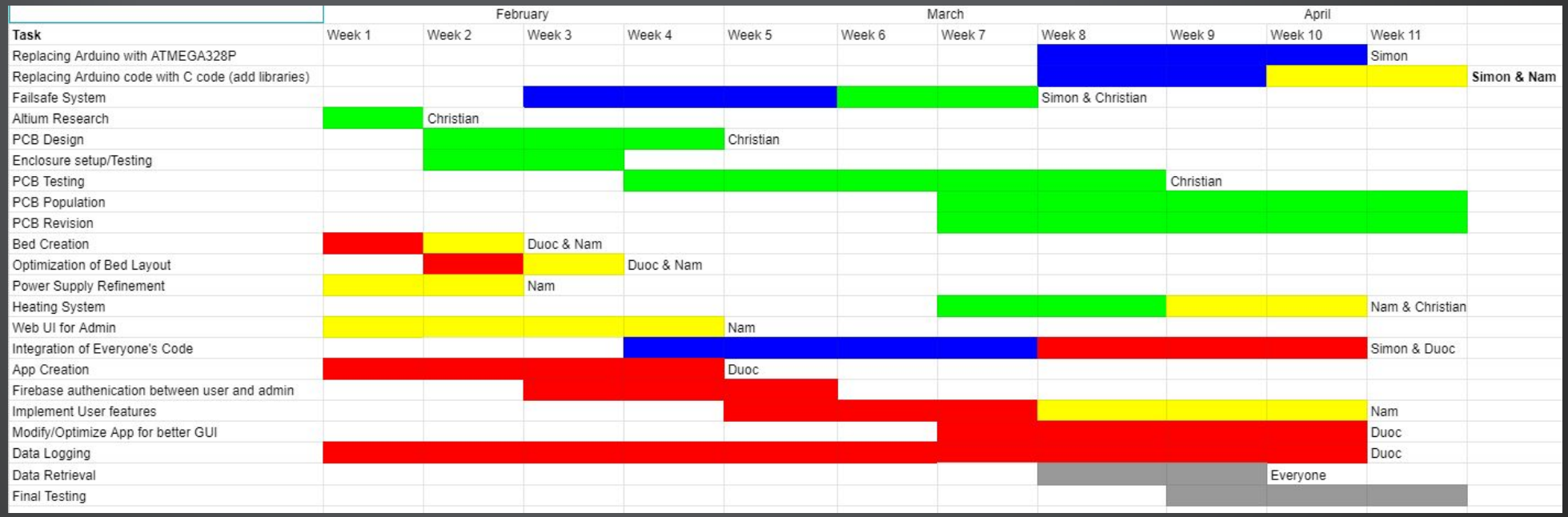
Project Management/Gantt Chart

Nam: Team Coordinator/Upgraded System Integration & Partial App Control

Simon: Budget Lead/System & Code Integration

Duoc: Cloud Server/Application Lead

Christian: PCB Population & Debugging



	February				March			April				
Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	
Replacing Arduino with ATMEGA328P											Simon	
Replacing Arduino code with C code (add libraries)												Simon & Nam
Failsafe System								Simon & Christian				
Altium Research		Christian										
PCB Design					Christian							
Enclosure setup/Testing												
PCB Testing									Christian			
PCB Population												
PCB Revision												
Bed Creation			Duoc & Nam									
Optimization of Bed Layout				Duoc & Nam								
Power Supply Refinement			Nam									
Heating System											Nam & Christian	
Web UI for Admin					Nam							
Integration of Everyone's Code											Simon & Duoc	
App Creation					Duoc							
Firebase authenication between user and admin												
Implement User features											Nam	
Modify/Optimize App for better GUI											Duoc	
Data Logging											Duoc	
Data Retrieval										Everyone		
Final Testing												


Question and Answer
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