

Automatic Green house system

TPJ452 Project Proposal



Course: TPJ452

Instructor: Gal Messinger

Group Number: 2

Group Members: Huang Zheng, Yu Chen

Member’s STD#: 025-775-115, 046-158-143

Date: December 6, 2016

Table of Contents

[1. Project Description 2](#_Toc462867104)

[2. Background 2](#_Toc462867105)

[3. Problem Statement 3](#_Toc462867106)

[4. Project Goals and Objectives 4](#_Toc462867107)

[5. Strategy 5](#_Toc462867108)

[6. Block Diagram 6](#_Toc462867109)

[7. WBS 7](#_Toc462867109)

[8. GUI 9](#_Toc462867110)

[9. Bill of Materials 10](#_Toc462867111)

1. Project Description

In this project, we are going to design a greenhouse system, which will help the plants to have a best environment and growing up with the scientific method. In the system, the sensors will detect and collect data of the soil moisture, air temperature, and light and give the corresponding feedback to environment to reach the expected effect.

We will use a LCD to display the current status and temperature and moisture of the environment. The system will connect to the cellphone app by the Bluetooth to control the system. In the interface, we are allowed user to see the info exactly same as the LCD, and user can use manual switch to control the system such as main switch, water pump, cooler and heater. As well, user will be able to set the temperature for the system.

1. Problem Statement

In this course, we are designing an Automatic Greenhouse System is very helpful for household. Assume a busy family want to eat fresh tomato (or other vegetables) that plant by themselves.

So, they are plan to plant tomatoes in the backyard, but they don’t have much time to take care tomatoes. However, if this busy family have an automatic greenhouse system, they don’t need to worry this situation. They system will help them to watering, and provide a computable temperature for the plants.

And also, it will help them to save a lot of time to work on other things.

1. Project Goals and Objectives

When system is powered on. The system will start to collect data and start to build a wonderful environment for the plants.

The plants growth needs Sun to make the photosynthesis. So we will install 4 light sensors that place on the top of the case, when morning is coming those 4 sensors will detect the light at same time to enable the cover that we installed on the top of the case, why we use 4 sensors? Because this will avoid the cover opened in the mistake.

Inside the case, there is a temperature sensor installed on the top side of the case, this will make sure the plants have a temperature that suitable for growth. On the cellphone app, we can set a corresponding temperature for the plant. However, when the temperature is higher than we set, the cooler will be activated by the system. Opposite, the heater will be activated when temperature is lower.

The water is very important for the plants, when soil moisture is lower than normal value (dry), the plants will grow slowly or dead by the dehydration. So, we will plug a soil moisture sensor on the ground the collect the soil moisture data. When the soil moisture is lower than normal, the water pump will be activated and start watering the plants until moisture is reached normal value.

## **Soil Moisture Monitoring Sytem:**

## In this part we are using Soil Moisture sensor to detect moisture of soil, and using the Red, Yellow, and Green LEDs to show the status of soil. We set the maximum value is 800 and minimum value is 500. So when the value of sensor is equal and higher than 800 the green led will be ON, that means the soil is wet and we don’t need to warting, but when the value is between 800 and 500 ,and yellow led will be ON, that means the soil is a little bitdry. Once the value is lower than 500, the red led will be ON, which means the soil is very dry, this will triggle the irrigation system, and water pump start the put water on the plant.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sensor Value** | **LED Color** | **Soil Status** | **Water Pump Status** |
| =>800 | Green | Wet | OFF |
| >=500 &&<800 | Yellow | a little bit Dry | OFF |
| >500 | Red | Very Dry | ON |

## **Light Control Cover**

## The second part is the light control cover. We installed 2 light sensors and 4 micro servos on the board, when both light sensors detect light and the value is higher than 500, it will triger the micro servos to open the cover. This is the easiest part in our project.

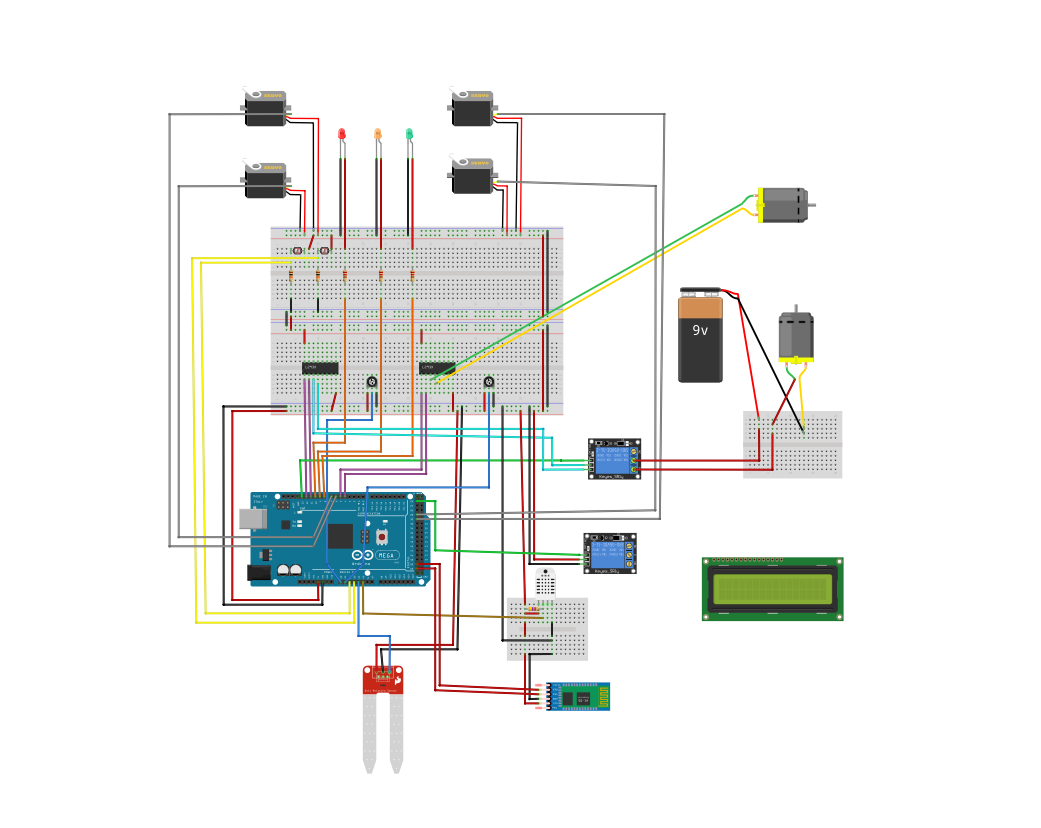
|  |  |  |
| --- | --- | --- |
| **Sensor Value** | | **Cover Status** |
| Light Sensor 1 | <500 | Cover is CLOSE |
| Light Sensor 2 |
| Light Sensor 1 | >500 | Cover is OPEN |
| Light Sensor 2 |

## Air Temperature Monitoring System:

## The third pard is the air temperture monitoring system. We can set the temperature into the system (curenttly not avaiable, system default temperture is 23 °C), when temperature is higher than 23 °C, then it will triger the Fan to cool down the air temperature. But when temperature is lower than 16 °C, the heater will trigger. The system will do nothing between 16 °C to 23 °C.

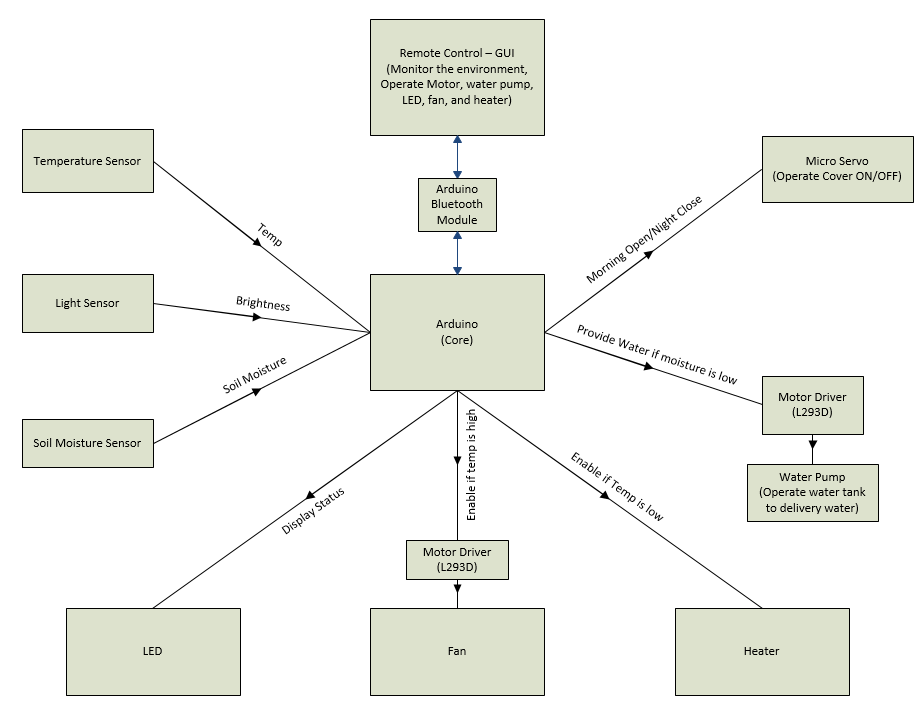
|  |  |
| --- | --- |
| **Air Temperature** | **Fuction** |
| > 23 °C | Fan (cooler) |
| >16 °C && <23 °C | Nothing Happen |
| <16 °C | Heater |

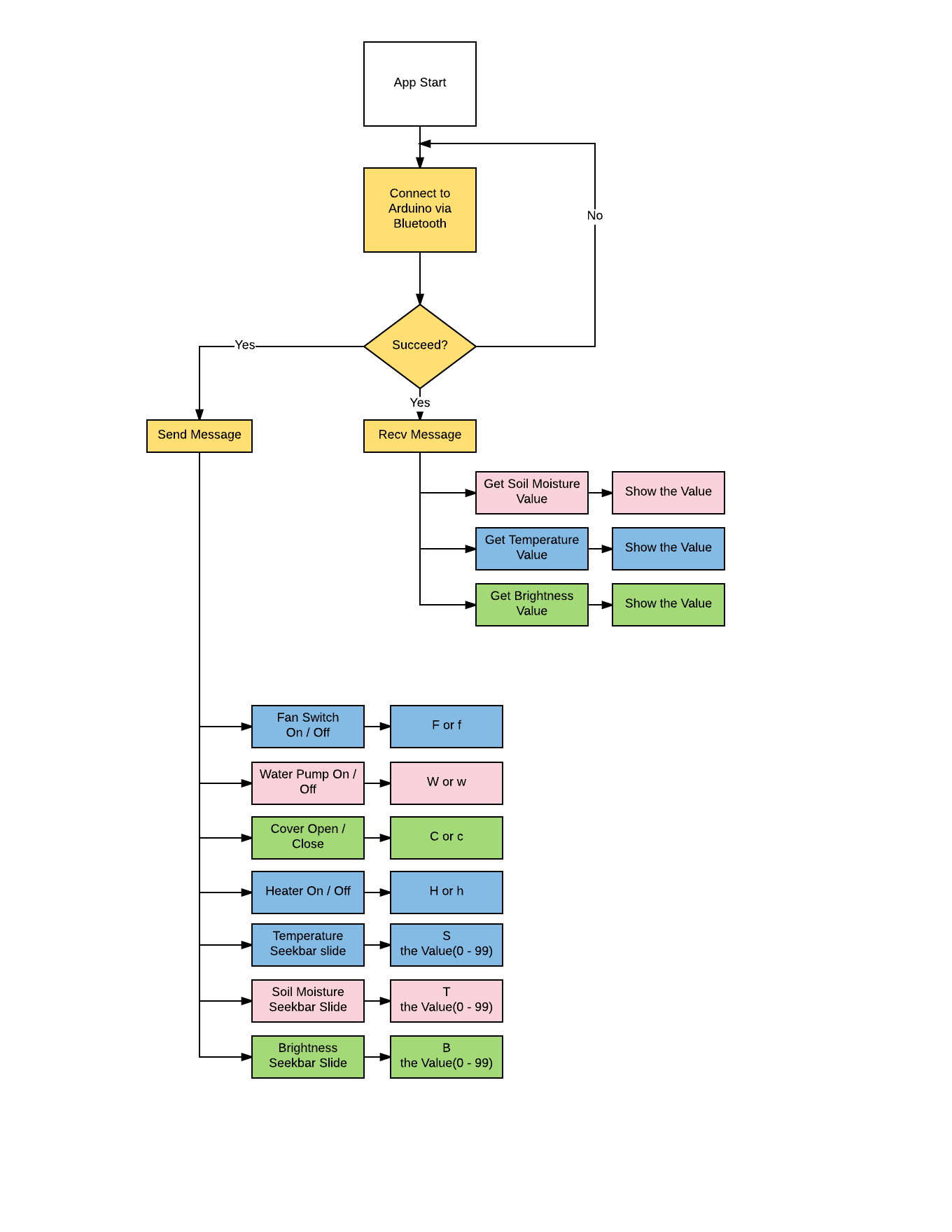
1. Block Diagrams



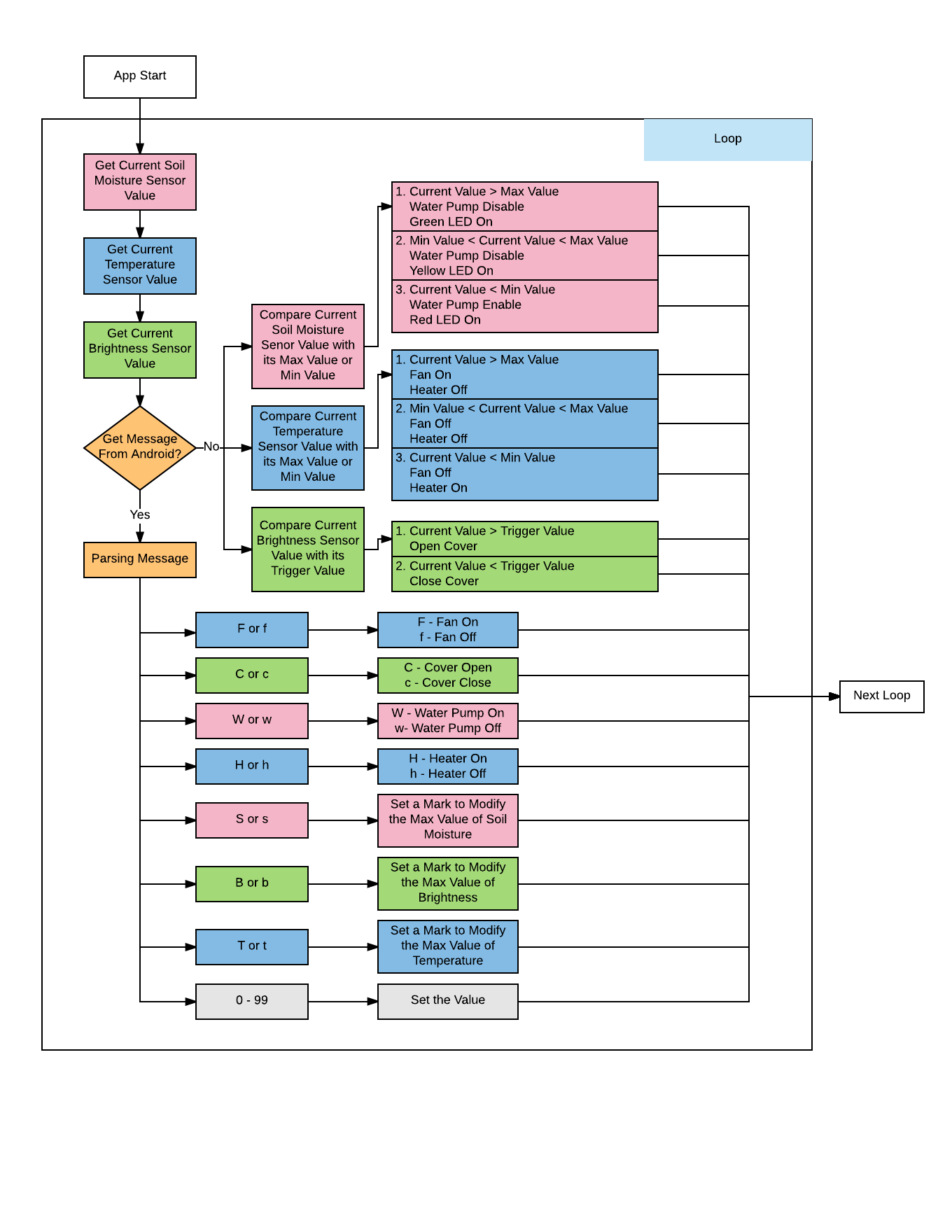


PCB schematic





Android app workflow



Arduino App workflow

**Input Functions:**

1. **Temperature Sensor:** the sensor can be used to detect and collect air temperature. It can activate the cooler or heater when temperature is higher or lower than set value. The data will be displayed on the both LCD and cellphone app.
2. **Light Sensor:** there are 4 light sensors used to detect the light and activate the cover in mode ON/OFF which installed on the top of case. The mode status will displayed on the both LCD and cellphone app.
3. **Soil Moisture/Humidity Sensor:** the sensor is used to detect and collect the data from the soil, and according to data to activate next step of process.

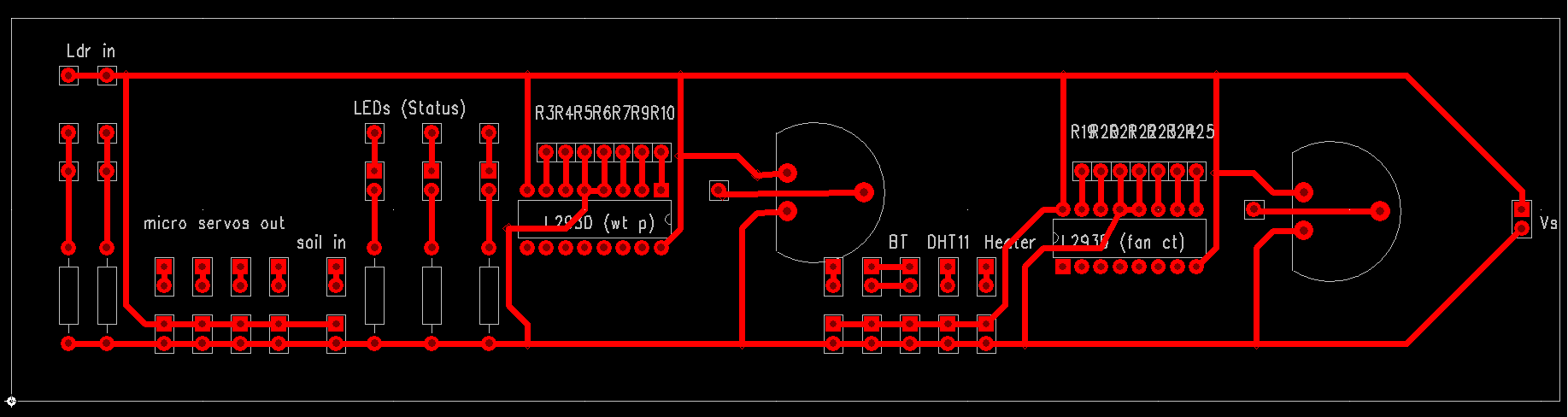
**Arduino:** Used as main processor, receive data from sensors, transmit data via Bluetooth, and controls micro servo, cooler, heater and water pump.

**LCD:** display status of temperature, soil moisture and output.

**Bluetooth Module:** used to communicate between Arduino and cellphone.

**Output Functions:**

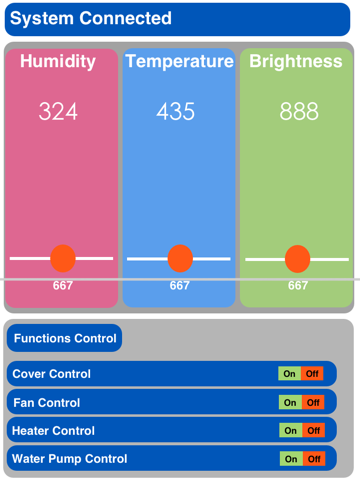
1. **Micro Servo:** used to operate the cover, condition of ON/OFF depends on the light sensor.
2. **Water Pump:** provide water to plants when soil moisture is lower than set value. The water pump works with the L293D motor driver.
3. **LED:** display soil moisture status.
4. **Fan (Cooler):** used to lower the temperature when temperature is higher than set value. The Fan works with the L293D motor driver.
5. **Heater:** used to provide heat to environment when temperature is lower than set value.



1. WBS

|  |  |  |
| --- | --- | --- |
| **Tasks** | **Effort** | **Member Responsible** |
| **1.0 Initiating** |  |  |
| 1.1 Research Information | 3 Days | Together |
| 1.2 Decide Topic | 1 Day | Together |
| 1.3 Learn to Use Arduino | 7 Days | Together |
| 1.4 Oral Presentation | 1 Day | Together |
| 1.5 Write Proposal | 1 Day | Together |
| 1.6 Test Arduino with Sample Code | 2 Days | Together |
|  |  |  |
| **2.0 Planning** |  |  |
| 2.1 Determine Require Parts and Components | 3 Day | Together |
| 2.2 Determine Project Budget | 1 Day | Together |
| 2.3 Evaluate Bill of Materials | 1 Day | Yu Chen |
| 2.4 Design Project Schedule | 1 Day | Huang Zheng |
| 2.5 Make Gantt Chart | 1 DAY | Together |
| 2.5 Assign Tasks | 1 DAY | Together |
| **3.0 Executing** |  |  |
| 3.1 Purchase Parts and Components | 10 Days | Huang Zheng |
| 3.2 Build Circuits on the Breadboard | 5 Days | Huang Zheng |
| 3.3 Test Sensors with Code | 1 Day | Yu Chen |
|  |  |  |
| **3.4 Build Each Individual Parts of Project & Programming Code** | (4 Days) | (Together) |
| ↘ 3.4.1 Cover with Light Sensor | 1 Day | Together |
| ↘ 3.4.2 Soil Moisture Sensor + Water Pump + Motor Driver | 1 Day | Together |
| ↘ 3.4.3 Fan with Motor Driver | 1 Day | Together |
| ↘ 3.4.4 Heater | 1 Day | Together |
| 3.5 Modify | 3 Days | Together |
| 3.6 Combine All Parts Together | 7 Days | Together |
| 3.7 Troubleshooting | 5 Days | Together |
| 3.8 Make PCB & Soldering | 3 Days | Huang Zheng |
| 3.9 Package The Project In a Case | 2 Days | Huang Zheng |
|  |  |  |
| **4.0 Monitoring and Controlling** |  |  |
| **4.1 Control Scope** | (3 Days) | (Together) |
| ↘ 4.1.1 Make Sure Project Meet Requirement | 3 Days | Together |
| **4.2 Control Cost** | (1 Day) | (Together) |
| ↘ 4.2.1 Budgeting | 1 Day | Together |
|  |  |  |
| **5.0 Closing Project** |  |  |
| 5.1 Write Documentation | 3 Days | Together |
| 5.2 Prepare The Presentation | 1 Days | Together |
| 5.3 Final Check of Project | 1 Day | Together |
| 5.4 Submit Project | 1 Day | Together |
| 5.5 Submit Report | 1 Day | Together |
| 5.6 Presentation | 1 Day | Together |

1. GUI



## System Monitor:

When the application start, user should choose the Arduino board to connect. Once they are paired, the application should read messages through Bluetooth channel. Getting the value of light sensor, temperature sensor, and soil moisture sensor. Show them on the screen.

## Remote Control

There are three progress bar indicate current condition values of all sensors. By dragging the bar, it is very easy to adjust the condition values. Arduino board will respond to the changes and adapt to new values.

## Emergency Only

For emergency use only, there are four switch to turn on and off fan, heater, water pump, and cover.

1. Bill of Materials

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **QTY** | **Matiral** | **Seller** | **Price ($)** |
| 1 | 1 pcs | Arduino Uno R3 Board | Creatron Inc | 27.99 |
| 2 | 1 pcs | SunFounder Mega 2560 R3 Board | Amazon.ca | 24.99 |
| 3 | 1 Kit | Kuman 20 in 1 Sensor Modules Learning Kit | Amazon.ca | 34.99 |
|  | ↘ | DHT11 - Temp Sensor Module | ⎯ | ⎯ |
|  | ↘ | Soil Moisture Sensor Module | ⎯ | ⎯ |
| 4 | 2 pcs | Photoresistor - Light Sensor | eBay.ca | 2 |
| 5 | 2 pcs | L293D - Motor Driver | Sayal | 10.17 |
| 6 | 2 pcs | Potentiometer | Sayal | 3.16 |
| 7 | 1 pack | LED (Red, Yellow, Green) | Sayal | 2 |
| 8 | 1 pcs | Resistor (220Ω, 10KΩ) | Sayal | 2.26 |
| 9 | 1 pcs | Switch | Sayal | 1.5 |
| 9 | 1 pcs | 12V DC Water Pump | Creatron Inc | 39.95 |
| 10 | 1 pcs | 5V DC Motor | Sayal | 5 |
| 11 | 2 pcs | 5v Single Channel Relay | Creatron Inc | 14.69 |
| 12 | 1 pcs | 5V 8 Channel Relay | Amazon.ca | 19 |
| 13 | 1 pack | Micro Servo | Amazon.ca | 17 |
| 14 | 2 pcs | Box | Dollarama | 6.78 |
| 15 | 2 pack | Jumber Wires | Amazon.ca | 22 |
|  |  |  | Total | 233.48 |