Final Project

Atmosphere Monitoring System

Due Date: June 12, 2020

EECS 113

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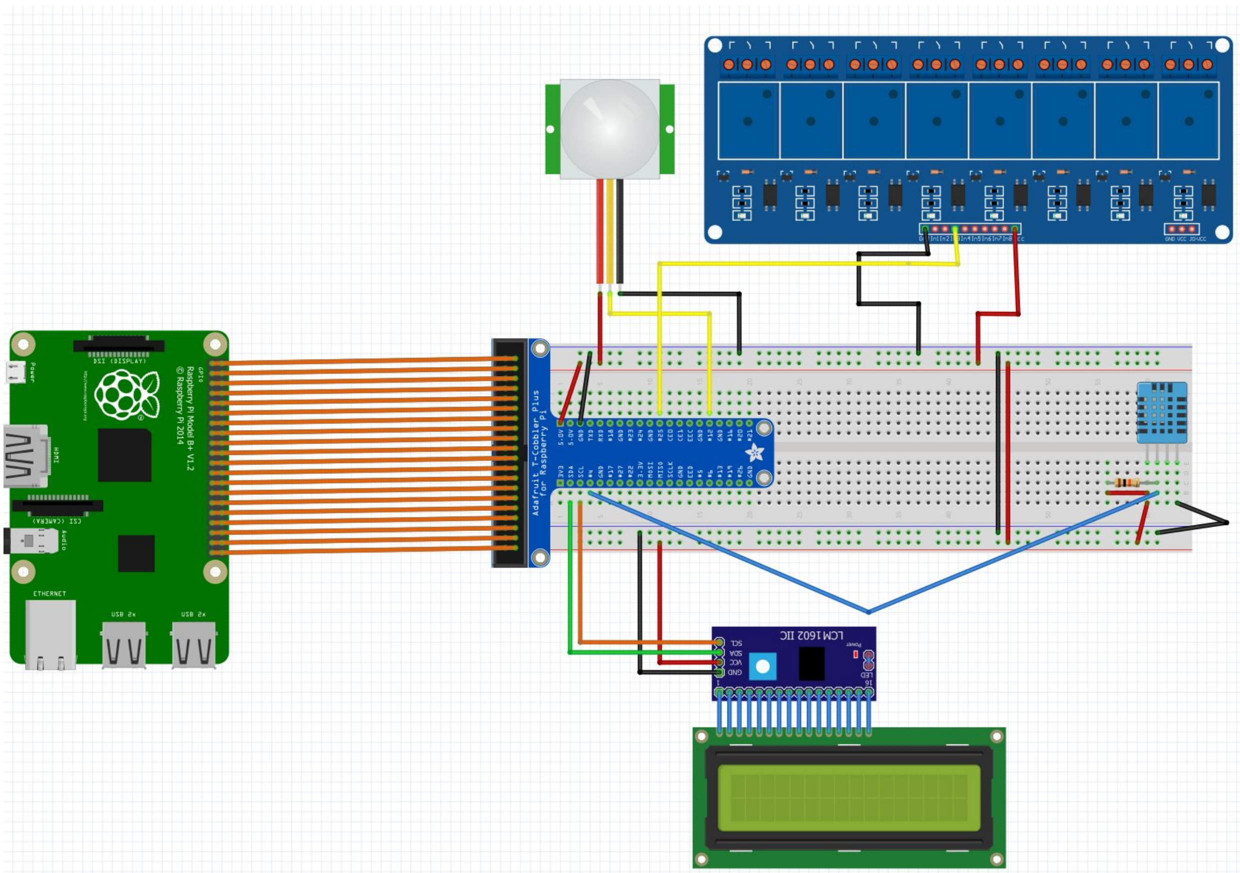
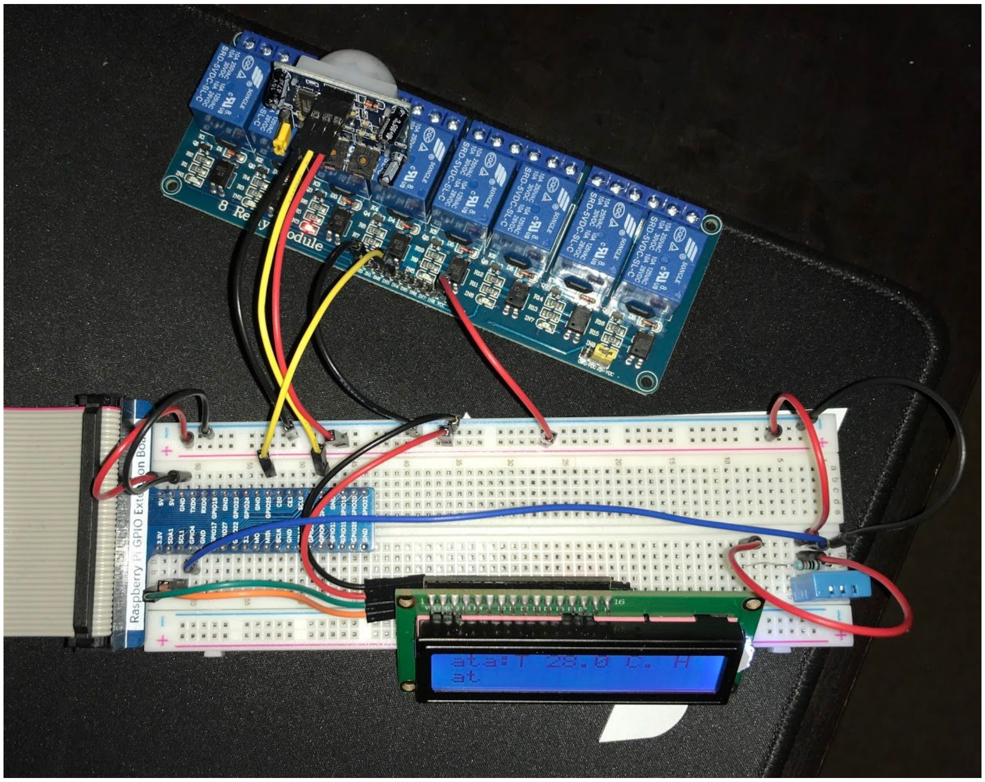
A. Schematics

a. Figure 1 (Made with Fritzing)

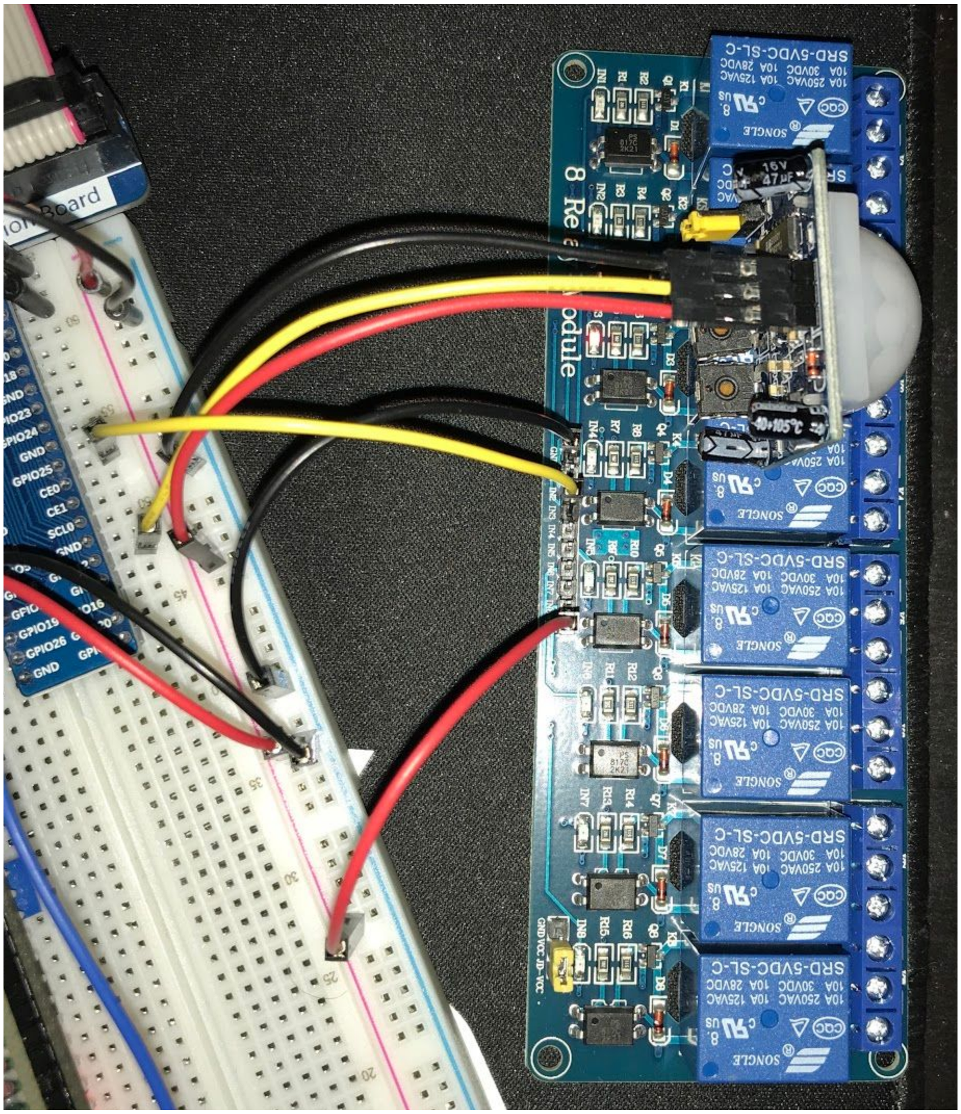


B. Images of Circuits

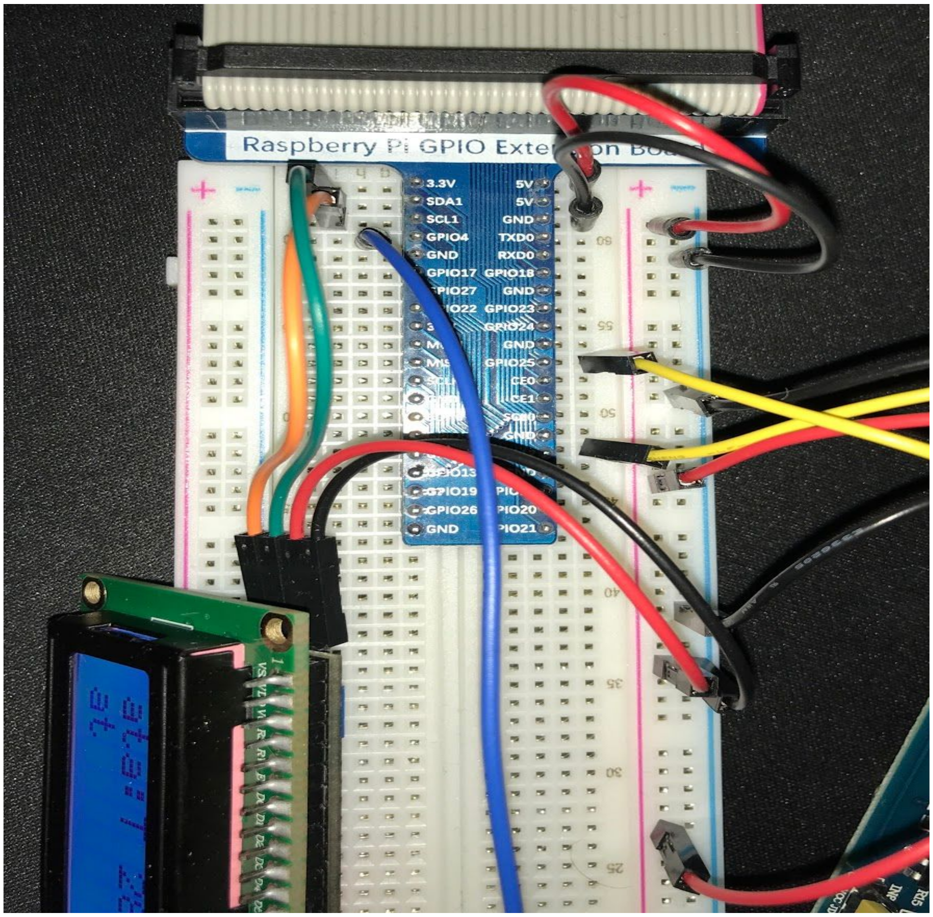
a. Figure 2. (Overall Circuit)



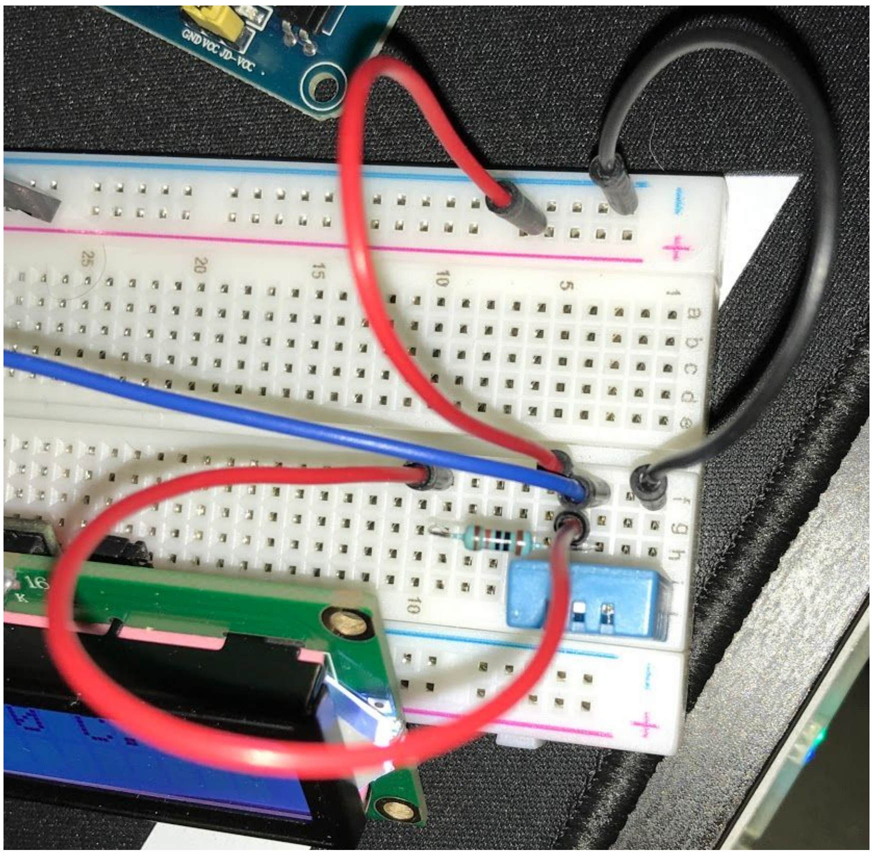
b. Figure 3 (Relay / PIR)



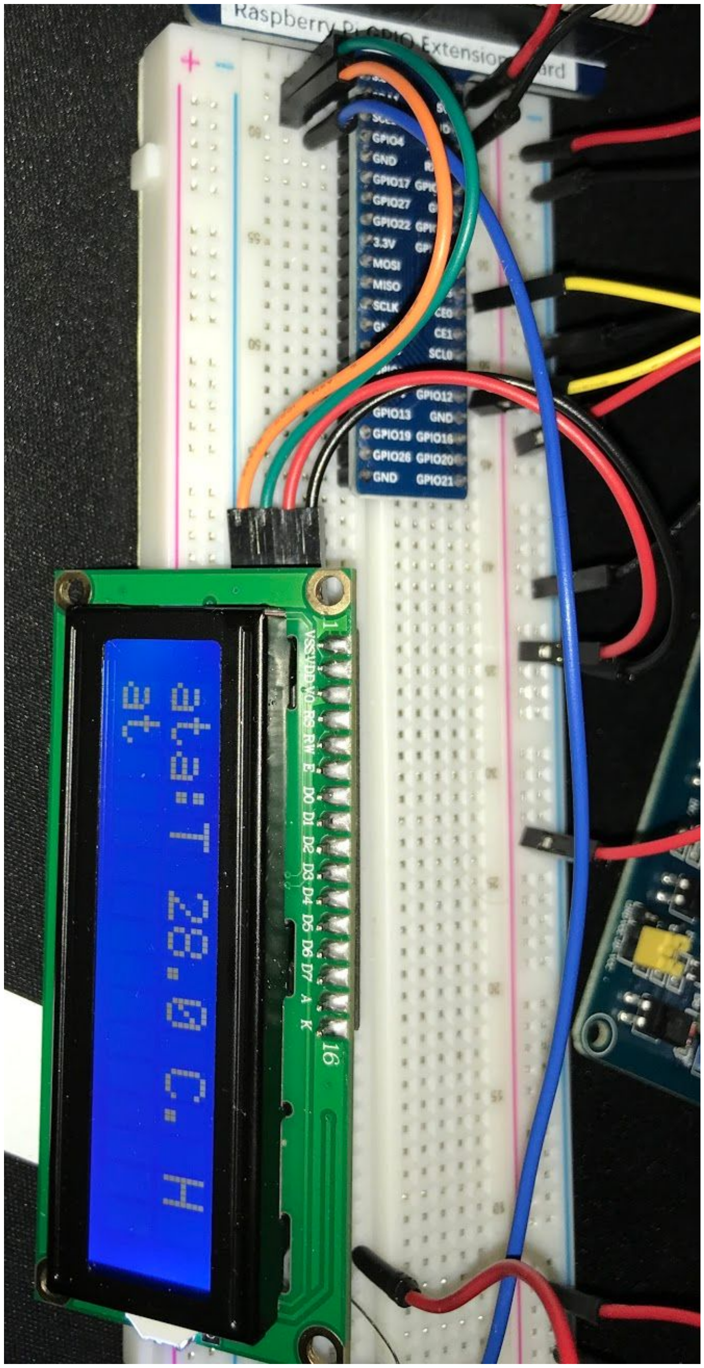
c. **Figure 4 (GPIO)**



d. Figure 5 (DHT Sensor)



e. Figure 6 (LCD/ Connections)

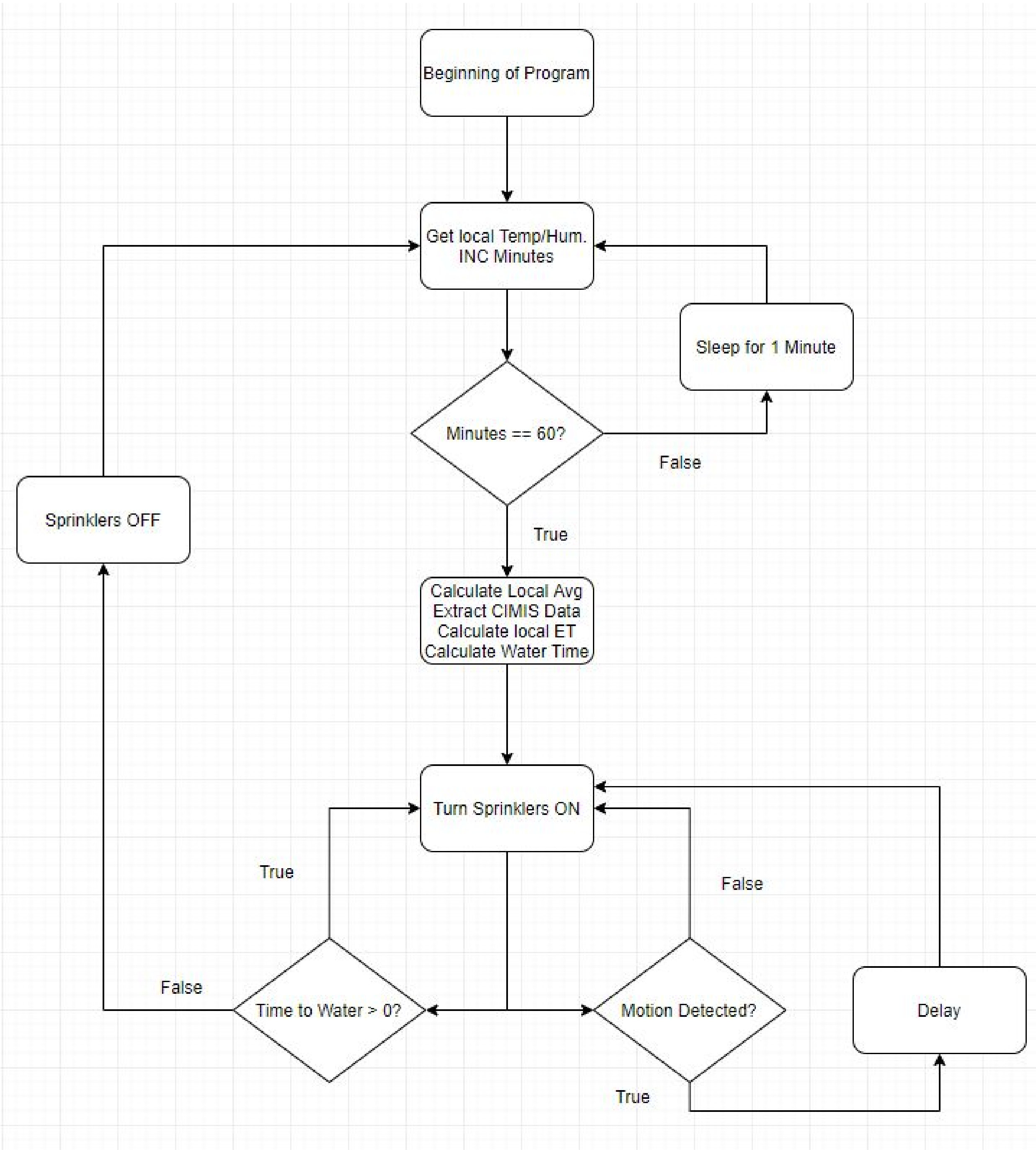


f. Testing of Components:

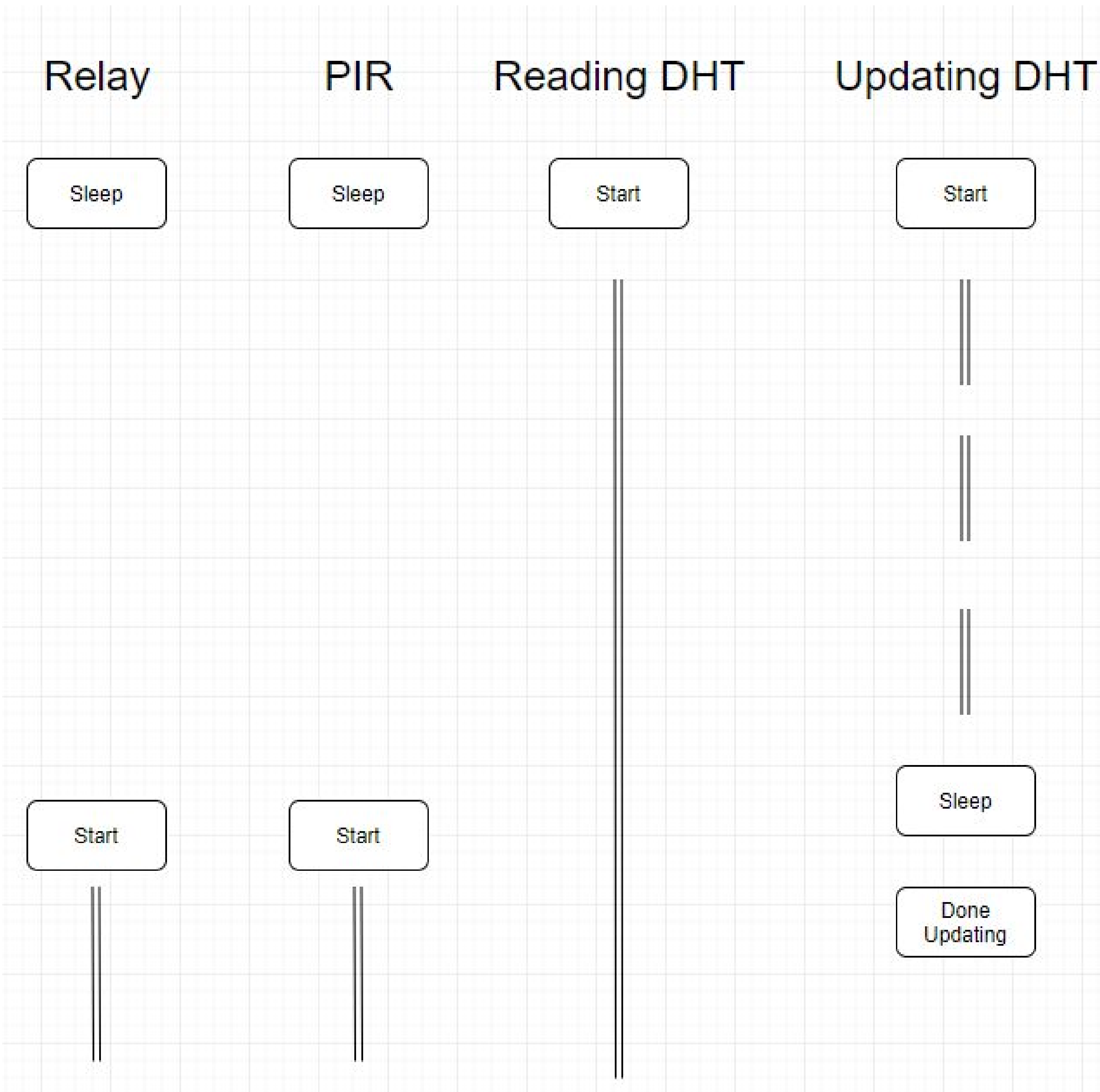
i. Before I began coding the final assignment, I first tested each and every component to verify that they are working properly. Code was written for each and every component and once all components were verified to be working, I began to work on the main aspect of the code. To display the most up to date information of the software, most of the data was printed on the terminal. On the LCD, there is a slight delay to show the information since it cannot be used with threading functionality independently. This is because junk will be displayed if it is used. Once I verified that the components and code were working properly, I then proceeded to run the code for 24 hours. The amount of gallons that were used were approximately 30 gallons assuming the reference values from the assignment PDF.

C. Software and Code

a. Figure 7 (Flowchart of Code)



b. Figure 8 (Flowchart of Multithreading)



c. Setup:

i. This portion of code initializes the GPIO Pins, sets up the LCD, creates a CIMIS object, and turns off the relay if it was on previously.

d. LCD:

i. The LCD is mainly used for significant events. For example, once we retrieve the values for temperature, humidity, and ET, we will display on the LCD those stats. Other significant events include when there is motion detected, and when sprinklers resume normal operations. These events are called when summoned in the threads of DHT, PIR, and Relay.

e. CIMIS Data/ Data Analysis:

i. The CIMIS data is a class and when summoned in the setup function, the values are initialized as zero so no errors arise when running the code for the first time. In the CIMIS class, there is a function that will be called on the hour mark to connect to the CIMIS server to retrieve the most recent temperature, humidity, and ET readings. This will then be updated in the DHT11 thread and will be used for analysis. In the event that the CIMIS servers are offline, the local averages for these values will be shown.

f. Relay:

i. Within this thread, there are three cases the relay could be in. The first case, the relay could be in is when the relay activity flag is set to True and there is still watering time for the sprinklers. In this case, the relay is kept in the on position and the watering time continues to update. The second case is when the relay activity flag is set to false and there is still watering time for the sprinklers. This case happens when there is an interrupt from the PIR sensor when motion is detected. In this case, the relay is turned off and the watering time does not update since we do not want to wet the client. The third case is when the relay activity flag is True and the water time left is zero. In such a scenario, the sprinklers have finished their activity and the relay needs to be turned off. From here, the DHT11 threads are summoned to calculate new values for the hour.

g. PIR:

i. This sensor thread is only active when the relay activity flag is set to True. When motion is detected, this sets the relay activity flag to False to stop the sprinklers. This will go into a loop that will check for motion and update the time that the PIR will be on for. This loop will be broken when motion isn't detected or when the timer limit is met. Once out of this loop, this will tell the relay thread to resume the relay activity when back into the relay thread

h. DHT11:

   i. The DHT11 has two threads for two distinct purposes. The first thread consistently reads the values of temperature and humidity at 1 second intervals. They are then placed into global variables for computation. The other thread is the main thread that controls mostly all the significant events. This thread updates the temperature list and humidity list every minute as new values are written. When the hour mark is met, there will be 60 values in each of the lists. This will then trigger the computation for local averages, pull values from the CIMIS servers, computate local ET and water time, set the activity flag for the sprinklers to True, and disable the DHT11 threads.

i. Typical Project Usage Scenario

   i. Information is extracted from the CIMIS server hourly, and depending on the data, it will decide if it's appropriate to turn on the sprinklers and proceed to calculate the irrigation time if it is appropriate. If there is movement detected during irrigation time, then irrigation will stop and will continue once movement is not detected. After irrigation is over, it will display the data on the LCD.