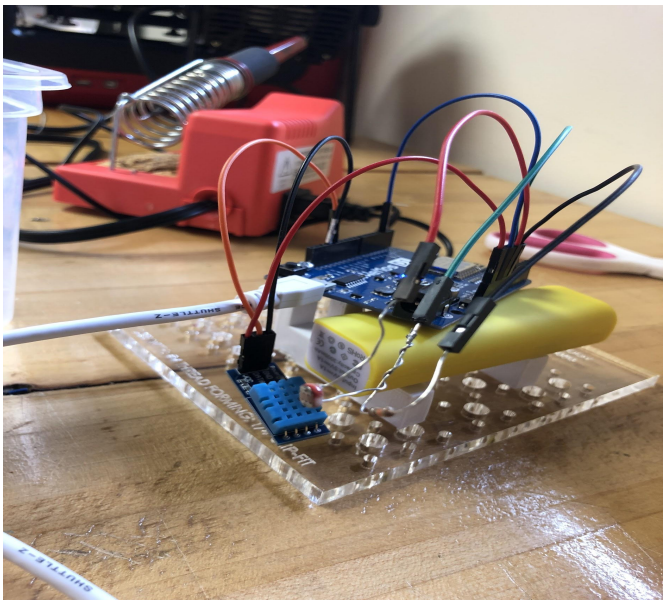

Design 2 Final Report

Matthew Bavoso and Jakob Niglio

Wednesday May 8th, 2019

Section F Group 4

“I pledge my honor that I have abided by the Stevens Honor System”

X_____

X_____

Abstract

The goal of this project was to create a system that can detect weather conditions. Specifically, the system was supposed to detect light levels, temperature, and humidity. Another goal was to become familiar with a program called LabView, a program where the team can display the data that they collected in unique and different ways. Group 4 had to design a system which was based off of a specific letter in the alphabet. The specifics that made their design unique was that they were the only ones to use the letter “F” as our ground for our build and furthermore they used two smaller letters instead of one big letter. Also, to connect their letters to the base board, they used the plastic pegs and melted them on. Our design fulfilled and surpassed Group 4’s expectations. It performed very well and collected the data over the seven days as expected with only one obstacle. The design held up well and did not break. The system gathered the data well for the seven days. However, there was one problem along the way where it only collected the light data this was because there was a faulty or bad wire that was messing up the whole system. To conclude this project, the team wanted to get the data and convert it into three simple charts that displayed the data in a simple way, where they can analyze the data easily. One finding that the duo found particularly interesting was that

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Introduction:

This semester we worked on a weather station that constantly monitors the light, temperature and humidity that surrounds it. The objective was to have a running machine that successfully made constant data readings from somewhere on the Stevens campus. We learned Arduino codings and how to correctly set up, wire and operate a Wemos D1 R1/R2 board. We were given wires, the Wemos board, a portable charger and a docking peg board and were told to 3D print a common letter or number that could successfully hold and stabilize our project. We chose to print two letter F's and soldered two plastic pegs to the vertical part of the letter. The letters would be laid out in an orientation that has been rotated 90 degrees counterclockwise. In our duo, Jake had the greater knowledge on coding, so he tended to focus more on the Labview and Arduino codes. At the same time, I focused more on the physical structure of the product, soldering the pegs, plugging in wires and sensors and erecting our physical project from the peg board upwards. We successfully completed our mission of having a working project.

Discussion

1. Requirements

   The requirements were to create a weather sensing system that…

   - Detected light levels, temperature, and humidity.
   - Recorded data every 15 minutes for 7 days which was to prolong the battery
     - We created a sleep function that shut off the battery every 15 minutes for 15 minutes.
   - 3D print a letter in the alphabet to create a base to hold all the items which include the 5 volt battery, the WeMos D1R2 board, the wires, and the sensors.
     - We 3D printed two small F's and laid them flat on the base board.
   - Display the data using a LabView program that took the data from the excel sheet and put into different charts and other things.
     - We used three Waveform Charts in the LabView program which display our data as a line chart so we can see the highs, lows, and means.

2. System Design

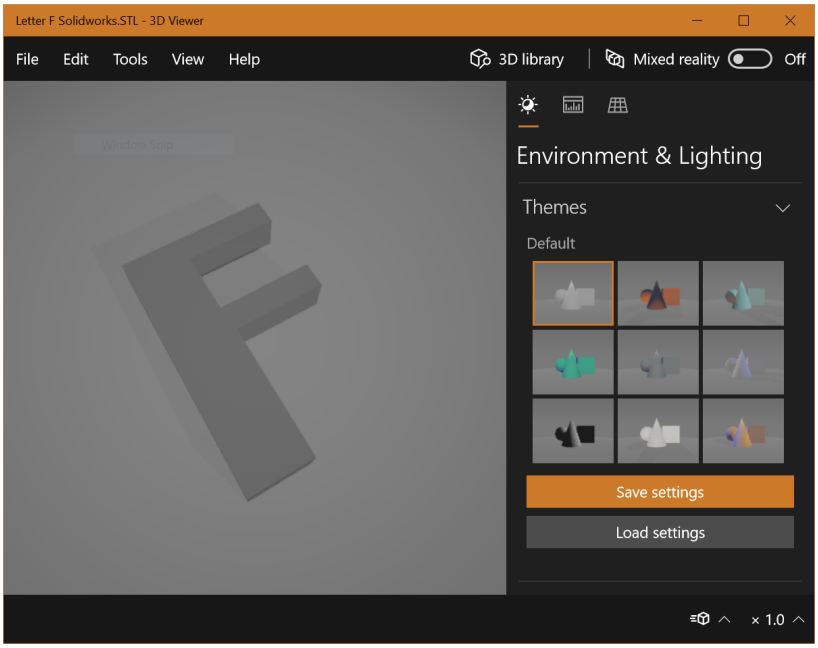
   - Preliminarily, the initial task was to determine how we wanted to set up our project physically. We were tasked with choosing letters to 3D print and use as a foundation for which the power cell and Wemos Board would sit. That was slightly difficult in multiple ways. First off, because there were a large number of possibilities, it was hard to narrow down to which ones we thought would work. We then had to consider how each would turn out in a CAD file, which eliminated most curvy letters from our selection process. We also had to consider how much

time each letter took to print as, since we wanted to make two, that would take a large amount of time, time that we could use to make further progress. We ultimately decided on the letter “F’ since it took only a half hour to print each one, was simplistic in terms of CAD design and had flat surfaces to lay our parts on.

- After this, we began testing out each individual sensor in preliminary fashion. The light sensor was tested in the Design Lab, the adjacent hallway and with a black jacket covering it (to minimize incoming light). The temperate readings were manipulated and tested in our lab, near a sunny window and while being held (to read surrounding body heat. Humidity was tested in room conditions and with a human exhale to increase moisture levels.

3. Mechanical Design
    - Our project’s major components are a clear plastic peg board, two 3D printed letter F’s, a portable charger, a WEMOS D1 R2 Board, wires, a light sensor, a temperature and humidity sensor and a USB-to-microUSB wire.
    - The two letters had plastic pegs soldered into their upright beam so that they would be secured in the board when lying down, rotated 90 degrees counterclockwise. Screw holes were made to the now upward facing legs of the F’s so that the Wemos Board could be attached. The portable charger sat across the main body of the letters and served as the main power source of our device.
    - Eight total wires were plugged into the WEMOS Board, three connected to the temperature and humidity sensor, three connected to the light sensor, and the rest crossing the board.

- The USB-to-microUSB wire connected the main power source, the portable charger, to the WEMOS Board itself.



4. Software Design and Coding
    - Our WeMos software design was the WeMos Baseline Version 3.
    - We integrated a sleep function in the software
        - Improves battery life
        - Allows data to be collected for longer
    - It would take the data that the system collected and it would upload to a server corresponding to the specific MAC address. This data will keep uploading constantly until the battery is done or until the group stops it. The data is put into an excel file and organized there.
5. Electrical and Wiring Design

- WeMos D1R2
    - DHT-11→ WeMos
        - GND → GND
        - DATA → D6
        - VCC → 5V
    - Photocell
        - Connect to port A0 and 3V3

```
#include "WeMosSleep.h"  //include sleep function library
WeMosSleep sleep;  //create class instance for sleep functions
calls placed in setup() after Serial.println("Wemos POWERING UP ..... ");
sleep.setNapSeconds(12); // sets Nap time to 12 seconds
sleep.setSleepMinutes(15);// sets Sleep Time to 15 minutes
//if it is time to wake, the code after the following function will run, otherwise system will go to sleep
sleep.checkWake();
next function should be placed at end of loop() prior to close loop bracket
sleep.sleep();  //this will stop loop
```

6. Final Evaluation
    - Overall, our project was a success with only one minor setback or obstacle we faced
        - The one obstacle we faced was that there was a faulty wire, which prevented us from receiving humidity and temperature data. Once we identified the problem, we replaced the wire and it began collecting data and uploading everything correctly
        - We collected the three sets of data for the seven days after fixing the problem

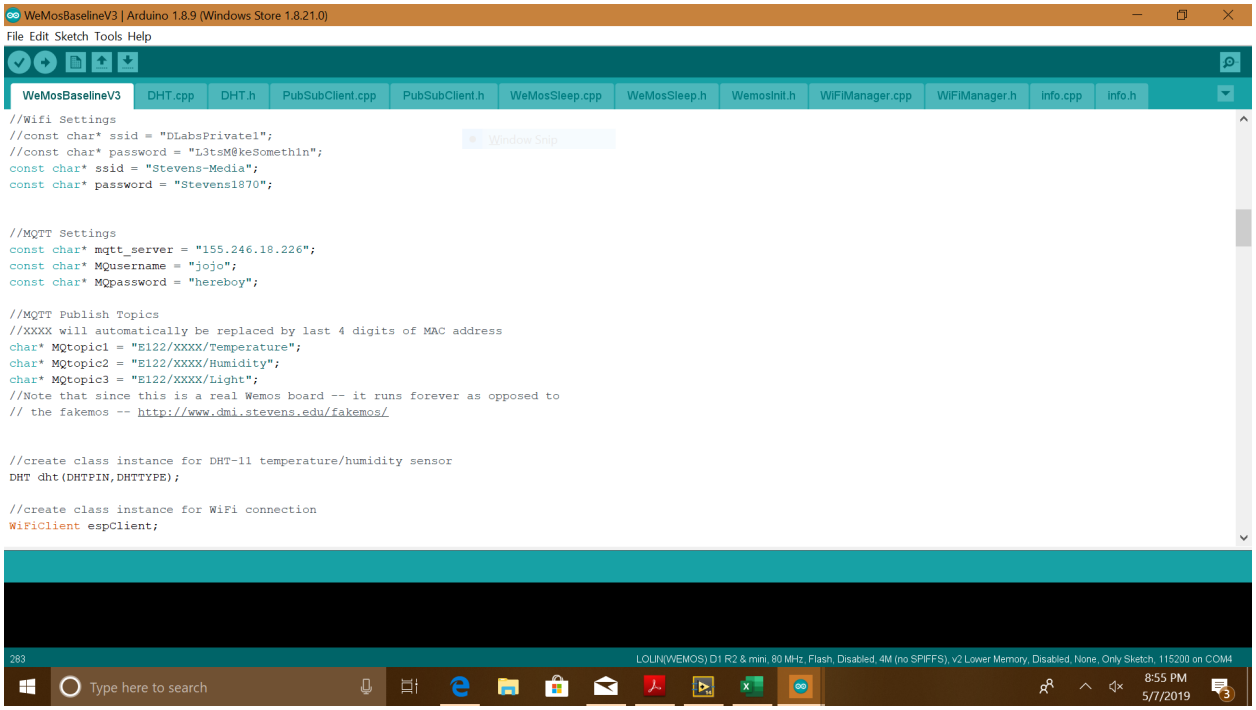
- We found our data…
    - Temperature fluctuated between 72 and 80. The average seemed to be about 74
    - Humidity fluctuated between 29 and 70. The average seemed to be about 33
    - Light levels fluctuated between 0.006 and 3. The average seemed to be around 1.5
- To represent our data…
    - Labview: We used three simple Waveform Charts because you can tell everything you need to know about the data. You can tell the extremes (maximum/minimum) and you can tell the average too.
    - Excel: Our data was filled out by date and time and the three readings for that specific time

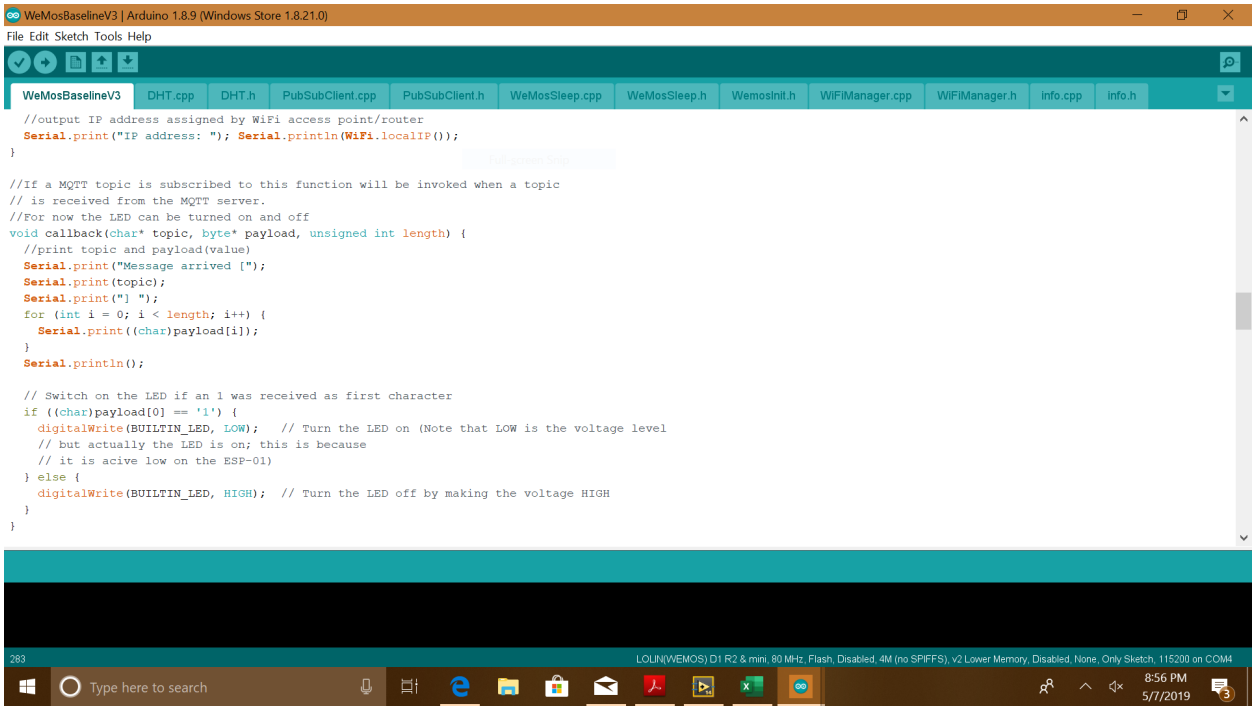
Conclusion and Recommendations:

Overall, our project was relatively successful. Over the weeks, we never seemed to have any large issues, except during the final week, when temperature and humidity readings cut out unexpectedly. Other than that now-resolved issue, we are overall very pleased with how this

semester's project went. It was very interesting learning how to 3D print and how to correctly wire and program such a setup. We feel that if we could do it again, we would generally stick to the same gameplan, as it worked very well this semester. One thing that we wished we had done early on was, instead of soldering on our pegs, we should have included them in our CAD file so that our printed F's could have had a more solidified foundation. Additionally, when our letters printed, they unfortunately tried unevenly, leaving them with a tolerable, yet noticeable curve that served to become a bit of a nuisance when reassembling the structure as a whole. However, these issues were extremely miniscule and did not serve as major obstacles. All in all, we are thrilled with how our project turned out.

Attachments





05/02/2019	03:35:14	F309	Temperature	77
05/02/2019	03:35:14	F309	Humidity	37
05/02/2019	03:35:14	F309	Light	2.065
05/02/2019	03:51:04	F309	Temperature	77
05/02/2019	03:51:04	F309	Humidity	38
05/02/2019	03:51:04	F309	Light	2.065
05/02/2019	04:06:53	F309	Temperature	77
05/02/2019	04:06:53	F309	Humidity	37
05/02/2019	04:06:53	F309	Light	2.061
05/02/2019	04:22:42	F309	Temperature	77
05/02/2019	04:22:42	F309	Humidity	38
05/02/2019	04:22:42	F309	Light	2.065
05/02/2019	04:38:31	F309	Temperature	77
05/02/2019	04:38:31	F309	Humidity	37
05/02/2019	04:38:31	F309	Light	2.061
05/02/2019	04:54:20	F309	Temperature	77
05/02/2019	04:54:20	F309	Humidity	37
05/02/2019	04:54:20	F309	Light	2.058
05/02/2019	05:10:09	F309	Temperature	75
05/02/2019	05:10:09	F309	Humidity	37
05/02/2019	05:10:09	F309	Light	2.061
05/02/2019	05:25:58	F309	Temperature	75
05/02/2019	05:25:58	F309	Humidity	38
05/02/2019	05:25:58	F309	Light	2.065
05/02/2019	05:41:46	F309	Temperature	78
05/02/2019	05:41:46	F309	Humidity	38
05/02/2019	05:41:46	F309	Light	2.061
05/02/2019	05:57:35	F309	Temperature	77

04/30/2019	15:55:09	F309	Light	0.545
04/30/2019	16:11:03	F309	Light	0.477
04/30/2019	16:26:57	F309	Light	0.523
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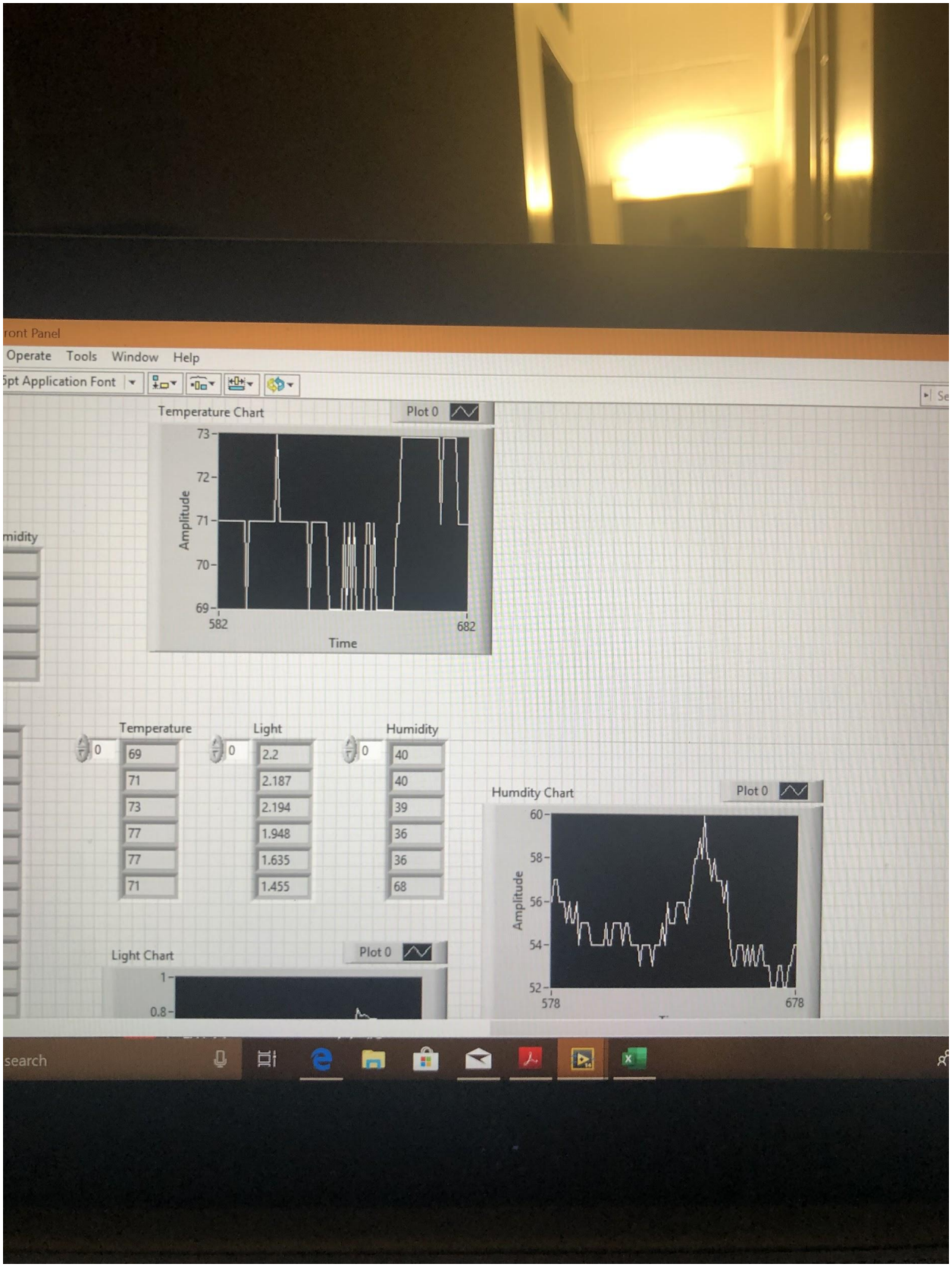
04/30/2019	17:14:35	F309	Light	0.474
04/30/2019	17:30:25	F309	Light	0.361
04/30/2019	17:46:14	F309	Light	0.3
04/30/2019	18:02:04	F309	Light	0.281
04/30/2019	18:17:57	F309	Light	0.281
04/30/2019	18:33:51	F309	Light	0.277
04/30/2019	18:49:45	F309	Light	0.255
04/30/2019	19:05:34	F309	Light	0.284
04/30/2019	19:21:23	F309	Light	0.223
04/30/2019	19:37:12	F309	Light	0.219
04/30/2019	19:53:04	F309	Light	0.223
04/30/2019	20:08:58	F309	Light	0.181
04/30/2019	20:24:52	F309	Light	0.139
04/30/2019	20:40:44	F309	Light	0.132
04/30/2019	20:56:38	F309	Light	0.168
04/30/2019	21:12:30	F309	Light	0.11
04/30/2019	21:28:21	F309	Light	0.123
04/30/2019	21:44:14	F309	Light	0.123
04/30/2019	22:00:04	F309	Light	0.129

Code Production	Group Effort-Led by Jakob
Wiring	Group Effort-Led by Matthew
Printing and Manipulation of Letters	Group Effort-Led by Matthew
Test of Sensors	Group Effort-Led by Jakob
Dorm where data was collected	Matthew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Temperature Chart
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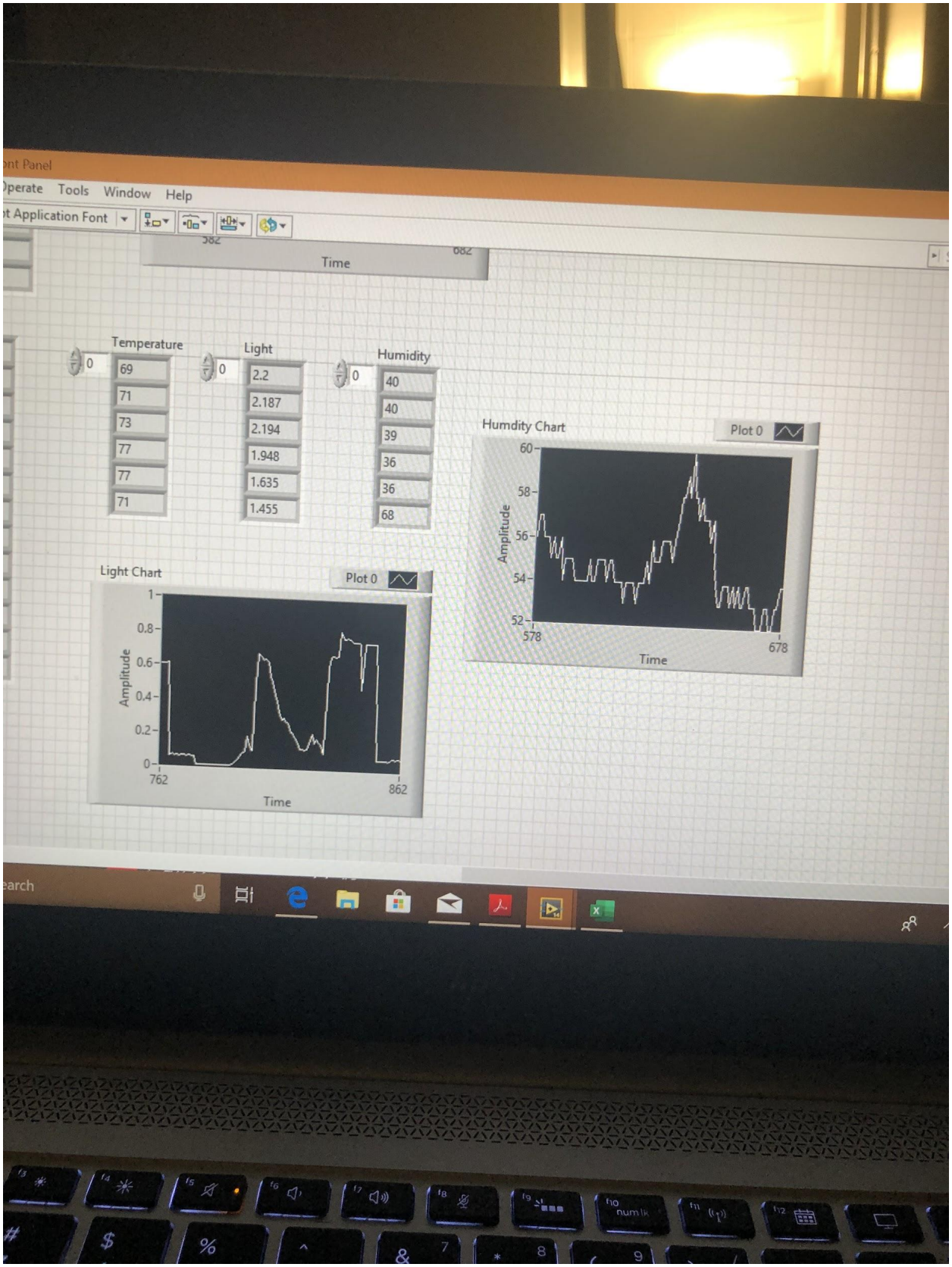
Temperature
Light
Humidity
Humdity Chart
Light Chart
Plot 0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2.2
2.187
2.194
1.948
1.635
1.455
40
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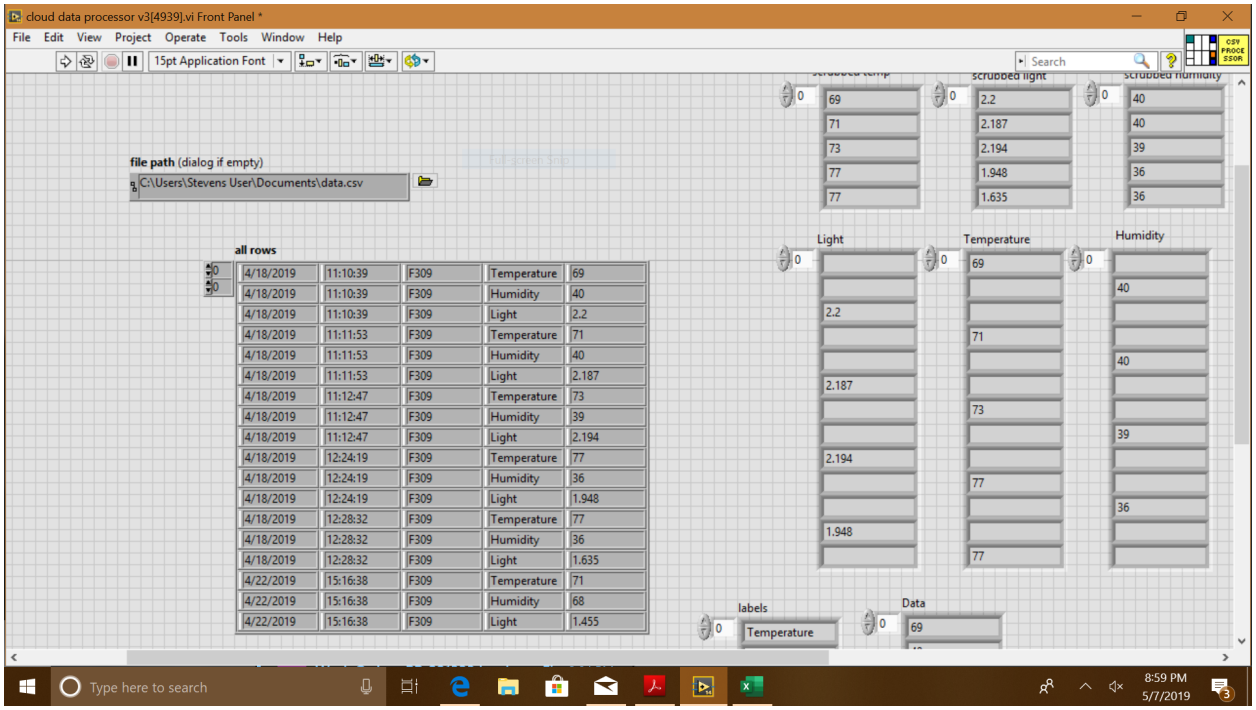
68
Humdity Chart
Plot 0
Amplitude
Time
578
678
Light Chart
Plot 0
Amplitude
Time
762
862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15pt Application Font
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all rows
4/18/2019 11:10:39 F309 Temperature 69
4/18/2019 11:10:39 F309 Humidity 40
4/18/2019 11:10:39 F309 Light 2.2
4/18/2019 11:11:53 F309 Temperature 71
4/18/2019 11:11:53 F309 Humidity 40
4/18/2019 11:11:53 F309 Light 2.187
4/18/2019 11:12:47 F309 Temperature 73
4/18/2019 11:12:47 F309 Humidity 39
4/18/2019 11:12:47 F309 Light 2.194
4/18/2019 12:24:19 F309 Temperature 77
4/18/2019 12:24:19 F309 Humidity 36
4/18/2019 12:24:19 F309 Light 1.948
4/18/2019 12:28:32 F309 Temperature 77
4/18/2019 12:28:32 F309 Humidity 36
4/18/2019 12:28:32 F309 Light 1.635
4/22/2019 15:16:38 F309 Temperature 71
4/22/2019 15:16:38 F309 Humidity 68
4/22/2019 15:16:38 F309 Light 1.455
Light
Temperature
Humidity
labels
Temperature
Data
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