**Dairy IoT Reflection**

**Summer 2018**

**Estimated Timeline**

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| From | To | Topic |
| April 14 | May 23 | Setting RFID and Arduino / Finding conversion |
| May 23 | June 13 | Calibrating RFID and Arduino / Checking readability |
| June 13 | June 20 | Setting RFID and Adafruit / Setting LoRa to LoRa |
| June 20 | June 27 | Setting ESP8266 / Posting data to ThingSpeak.com |
| June 27 | July 7 | Starting over with Priority1 RFIDRW-E-TTL |
| July 7 | July 12 | Optimizing power consumption |
| July 12 | July 19 | Reading many reader / Posting data to Thingspeak.com |
| July 19 | July 31 | Schematics / Finalizing components |
| July 31 | August 7 | Assembling |
| August 7 | August 10 | Experimenting / Debugging / Fixing |

**Part I: Setting RFID and Arduino / Finding conversion**

Got assigned on a dairy IoT project with PhD student Jingjie in Prof. Kim’s Lab (WISEST). On the first day, got the reader to read data. However, spent most time fixing reading problem and understanding how to send data via serial communication. Also met Master student Hanwook.

**Problem I:** A RFID reader kept reading the same data even though the reset pin on RFID was used.

**Solution:** Used a transistor from Plexus lab (2N4401) to power on and off, with active low transistor reset (increasing source voltage).

**Surprise/Learn:** The use of transistor with active low (V­gs). Reset pin on RFID did nothing, or still did not understand how to use it.

**Problem II:** Once receive data in HEX, did not know how to convert data to temperature.

**Solution:** With help of JJ, found a better document from another RFID module. Check last bit of temperature zone (must be 1), BIN to HEX(ASCII), decode ASCII to HEX and then flipped and convert to DEC then divided by 10.

**Surprise/Learn:** See conversion in action, re-learn Matlab code.

**Problem III:** Leading zero got truncated by Matlab.

**Solution:** Wrote Arduino function that prints 0 in serial communication.

**Surprise/Learn:** Function in C.

**Problem IV:** Attempt to send HEX instead of BIN. Failed to receive correct data in Matlab.

**Solution:** Stick with HEX (better solution found later).

**Surprise/Learn:** gain more understanding of data conversion and how data is sent in serial communication.

**General comment:** Learn more about Arduino, serial communication, data conversion, and re-learn Matlab. Did not spend lot of time on the project due to school and exams.

**Part II: Calibrating RFID and Arduino / Checking readability**

Met Prof. Choi for the first time in a meeting concerning a departure of JJ for 3 weeks. Worked with Hanwook most of the time from 8-4 pm weekdays. Got a task to create a program using Matlab to collect data for calibration.

**Problem I:** Attempt on one of real cow’s ears without a good plan. Threw it away afterward due to the smell.

**Consequence:** Got warned by Prof. Choi and told to be better at planning. Spend the rest of this part working on water bags and cooking meats.

**Surprise/Learn:** Practice makes perfect! Good plan means better work.

**Problem II:** Did not have a good plan and organization to collect data.

**Consequence:** Had to repeat a few experiments on those earlier experiments.

**Surprise/Learn:** Again planning! Make a good protocol when working with others.

**Problem III:** Reading failed after numbers of data (10K data). Issue of zeros.

**Solution:** Fixed Arduino code where it stuck in a loop forever.

**Surprise/Learn:** Testing is the key.

**Problem IV:** Had no proper tools to test angle and readability.

**Solution:** Bought a protractor and others for measuring.

**Surprise/Learn:** Be more prepared.

**General comment:** Wrote so many Matlab codes and even create Matlab apps. However, also spent a lot of time doing experiments.

**Part III: Setting RFID and Adafruit / Setting LoRa to LoRa**

After the part II, Hanwook left for a break. JJ was back. Bad communication with prof. so spent a few days waiting for LoRa. Most of the time spent to understand the tutorial code of RX and TX of Feather M0 LoRa.

**Problem I:** Realize that SoftwareSerial cannot be used on Feather.

**Solution:** Went back to HardwareSerial with some buggy transitions.

**Surprise/Learn:** Learn the difference between HardwareSerial and SoftwareSerial and how to use them.

**Problem II:** IC digital voltage isolator... what is it? And how to use…? Datasheet was not friendly to a novice!

**Solution:** Ask for JJ’s help

**Surprise/Learn:** it can be used to level shift voltage.

**Problem III:** Burned that one IC…

**Solution:** Soldered a new one…

**Surprise/Learn:** Learn how to solder with air heat and flux of IC on a breakout board.

**Problem IV:** Leading zero again when sent via radio

**Solution:** Got all data first and send in HEX as a package.

**Surprise/Learn:** The reading at RX was almost perfect!

**Part IV: Setting ESP8266 / Posting data to ThingSpeak.com**

Tried to figure out how to use ESP8266 WiFi module. Using ThinkSpeak due to its capability to analyze by Matlab.

Problem I: ESP8266 (ESP-12e) harder to be used.

Solution: Bought ESP8266 (ESP-1)

Surprise/Learn: ESP8266 (ESP-12e) might work.

**Part V: Starting over with new reader from Priority one RFIDRW-E-TTL**

Since the old reader output 5V and Adafruit cannot take that. We used a new reader that outputs 3.3V.

Problem I: New reader is pre-programmed and sends only ID if not asked for more detail.

Solution: Open source code can help.

**Part VI: Optimizing power consumption**

No sleep for ATSAMD21 somehow. Only standby mode

**Part VII: Reading many reader / Posting data to Thingspeak.com**

Handle multiple inputs and collision. In the end, did not really handle a collision…

**Part VIII: Schematics / Finalizing components**

Draw schematics in Altium in details and high level.

Problem I: Floating Ground of a reader caused by a NMOS, resulting in higher Vin to a MCU.

**Part IX: Assembling**

Integrating and prototyping a device on a prototype board. Breaking some parts.

**Part X: Experimenting / Debugging / Fixing**

Case cracked. Wire snapped. Position moved. Data collided. With help of Prof. Kim, we all managed to get through the preliminary experiment. The antenna tends to be problematic due to its thin wire.