

Goal:

The Goal of this project was to create means of communication that does not rely on outside infrastructure in order to work. I wanted the ability to send text messages, location, and pictures between two recipients. Furthermore everything should be able to be done on the PCB Board. With these requirements I started looking at parts.

Parts:

Computing and Power:

I decided to reuse the standard Feather M4 parts for my computing and power. None of the parts I used required anything that was not already available on the Feather M4, and besides the screen I chose, the other parts could be found in breakout boards sold by adafruit so I had confidence it would work.

Storage:

I used a standard microSD card for data storage. Nothing special about the decision.

Communication:

To be able to send messages at a distance, I decided on using a LoRa chip. It gave the ability to send bits over a 5 mile distance (assuming perfect conditions). Furthermore, it allowed communication between two chips with just the modules and an antenna (which could be made with a wire). Only con was the bit rate which ranged from 0.3 kbit/s and 27 kbit/s. Seeing that a standard picture was at least 100 Kb, I decided to abandon the idea for now. There was a decision on if I wanted to use 400 MHz or 900 MHz, but due to regulations in the area, the decision was made on my behalf.

Location:

For my GPS, I used the MTK3333 chipset as the same one was on the Adafruit website. It gave me time, date and location which was more than enough for me. Also helped that the chip had a built-in antenna which meant I did not need to use one but found that adding one would make getting a signal faster.

Screen:

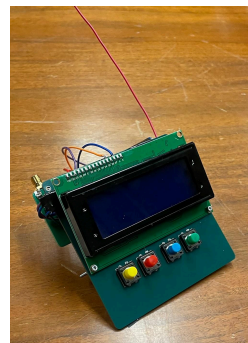
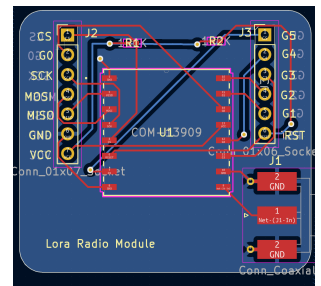
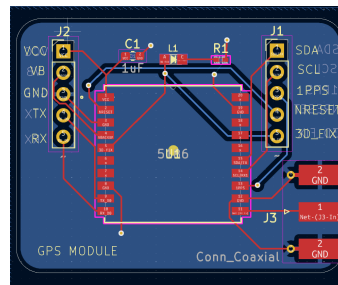
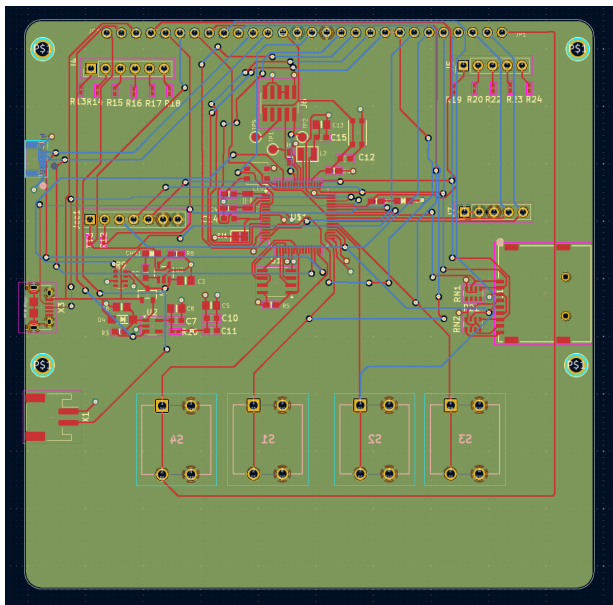
Decided to use an LCD display that had an I2C bus backpack as I did not have enough pins to afford not using the I2C bus. Furthermore since I was no longer able to send images, I used a LCD display for the looks.

Buttons:

To be able to send messages ordered a pack of 4 buttons to help with the communication between the user and board.

Impleantion:

Decided to break my project down into 3 boards, Main, LoRa, and GPS. Seeing how I had a feather M4 already, I could test each one individually which would make debugging the boards easier. Furthermore I decided to add extra pin outputs for the main board as I wanted to make sure all my pins were connected where they were supposed to be. Below I leave pictures of the board layouts. I made it so the breakout boards I made would be able to slide in the smaller two breakout boards onto the main one for a snug fit. Also design it so I would be able to screw on the screen onto the main board.



The Final Product is shown here. It works on a state machine which cycles through different modes to allow the user to accomplish a multitude of things. I created a Table to better explain

State	What does it do	What the buttons do
Boot-Up	Stays on a screen displaying "Waiting for GPS to get a Fix" Will automatically exit once done	Holding down the green button halts the fix and takes to the home screen. Allows all other functionality to work
Home	If GPS has a fix, Displays time and	Pressing the Green button moves to Read

	date. If it does not, it displays "Welcome"	
Read	Allows users to scroll through the microSD card to view old and new messages. Can copy cords from old messages to use in Track or Write	Pressing the Yellow button copies coordinates Pressing the Red button scrolls back Pressing the Blue button scrolls forward Pressing the Green button moves to Write
Write	Allows users to type out messages in morse code. Once ready, they are sent continuously till another device receives and sends back confirmation. All details(time, date, if gps is down) are written into the microSD card. Extra commands are available to send more info (ex. ?GPS sends current coordinates)	Pressing the Yellow button types out morse Pressing the Red button confirms morse char Pressing the Blue button sends message Pressing the Green button moves to Track
Track	Allows user to use GPS to know where they are at, or track coordinates they copied from the read stage	Pressing the Yellow button clears coordinates Pressing the Red button displays current coordinates Pressing the Blue button copies current coordinates Pressing the Green button moves to Receive
Receive	Will put users in a state where all other operation are halted in order to better receive a message	Holding the Green button moves to Home

Conclusion:

In conclusion the outcome did everything I set out to do. However I feel a better understanding of LoRa could have helped in allowing me to send images. The idea would be to create my own encoding of symbols and create text based images such as what is shown in this [link](#). Regardless of the software side, I believe my board layout could have been made better if I were to make the I2C backpack part of the main board. This would have let my LCD screen be flush with the body of the PCB and would eliminate the need for jumper cables I used to power it. Furthermore I would want to play around with the board cut out to make it more comfortable to hold and allow for a better place for the battery.