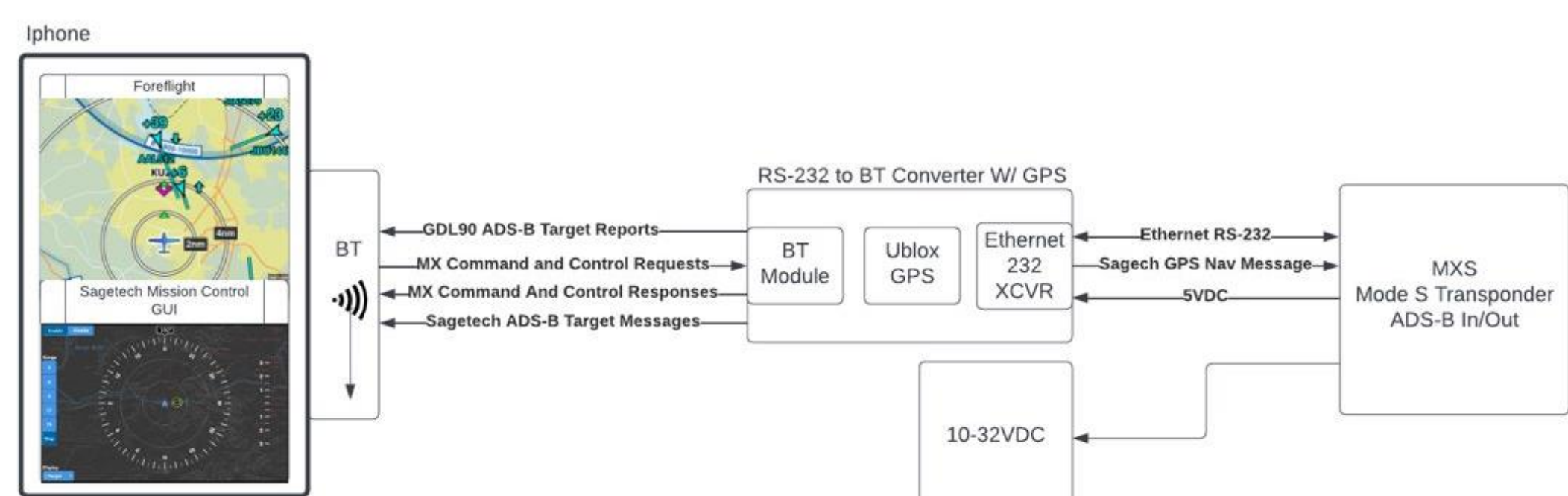


STUDENTS: Howard Her, Sai Jayanth Kalisi, Truong Hoang Pham, Jiaxin Xie

Introduction

- The goal of this project is to receive the GPS signal from an avionic unit using a GPS module connected to a Bluetooth ethernet dongle on the Sagetech MX Transponder.
- The received GPS data is then sent to an iOS application for displaying the aircraft's location on a map.
- The iOS application also enables configuring the installation message for the MX platform through the Bluetooth and ethernet connection.



System Diagram

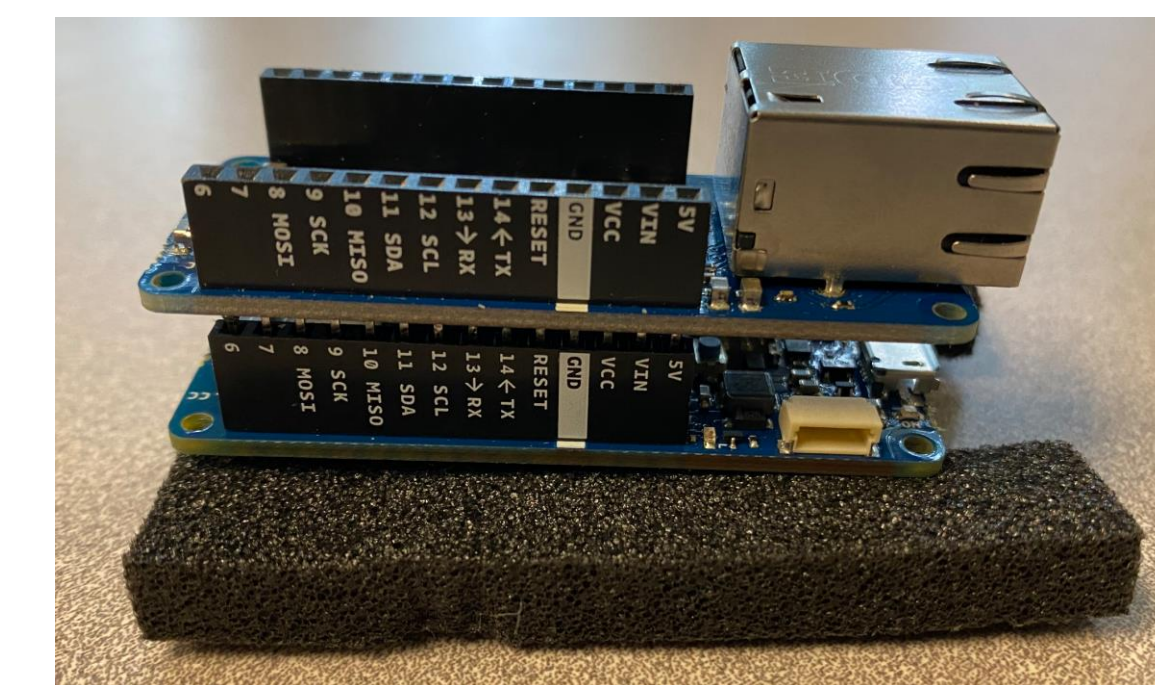
Design Framework, Languages, and Tools

- Quasar: Vue.js based cross-platform framework that we use to build the application.
- Vue.js: Open-source front-end JavaScript framework for building user interface and map of our application.
- Capacitor: An open-source framework to enable cross-platform ability of the App on iOS, Android, and Progressive Web Apps.
- Swift: We used Swift to write the plugin for the Sagetech SDK to encode and decode messages between the App and the MX Transponder.
- Arduino Microcontroller: We used Arduino as the middle node of our connection between the App and MX Transponder to manipulate the process of sending and receiving data.



Bluetooth (BT) Module

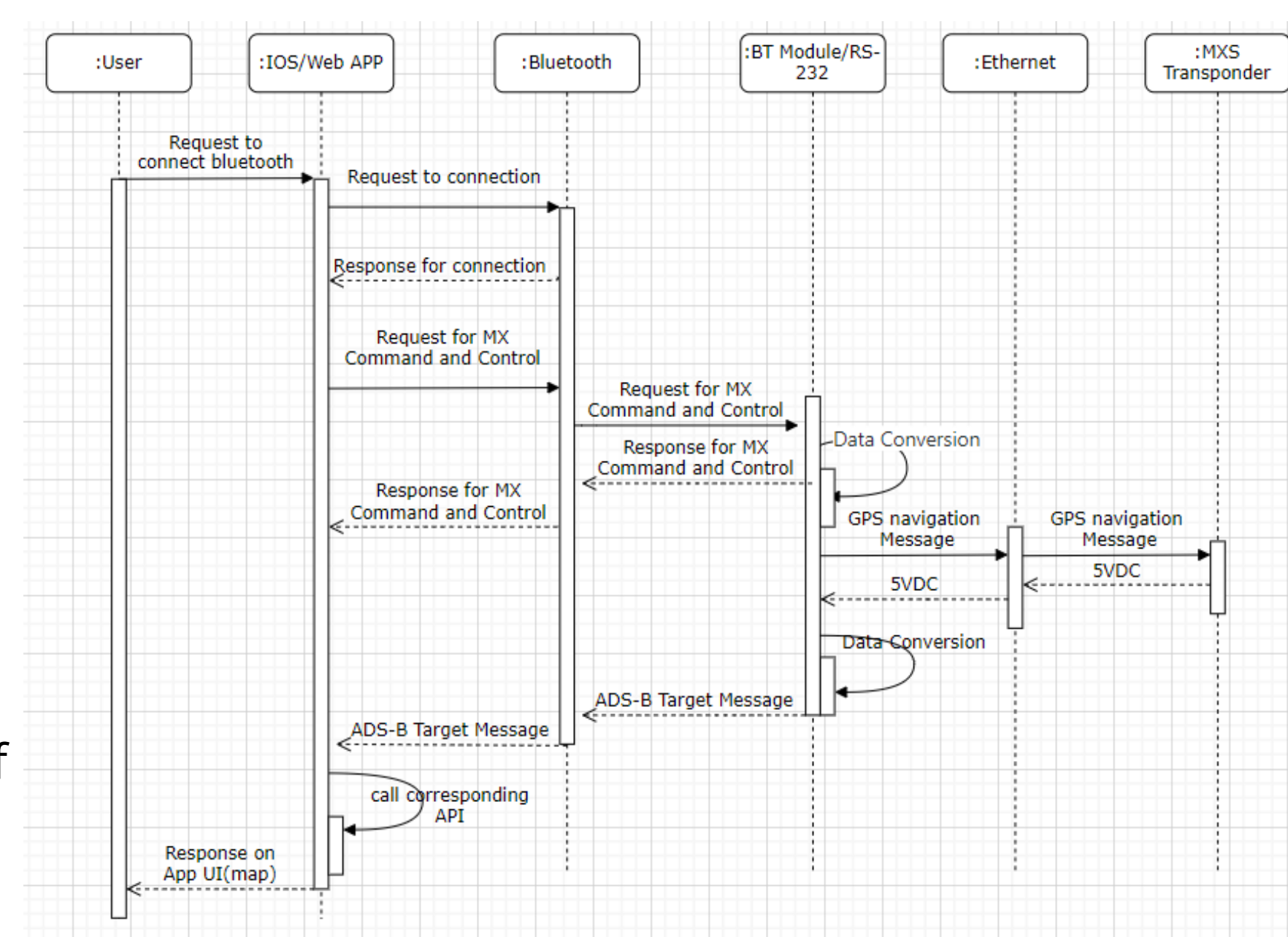
- The BT module serves as a central intermediary in a two-way connection between the iOS application and the transponder.
- The BT module connects to the transponder via Ethernet, facilitating data exchange in packages of bytes.
- The BT module enables wireless communication by establishing a Bluetooth connection with the iOS application.



Arduino MKR WiFi 1010

Interfacing between the Application and the MX Transponder

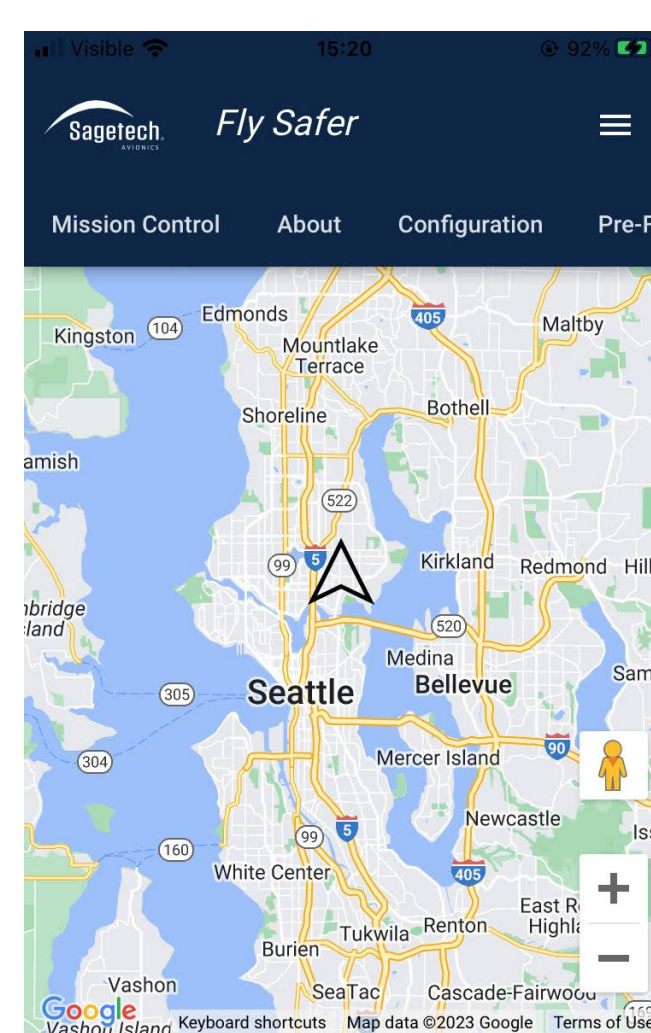
- The BT module receives/sends messages from/to the transponder in packages of bytes via ethernet.
- The BT module organizes data of bytes from the iOS application into a package and sends to the transponder via ethernet.
- The BT module receives/sends messages from/to the iOS application in bytes via Bluetooth connection.
- The BT module breaks a package of bytes from the transponder into bytes and sends to the iOS application via Bluetooth connection.



Communication b/w the App and the Transponder

Google Map for Displaying Aircraft Location

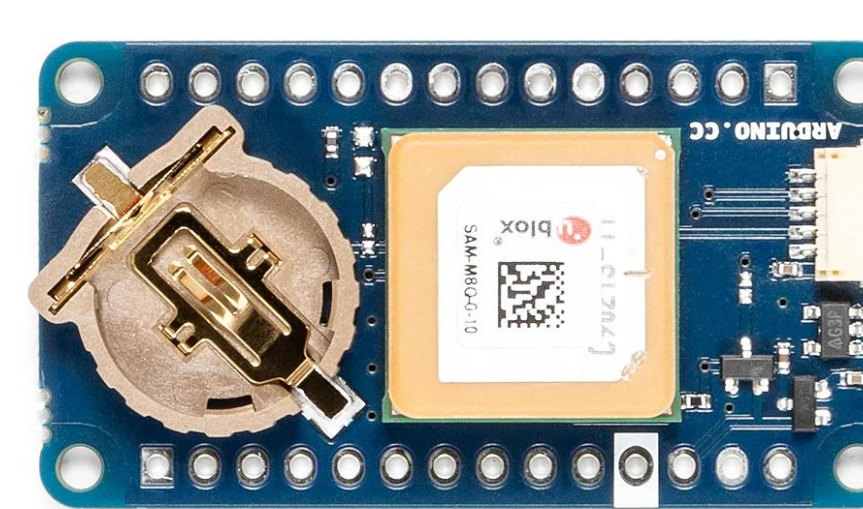
- One of our main goals in the project is to display the GPS location of the aircraft on our application.
- The map is implemented using Vue3-google-map API.
- It can show the location of the aircraft based on a set of longitude and latitude coordinates provided.
- It can change its location of display in response to the dynamically changing longitude and latitude coordinates.



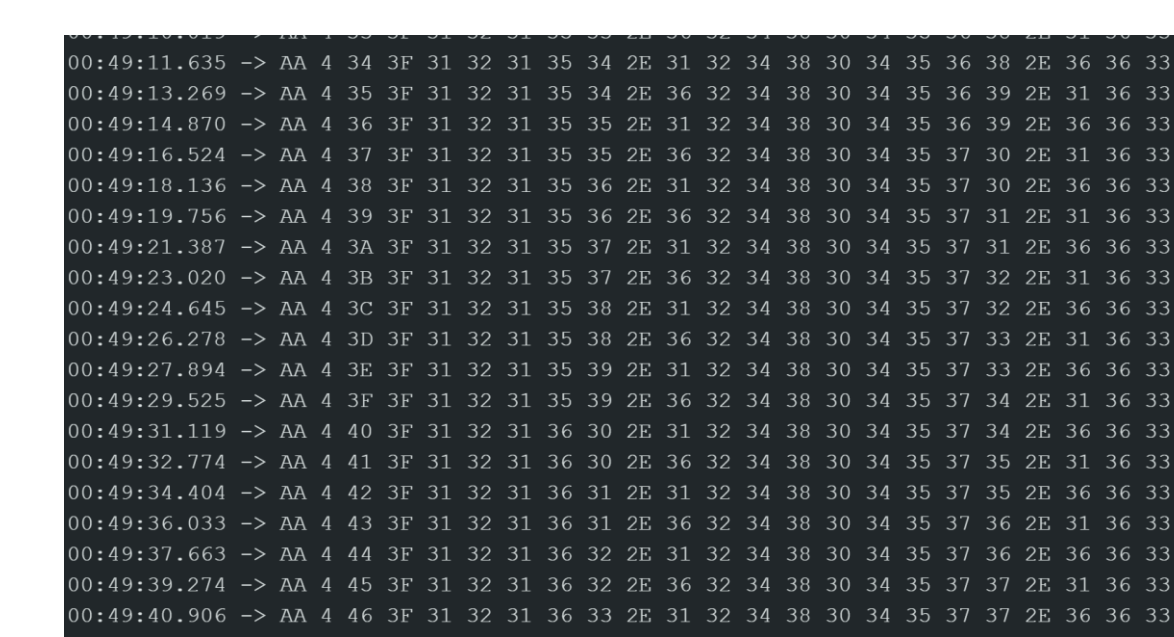
Mission Controls Page

GPS

- The MX Transponder obtains data via receiving coded messages from the ethernet cable. It receives status and installation messages. Among others, one such message is the GPS message.
- Began by using a Ublox GPS sensor, which is capable of procuring positioning data like latitude, longitude, and altitude, in addition to velocity, heading, and orientation.
- Testing used "manufactured" data to ensure all readings were acceptable to the MX Transponder. It is this data that is currently sent to the Transponder



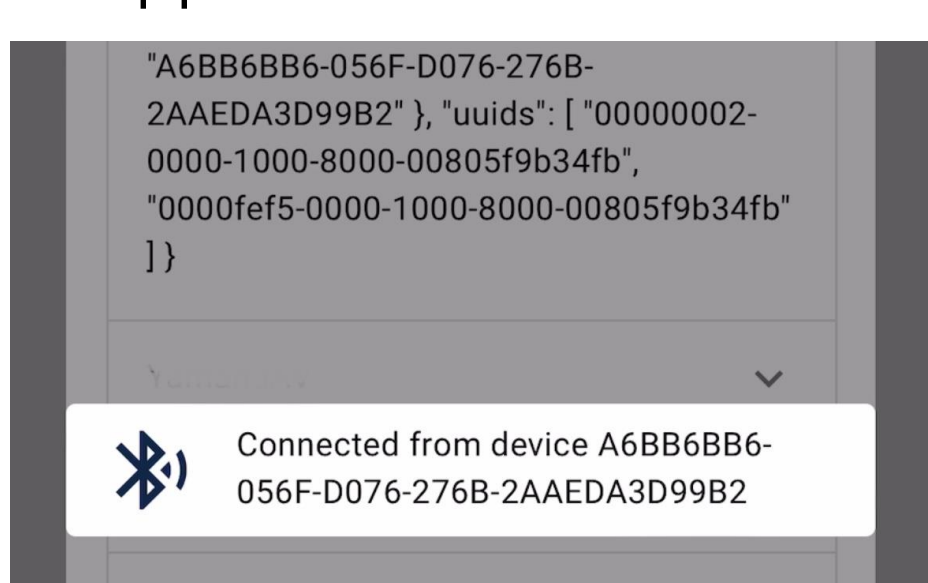
Ublox GPS Module



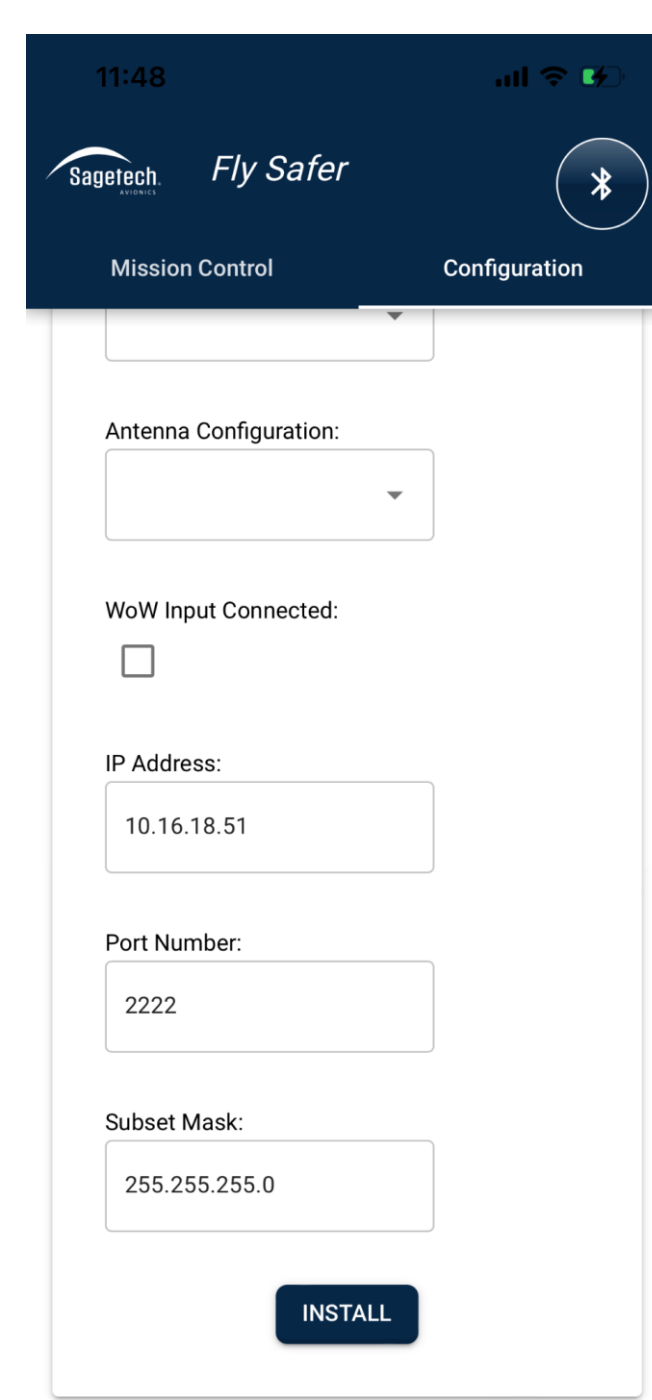
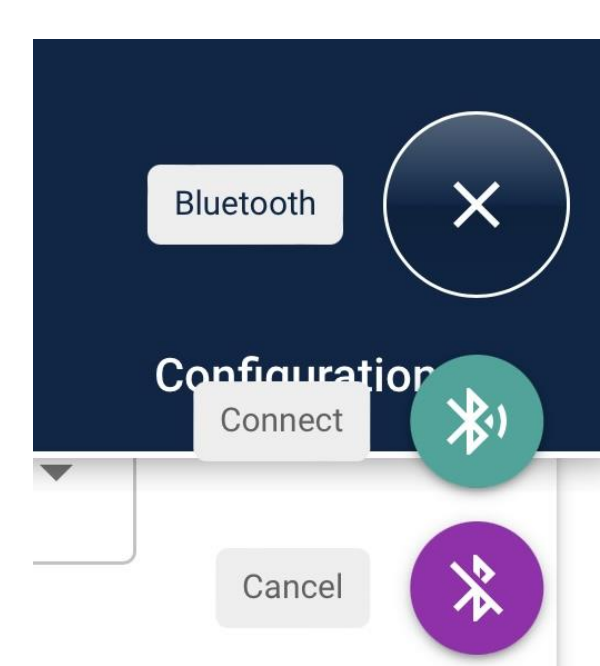
Manufactured GPS Data

Message Handling and Bluetooth Interaction

- The iOS application can connect to the Bluetooth module, interact by sending and receiving data.
- The iOS application encodes the information entered by the user and sends it to Bluetooth module in the format of bytes.
- The message in bytes received by the Bluetooth module will be integrated and decoded in the iOS application.



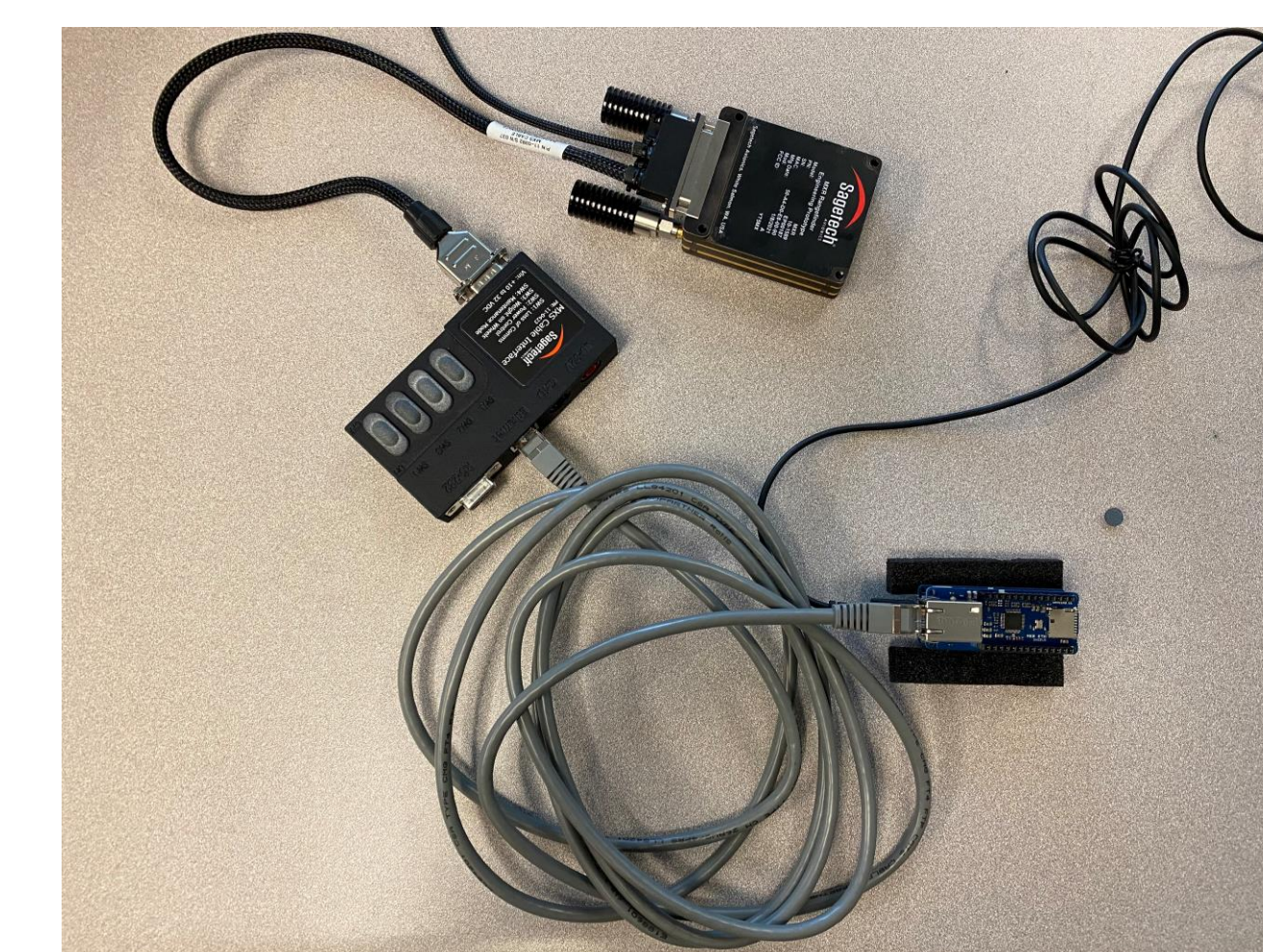
Bluetooth Connection Pages



Configuration Page

Results

- We are able to have the MX Transponder to communicate with the Application via the Bluetooth ethernet dongle correctly.
- The application is capable of configuring installation message to the MX Transponder.
- The MX Transponder is capable of reporting back to the application to check if the message sent is correct.
- Data encoding and decoding work properly between devices by using the Sagetech SDK.



Connection of Transponder to the BT Module

Future Work

- Getting the GPS Module to work to get us real GPS data that changes dynamically depending on the change of aircraft location.