Ballistic Acquisition Telemetry and Trajectory System using an Arduino

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Overview:

1. **Goal:**

   Report telemetry from a self-contained device to a fixed ground station.

2. **Components:**

   - Ground Station:

     Arduino -> Antenna/Receiver (Comms) -> Data processing.

   - Air Unit:

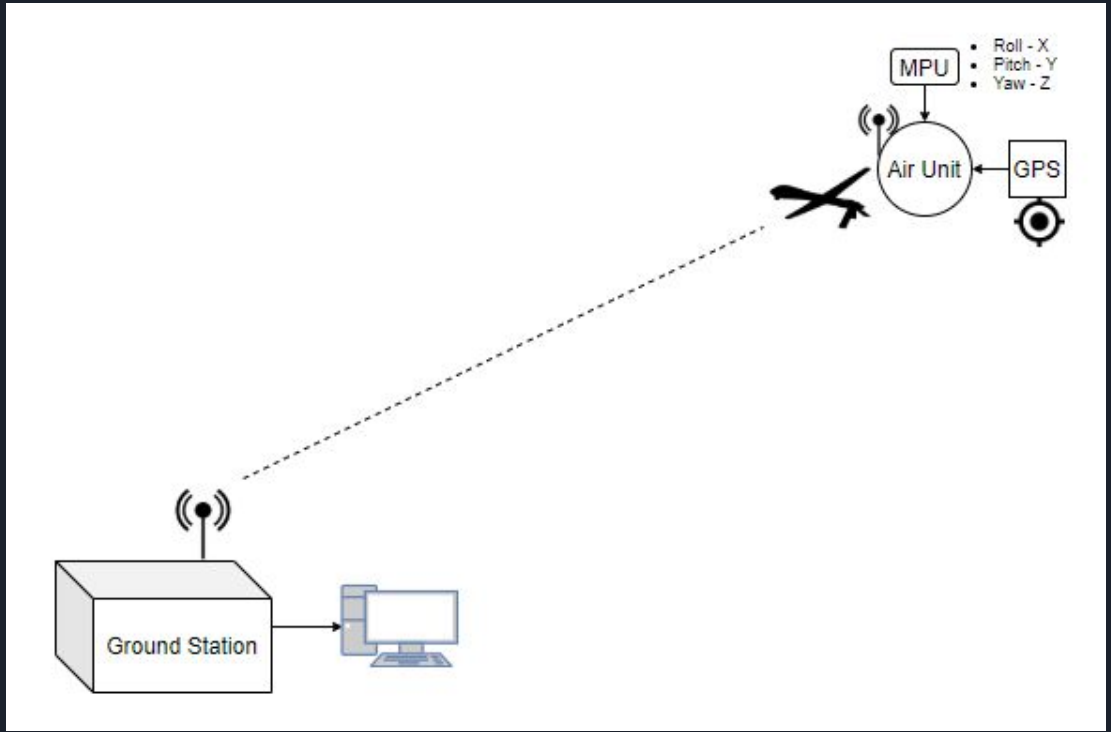
     Teensy -> IMU (initial measurement unit) - MPU -> Antenna/Transmitter (Comms).

3. **Results:**

   Data is output to the serial monitor according to the same scheme it's sent to the radio transmitter. Eg.

   < A.x, A.y, A.z | G.x, G.y, G.z | M.x, M.y, Mz | AD.x, AD.y, AD.z >

Overview:



Planning:

Software Component -> Teensy & (IMU-MPU, GPS) Code
-> Uno & PC Code

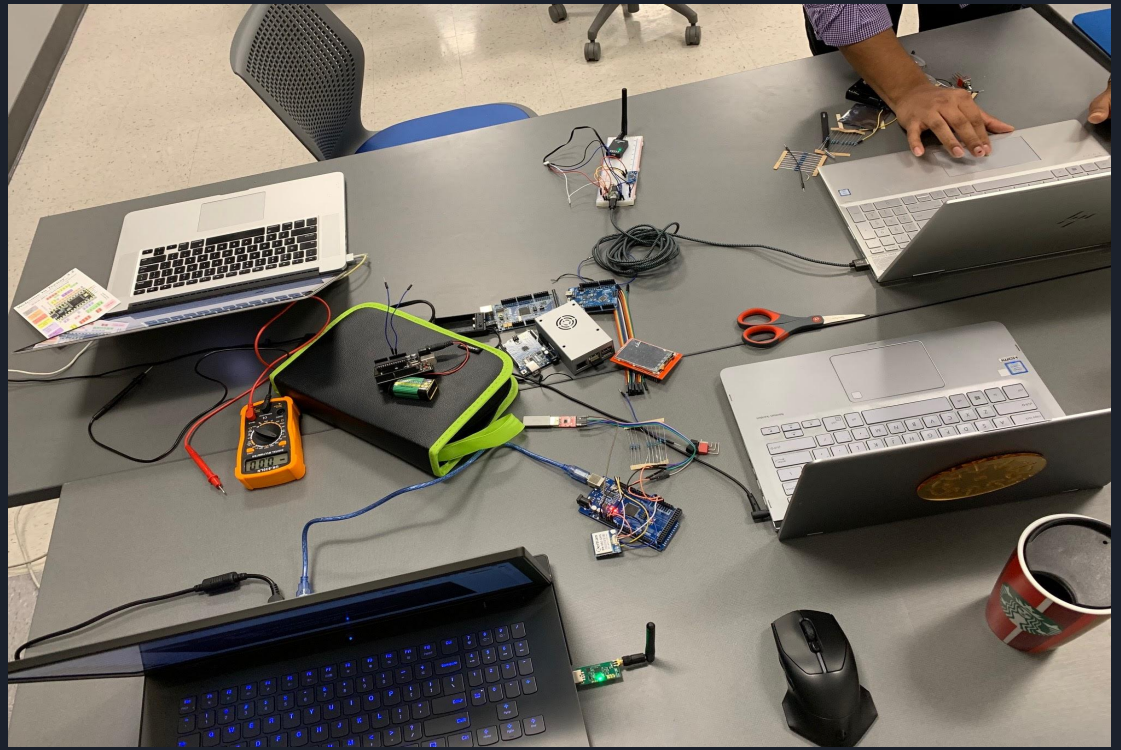
Antenna -> Communication RX/TX Connections and Configurations

Data Processing & Filtering

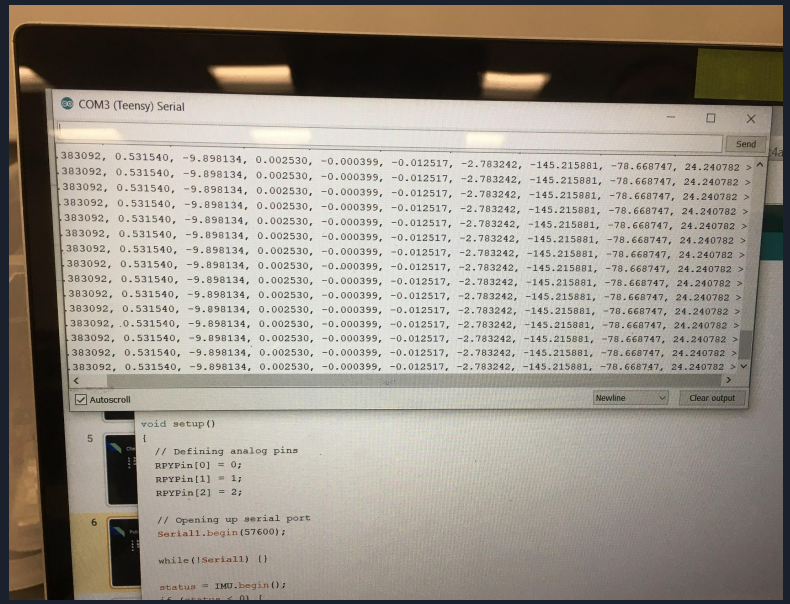
Hardware Component -> Uno - Physical Ground Ops.
-> Teensy - Physical Air Unit.

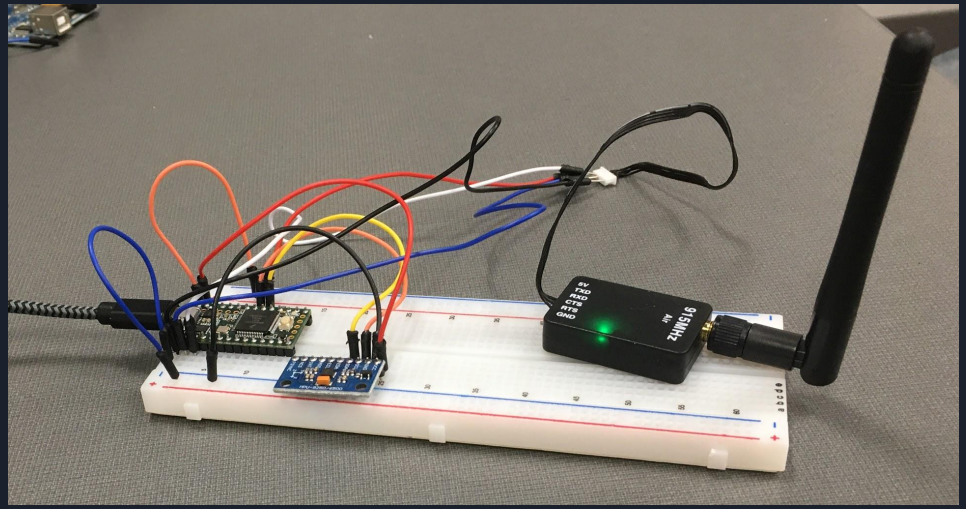
Design & Containers -> 3D CAD SOLIDWORKS

Planning:



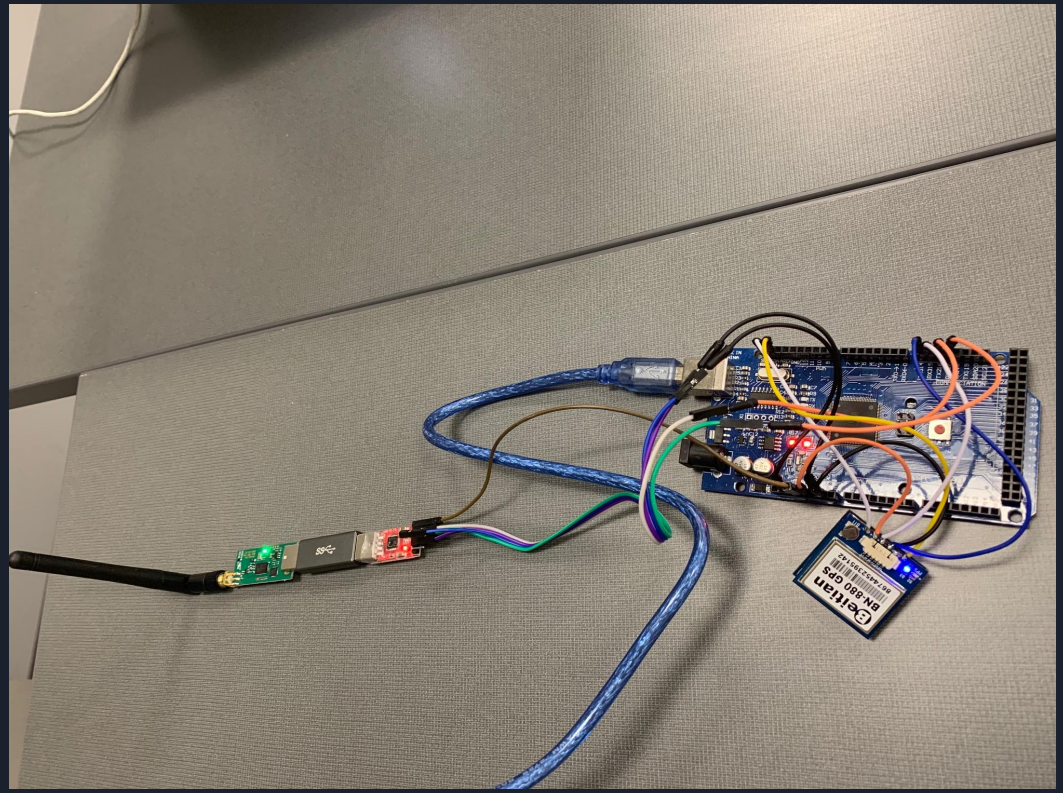
Progress (Air Unit):



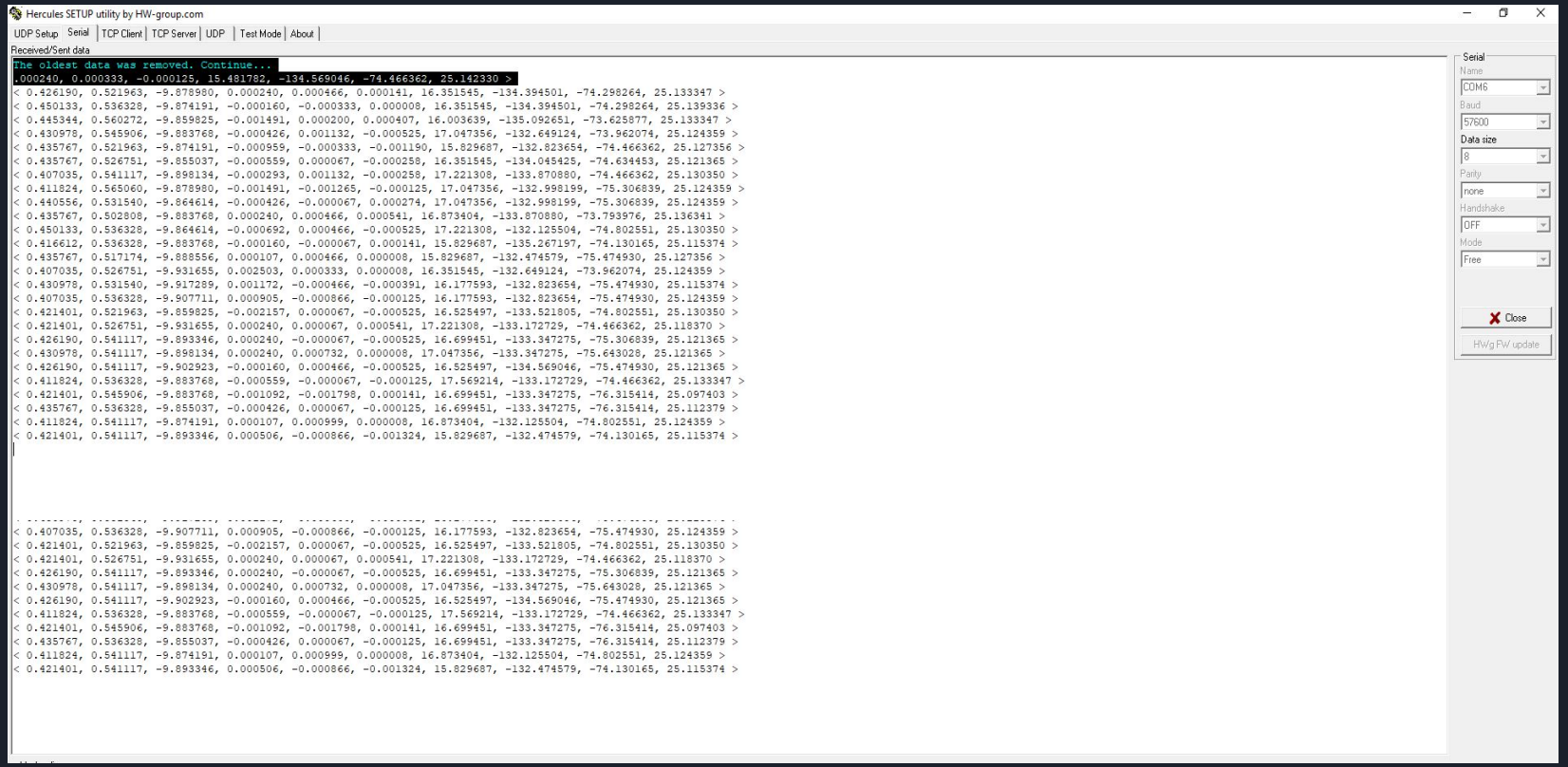


Air Unit (Drone):

Progress (Ground Station):



Data Readings:



Questions:

- How should each axis of data be mapped?
- What communication protocol is each component of the project using?
- How will the data be collected from the Arduino?
- How does the Beitan GPS work? How do we print data from it to the serial monitor repeatedly?
- How does the Serial*.available() function work?
- How many devices can the Mega handle?
- At what baud rate is the data optimally received at from each device?
- What have we learned so far?
- If we were to receive data from the computer, how would it be graphed?

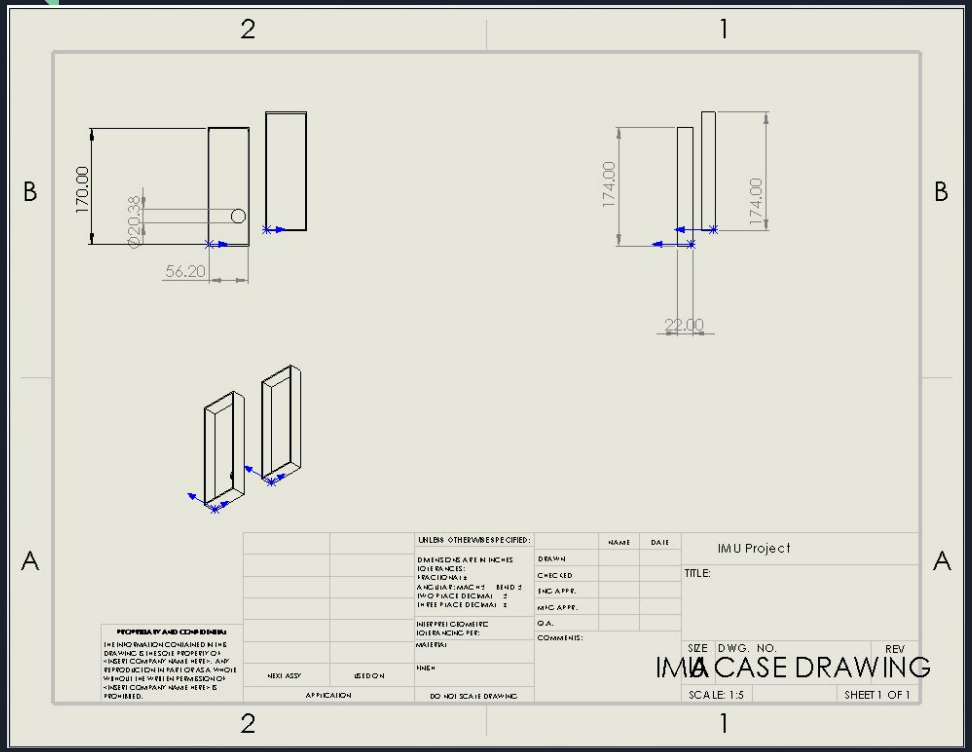
Challenges:

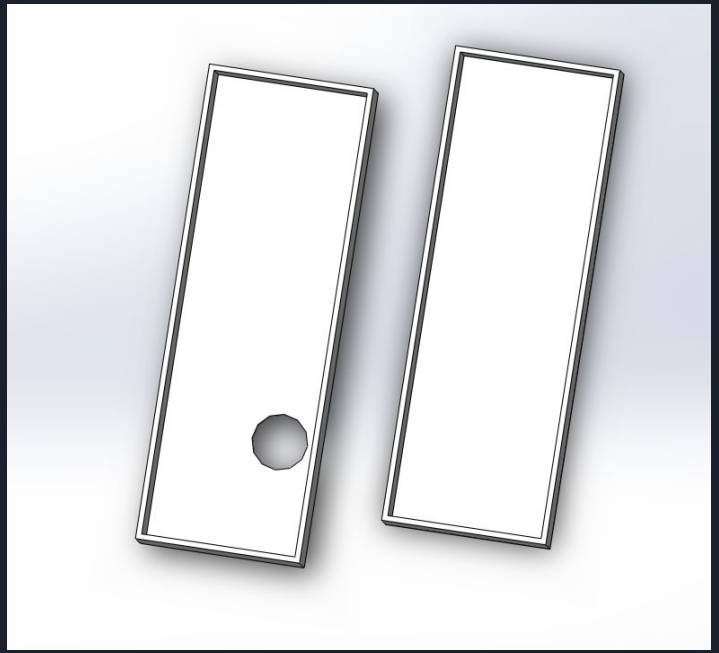
- Team Coordination.
  - Worked on better communication.
- Arduino Malfunction (UNO R3).
  - Replaced it with a Mega 2560.
- USB to TTL Problems (USB Slave).
  - Attempted to replace the radio telemetry unit with 3DR Radio 915MHZ with serial connections on both ends.
- Dealing with Arduino Libraries when reading from both MPU & GPS.
  - Need to merge the two code bases and deploy on Mega.

Future Work:

1. Building a container for both Air and Ground Units using Solidworks.
2. Setting up the Air Unit on a drone and run tests.
3. Connect multiple sensors, potentially a camera.
4. Continue answering the questions on slide 9.

IMU Case-Ground





References & Reproducibility:

GitHub:
https://github.com/SMikaelian/BATTS

Book Reference:
https://learning.oreilly.com/library/view/arduino-cookbook-3rd/9781491903513/ch01.html#getting_started