



RECOVERY TEAM REPORT

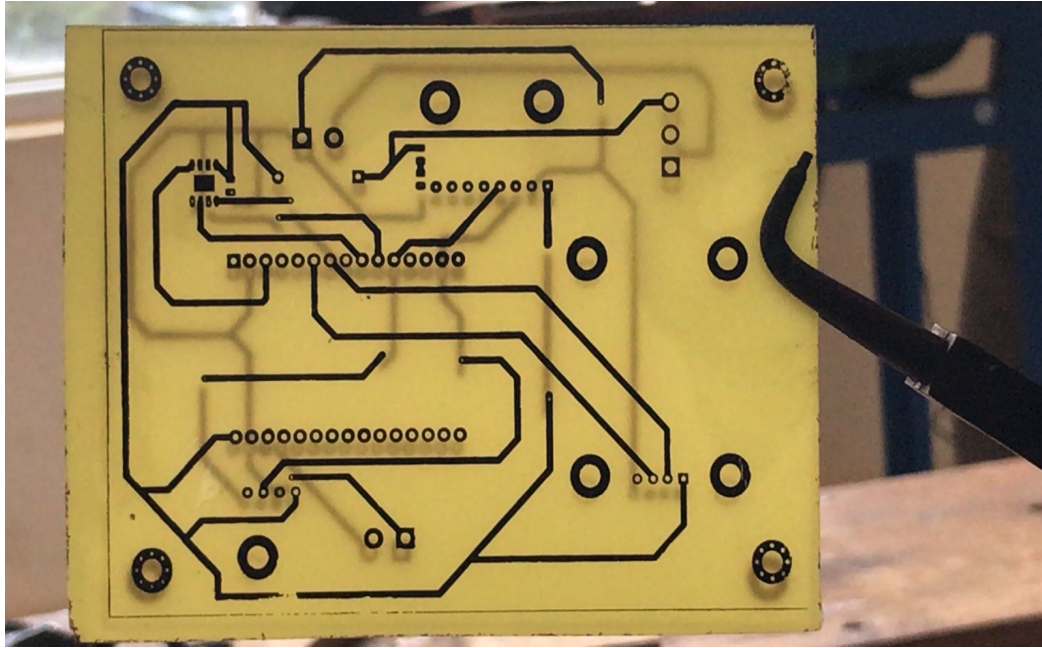
WEEK 6

TASK DONE WEEK 6

- Fabrication of PCB and etching [#28](#)
- Simulation of 3D printed piston [#43](#)
- Design of the piston holder
- Testing code for kalman filter
- GPS Real time tracking on base-station. [#6](#)



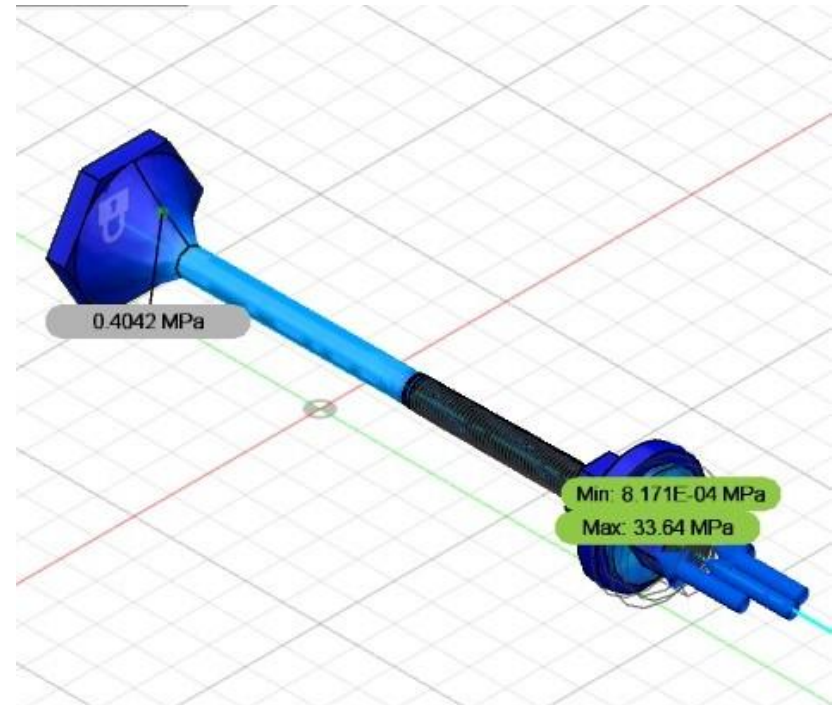
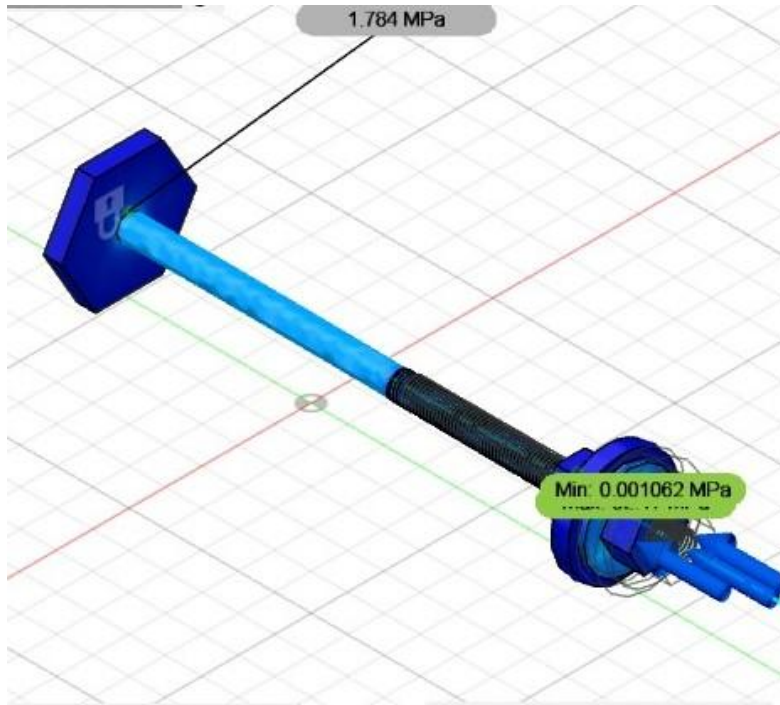
Fabrication of PCB and Etching



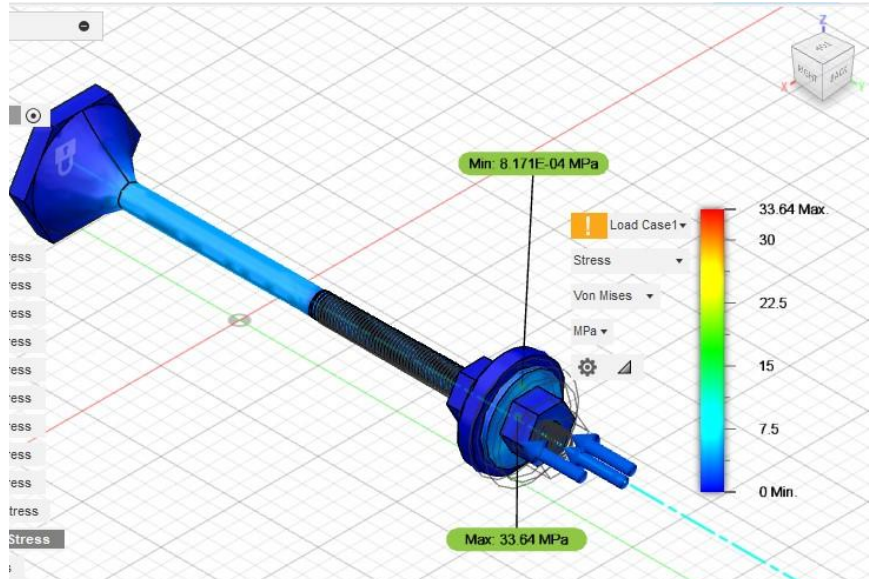
Successful transfer of the layout to the board

Successful etching of the process the flight computer.

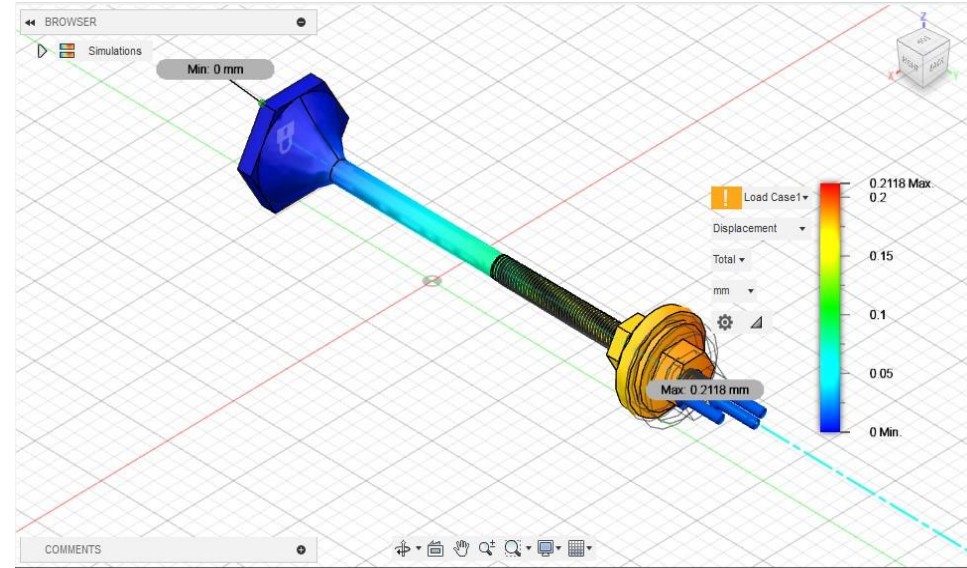
Simulation of 3D Printed Piston



Corner stress in two pistons (With and without reinforcement). 100N of force applied.



Stress Highlight: Nut closest to the force experiences the most stress (33.64 MPa), followed by the shaft of the bolt. 100 N applied.



Displacement Highlights: Maximum displacement happens at the end of the piston. This gradually recedes until zero at the other end. 100 N applied.

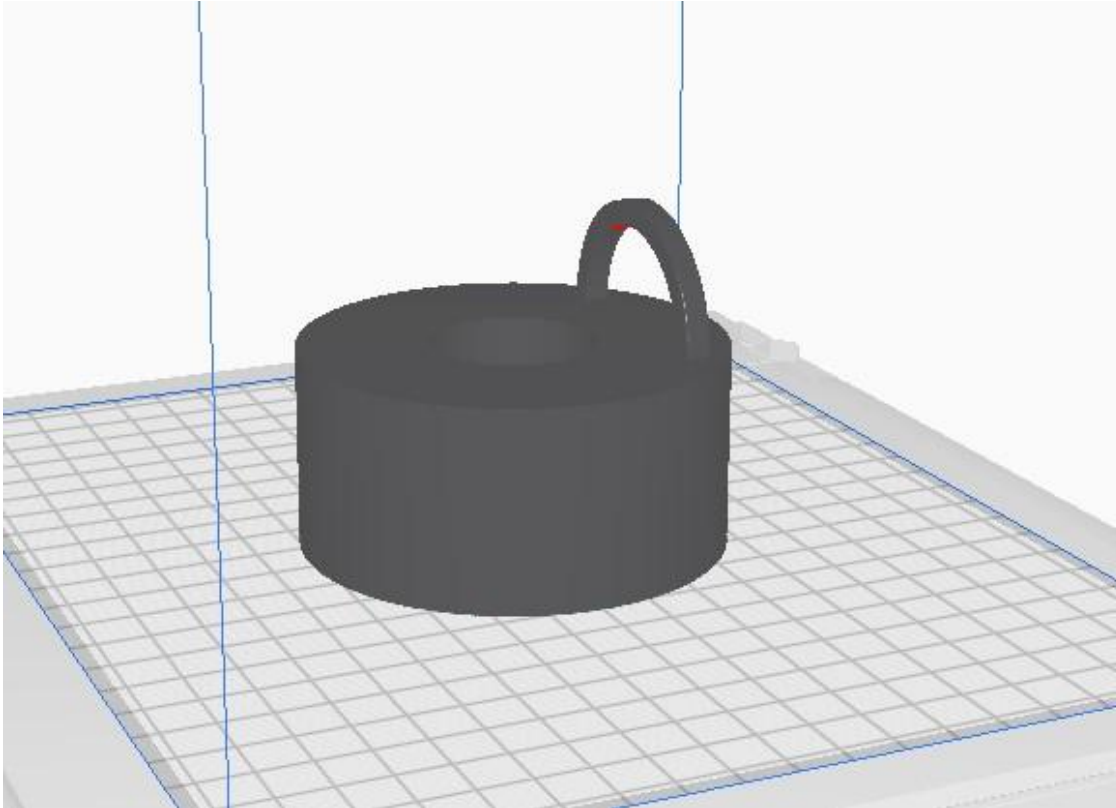
		5N	10N	20N	30N	40N	50N	60N	70N	80N	90N	100N
SAFETY FACTOR	MAX	15	15	15	15	15	15	15	15	15	15	15
	MIN	15	14.86	7.431	4.954	3.715	2.972	2.477	2.123	1.858	1.651	1.486
VON MISES STRESS (MPa)	MAX	1.682	3.364	6.729	10.09	13.46	16.82	20.19	23.55	26.92	30.28	33.64
	MIN	4.09E-05	8.17E-05	1.63E-04	2.45E-04	3.27E-04	4.09E-04	4.90E-04	5.72E-04	6.54E-04	7.35E-04	8.17E-04
DISPLACEMENT (mm)	MAX	0.01059	0.02118	0.04236	0.06354	0.08472	0.1059	0.1271	0.1483	0.1694	0.1906	0.2118
	MIN	0	0	0	0	0	0	0	0	0	0	0
STRAIN	MAX	0.00129	0.002597	0.005194	0.007792	0.01039	0.01299	0.01558	0.01818	0.02078	0.02338	0.02597
	MIN	2.87E-08	5.38E-08	1.15E-07	1.72E-07	1.30E-07	2.87E-07	3.44E-07	4.02E-07	4.59E-07	5.16E-07	5.74E-07
REACTION FORCE (N)	MAX	0.0856	0.1712	0.3424	0.5136	0.6848	0.856	1.027	1.198	1.37	1.541	1.712
	MIN	0	0	0	0	0	0	0	0	0	0	0
CONTACT PRESSURE (MPa)	MAX	2.174	4.347	8.695	13.04	17.39	21.74	26.08	30.43	34.78	39.13	43.47
	MIN	0	0	0	0	0	0	0	0	0	0	0
CONTACT FORCE (N)	MAX	0.6523	1.305	2.609	3.914	5.218	6.523	7.828	9.132	10.44	11.74	13.05
	MIN	0	0	0	0	0	0	0	0	0	0	0

Results of 11 simulations with different amounts of force.

<https://docs.google.com/spreadsheets/d/1NvJ6pXUdveLw251FrG-tFvC7kZtVW92Ass-LZihBGb4/edit#gid=0>

(Link to the above spreadsheet)

Design of the Piston Holder



Piston Holder with a u-bolt for attaching the shock cord of the parachute.

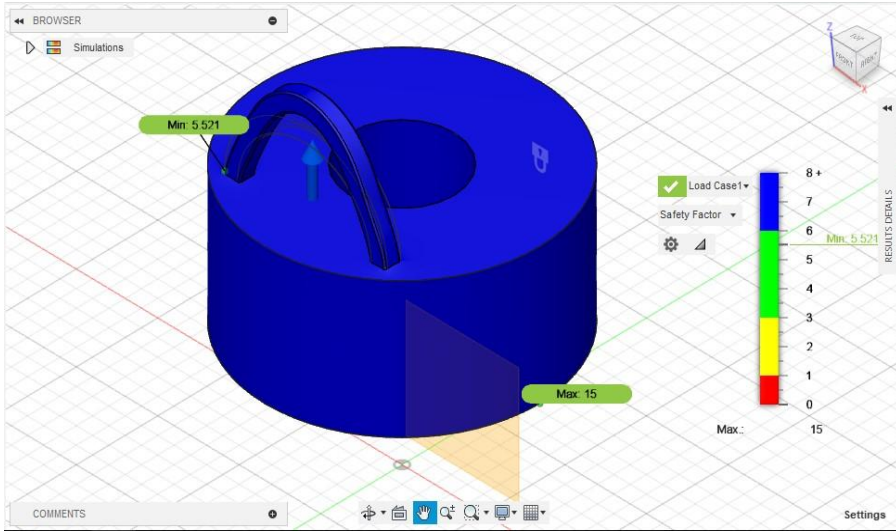
The designed U-bolt was subjected to a load of 132.6 N. (This is the opening load of the parachute)

$$\text{Opening Load} = \text{Drag} \times X_o \times X_1$$

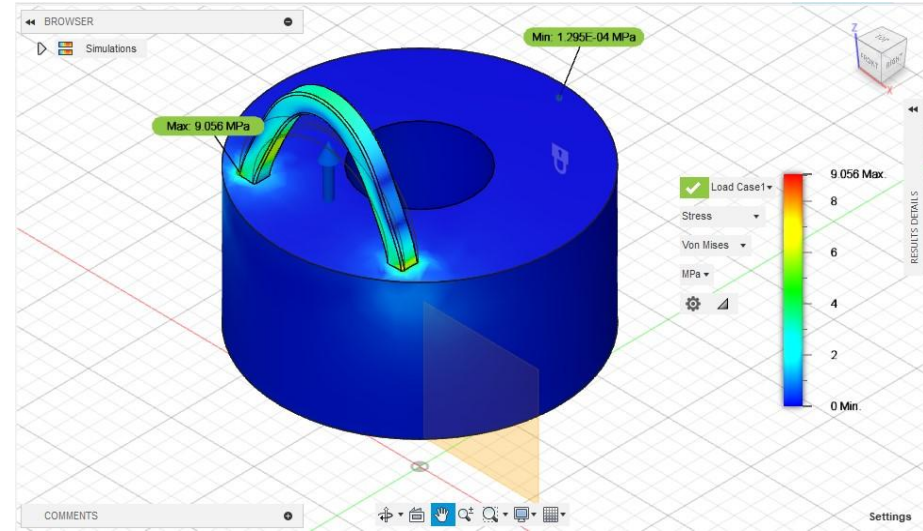
$$\text{Drag} \approx \text{weight}$$

$$X_o = 1.7 \text{ (Flat Circular Shute)}$$

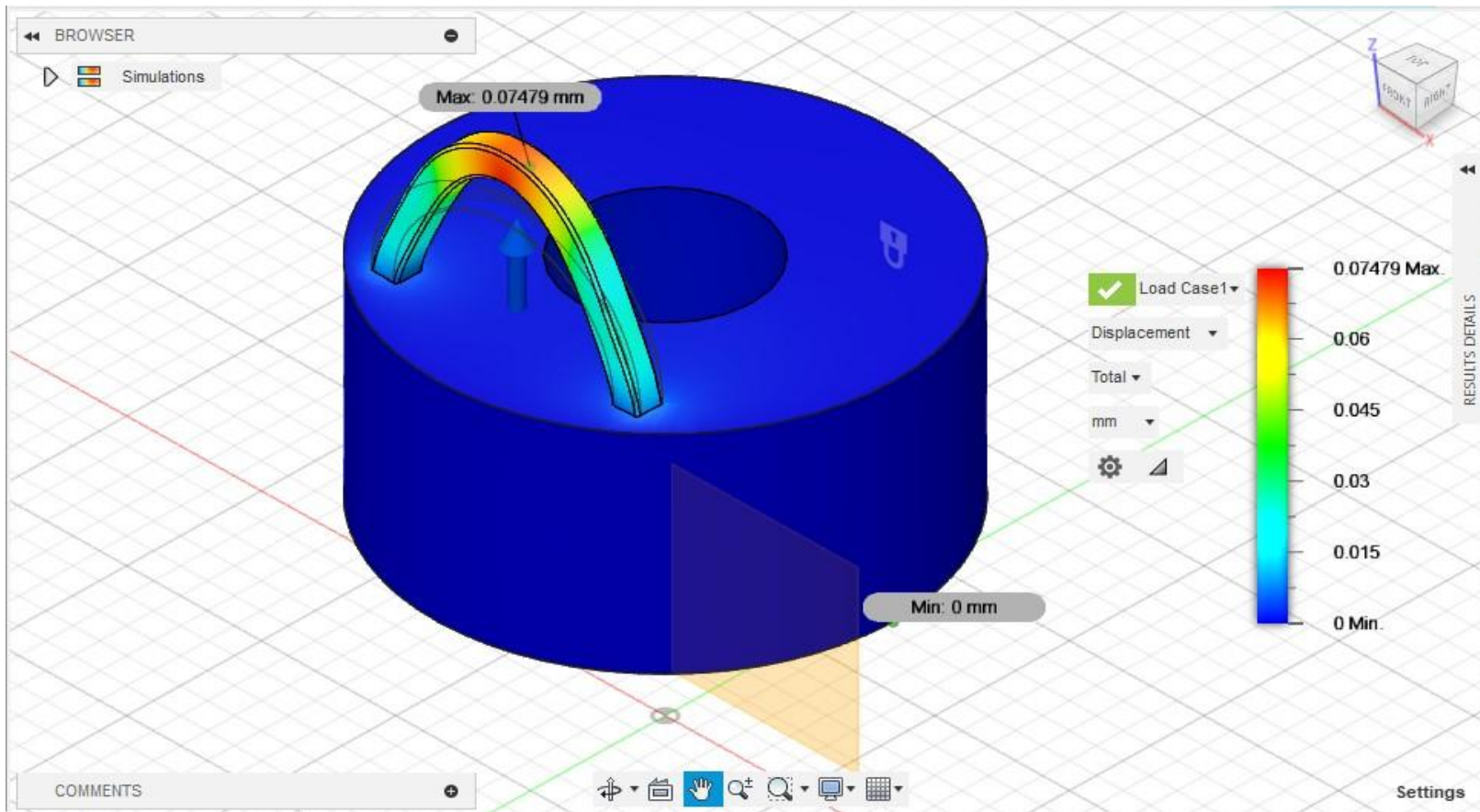
$$X_1 \approx 1.0 \text{ (Infinite Mass Cond.)}$$



Minimum Safety Factor = 5.521, Max = 15

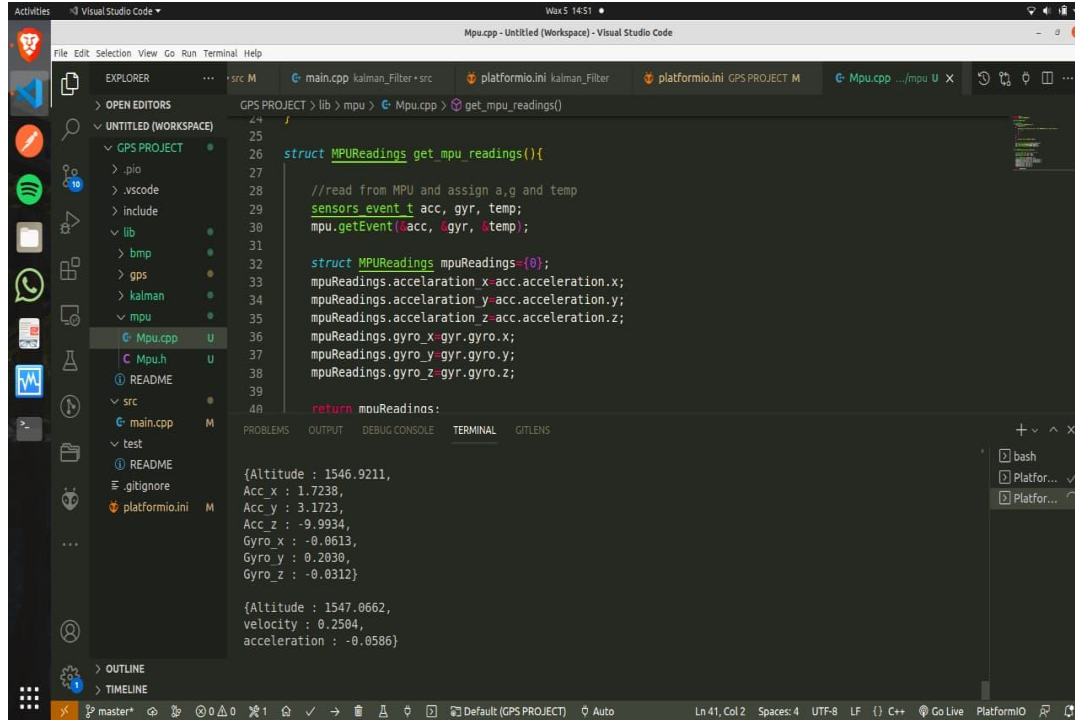


Maximum Stress = 9.056 Mpa



Maximum Displacement = 0.07479 mm (0.37%)

Testing code for kalman filter



The screenshot shows the Visual Studio Code interface with a C++ project for a Kalman filter. The Explorer sidebar on the left shows the project structure, including folders for .pio, .vscode, include, lib, bmp, gps, kalman, mpu, and src. The main editor displays the file `Mpu.cpp` with the following code:

```
44 //get_mpu_readings()
25
26 struct MPUReadings get_mpu_readings(){
27
28     //read from MPU and assign a,g and temp
29     sensors_event_t acc, gyr, temp;
30     mpu.getEvent(&acc, &gyr, &temp);
31
32     struct MPUReadings mpuReadings={0};
33     mpuReadings.acceleration_x=acc.acceleration.x;
34     mpuReadings.acceleration_y=acc.acceleration.y;
35     mpuReadings.acceleration_z=acc.acceleration.z;
36     mpuReadings.gyro_x=gyr.gyro.x;
37     mpuReadings.gyro_y=gyr.gyro.y;
38     mpuReadings.gyro_z=gyr.gyro.z;
39
40     return mpuReadings;
41 }
```

The TERMINAL panel at the bottom shows the output of the program, displaying two sets of sensor data:

```
{Altitude : 1546.9211,
Acc_x : 1.7238,
Acc_y : 3.1723,
Acc_z : -9.9934,
Gyro_x : -0.0613,
Gyro_y : 0.2030,
Gyro_z : -0.0312}

{Altitude : 1547.0662,
velocity : 0.2504,
acceleration : -0.0586}
```

Determined the kalman filter used by previous batch is okay, will proceed to use it.

GPS Real Time Tracking on Base-station

Transmit coordinates via mqtt to base station

The map is hosted on a local server

Map is displayed on base station. The coordinates pin a point (offline)



Applications Places Visual Studio Code Jun 8 23:25

App.jsx - N3-BaseStation - Visual Studio Code

```
1 // simulation.js M
2 mosquito.conf / M
3 App.jsx M X
4 Map.jsx M
5 package.json
6 Video.jsx
7 mosquito.conf simulat
8
9 frontend > src > App.jsx @ client
10
11 6 import Model from './components/model';
12 7 import Countdown from './components/countdown';
13 8 import Telemetry from './components/telemetry';
14 9 import Map from './components/Map';
15 10 import setting from './assets/setting.svg';
16 11
17 12 let client = new MQTT.Client('192.168.100.2', 1884, "dashboard");
18 //called when client connects
19 13 let onConnect = () => {
20 14 console.log("connected");
21 15 client.subscribe("ESP32/Connect/Success");
22 16 }
23 // connect the client
24 17 client.connect({
25 18 onSuccess:onConnect,
26 19 keepAliveInterval: 3600,
27 20 });
28 function App() {
29 21 let altitudeChartRef = useRef();
30 22 let velocityChartRef = useRef();
31 23 let accelerationChartRef = useRef();
32
33 24 let toRadians = (angle) => {
34 25 return angle * (Math.PI / 180);
35 26 }
36
37 27 let [altitude,setAltitude] = useState(0);//filtered altitude
38 28 let [gx,setGx] = useState(toRadians(0));
39 29 let [gy,setGy] = useState(toRadians(180));
40 30 let [gz,setGz] = useState(toRadians(0));
41 31 let [latitude,setLatitude] = useState(-1.0953775626377544);
42 32 let [longitude,setLongitude] = useState(37.01223403257954);
43 33 let [state,setState] = useState(0);
44 34 let [temperature,setTemperature] = useState(0);
45 35 let [connectionStatus,setConnectionStatus] = useState('disconnected');
46 36 let [stream,setStream] = useState(true);
47
48 // called when the client loses its connection
49 37 let onConnectionLost = (responseObject) => {
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CHALLENGES

- Misalignment of the traces during fabrication of the pcb
- Amplification of voltage from the load cell. (load cell may be different)



WEEK 7 TASKS

- Solder components on the PCB
- 3D printing of the piston holder
- Simulation and 3D printing of ejection cap

