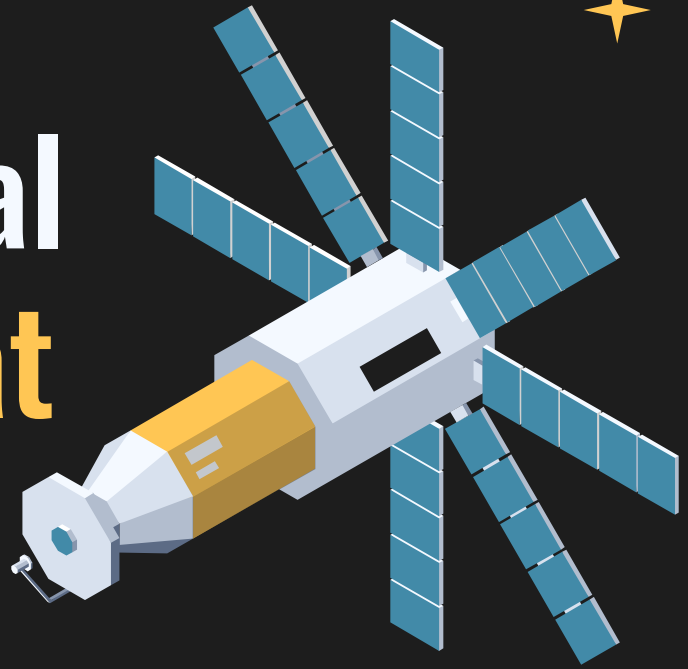
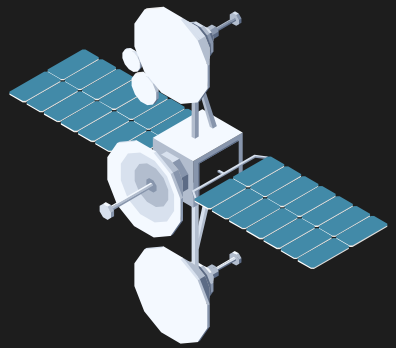
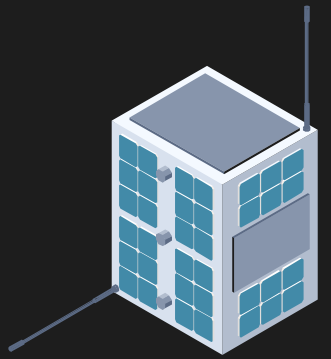
Satellite Design Final Project: The CubeSat

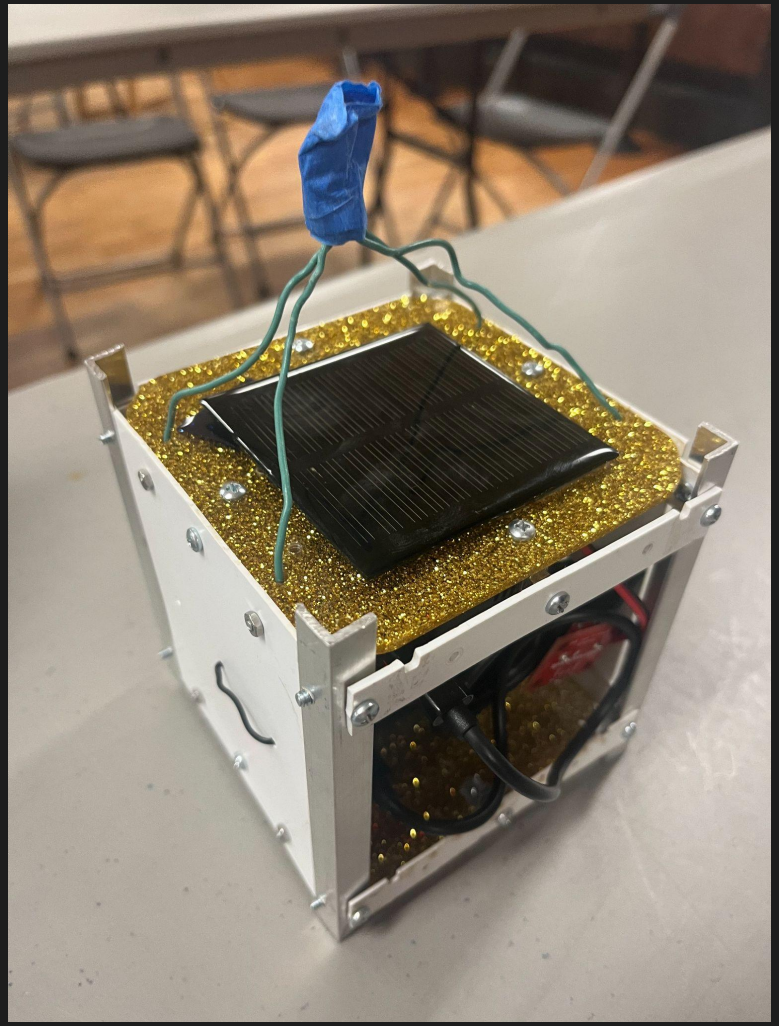
Sid Gupta



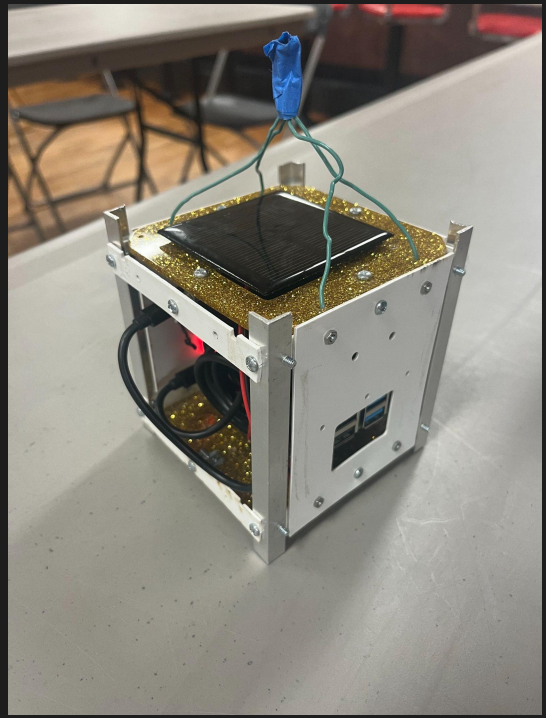
CubeSat Design



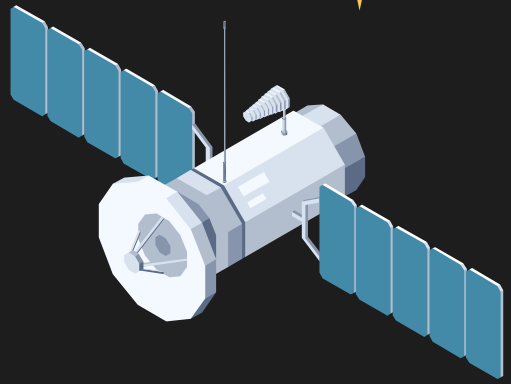




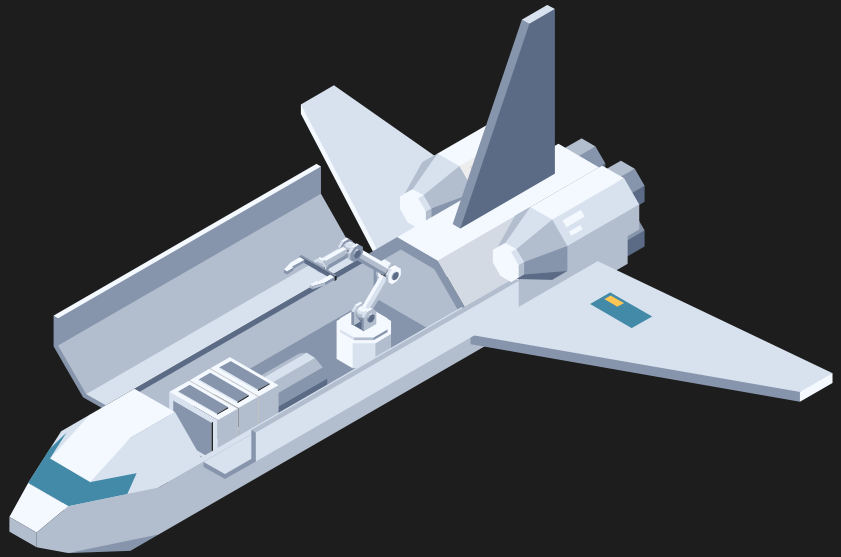
Camera on the Bottom



Overview: In the end, the CubeSat consisted of the Raspberry Pi, Battery Pack, IMU, Solar Panel, Camera, and Wires along with the frame of the CubeSat.



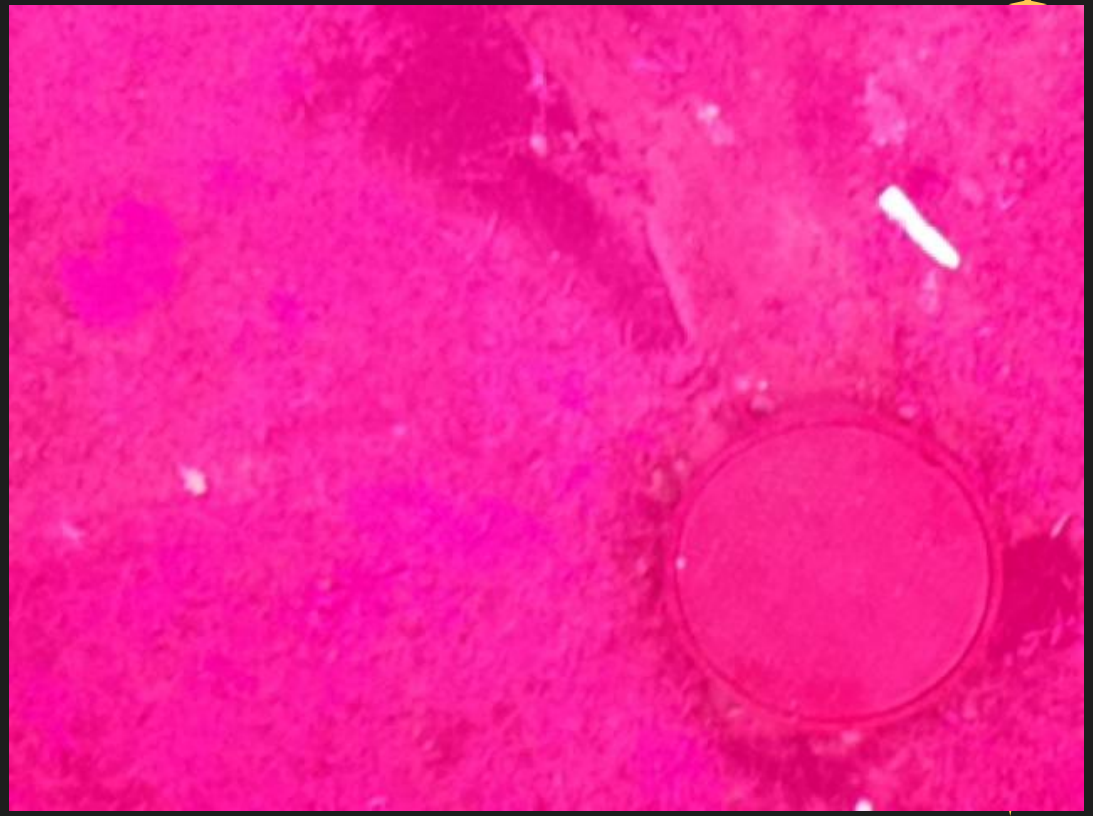
Final Flight: Results



Picture 1

Picture 2

Picture 3

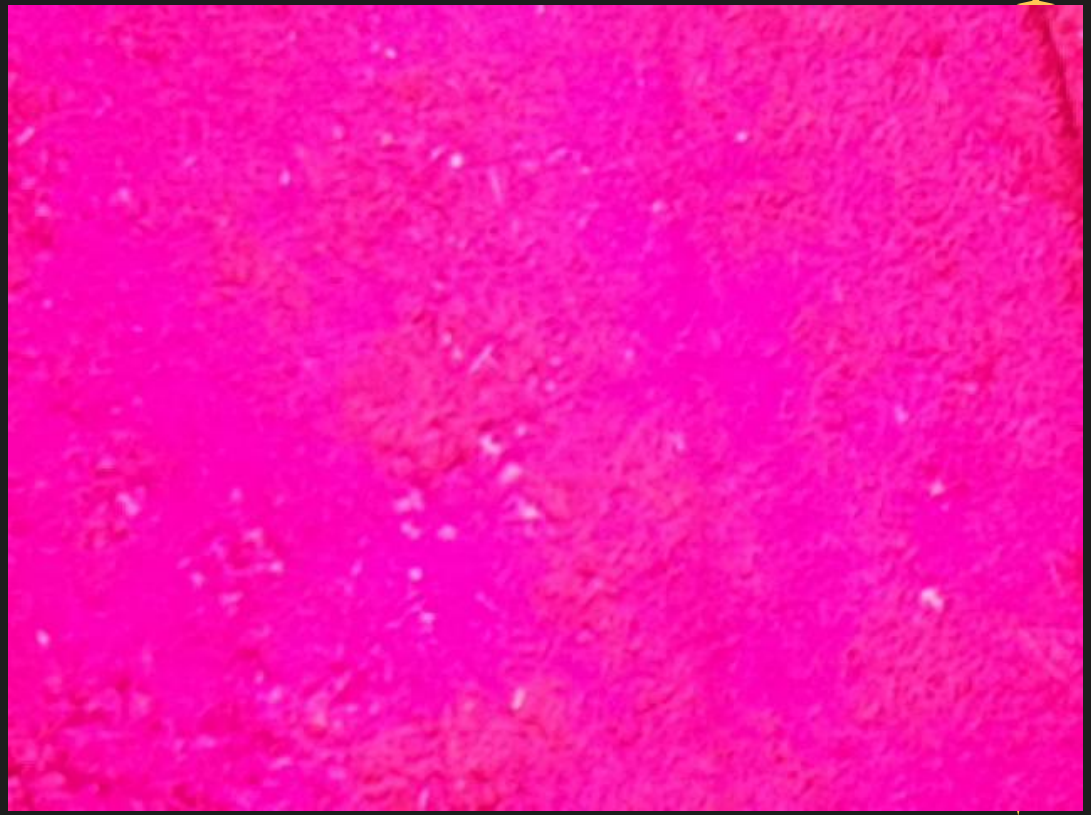


Picture 4

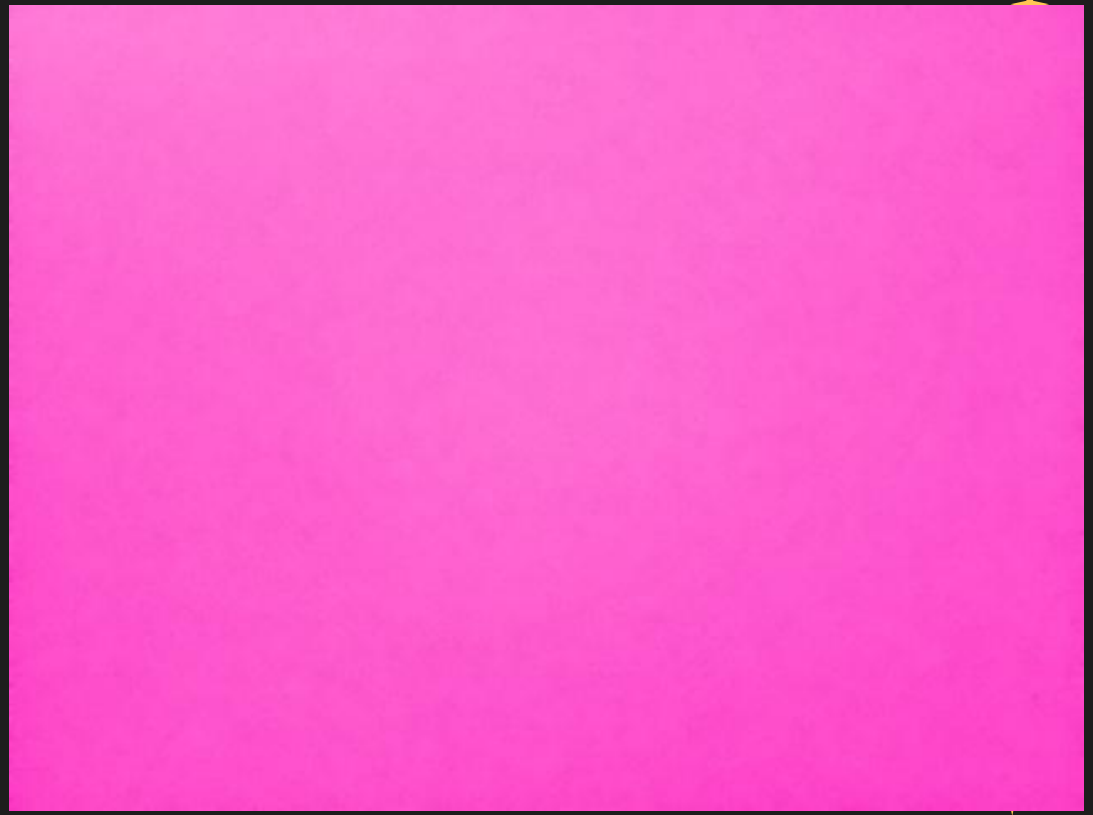
Picture 5

Picture 6

Picture 7



Picture 8



Picture 9

Picture 10

IMU Data

Data

```
timestamp, image_file, accel_x, velocity, position, mag_x, mag_y, mag_z
2025-05-15T17:52:53.269227, fly_image_0.jpg, 0.7600, 0.0004, 0.0000, -7.875, 12.6875, -4.6875
2025-05-15T17:52:54.385460, fly_image_1.jpg, 0.7700, 0.8599, 0.9598, -8.75, 11.875, -7.0
2025-05-15T17:52:55.485584, fly_image_2.jpg, 0.9300, 1.8830, 3.0313, -25.0, 4.5625, -29.75
2025-05-15T17:52:56.593993, fly_image_3.jpg, 1.6200, 3.6786, 7.1087, -26.25, -2.5, -35.5625
2025-05-15T17:52:57.708997, fly_image_4.jpg, 0.3700, 4.0911, 11.6703, -25.0, -9.25, -37.25
2025-05-15T17:52:58.804562, fly_image_5.jpg, -0.1800, 3.8939, 15.9364, -18.1875, -16.875, -40.375
2025-05-15T17:52:59.891890, fly_image_6.jpg, 3.3500, 7.5365, 24.1311, -14.875, -16.0625, -38.6875
2025-05-15T17:53:00.977107, fly_image_7.jpg, 5.0900, 13.0602, 38.3042, -9.0, -18.6875, -40.5625
2025-05-15T17:53:02.103493, fly_image_8.jpg, 0.4300, 13.5446, 53.5607, -18.6875, -24.75, -33.5
2025-05-15T17:53:03.218599, fly_image_9.jpg, 1.4300, 15.1392, 70.4425, -26.5, -18.1875, -33.875
```

Timestamp	Image File	Accel X	Velocity	Position	Mag X	Mag Y	Mag Z
2025-05-15T17:52:53.269227	fly_image_0.jpg	0.7600	0.0004	0.0000	-7.875	12.6875	-4.6875
2025-05-15T17:52:54.385460	fly_image_1.jpg	0.7700	0.8599	0.9598	-8.75	11.875	-7.0
2025-05-15T17:52:55.485584	fly_image_2.jpg	0.9300	1.8830	3.0313	-25.0	4.5625	-29.75
2025-05-15T17:52:56.593993	fly_image_3.jpg	1.6200	3.6786	7.1087	-26.25	-2.5	-35.5625
2025-05-15T17:52:57.708997	fly_image_4.jpg	0.3700	4.0911	11.6703	-25.0	-9.25	-37.25
2025-05-15T17:52:58.804562	fly_image_5.jpg	-0.1800	3.8939	15.9364	-18.1875	-16.875	-40.375
2025-05-15T17:52:59.891890	fly_image_6.jpg	3.3500	7.5365	24.1311	-14.875	-16.0625	-38.6875
2025-05-15T17:53:00.977107	fly_image_7.jpg	5.0900	13.0602	38.3042	-9.0	-18.6875	-40.5625
2025-05-15T17:53:02.103493	fly_image_8.jpg	0.4300	13.5446	53.5607	-18.6875	-24.75	-33.5
2025-05-15T17:53:03.218599	fly_image_9.jpg	1.4300	15.1392	70.4425	-26.5	-18.1875	-33.875

Interpretation

This CubeSat IMU data records a flight over roughly 10 seconds, capturing motion and magnetic field values in sync with image captures. The acceleration in the x-direction varied, with notable spikes like 5.09 m/s^2 at image 7, suggesting a thrust or maneuver. Velocity and position increased steadily, indicating forward motion or ascent, peaking at 15.14 m/s and 70.44 units respectively. Magnetic field readings (mag_x, mag_y, mag_z) show a clear shift from relatively stable values to intense fluctuations, likely due to changing orientation or external interference. Overall, the data suggests a controlled but dynamic flight path with increasing motion and variable magnetic conditions

How this scales:

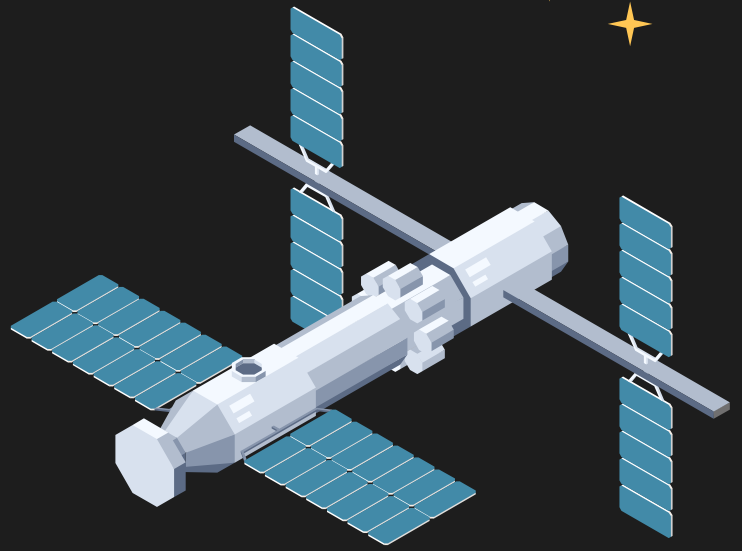
This CubeSat IMU data reflects small-scale motion typical of a test or low-altitude flight.

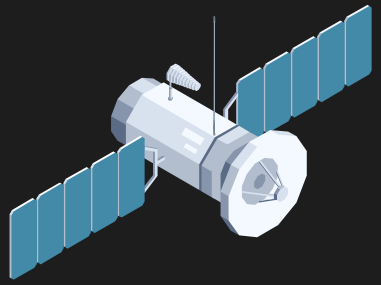
In a full-scale spaceflight, acceleration and velocity values would be significantly higher due to launch forces and orbital speeds.

While the sensor types remain the same, their data would need to be more precise and robust to support navigation in the harsher conditions of space.

Lessons Learned For Next Time

- Take photos closer together while maximizing exposure
- For the clearest photos don’t do them in broad daylight





The END