WORLD CANSAT/ROCKETRY CHAMPIONSHIP

WORLD FINALS (2021/22)

TEAM AUTOBOT JIT

CANSAT REPORT

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CONTENTS

AUTOBOT JIT CANSAT

1. OVERVIEW OF THE CANSAT LAUNCH

The AUTOBOT JIT Cansat (Fig.1.1) was 114 mm height around a diameter of 64mm and weighs about 140g which satisfies the WCRC rule that the Cansat should weigh upto 150g. The outer body of the Cansat is a composition of Polyvinyl Chloride (PVC) and the 1000 mAh Lithium-Polymer (Li-Po) battery is used for the Cansat power. The main payloads of the Cansat are to measure and transmit the Air Quality value using MQ-135 sensor and the acceleration and gyroscopic values of the Cansat using MPU-6050 sensor to the ground station. Then we launched the Cansat (Fig.1.2) successfully in both our two launches.

Fig.1.1

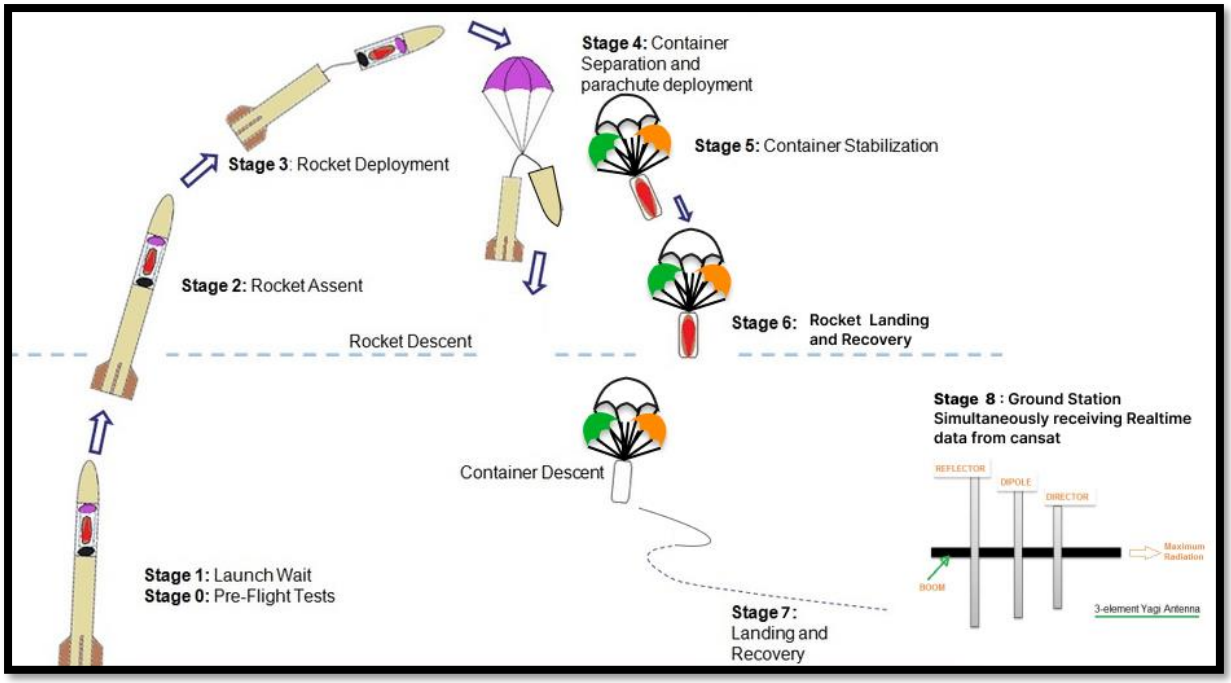

Fig.1.2.

2. GROUND STATION

The ground station of the cansat is PCB printed with the following sub-system which receives the data using Yagi Uda Antenna.

2.1 GROUND STATION SUB-SYSTEM

The ground station (Fig.2.1) is operated with the Arduino Nano along with LoRa Ra02 to communicate the Cansat and it was connected with the Yagi Uda antenna.

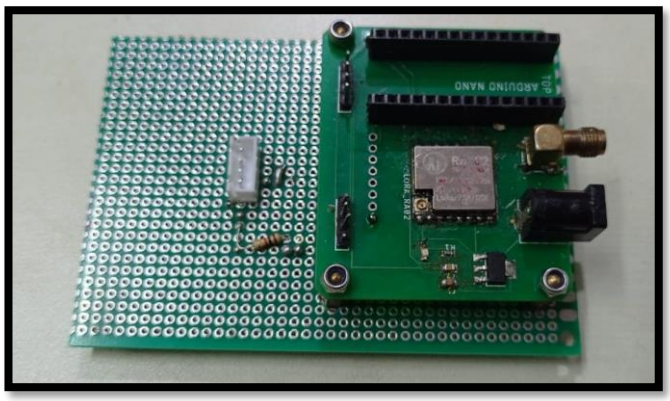

Fig.2.1

2.2 ANTENNA

Yagi Uda antenna (Fig.2.2) was used to collect the data as it has good amount of gain which helps us to get more amount of quality data. It has directional character, so beam is focused on particular direction to attain more gain.

Fig.2.2

3. CANSAT SUB-SYSTEM

The Cansat has 3 sub-system inorder to achieve the missions which has On-Board Computer, Electronic Power System and the communication module.

3.1 ON-BOARD COMPUTER

The On-Board Computer (Fig.3.1 & Fig.3.2) consists of Arduino nano as a Micro-controller with the operating voltage of 3.3 V and 5V. The MPU-6050 sensor is connected along with the On-Board Computer at the I2C communication. It was also one of the structural support for the Cansat as it is placed vertically.

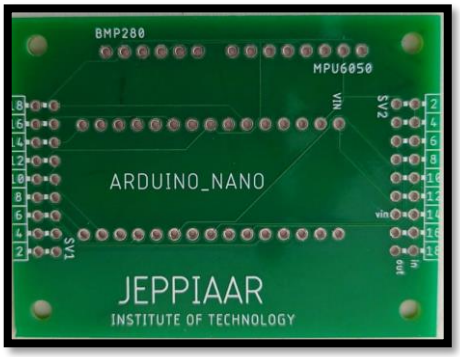

Fig.3.1

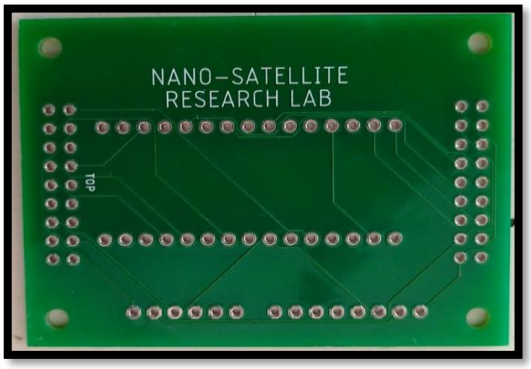

Fig.3.2

3.2 ELECTRONIC POWER SYSTEM

The Electronic Power System (Fig.3.3 & Fig.3.4) operates on 3.3V and 5V regulators with the operating voltage of 7.4 to 8.4. It also contains the Lithium-Polymer battery with the limit based switch trigger to power ON the Cansat.

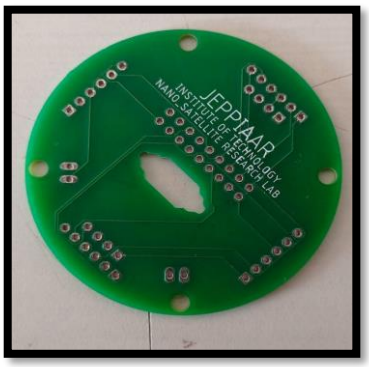

Fig.3.3

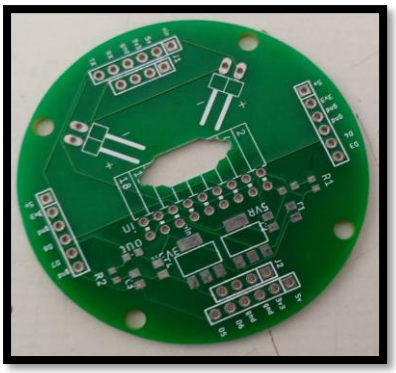

Fig.3.4

3.3 COMMUNICATION MODULE

The communication module (Fig.3.5 & Fig.3.6) is based on radio frequency of 440MHz and the LoRa Ra02 module with coil wound antenna. It operates at 3.3V along with the MQ-135 Sensor which is the primary mission.

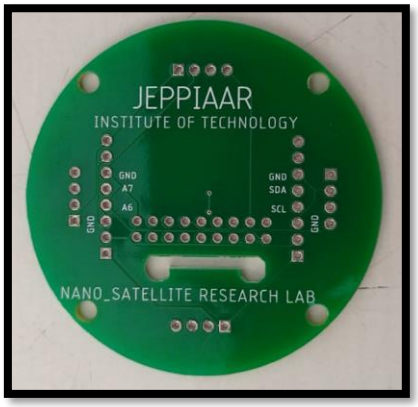

Fig.3.5

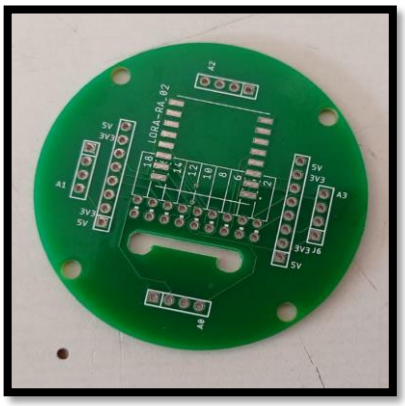

Fig.3.6

4. CANSAT OUTER BODY

The outer body (Fig.4.1) is made up of Polyvinyl Chloride (PVC) and the main reason to use this material is that it was less weight with great structural support to the Cansat and also cheap in cost.

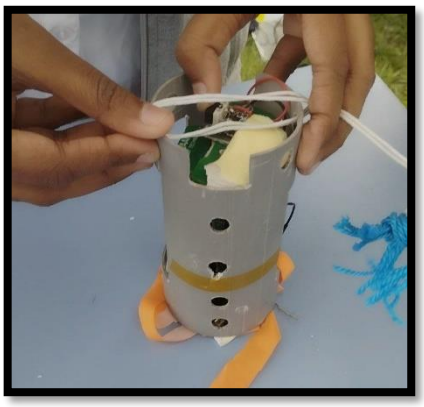

Fig.4.1

5. PRIMARY MISSION

The primary mission of the Cansat is to measure the Air Pollution and we add on another payload to measure the acceleration and gyroscopic data. The data should telemetry to the ground station atleast once for every 2 seconds.

6. SECONDARY MISSION

Through Ground Station we sent a telecommand (uplink) to Cansat, during the descent, which is possible to register visually (i.e. Buzzer Sound from the Cansat and literally that can be heard from the ground).

7. PARACHUTE

The parachute (Fig.7.1) is made up of rip-stop nylon material with a descent speed of 8m/s. It was a flat/hexagon parachute with a quantity of three.

Fig.7.1

8. BUDGET DETAILS

S.No.	Components	Count	Amount (INR)
1	Parachute	3	1000
2	Outer Body Structure	1	30
3	Air Quality Sensor	1	100
4	MPU6050	1	800
5	Arduino Nano	2	500
6	LoRa 02	2	1000
7	PCB Fabrication	4 PCB	400

8	**Antenna Yagi Uda - 3 Element**	**1**	**600**
9	**Coil Wound Antenna**	**1**	**100**
10	**Battery 2s**	**1**	**400**
11	**Limit Switch**	**1**	**100**
		Total Price in INR:	**Rs. 5100**
		Total Price in EURO:	**65€**

9. POST CANSAT ANALYSIS

The Cansat was launched successfully for both the time and the data was also collected successfully.

The Cansat collected the air pollution data using MQ-13 and also the acceleration and gyroscopic data (Fig.9.1 & Fig.9.2). The collected air pollution data was plotted in a graph (Fig.9.3) that represents the air quality of the launch site which denotes that the quality of the air was good. The peak above the hazardous stage denotes that the Cansat has travelled across some smoke which may be the rocket's smoke.

We also simulated and animated our Cansat with the collected data for the acceleration and gyroscope of the Cansat for the post analysis (Fig.9.4 & Fig.9.5).

Fig.9.1

```
DATA 2
LoRa Duplex
LoRa init succeeded.
Data:-  MQ135: 98 Acc: 198.67-6.26-48.24 Gyr: 0.13-0.97-0.0b
Data:-  MQ135: 100 Acc: -250.14-107.40125.50 Gyr: -0.05-1.400.09
Data:-  MQ135: 99 Acc: -241.32-166.87-91.08 Gyr: -0.04-1.300.03
Data:-  MQ135: 10ʕ ʕcc: -#1&.18-178$ʕ5'4.ʕʕNYr: 0.ʕʕA]ʕʕ%ʕ.<2/
Data:-  MQ135: 101 Acc: -206.18-178.25-41.57 Gyr: 0.00-1.240.04
Data:-  MQ135: 98 Acc: -250.14164.29224.43 Gyr: 0.09-1.180.03
Data:-  MQ135: 97 Acco%}67.4;5.76-62.15 Gyr: -0.07-0.990.00
Data:-  MQ135: 100 Acc: -250.14250.13-96.02 Gyr: 0.30-0.980.`s
Data:-  MQ135: 100 Acc: 67.60250.13-32.84 Gyr: 0.10-1.20-0.15
Data:-  MQ135: 100 Acc: 47.77250.1328{ʕ8 Gyr: 0.26%0.80-0.09
ʕData:-  MQ135: 99 Acc: -135.53-250.14-0.36 Gyr: 0.00-1.11-0.02
Data:-  MQ135: 98 Acc: -250.14-250.14-61.59 Gyr: 0.02-1.20-0.03
Data:-  MQ135: 98 Acc: -217.03-250.14-139.74 Gyr: 0.10-1.470.07
Data:-  MQ135: 98 Acc: -250.14-250.14-102.24 Gyr: 0.01-1.17-0.01
Data:-  MQ135: 96 Acc: -250.14-123.46-199.31 Gyr: 0.07-1.61-0.04
Data:-  MQ135: 97 Acc: 138.39-159.43-250.14 Gyr: 0.05-1.470.02
Data:-  MQ135: 96 Acc: -61.96-114.16-250.14 Gyr: 0.04-1.31-0.04
Data:-  MQ135: 92 Acc: -64.13-44.88-86.26 Gyr: 0.14-1.280.02
Data:-  MQ135: 96 Acc: -240.93-30.22-51.85 Gyr: 0.01-0.910.04
Data:-  MQ135: 97 Acc: 250.13-41.656.01 Gyr: 0.24-0.910.06
Data:-  MQ135: 95 Acc: -250.14-107.53250.13 Gyr: 0.08-1.230.17
Data:-  MQ135: 96 Acc: -81.59-207.64148.42 Gyr: 0.13-1.750.06
Data:-  MQ135: 96 Acc: -26.15-210.83250.13 Gyr: 0.14-1.530.16
Data:-  MQ135: 96 Acc: -107.66-250.14-26.14 Gyr: 0.05-1.380.08
Data:-  MQ135: 96 Acc: -239.19-250.1433.85 Gyr: 0.09-1.220.11
Data:-  MQ135: 96 Acc: -135.06-250.14250.13 Gyr: 0.04-1.080.06
Data:-  MQ135: 96 Acc: -250.14-250.14136.63 Gyr: 0.05-1.210.11
Data:-  MQ135: 96 Acc: -157.31-250.14250.13 Gyr: 0.06-1.350.13
Data:-  MQ135: 95 Acc: -140.11-250.14250.13 Gyr: 0.17-1.550.qpl
Data:-  MQ135: 95 Acc: -114.21-250.14139.52 Gyr: 0.07-1.170.11
Data:-  MQ135: 96 Acc: -81.96-250.14250.13 Gyr: 0.19-1.400.16
Data:-  MQ135: 97 Acc: 8.85-250.14170.66 Gyr: 0.09-1.360.12
Data:-  MQ135: 94 Acc: 24.18-250.14250.13 Gyr: 0.19-1.520.07
Data:-  MQ135: 95 Acc: -34.22-250.14250.13 Gyr: 0.21-1.620.15
Data:-  MQ135: 94 Acc: 58.40-250.14197.11 Gyr: 0.17-1.640.12
Data:-  MQ139: ʕ6 Acc: -10.68-255&11210-13Ayr:,0ʕ74-1.090&0i
Data:-  MQ135: 95 Acc: 127.60-250.14250.13 Gyr: 0.26-1.300.08
Data:-  MQ135: 96 Acc: 250.13-250.1495.37 Gyr: 0.21-1.240.04
Data:-  MQ135: 95 Acc: 177.89-250.14250.13 Gyr: 0.22-1.090.05
Data:-  MQ135: 94 Acc: 47.17-250.14159.52 Gyr: 0.14-0.96-0.01
Data:-  MQ135: 95 Acc: 239.40-250.1442.09 Gyr: 0.19-1.190.01
Data:-  MQ135: 94 Acc: 111.48-250.14122.04 Gyr: 0.15-1.200.06
Data:-  MQ135: 93 Acc: 226.83-250.1437.61 Gyr: 0.19-1.110.03
Data:-  MQ135: 95 Acc: 250.13-232.0618.63 Gyr: 0.16-1.260.04
Data:-  MQ135: 95 Acc: 250.13-201.0889.60 Gyr: 0.19-1.400.05
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Fig.9.2

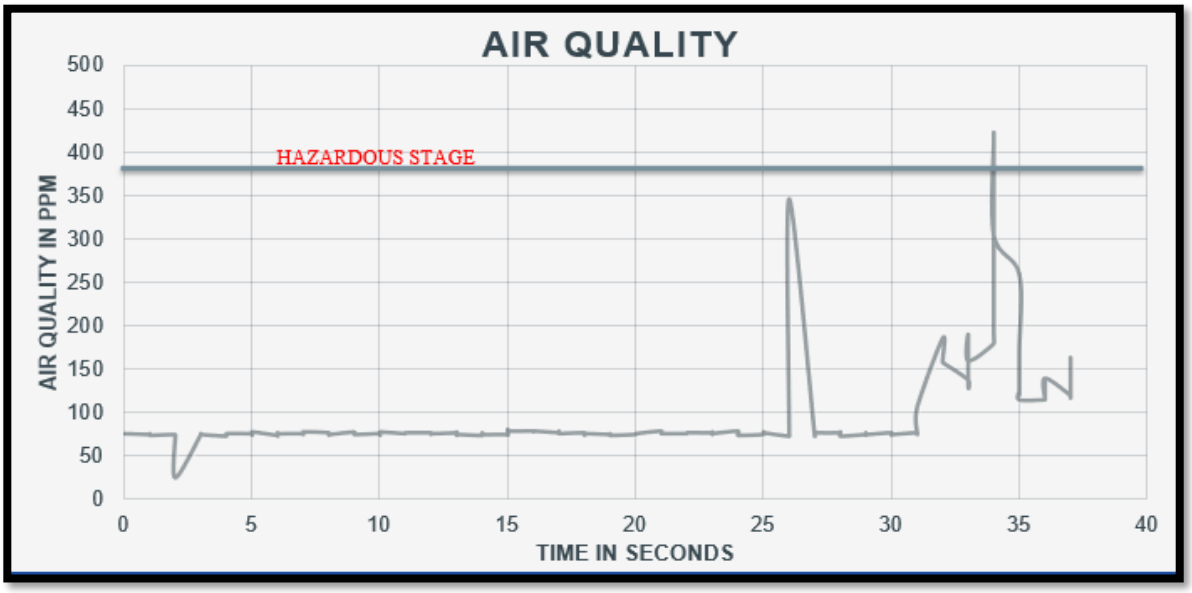

Fig.9.3

Fig.9.4

Fig.9.5

10.CONCLUSION

That’s how we build our Cansat, launched it and collected the data and post processed successfully. We also made our Cansat with cheaper in cost and good in quality. We made a graphical representaiton and also the acceleration and gyroscopic animation of the Cansat in the post analysis. The analysis was made using our collected data during the launch of the Cansat.