**CanSat Final Report**

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## Contents



## 1 Introduction

We started excited about the idea of building a satellite, even a small one, with the dimension of a Can. It was challenging, with a lot of invested time, but we managed to do this besides school, job and a bachelor project, as 3 of us are in the final year at the university. After brainstorming our secondary idea and do a lot of research in 2 days until the end of registration we managed to do it. We were very excited as we were selected as one of the ten initial teams, after a more research, design ideas and a lot of changed ideas we done the Preliminary Design Report. We changed a little for the Critical Design Report as we built the final CanSat as we anticipated. After a lot of tests we finally finished it and we were ready for the final launch. At the end, after a quite disappointed day we managed to get a few packages but not what we wanted in the first place.

## 2 Criteria and description

### 2.1. General

After we define the criteria based on the rules, we built a CanSat with the height of 115mm and the diameter of 66mm and a weight of approximately 280g. It has a hook attachment bar for the parachute. It is easy to open and make modification of it, it is portable because of the small dimension of it and of the ground system. It passed a lot of dropping tests and as it resisted to all we can say it is very shockproof. The steal cover from the bottom part confers stability in the fly part.
The parachute was built for a velocity of 8-9 m/s, as the rules said. It was made from a special material in the shape of a circle. We used a bright color for the material so it would have been

easy to see from distance. We have build 3 parachute of different dimensions with different cord's lenght for different weather conditions.
Our CanSat has a battery life of over 4 hour, as we have been told it should been, that keep on the satellite for various tests. We have an antenna that is contained of a 4 cm wire that extend beyond the diameter of the CanSat.


Figure 1: Final system

## 2.2. Primary Mission

For the primary mission we prepared sensors for collecting air quality, air temperature and air pressure. We took in consideration for this the redundancy of the data, so we have more sensors that measure the same physic component of the air.

## 2.3. Secondary Mission

As for the secondary mission, we collected data about air humidity, altitude, gyroscope, acceleration, speed and GPS. For this mission, we have redundancy for some sensors too. Besides the sensors data, we do some images from the higher altitude to the ground that will be analysed using a machine learning model. We would do some prediction and classification for the land types. This predictions help us to do a time-based analysis of the desertification, city development, water supply. Because of the selected launch area we want to do some prediction of the agricultural fields.

# 3 Tests

Figure 2: Parachute test

For testing phase we had the unit ones for each sensor, then for the integrated part of them, then we tested the integrated sensors in the can. We had parachute tests from the 3rd floor, 7th floor and with a drone from 30m and 100m. For the communication part, we started with a small dimension between the CanSat and the ground system and after this we reached 2000m in distance for one test and 100m in altitude and 600m in distance for another test. We done the final tests using a drone that had drop the CanSat from the 100m altitude, as this was the maximum distance we could reach with the drone and the payload, and collected data. We have verified the collected packages and the calibration of the sensors one more time, as the communication and the dropping part.

For this we collected some images too that helped us to do some tests of the Romanian fields. As we could reach only 100m in our tests the results were not be considered valid 100 percent but they were promising for the future part of the mission. After the machine learning model tests for the collected images we wanted to modify it for a better prediction. We done some specific calculus about the training dataset and applied it to the collected images As we can see the prediction of the images increase drastically.

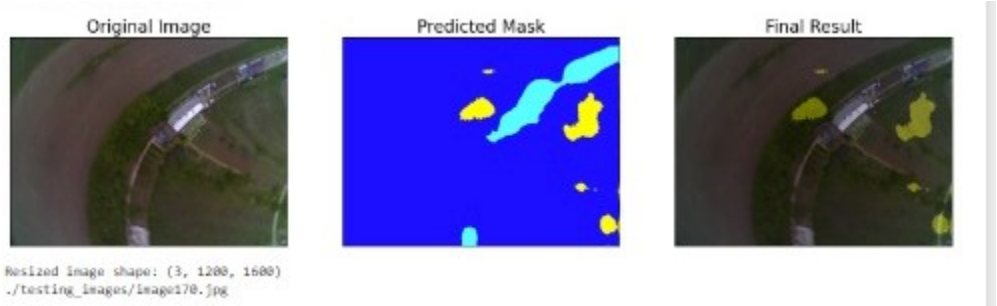


Figure 3: After prepossessing

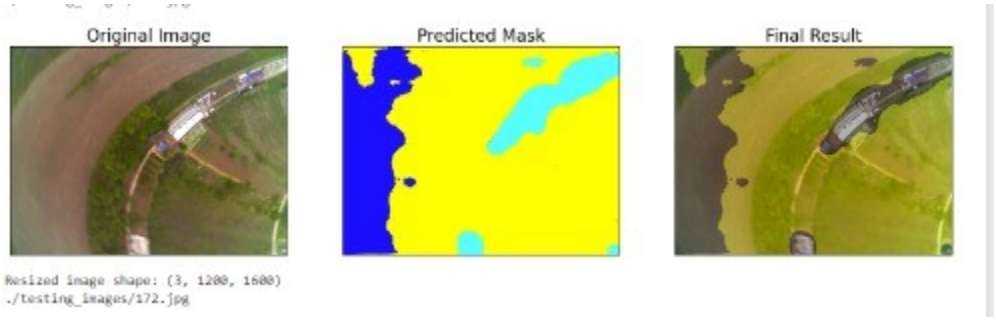


Figure 4: After prepossessing

## 4 Launch day

As for the launch day, we had problems only with the GPS sensor that would have been resolved after the opening to the sky altitude. We collected some data with the help of the car ride, even if our antenna was not designed for this type of transfer data. We had to follow the car with this in an more open place. Even if the experience was excited, we waited so long for the launch part that sadly did not take place as expected because of the weather.

## 5 Data analysis

As for data analysis. We made the simulation of the CanSat Movement for the received data. And the final graphs that are based on time and altitude. As the altitude change level was almost insignificant, the graphs based on altitude were not very useful.

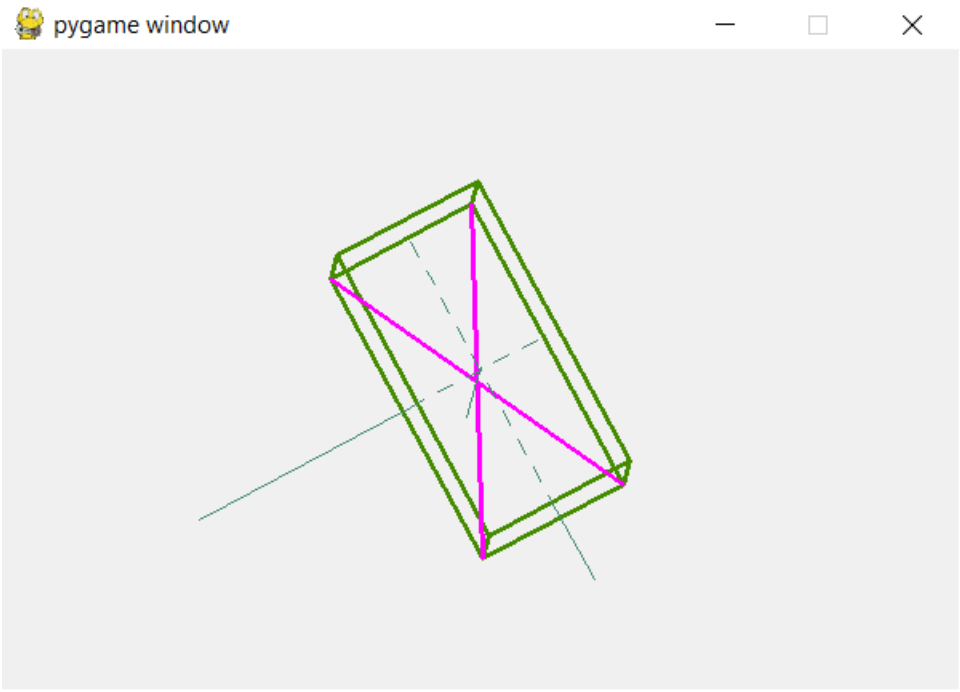


Figure 5: Movement simulation

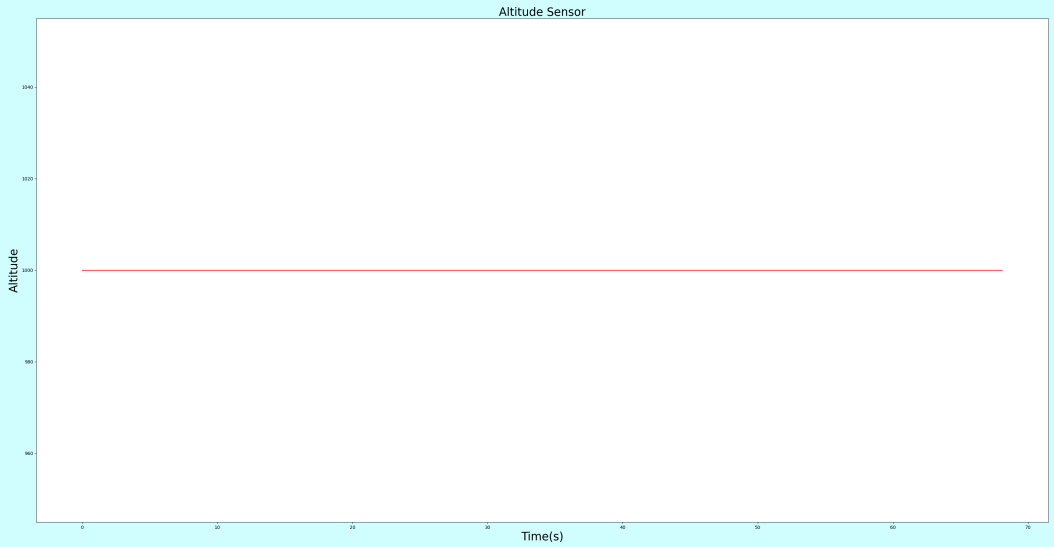


Figure 6: Altitude based on time

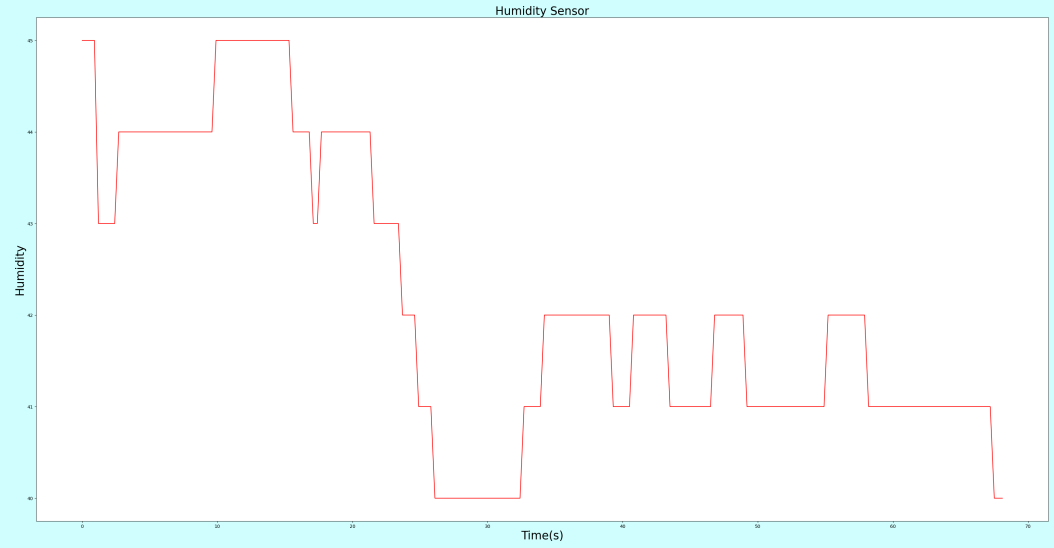


Figure 7: Humidity based on time

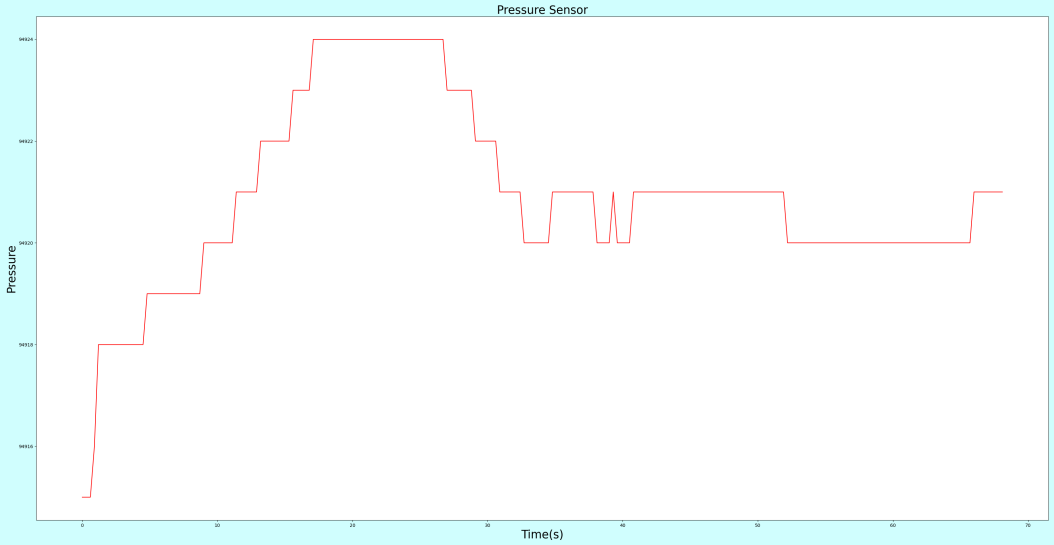


Figure 8: Pressure based on time

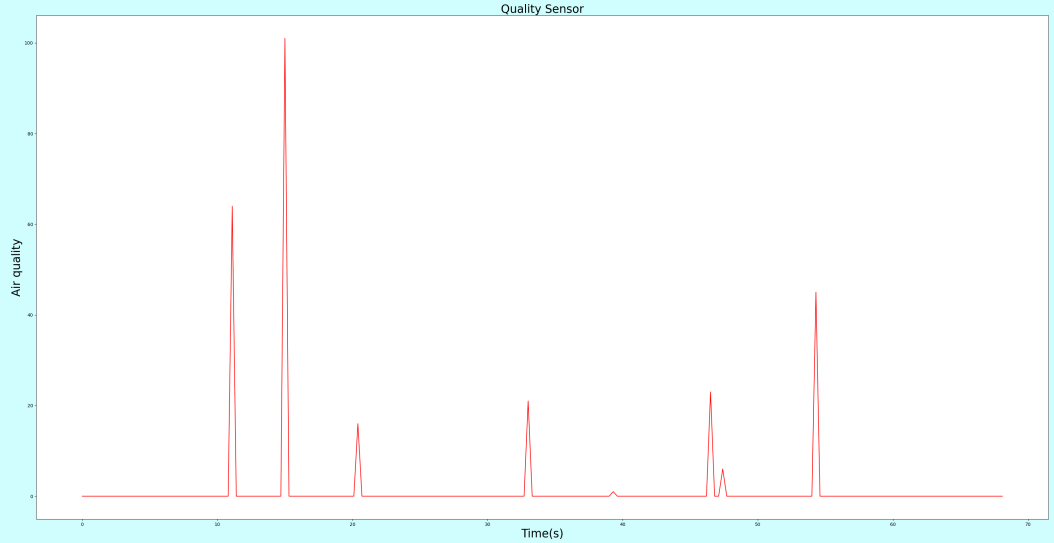


Figure 9: Air quality based on time

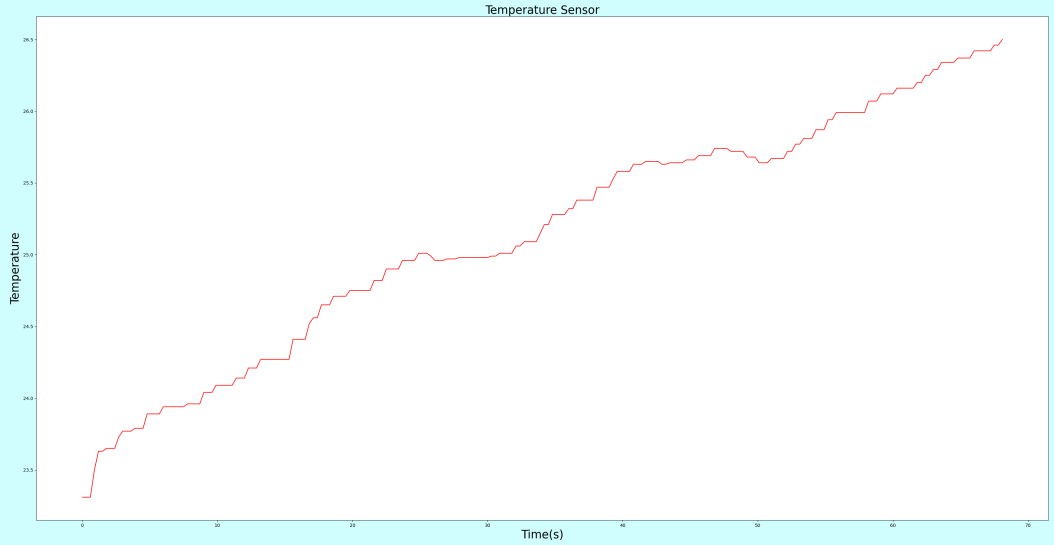


Figure 10: Temperature based on time

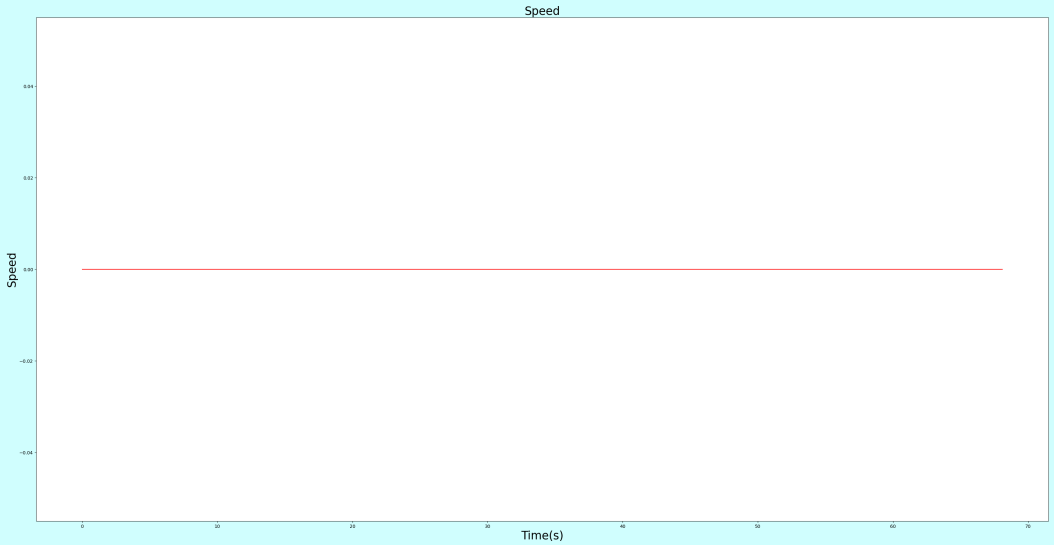


Figure 11: Speed based on time

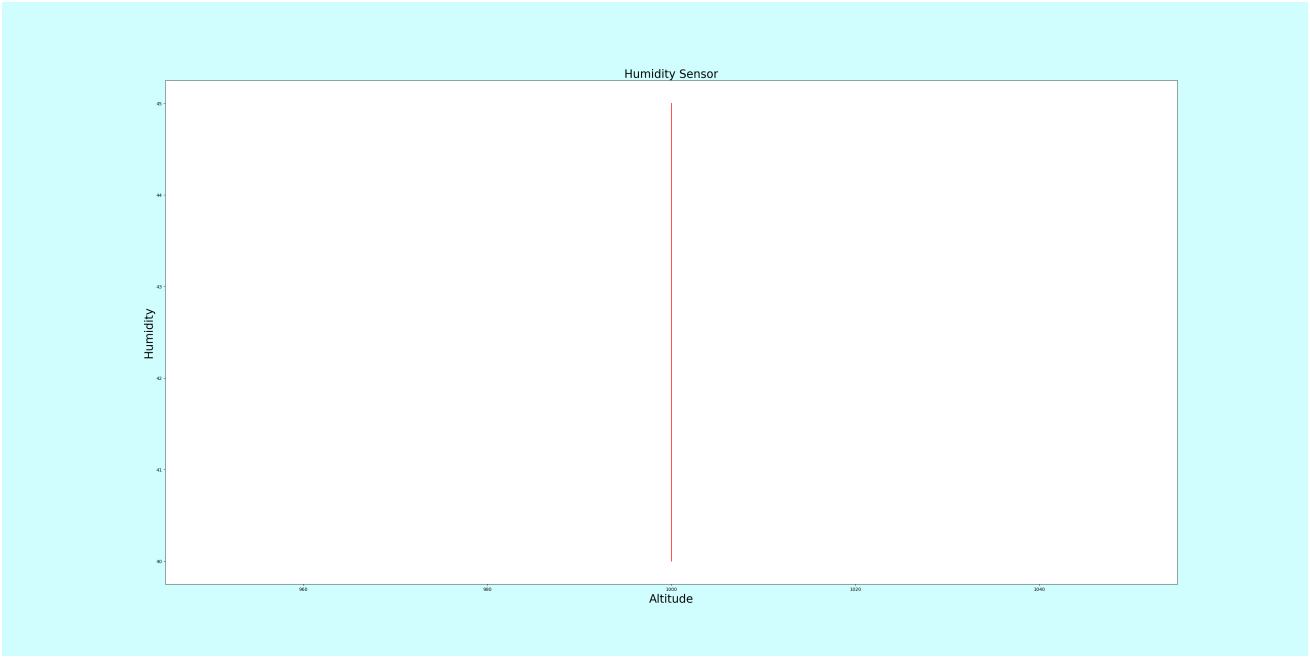


Figure 12: Humidity based on altitude

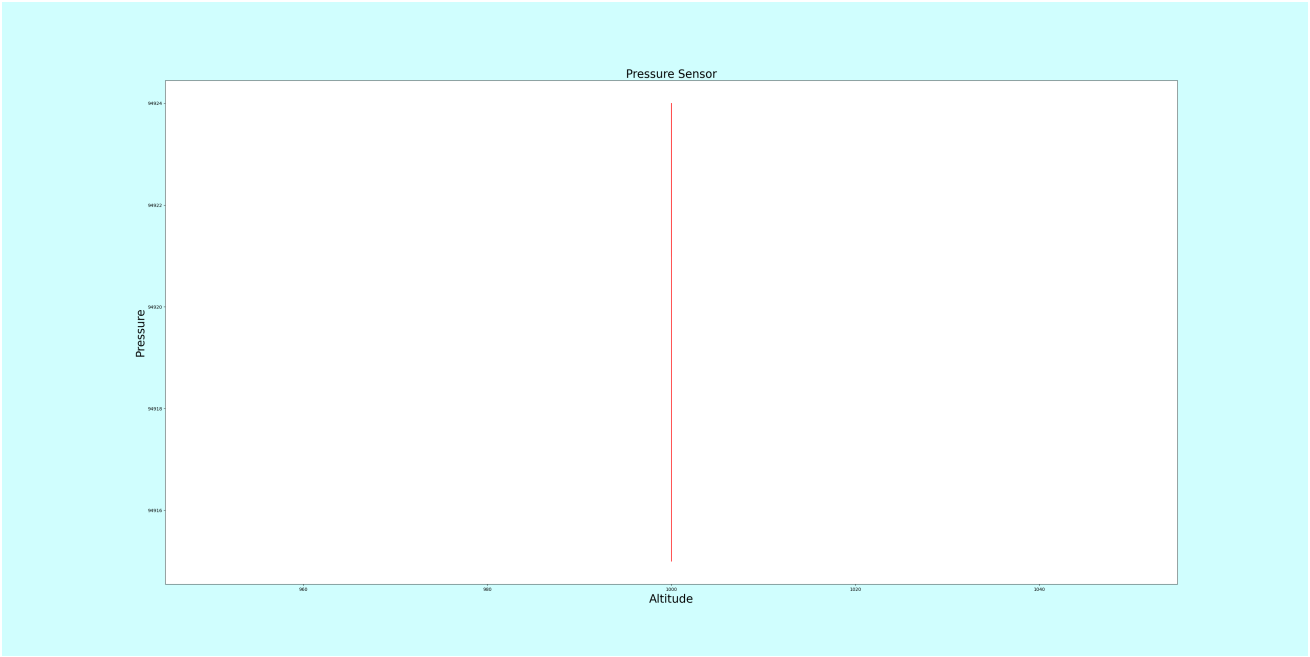


Figure 13: Pressure based on altitude

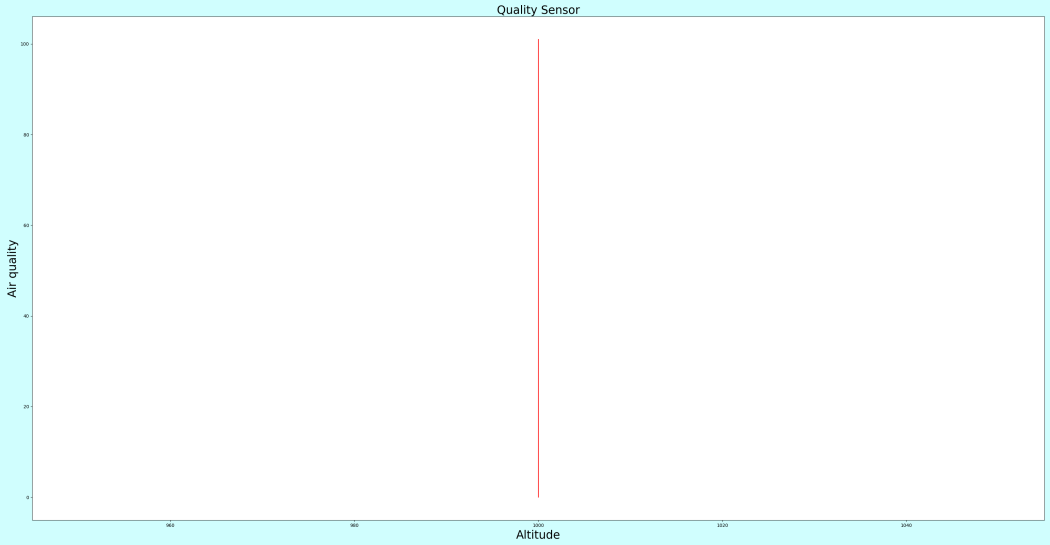


Figure 14: Air quality based on altitude

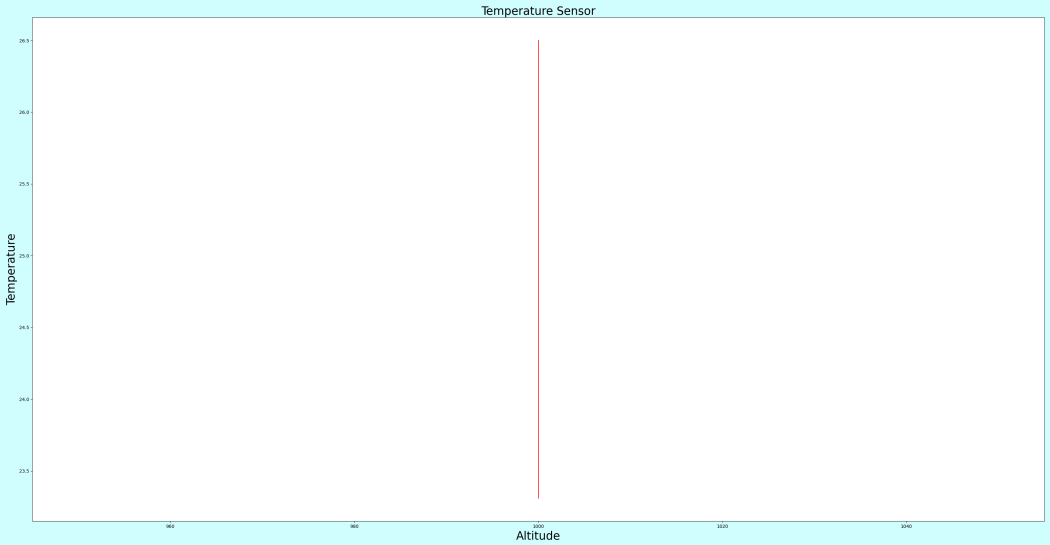


Figure 15: Temperature based on altitude

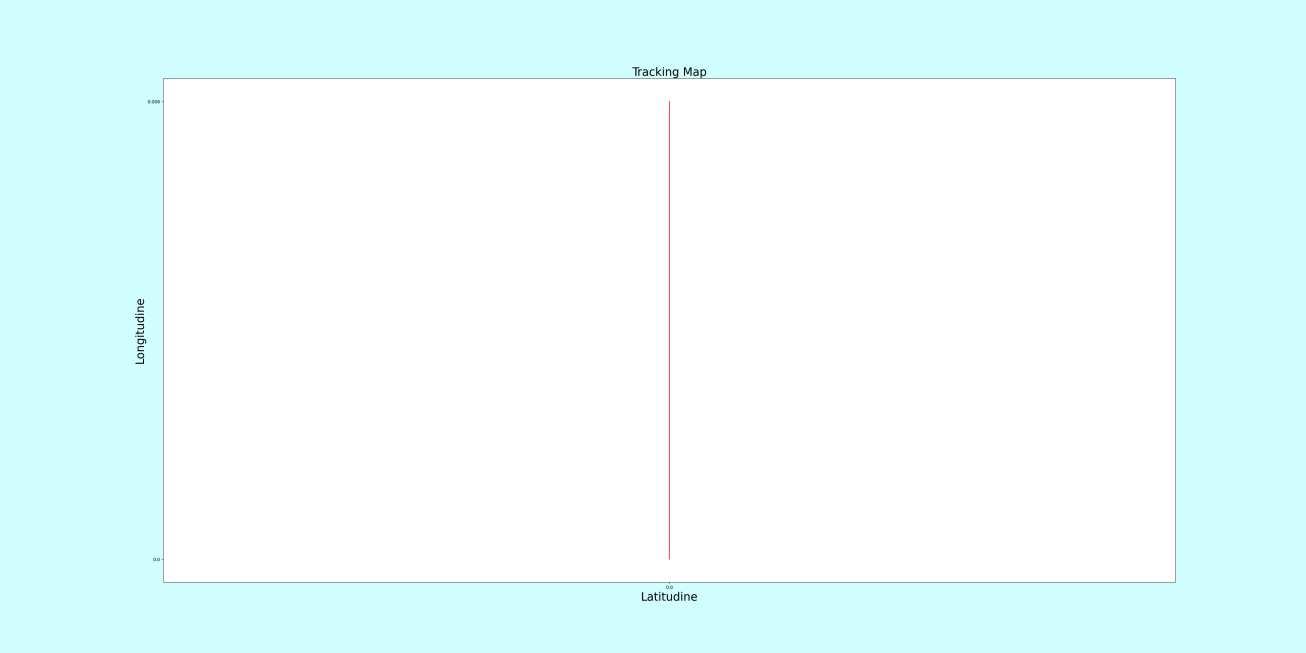


Figure 16: Traking map

## 6 Conclusions and Interpretations

As conclusions, taking in consideration the time based graphs, we can say the temperature is changing with a few degrees as it become hotter, the air quality is mostly constant besides some spines, the speed remains constant as it is not moving at all in the car and the pressure is changing without a visible interpretation, the humidity is the same, it is changing as the time increase, dropping with a few values. We could have seen how the CanSat move on the car ride and analysis the curves of the road.