CanSat 2nd Report - Skyfall Mission

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Ecole Decroly

1. Introduction

We are one of three teams proudly representing Decroly School, located in Uccle, Brussels. Our decision to participate in this contest stems from our shared passion for collaborating on meaningful, hands-on projects in the fields of science and robotics. As science enthusiasts, we often watch scientific videos online, and it was during one of these moments that we came across a video about the challenges faced by a Japanese probe SLIM during its landing (it fell on its side) (see sources 11, 12 and 13). This incident inspired us to design an innovative system capable of automatically righting itself. While our primary goal is to succeed in this competition, we are also driven by the opportunity to explore broader objectives that align with our vision and values.

We joined CanSat to learn more about electronics, physics and coding, but also in order to develop our leadership, teamwork, and collaboration skills. Our goal is to be creative and design a truly innovative technological object. The CanSat experience will also help us assess and confirm whether we are interested in pursuing a career in science.

a. *primary mission*

Our primary mission is mandatory and consists of recording atmospheric data such as temperature, pressure, etc. Then, we will send this data in real time to a ground station, so that we can recover the data even if our CanSat is lost.

b. secondary mission

Our secondary mission will be as follows: we will invent a system that enables the CanSat to upright itself after it has landed, regardless of the position in which it lands.

Upon reaching the ground, our CanSat will use sensors to determine its position relative to the surface and calculate how it should position its legs to stand vertically. It will then deploy its legs at the angles that were calculated previously.

This project stands out for its unique structure equipped with deployable legs that allow the CanSat to reposition itself vertically after landing. The integrated algorithm analyzes the CanSat's precise position and calculates the exact angles needed for each leg's deployment, ensuring optimal upright positioning.

Our secondary mission aims to provide a solution for rovers that are unable to right themselves after a failed landing on a planet or asteroid.

Our secondary mission aims to solve the issue encountered by the Japanese probe SLIM. Although SLIM successfully landed just 10 meters from its target, the landing ended in failure, with the rover tipping onto its nose, rendering its solar panels unusable. We found this unfortunate, especially given that SLIM managed to land very close to its target. We then thought it would be interesting to create a system capable of autonomously righting itself after landing, thus preventing such avoidable problems.

After landing, our CanSat will analyze its inclination data to verify whether it successfully repositioned itself upright. The algorithm used for self-righting will also log the angles and adjustments made during the process. This data will be analyzed to assess the effectiveness and reliability of the self-righting mechanism.

We believe that it is an interesting idea which is realistic and capable of being implemented, and that it has scientific value, namely addressing the issues faced by the Japanese probe.

2. Project description

2.1 Primary mission

We are going to measure temperature, humidity, altitude, pressure, GPS position, horizontal speed, and time. In order to measure these elements, we will use a BMP280 (temperature, pressure, altitude), a DHT11 (temperature and humidity), a GPS Neo-6M (GPS position), Powerboost 1000c (transformator), SD Module (SD data recording), battery and a RFM69 (radio module). For more information on these modules, please refer to Report 1

2.2 Secondary mission

Objective of the secondary mission:

The goal of the secondary mission is to design a CanSat that will be capable of accurately calculating its tilt relative to the ground (on all three axes: X, Y, and Z) after it has landed. It will then deploy four movable legs, each set at a different angle, enabling the CanSat to right itself in alignment with the gravitational force (i.e., standing upright and oriented towards the center of the planet). The deployment will be controlled by servo motors, which will be managed by a gyroscope. Our code will calculate the deployment angle based on the CanSat's tilt relative to the ground. In conclusion, the primary objective of our Secondary Mission is to measure the CanSat's tilt and then adjust its position accordingly.

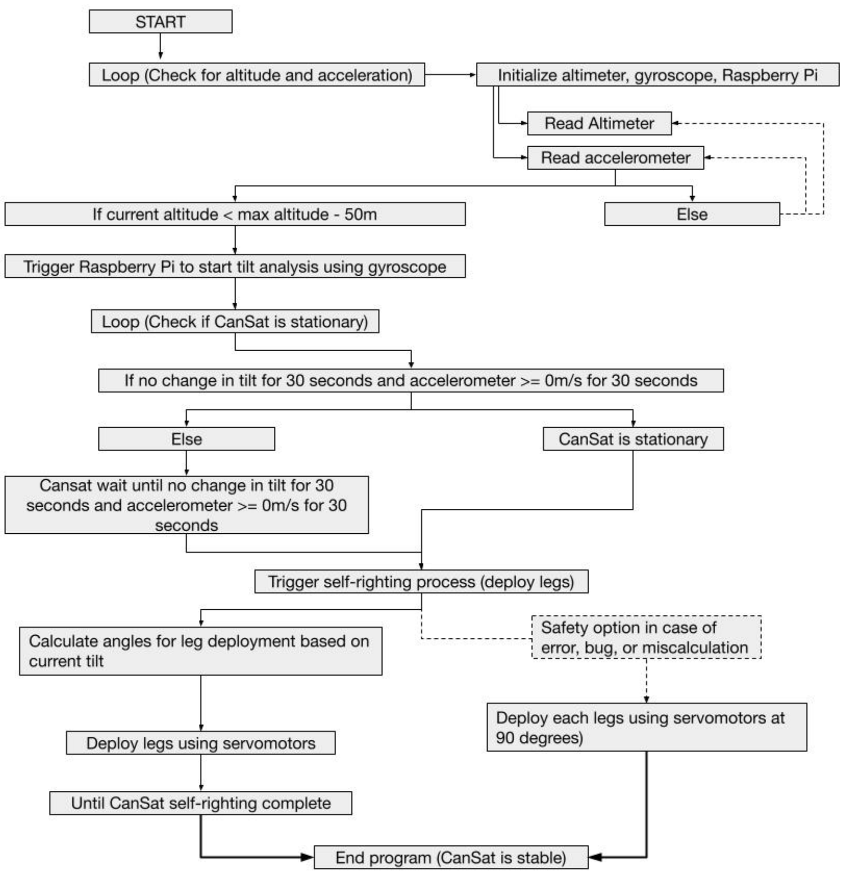
How the secondary mission will be triggered:

We will integrate an altimeter that will send data to the Raspberry Pi. When it detects an altitude at least 50 meters lower than its maximum, it will indicate that the CanSat has begun its descent. Then, the CanSat will analyze the gyroscope values (angles and speed): if these values vary consistently, it will confirm that it is still in flight. However, if no variation is detected for 30 seconds, it will assess its tilt to calculate the optimal angle for deploying its three legs, allowing it to self-right. If necessary, it will then activate its servomotors.

The gyroscope's accelerometer will also be able to detect take-off and release as additional data.

However, since we cannot rule out potential inaccuracies with the GY-91 on the day of the flight, we have implemented an automatic leg deployment function after a set period of time (it will be fixed on the basis of double the time estimated by the experts on site for the launch). Finally, to make locating the CanSat easier after landing, we have added a feature that activates a passive buzzer.

Code diagram for the secondary mission



Components of the secondary mission:

Another Raspberry pi pico	The Raspberry Pi Pico is a compact and powerful microcontroller based on the RP2040, a dual-core processor clocked at 133 MHz. It features 264 KB of RAM, 26 versatile GPIO pins, and supports MicroPython and C/C++. It is perfect for embedded projects, robotics, and automation.
GY-91 (MPU + BMP 280) • 6-axis Gyroscope (MPU 6050) • Altimètre BPM 280	The MPU 6050 is a sensor which measures the inclination (gyroscope) of the CanSat. This allows us to determine if the CanSat has landed (if it remains motionless for 30 seconds, then it has landed). After landing, this chip will give us the precise inclination of the CanSat and will thus allow precise calculations of the deployment angle of each leg. Moreover, this component is interesting for our secondary mission because it also features an accelerometer function. To measure the altitude at which the CanSat should start the angle analysis.

Other components :

3 ServoMotors (1 per leg) 12Kg/cm	To deploy the legs and thus straighten the CanSat.
Battery 1500mAh	It is the battery of our CanSat, it allows us to power the components with electricity and thus enable their operation.
Module SD	This component allows us to use an SD card to locally store all the data collected by the CanSat, in case our radio or receiver malfunctions.
Passive buzzer	A passive buzzer which produces sound when driven by an electrical signal generated by a microcontroller. In our CanSat, it will serve as an audible alert to indicate the CanSat's location, making it easier to retrieve our CanSat.

2.3 Mechanical design

2.3.1 Parachute Design

We started with a parachute that looks like a disc with a hole in the centre when it is flat. We wanted to make it look like a half-donut, so we attached lines of hooks to the outer and inner edges of the circle.

The circle's diameter was 1m with a hole in the middle with a diameter of 0.2m.

After several attempts we realised that our parachute did not work, so we decided to remove the fasteners from the inner edges to form a half-sphere instead of a half-donut. This worked straight away.

For our calculations we used the formula : $m\,g = \frac{1}{2} Cd\,\rho <, a\,v^2$.

Data :

m = mass = 0,3 kg → as light as possible to gain some margin

g = gravity = 9,81 m/s^2

Cd = Drag coefficient = ? → It depends on the form of the parachute

ρ = air density = 1,1 kg/m^3 → approximately

a = surface = $\frac{\pi}{4}\ m^2$

v = speed = 9 m/s → objective

Calculations :

$m\,g = \frac{1}{2} Cd\,\rho\,a_1 v_1^2$

$m\,g = \frac{1}{2} Cd\,\rho\,a_2 v_2^2$

$\frac{1}{2} Cd\,\rho\,a_1\,v_1^2 = \frac{1}{2} Cd\,\rho\,a_2\,v_2^2$

$a_1 v_1^2 = a_2 v_2^2$

$\pi \frac{d_1^2}{4} v_1^2 = \pi \frac{d_2^2}{4} v_2^2$

$d_1^2\,v_1^2 = d_2^2\,v_2^2$

$d_1 = 1\,m$

$v_1 = ?$

$d_2 = ?$

$v_2 = 9\ m/s$

We have 2 unknowns, so we need to calculate one of them.

We calculate the speed of our existing parachute (v_1) by launching it several times from a certain height and then averaging its speed.

This gives 3 m/s

We isolate

$d_1^2 \frac{v_1^2}{v_2^2} = d_2^2$

We remplace

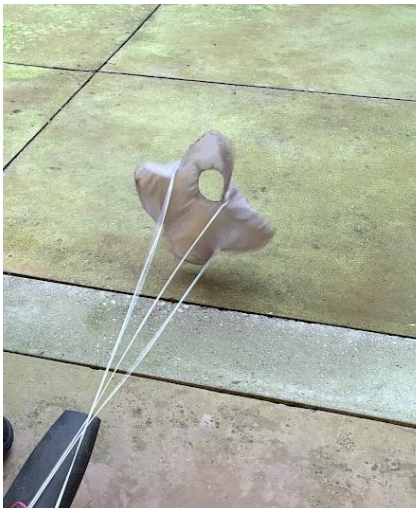
$1^2 \frac{3^2}{9^2} = d_2^2$

$d_2^2 = \frac{1}{9}$

$d_2 = \frac{1}{3}\,m \approx 0,33\,m$

Our parachute should therefore have a diameter of 0,33 m and a hole in the centre 5 times smaller, i.e. 0,07 m.

So we made this new parachute and tested it. The speed is between 8 and 9 m/s, just as we wanted. We also made a duplicate parachute in case the first one is damaged. To be ready for our tests of the complete CanSat and to be able to readjust our speed, we also made 2 other parachutes, the first one is a little larger and the second one is a little smaller.



2.3.2 Can Design

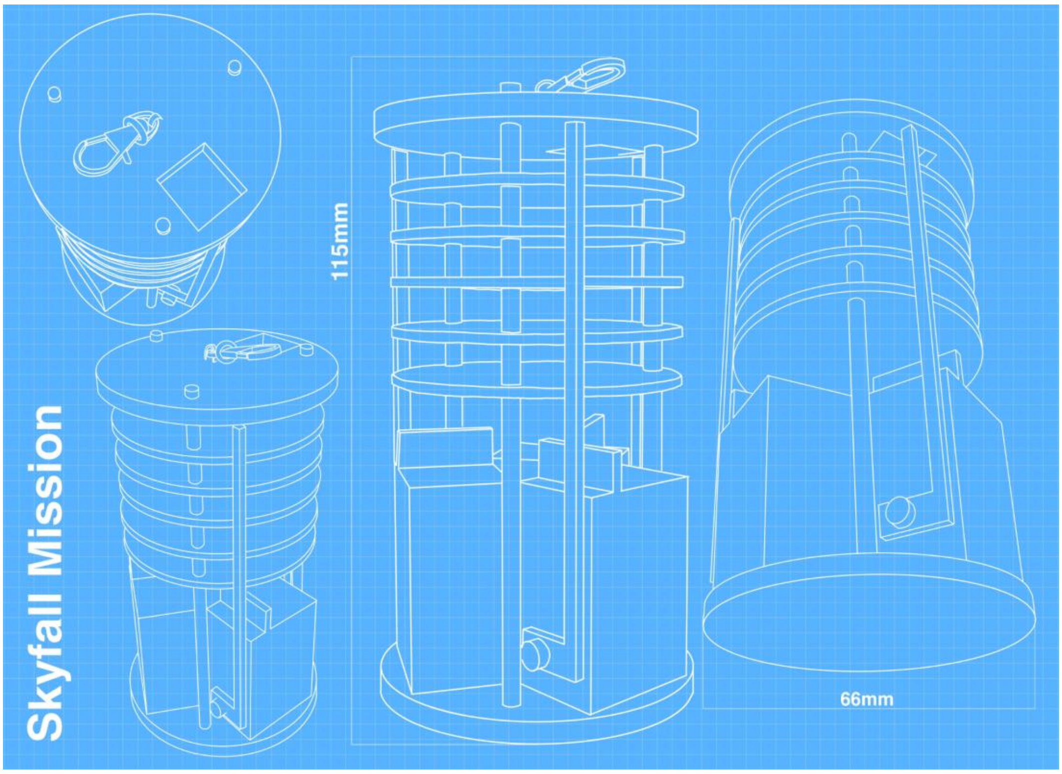


Figure 1 Our CanSat with its legs in their initial

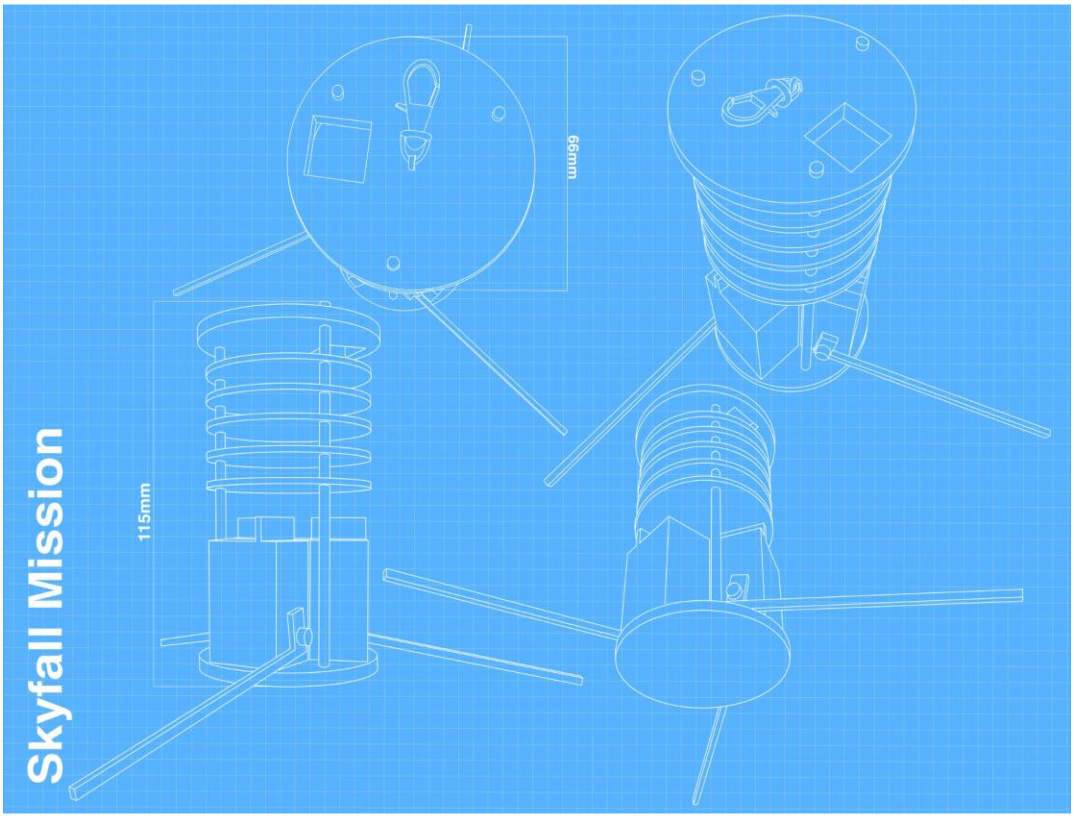


Figure 2 Our CanSat with its legs deployed

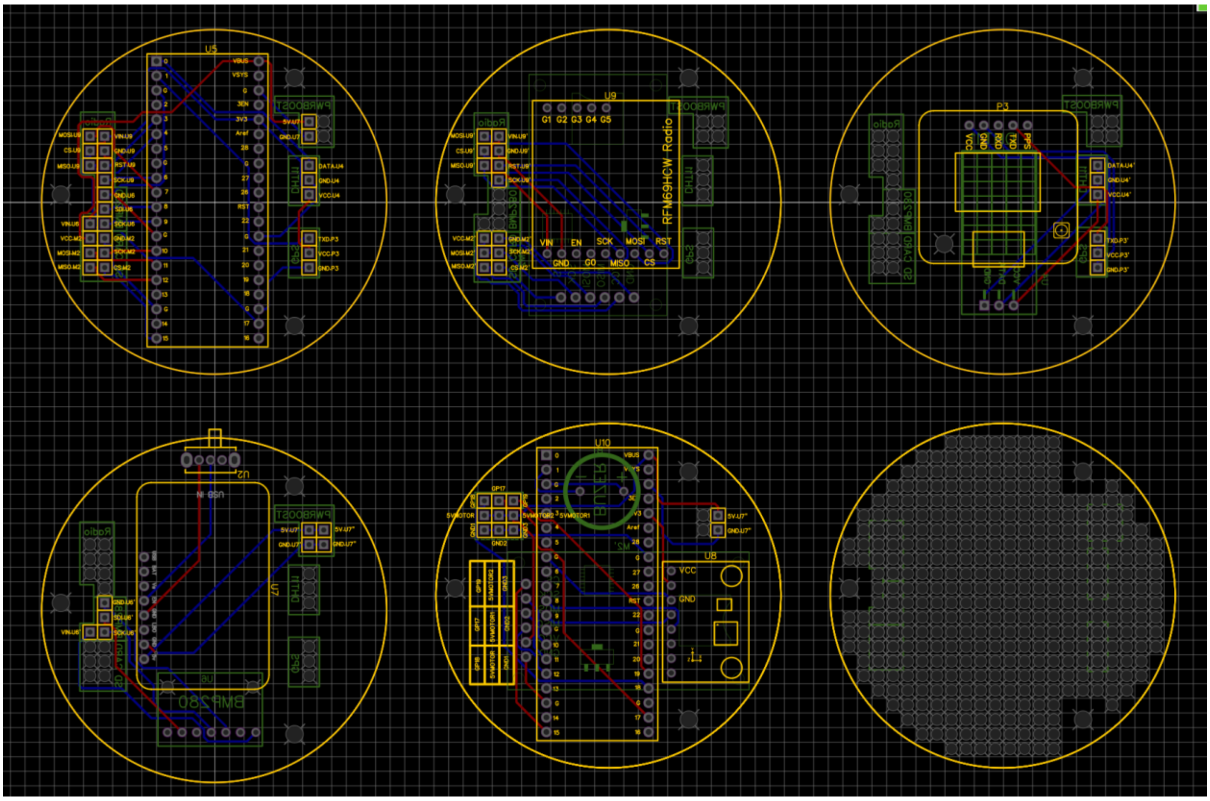


Figure 3 Our final PCBs

During the hardware design phase of the primary mission, we first realized that using electrical wires to connect components was fragile and consumed a lot of space. To address this, we decided to create custom PCBs to enhance robustness, safety, aesthetics, and compactness. This approach not only saves space but also provides better clarity and organization.

Our PCBs are round and stacked on top of each other, connected with solid AWG22 wires. The routing of our PCBs is 0.400 mm wide to avoid voltage drops. Additionally, we managed to combine our two missions onto 5 PCBs by placing components on both sides of the PCB and connecting the components of our primary and secondary missions to the same battery (and thus the same power boost). Therefore, there is only one switch for the entire CanSat.

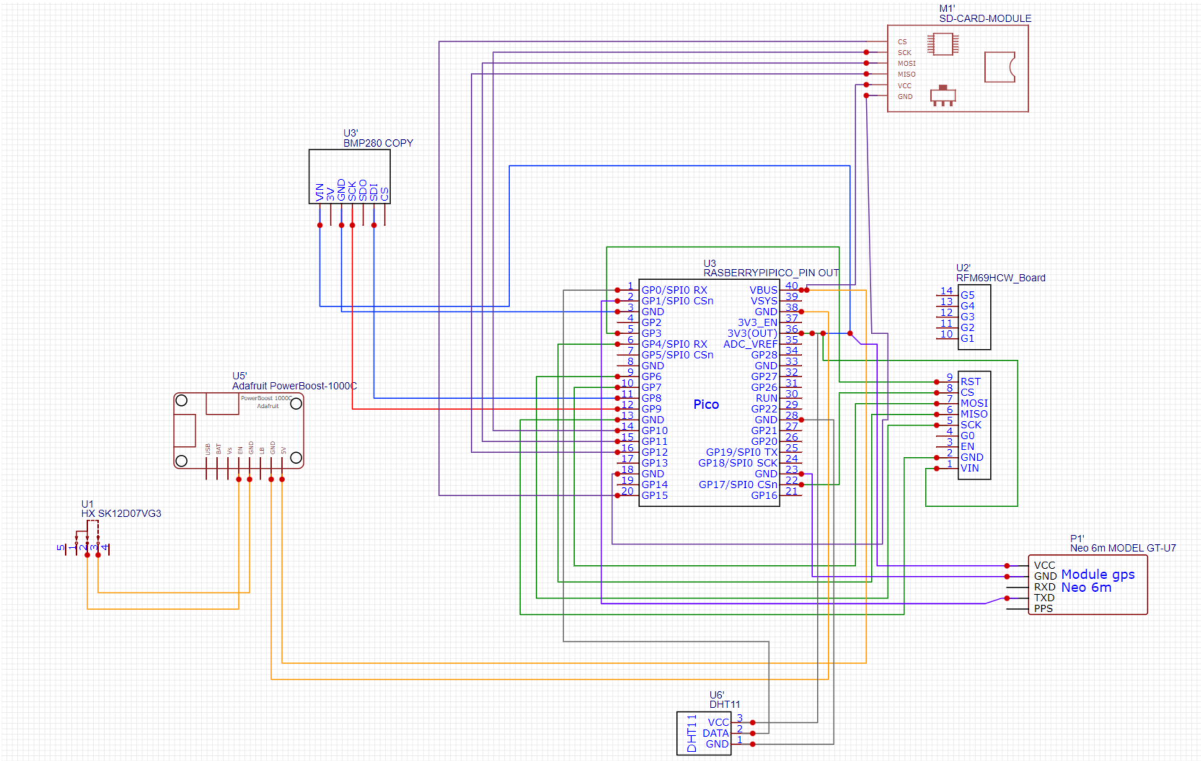
For the automatic upright mechanism, we ultimately decided to make three vertical notches along almost the entire length of the CanSat's fuselage to allow for the deployment of the legs. After writing Report 1, our physics teacher informed us that our initial idea—a motor system with a cable—was not feasible. We then reconsidered and opted for this new approach. Our servo motors will be positioned as shown in the diagram, forming a triangle at the bottom of the CanSat. They will activate the deployment of the legs through the designated slots. These will be operated by three servo motors controlled by the Raspberry Pi.

Above all, for practicality and safety, the primary and secondary missions will be handled by two separate circuits, each operated by its own Raspberry Pi. This setup allows us to test our PCBs as soon as the primary mission is complete, and ensures greater safety—if one Raspberry Pi fails, only one of the two missions will be compromised.

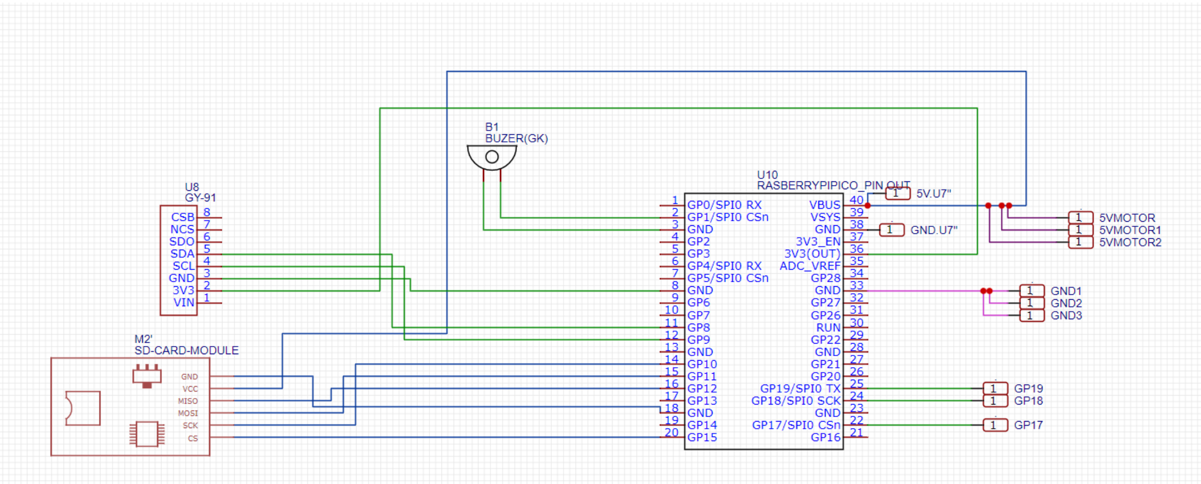
2.4 Electronic design

2.4.1 System overview

Primary mission :



Secondary mission :



Here are the details of the connections for our CanSat's primary mission, along with the components we are using: Raspberry Pi Pico, BMP280, RFM69, DHT11, GPS Neo-6M, Switch KH-SS12F44-G3.5, Powerboost Adafruit 1000C, Micro SD module, and a LiPo battery.

We selected most of our components, such as the Raspberry Pi Pico and BMP280, based on guidance from Innoviris, which we believe ensures compatibility and reliability. However, the GPS Neo-6M, DHT11, and Micro SD module were chosen independently, based on specific project requirements.

- GPS Neo-6M: Selected for its small size, high accuracy, and affordability, making it ideal for a compact system like our CanSat.
- DHT11: This thermometer and humidity sensor was chosen for its ease of use, accuracy for our mission's needs, and straightforward integration into the codebase.
- Micro SD Module: Selected to facilitate efficient data storage and retrieval for mission logs and sensor readings.

For the roles and functions of other components, such as the power management via the Powerboost Adafruit 1000C and the BMP280 for atmospheric pressure measurements, please refer to the detailed sections above. This carefully curated selection of components ensures a balanced mix of performance, size, and cost-effectiveness for the CanSat's mission.

2.4.2 Power consumption

Table 2: Expected power draw for all the electronics

Module	Expected power draw (mA)
RPi Pico	93
BPM 280	3
DHT 11	2.5
GPS Neo-6M	65
RFM69	100
RPi Pico 2	93
GY-91	5
Passive buzzer	2
3 servo moteurs (au repos)	20 x 3
Total	**423.5**

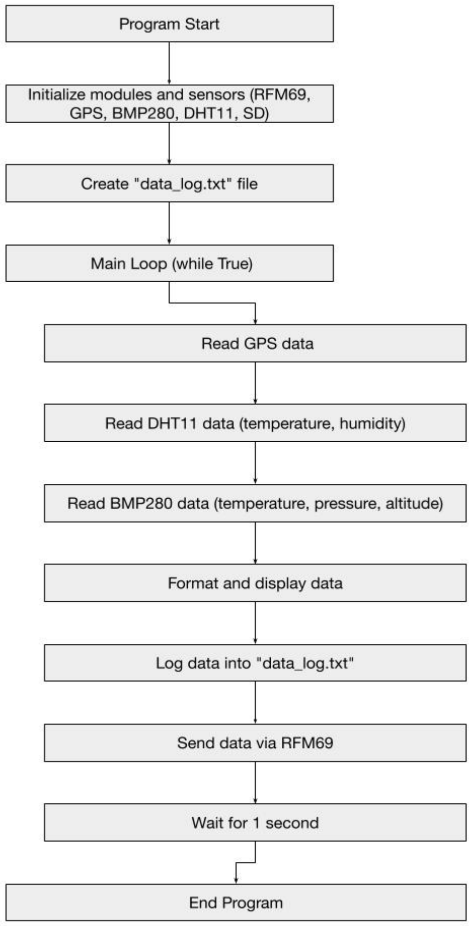
Battery and operational duration:

- *Battery capacity: 1400 + 1500 mAh.*
- *Estimated operational duration:*

$$Duration = \frac{Battery\ capacity}{Battery\ consumption} = \frac{2900}{423.5} = 6.84\ H \quad \text{or 6h50}$$

2.5 Software design

Our code is designed to manage a CanSat system, collecting and transmitting environmental and positional data through various sensors and modules. After importing the necessary libraries, the program configures the hardware components, including the RFM69 radio module, BMP280 and DHT11 sensors, the Neo-6M GPS module via UART, and an SD module for data storage. The BMP280 measures pressure and temperature, while the DHT11 provides temperature and humidity data. The GPS collects positional, altitude, and speed information.



A specific function we created calculates altitude from pressure using a standard formula. The program also initializes a file system on an SD card, where data is recorded to ensure its safety, even in the event of radio transmission interruptions.

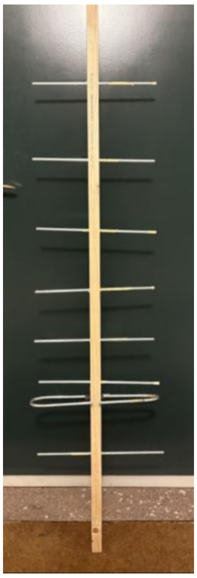
In the main loop, GPS data is read and formatted to include latitude, longitude, altitude, speed, and the number of satellites in use. The DHT11 and BMP280 sensors provide environmental measurements. The collected data is combined into structured messages and saved to the SD card to create a reliable log.

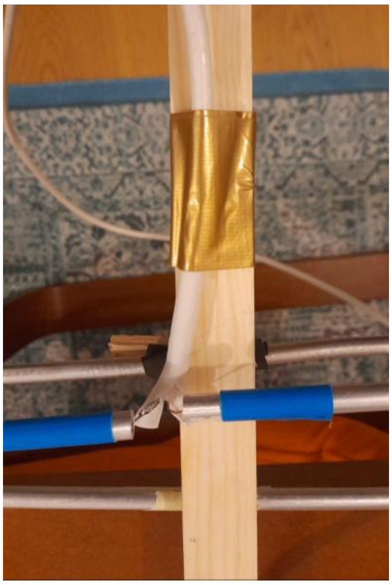
These messages are also transmitted via the RFM69 radio module to a base station, with a LED indicator lighting up to signal each transmission. The program integrates error-handling mechanisms to ensure continuous execution, even if some sensors or modules encounter issues. This approach enables the system to collect, store, and transmit critical data reliably and securely.

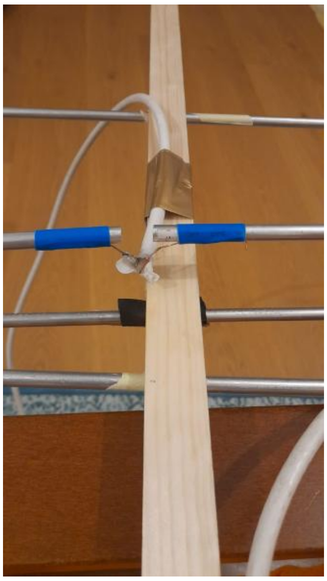
2.6 Ground station design & Data processing

2.6.1 Antenna & Data Capturing

We will use a Yagi antenna to improve the reception of data transmitted by the CanSat to our computer. We will collect all the data sent by the CanSat during the entire flight as well as during the ground phase. Afterwards, we will transfer all the recorded data to an Excel spreadsheet to convert it into graphs and analyse the flight. However, in case of poor radio connection, which affects the transmission of information via radio waves, we have a backup solution where the data is also recorded on an SD card integrated into the CanSat. We used a Yagi antenna calculator to determine the antenna's dimensions.







Enter Frequency (MHz)

The center frequency of the antenna in MHz

433

The amount of antenna elements (the more elements the more (inverse log) gain it has and directional beam becomes more narrow.)

8

Boom diameter **BD** in millimeters (the diameter of the PVC pipe where the antenna elements will be mounted on)

27

Antenna elements diameter **ED** in millimeters (the diameter of the antenna elements)

0.8

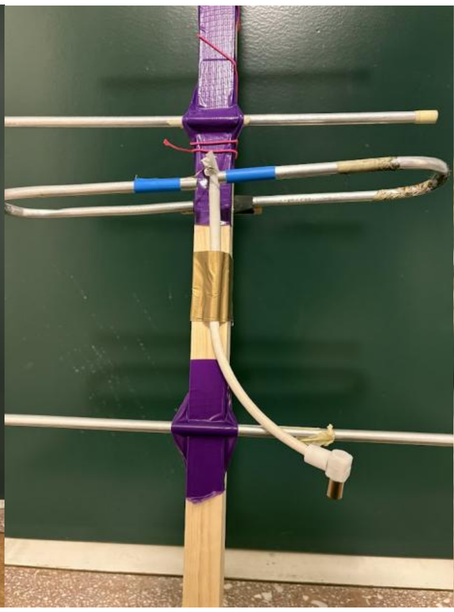
Is the boom constructed using conductive or non conductive material?

(•) Insulated (PVC/Wood)

( ) Not insulated (Aluminium/Copper)

	Metric (mm)	Imperial (inches)
Wavelength	692.36	27.258
Boom **BL***	1066.24 mm	41.978 inch
Gain	10.5 dB *(approx.)*	10.5 dB *(approx.)*
Reflector	Position **P** 0 mm	Position **P** 0 inch
	Length 333.72 mm	Length 13.139 inch
Dipole**	Position **P** 166.17 mm	Position **P** 6.542 inch
	Length 333.72 mm	Length 13.139 inch
Director 1	Position 218.09 mm (**P** +51.93 mm)	Position 8.586 inch (**P** +2.044 inch)
	Length 314.86 mm	Length 12.396 inch
Director 2	Position 342.72 mm (**P** +124.63 mm)	Position 13.493 inch (**P** +4.906 inch)
	Length 311.87 mm	Length 12.278 inch
Director 3	Position 491.58 mm (**P** +148.86 mm)	Position 19.353 inch (**P** +5.861 inch)
	Length 309.13 mm	Length 12.17 inch
Director 4	Position 664.67 mm (**P** +173.09 mm)	Position 26.168 inch (**P** +6.815 inch)
	Length 306.62 mm	Length 12.072 inch
Director 5	Position 858.53 mm (**P** +193.86 mm)	Position 33.8 inch (**P** +7.632 inch)
	Length 304.35 mm	Length 11.982 inch
Director 6	Position 1066.24 mm (**P** +207.71 mm)	Position 41.978 inch (**P** +8.177 inch)
	Length 302.29 mm	Length 11.901 inch

The results of our tests showed that the antenna's range was not long enough, so we wanted to improve it. To do this, we removed our metal rods from their holes because they were not straight, and placed them on the surface of the stick. We taped them in place and used a piece of string to secure them in place.
So now they're all oriented in the same direction, unlike the old one (photos above).
Note also that we've kept the same placement for each rod.


To improve our recovery distance even further, we are going to use a technique we learned in support 2. When we aim our CanSat, we need to do so in such a way that the metal rods on our Yagi antenna are as parallel as possible with the antenna in the CanSat, so that the data emitted by our CanSat has a better chance of being picked up by our Yagi antenna because it will cover a larger area.

2.6.2 Data Processing

We are going to create a ‘File reader’ in Python to retrieve the data from the SD card and use it in Visual Studio, where we will create graphs using the Matplotlib library. However, we will also use Excel to generate graphs from the data extracted from the SD card. This will allow us to compare the graphs and add extra security to the data analysis, in case the Python code generating the graphs crashes on launch day.

2.7 Recovery system

To retrieve our CanSat, we will use a GPS and a passive buzzer. The buzzer will emit a sound after the upright phase to indicate its location. Additionally, we are also going to paint our parachute in a way that makes it as visible as possible.

3. Testing

To date, we have already tested our primary mission, and it is functioning properly, with all components displaying their data correctly. Additionally, the Yagi antenna works well over a distance of at least 300 meters, although we haven't had the chance to test it at greater distances yet. As mentioned earlier, we have already built a test parachute to calculate the measurements for the final parachute.

<table>
<tr><td></td><td>Statut</td><td></td></tr>
<tr><td>Parachute</td><td>FUNCTIONAL</td><td>Tested twice and functional.</td></tr>
<tr><td>Primary mission</td><td>FUNCTIONAL</td><td>Everything has been tested and is functional.</td></tr>
<tr><td>Antenna</td><td>TESTING</td><td>Tested at a distance of 350m, waiting for improvement.</td></tr>
<tr><td>PCBs primary mission</td><td>IN PROGRESS</td><td>Waiting for delivery.</td></tr>
<tr><td>Code primary mission</td><td>FUNCTIONAL</td><td>Everything has been tested and is functional.</td></tr>
<tr><td>Secondary mission</td><td>IN PROGRESS</td><td><table>
<tr><td>raspberry pi pico</td><td>TESTED</td></tr>
<tr><td>Gyroscope</td><td>TESTED</td></tr>
<tr><td>Servo moteurs</td><td>TESTED</td></tr>
<tr><td>Buzzer passif</td><td>TESTED</td></tr>
<tr><td>altimetre</td><td>TESTED</td></tr>
<tr><td>accelerometre</td><td>TESTED</td></tr>
<tr><td>Lecteur SD</td><td>TESTED</td></tr>
<tr><td>Leg deployment</td><td>ON HOLD (see below)</td></tr>
<tr><td>Code</td><td>ON HOLD (see below)</td></tr>
</table></td></tr>
<tr><td>PCB secondary mission</td><td>ON HOLD</td><td>Waiting for delivery.</td></tr>
<tr><td>Code secondary mission</td><td>IN PROGRESS</td><td>Waiting to be tested in real condition.</td></tr>
<tr><td>Deployment system</td><td>IN PROGRESS</td><td>Waiting for the first « real » draft of the CanSat to know the precise position of the motor.</td></tr>
<tr><td>Design 3D</td><td>IN PROGRESS</td><td>Awaiting the last motors to create the precise 3D model.</td></tr>
</table>

```
18
Shell
📊 MPU6050 - Accélération : X=0.08g, Y=0.21g, Z=0.95g
Module stable depuis 56.0 secondes
Aucun mouvement détecté pendant 15 secondes
🌡   BMP280 - Température : 20.2C, Pression : 1009.32 hPa, Altitude calculée : 32.77 m
----------------------------------------
```

Figure 4 Test of our different components (This is our custom console): gyroscope, servomotors, passive buzzer, altimeter, accelerometer, SD reader

```
110,409.00,50.999999N,3.000000E,18:17:56,15.6m,0.057412km/h, nombre sattelite: 12,1028.26Pa,4.93°C,-60.23m,5°C,92%
111,413.00,50.999999N,3.000000E,18:18:00,13.6m,0.103712km/h, nombre sattelite: 12,1028.29Pa,4.96°C,-60.47m,5°C,92%
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113,420.00,50.999999N,3.000000E,18:18:11,12.7m,0.068524km/h, nombre sattelite: 12,1028.25Pa,4.97°C,-60.14m,5°C,92%
```
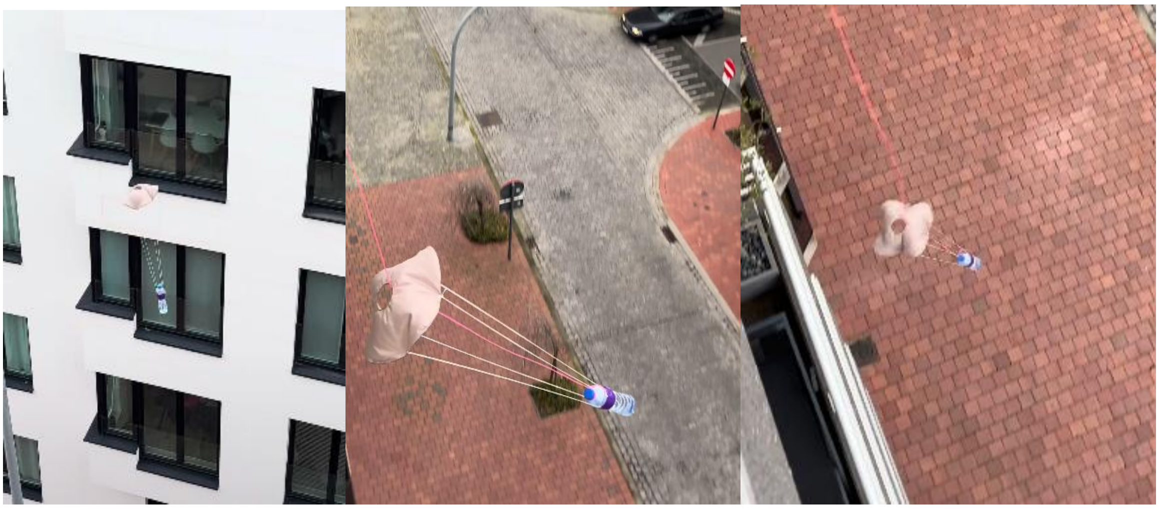

Figure 5 Data of our primary mission (SD carte): From left to right : counter, time, GPS data, local time, speed, Number of satellites, pressure, temperature, altitude, temperature, humidity



Test of our parachute

Test of our yagi antenna

Overview of our failures and how we addressed those failures:

	Failures	Solution
Parachute	The parachute did not deploy	We changed the arrangement of our tie wires.
Primary mission	Issues with strength and space, and problems with the GPS code.	We created custom PCBs and eventually found our mistake.
PCB primary mission	PCB was too wide	We did 2 versions.
Code primary mission	The GPS didn't work in the final code because a pin was named twice.	We reviewed the code several times and eventually found the error.
Secondary mission	N/A	N/A
PCB secondary mission	Voltage drop and therefore signal drop	We made the routings wider (0.254mm to 0.400mm)
Code secondary mission	we don't have any idee	We finally came up with an idea that allows us to use triple protection (tilt, altitude and acceleration) during flight, which prevents the Cansat from opening up during flight.
Hardware	Linking components with electrical wire was too voluminous, too fragile and insufficiently reliable	We created custom PCBs.
Battery	There is a risk that the battery will not be sufficient.	We have bought a second battery and will be soldering it to the first in parallel.

3. Requirements

No.	Requirement	Status
1	**Size of a standard soda can (115 mm height and 66 mm diameter)**	OK
2	**Antenna and parachute (folded) respect the CanSat diameter (66 mm)**	OK
3	**Weight between 300 g and 350 g**	OK
4	No explosive or flammable material	OK
5	4 hours of power from battery	OK
6	The battery can be changed on field	OK

No.	Requirement	Status
7	**Have a master switch**	OK
8	Have a reusable recovery system, such as a parachute (bright coloured fabric recommended)	OK
9	Parachute attachment should accept 100 N	not yet
10	**Flight time limited to 120 s**	OK
11	A descent rate between 8 and 11 m/s	OK
12	**Acceleration 20 g**	to be verified
13	**A positioning system can help retrieval (beeper, GPS, radio signal...)**	OK
14	Total value under €500	OK
15	Include real market cost of sponsored material	OK
16	**Respect assigned radio frequency**	OK

4. Overall progress

4.1 Human resources

Here is our team:

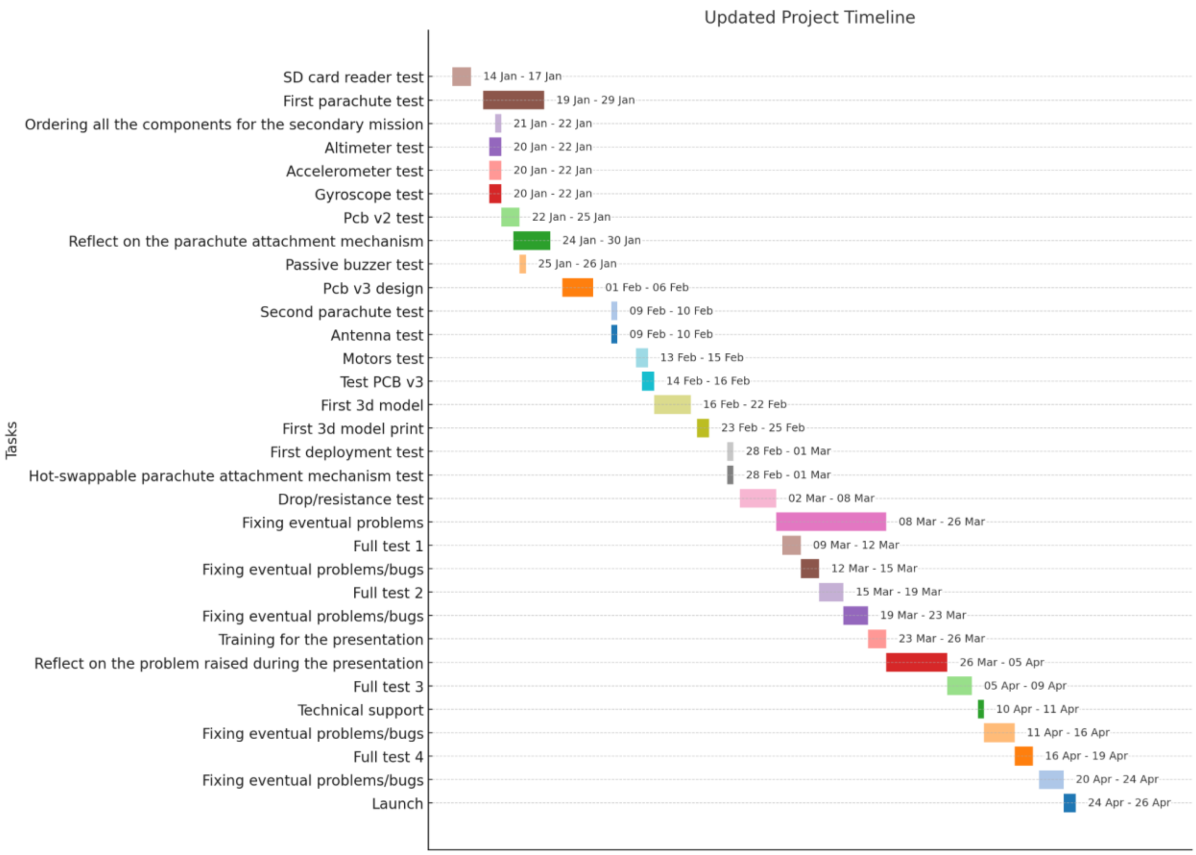
Figure 1: From left to right, Oscar Beck, Yann Lamperti, Yosha Schor, Gypsie Verbrugge, Kian Jongen, Sam Bruffaerts
All team members are in their final year at Decroly School in Brussels.

To learn more about the team, please refer to Report 1.

	Gypsie	Oscar	Kian	Yann	Yosha	Sam
Communication	⭐	⭐				⭐
Hardware	⭐		⭐	⭐	⭐	
Software		⭐		⭐	⭐	
Administration	⭐				⭐	⭐
3D		⭐		⭐		
Parachute			⭐			
Drafting	⭐	⭐	⭐	⭐	⭐	⭐
Engineering		⭐	⭐	⭐	⭐	⭐
Planification	⭐			⭐	⭐	⭐
Budget	⭐				⭐	⭐

4.2 Planning

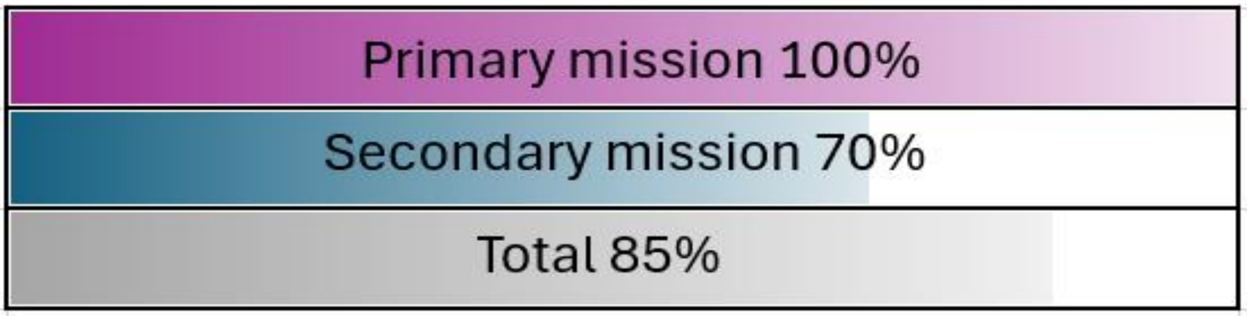
Timetable and planning:



Progress report:

	Status (in %)	
Registration	DONE (100)	

Calendar	IN PROGRESS (99)	We improve it over time
Logo	DONE (100)	
Contact	DONE (100)	
Primary mission	DONE (100)	
Code primary mission	DONE (100)	
PCB primary mission	IN PROGRESS (100)	
Secondary mission	IN PROGRESS (70)	Waiting for the last components
PCB secondary mission	IN PROGRESS (95)	Waiting for delivery
Modelling	IN PROGRESSE (40)	Waiting for the precise dimensions of the PCBs and components for the secondary mission.
Parachute	DONE (100)	
Antenna	IN PROGRESS (100)	
Social Media	IN PROGRESS (/)	



4.3 Budget

Part	Price	Shop	Order Date
BUDGET	500€		
CanSat Starter kit	-100€	The Hergée Museum	4/11/2024
Fabric (parachute)	-3€	Chien Vert	20/11/2024
GPS + DHT11	-26,98€	Amazon	22/11/2024
Wooden stick and metal tube (antenna)	-11,47€	Brico	24/11/2024
PCB custom v1	-44,39€	JLC	06/01/2025
PCB custom v2	-58,66€	JLC	15/01/2025

Raspberry Pi + Gyroscope	-25€	Amazon	22/01/2025
Rods and bolts	-8,27€	Brico	23/02/2025
Motors	-70,39€	Amazon	31/01/2025
Remaining budget	95,43 €		

5. Outreach

We are active on social media, and we have selected several platforms on which we post regular updates and progress videos:

- Our instagram account: https://www.instagram.com/skyfall_mission/
- Our TikTok account: https://www.tiktok.com/@skyfall_mission

We also want to create posters to put in our school and we regularly talk about our project to people we know.
We seek to ensure that our social media posts are fun, because we believe that humour and fun are the best way to attract the attention of our target audience, namely students. We also monitor social media and identify what is trending and then seek to incorporate these trending topics in our posts.

6. Discussion

The initial stages of the project have progressed successfully. We assigned specific roles to each team member, and each individual conducted research in his or her respective domains. This approach has allowed us to acquire substantial knowledge and expertise.

With the exception of the GPS module—which failed in the final code due to a duplicate pin assignment— all primary systems functioned correctly on the first attempt. This includes the Yagi antenna, as well as the temperature, pressure, and altitude sensors. As of now, our primary mission is fully operational.

We have successfully tested our final parachute, which is fully functional. Similarly, our Yagi antenna has been completed and is performing as expected.

Currently, we are working on our secondary mission. The gyroscope, altimeter, and accelerometer are functional, as are the motors.

Our next focus is on 3D design to develop a precisely engineered chassis that ensures optimal placement of all components. Each component will have a designated slot, molded to its exact shape, minimizing unnecessary movement and ensuring a robust final structure.

Regarding the hardware, during assembly we identified that using wired connections for the components consumed excessive space within the CanSat’s enclosure and introduced structural fragility. To address this, we have opted to design and manufacture custom PCBs (Printed Circuit Boards) to optimize internal space and improve reliability.

Additionally, we have decided to postpone soldering until the final stages of construction. This will ensure that all solder joints and electrical connections remain stable and clean at launch.

We remain confident in our ability to source sufficiently compact components that will fit within the constraints of our payload. Overall, we have strong confidence in the successful completion of this project, supported by our highly motivated and dedicated team.

7. Conclusion

We are thrilled to continue our journey with the CanSat project, which has proven to be an enriching and stimulating experience for all of us. Throughout this second phase, we have deepened our technical knowledge and strengthened our teamwork, problem-solving, and project management skills. What was once a concept is now materializing into a tangible, functional system, and we are proud of the progress we have made.

One of the most valuable aspects of this project has been the collaborative effort required to overcome challenges. Unlike traditional school assignments, the complexity and scale of this project have demanded an equitable distribution of tasks and strong interdependence among all team members. Through careful planning, perseverance, and adaptability, we have tackled obstacles such as optimizing our PCB design, improving our parachute, refining our antenna, and successfully implementing our primary mission.

Since our first report, we have achieved significant milestones: the majority of our primary mission components are now fully operational, our PCB designs have been refined for greater efficiency and reliability, and we have resolved critical issues such as the GPS malfunction. Additionally, we have made substantial progress on our secondary mission, testing key components such as the gyroscope, accelerometer, and servomotors. Our 3D modeling efforts are now focused on finalizing a robust and space-efficient chassis to ensure a structurally sound CanSat.

We remain fully committed to following our timeline and refining our work to meet all competition requirements. The enthusiasm within our team remains strong, and we are eager to see our CanSat complete its development and take flight. The journey so far has been both challenging and rewarding, and we are excited for the final stages ahead!

References

Please refer to Report 1.