CAN SAT IN GREECE

CDR

S.M.A.L.L. Sat

Table of Contents

1 Introduction **2**
1.1 Organization of Group 2
1.2 Mission Objectives 2
2. CanSat Description **3**
2.1 Mission Overview 3
2.2 Mechanical / Construction Design 3
2.3 Wiring diagram 6
2.4 Software Design 6
2.5 Recovery System 7
2.6 Ground Station Equipment 7
3 Project Scheduling **8**
3.1 CanSat Preparation Timeline 8
3.2 Needs Assessment 8
3.2.1 Budget 8
3.2.2 External Support 8
3.2.3 Testing Plan 8
4 Promotion Plan **8**
5 Specifications **8**

1 Introduction

1.1 Organization of Group

S.M.A.L.L. Sat Team Consists of the Team Leader, 8 active members and another 4 supportive members.
Aristotelis Thymianos serves as the Supervisor, primarily focusing on mentoring the team to achieve their goals effectively. Denis Romain, the Design Manager, oversees Mechanical Design for both Primary and Secondary Missions. Yonghan Du, as the Team Manager, handles Electrical Design, Telecommunication, and various other responsibilities related to the missions. Ioannis Apostolopoulos takes charge as the Avionics Manager, overseeing Electrical Design, Software design, and Aerodynamics Simulations. Aristeidis Sargkisian, a Team Member, manages Marketing & Social Media, Telecommunication, and Data Analysis while pursuing interests in Boxing, Reading, and Math. Sotiris Minogiannis, another Team Member, specializes in Mechanical Design while balancing interests in Tennis, Reading, Physics, Math, and Video Games. Tanya Haroun, the Marketing Manager, focuses on Marketing & Social Media along with the Recovery System. Weijun Ye contributes to the team with Web development and Telecommunication skills, alongside interests in Physics, Math, and Tennis. Filippos Solomos, a supportive Team Member, focuses on Marketing and Secondary Mission tasks. Philip Psichogios, another supportive Team Member, juggles Marketing, Mechanical Design, and hobbies like Fishing, Tennis, Basketball, and Video Games. Di An contributes to Telecommunication and Secondary Mission tasks while enjoying swimming, video gaming, Math, and computer science. Yubo Chen specializes in Mechanical Design and enjoys soccer and reading. Lastly, Xinyang Cheng as a supportive member contributes to Secondary Mission tasks.

The team meets once per week for the standard 1.5 hours session where everyone shares updates and tasks while the personal work of each member is varying based on tasks that each one has taken over and other responsibilities. Usually the avionics team meets during the weekend as well for longer sessions (approximately 3 hours) in order to complete the tasks. Before major events the team also meets on Tuesdays in order to catch up with deadlines for reports, presentations for events and bazaars.

1.2 Mission Objectives

Our secondary mission draws inspiration from the groundbreaking combination of magnetometer-equipped missions like NASA's Mars Science Laboratory (Curiosity Rover) and the innovative approaches to reusable and precisely landing spacecraft, as demonstrated by industry leaders such as SpaceX and Virgin Galactic. We aim to emulate a dual magnetometer approach, akin to that used in the Mars Reconnaissance Orbiter and the Curiosity Rover, to collect comprehensive magnetic field data from high altitudes, mirroring the detailed scientific inquiry possible on Mars but focused on Earth's magnetic environment. The data from the magnetometer will eventually be plotted into a graph and compared with existing ones from SuperMAG to capture the abnormalities and/or characteristics in order to forecast magnetic weather. Furthermore, inspired by SpaceX's reusable rockets and Virgin Galactic's precision landings, our CanSat is designed to achieve a targeted landing through glider and parachute systems. The GPS data will also be stored on board the CanSat and transmitted back to our station through Telecommunication. The onboard GPS data will be used for live adjustment of the CanSat flying path in order to achieve guided landing. With the support of guided landing and data from the magnetometer, our CanSat has a purposeful real-life application of forecasting magnetic weather and providing data for the magnetic field at locations without access to a stationary magnetic-substorm forecast station such as Pacific Ocean areas.

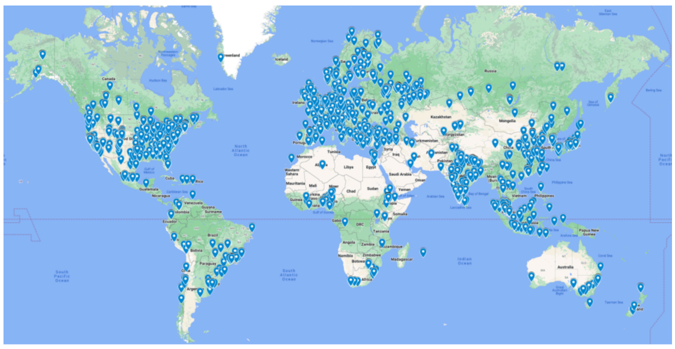


Image 1: SuperMAG Magnetometers location

The secondary mission of our project involves two main objectives aimed at broadening both the scientific scope and operational capabilities of our CanSat. Initially, we plan to measure the Earth's magnetic field using a magnetometer to detect nanotesla magnitudes, intending to deepen our understanding of the planet's magnetic properties. Additionally, we aim to achieve a precision landing on a preselected site, utilizing cutting-edge technology to ensure accuracy. The dual goals of precisely landing and effectively gathering and retrieving magnetic field data define our criteria for success. This approach emphasizes a comprehensive strategy, integrating advanced data collection with precision landing techniques to meet the mission's broad objectives effectively.

2. CanSat Description

2.1 Mission Overview

Our mission aims to deploy a CanSat equipped with sensors to collect atmospheric data and demonstrate autonomous guided landing capabilities. The CanSat will be launched by a rocket to an altitude of approximately 1000 meters, where it will separate and begin its descent. The descent will be controlled using a RAM type parachute to ensure a safe landing with a descent speed not exceeding 9 meters per second. The CanSat will collect data for altitude, pressure, temperature, GPS Coordinates and Magnetic field as it descents. At the same time the satellite will try to orient itself and glide to a predefined location on the ground by using its parachute and an onboard automated pilot system.

Key Elements:

- Barometer sensor (BMP280) for measuring atmospheric pressure and temperature.
- GPS module (Adafruit Ultimate GPS Breakout) for tracking location and logging GPS data.
- LoRa module (SX1278) for long-range communication with the ground station.
- MicroSD card for storing collected data locally.
- Teensy 4.1 microcontroller for processing sensor data and controlling the CanSat's functions.
- RAM type parachute for controlled descent and guided landing.
- Magnetometer for collecting data on the Earth's magnetic field (secondary mission).

Main Mission Overview:

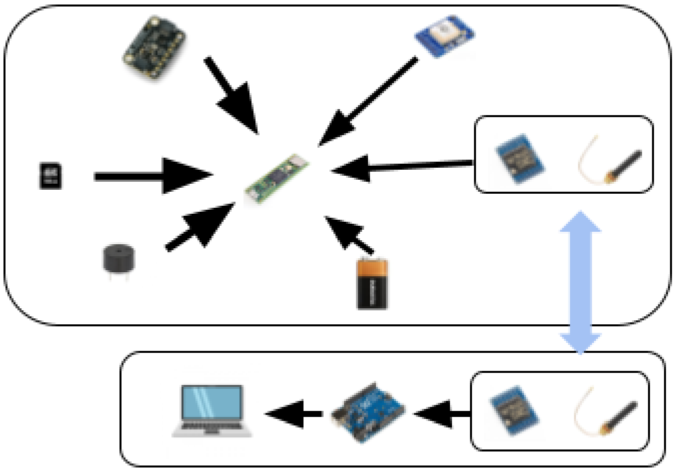


Image 2: Graphic representation of the main components used for the CanSat's Primary Mission and Ground Station.

2.2 Mechanical / Construction Design

The mechanical design of the CanSat will consist primarily of an inner structure, an outer casing, and a RAM chute. Two arms on either side of the CanSat will be connected to lines of the RAM chute, and will be controlled by servo motors to steer the CanSat. It should be noted that the CanSat will be horizontally oriented such that the longer side of either primary mechanical component will be parallel to the lateral axis. The outer casing will take the shape of a tube surrounded by a pattern of hexagonal holes for the sake of ventilation. These hexagonal holes will be normal to the shell at their central points, and will hence face the central lateral axis of the CanSat. The outer casing will have a diameter of 66mm, whilst the length of the tube, its longest dimension, will be 102.9mm. It should be noted that the hexagonal pattern will not cover the entirety of the outer casing's length for structural reasons. The inner structure will take the shape of two vertical discs parallel to the longitudinal axis of the CanSat, and joined by two longer, parallel plates normal to their faces. One of the discs will be a full 66mm in diameter, whilst the other will be slightly smaller at a diameter of 56.6mm such that the outer shell will be able to fit on and be bounded laterally by the larger disk. Four protrusions will extend from the inner side of each disc, with circular cavities that align with corresponding circular holes on the outer shell. This will allow for screws to pass through both components, thus locking the outer casing to the inner structure. Each protrusion will be identical, with only different orientations and placements. Furthermore, the protrusions will be placed symmetrically with respect to the central axes of the CanSat, and will hence be equidistant to the CanSat's central point. The length of the inner structure will be 106mm. The inner structure will house all electronic components of the CanSat, which may be placed on either side of the plates, or in the space in between them. The arms will take a teardrop-like shape, normal to which a small, cylindrical joint will be extended. These joints will pass through holes in the disks of the inner structure, where they will be joined to servos between the plates. The servos will be used to actuate the arms, the joints of which will have cavities corresponding to the servo shafts to improve connection. The steering lines of the RAM chute will be connected to the narrow ends of the teardrop by a knot passing through a small hole normal to the main face of the teardrop. The teardrop section of the arms will have a thickness of 4mm, whilst the joint will extend 6mm outward from the teardrop. It should be noted that the servos will be placed within the inner structure CanSat such that the space separating the teardrop section of either arm from the outer face of the corresponding disc of the inner structure will be 0.5mm wide. Hence, the total length of the CanSat will be 115mm. The inner structure, outer shell, and arms of the CanSat will be 3D printed with light weight ASA (LW-ASA) as it is the toughest 3D printing material (absorbs the most impact energy), and more stable under UV or extreme thermal conditions compared to LW-PLA. PLA has the highest static strength but is more brittle.

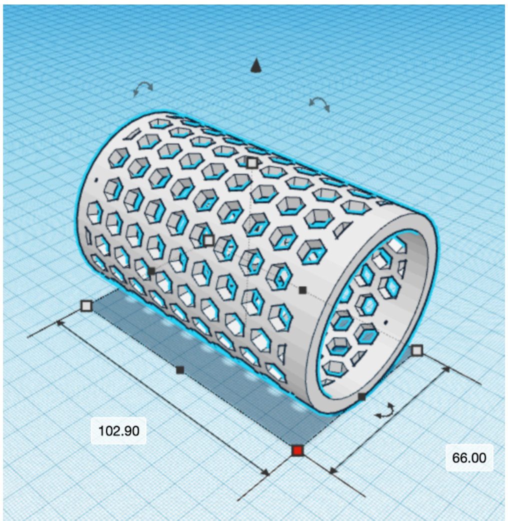


Image 3: Mechanical design of the outer casing

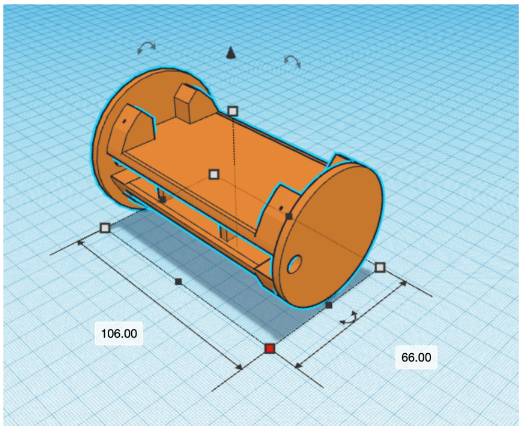


Image 4: Mechanical design of the inner structure

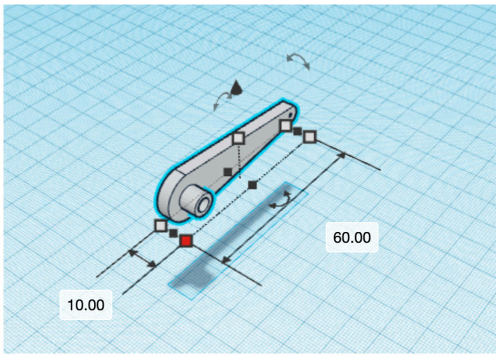


Image 5: Mechanical design of the arm(s)

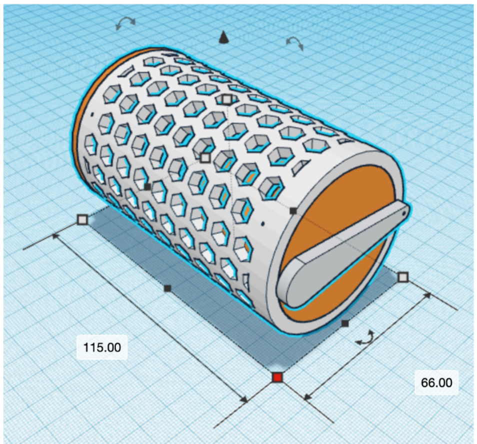
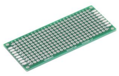
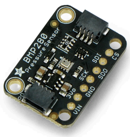
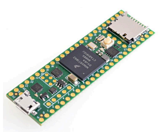
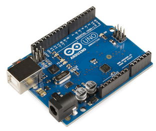
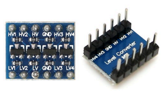


Image 6: Virtual snapshot of the assembled CanSat (excluding electronic components)

2.3 Electrical Schematics

Primary mission(including ground station):

Sensors/components	Image	Function
Perfboard		Prototyping board to connect wires and to build circuits.
Adafruit BMP280		Measure barometric pressure and temperature with very good accuracy. Used in weather sensing.
LoRa Module 433Mhz - SX1278		Used for long-range spread spectrum communication. It uses the SPI communication protocol and can be used with any microcontroller that supports SPI. Long transmission distance and high reliability.
Antenna RF 434MHz 2dBi 63.6mm u.FL		Used to transmit and receive radio frequency signals at a frequency of 433MHz.
Adafruit Ultimate GPS Breakout - 66 channel w/10 Hz updates - Version 3		Used to track location and log GPS data with high accuracy. Designed to be used with microcontrollers and can do up to 10 location updates a second. Have a built in data logging ability.
Teensy 4.1		The Teensy 4.1 is the newest iteration of the astoundingly popular development platform that features an ARM Cortex-M7 processor at 600MHz, with a NXP iMXRT1062 chip, four times larger flash memory than the 4.0, and two new locations to optionally add more memory. The highlight feature of this chip is the built-in SD card slot, making it suitable for a wide range of data logging purposes.
Arduino UNO		A microcontroller board that is based on the ATmega328p microcontroller. It can be used in a wide variety of applications and is similar to the Arduino Duemilanove but made for the use of a breadboard and has no dedicated power jack
Buzzer		A simple buzzer that makes tones upon command, and can be viewed as just a resistor in the circuit.
Level shifter		Level shifters are used to enable communication between devices operating at different logic levels (voltages). An Arduino Uno runs at 5V but a device like the NodeMCU uses 3.3V logic level.

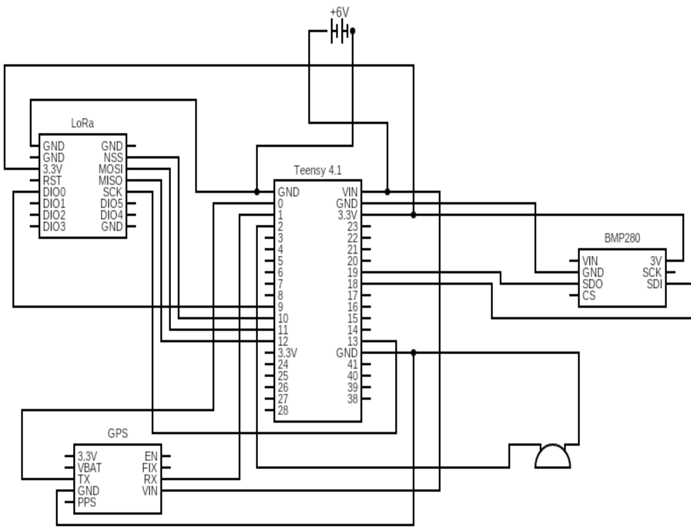


Image 7: Wiring diagram of the CanSat.

The wiring diagram of the CanSat is provided above, this consists of the entire composition of the primary mission. Moreover, the components used for transmission (telecommunication) are also included. The LoRa SX1278 module is responsible for transmitting all the data collected from the CanSat to the ground station at 433MHZ. Furthermore, the power supply of the primary mission will consist of an external battery connected to the teensy 4.1 as the microcontroller will power all the peripherals. Last but not least the overall idea of the CanSat is to have all the components powered and controlled by the teensy 4.1 as it is capable to do so with excelling ram, storage, and ports(SPI). However an external power supply is necessary for the actual launch.

For the power consumption analysis, we'll consider the power requirements of each electronic component in the CanSat system, including the newly added small servos. Here's an updated breakdown of the components and their estimated power consumption:

- Adafruit BMP280: Power Consumption: Typically operates in the range of 2.7V to 5V, with a maximum current consumption of 0.12 mA during active measurement and 0.5 µA in sleep mode.
- LoRa Module 433MHz - SX1278: Power Consumption: Typically operates at 3.3V with a maximum current consumption of around 100 mA during transmission and 10 mA during reception. In idle mode, the current consumption can be around 1 µA.
- Adafruit Ultimate GPS Breakout: Power Consumption: Typically operates at 3.3V with a maximum current consumption of around 100 mA during acquisition and 25 mA during tracking.
- Teensy 4.1: Power Consumption: The Teensy 4.1 typically consumes around 100 mA to 250 mA depending on the processing load and peripherals used.
- Buzzer: Power Consumption: The buzzer typically consumes a very small amount of power, usually in the range of a few milliamps.
- Level shifter: Power Consumption: The power consumption of the level shifter is negligible, typically in the microamp range.
- Small Servos (2): Power Consumption: Depending on the load and operation, small servos typically consume around 100 mA to 250 mA each.

To calculate the total power consumption for operating the CanSat for 4 hours, we first need to estimate the average power consumption of each component over the duration of the mission. Let's assume that the CanSat will operate at typical power levels for the duration of 4 hours:

- Adafruit BMP280: Average Power Consumption: (0.12 mA * 4 hours) = 0.48 mA
- LoRa Module 433MHz - SX1278: Average Power Consumption: (100 mA * 4 hours) = 400 mAh (transmission), (10 mA * 4 hours) = 40 mAh (reception)
- Adafruit Ultimate GPS Breakout: Average Power Consumption: (100 mA * 4 hours) = 400 mAh (acquisition), (25 mA * 4 hours) = 100 mAh (tracking)
- Teensy 4.1: Average Power Consumption: Assuming an average of 175 mA: (175 mA * 4 hours) = 700 mAh
- Buzzer: Average Power Consumption: Assuming a low power consumption of 5 mA: (5 mA * 4 hours) = 20 mAh
- Level shifter: Negligible power consumption over 4 hours.
- Small Servos (2): Average Power Consumption: Assuming an average of 175 mA per servo: (175 mA * 2 servos * 4 hours) = 1400 mAh

Now, we sum up the power consumption of all components:

Total Power Consumption = BMP280 + LoRa Transmission + LoRa Reception + GPS Acquisition + GPS Tracking + Teensy + Buzzer + Servos
= 0.48 mAh + 400 mAh + 40 mAh + 400 mAh + 100 mAh + 700 mAh + 20 mAh + 1400 mAh
= 3060.48 mAh

So, the estimated total power consumption for operating the CanSat for 4 hours is approximately 3060.48 mAh. This value represents the total amount of charge (in milliampere-hours) required to power the CanSat components continuously for 4 hours. The selection of the 4 hours time frame was made based on previous questions of other teams that participated in the competition that was found in the Discord channel.

Based on the estimated total power consumption of approximately 3060.48 mAh for operating the CanSat for 4 hours, we can explore some battery options to ensure sufficient power supply throughout the mission duration. One such option is the LiPo (Lithium Polymer) Battery, known for its lightweight nature and high energy density, making it suitable for portable applications like the CanSat. For this purpose, a LiPo battery with a capacity of around 4000 mAh to 5000 mAh would provide enough power for the CanSat's operation.

To calculate the power consumption, we need to sum up the power consumed by each electronic component in the CanSat system.

From the provided information, we have the power consumption values (in watts) for each component:

Adafruit BMP280: 0.7 W
LoRa Module SX1278: 0.13 W (per module, assuming 2 modules)
Antenna RF 434MHz: Negligible power consumption for receiving signals.
Adafruit Ultimate GPS Breakout: 0.05 W
Teensy 4.1: 0.5 W
Buzzer: Negligible power consumption.
Level shifter: Negligible power consumption.
We also have two small servos, for which we need power consumption values to calculate the total power. Assuming each servo consumes around 0.5 watts, the total power consumption for both servos would be 1 W.

Now, we can sum up the power consumption of all components:

Total Power = Power of BMP280 + Power of LoRa Modules + Power of GPS Breakout + Power of Teensy 4.1 + Power of Buzzer + Power of Level Shifter + Power of Servos

Plugging in the values:

Total Power = 0.7 W + (0.13 W * 2) + 0.05 W + 0.5 W + 0 W + 0 W + 1 W
= 0.7 W + 0.26 W + 0.05 W + 0.5 W + 0 W + 0 W + 1 W
= 2.51 W

Therefore, the estimated total power consumption for operating the CanSat is approximately 2.51 watts.

To calculate the energy consumption in watt-hours (Wh), we can use the formula:

Energy (Wh) = Power (W) × Time (hours)

Given that the total power consumption for operating the CanSat for 4 hours is approximately 2.51 W (as calculated earlier), we can plug this into the formula along with the time duration of 4 hours:

Energy (Wh) = 2.51 W × 4 hours = 10.04Wh

Therefore, the estimated energy consumption for operating the CanSat for 4 hours is approximately 10.04 watt-hours.

2.4 Software Design

Programming Language/Platform

The programming language that has been chosen for the S.M.A.L.L Sat is frequently used in Arduinos". This language is based on C and C++, and is used in the software "Arduino IDE" which has been selected due to its compatibility with our microprocessor, the Teensy 4.1, as well as our processor for the ground station(Arduino Uno). The version of the "Arduino IDE" that is being used is the Arduino IDE 2.3.2. The extension used to ensure compatibility with the Teensy

4.1 is called "Teensyduino," which is a library add-on to the Arduino IDE, allowing it to be used with various Teensy models.

Program/Storage Space

The S.M.A.L.L Sat will be controlled by a Teensy 4.1 microcontroller, leveraging its ample storage capacity to support data and program requirements. This is one of the primary reasons why it is being used. The Teensy 4.1 features 7936 thousand bytes of flash memory, as well as 1024 thousand bytes of RAM. This gives breathing room for the software design, and gives an ample amount of memory to work with. The microSD fitted onto the integrated microSD card holder can hold up to 32GB of storage for data collection, which is more than enough to support the mission. For transmission, the LoRa SX1278 uses a frequency of 433Mhz to transmit any data saved locally to the ground station, which is saved to another 32GB SD card for data processing post-mission, as well as to ensure the safety of the data on the ground.

Data Analysis

The data that is collected from the ground station transmissions, as well as the S.M.A.L.L Sat itself will be saved to text files. These files will be put through a python script, organizing and filtering the data for further and swifter analysis. This python script will be written by the Avionics Manager, Ioannis Apostolopoulos, due to his previous experience with programming and python. Multiple graphs will be formed using this data, such as temperature-altitude, altitude-time, pressure-time, NanoTesla-time, distance-time(A script would translate latitude and longitude coordinates over time to display distance traveled). Additionally, data related to location, heading, and the decisions made based off of those variables can help analyze the efficiency of our landing system, as well as report accuracy and suggest areas of improvement.

Flowcharts (On Board/ Ground Station)

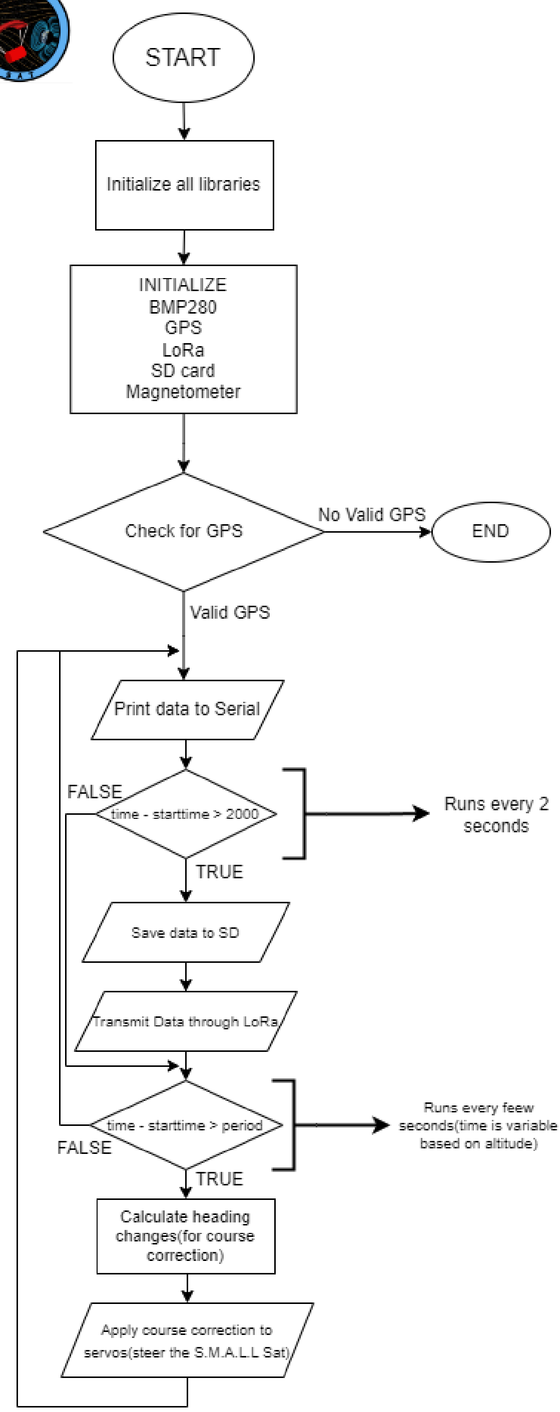


***Image 8**: Flowchart of main loop*

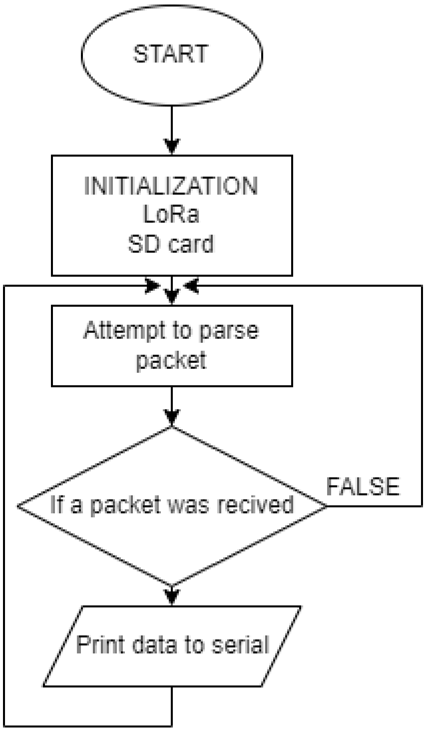


***Image 9:** Ground Station Flowchart*

2.5 Recovery System

Our Recovery system will include a RAM type parachute in order to complete our secondary mission which includes navigation and targeted landing. Our Parachute is a single skin paraglider designed with a special software called Singleskin and sewed by the team members in our laboratory using an electrical sewing machine. Below you may find some information about our paraglider along with some pictures of our design for reference.

Flat area = $0.99\ m^2$
AR = 4.7
Wingspan = $2.15\ m$
Projected area = $0.74\ m^2$
Projected AR = 3.27
Angle at wingtip = 115.5 deg
Average bridle angle = 95.3 deg
Num of cells = 5
Sell width = 47.32 cm
Root chord = 0.54 m
Wingtip chord = 0.18 m
Bridles height = 1.44 m

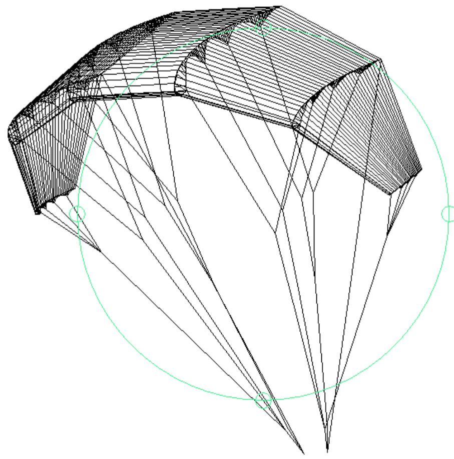


Image 10: Glider Design in 3D software

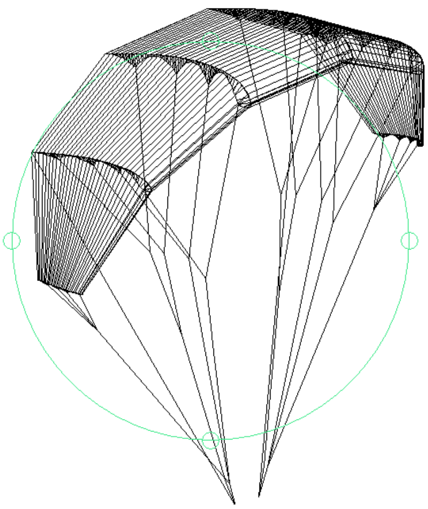


Image 11: Glider Design in 3D software

The reason we choose this type of parachute is to allow us to navigate the CanSat. Our Satellite will have two small arms which will unfold after the release from the rocket and they will steer the glider by breaking down each side of the wing. This is a basic technique used in paragliding in order to navigate when gliding into the air. By pulling down one edge of the wing, drag is created on this side of the wing and as a result the whole wing turns towards that direction. By using this technique the CanSat will be controlled to move to any direction except upwind.

The estimated flight time will be approximately 111 seconds.
The calculations of this number come from simple equations of constant velocity motion which can be found below:

$$\Delta x = v \cdot \Delta t \Rightarrow \Delta t = \frac{\Delta x}{v}$$

therefore as $\Delta x = 1000$ m and $v = 9 m/s$:

$$\rightarrow \Delta t = \frac{1000\,m}{9\,m/s} \approx 111\,s$$

2.6 Ground Station Equipment

For our ground station equipment, we utilize an Arduino UNO interfaced with an SX1278 LoRa module to receive telemetry data transmitted by our CanSat. To optimize communication range and reliability, we've constructed a Uda Yagi antenna specifically tuned to the 433 MHz frequency band. The base station software, programmed into the Arduino, initializes communication parameters, awaits incoming telemetry data, decodes it upon reception, and processes the data for display and analysis. A schematic diagram illustrates the electrical connections between the Arduino, LoRa module, and other components. Our transmission frequency is set at 433 MHz, although the specific channel and data encryption methods are notated separately. This setup ensures efficient reception and processing of CanSat data, allowing for real-time monitoring and analysis of mission parameters.
All data and measurements for our handmade antenna can be seen in Image 12 and some pictures of our antenna along with the 3D printed mounts for the elements can be seen in Image 13.

Frequency f: 433 MHz
Wavelength λ: 692 mm
Element diameter d: 8 mm
Boom diameter D: 27 mm

Total number of elements: 7
Boom length: 847 mm
Gain: 12 dBi (approx.)

Reflector length R: 346 mm
Reflector position R = 0

Dipole length F: 322 mm
Dipole position F (R-F): 138 mm
Gap at connection point g <= 9.2 mm

Director position D1 (R-D1): 190 mm, Length D1: 304 mm
Distance F-D1: 51.9 mm

Director position D2 (R-D2): 315 mm, Length D2: 300 mm
Distance D1-D2: 125 mm

Director position D3 (R-D3): 464 mm, Length D3: 295 mm
Distance D2-D3: 149 mm

Director position D4 (R-D4): 637 mm, Length D4: 291 mm
Distance D3-D4: 173 mm

Director position D5 (R-D5): 831 mm, Length D5: 288 mm
Distance D4-D5: 194 mm

Image 12: Calculations for Yagi Uda Antenna elements

Image 13.a & 13.b: Yagi-Uda Antenna

3 Project Scheduling

3.1 CanSat Preparation Timeline

The timeline of all tasks has been updating constantly and a detailed version can be found in the link below:
SMALL SAT Timeline.xlsx

Overall the team dedicated 2 months (Sep. & Oct.) in coming up with ideas, getting to know each other and organizing the tasks for the whole project. Another 3 months (Nov., Dec. & Jan.) were dedicated to training with simple Arduino circuits and sensors, 3D design and 3D printing and generic introductory tasks and projects. The last 2 months (Feb. & Mar.) are dedicated to the primary and the secondary mission of the CanSat.

3.2 Needs Assessment

3.2.1 Budget

Our budget until this time can be found in this link and a sum up of it can be seen below.

CanSat in Greece 2023		SMALL SAT	
ID	**Budget**	**% of Total**	**Subtotal**
1.	CanSat	84.30%	187.90€
2.	Ground Station	6.73%	15.00€
3.	Equipment	8.97%	20.00€
4.	Travel	0.00%	0.00€
5.	Other	0.00%	0.00€
	Total:	**100.00%**	**222.90€**

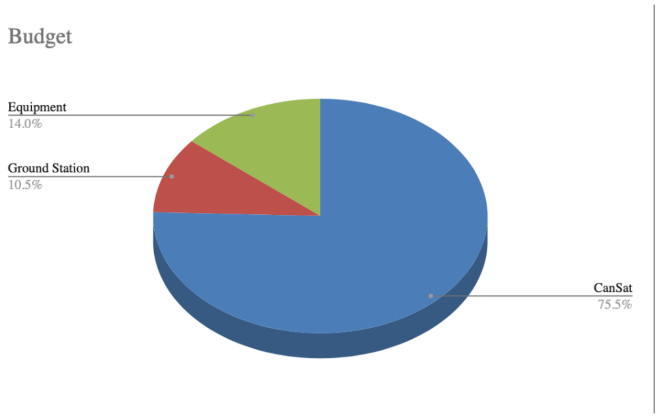


Image 13: Pie chart of S.M.A.L.L. Sat's budget composition

3.2.2 External Support

The team has received a lot of support both economically and in the form of knowledge sharing by many people and associations.

- Fundings for the purchase of the materials needed for the primary mission was raised from our participation in the Christmas bazaar of our School.
- Fundings for the materials needed for the secondary mission was raised from our sponsorship with the [ACS Athens - The institute](#).
- The team is currently seeking external funding from possible companies/businesses in Greece in order to cover potential further expenses.
- The team is currently planning another Bakesale in school to raise funds for the sensors of the secondary mission.

3.2.3 Testing Plan

We have been testing all sensors and the GPS with various methods including moving the CanSat from higher altitude to lower altitude and performing a range test for our telemetry system.

Additionally, as we perform the combined sensor test including bmp280 and gps, a range test was conducted simultaneously. While the sensor test was carried out in the front yard, we had the ground station back in the lab with open windows to test the trans-receive ability of the LoRa SX1278, this test concluded as a success however with some external interference corrupting a minimum amount of data.

Furthermore, a drop test was conducted by the team on the outer shell of the CanSat, dropping it from an altitude of approximately 4 m such that it would hit the ground at about 9 m/s. The mechanical structure of the CanSat's outer shell successfully resisted the impact force. Therefore, as the outer shell of the CanSat can withstand collisions at speeds exceeding the 9m/s descent speed of the CanSat, its structural integrity is proven to be applicable.

4 Promotion Plan

To promote our project, our team has been actively engaging in various promotional activities. While our website/blog is currently under development and not yet published, we are utilizing our Instagram account to provide regular updates and engage with our audience. Our Instagram account showcases our progress, team members, and upcoming events related to the CanSat project.

Instagram Site:
https://www.instagram.com/smallsat_acs

Promotional Actions Taken:

Participation in Christmas Bazaar: Our team participated in a Christmas bazaar where we showcased our project, interacted with attendees, and raised awareness about the CanSat competition.

Planning Bake Sale: We are planning another bakesale within the next month to further promote our project and raise funds for additional expenses.
Teacher Participation in Podcast: Our teacher participated in a podcast of the school media studio called Owlcast, where they discussed the CanSat club

and our project in detail.

Participation in Athens Science Festival 2024: Our team will participate in the Athens Science Festival 2024 to showcase our project to a wider audience and engage with science enthusiasts.

Articles by ACS Athens - The institute: Two articles have been written for our team by the Institute of ACS Athens, providing coverage and recognition for our project.
(Link of Articles: launching-dreams-acs-athens-cansat)

5 Specifications

In order for the CanSat to be safely launched on the rocket, it must meet the specifications listed in the competition entry instructions.

Characteristics	Measurement (Unit)
Length of CanSat (mm)	115mm
Mass of CanSat (g)	250 g
Diameter of CanSat (mm)	66mm
Length of folded recovery system (mm)	45mm
Scheduled Flight Time (s)	~111s
Calculated descent speed (m/s)	9m/s
Energy consumption (Wh)	10.04 Wh
Used Radio Frequency (Hz)	433 MHz
Total cost (€)	142.9 €

On behalf of the S.M.A.L.L. Sat team, I confirm that our training satellite CanSat complies with all the characteristics and limitations set by SPIN - Space Innovation, organizer of the CanSat in Greece 2024 competition.

Athens, 25/3/2024

Thymianos Aristotelis