Project Report: Aarohan - Nepal's Space Research on High Altitude Balloon

Team Aarohan - SEDS Nepal

Project Overview

Aarohan represents a pioneering endeavor initiated by SEDS Nepal, aimed at propelling high-altitude balloons into the stratosphere. This project, in collaboration with esteemed institutions, is an exemplar of student engagement in the domain of space research and technology.

Objectives

1. Detect and quantify ozone levels in the stratosphere.
2. Capture high-resolution images and conduct Earth observations using GoPro technology.
3. Record humidity and temperature at varying altitudes.
4. Employ advanced sensors to detect dust particles in the upper atmosphere.
5. Explore innovative strategies and techniques for project execution.

Project Milestones

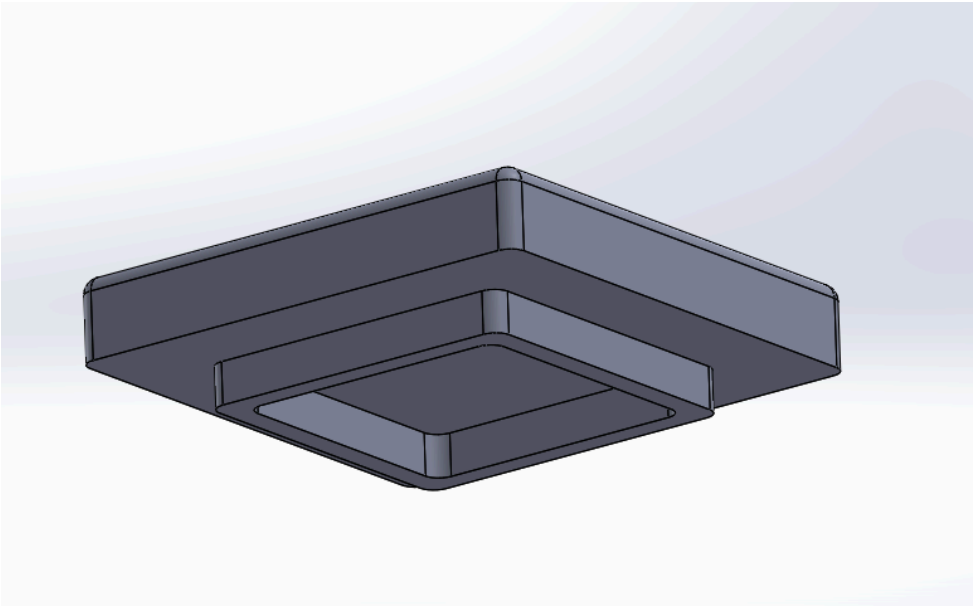
Research and Materials

Our project has procured the essential materials to ensure a successful mission:

- Balloon: We have acquired an 8245-H Hwoyee Weather Balloon, 1600 grams, to serve as the vehicle for our payload.
- Drogue Parachute: This is instrumental in the safe landing of the payload following the balloon's ascent.
- Payload Structure: We designed the payload structure utilizing Styrofoam for superior insulation, shock absorbency, and moisture resistance.
- Kapton Tape: The use of Kapton tape provides essential temperature insulation as the balloon ascends to extreme altitudes.
- Aluminium Foil: This is employed for additional insulation of electronic components and payloads.
- Nylon Wire We utilized nylon wire to connect the payload, parachute, and balloon securely.
- Nichrome Wire: Nichrome wire is an integral part of our flight termination system, known for its resilience against heat, corrosion, and oxidation.

Mechanical Design

Our rigorous discussions have led to the selection of employing two CanSats in our project, enhancing our data collection capabilities.



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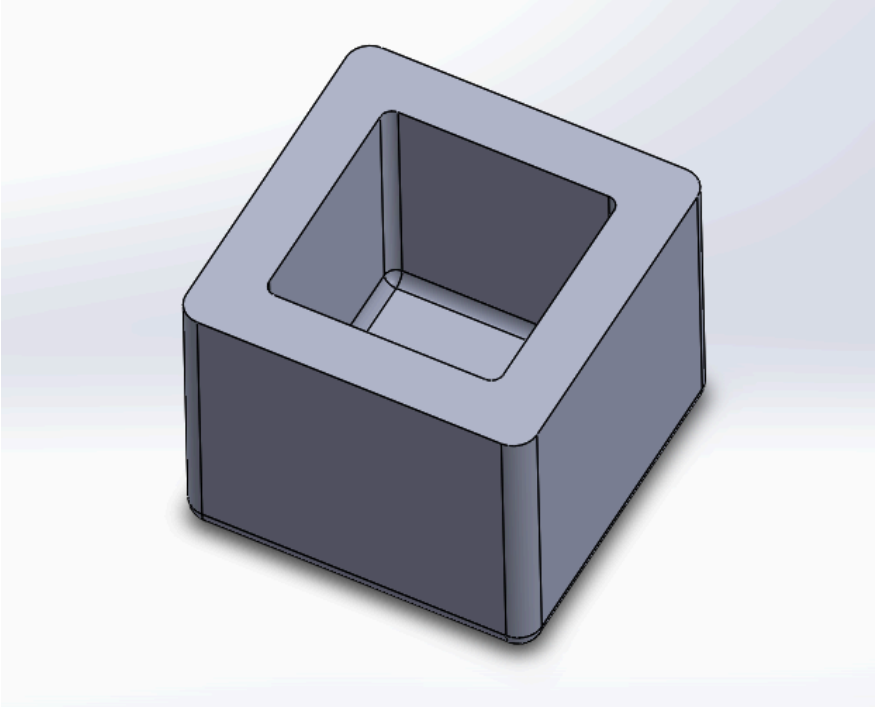


Fig. Box for payload

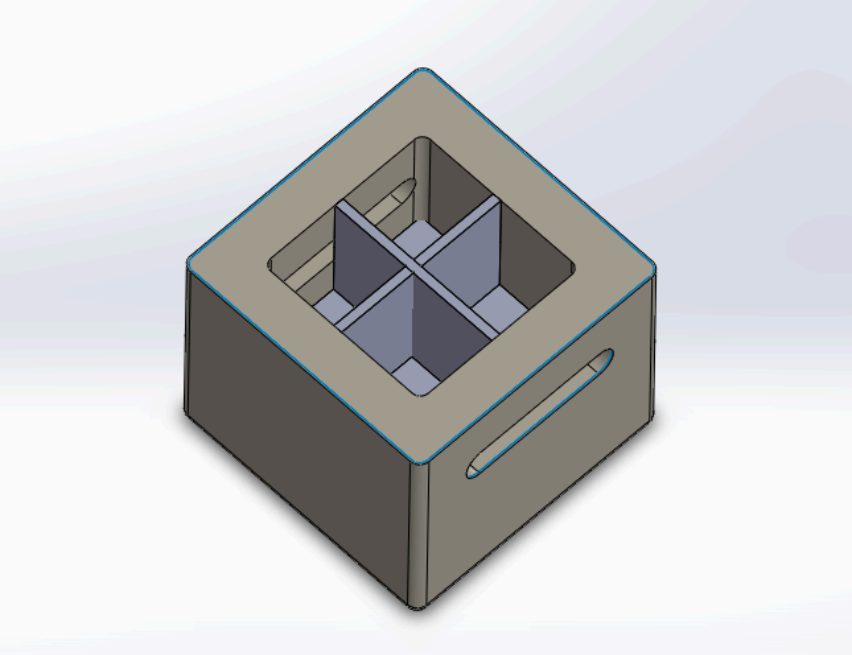


Fig. Sectioning for payload placement

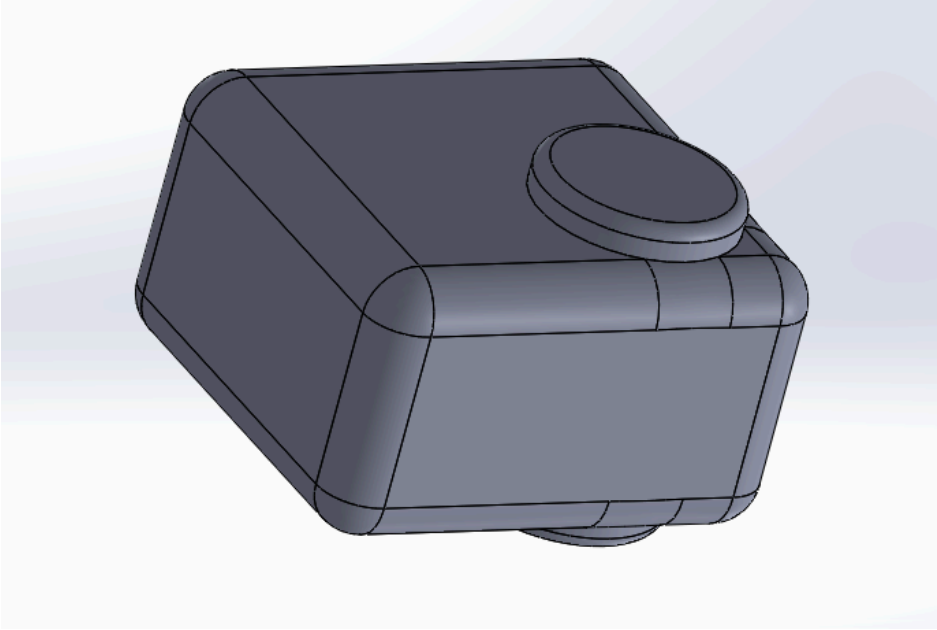


Fig. Gopro

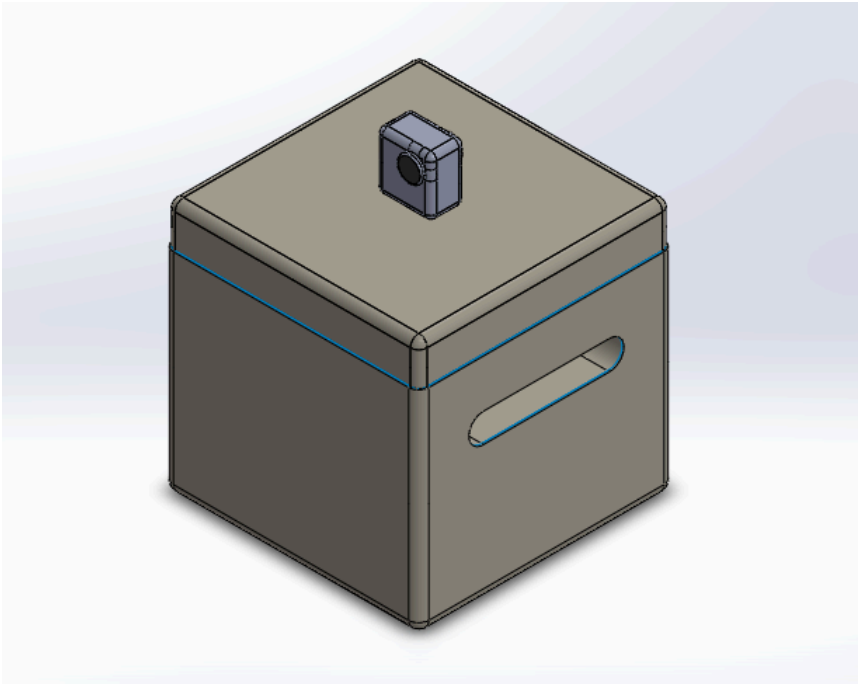


Fig. Emplacement of gopro

Simulation

To ensure the safety of our mission, comprehensive simulations have been conducted using ANSYS 2022R1 software. Key figures include mesh analysis, energy summary, and deformation analysis. These simulations have been pivotal in validating our design choices.

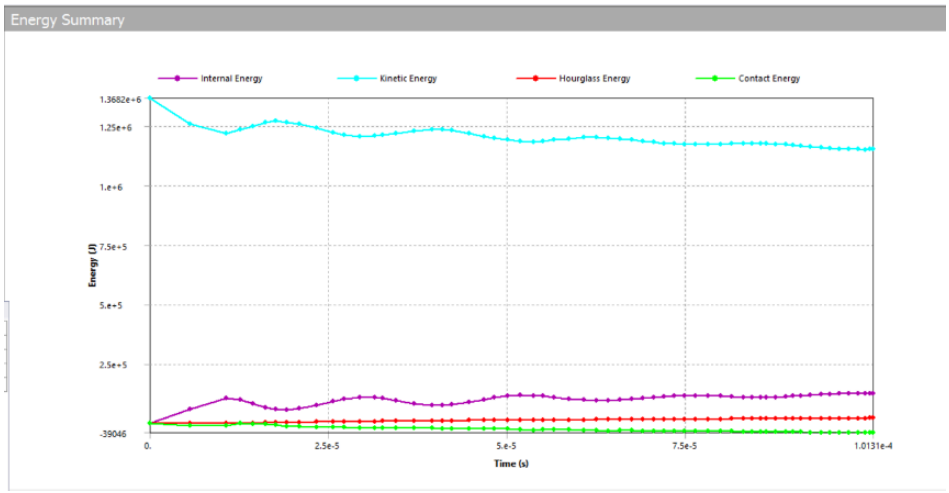


Fig 1: Mesh Analysis

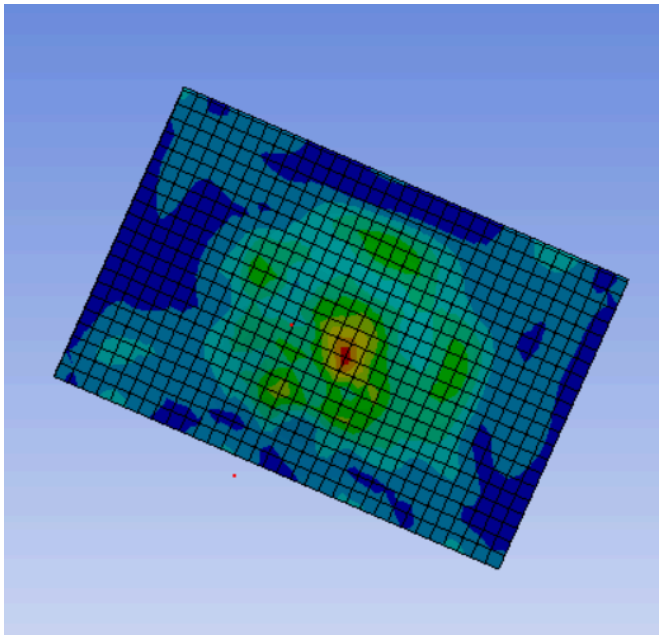


Fig 2: Equivalent Deformation from back

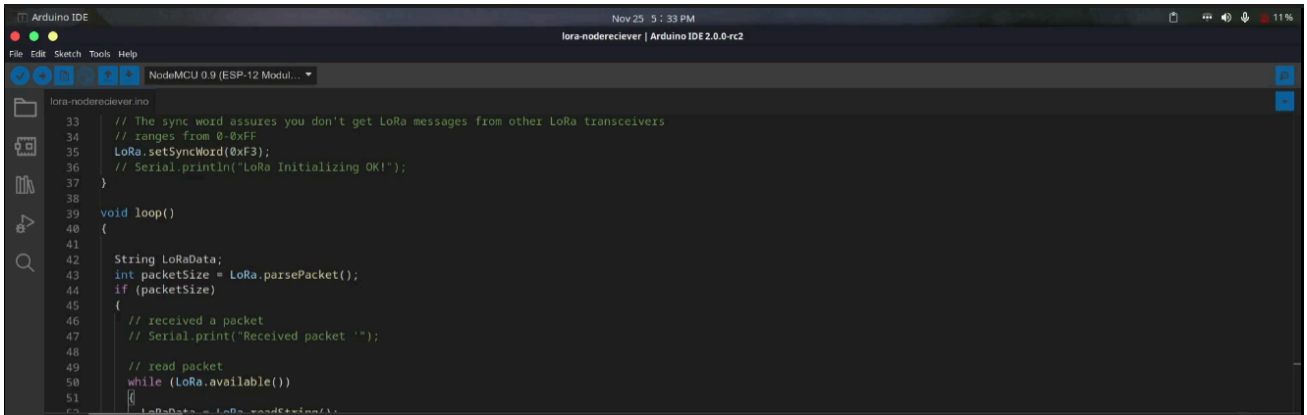
Recovery System

Extensive research led to the selection of a Servomotor mechanism for parachute deployment. Its lightweight design and reliability are well-suited for our project.

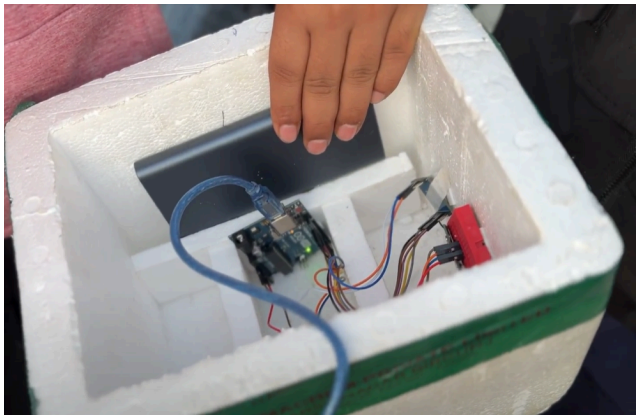
Electronics Testing (Drop Test)

Our electronics system encompasses a Lora Module, GPS for data transmission, Arduino UNO, and Esp32. A successful drop test was conducted using a lightweight parachute and probe. The test validated our ability to collect data during descent without any damage to the electronics.

Data Received During Drop Test



Pictures of connections and assembly



Academic Collaboration

Our project has ventured to expand our knowledge by collaborating with the Hydrology and Meteorological Department of Tribhuvan University. We had the privilege to witness the government's daily weather balloon launches and to study the electronics and software used in their operations.

Future Developments

The next milestone in our project is gaining access to helium, which will be funded by the National Association for Science and Technology (NAST). This funding will ensure the timely execution of our mission.

Conclusion

This project report serves as a testament to the dedication and collaborative spirit of SEDS-Nepal's Team Aarohan. As of now, we remain on track to meet the original project deadline. Our ongoing research aims to refine the flight process, enhance equipment safety, and prepare for the helium acquisition. Our unwavering commitment to pushing the boundaries of space research and technology continues to drive our progress.

Acknowledgments

We express our heartfelt gratitude to all team members, mentors, and supporters for their unwavering dedication to the success of Project Aarohan.