AVALOKAN - GRAHGAAMI

CanSat Competiton 2024

Contents

AVALOKAN 2024

1. Preamble

Welcome to the **AVALOKAN**, a Cansat competition organized by Chandigarh University Astronomy Club. This event is designed to challenge and inspire the brightest minds in computational logic and algorithm development. The **AVALOKAN** offers a unique platform for students to apply their theoretical knowledge to practical, real-world problems in Boolean satisfiability. Participants will have the opportunity to develop innovative solutions, enhance their problem-solving skills, and engage in interdisciplinary collaboration.

2. Problem Statement

Design and develop a CANSAT capable of observing and analyzing Martian meteorological parameters. The CANSAT should demonstrate robustness in a simulated Martian environment, maintaining stable orientation and communication with a dedicated ground station.

3. General Information

3.1 Introduction to AVALOKAN Competition 2024

The **AVALOKAN** 2024, organized by the Chandigarh University Astronomy Club, presents a unique challenge focused on the development of CANSATs for planetary exploration. Participants, primarily Indian students, are tasked with designing unmanned aerial vehicles (UAVs) capable of withstanding Martian terrain conditions and conducting meteorological observations. This competition aims to foster innovation, interdisciplinary collaboration, and practical application of engineering and computational skills in a simulated extra-terrestrial setting. Through rigorous selection and evaluation processes, teams compete to demonstrate their CANSATs' functionality, robustness, and ability to meet stringent mission requirements, enhancing their understanding of aerospace engineering and positioning themselves for future career opportunities in space exploration.

3.2 Objectives of the challenge

- To design and develop a CANSAT to observe and study Martian meteorological parameters.
- To develop an understanding of potential performance scope in a foreign planet.
- To promote in-depth domain study for enhanced knowledge and awareness.
- To represent skill-specific teamwork, domain knowledge, innovation, and presentation ability.

3.3 Outcome of Student Community

Participants will gain hands-on experience in CANSAT design and electronics architecture, mission planning and operation. This competition will enhance their understanding of aerospace engineering further boosting their career development.

3.4 Schedule of Events

#	Description	Date
1.	Launch of the Event	1st June 2024
2.	Last date of team registration and Document Submission (Phase-I) Online	31st August 2024
3.	Last date of proposal draft (Phase-I) Ideathon online	31st August 2024
4.	Results of (Phase-I) announcement (A maximum of 30 teams will be selected)	4th September 2024
5.	Submission of Design report by selected teams	10th September 2024
6.	Selection of Final teams based on design report	12th September 2024
7.	Final Field Round (Phase-II) Offline	4th & 5th October

3.5 Venue

The final onsite evaluation shall be conducted in the Chandigarh University Campus in Punjab in October 2024. The teams must present operational demos subject to their models. For information about the GrahGaami 2024 competition venue, kindly follow our updates on the website.

3.6 Intellectual Property Rights

All designs and innovations remain the intellectual property of the respective teams. The organizers may request permission to showcase the designs for promotional purposes.

4. Participating Teams

4.1 Registration

All teams must complete the registration process on the website. The registration procedure includes:

1. Team login account creation.
2. Fill out the team details and download the auto-generated registration form.
3. Upload duly signed auto-generated form.
4. Upload proposal file in .pdf format (Max. pages:20 and Max. file size: 10 MB) and presentation (Max. slides:15 and Max. file size: 5 MB).

NOTE: Registration shall be deemed completed only after uploading as per steps 3 and 4.

4.2 Team Members

- The competition is open to students of Indian origin studying in educational institutions located in India.
- Only one team shall participate in the event from an Institute.
- The team consists of students pursuing diplomas/graduation/research.
- The team must consist of 4 students from the same Institute.
- The maximum age of any student member shall be 25 years.
- The team must be mentored by a faculty from the same Institute.
- The team may have an additional mentor from the industry.

4.3 Team Lead Responsibilities

Each team must appoint a team lead who will be the primary point of contact with the organizers.

4.4 Selection Process

The selection is a two-step process wherein, in Phase I a maximum of 30 teams will be selected from initially registered teams based on the evaluation of proposals. From the Design report, a maximum of 10 teams will be selected for the Phase II Field Round based on the evaluation of the design and demonstration of the prototype. The decision of the organizers in this regard will be final and binding.

5. Mission Requirements

5.1 Basic requirements

- The CANSAT shall have a maximum dimension of 0.1 to 0.3 meter per side.
- The CANSAT mass shall be no more than the specified range below.
- The CANSAT shall be able to maintain its orientation in space and perform a safe descent.
- The CANSAT shall be equipped with a mechanism to control its descent rate.

5.2 Structure Requirements

- The CANSAT structure must be robust enough to withstand launch conditions, including acceleration, vibration, and shock.
- The structure should allow for easy integration and removal of all internal components.
- Material selection should consider weight, strength, and thermal properties.
- The CANSAT must include an external switch for power and an accessible data port for communication and programming.

5.3 Power requirements

- The CANSAT shall include a power subsystem with a schematic showing all power connections, including sources, resistors, and major components.
- Lithium Polymer batteries are prohibited.
- The power subsystem must have an external switch and show all types of connections and mounting details.
- The power budget should include energy balance, the power consumption of each component, and the total power consumed.

5.4 Descent & Recovery Requirements

- The CANSAT must include a descent control system capable of controlling its descent rate.
- A recovery system should ensure the CANSAT lands safely and can be recovered undamaged.
- The descent system should be tested thoroughly to confirm reliability.

5.5 Communication Requirements

1. Communication Mode: The CANSAT must use RF (radio frequency) radio mode for communication.
2. Ground Station:
– The CANSAT must have a dedicated ground station for communication.
– The ground station should include a laptop, antenna, and power supply, and remain operational during launch and descent.
– The ground station must ensure real-time data collection, display telemetry in engineering units, and plot data during flight.
– The ground station antenna should be elevated for adequate coverage and range, ensuring stability and portability.

5.6 Ground Station

- The CANSAT must have a dedicated ground station for communication.
- The ground station shall include a laptop, antenna, and power supply, remaining operational during launch and descent.
- The ground station must ensure real-time data collection, display telemetry in engineering units, and plot data during flight.
- The ground station antenna should be elevated for adequate coverage and range, ensuring stability and portability.

5.7 Team Composition and Management

- The team must be well-organized, detailing roles and responsibilities, communication plans, and project management strategies.
- Include a detailed Gantt chart or similar timeline showing task start and stop dates, durations, and periodic update meetings.

5.8 Mission Overview

- The mission overview should cover the primary and secondary objectives, system-level requirements, and any external support utilized.
- Include diagrams, tables, and demonstration results to illustrate the system overview.
- Key components, engineering drawings, launch and descent strategy, post-launch recovery, and data analysis methods should be detailed.

5.9 Subsystem Details

- Payload Subsystem: Detailed design, electrical and mechanical interfaces, deployment mechanism, and specifications.
- Housekeeping Subsystem: Including necessary sensors, actuators, attitude controls, power systems, and communication systems.

5.10 CANSAT Algorithm

- Describe functional requirements and mathematical formulations.
- Use flowcharts to explain the CANSAT algorithm, including software sequencing, sampling rates, telemetry and telecommand details, data storage, reset loops, and simulation strategies.
- Provide software architecture, programming language, development environment, and summary of software tasks.

5.11 Ground Station

- Detail the ground station's power supply, antenna pattern and type, telemetry display, command software, real-time data collection, user interface, and simulation mode for command transmission.
- Ensure the ground station can generate .csv files of all sensor data and maintain telemetry in the event of a processor reset.

5.12 CANSAT Integration and Testing

– Outline integration methodology and subsystem test plans for payload, mechanical structure, command and data handling, power supply, and ground station.

5.13 Mission Operations & Analysis

- Provide detailed plans for mission operations, including pre-launch, launch, in-flight, and post-recovery phases.
- Analyze mission data and provide a report on mission success and areas for improvement.

5.14 Requirements Compliance

– State the design compliance to requirements and mention any deviations with proper justifications.

5.15 CANSAT Specification

S. no.	Criteria	Specifications
1.	Size	Must fit within a cylindrical volume with a diameter of 0.1 to 0.3 meters and a maximum length of 0.3 meters.
2.	Weight	500 to 1500 grams
3.	Power Source	Battery operated only
4.	Communication	RF radio mode only
5.	Payload Mass	50 to 200 grams
6.	Recovery System	Parachute or other controlled descent systems for safe landing
7.	Launch System	Compatible with the official launch system
8.	Operating Time	At least 0.5 hour
9.	Safety	No explosives, detonators, pyrotechnics, flammable materials, dangerous materials, or biological pay-loads allowed.

5.16 Telemetry

S. No.	TM Parameter	Function	Resolution/Format
1	<TEAM ID>	Team Number	
2	<TIME STAMPING>	Time since the initial power	Seconds
3	<PACKET COUNT>	Count of transmitted packets	Integer
4	<ALTITUDE>	Altitude in units of meters and must be relative to the ground	0.01 meters
5	<PRESSURE>	Measurement of atmospheric pressure	0.1 pascal
6	<TEMP>	Temperature in Celsius	0.01 °C
7	<VOLTAGE>	Voltage of the CANSAT power bus	0.001 Volts
8	<GNSS TIME>	Time generated by the GNSS receiver	Seconds
9	<GNSS LATITUDE>	Latitude generated by the GNSS receiver	0.00001 degrees
10	<GNSS LONGITUDE>	Longitude generated by the GNSS receiver	0.00001 degrees
11	<GNSS ALTITUDE>	Altitude generated by the GNSS receiver	0.01 meters
12	<GNSS SATS>	GNSS satellites connected	Integer number
13	<ACCELEROMETER DATA>	Data received from the gyroscopic sensor i.e. acceleration and roll & pitch parameters	m/s^2
14	<GYRO SPIN RATE>	The spin rate of Mechanical Gyro with respect to CANSAT	deg/s

[Refer to below for further clarification.]

Key Adjustments and Considerations:

1. Increased Precision: For Martian meteorological observations, higher precision is required for altitude, pressure, and temperature measurements.
2. Temperature Resolution: The sensor can detect changes in temperature as small as 0.01 degrees Celsius.
3. Voltage Resolution: Finer resolution to ensure accurate power monitoring of the CANSAT.

4. GNSS (Global Navigation Satellite System) Data Precision: Enhanced precision for GNSS latitude, longitude, and altitude to ensure accurate positioning, which is critical for Martian exploration.
5. Packet Count and Time Stamping: Maintaining these parameters for communication and data logging consistency.
6. Gyro Spin rate: A CANSAT may not undergo continuous spin, this parameter in the table refers to the measurements from gyroscopic sensors that detect any rotational movement. This data is used to control and adjust the satellite's orientation accurately, ensuring the success of its Martian meteorological observations.

Application to Martian Meteorological Observations:

- Point its sensors and instruments accurately at the Martian surface or atmosphere.
- Maintain stable orientation for consistent data collection.
- Adjust its position and orientation to optimize measurements based on the satellite's orbit and mission phase.

5.17 Arena Sketch

1. Control and Monitoring Station:
- Central location for operators to control the CANSAT.
- Monitor data and track the satellite's performance.
- Equipped with computers with telemetry software.
- Communication equipment.
- Real-time data analysis tools.
- Display monitors.
2. Landing Platform:
- Designated area for take-off and landing of the CANSAT prototype.
- Flat surface with marked boundaries.
- Equipped with sensors to capture take-off and landing accuracy.
3. Terrain Features:
- Simulated Martian surface with varied terrain.
- Rocks, dunes, slopes, and uneven surfaces to mimic Martian topography.
4. Atmospheric Simulation Zone:
- Simulated atmospheric conditions.
- Wind machines to simulate wind conditions.
- Dust generators to mimic Martian dust storms.
- Heating/cooling elements to create temperature variations.

5.18 Testing Protocols

1. Pre-Flight Checks:
- Verification of the operability of all systems will be done.
- Appropriate sensor calibration will be checked.
- Communication links must be properly established.
2. Take-off and Landing Tests:
- Evaluation of the CANSAT's ability to take off accurately.
- Assessment of landing accuracy on the designated platform.
3. Navigation and Stability Tests:
- Testing of CANSAT's performance in navigating varied terrain.
- Assessing stability during movement.
4. Data Collection and Transmission:
- Sensor tests in different atmospheric conditions will be carried out.
- Accuracy of data collection and transmission will be observed.

6. Contact for Further Queries

If you have any further queries or require clarification regarding the AVALOKAN 2024 @GrahGaami, please feel free to reach out to the organizers using the following contact information:

Email: - cuacindia@gmail.com

Phone: -9820023642

We encourage you to visit the competition website regularly for updates, frequently asked questions, and any additional information regarding the challenge.