NIRDESHAN - GRAHGAAMI

Path Following Robot Competiton 2024

Contents

PATH FOLLOWING ROBOT COMPETITION 2024

1. Preamble

Welcome to the **NIRDESHAN**, a path-following robot competition, organized by Chandigarh University Astronomy Club. This event is designed to challenge and inspire the brightest minds in robotics, artificial intelligence, and engineering. This competition offers a unique platform for students to apply their theoretical knowledge to practical, real-world problems in robotics and autonomous systems. Participants will have the opportunity to design, develop, and deploy innovative robots that can navigate complex paths, enhance their problem-solving skills, and engage in interdisciplinary collaboration to push the boundaries of robotics and automation.

2. Problem Statement

Design a robot that can autonomously follow a complex path, avoiding obstacles and adapting to changes. Utilize sensors and algorithms to detect and navigate the path efficiently. Complete the path in the shortest time possible while maintaining accuracy. The robot must demonstrate precision, speed, and innovative design.

3. General Information

3.1 Introduction to NIRDESHAN Competition 2024

The **NIRDESHAN** Competition 2024, themed "Smart Navigation Challenge," aims to inspire students to design, build, and innovate autonomous robots that can efficiently navigate the rugged and unforgiving Martian terrain. The competition provides a platform for students to apply their engineering and problem-solving skills in a simulated extraterrestrial environment, mimicking the challenges faced in planetary exploration and robotic space missions. By participating in **NIRDESHAN**, students will demonstrate their ability to think creatively, work collaboratively, and develop innovative solutions to real-world problems.

3.2 Objectives of the challenge

- Develop an autonomous path-following robot that can detect and follow predetermined paths marked by visual or magnetic lines on the floor.

- Design a robot that can adapt to changing environments and varying temperatures and humidity.
- Create a robot that can utilize robust algorithms to manage path deviations and obstacles.
- Enhance the efficiency and autonomy of industrial and service robotics.
- Reduce reliance on human intervention.
- Enable more extensive automation.

3.3 Outcome of Student Community

Participants will gain hands-on experience in robot design and development. They will enhance their understanding of robotics and automation. This competition will boost their career development in robotics and related industries. Students will develop essential skills in problem-solving, critical thinking, and collaboration. They will become more attractive to potential employers in the robotics industry.

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 Awards and Recognitions

– First Prize: - 20,000/-
– Second Prize: - 15,000/-
– Third Prize: - 10,000/-

3.7 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.

3.8 Contact Information

Website Address: https://cuac.in/
Email Address for team communication: cuacindia@gmail.com

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.
- Multiple teams shall participate in the event from a single 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

#	PATH FOLLOWING ROBOT	
1.	Maximum Weight	5kg.
2.	End to End Dimension (Rover Alone) Length X Breadth X Height	<200mm x 200mm x 200mm.
3.	Propulsion	1. Electric motors only. 2. Maximum of 4 wheels.
4.	Control system	1. Autonomous movement capability required 2. Sensors and algorithms enabled
5.	Power source	1. Battery operated only 2. Maximum Voltage: 16.8 V
6.	Communication	Wireless communication allowed
7.	Movement Capabilities	1. Minimum speed: 0.3m/s 2. Maximum speed: 10m/s
8.	Safety Features	Emergency Stop protocol

6. Task Requirements

Navigation and Path Detection:

Sensors:

- Camera Systems: High-resolution, wide-angle cameras for visual line detection.
- Magnetic Sensors: To detect magnetic lines in case of low visibility due to dust storms.
- LIDAR/RADAR: For obstacle detection and terrain mapping.

Algorithms:

- Line Following Algorithm: Advanced image processing and machine learning techniques to accurately follow lines.
- Path Prediction: Algorithms to predict and adapt to changes in the path.
- Obstacle Avoidance: Real-time decision-making algorithms to navigate around obstacles.

Robustness and Durability:

Material:

- Construction: Durable, lightweight materials resistant to extreme temperatures (-120°C to 20°C) and Martian dust.
- Dust-Proofing: Sealed components to prevent dust ingress.

Temperature Control:

- Insulation: Thermal insulation to maintain operational temperatures.
- Heaters/Coolers: Active thermal management systems to regulate internal temperature.

Mobility:

Locomotion System:

- Wheels/Tracks: All-terrain wheels or tracks designed for traction on rocky and sandy surfaces.
- Suspension: Adaptive suspension system to handle uneven terrain.

Drive Motors:

- Brushless DC Motors: Efficient and durable motors with high torque capabilities.

Speed Control:

- Variable Speed: Adjustable speed control for manoeuvring in different terrains.

Power Supply:

Energy Sources:

- Solar Panels: High-efficiency solar panels for energy harvesting.
- Batteries: Rechargeable batteries with high energy density and temperature resilience.

Energy Management:

- Power Management System: Smart energy management to optimize power usage and storage.

Autonomy and Control:

Autonomous Systems:

- AI and Machine Learning: For decision-making, path planning, and adaptation to new environments.
- Redundancy: Multiple layers of decision-making to ensure reliability.

Communication:

- Communication Modules: High-gain antennas for communication with Earth.
- Data Handling: Efficient data storage and transmission systems.

Scientific Instruments:

Data Collection:

- Sensors for Environment Monitoring: Temperature, humidity, radiation sensors.
- Sample Collection Tools: Robotic arms or drills for soil and rock samples.

Analysis Equipment:

- Miniature Labs: Onboard laboratories for initial analysis of collected samples.

Software and Firmware:

Operating System:

- Real-Time OS: For reliable and time-critical operations.

Control Software:

- Navigation Software: For autonomous path following and obstacle avoidance.
- Diagnostic Software: For system health monitoring and diagnostics.

Mechanical Design:

Structure:

- Compact and Modular Design: Easy assembly, maintenance, and upgrades.

- Weight Distribution: Balanced design for stability and efficiency.

7. Contact for Further Queries

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

•Email: - cuacindia@gmail.com
•Phone: - 9820023642
•Website: - https://cuac.in/contact-us/

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