UNIVERSITY ROVER CHALLENGE 2024
Team VICHARAKA

Forging history's uncharted path, a groundbreaking project redefines the realm of possibilities at IISc

What is URC

Introduction

The University Rover Challenge (URC) is the world's premier robotics competition for college students. It is held annually in the desert of southern Utah in the United States, whereby student teams are challenged to design and build the next generation of Mars rovers that will one day work alongside astronauts exploring the Red Planet.

Why do we wish to participate

- **Interdisciplinary Collaboration :** The URC demands collaboration across various engineering disciplines, including mechanical, electrical, software and even scientific disciplines such as biology, chemistry and earth-science. This project will foster teamwork and communication among the students from different streams, enriching our learning experience.

- **Problem-Solving and Innovation :** The rover challenge presents complex problems that require innovative solutions. By participating, we will be encouraged to think outside the box and develop creative solutions to overcome challenges, enhancing our problem-solving abilities.

- **Visibility and Reputation :** Winning or performing well in such a prominent international competition can significantly boost the reputation of the B.Tech program at IISc. It will also bring positive attention to the university, showcasing its commitment to cutting-edge education.

- **Hands-On Learning Experience :** The URC provides an exceptional hands-on learning experience for the students. By designing, building, and testing a rover for this challenge, we will gain practical knowledge and skills that are highly valuable in our academic and professional careers.

- **Networking and Exposure :** The URC is attended by leading experts, researchers, and professionals from the space and robotics industries. Participating in the event will give us the opportunity to network with these experts and potentially open doors for future research collaborations or job opportunities.

- **Inspiration for Future Batches :** By participating in the URC, the current B.Tech batch can become an inspiration for future batches at IISc. Our success can motivate upcoming students to take on challenges and push the boundaries of what they can achieve.

- **Building a Strong Robotics Culture :** Engaging in the URC will foster a strong robotics culture within the B.Tech program at IISc. It will encourage more students to take an interest in robotics and robotics-related research, creating a positive impact on the university's academic ecosystem.

- **Promoting Technological Advancement :** The URC emphasizes technological advancement and innovation. By participating, IISc will contribute to the advancement of robotics and space exploration technology, showcasing its commitment to progress and cutting-edge research.

- **Supporting Student Ambitions :** As the first B.Tech batch to participate, funding from the university will demonstrate the institution's support for the students' aspirations and willingness to invest in their growth and development.

- **Opportunity for Pioneering :** Participating in the URC would be a pioneering opportunity for the new B.Tech batch at IISc. It allows them to make their mark and build a legacy as the first-ever IISc team to compete in this prestigious global event.

What do we seek funding for

Major Components which would require extensive finance include :

- **Components for the Rover :** This includes the essential hardware components that form the rover's structure, chassis, wheels, suspension, motors, and other mechanical parts. (The cost here may vary depending on the design and complexity of the rover)

- **Rover Modules:** These refer to specialized modules and instruments that fulfill specific functions of the rover, such as scientific instruments for data collection, cameras for navigation and imaging, sensors for terrain analysis, and manipulator arms for tasks like sample collection.

- **Rover Power Sources :** This includes batteries, solar panels, or any other innovative power generation methods required to sustain the rover's operation throughout the challenge.

- **Rover Communications Equipment :** This encompasses the communication systems necessary for the rover to send and receive commands from the base station. It includes radios, antennas,transceiver, cables and other related equipment.
- **Base Station Equipment :** The base station serves as the control center for the rover, and the budget must include the cost of setting up this station. This includes computers, monitors, controllers, and any other necessary hardware for data analysis and command transmission.
- **Command and Control Equipment:** This category covers all the peripherals required for commanding and controlling the rover. It includes input devices, user interfaces, and software tools that the team will use to operate the rover during the challenge.

Additional expenses involve :

- **Visa and Travel Documentation :** Since URC is held in USA, we require visas to enter and participate and hence the costs associated with visa applications and travel documentation.

- **Promotion and Outreach :** To create awareness about the team and its endeavors, funds would be required for promotional materials, websites, social media campaigns, and other outreach activities.

- **Educational and Outreach Programs :** Involving local schools or educational institutions in the project will necessitate funding for organizing workshops, demonstrations, and educational programs to inspire future scientists and engineers.

- **Contingency Funds :** It would be crucial to have a contingency budget in case of unexpected expenses or cost overruns during the project.

- **Testing and Prototyping :** Before the actual competition, we would need to design, build, and test our rover prototypes. This phase would require purchasing materials, components, and equipment for testing, and funding is essential for these pre-competition preparations.

- **Documentation and Reporting :** Keeping track of the project's progress and documenting the development process is essential. Funding would be necessary for cameras, software, and materials to create presentations, reports, and videos.

- **Safety Measures and Insurance :** Ensuring the safety of team members and the rover during the development and testing phase is crucial. Funding might be needed for safety equipment, training, and insurance coverage.

What do we have to do

Our rover would embark on its journey to accomplish the following decisions:

- **Extreme Retrieval and Delivery :** Rovers are tasked with retrieving specific objects from challenging locations, such as hills, craters, or caves, and delivering them to specified drop-off zones. This mission tests the rover's mobility and dexterity.

- **Autonomous Navigation Mission and Traversal :** Rovers often need to navigate autonomously through a predefined terrain, avoiding obstacles and reaching designated waypoints. This task assesses the rover's autonomy and navigation capabilities.

- **Life Detection and Science Cache Retrieval :** Rovers must locate and collect designated "samples" (usually markers or objects) from the competition site and return them to a designated drop-off location. This task simulates the rover's ability to collect and store samples for further analysis. The rover must have a life detection capability instrument or assay of the team's choosing.

- **Equipment Servicing :** The rover would be required to inspect and manipulate various "equipment" (typically predefined objects) and perform simulated maintenance tasks.
- **Terrain Analysis and Mapping :** The rover may need to map the terrain and identify specific features or objects of interest, demonstrating its remote sensing and mapping capabilities.
- **Communication Relay :** Rovers might be required to act as communication relays between a base station and a distant point, testing their ability to establish and maintain communication links.
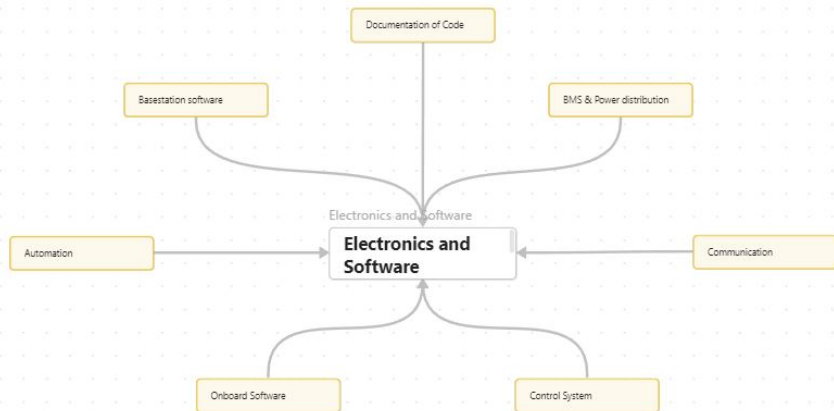
Compostion

We have the following primary submodules

- Electrical and Software Subsystem
- Mechanical Subsystem
- Life-Detection and Bioscience Module
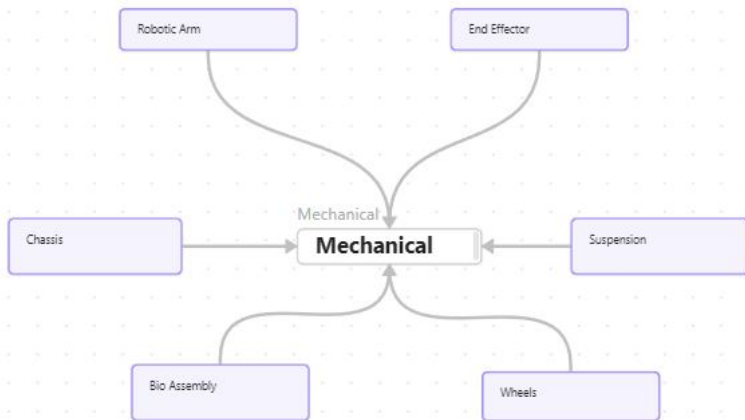- Design and Logistics Module

Associated tasks for each module and subsystem will be explained in the further slides
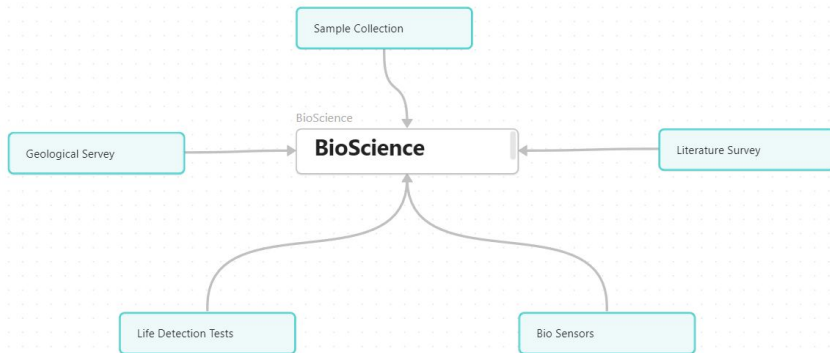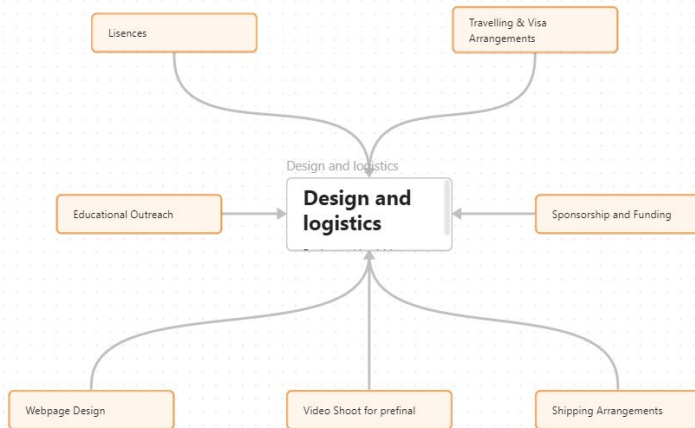
Electronics and Software Subsystem

Mechanical Subsystem

Life-Detection and Bioscience Subsystem

Sample Collection

BioScience

BioScience

Geological Servey

Literature Survey

Life Detection Tests

Bio Sensors

Design and Logistics Module

Looking Forward

We have two broad ways of going forward:

- **Future Competitions :** Successful completion and realization of this competition in the scheduled time frame would help us to trigger off a legacy of various international competitions such as Intelligent Ground Vehicle Competition (IGVC), International Autonomous Underwater Vehicle Competition (IAUVC), International Aerial Robotics Competition (IARC) ... to name a few as well as laying foundations and establishing reputation for our newly laid down Robottics CLub. We would be formidable opponents combined the skilled-expertise as well as the mind-bending R and D of IISc.

- **Industry :** We intent to scale this model up and revolutionize it with the latest deep tech whereby it would have potential market value.

Tentative Deadlines

- **Registration :** Deadline: Wednesday, October 26, 2022 No significant deliverables required, only team details via URC website.
- **Preliminary Design Review (PDR) :** Deadline: Friday, December 2, 2022 Focus on team structure, resources, and project management including Gantt chart, initial budget, fund-raising plans, recruiting, and outreach and technical details on rover's design, development, and prototyping.
- **System Acceptance Review (SAR) :** Deadline: Friday, March 3, 2023 Demonstrate rover's capabilities and customization for each mission ,submission of written and video components. (Competitive milestone, judged against other teams. Top 36 teams with the highest scores invited to compete in the field.)
- **Field Competition :** May 31 – June 3, 2023 Location: Mars Society's Mars Desert Research Station (MDRS) near Hanksville, Utah, USA