Report on Report on the Project: Project Rover

Project Title:

Project Rover

Team Members:

- **Happy Verma** and Team

Guide:

- **Jai Kumar**, Assistant Professor, Department of Mechanical Engineering

Introduction:

The **"Project Rover"** is a robotic system developed to provide economical and efficient remote sensing, experimentation, and off-terrain exploration capabilities. Inspired by NASA's Mars rover, this robot is designed as a minimum viable prototype capable of traversing rough terrains and hard-to-reach areas, such as dense forests. While it is not designed for space exploration, its modular design allows for potential upgrades, making it suitable for various applications, including military-based surveillance. The robot is controlled remotely via a smartphone app using Bluetooth technology, with the possibility of satellite control through further upgrades.

Objective:

The primary objective of the project was to design an affordable and capable rover that can assist in remote exploration and surveillance. The rover was intended to perform tasks such as remote sensing, data collection, and military surveillance in terrains that are difficult for humans to access. The project aimed to create a versatile robot that could be controlled remotely while being durable enough to withstand harsh conditions.

Features and Working:

- **Communication**: The robot uses Bluetooth technology for communication, allowing for easy and low-cost remote control through a smartphone app.
- **Terrain Navigation**: Inspired by the Mars rover, this robot is capable of traversing rough and challenging terrains such as rocky surfaces and dense forests.
- **Modular Design**: The rover's design offers flexibility for future upgrades. With minor modifications, it can be made suitable for more advanced uses, including satellite-controlled operations.
- **Applications**: The robot's primary application is in military surveillance, where it can aid in reconnaissance and mission planning. It can be further adapted for other remote exploration tasks depending on the requirements.

Methodology:

1. **Design & Prototyping**: The team designed a robust rover that can withstand off-terrain conditions. The design was kept modular to allow for future upgrades.
2. **Communication & Control**: Bluetooth communication was implemented to control the rover through a smartphone app, providing a simple and economical remote control option.
3. **Testing**: The rover was tested on rough terrains and simulated environments to evaluate its performance and stability.

Results:

The **Project Rover** successfully demonstrated its ability to traverse rough terrains and perform remote tasks such as surveillance. The prototype was affordable and functional, allowing for military applications and possible extensions to other fields. The rover's modular design proved to be adaptable for future enhancements.

Conclusion:

Project Rover met its goal of being an economically viable, off-terrain robot capable of remote sensing and experimentation. Its flexibility and adaptability provide a solid foundation for future upgrades, potentially expanding its applications beyond military surveillance into areas such as environmental monitoring, disaster relief, and remote scientific experiments.

Learning Outcomes (Based on Bloom's Taxonomy) and CO-PO Mapping

1. Knowledge (Remembering) – CO1, PO1

- The team gained foundational knowledge about robotic systems, Bluetooth technology, and off-terrain navigation. This knowledge was applied in designing and controlling the rover.

Example Outcome: Students recalled key concepts in mechanical design and communication technology and applied them to build a functional prototype.

2. Comprehension (Understanding) – CO2, PO2

- The team demonstrated an understanding of remote sensing technologies and the need for durable designs in rough terrains. They understood how to integrate control systems and mechanical components.

Example Outcome: The team was able to explain how Bluetooth communication controls the rover and how its modular design allows for adaptability in harsh environments.

3. Application (Applying) – CO3, PO3

- The students applied their theoretical knowledge to build a working prototype of the rover. They successfully implemented Bluetooth technology for communication and designed the mechanical structure to withstand off-terrain conditions.

Example Outcome: A functional prototype was created that could be controlled remotely through a smartphone app, effectively navigating rough surfaces.

4. Analysis (Analyzing) – CO4, PO4

- The team analyzed the interaction between the rover's mechanical components and the communication systems. They identified challenges in maintaining stable control in difficult terrains and addressed these through their design.

Example Outcome: The students analyzed the performance of the rover on various surfaces and made necessary design improvements to enhance its stability and control.

5. Synthesis (Creating) – CO5, PO5

- The team synthesized their knowledge to create a modular rover that allows for future upgrades. The design was flexible enough to accommodate potential modifications, such as satellite-based control.

Example Outcome: The team successfully created a rover that not only performs well in its current form but can also be upgraded for more advanced applications, such as long-range surveillance.

6. Evaluation (Evaluating) – CO6, PO6

- The team evaluated the rover's performance in real-world conditions, including rough terrain and military surveillance scenarios. They assessed the cost-effectiveness of the design and justified the use of Bluetooth technology for communication.

Example Outcome: The rover was tested in different terrains, and the team concluded that it met the project's objectives, with the possibility for further enhancements at a manageable cost.

Mapping with Course Outcomes (COs) and Program Outcomes (POs):

1. **CO1**: Apply knowledge of mechanical engineering and control systems in the design of the robot.
   - **PO1**: Engineering Knowledge.

2. **CO2**: Demonstrate understanding of remote communication technologies and their application in robotic systems.
    - **PO2**: Problem Analysis.
3. **CO3**: Apply theoretical concepts to create a functional prototype of the robot.
    - **PO3**: Design/Development of Solutions.
4. **CO4**: Analyze the interaction between mechanical components and communication systems to optimize performance.
    - **PO4**: Investigation.
5. **CO5**: Develop a modular robotic design that allows for flexibility and future upgrades.
    - **PO5**: Modern Tool Usage.
6. **CO6**: Evaluate the performance and cost-effectiveness of the designed robot.
    - **PO6**: Engineering Practices.