MULTIFUNCTIONAL ROVER

Project Reference No.: *47S_BE_4734*

College *: R.N.S. Institute of Technology, Bengaluru*
Branch ***:*** *Department of Electronics and Instrumentation Engineering*
Guide(s) ***:*** *Mr. G. N. Srikanth*
Student(S) ***:*** *Ms. Anushree P.*
Ms. Supriya R.
Ms. Chitra R. Kale
Ms. Prakruthi M. P.

Keywords:

Flight Rovers, Digital Humidity and Temperature sensors (DHT), Electro Selective Pattern (ESP) camera, pick and place robot.

Introduction:

Multifunctional rovers, equipped with two-arm, wheel-based designs and a suspension system, navigate diverse terrains for scientific exploration. The HC-05 Bluetooth module facilitates wireless communication with external devices, crucial for remote control and data transfer, especially in areas which are inaccessible to humans. The Arm Robot App allows intuitive remote operation, enabling users to control movements and manipulate arms wirelessly, enhancing versatility in exploration tasks. Integrated DHT11 sensors provide essential environmental data, measuring temperature and humidity for insightful analysis of the rover's surroundings. The ESP-32 camera, coupled with the microcontroller, captures real-time images and video, facilitating surveillance and detailed terrain analysis during planetary or terrestrial missions. This visual data, transmitted wirelessly, aids operators in making informed decisions based on the rover's observations. Additionally, photoresistors and LED lights enhance navigation and visibility in diverse environmental conditions, ensuring the rover's effectiveness. Additionally, pick and place robots enhance the rover's capacity for scientific research and data collection by automating object manipulation, thereby strengthening its capabilities even further. These features collectively empower the rover for comprehensive exploration and analysis, advancing our understanding of various environments and phenomena.

Objectives:

- Design and develop a multifunctional rover equipped with integrated sensors for humidity and temperature monitoring.
- Develop a user-friendly mobile app enabling Bluetooth control for rover movement.
- Incorporate a robust live video surveillance system for real-time monitoring.
- Ensure seamless data transmission between sensors and the rover's control interface.

- Enhance rover adaptability for diverse terrains and operational conditions.
- Integration of pick and place robot attachment.

Methodology:

- The block diagram in Figure.1. illustrates the multifunctional rover's signal processing flow, emphasizing the pivotal role of the Arduino Uno as the central processing unit. Acting as the brain of the rover, the Arduino Uno orchestrates the coordination of input and output signals from various sensors and modules to ensure seamless operation.
- The HC-05 Bluetooth module serves as a crucial component for wireless communication, enabling remote control and data transfer between the rover and external devices.
- Environmental data acquisition is facilitated by integrated DHT sensors, such as the DHT11 models, which provide essential temperature and humidity readings. These sensors play a critical role in understanding the rover's surroundings during exploration missions, offering valuable insights into environmental conditions.
- The ESP-32 camera captures real-time visual perspectives, enabling surveillance, and detailed terrain analysis. This visual data, combined with information from other sensors, enhances the rover's situational awareness and decision-making capabilities during exploration tasks.
- Photoresistors and LED lights are integrated into the rover's design to enhance navigation and visibility in various environmental conditions
- Furthermore, the pick and place robots automate object manipulation tasks, allowing the rover to handle objects with precision and efficiency
- The Rover works on the principle of Rocker Bogie mechanism that utilizes a rocking forward leg and pivoting rearward leg, allowing the rover to traverse obstacles twice its wheel diameter while maintaining stability, with a maximum tilt resistance of 45 degrees.

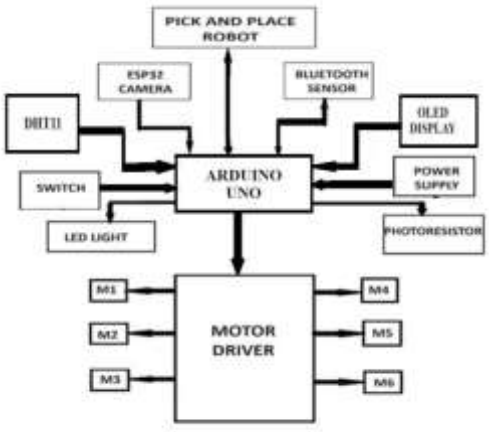

Figure.1. Block diagram of Multifunctional rover

Conclusion:

The multifunctional rover, incorporating Bluetooth, a DHT11 sensor, an ESP camera, and a pick-and-place robotic arm, represents a leap in technological advancement. Weighing between 6 to 7 kilograms, the rover's design ensures that its DC motor can handle this weight safely. Its construction is straightforward, making it an easily accessible device. It operates efficiently, minimizing energy consumption and reducing the need for expensive fuels and batteries for household applications. The rover is good at navigating rough terrain. The design showcases the functionality of the rocker bogie system across various surfaces, with torque adjustments based on weight distribution. It boasts the capability to ascend angles of up to 45 degrees. The robotic arm, equipped with a gripper, can lift lightweight objects and relocate them as needed. Utilizing DHT11 sensors, the rover gauges humidity and temperature in its surroundings. The ESP32 camera module streams live video, enhancing its observational capabilities. Additionally, a photoresistor senses the presence of light in the ambiance of the rover which aids in navigation and live video surveillance by activating LED lights when necessary.

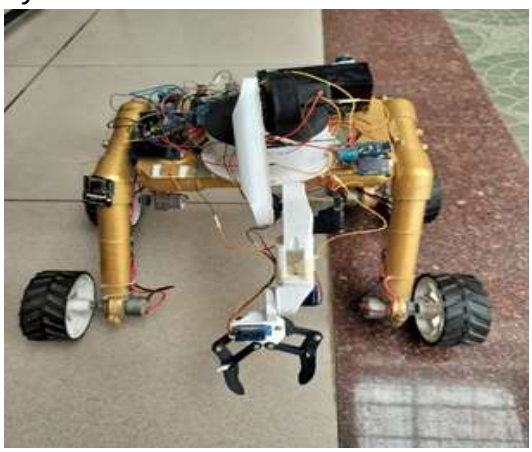

Figure.2 . Motion of Robot in Terrain Figure.3. Pick and Place Mechanism

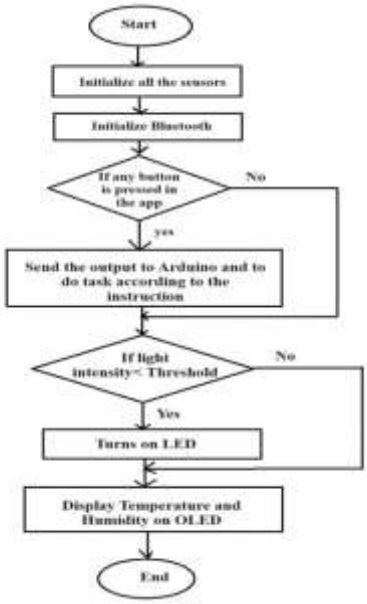

Figure 4.6 Flowchart of working model

Scope for future work:

- **Voice Detection**: Implementing voice command functionality for seamless rover control, enhancing user interaction and ease of operation.
- **Sample Collector**: Autonomous soil, rock, or material collection for analysis, aiding in scientific study and exploration.
- **Geo-tagging**: Integration of geo-tags for precise location tracking and navigation, ensuring accurate mapping of exploration paths.
- **Obstacle Detection**: Crucial obstacle detection systems equipped with a variety of sensors, ensuring safe traversal through challenging terrain.
- **Object Recognition**: Utilizing advanced object recognition technology, enabling the rover to identify and analyze predetermined objects, providing valuable data to the central station.
- **Path Planning**: Advanced path planning algorithms to optimize rover routes, maximizing efficiency and reducing navigation time.
- **Autonomous Navigation**: Implementing autonomous navigation capabilities, allowing the rover to navigate predetermined routes independently.