

Multi-Function Rover Based on Rocker-Bogie Mechanism

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Abstract - Rovers were initially designed for space exploration. They can move across planet surfaces (other than earth) to find out information and to take samples. They can collect dust, rocks, and even take pictures. Rover stands for remotely operated video enhanced receiver. Rover is next generation of Bluetooth, infrared & cellular services. Rover technology can be ranging from power full laptop to simple cellular phones. The technology which enables the scalable location aware computing. This involves automation availability of information & services based on current location of user. But we have taken this technology to be used on earth.

Key Words: Mars Rover, Rocker Bogie Mechanism, Rover Technology, Six wheel robot

1. INTRODUCTION

A rover or sometimes planetary rover is a space exploration vehicle designed to move across the surface of a planet or other celestial body. Some rovers have been designed to transport members of a human spaceflight crew; others have been partially or fully autonomous robots. Rovers usually arrive at the planetary surface on a lander-style spacecraft. Rovers are created to land on another planet, besides Earth, to find out information and to take samples. They can collect dust, rocks, and even take pictures. They are very useful for exploring the universe.

Rovers have several advantages over stationary landers: they examine more territory and they can be directed to interesting features. If they are solar powered, they can place themselves in sunny positions to weather winter months. They can also advance the knowledge of how to perform very remote robotic vehicle control which is necessarily semi-autonomous due to the finite speed of light.

1.1 OBJECTIVES

- To obtain the desired "Crawling movement" of the rover to demonstrate its motion over various surfaces and obstacles.

- To understand how different networks are used to control the robotic Rover and its functioning with other electronic and electrical components.
- To provide new and better mode of patrolling, recon, rescue and spying operations.

2. LITERATURE REVIEW

- **K. Yoshida. et.al**, In this paper the author has investigated kinetic behavior of a planetary rover with attention to tire-soil traction mechanics and articulated body dynamics, and thereby study the control when the rover travels over natural rough terrain. The relationship of load-traction factor versus the slip ratio is modeled theoretically then verified by experiments. Simulations are carried out to be compared with the corresponding experimental data and verified to represent the physical behavior of a rover.
- **Ashish U. Bokade. et.al**, In this paper proposed a method for controlling a wireless robot for surveillance using an application built on Android platform. The Android has a video screen for surveillance and buttons to control robot and camera. Android Smartphone and Raspberry pi board is connected to Wi-Fi. An Android Smartphone sends a wireless command which is received by Raspberry pi board and accordingly robot move. The Raspberry pi programming is done in python language.

3. MAIN COMPONENTS

3.1 Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Six motors are used which are each connected to six tires of rover.



Fig -3.1 DC Motor

3.2 Arduino

Arduino is a computer designed specifically for controlling hardware which in this rover is used for controlling the motors. Arduino consists of both a physical programmable circuit board, a piece of software, or IDE (Integrated Development Environment) that runs on a computer and which is used to write and upload computer code to the physical board.



Fig -3.2 Arduino

3.3 Frame

Frame of the rover consist of rocker and bogie, which are connected to a body. The links of rocker and bogie are made up of PVC pipes. The bogie can freely swivel around its joint and additional movement is provided by rocker. Two sets of rocker and bogie are used which are then supported at the top by a body in between them. The body is made up of sheet metal and provide necessary strength to links of rocker and bogie.

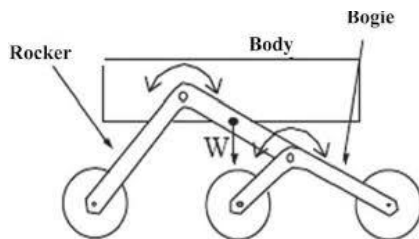


Fig -3.3 Rover Frame

3.4 Tires

Tire are used to support the rover load, transmit traction and provide braking forces to the road surface, absorb road shocks, and help in changing and maintaining the direction of travel. The tires are made of plastic with rubber gripping at the surface to provide traction. Six tires are used in the rover and connected at the end of six links of rocker and bogie.



Fig -3.4 Rover wheel

3.5 Battery

A lithium-ion battery or Li-ion battery is a type of rechargeable battery. They have high energy density, tiny memory effect and low self-discharge. It is used to provide electric power for hardware and also to drive the motors.



Fig -3.5 Battery

3.6 Camera

The live video stream is provided by the Pi's camera module. The camera server is a program that allows clients to connect, and continuously captures frames from the camera, sending them as a stream of JPEG encoded images to the connected device.



Fig -3.6 Camera module attached to Raspberry Pi

4. WORKING

Rocker-Bogie mechanism is responsible for movement in rover. The six wheels mounted on rocker-bogie suspension system ensure that wheels remains on the ground while driving over rough terrain and allows the rover to go over obstacles. Each wheel has its own motor. The vehicle turns in its place making a full revolution, and

to swerve and curve, making arching turns. The rover is designed to withstand a tilt of 45 degrees in any direction without overturning. The rover is wireless controlled and the signal is provided from a Smartphone which is linked to Arduino via software.

5. APPLICATIONS

- **Suspicious package handling:** Designed to enhance airport security by quickly removing suspicious luggage and packages from baggage handling areas, in public places.
- **Commercial mining operations:** Equipped with a camera system, it can perform 3d underground mapping and also useful in post-blast inspections and unstable or dangerous mining areas.
- **Safe agriculture:** The spraying of pesticides which is harmful to workers can be replaced by rovers.

6. CONCLUSION

With increasing advancements in Rover technologies for extraterrestrial exploration, this robotic technology can also be seen as a potential application on earth. Its real time video surveillance and feedback feature helps in detecting various threats in places where human reach is not possible. It can also be used in military and defense field because of its compact design. Rovers in near future may replace the need of human requirement for recon, surveying, threat handling and so on. There is unlimited potential in this technology to be used in various applications.

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