Planetary Rover With Multiaxial Solar Tracking System

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Abstract- *MThis project is aimed at developing efficient power equipment for the effective utilization of solar power source available in the natural environment and able to move over different terrains. This is an integrated robotic application that can be accessed through remote sensing; this system can be used to automate the workflow of service requests for the various facilities based on the application. This is one integrated system that covers different kinds of facilities like cruise over different terrains, solar tracker and stair climber etc,. This allows users to operate the rover at different sites and explore its surface without human interaction.*

Since solar power source is very economical and renewable it is used widely. But most of the rovers have fixed face solar panels (uni-direction panels). Our design here uses special equipment called 'solar tracker'. Using solar tracking device we can improve the power grasping capacity of the rover. A solar tracking system adjusts the face of the solar panel or reflective surfaces to align with the sun as it moves across the sky.

Hence making the rover more efficient.

Keywords- Multiaxial solar panel,Energy capacity,Rover

I. INTRODUCTION

A rover is a planetary surface exploration device. Designed to move on and across the solid surface of a planet and other celestial bodies using solar or nuclear power systems. There are many designs based on the specific application, some are manually operated, while some are autonomous. NASA recently started an ambitious exploration program of Mars. Pathfinder is the first over explorer in this program. Future rovers will need to travel several kilometres over periods of months and manipulate rock and soil samples. The term "rocker" describes the rocking aspect of the larger links present each side of the suspension system and balance the bogie as these rockers are connected to each other and the vehicle chassis through a modified differential. In the system, "bogie" refers to the conjoining links that have a drive wheel attached at each end. Bogies were commonly used to bare loading as tracks of army tanks as idlers distributing the load over the terrain. Bogies were also quite commonly used on the trailers of semitrailer trucks as that very time the trucks will have to carry much heavier load. Figure shows Rocker Bogie Mechanism As accordance with the motion to maintain centre of gravity of entire vehicle, when one rocker moves upward, the other goes down. The chassis plays vital role to maintain the average pitch angle of both rockers by allowing both rockers to move as per the situation. The physics of these rovers is quite complex. To design and control these analytical models of how the rover interacts with its environment are essential. Models are also needed for rover action planning. Simple mobility analysis of rocker-bogie vehicles have been developed and used for design evaluation in the available published works.

II. OBJECTIVE

- The main objective of the project is to design the prototype and it is as follow:
- Propose a design of rover that will increase the mobility and functionality in cruising over different terrains.
- Increase in power grasping capacity of the solar panel.
- Increase the efficiency of the rover and prolonged work life.
- Make use of modern technology to solve modern day problems.
- Making the total prototype as cost effective and as less expensive as possible.
- Forming of a robotic structure that would support multiple applications in fields like surface exploration, security system, agricultural equipment etc.
- Implementation of artificial intelligence and much more

III. SYSTEM ANALYSIS

System analysis and design are the application **of** the system approach to problem solving generally using computers. To reconstruct a system the analyst must consider its elements output and

EXISTING SYSTEM

In the current system there is no common service running in order to handle the vehicle (rover) with a moveable (multi axis rotation) solar tracker implemented on it. Whereas most of the rovers come with a fixed plate solar panel.

It doesn't have much efficiency compared to 'rover with a solar tracking system. Also there are many limitations for a fixed plate solar panel, like lack of rotation, efficiency only at an instant angle, lack of degree of freedom etc.

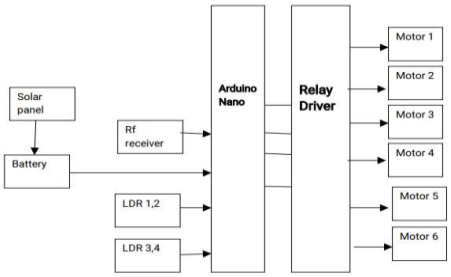
The rover has to travel across the surface to complete the given tasks within the given time, irrespective of the work direction. Where the fixed plate rover may fail, as its efficient work point is fixed.

This system lacks in maintaining an efficient system of power generation, degree of freedom and has limited work points**.**

PROPOSED SYSTEM

Proposed system has several objectives that overcome the problems in existing system. Proposed system includes an effective tracking system to enhance power generation issues. Tracking system movements are independent over the rover movements, hence power will be generated irrespective of the rover direction.

IV. DESIGN

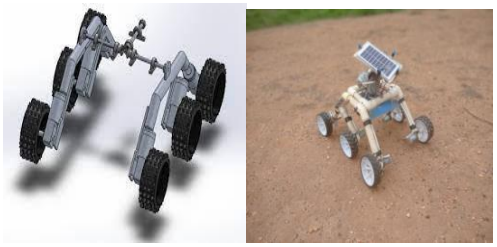


The energy generated by the solar panel has been stored in the reserve battery. The rover movements are controlled by the Rf receiver connected through an arduino module and relay driver which handles the motors. In the time the rover works by the power developed in the solar panel, also there is a reserve battery for saving power to work in the absence of the sun.

Arduino being the heart of the system it controls most of the activities in the systinputs, processors, controls feedback and environment.**em. In the solar tracking** system the movement of the solar panel towards the sun is done by actuating particular servo motors. Where the LDR's help the arduino to position the solar panel perpendicular to the sun rays. In this phase the reserve power is used. Here there is no interference of the rf circuit, the way the solar tracking system works independently. Even if the rover is at partial rest or at working condition the tracking system keeps working on its own. Under the pre-set instructions by the user in arduino memory.

Rover is driven by the six motors provided with wheels, controlled by the relay driver. This operation is not independent. Because the movements are controlled by the user through the RF transmitter. Say, the movements can be independent if the instructions are pre set by the user. In our design we have opted to control the rover by rf signal. Once the user sends the signal to the rf receiver. The received signal is then processed to relay motor drive, which then actuates the motors to rotate the wheel and required movements are obtained.

This are the architecture and components used to build our system and a glance of working. Idea and component may be updated with the technology. Allowing the developer easily extend its applications. With the new elements encapsulated styling and customize system behavior according to the required application.



V. TESTING

The testing phase is an incredibly important part of product development. Here we have the chance to increase the credibility and performance of the project (product). The main aim of the testing phase is that it provides a clear picture of the capabilities of the project in each and every aspect. Such as mechanical, electrical, functionality and performance of the rover, over different terrains. However with the product testing a clear image of the product performance is provided. So as the project (rover) runs smoothly according to the application, it gets certified for its capabilities.

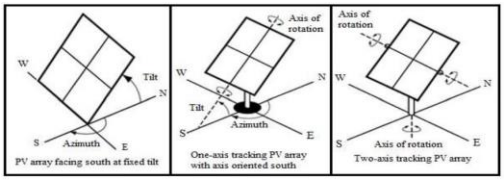
Functionality testing

As per the ground level experimentation by rocker bogie manufactured; tested found that the performance satisfactory below are the results are shown see fig. on different obstacles and different surfaces.

This work shows how the rocker bogie system works on different surfaces. As per the different weight acting on the link determines torque applied on it. By assuming accurate stair dimensions, accurately dimensioned rocker bogie can climb the stairs with great stability. The design and manufactured model can climb the angle up to 45˚. During the stair climbing test for length more than 150 mm (6 inch) the system cannot climb the stair. It can be possible to develop new models of rocker bogie which can climb the stairs having high lengths

VI. CONCLUSION

We have attempted to design and implement a robotic project using automation technology. The main goal of our project was to develop an efficient way of utilising renewable energy to ensure environmental safety and reduce cost of manufacturing. Which is necessary for modern day industry with growing technology and also add a new revolution in aerospace industry for upcoming generations. This project helps engineers to access the basic ideology about working of planetary rover with solar tracking system.In this project we have experimentally explained a technology that shows we can implement solar tracking system can be implemented not only on a stationary surface but can also be implemented on a mobility rover. Also there is a possibility of making the rover completely autonomous with all the upcoming AI (Artificial Intelligence) up gradations. This project is indigenously developed for the study porous. For now it may be a prototype but in future it will be an actual model used for space exploration and more.Although, there are some **risks of using** completely autonomous rover, we hope that these will be eradicated gradually with the growth of this industry. As for now, we can rightfully say that embedded systems and AI are leading us towards a new horizon in the mechanical/automobile revolution as well as in our everyday life.



VII. FUTURE ENHANCEMENT

In this project the system digitalizes the manual operations to be made but it still requires operator concern to operate and manage the rover actions that can be enhanced using RPA (Robotic Process Automation) tools to minimize the operator's work. By implementing RPA tools in our project, it automates the operator's work. And by implementing GPS (Global Positioning System) we can also track down its location and control its actions through remote sensing satellites. By implementing all this rover will be much more efficient to use.

VIII. ACKNOWLEDGMENT

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