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Remote Controlled Rover Using Rocker Bogie Mechanism

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Abstract: ***The rocker-bogie suspension system has robust capabilities to deal with uneven terrain becauseof it's distributing the payload over its six wheels uniformly. Most of the cover designs have been developed for Mars and Moon surface in order to understand the geological history of thesoil and rocks. Exploration operations need high speed and long distance traversal in a short mission period due to environmental effects, climate and communication restrictions In this research, a new suspension mechanism has been designed and its kinematic analysis results were discussed. One of the major shortcomings of current Rocker-Bogie rovers is that they areslow. In our project, we have focused on six-wheeled rocker bogie suspension system design which has advantage of linear bogie motion in protecting the whole system from getting rollovers during high- speed operations. This has greatly increased the reliability of structure on rough terrains and also enables its higher speed exploration with same obstacle height capacity as twice the diameter of wheel. The project aims to improve some basic working so that it can perform in a better way.***

I. INTRODUCTION

The rocker-bogie suspension system was initially used for the Mars Rover and is currently NASA's preferred design for rover wheel suspension. The perfectly designed wheel suspensionallows the vehicle to travel over very uneven or rough terrain and even proceed over obstacles.This rocker suspension is a type of mechanism that allows a six-wheel vehicle to constantly keep all six wheels in contact with a surface when driving on uneven terrain surfaces. The rocker bogie mechanism describes a method of driving a rover so that it can progressively stepover most obstacles rather than impacting and climbing over them. Most of the benefits of thismethod can be achieved without mechanical modification to the same designs – only a changein control structure. Some machine changes are suggested to gather the maximum profit and togreatly increase the effective speed of future rovers. The rocker bogie mechanism is one of themost popular suspension mechanisms, which was initially designed for space travel vehicles having its own deep history embedded in its development.

II. PROBLEM DEFINITION

The Rocker-Bogie Mobility System was designed to be used at slow speeds. It is capable of overcoming obstacles that are on the order of size of a wheel and also use for survilliance. However, when surmounting a sizeable obstacle, the vehicles motion effectively stops whilethe front wheel climbs the obstacle. The rocker-bogie suspension system has robust capabilities to deal with uneven terrain because of its distributing of the payload over its six wheels uniformly, while there is one major shortcoming to high-speed traversal over the planar terrain. Here we aim to overcome the above mentioned issues.

III. LITERATURE SURVEY

1) Para Bimal Saraiya "Design of Rocker Bogie Mechanism" The proposed modification increases in the stability margin and proved with valuable and profitable contrasting the SSFmetric with the 3D model simulations done on AUTOCAD. Study of the existing models of rocker bogie suspension enabled rovers and tried to manufacture a similar kind with the material available.

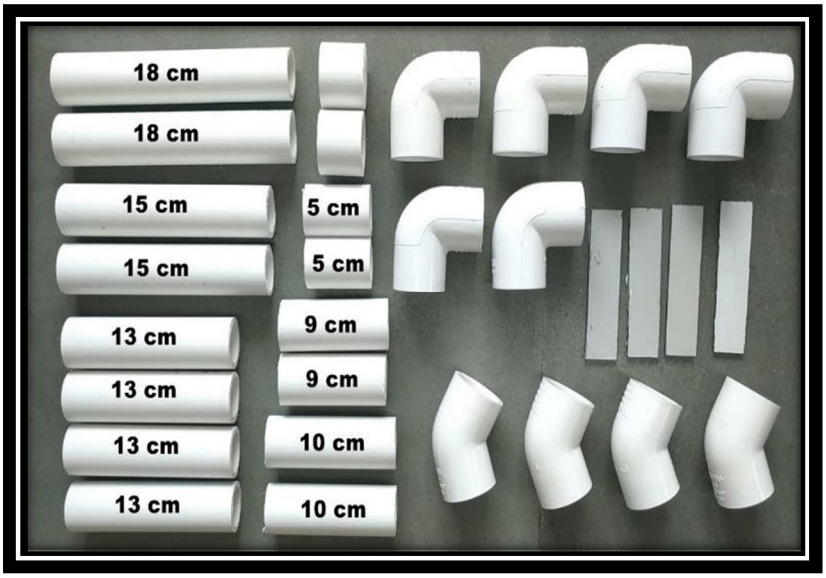
2) Roshan Sharma, Rajesh Jaiswal, Ankit Yadav, Subash Roy "Design and Fabrication of Rocker Bogie Mechanism Automated Combat Rover" The proposed paper presents a special design in seeking after of developing the rocker-bogie portability framework in customary overwhelming stacking vehicle conduct while high-pace traversal is required and to expand the battery effectiveness and working time of the Rover, which become made achievable theuse of the autonomous directional control machine which utilizes least power modules organized upon the working condition and circumstance.

3) Rajat Murambikar, Vinay Omase, Vivek Nayak, Karan Patil, Prof. Yogesh Mahulkar "Design and Fabrication of Rocker Bogie Mechanism using Solar Energy" Infused solar energy generation, sun tracking and design characteristics to create a modern, more updated and less sophisticated version of Rocker Bogie Rover. Tested its abilities and finally reviewed and updated calculations.
4) Abhisek Verma, Chandrajeet, Yadav, Bandana, Singh, Arpit, Gupta, Jaya, Mishra, Abhishek, Saxena "Design of Rocker-Bogie Mechanism". The proposed paper produces a novel design in pursue of increasing the rocker-bogie mobility system in conventional heavy loading vehicle behaviour when high-speed traversal is required.The proposed modification increases in the stability margin and proved with valuable and profitable contrasting with the 3D model simulations done in SOLIDWORKS.

IV. COMPONENTS OF ROVER

A. PVC Pipe

PVC Pipe is shown in fig.1 This Pipehave adequate strength, durability, easy installation, and low cost formaking the body of rover.



B. Wheels

Wheels is shown in fig.2 This Wheelhaving Diameter 7 mm.

C. Motor

Motor is shown in fig.3. This is Geared DC Motor Having 100 RPM working on 12V Supply.

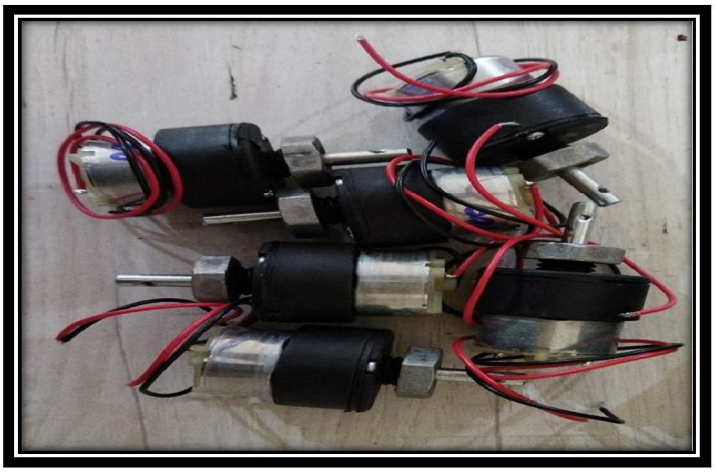


Fig.3

D. ESP 32 Cam Board WithCamera module-:

ESP32 Cam Board Shown in Fig.4, Thisboard contain the ESP32 Cam module with it.

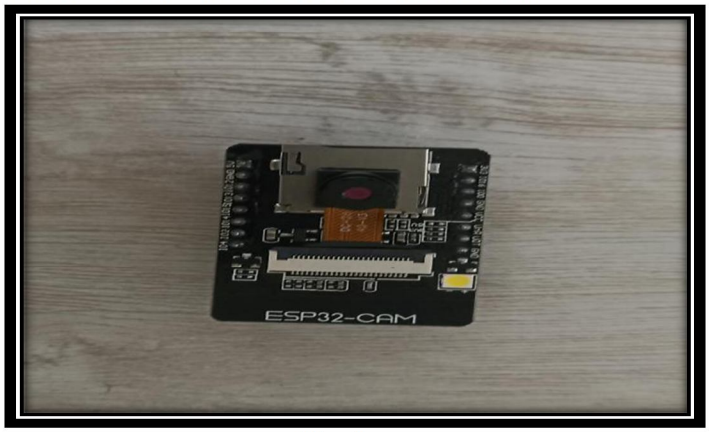


Fig. 2

E. AMS 1117

AMS 1117 shown in fig.5. this moduleuse to convert the 12V voltage into 5Vvoltage for camera.

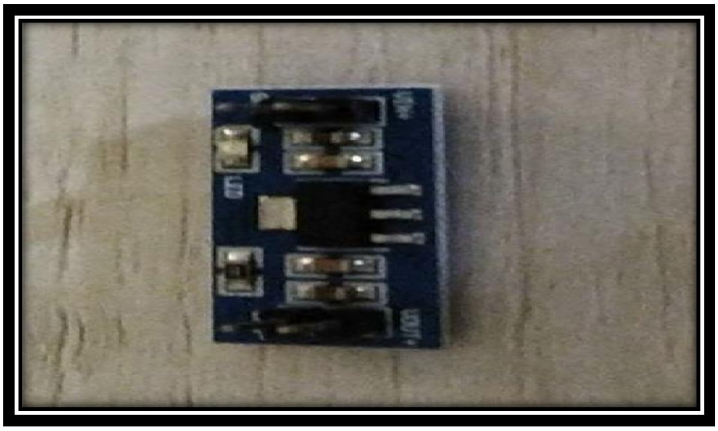


Fig. 3

F. Motor Driver

Motor Driver shown in fig.6, This is L293D Motor driver use to drive the six wheel motors of the rover.

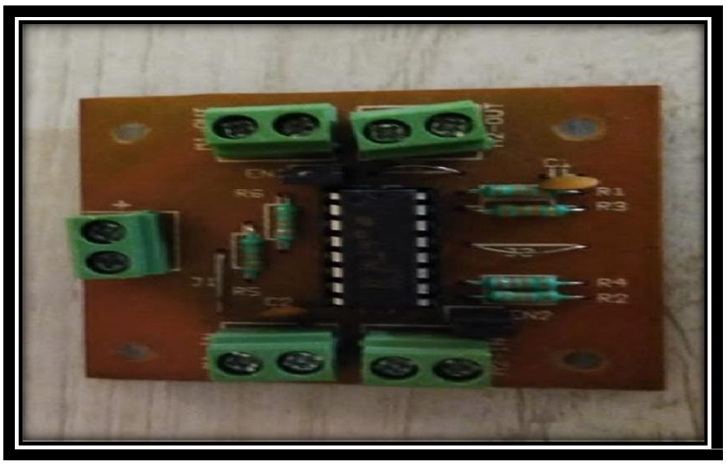


Fig. 4

G. Battery Pack

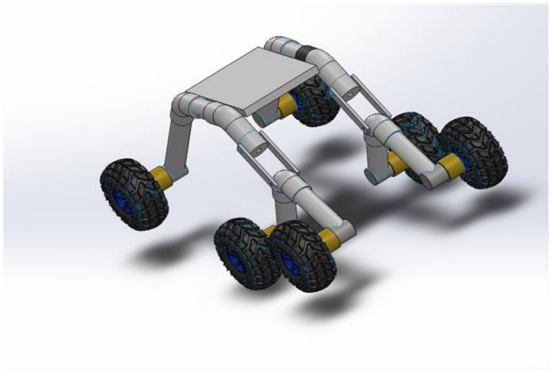
Battery is Shown in Fig.7, This is 12Vvolt Rechargeable Battery Pack use forrover.

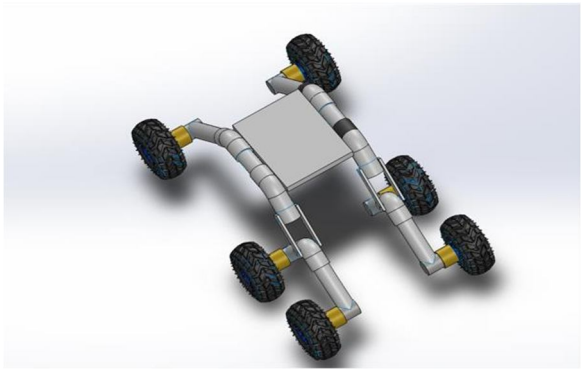
Fig. 5

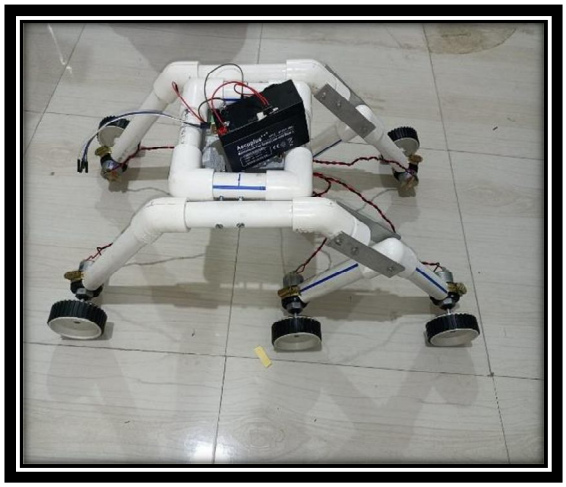
V. METHODOLOGY

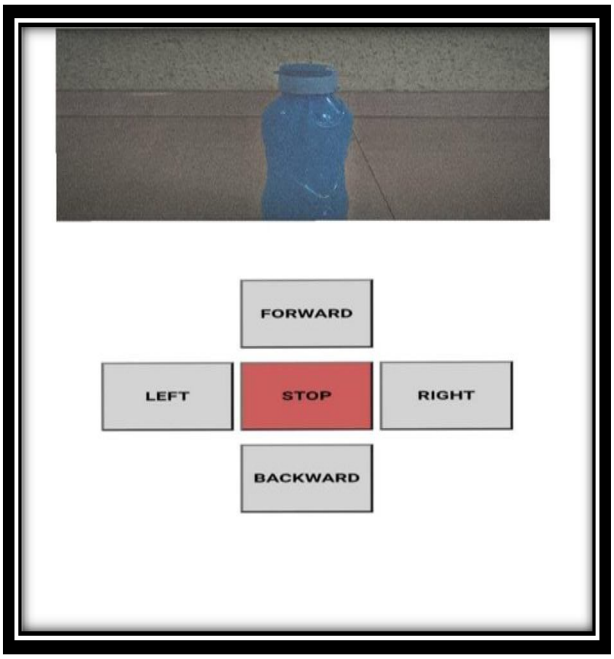
1) The system uses ESP32 Cam Board as the microcontroller.
2) The main reason behind selecting this microcontroller is it has inbuilt Wi-Fi which makesit suitable for IoT remote control and monitoring applications.
3) It also has a camera slot and an ESP32 camera can be used on the rover.
4) The rover uses L293D Motor Driver for driving all the motors connected to the rover
5) Rocker Bogie type of suspension is used in the system so that the rover can be operated onoff roads or more specifically it can be operated on any type of land.
6) Blynk app is used for remote controlling of the robot as well as the camera video streamingfrom the robot can also be seen in the same app
7) Since the Rover are connected to an app hence the rover can be controlled from app easilyin less time and high efficiency.

VI. DESIGN OF ROVER









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VII. RESULT

Testing the distance of controlling the rover through ESPCAM32 Cam Board is done 6 timesby controlling the rover at a certain distance, whether ESPCAM32 Cam Board can accept thecommand or not. The test results can be seen in Table 1

Testing Rover Connection

No.	Testing	Distance	Status	Visuals
1.	Testing 1	1m – 3m	Connected	Clear
2.	Testing 2	4m – 6m	Connected	Clear
3.	Testing 3	7m – 9m	Connected	Clear
4.	Testing 4	10m – 12m	Connected	Clear
5.	Testing 5	13m – 15m	Connected	Clear
6.	Testing 6	Above 15m	Disconnected	Distort (Disconnect)

The test results in Table 1 can be concluded that the control distance from the surveillance rover can only be controlled with a maximum distance of 15 meters, if the control is carried out at a distance of more than 15 meters, the monitoring robot cannot run because the connection between the android smartphone and ESP32Cam Board has been lost. ESP32CamBoard testing is the basis for controlling rover. If the ESP32Cam Board has been successfullyused, the next step is testing the IP camera on Rover.

Testing ESP32 Cam Connection

No.	Command	Successful	Failed	Percentage of Success
1.	Rover Connection	9	1	90%
2.	Cam Connection	10	0	100%
3.	Move Forward	10	0	100%
4.	Move Backward	10	0	100%
5.	Turn Left	10	0	100%
6.	Turn Right	10	0	100%
7.	Stop	10	0	100%

Overall testing of the system is carried out 10 times per instruction on Rover to ensure that rover can function as it should. The rover is used to perform all of its functions in accordancewith the commands on the web browser that is packed on android app. Table 2 shows the results of overall system testing conducted by rover.

VIII. TECHNICAL DETAIL OF ROVER

1) Total Length of Rover = 540 mm
2) Total Width of Rover = 330 mm
3) Total height of Rover = 210 mm
Weight of Rover = 2.09 kg

IX. FUTURE SCOPE

1) This system can be configured to work on protocol other than Wi-fi.
2) Other Mechanism for application Can be added in the system
a) SPY Operation
b) Rescue Operation
c) Surveillance Operation
3) Sensors can be incorporated in order to monitor an area under observation.

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X. CONCLUSION

The proposed paper produces a novel design in pursue of increasing the rocker-bogie mobilitysystem in conventional heavy loading vehicle behavior when high-speed traversal is required.The proposed modification increases in the stability margin and proved with valuable and profitable contrasting with the 3D model simulations done in SOLIDWORKS. In future, if thesystem installed in heavy vehicles and conventional off road vehicles, it will definitely decreases the complexity as well as power requirements to retain bumping within it Future scopes of Rocker Bogie Mechanism are in military operations as a weapon carrier & for locating coal deposits in coal mines.

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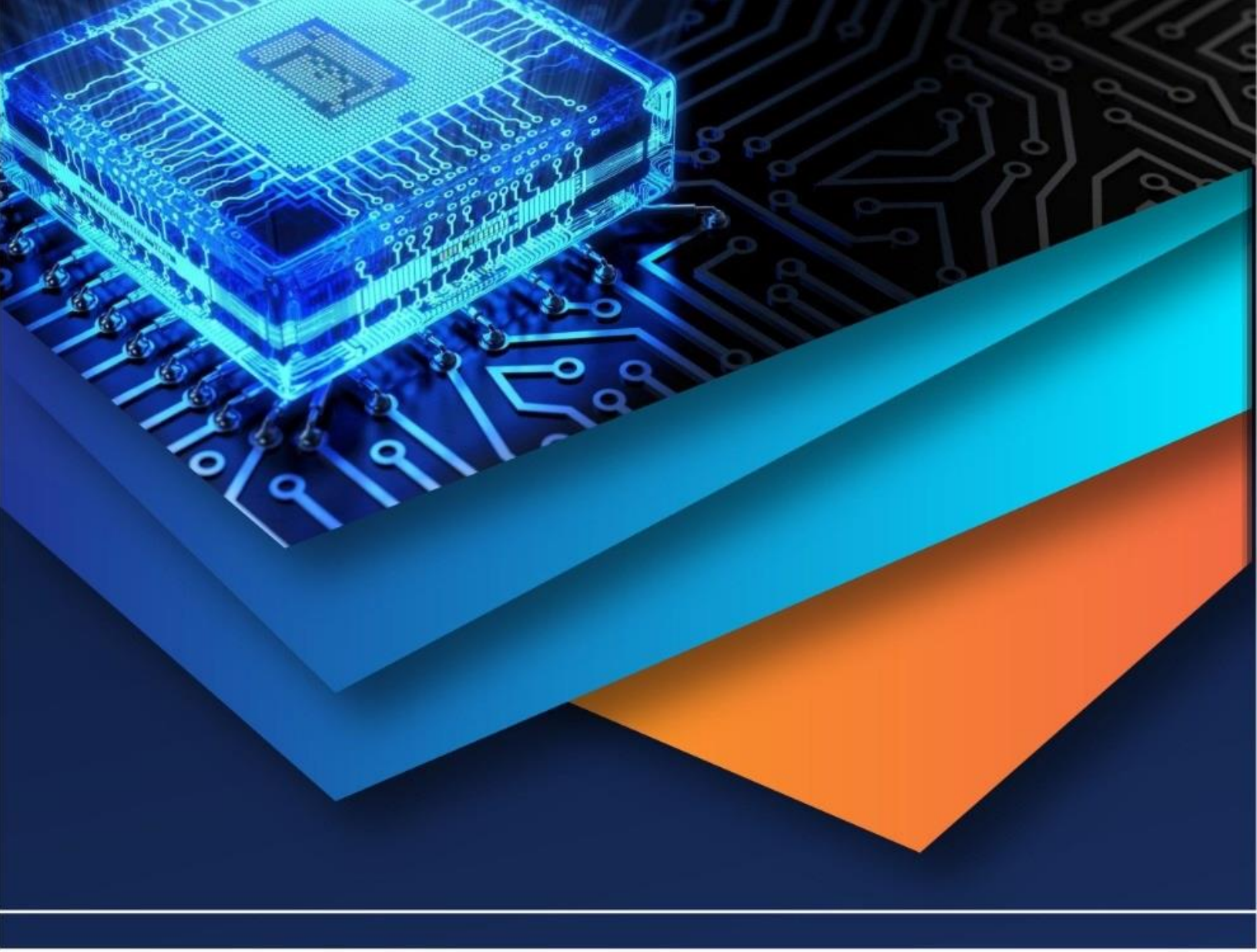

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