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Rocker Bogie Robot

[1]Nikhil Wani, [2]Ankush Ghodeswar, [3]Aditya Mhetre, [4]Nitish Netake

[1,2,3,4]Student, Mechanical Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India

***Abstract* - The rocker-bogie suspension system has robust capabilities to deal with uneven terrain because of its distributing the payload over its six wheels uniformly. One of the major shortcomings of current Rocker-Bogie rovers is that they are slow. 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.**

Keywords: Rocker bogie; Wheel type mobile robot; Stair climbing; Rover.

I. INTRODUCTION

The Rocker-Bogie Mobility system was a designed to be used at the slow speeds. It is capable of overcoming obstacles that are on the order of the size of a wheel. However, when surmounting a sizable obstacle, the vehicle motion effectively stops while the front wheel climbs the obstacle. When operating at slow speed, dynamic shocks are minimized when this happens. For many future planetary missions, rovers will have to operate at human level of speeds. Shocks resulting from the impact of the front wheel against an obstacle could damage the payload or the vehicle. This paper describes a method of driving a Rocker-Bogie vehicle so that it can effectively step over most obstacle rather than impacting over them. Most of the benefits of this method can be achieved without any modification to existing design only a change in control strategy. Some mechanical modification changes are suggested to gather the maximum benefits and to greatly increase the effective operational speed of future rovers.

One of the major shortcomings of current planetary rover is that they are slow. In order to be able to overcome significantly rough terrain (i.e., obstacles more than a few percent of wheel radius) without significant risk of flipping the vehicle or damaging the suspension over the obstacles by having wheels list each piece of the suspension over the obstacle on portion at a time.

The rocker-bogie suspension mechanism which is currently NASA's approved design for wheeled mobile robots, mainly because it has its sturdy or resilient capabilities to deal with obstacles and because it uniformly distributes the payload over its 6 wheels at all times. It also can be used for the other purpose to operate in rough roads and to climb the steps. It is having lots of advantages but one of the major disadvantages is the rotation of the mechanism when and where is required. The rotation can be possible by providing individual motors to individual wheels which can cause arise in cost and complicacy in design. Here an attempt is made to modify the existing design by incorporating a gear type steering mechanism which will be operated by a two motor which simplifies the design as well as the total cost and operating cost of the mechanism.

The rocker-bogie mechanism is one of the most popular linkage mechanisms, which was initially designed for space travel vehicles having its own deep history embedded in its development. By construction it is a wheel robot which comprises of 8 actuator wheels. The suspension system and these rockers are connected to each other and the vehicle chassis through a selectively modified differential in order to balance the bogie. By construction it has main frame containing two linkages on each side that are called the "rocker". One end of the rocker is connected to rear wheel, and the other end is connected to a small to maintain center of gravity entire vehicle as accordance with the motion, when one rocker moves down-word, the other goes upward. The chassis plays vital role to maintain the average pitch angle of the both rockers to move as per the situation. As per the acute design, one end of a rocker is fitted with a drive wheel and the other end is pivoted to a bogie which provides required motion and degree of freedom. In the system, "bogie" refers to the conjoining links that have a drive wheel attached at each end.

II. LITERATURE SURVEY

The concept of our research work is to create a rocker bogie drive system based on those of NASA. NASA developed the rocker-bogie suspension system for their rovers and was implemented in the Mars Pathfinder's and Sojourner rover. The rocker-bogie suspension system passively keeps all six wheels on the robot in contact with the ground even on uneven surfaces. This creates for great traction and maneuverability (Harrington & Voorhees).

In this work the proposed steering mechanism was designed and the modeling was done in CATIA (V-5) and the

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same was analyzed for static analysis for the proposed torque condition of the motor in ANSYS. All the results in the analysis were analyzed for static analysis [1].

The researchers discuss the concept and parameter design of a Robust Stair Climbing Compliant Modular Robot, capable of tackling stairs with overhangs. Modifying the geometry of the periphery of the wheels of our robot helps in tackling overhangs. Along with establishing a concept design, robust design parameters were set to minimize performance variation. The Grey-based Taguchi Method was adopted for providing an optimal setting for the design parameters of the robot. The robot prototype was shown to have successfully scaled stairs of varying dimensions, with overhang, thus corroborating the analysis performed [2].

An analysis method to make the rocker bogie mechanism can climb up a stair was achieved in the work. The east coast of Malaysia faced a massive flood from heavy downpour, leading to huge flood damage and caused irreparable loss to life and property. The flood carries the debris, soil and trees along their path, damaging the road and building structure, leaving the road become uneven. This situation gives difficulty to task force bearing aids during the post disaster management. The research paper proposed an intelligent inclined motion control of an amphibious vehicle while moving on uneven terrain surface [3].

III. PROBLEM STATEMENT

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 surveillance.

However, when surmounting a sizeable obstacle, the vehicles motion effectively stops while the 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.

IV. METHODOLOGY

- Block Diagram consists of Atmega328, Bluetooth Module, Ultrasonic sensor, Motor driver, Motor, Relay and Battery.
- 12V 1.3 A Power Supply is given to the system using battery.
- Robot is controlled using mobile app connected to project via Bluetooth module.
- Ultrasonic Sensor is used to detect the obstacle.
- If any obstacle is detected, relay will get ON in order to drive smoothly.

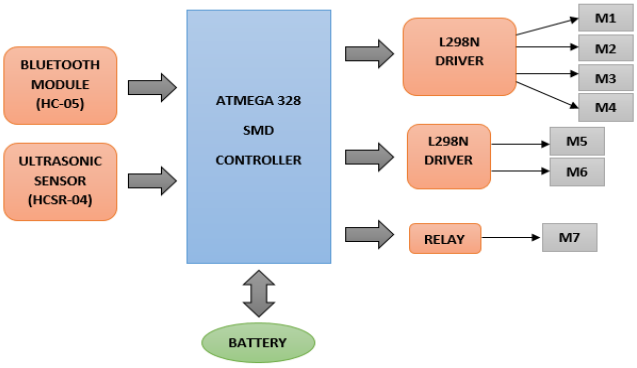

Figure 1: Block Diagram

Advantages

- The main advantage of this mechanism is no suspension is required, and total loads are distributed equally over all wheels.
- More stable over rough terrains while maintaining stability.
- Easily overcome obstacles over some extend.
- Ability to climb any tilt surface.
- Mechanism is very useful when the robot is driving on the dry sand like surface.

Applications

- Mobile robots can be used in several applications.
- Dangerous area operations such as nuclear plants.
- Planetary exploration and pipe investigation.
- Extreme temperature and narrow field investigations.
- Pyramid exploration robots.
- Mine Detection.

V. CONCLUSION

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. In future, if the system installed in heavy vehicles and conventional off road vehicles, it will definitely decrease 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.

REFERENCES

[1] P. Panigrahi, A. Barik, Rajneesh R. & R. K. Sahu, “Introduction of Mechanical Gear Type Steering

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Mechanism to Rocker Bogie", Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-5, ISSN: 2454-1362, 2016.

[2] Bhole, S. H. Turlapati, Raja shekhar V. S, J. Dixit, S. V. Shah, Madhava Krishna K, "Design of a Robust Stair Climbing Compliant Modular Robot to Tackle Overhang on Stairs" arXiv:1607.03077v1 [cs.RO], 11 Jul 2016.

[3] M. D. Manik, A. S. Chauhan, S. Chakraborty, V. R. Tiwari, "Experimental Analysis of climbing stairs with the rocker-bogie mechanism", Vol-2 Issue-2 P.No. 957-960IJARIIE-ISSN(O)-2395- 4396, 2016.

[4] B. D. Harrington and C. Voorhees, "The Challenges of Designing the Rocker-Bogie Suspension for the Mars Exploration Rover", Proceedings of the 37th Aerospace Mechanisms Symposium, Johnson Space Center, page No. 185-1985, May 19-21, 2004.

[5] Y. L. Maske, S. V. Patil, S. Deshmukh, "Modeling and MBD simulation of stairclimbing robot with rocker bogie Mechanism", International Journal of Innovative Research in Technology, 101743, Volume 1 Issue 12, Page no. 267-273,ISSN: 2349-6002, 2015.

[6] N. Yadav, B. Bhardwaj, S. Bhardwaj, "Design analysis of Rocker Bogie Suspension System and Access the possibility to implement in Front Loading Vehicles", IOSR Journal of Mechanical and Civil Engineering, e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 12, Issue 3 Ver. III, PP 64-67, May - Jun. 2015.

[7] L. Bruzzone and G. Quaglia, "Review article: locomotion systems for ground mobile robots in unstructured environments", Mech. Sci., 3, 49–62, 2012. DOI: 10.5194/ms-3-49-2012.

[8] F. Ullrich, A. Haydar G., S. Sukkarieh, "Design Optimization of a Mars Rover's Rocker-Bogie Mechanism using Genetic Algorithms", Proceedings from 10th Australian Space Science Conference, Page No. 199-210, 2010.

AUTHORS BIOGRAPHY

Nikhil Wani,
Student, Mechanical Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

Ankush Ghodeswar,
Student, Mechanical Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

Aditya Mhetre,
Student, Mechanical Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

Nitish Netake,
Student, Mechanical Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

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