Mutli Operational Land Crawler (Obstacle beater)

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***Abstract*: This crawler deals with the important aspect of improving the rover from its previous designs. The rover has to operate on rough and harsh environments for which it was designed but several factors restrict its operational capabilities, so the focus of our research is to overcome restrictions or to decrease it to within an acceptable range for its smooth performance. Our research on the restrictions of the rover conducted by our team focused mainly on the drive system and its drive modules which were not efficient, the linkage, the overturning or tilt range of the rover and the battery inefficiency from the other restrictions and problems that were obtained from the literature review and research so, we conducted research on how to improve that. The rover has been completely made from PVC to increase its capability to withstand shocks, vibrations and mechanical failures caused by the harsh environment where it is operated on. Using CAD software, the design of the rover has been fine-tuned and by experimenting with prototypes and models of the rover in the experimental setup of the live test, improvements and feature were included into the land crawler. The result of the project was the implementation of independent directional control utilizing minimum drive modules which increases the efficiency of the battery and increases the operating time of the rover, near zero tilt of the main body of the rover by self-balancing of the body counterweight method which decreases the tilt or overturning percentage of the crawler and its stability and finally by direct linkage of the various links comprising the crawler which increases the loading capacity. Thus, the various improvements ensure structural, tilt stability, mechanical integrity and overall weight reduction and mechanical feasibility.**

***Index Terms*: Crawler, friction, suspension, 3 legged, CAD**

I. INTRODUCTION

Here we have designed a new type of crawler for overcoming obstacles way the human being can't reach the main of this concept is to the crawler Mobility system was designed to be used at 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 vehicles motion effectively stops while the front wheel climbs the obstacle. When operating at low speed (greater than 10cm/second), dynamic shocks are minimized when this happens. For many future planetary missions, rovers will have to operate at human level speeds (~1m/second). 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 mini crawler vehicle so that it can effectively step over most obstacles rather than impacting and climbing over them. Most of the benefits of this method can be achieved without any mechanical modification to existing designs – only a change in control strategy. Some mechanical changes are suggested to gather the maximum benefit and to greatly increase the effective operational speed of future rovers.

II. LITERATURE REVIEW

The commencement of rocker bogie suspension framework can be followed to the advancement of planetary meanderer which are versatile robots, particularly intended to proceed onward a planet surface. Early wanderers were tele-worked like the Lunokhod I while ongoing ones are completely independent, for example, FIDO, Discovery and as of late created Curiosity damages investigation meanderer. The wanderers should have been exceptionally powerful and dependable, as it needs to withstand dust, solid breezes, consumption and huge temperature changes under baffling conditions. Most extreme meanderers stay controlled by batteries which are revived by sun powered boards amid the day introduced over yonder surface. The headway arrangement of meanderers stays critical to empower it to achieve target destinations, lead research, and gather information and to position itself as per the interest. There are three fundamental kinds of wanderer headway grew so far for example wheeled, legged and caterpillar motion. The fundamental distinction between the different structures of planetary robots lies in the kind of movement framework. Indeed, even subsequent to creating numerous legged and cross breed robots, most specialists still spotlight on wheeled movement for meanderers as a result of its train straightforwardness and focal points and among wheeled velocity plan, the rocker bogie suspension framework based structure stay generally supported. The antiquated FIDO meanderer and the Sojourner contain 6 autonomously controlled and driven wheels suspended from a rocker-bogie instrument for greatest suspension and ground freedom. Rough Seven Rover has a comparative suspension framework simply vary in front wheels. The Nanorover and Nomad Rovers have four guided wheels suspended from two intruders and CRAB Rover uses two parallel bogie systems on each side to beat snags and extensive openings. To the extent the underlying exploration is concerned, the product advancement looks for an ideal in the obliged arrangement space given an underlying arrangement and Dr. Li et al. determine a numerical model to sum up wanderer suspension parameters which characterize the geometry of the rocker-bogie framework. The target behind advancement of rocker bogie suspension framework is to build up a framework which limits the vitality utilization, the vertical dislodging of the wanderer's focal point of mass and its pitch edge. In this exploration, our undertaking is to exchange these significant points of interest inserted with the rocker bogie framework into customary vehicles so as to expel distress and complexities present in ordinary suspension framework all in all and suspension arrangement of substantial vehicles specifically.

III. CONSTRUCTION PRINCIPLE

The landcrawler design consisting of no springs and stub axles in each wheel which allows the chassis to climb over any obstacles, such as rocks, ditches, sand, etc. that are up to double the wheel's diameter in size while keeping all wheels on the ground maximum time. As compared to any suspension system, the tilt stability is limited by the height of the centre of gravity and the proposed system has the same Systems employing springs tend to tip more easily as the loaded side yields during obstacle course. Dependent upon the centre of overall weight, any vehicle developed based on Landcrawler suspension can withstand a tilt of at least 50 degrees in any direction without overturning which is the biggest advantage for any heavy loading vehicle. The system is designed to be implemented in low speed working vehicles such as heavy trucks, Bulldozers which works at slow speed of around 10 centimetres per second (3.9 in/s) so as to minimize dynamic shocks and consequential damage to the vehicle when surmounting sizable obstacles.

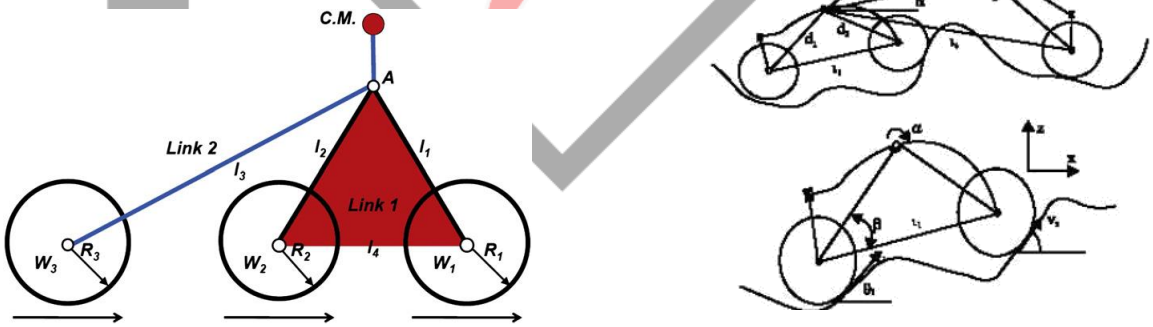
IV. MECHANICAL DESIGN

Several constrains were taking into account in the first phase of the mechanical design. They were:

- weight
- moving ability
- power request

Any of the above influenced the others and was sometimes in contradiction. We wanted a light robot, with high power and torque to move easily and firmly, and it must work in the small space given by the land.. These were the main features for the robot we had in mind,but being realistic we knew from the beginning that we will have to arrive to a compromise between them to be successful.

V. MECHANISMS INVOLVED



The rocker bogie component is a standout amongst the most well-known linkage instruments, which was at first intended for space travel vehicles having its very own profound history installed in its improvement. By development it is a wheel robot which contains 6 incited wheels. The expression "rocker" depicts the shaking part of the bigger connections present each side of the suspension framework and these rockers are associated with one another and the vehicle undercarriage through a specifically changed differential so as to adjust the bogie.

By development it has principle outline containing two linkages on each side that are known as the "rocker" (see Figure 1). One end of the rocker is associated with the back wheel, and the opposite end is associated with a little

To keep up focus of gravity of whole vehicle as agreement with the movement, when one rocker moves down-word, the different goes upward (Figure 1). The frame assumes fundamental job to keep up the normal pitch edge of the two rockers by enabling the two

rockers to move according to the circumstance. According to the intense plan, one end of a rocker is fitted with a drive haggle opposite end is rotated to a bogie which gives required movement and level of opportunity.

VI. SUSPENSION & FRICITION MECHANISM

Land crawler suspension has every one of the characteristics required for navigating the very uneven surfaces. We should examine a portion of its astounding characteristics.

1. Its most striking preferred standpoint is its impediment climbing capacity. It can climb vertical statures equivalent to twice of its wheel measurement. Typical vehicles can scarcely climb statures up to half of their wheel breadth.

2. For vehicles utilized for uncovering, spring-based suspensions can't be utilized. Henceforth it gives a superior substitute.

3. The suspension limits the sideways tilt by practically half while crossing two distinct snags on opposite sides of edge.

Pipe framework is maybe a standout amongst the most vital foundations in the modem society that successfully transports important assets, for example, grass and water. In this way, constant and cautious checking and review of the pipelines are expected to guarantee the best possible working of the framework.

Be that as it may, the vast majority of the pipelines are covered under the ground that is inaccessible of human administrators. Thus, a vast numberof crawler robots are created with the reason for completing an examination inside the review of intrigue. Among various movement methodologies utilized by in-pipe robots, utilizing wheels appended on leg is most regular as wheels give productive methods for impetus.

These wheeled in-pipe robots require certain methods for giving squeezing power on thewheels to keep up the footing. For instance, crawler robot going through vertical segment of the pipe willdefinitely need more rubbing power than while moving on a level plane.

All these land crawler robots normally utilize three bar linkage with consistent connection. Be that as it may, the three-bar linkage system generally utilized via land crawler robots have inadequacy of being vitality wasteful.

VII. RESULTS & DISCUSSION

Various tests were conducted to determine how the improved resurvey rover would perform against its predecessor designs by use of Negative Moment vs. Obstacle Height and their responses were obtained and their graphs were plotted,and comparisons were made

We studied the existing models of crawler suspension enabled rovers and tried to manufacture a similar kind with the materials available. We made a slight modification with the introduction of mechanical gear type steering system. The materials used in the manufacturing of the rover were sp.v.c pipes. Crawler arms were made using steel plates of 5mm thickness and holes were punched throughout the arms to reduce the weight of the rover. The crawlerand bogie were joined using bearings. Both the crawler arms were connected using stainless steel rod and bearings. For the steering system platform base was cut according to the required dimensions on which six gears were mounted (one master gear, two idlers and two-wheel gears).

All the gears used non corrosive iron material .The text track used for this project is un even platform and fluid flowing area with rocky obstacles and analysed which comparing the disturbances in the ATV's Centre of Gravity position in each of the two operating modes, contrasting the response of these two distinctive configurations of the crawler suspension against upcoming obstacles that can be present along the system generated obstacles and roadblocks.

VIII.CONCLUSION

The steering mechanism was successfully installed and operated using mechanical gears in the existing rocker bogie rover design. The drawback of this system is that the rover designed with this steering mechanism is limited to traverse in less rough or only plain surface. Attempts can be made to modify and solve this problem to design a more stable rover so that the vehicle can travel in both smooth and rough surface.

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. Presented situation was faced presenting two modes of operation within same working principle which is a rocker-bogie system with a robust obstacles traverse features and another is an expanded support hexagon achieved by rotating the bogies of each side of the vehicle. The proposed modification increases in the stability margin and proved with valuable and profitable contrasting the SSF metric with the 3D model simulations done in SOLIDWORKS. In future, if the system 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.

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