Rocker Bogie Robot

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Abstract – 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. The need to develop a highly stable suspension system capable of operating with multi rough surface while keeping all the wheels contact with the ground. To design mechanism that can traverse terrains where the left and right rockers individually climb different obstacles. To sustain a tilt over a 50deg without tipping over the sideways.

***Key Words*: Rocker Boogie Mechanism, Components Detail Drawing**

1. INTRODUCTION

Research into legged machines is expanding rapidly. There are several reasons why this is happening at this particular time. The main one is that it has recently become popular and practicable to build on-board computers into small vehicles. In the last few years thev development of computer-controlled machines, especially industrial robots, has resulted in techniques which taken together provide most of the technical base to make walking machines possible. For many years walking machines have been thought of as rough country vehicles, but recently a new impetus has come from the expansion of the need to handle radioactive materials in awkward environments and, in particular the repair and decommissioning of nuclear power stations. What is the case for building legged vehicle rather than wheeled or tracked ones? One reason is an interest in the legged locomotion itself, and the other is the superiority of legs over wheels or tracks. 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 as accordance with the motion to maintain center of gravity of entire vehicle, when one rocker moves up- ward, 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. In spite of the advantages of walking machines for a variety of tasks, very seldom any of them did show an actual competitive edge in practical applications, perhaps the main reason is the fact that wheeled vehicles have a tradition that cannot be matched by other configurations so that the designer may refer to a well consolidated technology, without the need of resorting to simulations, experimental tests and other studies which slow the design process and increase the cost. But it is not only a matter of a consolidated design practice; legged vehicles usually have reciprocating parts, which undergo to a high number of fatigue cycles, are usually highly stressed, require complex control systems and often have higher energy consumption, in spite of a greater theoretical efficiency. The potential advantages, coupled with scientific curiosity, are the justification of research into, and development of a legged vehicle. Finally we treat it as a challenge to design a legged vehicle and thus have chosen it.

2. Literature Review

1. Roland Siegwart [2008] published a research paper on “Planetary Vehicle Suspension. A study of locomotion performance of different suspension types was conducted in order to find the rover that matches best any given mission requirements. Two modeling approaches were chosen to evaluate the performance on hard ground and obstacles, as well as on loose soil and inclined planes. A number of metrics were defined which precisely specify what qualifies as good or bad performance. The simulations revealed significant differences between the various configurations for important metrics like torque, power or velocity. These results were used to characterize the performance of each rover and put it in relation to the weighted mission requirements. The sum of the performances multiplied by the weight factors of the requirements was taken as the measure for how good a rover fits the mission needs. This study has shown that a four wheeled rover can be a valuable alternative to the rocker bogie but only in very specific missions.

2. Thomas M. Howard [2006] published a research paper on ‘’Trajectory and Spline Generation for All-Wheel Steering Mobile Robots We present a method for trajectory generation for all-wheel steering mobile robots which can account for rough terrain and predictable vehicle dynamics and apply it to the problem of generating optimal motion splines. There has been little work in trajectory generation for vehicles with all-wheel steering capability compared to the Ackermann, differential-drive, or omnidirectional mobility system models. The presented method linearizes and inverts forward models of propulsion, suspension, and motion to minimize boundary state error given a parameterized set of controls. Our method for generating optimal motion splines between a set of state boundary constraints optimizes the free path heading boundary constraint while meeting position and orientation state constraints. We demonstrate this algorithm on the Rocky 8 rover platform, where parameterized linear velocity, curvature, and path heading controls are generated which satisfy position, orientation, and path heading constraints in rough terrain.

3. Kazuya Yoshida published a research paper on “This paper investigates a physical model of the wheel traction in the relationship of the motion dynamics, and thereby studies the cases where a rover negotiates with natural rough terrain, slips and stacks on a steep slope. Experiments are carried out with a rover test bed to observe the physical phenomena and extract essential parameters, and the dynamic simulations are carried out to be compared with the experimental data. Illustrative simulations show that the motion of the vehicle, including the adaptive response of the rocker-bogie suspension to rough terrain and the development of the slip on a sandy slope, is successfully modeled and simulated with the in-house software dedicated for dynamics simulation.

4. R. Stapleton published a research paper on ‘’ Dynamic analysis of a four-wheel off-the-road vehicle the same author mentions some of the problems associated with the design of a lunar vehicle in ref. [2]. The first vehicles considered for manned lunar exploration were large and tank-like. Initially, planners postulated that the vehicle should help protect the astronaut(s) from the lunar environment. As mission profiles were more clearly defined, a different kind of vehicle was identified. Some of the requirements specified for the actual flight vehicles are presented here: • Maximum mobility must be maintained while crossing soft soil and lunar obstacles. • The folded vehicle must fit into a small storage space during transportation to the moon and then unfold to the lunar surface quickly with a minimum of astronaut effort. • The vehicle must be capable of carrying a payload weighing 2½ times its unloaded weight over very rough terrain at relatively high speeds. In addition, design and construction time was very short--much less than that normally required by conventional automobile manufacturers. The Lunar Rover Vehicle (LRV) was built to increase astronaut mobility during the last three NASA manned lunar exploration missions. This paper presents the salient features of a project initiated to predict tire and suspension loads caused by vehicle tire impact with lunar obstacles. The design integrity of a vehicle used here on the earth could normally be verified by testing actual hardware. Unfortunately, definition of an adequate testing program for the flight version of the L-RV that could be used in lieu of analysis was not considered feasible for the following reasons: • Testing on the lunar surface was impractical

3. Objectives of the project

The objective of this project is to design a small, robust and highly maneuverable walking robot. It will be designed for walking on the different platforms like rough terrains, smooth surfaces, overcoming obstacles in its path and climbing over obstacles of certain height, choosing different predetermined gaits and to have good stability, speed as well as payload capacity. This robot would provide a platform for the study of the control of legged vehicles, environment sensing, path planning and task accomplishment. Creating such a platform is the fundamental purpose behind the project. There are various distinct components of the project. The first is mechanical design of the robot itself. Choosing a good mechanical design will facilitate all future work and will minimize the need for redesign. A good leg design will allow for simple and adaptive control of the robot’s motion. The second aspect of the project is the use of microcontrollers and the design of the electronic interfaces. It is very important to have a good interface between the control station and the components to be controlled. The third factor involved in design of the robot is the control architecture. The control scheme will rely on the mechanical design and controller chosen but this should only be at a low level in the control hierarchy. The actual software architecture should be essentially platform independent and should allow for the desired level of autonomy. Adaptation to the surrounding environment and terrains, use of sensors, improving 'Energetic Efficiency' and optimizing for power are the other important objectives.

4. Drawing of model

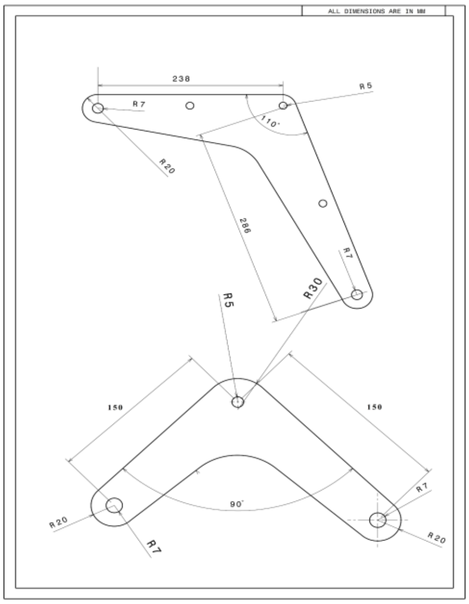
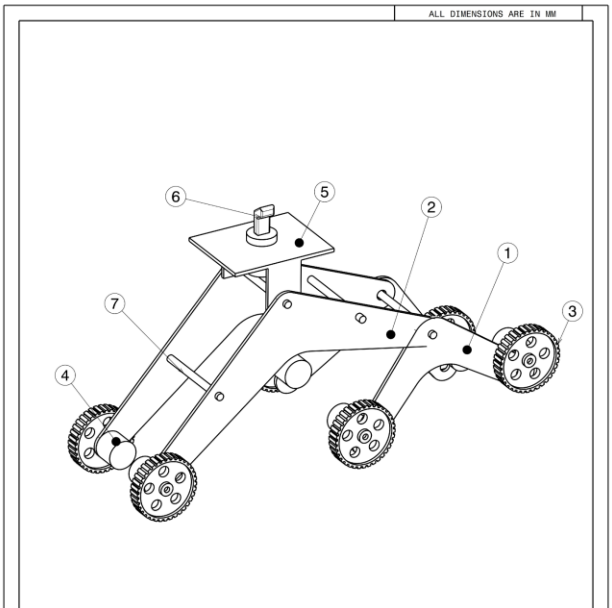


Figure 1: Base frame



Sr.No	Component Name	Quantity
1	Arm 1	2
2	Arm 2	2
3	wheel / Leg	6
4	Motor	6
5	Top Frame	1
6	Camera	1
7	Support Fixture	4

Figure 2: Robot part information

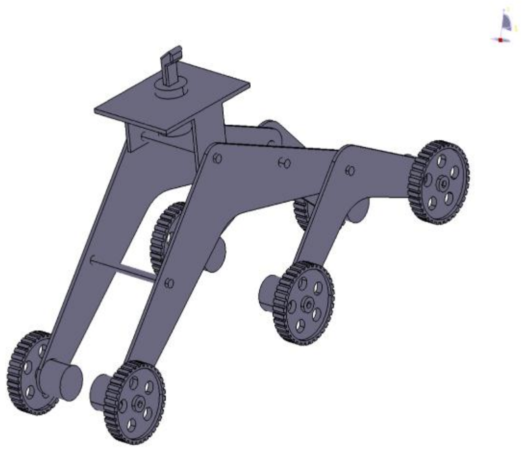


Figure 2: 3D Drawing

5. Material Specification

Sr no.	Process	M/c	Time (mint)
1)	Acrylic glass fiber 300x300	Cutting M/c	20
2)	Acrylic glass fiber 200X200	Cutting M/c	20
3)	Cutting of Square Angle	Cutting M/c	20
4)	Acrylic glass fiber 120X150	Cutting M/c	20
5)	Cutting of Acrylic glass fiber size larger than exact size	Hand cutting	80
6)	Acrylic glass fiber size of housing	Hand cutting	80
7)	Cutting of Acrylic glass fiber size larger than exact size	Hand cutting	80
8)	Drilling Dia 15/10/8 mm	Hand cutting	80

6. Advantages and Limitations

Advantages

1. The design incorporates independent motors for each wheel.
2. There are no springs or axles, making the design simpler and more reliable.
3. It can move in harsh environment
4. It can work in place which are beyond human reach

Disadvantages

1. In rocker bogie any obstacle comes it way will not ride over it.
2. The impulsive collisions decrease the cleansing capability of system
3. It is highly unstable on high speed
4. This mechanism should pick speed when there is a flat surface or there are no obstacles ahead

7. Conclusion

We can develop this mechanism to create wonders and can be used in almost all our related fields. We have tried our best to this project much more economical and efficient. 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.

8. References

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2. Thomas M. Howard published a research paper on ''Trajectory and Spline Generation for All-Wheel Steering Mobile Robots [2006]

3. Kazuya Yoshida published a research paper on "This paper investigates a physical model of the wheel traction in the relationship of the motion dynamics

4. R. Stapleton published a research paper on '' Dynamic analysis of a four-wheel off-the-road vehicle The same author mentions some of the problems associated with the design

9. Biographies

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