DESIGN OF TRAVERSING STEEP ROVER USING ROCKER BOGIE MECHANISM

R.Suresh[1]
Assistant professor,
sureshr@pmu.edu

K.V.Keerthi Priya[2]
Student
Keerthirajam103@gamil.com

C.J.Sonasri[3]
Student
Sona230401@gmail.com

Department of Aerospace Engineering,
Periyar Maniammai Institute of Science & Technology,
Thanjavur, Tamilnadu

ABSTRACT - ***This paper describes the 8-wheeled drive mechanism of the mars rover.The current rover are developed by Rocker bogie mechanism and it is NASA's f avored design. One of the major shortening's of current Rocker bogie rover is that they are slow. We enhance the high climbing capacity of the rover using 8 wheels to improve t he mobility system. In this system there were eight links at both sides of the mechanism and balancing the rover in the moving condition. The rover leg ensure that it can traverse over highly rugged terrain and it allows to maintain the center of gravity of the vehicle. This project focuses on the mobility system of the rover.***

I. INTRODUCTION

The Mars was representative blood and war yet for such a large number of individualities moment the red earth might hold the key for brilliant new future for humanity. In its own particular manner the earth's eroded red face recounts an account of annihilation. Billions of times prior the fourth earth from the sun might have been confused with earth's more modest binary with fluid water on its face and may indeed life. Presently the world is a chilly, infertile desert with not numerous suggestions of fluid Water. Yet, following quite a while of study exercising orbiters, landers, and meanderers, experimenter have uncovered Mars as a dynamic, windblown scene that could relatively conceivably hold onto microbial life underneath its eroded face indeed moment. The reality of the situation will come out at some point however anyhow, Mars will keep on involving the mortal creative mind, a flashing red signal in our skies and

stories.U.S., European Union, Russia, and India are effectively circling Mars or rovering across its face. A six wheeled vehicle planned by NASA to probe the external subcaste of the Mars.Sojourner was moved in 1996 and showed up in 1997. Additionally, the Spirit and event were moved in 2003 and appeared in 2004, moving the photographs of Mars. The Curiosity, was transferred in 2011 and arrived in 2021. The fifth mars gypsy, Perseverance, was transferred in 2020 and arrived in 2021. The rovers were intended to navigate with a considerable lot of simplicity over the rough martian home. Our task centers around how the meanderer will negotiate the ideal of mortal creative mind exercising 8- wheel bone of a kind drive system. This element permits to move over high deterrents, while motioning every one of the eight bus in touch with the ground (6). The plan consolidates free machines for each wheel. The rocker- bogie anticipation setup has transformed into a shown flexibility activity known for its unexampled vehicle permanence and handcuffs climbing limit. Following a many invention and examination meanderer prosecutions, the frame was effectively flown as a point of Mars Pathfinder's Sojournerwanderer.Whenever the Mars Exploration Rover (MER) Design was first proposed, the operation of a rocker- dread suspense was the irrefragable choice as a result of its wide heritage (8). The test presented by MER was to plan a light weight rocker- dread suspense that would allow the versatility to store inside the confined space accessible and convey into a design that the meanderer could also securely use to departure from the Lander and probe the Martian face (3). While erecting a robot you'd like it to be principally as straightforward as could really be anticipated. By and large you'd noway bear a suspense frame, yet there were a many exemplifications when a suspense frame can not be stayed down from. The expression" bogie" alludes to the connections that have a drive wheel at each end. Interferers were regularly employed as burden bus in the tracks of fortified force tanks as loafers dispersing the mound over the terrain (4). Interferers were also naturally employed on the campers of semi-big equipages. The two operations presently favor following arm dormancies. The rocker- bogie configuration has no springs or end axles for each wheel, permitting the gypsy to move over impediments, for illustration, shakes, that depend on double the wheel's distance across in size while keeping every one of the six bus on the ground (5). Likewise with any suspense frame, the slant security is confined by the position of the focal point of graveness.

II. DESIGN OF ROCKER BOGIE ROVER

The significant variable in assembling of rocker bogie system is to decide the components of rocker and bogie linkages and points between them[7]. The lengths and points of this instrument can be changed according to prerequisite. In the work the point is to make the rocker bogie instrument which can defeat the deterrents of 150 mm level (like stones, wooden squares) and can move over steps of level 150 mm. Likewise another objective is to climb any surface at a point of 45˚. To accomplish the above targets we had plan the rocker-bogie model by expecting step level 150 mm and length 370 mm. Utilizing Pythagoras hypotheses, track down the elements of the model[2]. It have the two points of linkages are 90˚. The target of the examination work is step climbing. To accomplish appropriate step climbing the components of linkages ought to be legitimate. Expect the step level and length 150 mm and 370 mm individually. To climb steps with higher dependability, it is expected that only one sets of wheel ought to be in rising situation at a time. Thus to observe aspect of bogie linkages, first sets of wheels ought to be set at level position spells almost certain doom for toward the finish of the rising. Furthermore, second pair ought to be set not long before the beginning of rising. There ought to be a few distance between vertical edge of step and second sets of wheel to striking of wheels.

III. METHODOLOGY

The 8 wheel drive system with a unique wheels that allow it to turn 360 degree on the same spot. This unique wheel design allows the rover to overcome the rough terrains and maintain stability. The major aim of our project is to design a rover which has an effective mechanism to ensure the stability during ascent and descent through any obstacles. The inclined stability is limited by the height of the centre of attraction. Active suspension that could lift the chassis up to 15 cm from the ground that makes the rover move smoothly, which increases stability and allows the rover to spin around without motion. Can carry up to2 to 3 kg of science equipment. Materials play a key role in the design of many critical structures and components so in our rover we use Aluminium and light weight metals. The traverse steep rover features eight wheels that are made up of Aluminium in order to make them more robust due to the wear and tear of Mars rover wheels endured while driving over sharp and pointy rocks. Aluminium 6061 in an alloy, containing magnesium and silicon as a major elements. It is a medium to high

strength heat-treatable alloy with a strength higher than 6005A. It is a very good corrosion resistance and very good weldability although reduced strength in the weld zone. It has medium fatigue strength. Considering various parameters such as yield strength, material availability, density , strength, material availability, density, strength to weight ratio and mainly the availability and cost of the material we use Aluminium 6061.It was chosen for its good physical properties and great weldability.

IV. MATERIAL SELECTION

Materials play a key role in the design of many critical structures and components so in our rover we use aluminium and light weight metals. The traverse steep rover features eight wheels that are made up of aluminium in order to make them more robust due to the wear and tear of mars rover wheels endured while driving over sharp and pointy rocks. Considering various parameters such as yield strength, material availability, density, strength-to-weight ratio, and mainly the availability and cost of the material we use aluminum 6061[1]. Aluminium 6061 a precipitation hardening alloy majorly comprises of magnesium and silicon. It was chosen for its good physical properties and great weldability.

V. ROVER ELECTRONICS

Power system

Battery :

We used 12v 7.2AH lead acid battery, as lead acid provides reliable, reasonable current capacity, It could be the most efficient way to power the rover.

Power supply board :

Power supply board is a device used for regulating and supplying power to the connected components.

Relay module

We use relay module for switch that can be turned on or off deciding to let current flow through or not. It is used to control a high current using a low current signal.

Drive system

Motors :

We use 12v DC geared motors with 60rpm, high starting torque for driving heavy loads. Each wheel has separate DC motors which helps the rover to move forward or backward.

Wheels :

The wheels on each side of the rover is individually driven by separate rotors is individually driven by separate rotors, which allows the rotor to run smoothly on uneven terrain and climb obstacles.

Main control system:

The brain of this rover is actually an Arduino nano board. It is microcontroller with removable base. We use this to tell the board, what to do by sending a set of instructions to the microcontroller on the board. The subsystem are controlled by Arduino nano board.

Communication system

Bluetooth HC-05

We use Hc - 05 bluetooth module to replace cable connection, a serial communication to communicate with the electronics.

Sensor

Ultrosonic sensor:

We use ultrosonic sensor to measure the distance to wide range of objects regardless of shape , colour or surface. It is also used to detect objects and to measure an approaching or receding object.

Performance at different conditions:

As per the ground level experiment, tested found that the performance satisfied below are the result on different obstacles and different surfaces.

Fig 1 SIDE VIEW IN ROUGH TERRAIN

Fig 2 MODEL ISOMETRIC VIEW

Fig 3 ROTATIONAL MOTION IN ROUGH TERRAIN

Fig 4 TRAVERSING ON SLOPE

VI. RESULT AND DISCUSSION

The Mars rover has been designed with existing version and final prototype has been built. In order to maintain stability of the vehicle, we can add some developments like attaching arms to the rover. It can be made more useful for the rover to travel on most critical surfaces.

VII. CONCLUSION

In this project, we have presented design, animation, Material selection and components selection. We used Solidworks 14 to complete the design (Isometric view, Top view, Front view, Side view) and Solidworks motion to complete the animation.The final model is tested on different obstacles and different surfaces.

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