JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

FABRICATION OF SURVEILLANCE ROBOT WITH ACTION CAMERA MOUNT AND IT'S ADAPTABILITY FOR OFF-TERRAIN SURFACES

GHV. Prasad Babu[1], Srujith Kumar G [2], Dolendra K [3] ,Hanush Yadav M [4] ,Syed Sardhar [5]

[1]Assistant professor, [2,3,4,5]UG Scholar, Dept. of Mechanical Engineering

Geethanjali Institute of Science & Technology (Autonomous), Kovur (M), S.P.S.R. Nellore Dt, Andhra Pradesh

ABSTRACT:

In rough and uneven environments like wildlife sanctuaries and zoological parks, rocker-bogie-based mobile robots are excellent for surveillance and monitoring tasks. Being able to move over natural terrain, such as soil, grass, stones, slopes, and uneven ground surfaces, is often necessary for animal monitoring over large areas. It may be difficult for wheeled conventional systems to navigate such terrains, which can reduce surveillance effectiveness. The robot is able to move through rough terrain while maintaining constant wheel contact with the ground thanks to the rocker–bogie suspension mechanism, which provides high mobility and stability. The robot can move over uneven surfaces and climb obstacles thanks to this mechanism, which improves its stability and traction. A rocker–bogie-based surveillance robot with an action camera is developed for this project to remotely monitor wildlife areas. The robot is able to transmit visual information and capture real-time video for observation without causing harm to humans or animals. The rocker–bogie mechanism provides effective terrain adaptability, as demonstrated by experimental testing on grass, sand, bumpy roads, inclined planes, and obstacles. Wildlife sanctuaries and zoological parks can use the proposed system for remote animal monitoring, habitat observation, and security surveillance.

Keywords: Rocker bogie, Surveillance robot, Off-terrain mobility, Wildlife monitoring, Mobile rover.

I.INTRODUCTION

Mobile robotic systems have grown in importance over the past ten years for surveillance and monitoring in places that humans can't get to or are unsafe from. Monitoring animal movement and environmental conditions in wildlife sanctuaries, zoological parks, and forest reserves necessitates mobility across slopes, soil, grass, and other uneven terrain. Due to their limited terrain adaptability, conventional wheeled robots frequently struggle to move effectively in such circumstances. To overcome these challenges, the rocker–bogie suspension mechanism is used because of its superior stability and obstacle-climbing capability. The robot can move smoothly over rough and uneven surfaces thanks to this mechanism, which keeps all

wheels in constant contact with the ground. The rocker–bogie design was originally created for planetary exploration rovers like the Mars Pathfinder's Sojourner rover. It has proven to be extremely reliable for traversing terrain. A rocker–bogie-based surveillance robot with an action camera mounted on the chassis for real-time monitoring is built in this project. The robot is built to remain stable while traversing off-terrain surfaces like sand, grass, uneven ground, and obstacles. The mounted camera makes it possible to observe animals and the environment from a distance without causing harm to wildlife or requiring human presence in sensitive areas. The proposed system demonstrates how a simple yet effective rocker–bogie suspension design can be applied to surveillance applications in wildlife sanctuaries and zoological parks, providing a mobile platform capable of monitoring large natural habitats safely and efficiently.

II. LITERATURE REVIEW

Robotic surveillance systems have become increasingly important in recent years for monitoring large, intricate environments like wildlife sanctuaries, zoological parks, and protected forest areas. These areas frequently cover vast terrains with uneven ground, obstacles, and vegetation, making manual monitoring time-consuming and difficult. The coverage of traditional fixed camera systems is limited, and they are unable to effectively monitor locations with rough terrain. As a result, mobile robotic surveillance systems are being looked at as a good way to keep an eye on things in real time in these kinds of settings. Mobile robots equipped with cameras and wireless communication technologies have been widely studied for security and surveillance purposes. Real-time video data can be captured by these robots as they move across various terrains and monitor activities in vast open spaces. Robotic surveillance systems can be used by authorities in wildlife sanctuaries and zoological parks to observe animal behavior, track animal movement, and ensure visitor safety. They can also assist in the detection of abnormal circumstances like visitors going missing in large parks or people entering restricted areas. For robots operating in natural environments, terrain adaptability is an important design factor. A stable mobility mechanism that can keep balance and traction on uneven surfaces like soil, grass, stones, and slopes is needed. The rocker–bogie suspension system has been widely used for such applications because of its ability to maintain continuous ground contact and climb obstacles. This suspension mechanism, which was initially developed by NASA for planetary rovers, enables robots to move effectively over rough terrain while maintaining stability. Rocker-bogie-based mobile robots are capable of operating in unstructured environments, climbing obstacles, and successfully traversing uneven surfaces, according to a number of studies. Because of its passive suspension design and effective load distribution, the mechanism allows all wheels to remain in contact with the ground, improving stability and maneuverability. Rocker-bogie robots are suitable for surveillance tasks in large outdoor environments, where traditional wheeled robots may struggle, due to these characteristics. Mobile robots' integration of cameras and wireless communication modules for security and remote monitoring has also been the subject of recent research. Improved situational awareness and quicker emergency response are made possible by these systems, which enable operators to view real-time video feeds from faraway locations. These robotic systems can be used in places like wildlife sanctuaries and zoological parks to keep an eye on visitors, find people who have gone missing, and ensure safety without affecting the natural environment. A rocker–bogie-based surveillance robot with an action camera that was developed on the basis of these studies is an efficient method for monitoring large outdoor areas. The robot is suitable for applications such as zoo and wildlife sanctuary surveillance, visitor safety monitoring, and search assistance for

missing persons due to its ability to navigate uneven terrain and real-time video monitoring.

Objective

• The objective of the project is to design a small, terrain vehicle and easy to steer and handle.

• It will be designed for working on different platforms like rough terrains, smooth surfaces, overcoming obstacles in its path and climbing over obstacles of certain height.

• It can be use for live video feed and image capturing in borders.

III.DESIGN OF ROCKER BOGIE

The important factor in manufacturing of rocker bogie mechanism is to determine the dimensions of rocker and bogie linkages and angles between them. The lengths and angles of this mechanism can be changed as per requirement. In the work aim is to manufacture the rocker bogie mechanism which can overcome the obstacles of 150 mm height (like stones, wooden blocks) and can climb over stairs of height 150 mm. Also another target is to climb any surface at an angle of 45˚. To achieve the above targets we had design the rocker-bogie model by assuming stair height 150 mm and length 370 mm. Using Pythagoras theorem, find the dimensions of the model. It have both angles of linkages are 90˚.

A. Design calculation

The objective of the research work is stair climbing. To achieve proper stair climbing the dimensions of linkages should be proper. Assume the stair height and length 150mm and 370 mm respectively. To climb stairs with higher stability, it is required that only one pair of wheel should be in rising position at a time. Hence to find dimension of bogie linkages, first pair of wheels should be placed at horizontal position means at the end of the rising as shown in Fig.1. And second pair should be placed just before the start of rising. There should be some distance between vertical edge of stair and second pair of wheel to striking of wheels.**Rocker Bogie Mechanism Working**

Because there are no springs or stub axles for each wheel in the rocker-bogie design, the rover can climb over rocks up to twice the size of the wheel while keeping all six wheels on the ground. The height of the center of gravity limits the tilt stability, as it does with any suspension system. Systems that use springs are more likely to tip when the loaded side gives way. The mission's rover can withstand a tilt of at least 45 degrees in any direction without tipping over due to its center of mass. As with all fluid disturbances, the high-pressure gas that comes out of the cylinder initially flows in the form of a "wave front." A wave front is created when the exhaust gas pushes into a pipe that has already been occupied by gas from previous cycles. The wave moves on by transferring energy to the next gas downstream, and so on to the pipe's end once the gas flow itself stops. This wave will reflect some of its strength in the opposite direction of its travel if it experiences any temperature or cross sectional changes. Wave dynamics explains the fundamental principle. By varying its diameter (cross section) and length, a heat chamber exploits this phenomenon to ensure that these reflections return to the cylinder at the desired point in the cycle. a recreation of a functioning heat chamber. It does a good job of showing the positive part of the exhaust pulse, but there are a few mistakes in this animation: the exhaust wouldn't go all the way through the pipe, and the diverging section's suction wave isn't shown. The newly drawn mixture cannot travel all the way down the header pipe.

Applications

• Zoo and Wildlife Sanctuary Surveillance

The robot can be used to monitor animal enclosures and open habitats without disturbing wildlife. It enables continuous observation of animal behavior and movement in natural environments.

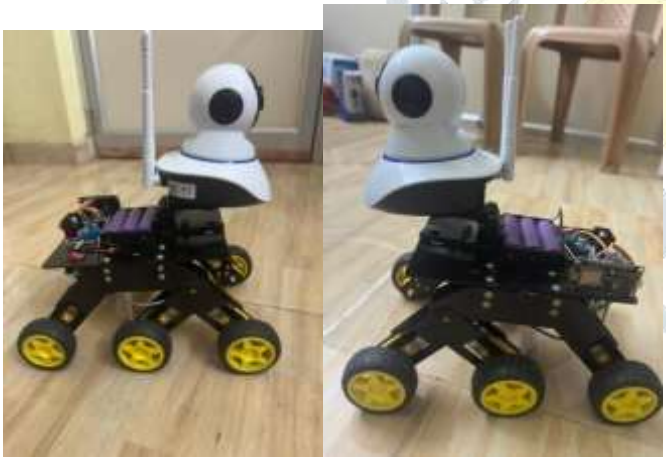
• Missing Person Detection and Monitoring
In large sanctuaries or parks, visitors may sometimes get lost or enter restricted areas. The robot can assist in locating missing persons by providing real-time visual monitoring in remote or hard-to-reach areas.

• Restricted Area Monitoring
The system can be used to monitor restricted or dangerous zones where human access is limited, ensuring safety and preventing unauthorized entry.

• Disaster and Emergency Surveillance
The robot can be deployed in disaster-prone areas such as landslides or collapsed structures to inspect conditions without risking human life.

• Military and Security Applications
The robot can be used for ground-level reconnaissance and surveillance in rough terrains where human access is risky.

IV.RESULTS:



V.CONCLUSION

This project presents the design and fabrication of a rocker–bogie based surveillance robot with an action camera mount for off-terrain applications. The rocker–bogie mechanism provides excellent stability and allows the robot to traverse uneven surfaces such as sand, grass, rough roads, and obstacles while maintaining continuous wheel contact.

The integration of DC gear motors, motor driver, and ESP-based control system enables effective wireless operation of the robot. The mounted camera provides real-time visual monitoring, making the system suitable for surveillance purposes in large and complex environments.

Experimental testing on different terrains confirmed that the robot can successfully adapt to off-terrain conditions and maintain stability during movement. The system demonstrates the potential of rocker–bogie mechanisms in real-world applications such as wildlife monitoring, zoo surveillance, and search operations for missing persons.

Overall, the project provides a cost-effective and efficient solution for remote surveillance in challenging environments, and it can be further enhanced with advanced features such as AI-based detection, GPS tracking, and autonomous navigation.

REFERENCES

[1] P. Panigrahi, A. Barik, Rajneesh R. & R. K. Sahu, “Introduction of Mechanical Gear Type Steering Mechanism to Rocker Bogie”, Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-5, ISSN: 2454-1362,2016.

[2] A. 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.

[9] Bui H. A., Mac T. T., Nguyen X. T., *"A Human Tracking System for the Rocker-Bogie Mobile Robot Utilizing the YOLOv8 Network,"* Vietnam Journal of Computer Science, vol. 12, no. 2, pp. 171–192, 2025.

[10] Sreevidya T. R. et al., *"Development of a Surveillance Robot with a Rocker Bogie Design for Versatile Terrain Navigation,"* IOP Conference Series: Materials Science and Engineering, vol. 1295, 2023.