IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, April 2024

Automatic Pothole Detection

Prof. C. S. Tikhe[1], Gargey Mahajan[2], Pratik Lande[3], Jayesh Nehete[4], Mehraj Pathan[5]
Guide, Department of Electronics and Telecommunication[1]
Students, Department of Electronics and Telecommunication[2, 3, 4, 5]
Pimpri Chinchwad Polytechnic, Pune, Maharashtra, India

Abstract: *The "Smart Mobility Solution: Autonomous Pothole Detection and Obstacle Avoidance System" project introduces a comprehensive approach to urban driving challenges, addressing both obstacle avoidance and proactive pothole detection. Leveraging an integrated system comprising an Arduino Nano microcontroller, GSM800 module, GPS Neo-6M module, ultrasonic sensor, IR sensor (E18), four DC motors (160 RPM), and a Li-ion battery pack, this initiative aims to redefine the landscape of urban transportation. A critical innovation within this project lies in the incorporation of an ultrasonic sensor, ingeniously situated between the chassis, actively measuring ground clearance. This sensor serves a dual purpose by not only detecting obstacles but also identifying potholes on the road. Upon detection of a pothole, the system triggers a sophisticated mechanism that combines the GPS Neo-6M module for precise location determination and the GSM800 module for instantaneous transmission of this data. This proactive approach towards pothole detection contributes significantly to the timely maintenance of urban road infrastructure.*

Keywords: obstacle avoidance, Ultrasonic sensor, GPS, GSM800

I. INTRODUCTION

The Automatic Driving and Potholes Detector project represents an innovative and intelligent solution in the realm of autonomous vehicles. Combining cutting-edge technologies, this system aims to enhance the safety and efficiency of automated transportation by addressing two critical challenges: obstacle avoidance and pothole detection. The core components of this project include an ultrasonic sensor, Arduino Nano microcontroller, GSM800 module, GPS Neo 6M module, four DC motors, Li-ion battery, and an IR sensor E18.

The primary objective of the system is to create a self-navigating car that not only adeptly avoids obstacles using infrared sensors but also actively detects and reports potholes in its path. The integration of an ultrasonic sensor beneath the chassis enables the car to gauge ground clearance, identifying potholes by measuring deviations in surface elevation. Upon detecting a pothole, the system employs the GPS module to pinpoint the exact location and utilizes the GSM module to transmit this information in real-time.

The autonomous vehicle's functionality is orchestrated by the Arduino Nano, which processes data from various sensors and controls the DC motors for navigation. The inclusion of a Li-ion battery provides a stable 11.1V power supply, ensuring continuous and reliable operation. The IR sensor E18 contributes to the obstacle avoidance feature, allowing the vehicle to make dynamic adjustments to its path to steer clear of potential obstructions.

This project not only addresses the technological challenges associated with autonomous navigation but also emphasizes the importance of infrastructure monitoring. By actively reporting pothole locations, the system contributes valuable data that can aid in city planning and maintenance efforts. The prospect of a self-driving vehicle equipped with advanced obstacle avoidance and pothole detection capabilities signifies a significant step towards safer and more efficient transportation systems. The ensuing sections will delve deeper into the individual components, operational features, and potential enhancements of this Automatic Driving and Potholes Detector.

II. LITURATURE REVIEW

Rode etal in his study said that, vehicles equipped with Wi- Fiwould gather road face information and transmit it to a Wi- Fi access point. The access point also sendsout cautions to other near vehicles about the peril. It turnsout, still, that the system is an expensive one since Wi-Fi stations must be placed in all vehicles and fresh access points must be set up.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, April 2024

Salari and Yu in their study developed a system for relating potholes using ray imaging. When the ray source deformation is shown in the recorded filml and, pavement torture similar as potholes may be linked. Potholes may be detected using a variety of styles, including multi-window median filtering and pipe partitioning. The intensity and form of these potholes are used to further categorise them. It is a good method for relating potholes, still because of the unevenness of the road face; the cameras take unsteady filml and, reducing the effectiveness of pothole identification.

III. BLOCK/CIRCUIT DIAGRAM

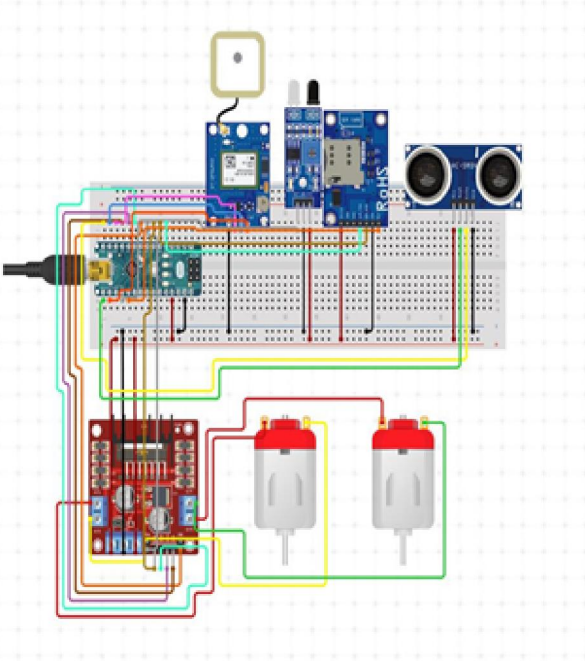

Fig. 1 Circuit diagram of system

IV. EQUIPMENTS USED

- Ultrasonic sensor
- Arduino nano
- Gsm800L
- GPS Neo 6m
- 4 Bo motor dc 160 rpm
- Acrylic base 30x25 cm
- li-ion 3.7v 3 cell in series = 11.1v supply
- IR sensor e18 for obstacle detection
- L298N

V. ADVANTAGES of SYSTEM

The Automatic Driving and Potholes Detector project, utilizing an array of sensors, GPS, and GSM modules, offers several advantages:

- Enhanced Road Safety: The project contributes to increased road safety by providing an autonomous system capable of obstacle avoidance and real-time pothole detection, reducing the risk of accidents.
- Proactive Infrastructure Maintenance: The system's ability to detect and report potholes allows for proactive road maintenance, enabling authorities to address issues promptly and prevent further deterioration.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, April 2024

- Live Location Reporting: The integration of GPS and GSM modules enables live location reporting, providing valuable data for tracking and monitoring the vehicle's movement in real-time.
- Optimized Traffic Flow: By incorporating obstacle avoidance mechanisms, the project aims to contribute to smoother traffic flow, especially in urban areas with congested road networks.
- Scalable Technology: The project's modular design and use of widely available components make it scalable and adaptable for integration into various vehicles and transportation systems.
- Efficient Resource Allocation: The data generated by the system can be used for efficient resource allocation in road maintenance, ensuring that repairs are prioritized based on real-time conditions.
- Cost Savings: Proactive maintenance and early detection of road issues can result in cost savings for municipalities, as addressing problems before they escalate may require fewer resources.
- Versatility for Various Environments: The adaptability of the project makes it suitable for deployment in diverse environments, from urban streets to rural roads, addressing road safety concerns across different landscapes.
- Technology Integration: The project integrates advanced technologies like GPS, GSM, and sensors, showcasing the potential of combining these technologies forcomprehensive solutions in autonomous vehicles.
- Educational Value: The project has educational significance, providing opportunities for learning and research in fields such as robotics, IoT, and autonomous systems.
- Potential Impact on Insurance: The incorporation of advanced safety features may influence the insurance industry, potentially leading to the development of new insurance models for autonomous and technologically advanced vehicles.

VI. RESULT

The working model of a proposed project system is shown in figure 2

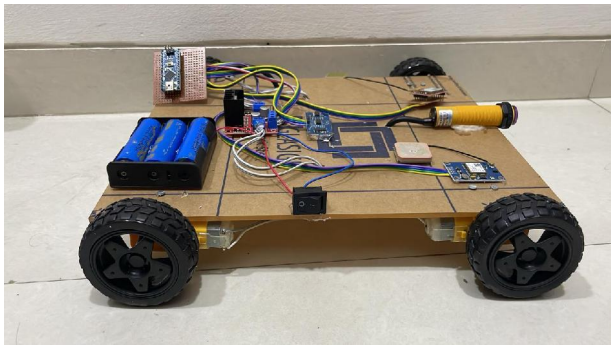

Fig. 2 Proposed working model

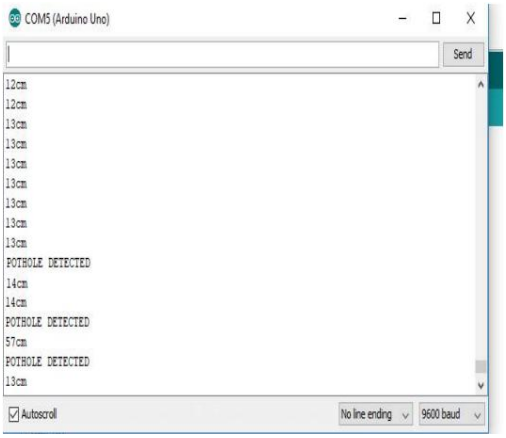

Fig. 3 Serial Monitor Window

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, April 2024

Figure 3 shows screenshot of serial monitor window of ARDUINO IDE. When the distance between vehicle and road surface is greater than threshold distance then pothole is detected.

VI. CONCLUSION

In conclusion, the Automatic Driving and Potholes Detector project presents a comprehensive and innovative solution aimed at improving road safety, infrastructure maintenance, and advancing the field of autonomous driving. The amalgamation of diverse technologies such as sensors, GPS, and GSM modules demonstrates the potential for creating intelligent and responsive systems for navigating dynamic environments.

The project's strengths lie in its ability to autonomously avoid obstacles, detect potholes in real-time, and provide live location reporting through GPS and GSM integration. These features have the potential to significantly enhance road safety, reduce accidents caused by obstacles, and enable timely infrastructure maintenance, particularly in addressing potholes.

VII. ACKNOWLEDGMENT

We would like to express our gratitude to Ms. Chaitali Tikhe, Lecturer of Electronics and Telecommunication Department at Pimpri Chinchwad Polytechnic, for her invaluable guidance and support throughout the research process. Her expertise and mentorship have been instrumental in shaping this study. We are deeply appreciative of her time, patience, and encouragement, which have contributed significantly to the completion of this paper.

REFERENCES

[1]. NikolausCorrell, Bradley Hayes, et al.Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms
[2]. Sebastian Thrun, Wolfram Burgard, and Dieter Fox"Probabilistic Robotics", MIT press.
[3]. Alfred Leick, Lev Rapoport, and Dmitry Tatarnikov"GPS Satellite Surveying".
[4]. Bern Grush, Barrie Kirk"Autonomous Vehicles: Opportunities, Strategies, and Disruptions"
[5]. Ramon Pallas-Areny, John G. Webster, "Sensors and Signal Conditioning" .
[6]. Edward A. Lee, Sanjit A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach" .
[7]. Paul Scherz, Simon Monk, "Practical Electronics for Inventors".
[8]. Alberto Cerpa, Deborah Estrin, "Wireless Sensor Networks: Principles, Design and Applications