Automatic Humps and Pothole Detection

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ABSTRACT

This abstract introduces a novel system for the automatic detection of speed humps and potholes on roadways, aiming to enhance road safety and improve the driving experience. Speed humps and potholes are common road hazards that can lead to accidents, vehicle damage, and discomfort for passengers. Traditional methods of detecting these road anomalies rely heavily on manual inspections, which are time-consuming, costly, and often result in delayed maintenance. To address these challenges, our proposed system leverages cutting-edge computer vision and sensor technologies.

The core components of our system include cameras, LiDAR (Light Detection and Ranging) sensors, and machine learning algorithms. Cameras capture real-time images of the road surface, while LiDAR sensors provide detailed depth information. The collected data is then processed through a deep learning model specifically trained for speed hump and pothole detection. The model identifies and classifies road anomalies, distinguishing between speed humps, potholes, and regular road surfaces.

Keywords: Road Safety, Smart Transportation, Speed Hump Detection, Pothole detection, Sensor Network.

I. INTRODUCTION

The global transportation landscape is undergoing a significant transformation, driven by the convergence of cutting-edge technologies, urbanization, and the pursuit of safer and more efficient mobility solutions. In this era of smart cities and connected vehicles, the Internet of Things (IoT) has emerged as a pivotal enabler of innovative transportation systems that enhance road safety and infrastructure maintenance. Among the persistent challenges faced by road authorities and drivers alike are the identification and management of road anomalies, notably speed humps and potholes.

This project introduces an innovative solution to address these challenges, utilizing the power of IoT to automate the detection and reporting of speed humps and potholes in real-time. By seamlessly integrating sensors, data analytics, and wireless connectivity, our system promises to revolutionize the way we perceive and manage road hazards.

This IoT-based approach not only enhances the safety of road users but also optimizes the allocation of resources for road maintenance, contributing to the development of smarter and more sustainable transportation infrastructures.
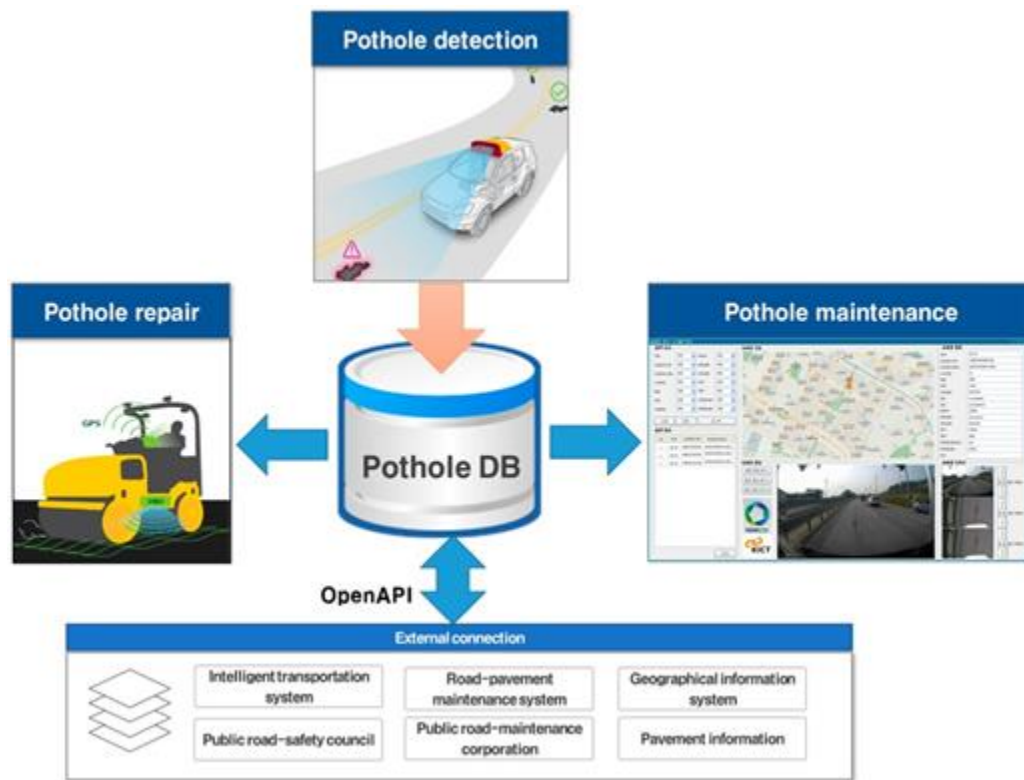

Fig. 1. Pothole Detection and prevention using sensor

II. REVIEW / LITERATURE SURVEY OF CONFERENCE/JOURNAL PAPERS SUPPORTING PROJECT IDEA

Sr. No	1
Paper Title	Automatic Detection of Potholes and Humps on Roads
Author	Prof. Chandrakant Bhange, Sneh Kurhade, Laukik Arewer, Ashish Kumar.
Year	2022
Problem solved inthis paper Existing ProblemStatement	The problem addressed in this paper is the detection and notification of Humpsand Pothols on roads to aid drivers.
Technique used to solve problem Existing Problem Solution	It mentions various approaches such as SVM based techniques, an droid based road danger detecting system, Gps and Accelerometer based methods,Vision based systems using cameras, Sensor equipped public transportation systems.
What will be future work:Future Scope	Integration of machine learning, real time data anlysis, crowdsourcing and Datasharing, Infrastructure improvement.
Sr. No	2
Paper Title	Automatic Detection and Notification of Potholes and Humps on Roads using IoT.
Author	Swetha, Punith gowda, Lalithesh, Deepak Sharan, Shivuprasad

Year	2020
Problem solved in this paper Existing Problem Statement	The problem solved in this paper is the detection of potholes and humps on roads using low-cost ultrasonic sensors and alerting drivers through a mobile application to avoid potential accidents. captures the geographical coordinates of the potholes and humps using a GPS receiver and sends the data to maintenance authorities for analysis and action.
Technique used to solve problem Existing Problem Solution	The technique used to solve the problem Utilizing low-cost ultrasonic sensors, Integration with Node MCU microcontroller, GPS coordinates and Thing Speak cloud.
What will be future work : Future Scope	Future work in this area could Safer route recommendations, Integration with smart city infrastructure, Expansion to other road conditions, Collaboration with maintenance authorities.
Sr. No	3
Paper Title	Detection pothole and humps on the road and information sharing.
Author	Prof. Lavanya, Vijayalakshmi, Manu, Kushbu, Varsha
Year	2020
Problem solved in this paper Existing Problem Statement	detection of potholes on roads. This system, that we call the Pothole Detection System, uses Accelerometer Sensor of Android smartphone for detection of potholes and GPS for plotting the location of potholes on google maps.
Technique used to solve problem Existing Problem Solution	Image segmentation techniques for pothole detection, Hybrid classifiers like neural network and fuzzy rule base, Ultrasonic sensors for pothole and hump detection, Kinect sensor for capturing RGB and depth images, Partial differential equations for image segmentation, Support Vector Machine (SVM) for pothole detection.
What will be future work : Future Scope	Development of intelligent and autonomous vehicles that can detect and avoid potholes using the proposed detection systems. Integration of the pothole detection systems with smart city infrastructure for efficient road maintenance and repair planning. Investigation of the scalability and feasibility of implementing the proposed systems on a larger scale, such as city-wide or nationwide deployment
Sr. No	4
Paper Title	Development of an Effective Road Surface Monitoring System for Automated Pothole Detection.
Author	Prof. Kanchan Pradhan, Daphal Pooja, Gardi Komal, and Salke Priyanka.
Year	2019
Problem solved in this paper Existing Problem Statement	The problem solved in this paper is the development of an effective road surface monitoring system for automated pothole detection. This system aims to provide real-time information to drivers about potholes on the road, helping them avoid accidents and enabling authorities to take preventive

	actions.
Technique used to solve problem Existing Problem Solution	use of a wireless sensor network and an ultrasonic sensor.
What will be future work : Future Scope	Integration with smart city infrastructure and Expansion to other road surface anomalies.
Sr. No	5
Paper Title	A Cost Effective Solution for Pothole and Hump Detection on Roads in India.
Author	Lokesh S and Srinivas G.
Year	2019
Problem solved in this paper Existing Problem Statement	Address the issues of potholes and humps on roads in India, which contribute to traffic congestion, accidents, and loss of human lives. The paper aims to propose a cost effective solution for the automatic detection of potholes and humps on roads and collecting data to fix the problem.
Technique used to solve problem Existing Problem Solution	Use of a camera with Raspberry Pi and an Android application for capturing images of potholes and humps and sending them to a server for necessary actions to be taken It captures the geographical location coordinates of the potholes and humps using a global positioning system (GPS) receiver.
What will be future work : Future Scope	The future scope of the proposed solution includes the integration of machine learning algorithms to improve the accuracy of pothole and hump detection. This can involve training the system to differentiate between actual potholes and other road irregularities, such as speed breakers or road cracks. Additionally, the system can be enhanced to provide real-time alerts to drivers through mobile applications or in-vehicle systems.
Sr. No	6
Paper Title	Automatic Detection of Potholes and Humps on Road.
Author	Parag Kadale, Shivam Barde, Anand Pawar.
Year	2018
Problem solved in this paper Existing Problem Statement	potholes on roads and the development of a system to provide timely action to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify the potholes, and the depth of the pothole is displayed on an LCD screen.
Technique used to solve problem Existing Problem Solution	Displaying the depth of the detected pothole on an LCD screen. Incorporating a GPS receiver to capture geographic location and time. Implementing a DC motor driver (L293D) to control the movement of the robot.
What will be future work : Future Scope	Integrating the pothole detection system with a centralized database to create a real time monitoring and maintenance system. Developing a mobile application that allows users to report potholes and receive updates on their status. Exploring the use of

	advanced sensors, such as LiDAR or radar, for more precise and efficient pothole detection.
Sr. No	7
Paper Title	Automatic Detection of Potholes and Humps on Roads to Driver Using PIR Sensor.
Author	Mr.S. Rajadurai, Mr.P. Thiyagarajan, Ms.R. Sandhiya.
Year	2018
Problem solved in this paper Existing Problem Statement	The problem addressed in this paper is the high number of road accidents and casualties in India, caused by factors such as bad roads, careless user behavior, and poor enforcement of traffic rules. The paper proposes a solution that involves using sensors in vehicles to detect road anomalies like potholes, and transmitting this data to a central system for analysis.
Technique used to solve problem Existing Problem Solution	The paper mentions the use of tri-axial accelerometers as sensors for collecting data on road roughness. Machine learning techniques are also suggested to improve the efficiency and accuracy of the system. Additionally, the paper mentions the use of PIR sensors for motion detection.
What will be future work : Future Scope	The future scope for this article includes the potential for further advancements in sensor technology and machine learning algorithms to improve the accuracy and efficiency of the system . Additionally, the integration of other data sources such as GPS and traffic cameras could enhance the capabilities of the system.
Sr. No	8
Paper Title	Automatic humps and pothole detection on road.
Author	Mahesh Jala, Ajay Chauhan , Prof. Varun Mishra.
Year	2017
Problem solved in this paper Existing Problem Statement	The problem solved in this paper is the detection of potholes on roads and the development of a system to provide timely action to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify the potholes, and the depth of the pothole is displayed on an LCD screen.
Technique used to solve problem Existing Problem Solution	Utilizing ultrasonic sensors to detect potholes and obstacles on the road. Using IR sensors to detect infrared light and transform it into an electric current. Interfacing the controller and communication module with the Max 232 block. Displaying the depth of the detected pothole on an LCD screen.
What will be future work : Future Scope	Integrating the pothole detection system with a centralized database to create a real time monitoring and maintenance system. Developing a mobile application that allows users to report potholes and receive updates on their status. Exploring the use of advanced sensors, for more precise and efficient pothole detection. Investigating the possibility of autonomous repair systems that can automatically fill detected pothole.
Sr. No	9
Paper Title	Automatic Detection and Notification of pothole and Humps on Roads Using IOT.
Author	Kunal D. Patil, Shardul R. Patil, Vipul V. Kale, and Shubham S. Thorat.

Year	2017
Problem solved in this paper Existing Problem Statement	The problem statement of the paper is to address the issues of potholes and humps on roads in India, which contribute to traffic congestion, accidents, and loss of human lives. The paper aims to propose a cost effective solution that collects information about the severity of potholes and humps and helps drivers to drive safely.
Technique used to solve problem Existing Problem Solution	paper mentions the use of a camera with Raspberry Pi and an Android application for capturing images of potholes and humps and sending them to a server for necessary actions to be taken.
What will be future work : Future Scope	The system can be enhanced to provide real time alerts to drivers through mobile applications or in-vehicle systems, allowing them to take necessary precautions while driving on roads with potholes and humps.
Sr. No	10
Paper Title	Detecting Potholes And Humps Using Simple Image Processing Techniques And Real World Footage.
Author	Samyak Kathane, Vaibhav Kambli, Tanil Patel, Rohan Kapadi.
Year	2017
Problem solved in this paper Existing Problem Statement	Detection of potholes on roads using image processing techniques. The proposed system aims to identify potholes in real-time and provide timely alerts to drivers, reducing the potential for accidents and vehicle damage . The system utilizes various image processing techniques such as frame extraction, gray scale conversion, filtering, edge detection, contour detection.
Technique used to solve problem Existing Problem Solution	The techniques used in the article "Detecting Potholes Using Simple Image Processing Techniques and Real World Footage" include: Preprocessing, Blurring, Morphological Operations, Edge Detection , Segmentation, Threshold.
What will be future work: Future Scope	The future scope for the article" Detecting Potholes Using Simple Image Processing Techniques and Real-World Footage" includes the following possibilities: Integration with Autonomous Vehicles: As autonomous vehicles become more prevalent.

III.LIMITATIONS OF EXISTING SYSTEM

- **Accuracy and False Positives**: Detection systems may occasionally produce false positives, incorrectly identifying road irregularities as humps or potholes. This can result in unnecessary alerts and maintenance actions, wasting resources.
- **Limited Detection Range**: Some systems may have a limited detection range, which can result in late notifications to drivers or maintenance crews, reducing their ability to respond promptly.
- **Dependence on Road Surface Conditions**: The accuracy of detection can be influenced by road surface conditions, such as wet or icy surfaces, which may affect the sensor's ability to identify humps and potholes accurately.

- **Sensor Calibration and Maintenance**: Maintenance and calibration of sensors can belabor-intensive and expensive. Sensors may require frequent adjustments orreplacements to maintain accuracy.
- **Vulnerability to Environmental Factors:** Environmental conditions like heavy rain,snow, or fog can impair the performance of certain sensors or cameras, leading to reduced accuracy in detecting road anomalies.

IV.CONCLUSION

In conclusion, the development and implementation of automatic humps and pothole detection systems represent a significant stride towards safer and more efficient road transportation. These systems leverage advanced technologies, including IoT, computer vision, and machine learning, to address critical road infrastructure challenges.

V. REFERENCES

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