IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Pothole Alert System For Safer Two-Wheeler Riding

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Abstract: This study has been undertaken to investigate the determinants of stock returns in Karachi Stock Exchange (KSE) using two assets pricing models the classical Capital Asset Pricing Model and Arbitrage Pricing Theory model. To test the CAPM market return is used and macroeconomic variables are used to test the APT. The macroeconomic variables include inflation, oil prices, interest rate and exchange rate. For the very purpose monthly time series data has been arranged from Jan 2010 to Dec 2014. The analytical framework contains**.**

Keywords: LiDAR technology, IoT, Road safety, GPS module, Geolocation, Real-time sensor data, Alert system, Web platform.

I. Introduction

The monsoon season in India presents a recurring challenge, where inadequately constructed and poorly maintained roads often deteriorate, leading to the formation of hazardous potholes. These road imperfections have significant consequences, contributing to approximately 6% of accidents, with a particular focus on two-wheeler vehicles. The inherent vulnerability of two-wheeler riders to such hazards underscores the urgent need for innovative solutions to mitigate accidents caused by potholes.

In response to this critical issue, this project introduces an advanced approach to assess pothole severity and provide timely warnings to riders, enabling them to take evasive measures. The data is meticulously logged within the device's internal storage and seamlessly transmitted to a remote database when an internet connection is established, with a dedicated web page providing an intuitive map interface that serves as a valuable resource for both the general public and municipal officials, facilitating the visual exploration. Integral to our system is its adeptness in real-time sensor data processing, enabling the instantaneous identification and classification of pothole severity levels, upon detection, generates immediate alerts for riders ,while also integrating with a web platform to offer a comprehensive view of road conditions and contribute historical data on pothole occurrences, serving as a proactive tool for enhancing road safety.

II. Abstract

The "Pothole Alert System for Safer Two-Wheeler Riding" project addresses the pressing issue of road safety in India, particularly during the monsoon season when hazardous potholes are prevalent. Potholes are responsible for approximately 6% of accidents, with a significant number involving two-wheeler vehicles. To mitigate these accidents, this innovative system employs a GPS module to pinpoint potholes' exact locations and assess their severity. The data is stored on the device and later transmitted to a remote database when an internet connection is available. A dedicated web page displays this information on a map, allowing both the public and municipal officials to understand the distribution of potholes. The system processes real-time sensor data to instantly identify and classify potholes by severity. When a pothole is detected, it generates immediate alerts for riders through various communication channels, including visual indicators on the vehicle's dashboard and audible alarms. Integration with a web platform also provides historical data on pothole occurrences and road conditions. This project's goal is to reduce accidents caused by potholes by implementing an intelligent system that rapidly detects and communicates pothole severity to two-wheeler riders. It not only enhances road safety but also encourages collaboration between the public and relevant authorities to facilitate proactive road maintenance. In summary, the Pothole Alert System is a comprehensive solution that leverages technology to address a critical safety issue on Indian roads and fosters a more proactive approach to road maintenance and safety.

III. Literature Review

First Study: June 2012, Author: SHENU P M, Methodology: Utilizing LiDAR sensors and laser technology, the second study presents an approach to analyze potholes and bumps to prevent crashes. This research revolves around the "Automated Detection of Dry and Water-Filled Potholes using a Multimodal Sensing System."

Second Study: August 2015, Authors: Rajeshwari Madli, Santosh Hebbar, Praveenraj Pattar, Varaprasad Golla, Methodology: The first study proposes a real-time application of sensors and modules to prevent fatal crashes and accidents. The system focuses on the "Automatic Detection and Notification of Potholes and Humps on Roads to Aid Drivers."

Third Study: March 2019, Authors: V.N. Raj Sudarshan, S. Ramesh, S. Damodaran, M. Uthavanatha, Sarath Santar, M. Kamalakannan, Methodology: The third study introduces a novel concept of placing LiDAR sensors on two-wheelers to create a real-time alert system for riders. It focuses on "Pothole and Hump recognition using LiDAR sensor."

IV. Methodology

LiDAR operates on a similar concept to Electronic Distance Measuring Instruments (EDMIs), in which energy reflected from a laser beam shot from a transmitter is recorded. It is possible to calculate the distance between the transmitter and reflector using this laser's time of travel (ToT). The reflector may be a manmade prism or an object found in nature. This distance is one of the main measurements used for LiDAR ranging, and when combined with other readings, it also yields the reflector's coordinates. The paragraphs that follow illustrate this.

In the LiDAR project, we aim to utilize LiDAR technology for detecting and identifying road surface irregularities such as potholes and speed bumps. The system will be designed to analyze the change in distance between consecutive laser shots. When the LiDAR sensor hits an object, such as a pothole or a speed bump, at an angle, it will register a change in the measured distance. If the distance increases between consecutive shots, it will be noted as a pothole, indicating a depression in the road surface. Conversely, if the distance decreases, it will be interpreted as encountering a speed bump, indicating an elevated obstacle.

This project intends to leverage LiDAR's high precision and rapid data acquisition capabilities to create a comprehensive mapping system that can identify and categorize road surface irregularities in real-time. By implementing LiDAR technology in this manner, we aim to enhance road safety and facilitate efficient road maintenance by providing accurate and timely information about potential hazards to drivers and maintenance crews.

V. Hardware Description

A. LiDAR Sensor

fig 1.1

The TF Luna LiDAR detector is a compact and featherlight Time- of- Flight(ToF) LiDAR device designed for precise distance dimension and handicap discovery in a variety of operations. It operates by emitting palpitated infrared ray shafts and measuring the time it takes for these beats to bounce back from objects in its terrain. With a range of over to 8 measures and a 160- degree field of view, the TF Luna is suitable for tasks similar as collision avoidance in robotics, altitude control in drones, and propinquity seeing in artificial robotization. Its small form factor, low power consumption, and accurate distance dimension capabilities make it an excellent choice for systems taking dependable LiDAR data. The TF Luna detector is known for its ease of integration with colorful microcontrollers and platforms, as it communicates over a simple diurnal interface.The TF Luna is well- suited for a range of operations where accurate distance seeing and handicap discovery are critical.This is the Benewake Software for LiDAR TF Luna.

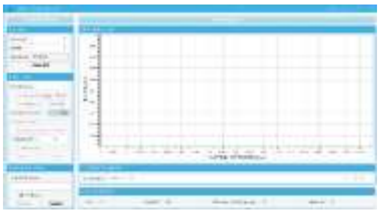

fig 1.2

B. ESP32 Module

The ESP32 is a protean and important microcontroller and Wi-Fi/ Bluetooth system-on-chip (SoC) manufactured by Espressif Systems. It combines a double-core processor, a rich set of supplemental interfaces, inculcated wireless connectivity (Wi-Fi and Bluetooth), and expansive libraries for IoT(Internet of Things) operations. The ESP32 is known for its low power consumption, making it suitable for battery-powered and energy-effective bias, and its support for a wide range of development platforms and programming languages, making it a popular choice for IoT, and DIY systems.

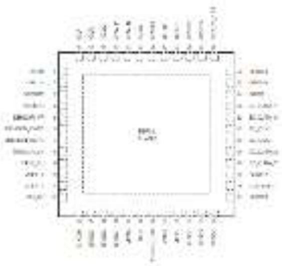

fig 1.3

C. GPS Module

A GPS module for a microcontroller is a compact electronic device that integrates a Global Positioning System receiver, which allows the microcontroller to directly determine its geographic position by entering signals from onboard GPS satellites. These modules generally give latitude, longitude, altitude, and accurate time data, enabling a microcontroller to accumulate position information for operations, including navigation, shadowing, geofencing, and position-grounded services. They frequently offer a simple interface for communication with microcontrollers, making it convenient to integrate GPS capabilities into systems without the need for complex GPS signal processing, therefore enhancing the microcontroller's functionality by adding position-alertness.

fig 1.4

D. Vehicle Integration Interface

A Vehicle Integration Interface, in terms of hardware, serves as a ground for connecting to a vehicle's onboard systems, including the electronic control unit (ECU) and vehicle diagnostics haven. This essential element enables communication with the vehicle's internal electronic systems, furnishing access to individual data, performance parameters, and control functionalities. By establishing this connection, it facilitates real- time monitoring, diagnostics, and implicit customization of the vehicle's operation, making it a pivotal tool for line operation, vehicle tuning, and remote vehicle operation.

E. Flow Diagram of Sensor Alert System

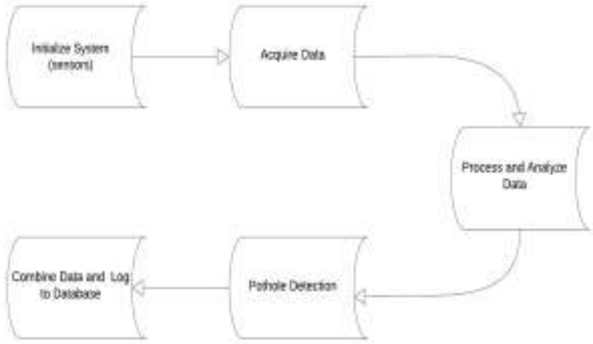

fig 1.5

The system is initialized when the vehicle is powered on. Sensors are activated and are on alert to gather information from detected potholes. The data is then processed and analyzes further to verify if it is a pothole. Send an alert to the vehicle rider about pothole The data about pothole’s location is stored in the database.

VI. Software Description

The system comprises several key software components that work together to ensure its functionality. To begin with, there's the Firmware/Embedded Software, responsible for controlling hardware components, managing data, and facilitating communication with the vehicle's systems. It serves as the backbone of the entire system.

Additionally, Data Processing Algorithms play a vital role in real-time sensor data processing, enabling the system to detect potholes and classify their severity swiftly.

To store and manage the collected data, the Database Management System software is used, ensuring the efficient creation, management, and synchronization of a remote database dedicated to storing pothole information.

The Web Application component is a web-based interface essential for visualizing pothole data on a map. It incorporates various web technologies like HTML, CSS, JavaScript, and server-side scripting to provide an accessible platform for users.

For seamless communication, Communication Protocols software is employed to support diverse channels such as HTTP/HTTPS for web-based communication.

Geographical Information System (GIS) Software is used for mapping and visualizing pothole data, allowing for a comprehensive view of the data's geographical context.

Security Measures are integrated into the system, encompassing access control and encryption software to safeguard both the data and the device.

The Integration with a Web Platform involves the development of APIs and software components that enable the system to integrate with a web platform for data presentation and analysis.

Furthermore, Historical Data Management software is crucial for storing, retrieving, and analyzing historical pothole data, providing insights over time.

Lastly, if applicable, User Interface (UI) development is undertaken to create a user-friendly interface for system configuration and monitoring. These software components collectively form the framework of the system, ensuring its effectiveness and reliability.

VII. Expected Result

Installation on Vehicles: The implementation of the system involves the installation of the pothole and speed bump recognition technology onto vehicles.

Utilization of LiDAR Sensor Technology: The system utilizes advanced LiDAR (Light Detection and Ranging) sensor technology for the precise detection of potholes and speed bumps on road surfaces.

Alerting Driver with Alarms: Upon detecting potholes or speed bumps, the system provides immediate warnings to the vehicle's driver through audible alarms, ensuring driver awareness of the upcoming road conditions.

Transmission of GPS Location Data: The system seamlessly transmits GPS location data to municipal authorities. This data includes the precise geolocation of detected road anomalies, which can be valuable for authorities in making informed decisions regarding road maintenance and safety enhancements.

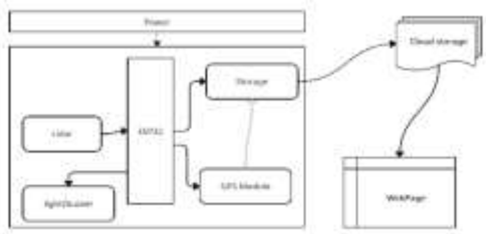

fig 1.6

VIII. Advantages of the designed system

a) Enhanced Road Safety: The system significantly enhances road safety by alerting drivers to the presence of potholes and speed bumps, reducing the risk of accidents and damage to vehicles.

b) Accurate Detection: Utilizing LiDAR sensor technology ensures accurate and reliable detection of road anomalies, minimizing false positives and false negatives.

c) Real-time Alerts: The system provides real-time alerts to drivers, allowing them to take timely corrective actions, such as slowing down or maneuvering, to mitigate the impact of road irregularities.

d) Data for Municipal Authorities: Sending GPS location data to municipal authorities facilitates efficient road maintenance and repair, as it provides precise locations of potholes and speed bumps.

e) Cost-effective Solution: Compared to manual inspection and reporting, the system offers a cost-effective solution for identifying and addressing road anomalies.

IX. Testing of the System Prototype

a) Location detected by GPS module and respective LED colour blinks according to distance

fig 1.7

b) GPS location, date and time is shown as output when distance is increased above threshold distance.

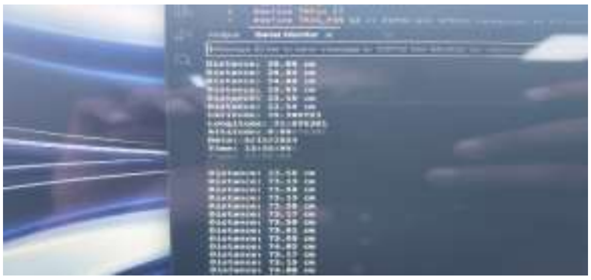

fig 1.8

c) Output Display on Webpage.

fig 1.9

X. References

[1] Sabari Kanth K K , *"Pothole Detection System in Vehicle"* ,International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075 (Online), Volume-10 Issue-8, June 2021.

[2] M.S. Kamalesh , Bharatiraja Chokkalingam ,Jeevanantham Arumugam, Gomathy , Sengottaiyan, Shanmugavadivel Subramani and Mansoor Ahmad Shah, *"An Intelligent Real Time Pothole Detection and Warning System for Automobile Applications Based on IoT Technology"*, Journal of Applied Science and Engineering, Vol. 24, No 1, Page 77-81, June 27 2020.

[3] Gouravi Tandel, Pranali Sawant, Mandar Ghadi, Shubham Jain, Poonam Joshi, *"Automatic Detection of Potholes and Humps with Complaint Registration and Notification System"* , International Journal of Engineering Research & Technology.

[4] V.N.Raj Sudarshan, S. Ramesh , S.Thamodharan , M. Uthavanatha , Sarath Santar , M.Kamalakannan , *"Pothole and Hump*

recognition using LiDAR sensor", International Research Journal of Engineering and Technology (IRJET), Volume: 06, Mar 2019.

[5] T S Arulananth, M. Baskar, K. Thrishma, N. Srilekha, Sai Supraja, Ch. Ravalika , "*Pothole Detection Using Arduino and Ultrasonic Sensors"*, Mandal, J.K., De, D.(eds) Advanced Techniques for IoT Applications. EAIT 2021. Lecture Notes in Networks and Systems, vol 292.

[6] G. Singal, A. Goswami, S. Gupta, T Choudhury *" PITFREE: Potholes Detection on Indian Roads Using Mobile Sensors"* IEEE 8th International Advance Computing Conference (IACC), 14th-15th dec. 2018.

[7] Etukala Jaswanth Reddy, Padhuri Navaneeth Reddy, Govindula Maithreyi, *"Development and Analysis of Pothole detection and Alert based on NodeMCU"*2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE).

[8] Dhwani Desai, Abhishek Soni, Dhruv Panchal, Sachin Gajjar, *"Design, Development and Testing of Automatic Pothole Detection and Alert System"*2019 IEEE 16th India Council International Conference (INDICON).

[9] Government of India Transport Research Wing Report, *"Road Accidents in India"*, Ministry of Road Transport and Highways [Online], 10 June 2019.

[10] R. Madli, S. Hebbal, P. Pattar and V. Golla, *"Automatic Detection and Notification of Potholes and Humps on Roads to Aid Drivers,"* in IEEE Sensors Journal, vol. 15, no. 8, pp. 4313-4318, Aug. 2015.