



Path Pulse - A Smart Pathhole Detection

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Abstract—

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Road infrastructure plays a vital role in transportation safety, and potholes are a common road defect that can cause vehicle damage, traffic disturbances, and road accidents. Traditional pothole reporting methods often lack an efficient mechanism for accurately identifying locations, monitoring repair status, and maintaining centralized records. To address these challenges, this paper presents **PathPulse AI**, a geolocation-based pothole reporting and road safety management system designed to support the reporting, visualization, and management of pothole-related information. The proposed system enables pothole reports to be associated with geographical coordinates and displayed on an interactive map, helping users identify reported road defects and understand their locations.

It also supports the management of pothole details, including severity and status, while providing database management features to organize reports and facilitate their retrieval. The system incorporates database storage and reporting mechanisms to support the maintenance of pothole records and improve information accessibility. By bringing location-based reporting and status monitoring into a unified platform, PathPulse AI aims to assist road users and responsible authorities in identifying road maintenance needs and prioritizing potential problem areas. The proposed system provides a foundation for more systematic road defect monitoring and can be extended in the future with automated image-based pothole detection, advanced severity classification, and analytical tools for road maintenance planning.

Keywords— PathPulse AI ; Pothole Reporting; Geolocation; Road Safety; Interactive Mapping; Road Maintenance Management



I. INTRODUCTION

Road safety is an important concern due to the increasing number of road defects, particularly potholes, that can cause accidents, vehicle damage, and traffic congestion. Identifying and reporting potholes in a timely manner is essential for maintaining safe and reliable road infrastructure. However, traditional reporting methods may make it difficult to identify exact locations and monitor the repair status of road defects.

To address these challenges, PathPulse AI is developed as a geolocation-based pothole reporting and road safety management system. The system enables users to report potholes and view their geographical locations on an interactive map. It also supports the management of pothole details, including location coordinates, severity, and status. The system maintains organized records that help users search, filter, and monitor reported potholes efficiently.

The main objective of PathPulse AI is to provide a centralized platform for pothole reporting, location visualization, and status monitoring. By integrating geolocation and database management, the system aims to improve access to road defect information and support road maintenance activities. In the future, the system can be enhanced with automated pothole detection and advanced analytical techniques to further improve road safety management.

Road infrastructure is a fundamental component of economic development and urban mobility, providing connectivity between residential areas, commercial centers, and essential public services. However, the increasing pressure on road networks, changing weather conditions, heavy vehicle loads, and inadequate maintenance can lead to the deterioration of road surfaces. Potholes are among the most common forms of road damage and can significantly affect transportation efficiency and public safety. Their presence may increase the risk of accidents, cause damage to vehicles, and create difficulties for pedestrians

and cyclists. Conventional road inspection and maintenance practices often require considerable time and human effort, particularly when monitoring large road networks. Therefore, effective road condition monitoring, accurate defect localization, and timely reporting are essential for improving road maintenance practices. The integration of digital technologies, geospatial information, and centralized data management offers opportunities to improve the identification, documentation, and monitoring of road defects. Such approaches can support informed maintenance decisions, improve resource allocation, and contribute to the development of safer and more sustainable transportation infrastructure.

II. LITERATURE REVIEW

Previous research has explored various techniques for identifying road damage and improving road condition monitoring. Ma et al. [1] reviewed computer vision techniques for pothole detection, including image processing, three-dimensional road modelling, and deep learning. Their study highlighted the development of automated detection methods while identifying challenges associated with reliable road damage assessment. Arya et al. [2] introduced the RDD2020 dataset, containing road images from India, Japan, and the Czech Republic, to support the development and evaluation of automatic road damage detection techniques. This dataset provides valuable resources for researchers working on road damage classification and monitoring. However, image-based detection approaches primarily focus on identifying and classifying road defects, rather than managing the complete reporting and monitoring process.

Although existing research has contributed to improving road damage detection, effective road maintenance also requires accurate location information, organized records, and systematic tracking of reported defects. PathPulse AI addresses this practical need through a geolocation-based pothole reporting and management system that displays reported



potholes on an interactive map. It supports the organization of pothole information, including geographical coordinates, severity, and status, helping users search and monitor reports efficiently. Unlike systems primarily focused on automated image recognition, the proposed system emphasizes location visualization, report management, and status monitoring within a unified platform. Its main contribution is the integration of these functions to support road defect monitoring and maintenance planning. Future enhancements may include automated pothole detection, advanced severity classification, and analytical features to further improve road infrastructure management.

III. METHODOLOGY

The methodology of PathPulse AI involves the design and development of a geolocation-based pothole reporting and road safety management system. The system follows a structured approach consisting of pothole reporting, geographical location identification, map visualization, and database management. Users can report potholes, and their geographical coordinates are used to represent the reported locations on an interactive map. Each report can include relevant information such as pothole severity and current status, enabling systematic monitoring of road defects.

The system is evaluated through functional testing of its major components, including report creation, geographical location display, status management, and report retrieval. Map visualization is also examined to ensure that pothole markers correspond to their recorded geographical coordinates at different zoom levels. The results of these tests can be used to identify implementation issues and assess the system's practical usability. The methodology emphasizes accurate record management and consistent location representation rather than claiming automated pothole detection.

PathPulse AI aims to provide an organized and accessible approach to road defect monitoring. Ethical considerations include protecting user

information, securing stored records, and ensuring that reported locations and severity information are represented responsibly. The system can be extended in the future with image-based pothole detection, advanced data analysis, and additional evaluation techniques to improve road maintenance planning.

IV. RESULTS AND DISCUSSION

1. ADMIN PAGE

a) Admin Dashboard

The PathPulse AI dashboard displays key statistics, including total reports, active potholes, resolved potholes, and high-severity potholes. It also provides a Pothole Detection Ride feature that uses GPS tracking and accelerometer data to support pothole detection and location mapping.

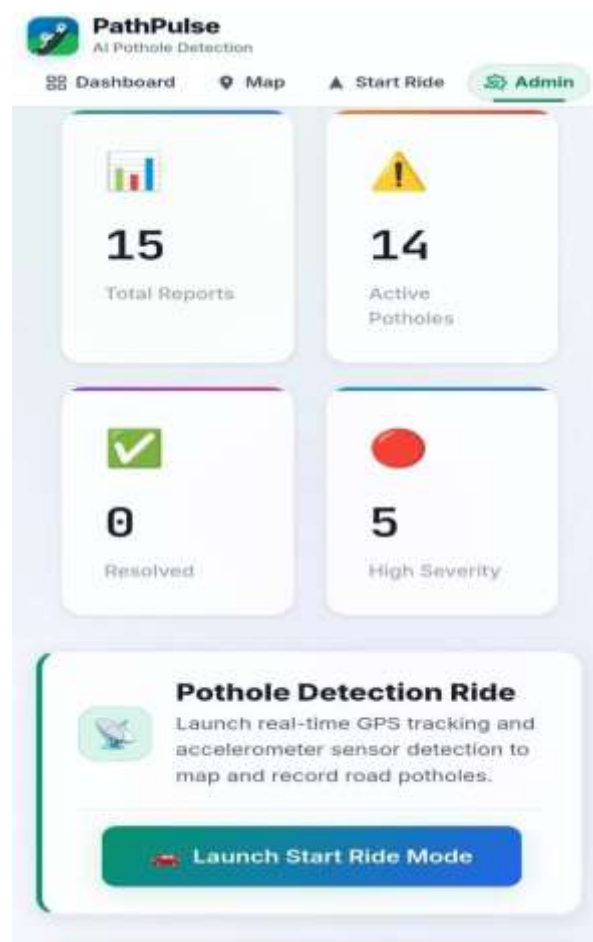


Fig. 1a. Admin Dashboard of the PathPulse



b) Detecting pathole by admins

The accelerometer interface displays real-time X, Y, and Z axis readings, acceleration magnitude, and a live graph. These sensor readings support the identification of sudden movements that may indicate potholes during a ride.



Fig. 1b. Accelerometer Sensor Data for Pathole Detection

c) Reported Patholes

The reported pothole data interface displays pothole IDs, geographical coordinates, severity levels, and report details. It also provides status filters, date selection, and search options to help administrators efficiently manage pothole records.

Shows the latitude and longitude based on detected patholes in admin reported data, and also show the date and time.

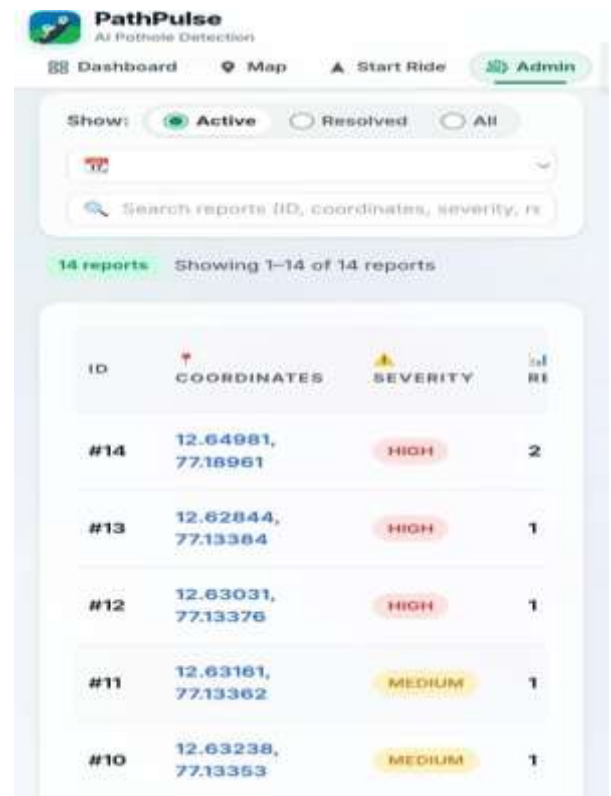


Fig. 1c. Reported Pothole Data in the Admin Panel

2. USER PAGE

a) User Map page

The user interface provides an interactive map for viewing locations and selecting destinations. It includes location search, current location access, map controls, and pothole viewing options to support navigation and road defect monitoring.

This map includes 3D and 2D view and we can search the destination manually by palcing the place name.

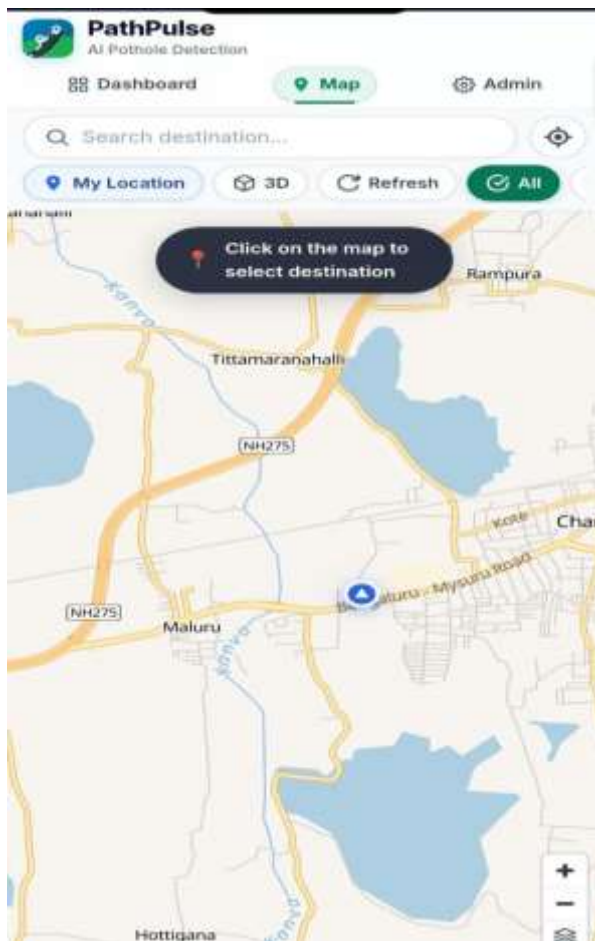


Fig. 2a. User Interface of the map

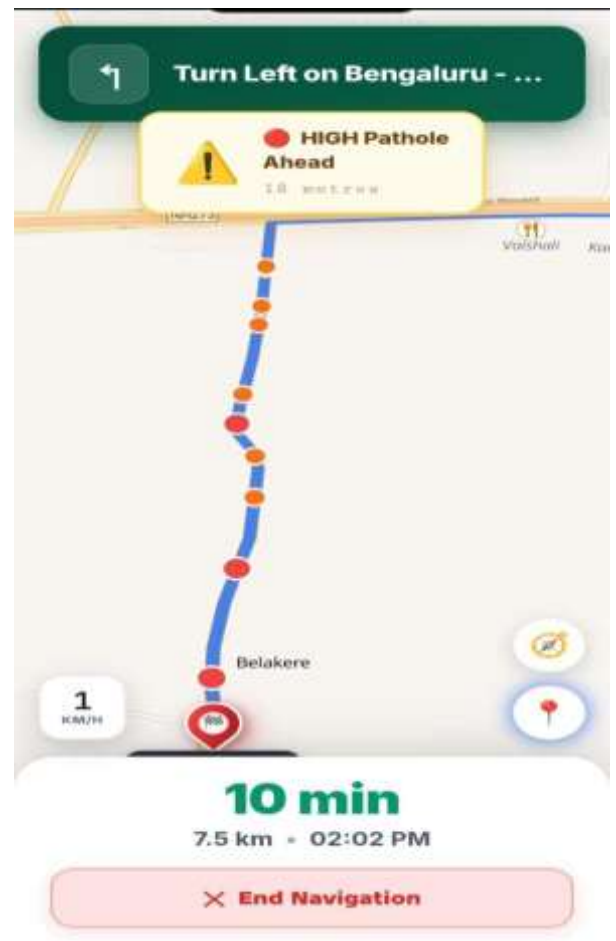


Fig.2b. Real-Time Navigation and Pothole Warning Interface

b) Navigtion with pathole mark

The real-time navigation feature of PathPulse AI integrates route guidance with pothole hazard notifications. The interface displays turn-by-turn directions, the remaining travel distance, estimated travel time, and nearby pothole warnings. Each warning indicates the pothole severity and its distance from the user, helping drivers anticipate road hazards along the selected route. The map also highlights reported pothole locations using visual markers. This integration supports safer route awareness and helps users make informed decisions while travelling.

V. CONCLUSION

PathPulse AI provides an integrated approach to pothole detection, reporting, and road hazard monitoring using GPS tracking and accelerometer sensor data. The system displays pothole locations on an interactive map, classifies their severity, and provides real-time navigation warnings to users. The administrative dashboard supports report management and monitoring of road conditions. By combining sensor-based detection, geographical mapping, and navigation assistance, PathPulse AI aims to improve road safety awareness and support efficient identification of road defects. In the future, the system can be enhanced with advanced machine learning techniques and wider real-world testing to improve detection reliability and support large-scale implementation.



REFERENCES

- [1] X. Li and D. W. Goldberg, "Toward a mobile crowdsensing system for road surface assessment," *Computers, Environment and Urban Systems*, vol. 69, pp. 51–62, 2018, doi: 10.1016/j.compenvurbsys.2017.12.005.
- [2] G. Singh, D. Bansal, S. Sofat, and N. Aggarwal, "Smart patrolling: An efficient road surface monitoring using smartphone sensors and crowdsourcing," *Pervasive and Mobile Computing*, vol. 40, pp. 71–88, 2017, doi: 10.1016/j.pmcj.2017.06.002.
- [3] H. B. Salau, A. J. Onumanyi, A. M. Aibinu, E. N. Onwuka, J. J. Dukiya, and H. Ohize, "A survey of accelerometer-based techniques for road anomalies detection and characterization," *International Journal of Engineering Science and Application*, vol. 3, no. 1, 2019.
- [4] C. Ma, W. Wang, and others, "An automated machine-learning approach for road pothole detection using smartphone sensor data," *Sensors*, vol. 20, no. 19, Art. no. 5564, 2020, doi: 10.3390/s20195564.
- [5] Y. Wang et al., "A real-time pothole detection approach for intelligent transportation system," *Mathematical Problems in Engineering*, 2015, doi: 10.1155/2015/869627.