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Android Pothole Detection System
Using Deep Learning

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Abstract:- In recent years, technology has contributed to improving transportation systems, but the maintenance and upkeep of road networks remain a challenge despite these advancements. Potholes, cracks, and other road defects can lead to accidents, traffic congestion, and expensive repairs. An android pothole detection system that utilizes smartphone sensors and machine learning algorithms has the potential to revolutionize road maintenance and safety. This proposed system will use a smartphone camera to detect potholes and distinguish them from other road irregularities. It will also be integrated with a backend database that can store and analyze data on road conditions, enabling authorities to prioritize maintenance and repairs. The android pothole detection system can offer several benefits, including reducing road accidents, lowering repair costs, and minimizing traffic congestion. Our proposed solution aims to crowdsource information from people who face these issues and forward it to relevant authorities using an Android application. To achieve this, we will utilize a Deep Learning model capable of detecting potholes, collecting information from users, and sending it to authorities. The success of this solution depends on the accuracy of the Deep Learning model, the quality of user-provided information, the responsiveness of relevant authorities, and user engagement. Therefore, the system must have appropriate parameters to manage these factors and guarantee the solution's effectiveness. In conclusion, utilizing technology for android pothole detection can lead to effective and timely repairs, contributing to overall road safety and reducing vehicle damage. The proposed android pothole detection system brings people together to work on a common problem and has the potential to revolutionize road maintenance and safety, providing safer and more efficient means of travel for everyone.

Keywords:- *Deep Learning , Road Safety , Efficient Means To Travel , Smartphone Sensors.*

I. INTRODUCTION

In recent years, there have been numerous advancements in technology that have contributed to the improvement of transportation systems. For instance, the use of GPS and sensors in vehicles and on roads has greatly enhanced the efficiency and safety of transportation. Additionally, the development of autonomous vehicles has the potential to revolutionize the transportation industry, providing safer and more convenient means of travel.

However, despite these advancements, there are still many challenges that need to be addressed. One of the biggest challenges is the maintenance and upkeep of road networks, particularly in areas with high traffic volumes. Potholes, cracks, and other road defects are common occurrences, and if left unaddressed, they can lead to accidents, traffic congestion, and costly repairs.

The implementation of a pothole detection system can significantly mitigate these issues. By detecting and reporting road defects in real-time, authorities can take prompt action to repair and maintain road networks, preventing accidents and other associated problems. Moreover, the system can provide authorities with data on the frequency and severity of road defects, enabling them to make informed decisions on prioritizing repairs and allocating resources.

Overall, the development of a pothole detection system is crucial in ensuring the safety and functionality of road networks. By leveraging technology, we can efficiently and effectively address road defects, promoting safe and efficient transportation for all.

II. BACKGROUND

Road networks are crucial for connecting communities and supporting economic growth, but regular usage and other factors can lead to potholes and other road defects that pose safety risks and cause inconvenience for commuters. Traditional methods of pothole detection can be time-consuming and inaccurate, but leveraging technology such as sensors and machine learning algorithms can provide real-time and accurate data on pothole locations and severity. The

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development of an android pothole detection system that can leverage smartphone sensors and machine learning algorithms has the potential to revolutionize road maintenance and safety. The proposed system will use the smartphone's GPS sensors to detect potholes and distinguish between potholes and other road irregularities. The system will also be integrated with a backend database that can store and analyze data on road conditions, allowing authorities to prioritize maintenance and repairs. The android pothole detection system can provide several benefits, such as reducing road accidents, lowering repair costs, and minimizing traffic congestion. The development of such a system has the potential to revolutionize the transportation industry, providing safer and more efficient means of travel for all.

III. LITERATURE SURVEY

- *Report titled (2020) -A modern pothole detection technique using deep learning.*

In India, road accident detection and avoidance pose a significant challenge due to the use of poor quality construction materials in the road drainage system. These issues lead to early road damage and the formation of potholes, which in turn can cause accidents. According to a report submitted by the Ministry of Road Transport and Highways transport research wing in New Delhi, approximately 4,64,910 accidents occur per year in India. To mitigate this problem, this paper proposes a deep learning-based model that uses images and videos to detect potholes early, thereby reducing the chances of accidents. The model is based on Transfer Learning, Faster Region-based Convolutional Neural Network (F-RCNN), and Inception-V2. While there are many models for pothole detection that use machine learning techniques with accelerometers, relatively few models can be found that rely solely on machine learning techniques to detect potholes using images and videos. The results of this study demonstrate that our proposed model outperforms other existing techniques for pothole detection.

Issue - The model's performance is significantly impacted when it is exposed to natural phenomena such as rainfall or snowfall.

Author - Abhishek kumar

- *Report titled (2017) - An Early Warning System for Traffic and Road Safety Hazards Using Collaborative Crowd Sourcing.*

The growing number of vehicles on the roads poses a challenge for the road maintenance department to address the demand for timely repairs, necessitating the need for a comprehensive approach To detect road construction issues such as potholes, bumps, corrugations, waves, and defective street cuts.. However, without an improved real-time traffic alerts system, efficiently maintaining city roads will be a daunting task. Therefore, there is a pressing need for a more effective monitoring system that can detect and resolve road infrastructure issues. In this research, an analytical model of a system is presented that can detect pavement deformities. The system employs a mobile application that uses the in-built accelerometer in smartphones to capture the accelerometer profile and identify the location of pavement deformities. The system also takes into account the variations in accelerometer values in relation to the vehicle speed.

Issue - Merely relying on an accelerometer does not ensure accurate results, and this approach is ineffective when a person is not riding a vehicle.

Author - Pooja P.R & Balaji Hariharan

- *Report titled (2021) -Deep Learning Approach to Detect Potholes in Real-Time using Smartphone.*

The identification and timely mapping of potholes is crucial to prevent road accidents. Currently, identifying roadway damage is a labor-intensive manual process. This research proposes a system that utilizes deep learning algorithms and integrates with smartphones to detect potholes in real-time. The system includes a smartphone application that maps all potholes along the user's route. Meanwhile, the deep learning object detection algorithm, Single Shot Multi-box Detector (SSD), runs in the background, using the mobile camera to detect potholes. Whenever an unregistered pothole is detected by SSD, the coordinates are updated in the database in real-time. In addition, a Deep Feed Forward Neural Network model continuously assesses accelerometer and gyroscope readings to detect unregistered potholes. The dual mechanism of camera-based and accelerometer-gyroscope based detection not only cross-validates detections but also provides stable results even if one mechanism fails. The pothole coordinates are rendered on the map user interface within the same application. With a map/navigation feature as the front end and a two-fold deep learning pothole detection algorithm as the backend, this system is an efficient and cost-effective solution for real-time pothole detection.

Issue - It is unnecessary to determine the area of individual potholes since there are often numerous potholes on a road, and this is an insufficient parameter. Contracts are typically issued to repair the entire road to address this issue.

Author - Shubham Kokate , Uday more

IV. METHODOLOGY

Our proposed solution aims to address ongoing road problems by crowdsourcing information from people facing these issues and forwarding it to relevant authorities using an Android application. To achieve this, we will utilize a Deep Learning model capable of detecting potholes, collecting information from users, and sending it to authorities. The steps involved in implementing this solution are depicted in the figure below.

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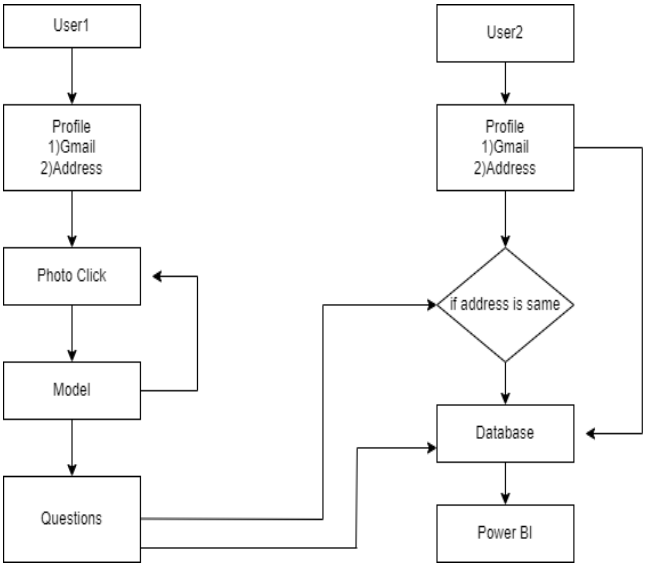

Fig 1:- The steps involved in implementing this solution

The first step involves User 1 uploading an image to detect the pothole. After detecting the pothole, User 1 is prompted with quick questions about the issue. Next, User 2 from the same neighborhood is asked about the challenges they have faced due to the pothole problem, along with others. All collected information is stored in a database and sent to relevant authorities for analysis. This proposed solution has the potential to enhance road maintenance and safety, reducing accidents and minimizing traffic congestion.

However, there are several constraints that may hinder the effectiveness of the Android pothole detection system. These include hardware limitations, battery life, data availability, network connectivity, privacy, security, cost, and legal compliance.

Additionally, there are parameters that the system should include to ensure effectiveness, such as geolocation, user feedback, database management, communication protocols, security, and user engagement.

Overall, the success of this solution depends on the accuracy of the Deep Learning model, the quality of user-provided information, the responsiveness of relevant authorities, and user engagement. Therefore, the system must have appropriate parameters to manage these factors and guarantee the effectiveness of the solution. Successfully implementing this solution can improve road safety, making a significant impact on people who use the roads frequently.

V. CONCLUSION

Detecting potholes on the road is crucial for ensuring human safety and minimizing vehicle damage. However, the pothole detection problem presents many challenges due to the varying sizes of potholes, diverse road construction materials used, different traffic conditions, and changing weather scenarios. To address this issue, this research collected 1300 pothole images to test various object detection models. The proposed architecture utilizes a smartphone camera to capture images of potholes and sends sufficient information to authorities for them to take action with priority. This approach will not only provide drivers and commuters with advisories for safe driving but also deal with local issues that arise. In conclusion, utilizing such technologies for pothole detection can lead to effective and timely repairs, contributing to overall road safety and reducing vehicle damage.

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