SURVEY ON ARTIFICIAL INTELLIGENCE POWERED POTHOLE DETECTION, REPORTING AND MANAGEMENT SOLUTION

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Abstract - A pothole is a road defect that causes accidents. The number of accidents caused by potholes has increased in India as a result of increased transportation. As a result, a few approaches have been devised to locate potholes using sensors in order to reduce the loss of human life as a result of potholes. These techniques are restrictively costly and inadequate. Subsequently, we've formulated an astute system that utilizes cell phones outfitted with cameras and GPS sensors. We are detecting potholes with the "YOLO object detection" technique. A pothole is located by the application. Users can submit photographs of potholes in their neighborhood. The YOLO algorithm verifies the uploaded image after it is uploaded. The pothole's position is then shown on a map. Potholes can be filled by the local civic authority. As a result of this method, we are implementing a tech-savvy and long-term solution for pothole detection, and this technique can successfully assess street road conditions using a cellphone.

Key Words: Convolution neural network, Image classification, Object detection, Roads safety, Pothole detection, YOLO model

1. INTRODUCTION

India, universe's second most populated nation, has a very much evolved road organization. Streets are India's most frequent means of transportation, carrying 90 percent of the country's traveller traffic and 65 percent of its freight. Regardless, the majority of India's streets are tiny and congested, with a poor quality surface and insufficient street maintenance requirements.

The number of vehicles on the road has increased dramatically in the last two decades. This increase in the number of vehicles has resulted in concerns such as traffic congestion during rush hour and multiple road accidents, with the primary cause being the poor quality of the roads. The intelligent transportation system is now working in the area of traffic congestion control, which is extremely important right now.

Potholes produced as a result of severe rains, a poorly designed drainage system in urban areas, and the passage of heavy vehicles become a major source of mishaps and human deaths. Ministry of Road Transport and Highways' evaluation report indicates total of 1.47 lakh people have died as a result of road accidents. According to the most recent numbers from a few state governments, potholes claimed the lives of 3,597 people across the country in 2017, an increase of more than half from the year before. Every day, almost 30 people die on the streets as a result of potholes.

With regular weather fluctuations, wear and tear, and poor municipal finances, maintaining road conditions is a struggle. Not to mention that keeping people informed is a challenge. As a result, this is an application focused at addressing the aforementioned issues. To develop a reporting system in which a citizen can photograph a scene and feed it to a machine learning model that would geocode, validate, and track down potholes in the road area. This was accomplished by employing convolutional neural networks to train for object tracking on numerous images. A mobile application or a website can be used to view the damage on the roadways. A dynamic report is also provided for the closest authority of concern, which they can access and edit in order to establish and manage work orders within their jurisdiction. -dash board that is based on a web/mobile app.

2. Initiation to Existing Pothole Detection

2.1 Detection of potholes and inter-vehicular communication

Shambhu Hegde and et al proposed an intelligent transportation system that uses ultrasonic sensors to detect potholes. It transmits a warning signal to vehicles within a 100-meter radius using the Zigbee module. The system's limitation is that it only issues warnings after identifying potholes, which makes it ineffective in assisting drivers in preventing accidents.

2.2 Detection of Potholes in the Pavement Distress Image

SVM was used. Jin Lin et al. [3] proposed a Support Vector Machine-based model for pothole recognition that distinguishes potholes from other road abnormalities such as splits and fractures. Partial differential equations are used to segment the

images. A series of pavement photos is used to train the SVM to detect potholes. The training model fails to recognize pavement flaws if the photos are not well illuminated, which is a limitation to this model.

2.3 A Mobile Sensor Network Based Road Surface Checking System

Mircea Strutu, et al [7] proposed a model which made use of accelerometers to recognize deformations out and regarding area. It additionally made use of GPS structure to perceive the right region of the disfigurements. The pothole location calculation can run in moving vehicles that are furnished with GPS, accelerometer, nearby PC and a remote switch. The accumulated data is shipped off the focal data set utilizing the Passage ways which can be used for additional handling. The requirement of this model is that setting this up turns out to be very costly.

2.4 Pitfalls and Potholes Spot

Prachi More et al. [12] proposed a technique in which a vehicle's vertical and horizontal accelerations are measured. Sensors positioned on the vehicle's route are used to record its progress on the subject. The co-ordinates are recorded by the GPS devices that have been placed. They are then analyzed to find potholes along the same route path. For testing purposes, a Fire Bird V Robot. It is utilized at a continuous speed. It is equipped with a servo motor that rotates 0-180 degrees in conjunction with an IR Sharp sensor it looks for changes in steady speed. If there is a lot of variation, It indicates the presence of a pothole when it is detected. The robot gains to a whole stop. The camera catches the moment.

Pot hole, while the pothole's coordinates are recorded.

3. Literature Survey

Year	Author	Title & Architecture	Domain & Problem Statement	Conclusion & Result
2019	Shebin Silvister, Dheeraj omandur,Shubham Kokate	Deep learning approach to detect pot holes in real time using smartphone	• Detection, and mapping of potholes in a precise and punctual manner is an essential task in avoiding road accidents. • In this paper, a system which uses deep learning algorithms and is integrated with smartphones to detect potholes in real-time.	▪ The system follows two-fold cross verification mechanism to detect potholes using the camera as well as accelerometer and gyroscope sensors of the Android device. ▪ Camera-based detection uses lightweight, custom trained Single Shot Multi-Box Detector-Mobile Net, a deep learning algorithm with Tensor Flow object detection API.
2020	Roopak Rastogi, Uttam Kumar, Archit Kashyap, Shubham Jindal	A Comparative Evaluation of the Deep Learning Algorithms for Pothole Detection	To apply the performance of neural network algorithms such as YOLO and Faster RCNN with VGG16 and ResNet-18 architectures for pot hole detection that is	The pothole detection problem present more challenges with varying pothole size, diverse road construction materials used, different traffic conditions, and changing weather.

			both fast and precise.	
2021	Kavitha R and Nivetha S	Pothole and Object Detection for an Autonomous Vehicle Using YOLO.	Use of YOLOv3 algorithm to train our CNN model to make them detect potholes, crackpot and wetland that causes accidents.	• Object detection in autonomous vehicle for detecting the objects using YOLO algorithm and it is configured to detect the object classes like: car, person, truck, bus, pothole, traffic light, motorcycle with increased computation power with more assets. • Pre-trained images with help of tensor flow labelled PASCAL VOC image database. Second method is implemented on Raspberry pi 4 a popular embedded computer board explores suitability for the running objects and displayed on 7 inch display board.
2019	Alfandino Rasyid, Mohammad Rifki Ulil Albaab, Muhammad Fajrul Falah, Yohanes Yohanie Fridelin Panduman, Alviansyah	Visual detection of potholes utilizing a machine learning method and an Internet of Things video streaming platform.	• Machine learning method that captures the frames with a combination of high-computational computer and mini-computer.	• Based on the experiments that have been conducted, it can be concluded that potholes can be detected by a machine learning object detection system which is assembled on a portable small device. • And also in that device, the image ZMQ library can be applied to do the video streaming activities. It can use the detection model, GPS, IMU sensor well
2020	Abhishek Kumar, Chakrapani, Dhruba Jyoti Kalita, Vibhav Prakash Singh	A Modern Pothole Detection Technique using Deep Learning.	The proposed modern based pothole detection method using the common techniques like “use of FRCNN”, “inception v2 model” which detects potholes in videos/images in real-time.	System will detect the location of the pothole and upload the same on map(reflected in an android app developed) so that other users who have no camera mounted on their vehicle can get alerts about the pothole using the app only.

2020	Ping Ping, Xiaohui Yang, Zeyu Gao	A Deep Learning Approach for Street Pothole Detection , YOLO V3 Architecture	To implement the machine learning and deep learning models of YOLO V3, SSD, HOG and Faster R-CNN for pothole detection systems.	• This study offers a pothole detection system that uses deep learning algorithms to detect potholes on the road using only a camera mounted on a car's dashboard and an internet connection. • The preprocessed dataset is used to train and evaluate four models: YOLO V3, SSD, HOG with SVM, and Faster R-CNN. Available data is selected and then labeled image file is converted to train record which will be used as input by the models.

CONCLUSION:

Our approach was to detect potholes on the road using machine learning algorithms like YOLO3 and manage to maintain road infrastructure by connecting citizens and authorities together using cross platform website where citizens can report the issues and municipalities can act on that. The features like pothole based Route Navigation would better help the citizens and authorities to keep a track of their area.

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