Early Pothole Detection Method And Accidental Preventive Technique Using Machine Learning Algorithm

Anushree Prabhu[1], Sushmitha M[2], Shravani M[3], Nikitha M[4], Suhaas K P[5]
[1,2,3,4,5]*The National Institute of Engineering*
E-mail[1]: anushree2804@gmail.com
E-mail[2]: sushchumpa @gmail.com

***Abstract*— Maintenance of roads is one of the major problems in developing countries. Nowadays many people lost their lives by road accidents. Potholes may cause more accidents which also damages the vehicle. We need a system which will be helpful in getting the information about poor road conditions, collecting this information and to notify the government authority to take the necessary action. This paper describes how detection of potholes is done and gives an early notification about potholes to users through voice note. This system requires an android application to collect the pothole values and these values are sent to the cloud. Using the DBSCAN machine learning algorithm, clustering is done based on the values obtained to get the potholes count within the given range and later necessary action will be taken by the government officials.**

Keywords—Accelerometer; Alert; Android application; Clustering; DBSCAN; Fall threshold; Machine learning; User;

I. INTRODUCTION

India is one of the fastest developing countries today and has a vast network of roads. Major transportation in India is through roads. Maintenance of roads is one of the major problems we are facing today. Due to poor maintenance of roads, accidents are increasing day by day. Many accidents are caused by the formation of potholes. So, identification of these potholes not only avoid accidents but also helps to maintain roads.

To solve this kind of problem an effective solution is needed. Early detection of potholes must be identified before and send to other users through voice note. Using machine learning algorithm number of potholes count will be detected. And later actions will be taken on the detected potholes by the concerned authority.

II. EXISTING SYSTEM

Everything is manual in the existing system because the driver must manually look for potholes while driving. Sometimes, a driver may encounter sudden potholes on the way in which he may lead to accidents. So, this system is very risky and many people have lost their lives.

Maithili Naik, Nischita Jaiwant, Neha M, N.M. Anmol, Prof. R. Mattimani, Dr. R.M. Banakar [1] proposed a system for pothole detection through IOT in which it senses the potholes using an ultrasonic sensor mounted to a vehicle and location is tracked with the help of JavaScript programming. This vehicle belongs to a government official and the task of the driver is to drive across the city. The detected pothole values and location is transferred to the cloud. The values stored in the cloud are sent to the government official through a mobile application. Later necessary action will be taken by the government official.

In [2] S. Gnanapriya, V.B. Padmashree, V. Bagyalakshmi, and G.A. Pravallikha proposed a system which has an advanced sensor system helpful to track and update the potholes. Vibration sensors are used, and accelerometer is responsible for detecting the pothole direction. A threshold level is set before and if the threshold level exceeds the fixed level it will be considered as a pothole. The collected values from the sensors are sent to Arduino and GPS sensor helps in where exactly the potholes are present. Through IOT data is sent to the web server and necessary action will be taken by transport official.

A proposed system by Sumit Srivastava, Ayush Sharma, Harsh Balot [3] which is a user -friendly because this mobile application is connected to cloud and alerts driver about the upcoming potholes. In real time, the ultrasonic sensor detects the distance changes between moving vehicle and road. These ultrasonic modules are mounted onto a test vehicle. It retrieves the nearby pothole data from AWS Database service after getting the user location. The distance between pothole and user will be calculated and if the user is in range it alerts the user by a push notification i.e. warning about nearby potholes.

In [4] Collinson Colin M. Agbesi, Ebenezer K. Gavua, Seth Okyere-Dankwa, Kwame Anim Appiah, Kofi Adu-Manu Sarpong proposed a system using IOT enabled a device which has an open hardware device and a prototype vehicle to build, detect, report and to manage potholes. Arduino microcontroller board and light emitting diode are interfaced to give signals for detection of potholes. A vehicle

is mounted with a camera which identifies the location information, location image to report and store pothole information which alerts on subsequent road usage. This information is stored in the Database and reports to the concerned authority for further actions.

III. PROPOSED SYSTEM

Nowadays smartphones usage is rapidly increasing. So, in this proposed system we are using an android application to collect the data about potholes. In [4] detecting of potholes is done through images captured by the camera and it will be sent to the cloud. Processing of image in the cloud takes more time and occupies more space. So, in our proposed system we are using an accelerometer to detect potholes. In [2] accelerometer is used to detect the potholes by using the vibrations which are caused due to potholes. But in our system, we are creating an android application for the accelerometer to detect the current potholes so that multiple users can also be involved.

Users can access this application by installing the app and giving permission to access the location. Once the user starts the application it will be always running in backend until the user stops the application. Data will be collected through this application and send to the cloud. Data includes latitude, longitude, and fall threshold values which is sent to the cloud and stored in Database as shown in the Fig.3. All these collected data will be under the authority of admin. Here admin refers to the government official who will be taking care of road maintenance. Considering the values obtained in the database some threshold value is set so that if the value obtained is greater than the fixed threshold it is considered as a pothole. So, clustering of a threshold is done for every 20 meters and the number of potholes within that distance will be clustered as shown in Fig.5.

For grouping, we are using a machine learning algorithm called Density-based spatial clustering of applications with noise (DBSCAN). It is one of the most commonly used clustering algorithms as shown in Fig 2.

DBSCAN groups point together which are close to each other. Groups are formed based on distance measurement and the minimum number of points. It requires two parameters:

1. ***eps***: It is the minimum distance between two points i.e. if the distance between two points is equal or lower than the eps value they are considered as neighbors.
2. ***minPts***: It is the minimum number of points to form a dense region.

While choosing the eps value many values will not be clustered if the value is too small and clusters will merge and many of the objects will be in the same cluster if the chosen data is too high. In our proposed system we are using eps value set to 20 meters and minPts to zero. So that within 20 meters range number of potholes can be clustered together.

Fig.1: *System model of pothole detection*

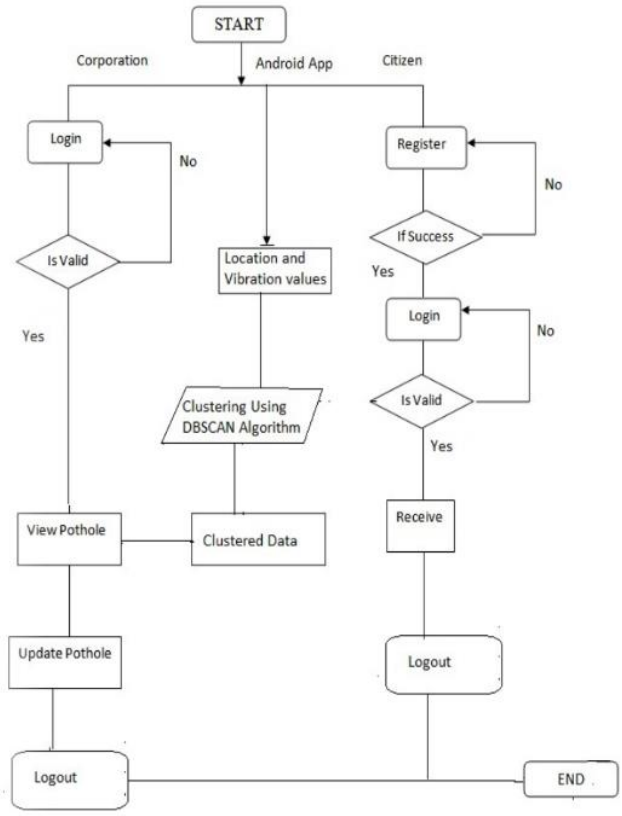

Fig.2: *Flowchart of the system*

Admin will be holding a login option as shown in Fig.4 where clustering is done. After getting the number of potholes admin can take necessary action. After taking the action it is set recovered. Later detected region gets removed after the completion of work.

For the users, alerts will be made at a given location regarding the potholes. Constantly the application receives information regarding its location coordinates and the same is displayed on smartphones. [4] A buzzer and two vibrators are used to provide an alert. But in our system alert will be made through voice note before pothole appears. This system is modeled as shown in the Fig.1.

IV. RESULTS

id	lat	lon	vib
173	12.4568	76.3698	9.3256
174	12.4561	76.3698	6.325
175	12.4561	76.3698	6.325
176	11.2356	77.3698	7.3256
177	11.2356	77.3698	7.3256
178	11.2356	77.3698	7.3256
179	10.2356	20.3256	8.3256
180	10.2356	20.3256	8.3256
181	12.3253	76.2356	9.32536

Fig.3: *Potholes generated values*

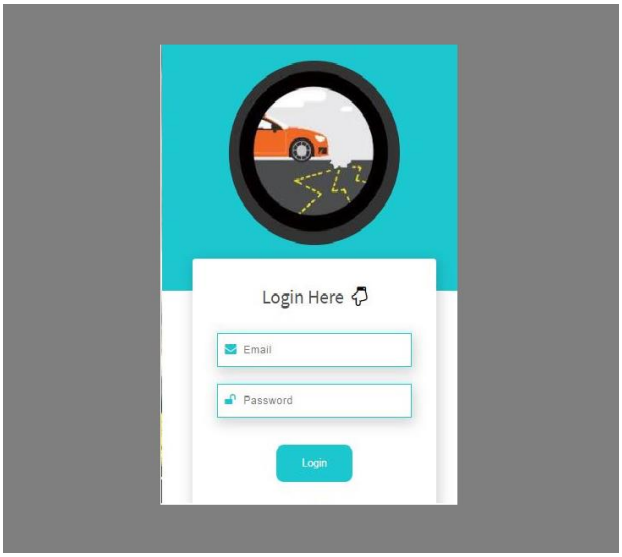

Fig.4: *Admin login page*

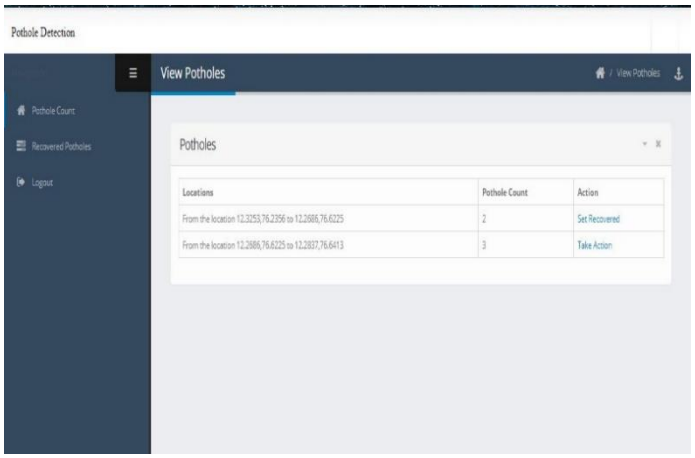

Fig.5: *Number of potholes generated using clustering*

CONCLUSION

We have implemented a pothole detection system which gives an early notification about the potholes and helps to minimize the number of road accidents. Using android application, detection of potholes is done by the citizens. Using a machine learning algorithm, detected pothole values are clustered and the stored values look after by the admin who is one of the government officials. And, the admin takes further action to recover the pothole for better maintenance of roads.

This system is cost effective because it does not include any hardware equipment and also helpful to the public as well as the governing body for the development of the country.

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