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# Pothole Detection using IoT, Android and iOS

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**Abstract -** Due to various reasons, potholes are created which causes problems in day to day lives of the people. The objective of this project was to make transparency between people and provide updates about potholes in their travel route. This project was focused on getting the data from a cloud database, reported by the user, and that data could be accessed through the mobile application. Project has achieved detecting the potholes and reporting the potholes successfully on the database. People can view the current pothole conditions and can report a pothole manually which is a key feature of the app. The IoT device can detect a pothole and location with the help of sensors like accelerometer, GPS, Arduino. The detected latitude, longitude, z axis values are sent to the cloud database for reporting. The future scope is to detect depth of the pothole to get accuracy in data and solve the problem more efficiently.

***Key Words***: Accelerometer, GPS sensor, sensing, potholes, detection, location.

## 1. INTRODUCTION

Potholes have always been a menace and are one of the biggest problems which people face on a daily basis while they travel. There is presently no such system to track potholes on the road in India [1]. Our approach to detect potholes is using an IoT device fitted in cars. Users can also report manually through Android and iOS applications. This system can track and record the potholes in a centralized system. It displays the pothole's progress on the map. This system will aid to reduce accidents and fatalities on roads due to potholes.

## 2. RELATED WORK

A. A pothole detection system was created using various Android smartphones with accelerometers. They worked with accelerometers present in various smartphones using various pothole detection algorithms to deploy this system [2].

B. There are various systems that use mobile sensing technology for detection of potholes. This part provides a short explanation about different mechanisms which were implemented on various resources. There is an image recognition method which Yu and Salari proposed for pothole detection is based on laser imaging technique, which collects the road information using algorithms like Artificial neural network [3].

C. Another method by researchers Lin and Liu used using a vector machine algorithm could provide high accuracy.[4] This has high accuracy but requires more computational power.

## 3. TECHNICAL REQUIREMENTS

The following technical requirements were chosen as a basis for pothole finder system:

1. System should be able to detect potholes along with its location while driving in a passenger car. Two-wheeler vehicles such as motorcycles and scooters are not considered.

2. System should be able to detect potholes in real time. Collection of raw data will be stored in a local SD card in the system.

3. Data will be then pushed into a cloud database, and processed and stored into it.

4. A smart-phone is required with Android OS or IOS to access the application for viewing the pothole.

5. An authenticated phone number is required to report through the mobile application.

6. System available on mobile should be able to display potholes on its locations.

7. Internet connectivity for viewing data in mobile.

## 4. ARCHITECTURAL DESIGN

The device is based on Arduino which is connected with sensors consisting of a 3-axis accelerometer ADXL345 used to detect a vertical force(pothole) using z-axis [5]and keeping a note of device positioning using x-axis. Accelerometer was tested at different sensitivities, using at 4g and 8g no accuracy was obtained as shown in fig.1. Using 16g in ADXL345 accuracy was observed as shown in fig.2. A GPS module, Ublox NEO-6M GPS [6] is used to record the location of the pothole.

GPS sensor positioning is at 2.5m with starting time 27 sec. When a pothole is detected, the algorithm will capture the location of the pothole. It records the latitude and longitude along with the vertical force on the z-axis. This data will be pushed in a cloud database to display on a GUI. But first it is stored locally on the device in a Micro SD card as data might be lost while being transferred into the database through a Wi-Fi module.

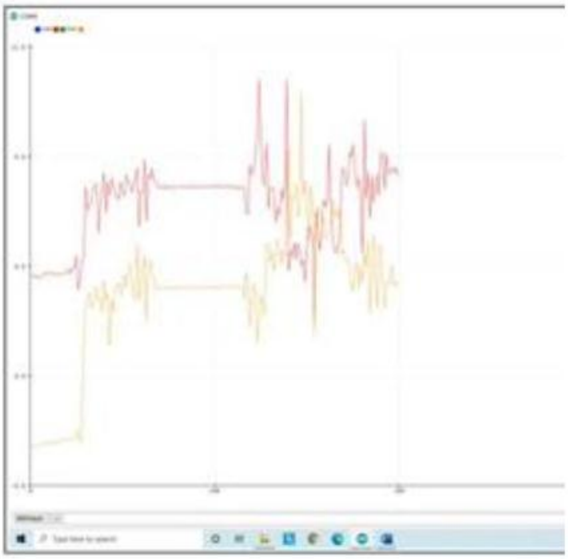

**Fig -1**: Output using 4g sensitivity

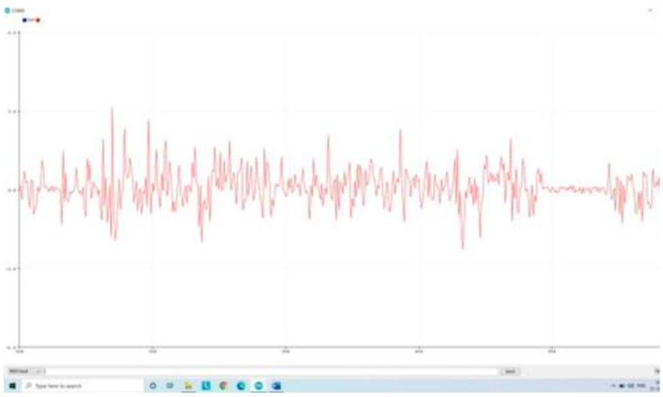

**Fig -2**: Output using 16g sensitivity

After storing locally a Wi-Fi module in the device will transfer data through the internet into a cloud database. In the database, the algorithm will check the data and no recurring data will be added. This data is then fetched into Mobile using the internet.

The algorithm will detect the pothole and its location and record the information in the database as shown in diagram fig.3.

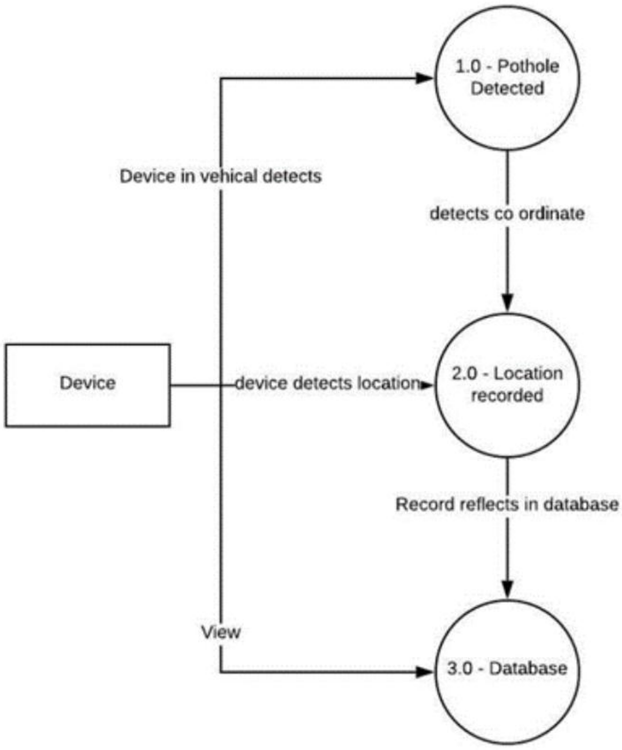


**Fig -3**: Device architecture

Only authenticated users will be able to access the mobile application. Users will require to register in order to login into the app as shown in fig.4. After login, users can view potholes on map as shown in fig.5. Users can also report potholes manually as shown Fig. 6.

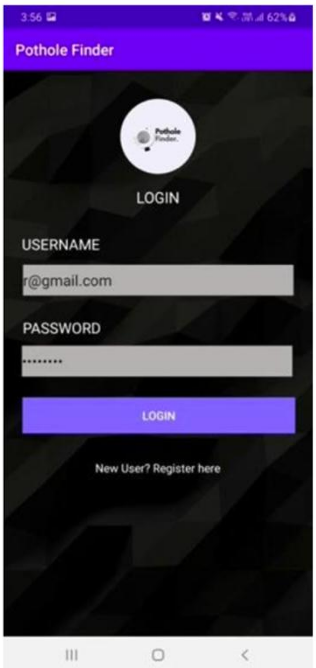


**Fig -4**: Login UI

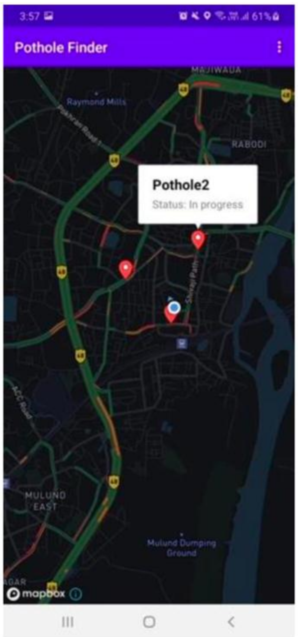


**Fig -5**: Map View

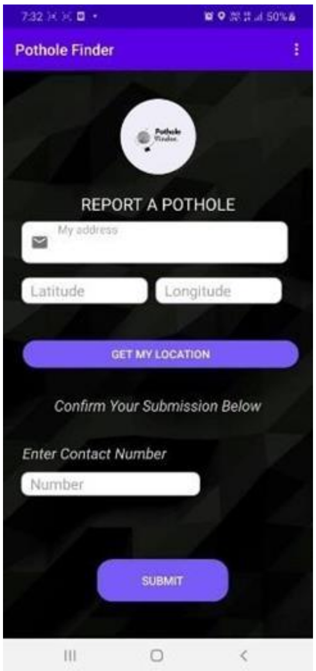


**Fig -6**: Report a pothole

The System architecture diagram is as shown in fig. 4.7. It gives the structure of the system. Data will be collected from Device and sent to a cloud database and then fetched into a mobile application where it will be displayed on a GUI.

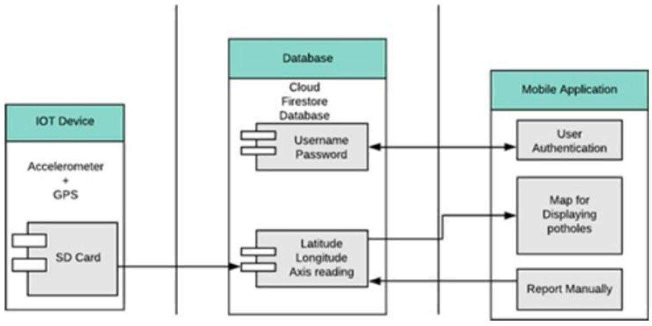


**Fig -7**: System Architecture

## 5. RESULTS

This section explains the results and experiments on the approaches of pothole detection. This result considers the data based on the sensors and data reported by the users IoT device using various sensors.

A. IoT device using various sensors. The IoT device consists of sensors which assist the car to detect and report a pothole. The IoT device is well fitted inside the car allowing it to be rigid.

The device contains an accelerometer, GPS Sensor, SD card.

B. Application using Android and IoS. The application allows users to report and view the pothole location using a cloud database. Users can report data and view the progress of the pothole. As shown in the fig. 6. After the pothole is reported, the database will show the status of the pothole. The database updates the status of the pothole when the pothole is reported, currently in progress or completed.

## 6. CONCLUSION AND FUTURE WORK

This paper describes algorithm for finding pothole and using the data, providing information to people. People can use their smartphones to track the potholes in their route.

The future work includes detection of the size of the pothole to get more accurate data and use it to solve the issues easily.

## ACKNOWLEDGEMENT

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