Government Polytechnic, Yavatmal

Department of Computer Engineering 2020-2021

Course Name:- Capstone Project – Execution and Report Writing (22060)

Topic:- "Android Application for Pothole Detection System"

Course Teacher:- Prof. G.K. Yadav

Team Members:-

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CERTIFICATE

This is to certify that Mr. Ayush Chiddarwar, Manthan Watile, Prajwal Chaudhari, Ms. Pranjal Sharma, Diksha Mohod. From (institute) Government Polytechnic Yavatmal having Enrollment No. 1801350073, 1901350240, 1901350236, 1801350029,1801350018 has completed **Final Year Project Report** having title **"Android Application for Pothole Detection System"** in group consisting of five Candidates under the guidance of the Faculty guide.

Name & Signature of Guide _____

Name & Signature of HOD _____

EXAMINER CERTIFICATE

PROJECT ENTITLED

"ANDROID APPLICATION FOR POTHOLE DETECTION SYSTEM"

Submitted By

Ayush Chiddarwar

Pranjal Sharma

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Is presented and approved for the Diploma in

Computer Engineering

of

MAHARASHTRA STATE BORD OF TECHNICAL EDUCATION, MUMBAI

Internal Examiner	External Examiner
Name:	Name:
Date:	Date:

ACKNOWLEDGEMENT

This project is done as a semester project, as a part course titled "**Android Application for Pothole Detection System**" We are really thankful to our **Principal Dr. D.N. Shingade** and the **HOD Dr. M.V. Sarode** Computer Engineering, Government Polytechnic, Yavatmal for his valuable guidance and assistance, without which the accomplishment of the task would have never been possible We thank to **Prof. G.K. Yadav** for giving this opportunity to explore into the real world and realize the interrelation without which a Project can never progress. In our present project we have chosen the topic- "**Android Application for Pothole Detection System**". We are also thankful to parents, friend and all staff of Computer Engineering department, for providing us relevant information and necessary clarification, and great support.

Submitted by:

1. Ayush Chiddarwar

2. Pranjal Sharma

3. Diksha Mohod

4. Manthan Watile

5. Prajwal Chaudhri

ABSTRACT

The topic of our project is Android Application for Pothole Detection System. In this project we will create a system which can be used to collect the data of Potholes, Road Condition along with Co-ordinates. The purpose of the project is to collect the data about the Potholes with their co- ordinates, Road Condition etc. By using this project, it will be easy to study the road conditions along with the standards of Travelling and Transportation. Keeping all the records on database so there will be no need of physical paper/ register. We have used Java, PHP, SQL for this project. In this project when the user starts its journey this application starts to collect the data from Accelerometer along with the co-ordinates and stores in the Database. Application monitors for change in acceleration motion. When such a change is recorded, the application collects the data for longitude and latitude. This Application then adds the time, geographical co-ordinates and the severity of the pothole to the event log. The application is based on the Android's built- in Accelerometer. The benefit of this project is that "it provides Local Authority with the Location and the severity of the potholes, which they can repair and ultimately will result in safer and a more enjoyable driving experience".

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CHAPTER 1

1.1 Introduction

In recent years, fast economic growth and rapid technology advance have led to significant impact on the quality of traditional transport system. Intelligent transportation system (ITS), which aims to improve the transport system, has become more and more popular. For the safety of traffic, road users often feel uncomfortable when they drive on the rough roads, especially the potholes on the road. Potholes are cracks and cavities on roads caused by change in the temperature. Over long period of time roads weaken under the weight of heavy vehicles. This causes small cracks. Poor Maintenance and negligence causes the cracks to expand. Continued pressure on the cracks lead to potholes. 1) As India continues to suffer from worsening weather conditions each year 2) the issue of potholes remains an important issue. However Local Authorities are falling behind in repairing damage to the roads. Daily 1214 accidents takes place in India and poor road conditions significantly play an important role in these numbers.

The pothole on the road causes serious harm to drivers' safety. Therefore, drivers' safety may be improved with the establishment of real-time pothole detection system for sharing the pothole information. This study proposes a pothole detection method based on the mobile sensing and shares the pothole information with road users and government. For this purpose, the mobile device should be equipped with G-sensors and GPS to collect accelerometer data and location information. Our project aims to create an Android Application that automatically records potholes and logs their exact location using Latitude and Longitude also it records the severity of pothole to estimate the danger. This will hopefully significantly increase the numbers of potholes reported which will help the local authority to maintain the road condition, help them to trace the pothole and repair it. Ultimately creating a safer, enjoyable and smooth road journeys. The data collected by this application can be used for the study and survey purpose, saving lot of resources like time, money, man power etc.

1.2 Motivation

This project was suggested by our Supervisor, Prof. G.K. Yadav. For us this was a challenging project as we had no prior experience of Android development. We choose the Android platform because it is one of the fastest growing mobile operating systems in the market and it's an open source development. This project allowed us to gain an understanding of how some of the built in frameworks can be utilized to develop application. Furthermore this project demonstrates how mobile applications can contribute to improve road worthiness, road safety and a better driving experience in India and neighboring countries.

1.3 Modules

Client side (Application):- Application welcomes user with login and register screen. After successful account registration, user can login and start using application services. "Start" button used to collect data while driving. "View History" button is used to show user about data collected by application on potholes and their location. "About Us" is used to present information regarding project and team members. "logout" button is used to kickout user from the application and close all the operations.

Server Side & Database:- Server side consist of php programs for login, registration, data collection, data processing, user history, logout etc. It also deals with the database. It uses JSON for sending confirmation message to the client application. Server programs stores data into the database in an arranged manner.

1.4 Overview

This application is based on the Android's built-in Accelerometer. An Accelerometer is a device that measure acceleration relative to free fall. Any significant changes in the phone's acceleration are logged by the Senior Event Listener. This event is then added to an event log.

1.5 Technology and Resources Used

Server Side:-

- XAMPP Server
- PHP
- JSON
- PhpMyAdmin
- MySQL
- HTML
- Domain name and Server space(hosting)

Client Side (Application):-

- Java
- JSON
- Android Studio
- External Emulator

1.6 Objectives

The objectives of this project were to create an Application

1.6.1 That can identifying change in acceleration.

1.6.2 That can obtain the most accurate location data possible.

1.6.3 That is able to transmit data to an external destination(server).

1.6.4 That has a good user interface-easy to use and clear instructions.

CHAPTER-2

2.1 LITERTURE SURVEY

As part of our initial research we decided to investigate applications that offer the same or similar services for android platform. Our aim is to see how these applications work and to see how they can be improved. To date we have identified some Android Apps that offer the same service– Pothole Finder, Road Detector etc. We also looked at photo driven applications and pothole reporting websites.

Photo driven applications - There are several applications (some developed by local authorities) that offer pothole reporting systems that require the user to take a photograph and upload it with the location data as opposed to a detection system. These can be used for a number of reports (potholes, graffiti, broken lights etc)

https://play.google.com/store/apps/details?id=com.sbordolo.pothole finder– "Pothole Finder" a similar kind of app which uses Google Map to locate potholes.

https://play.google.com/store/apps/details?id=com.rodec.roaddetector

- "Road Detector" is a example of the Application developed by the local authority.

http://www.androidzoom.com/android_applications/tools/pothole-agent_isud.html

-"Pothole Agent" A similar kind of Concept used to locate the pothole problem

www.a ndroidz oom.c om/android_a pplica tions/produc tivity/fixmystre e t_xp p.html - "Fix My Street" a similar kind of app designed to tackle the potholes problem. In addition to phone applications, there are several websites that allow users to report potholes. www.ripoff.ie

Other similar websites include

- Pothole Watch(http://www.potholewatch.com)
- Watch That Hole (http://www.watchthathole.com)

I would not recommend this as there was no explanation of what each button did or how to use the application. The user interface was poor and offers little instruction to the user. We were able to figure out most of the functionality by trial and error but we do not believe the average user would have the patience or technical knowledge to be able to do so. One of the flaws identified was that the GPS is not automatically turned on when launching the app. The user needs to go to the phone's settings to turn it on.

2.2 Problem Definition

Some shortcomings are in previous pothole detection methods as follows: (1) Device reports a single pothole multiple times (2) high false positives may be generated with considering many threshold for pothole detection; (3) the precise pothole location has not been investigated. Therefore, this study proposes a real-time pothole detection method based on mobile sensing to collect and normalize the accelerometer data from mobile device for free angle establishment. Furthermore, a pothole detection algorithm is proposed to consider several thresholds and combine several pothole detection approaches for pothole detection accuracy improvement.

2.3 Overall impressions

Neither of the applications we investigated were satisfactory from the perspective of the end user, Applications should be user friendly and easy to figure out. We intend to create an application that addresses these issues.

2.4 Our Views

An user friendly GUI can create a great impression on user and eventually it can attract large users. Most of the application lacks in GUI and user experience. Our app is minimalistic and feature pack with a good GUI. Most of the services which we tested, used was not accurate and properly functional. This is a matter of concern as the application fails to achieve its objective therefore we aggressively worked on the proper functioning and working of application.

CHAPTER-3

SCOPE OF PROJECT

This Application is developed using Java for Android users. As most of the smart phones users are android, it has a large user base. It uses location (GPS) and accelerometer sensor to sense the shockwave and change in the motion. So, it wouldn't support those smart phones which lacks these hardware specification.

- These application needs a basic hardware and software requirement which can be seen in every smart phones sold today in the market.
- These application can be used only while you are travelling/driving.
- You can see the exact location of pothole via Google Maps.
- It stores all the data of user and pothole along with the co- ordinates, intensity and time.
- This application shows you the readings captured by sensors of your smart phone in real time.
- This project is consist of mainly 3 parts

1. User/Client application
2. Server Side
3. SQL Database

CHAPTER –4

4.1 Methodology:

1. Firstly we installed all the required softwares and supporting files.
2. We setup our software and tools according to our project requirement.
3. We started our project by designing the GUI and the basic functionality of our application.
4. We implemented the sensor logic and location program in our application, which is the core part of the project.
5. We also change some GUI appearance and worked on the sensitivity of the Accelerometer and sensitivity of location for precise co-ordinates.
6. Now, we were at the completion of user side code and application interface. We heads towards the server side.
7. We started the server side code by creating php files for different functionalities such as history button, login button, register button, etc.
8. After clearing the server and user side code, we moves for database as it will store all user and pothole data send by application.
9. We designed our database small and simple, we created two tables
    - User table to store data of clients.
    - Phdata to store the data of potholes.
10. Now it was the time to host our php files on the server, therefore we purchased a domain name and a server hosting. The name of our domain is potholedetection.tech.
11. We successfully hosted our project on server space and tested the application and search for the bugs and error and worked on the code if needed.
12. Then we presented our project to our respective course faculty for their review and thoughts.

4.2 Structure of Project

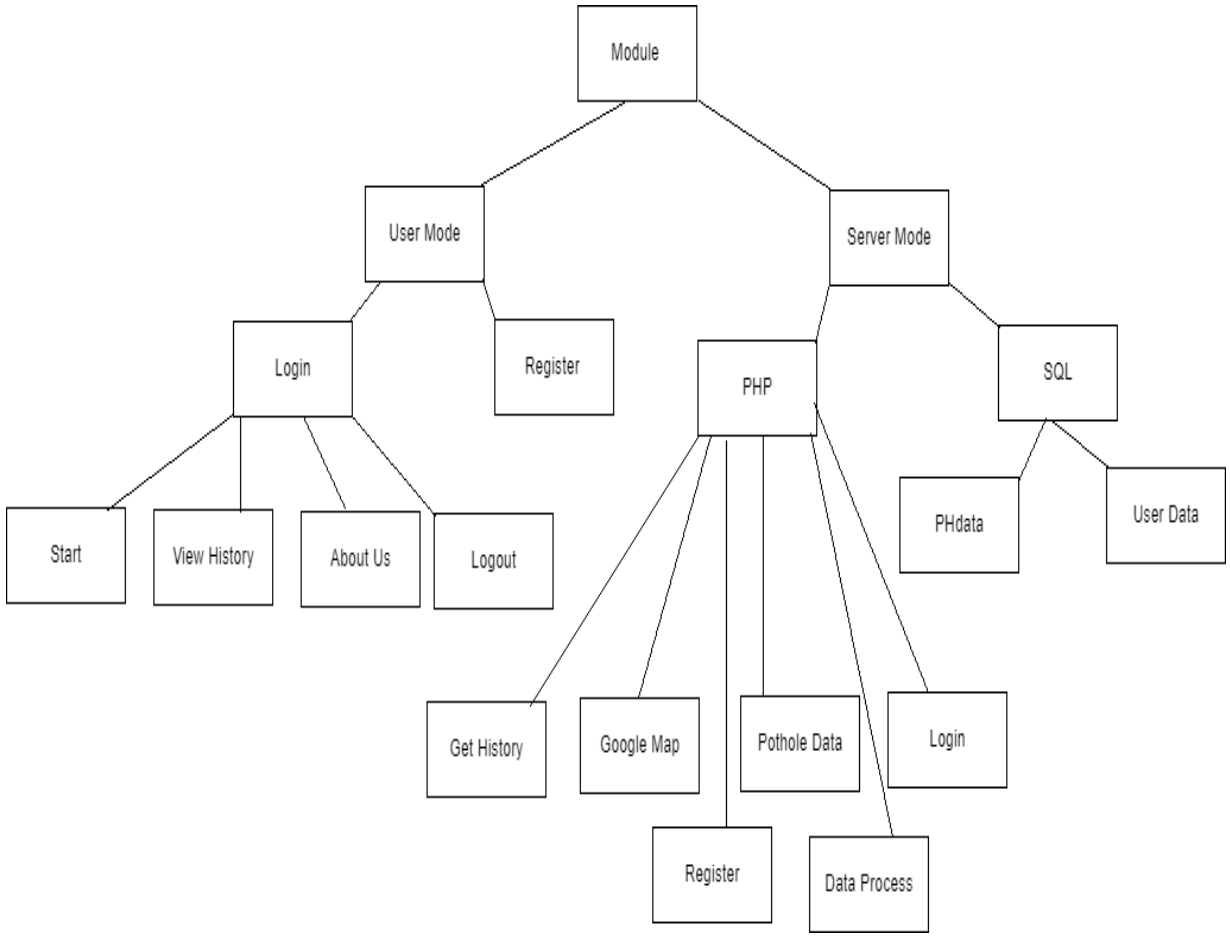


Fig 4.1

4.3 Action Plan

Table 4.1 Action Plan

Sr.no	DETAILS OF ACTIVITY	START DATE	FINISH DATE	NAME OF RESPONSIBLE TEAM MEMBERS
1.	Deciding and installation of software used.	25-03-2021	03-04-2021	Ayush Chiddarwar, Pranjal Sharma, Diksha Mohod, Manthan Watile, Prajwal Chaudhari.
2.	Rough work of GUI and all android pages in the project.	05-04-2021	10-04-2021	All members
3.	Implementation of android pages in PHD module.	15-04-2021	24-04-2021	All members
4.	Created database for PHD module and connected with server side PHP pages.	26-04-2021	04-05-2021	All members
5.	Implementation of pages in user module.	05-05-2021	14-05-2021	All members
6.	Connected the database with the application.	15-05-2021	27-05-2021	All members
7.	Created a report and discussed with guide.	28-05-2021	31-05-2021	All members
8.	Submit the final report, project to guide.	04-06-2021	04-06-2021	All members

CHAPTER-5

5.1 Details of Design, Working and processes.

As it's name suggest"Pothole Detection", it detects thepothole on the road while you are travelling. Here are some glance of app interface:-

User side:

Application Icon –

Fig 5.1

Welcome Page –

As soon user click on icon, home page will appear on the screen. Which consist of two buttons Login and Register.

Fig 5.2

Login Page – After selecting the Login option user will directed to the login page where username and password will be asked for login approval. If user has no account, there will be a option "New User? Register" at right bottom corner of the screen; which will direct user to the register page for account registration purpose.

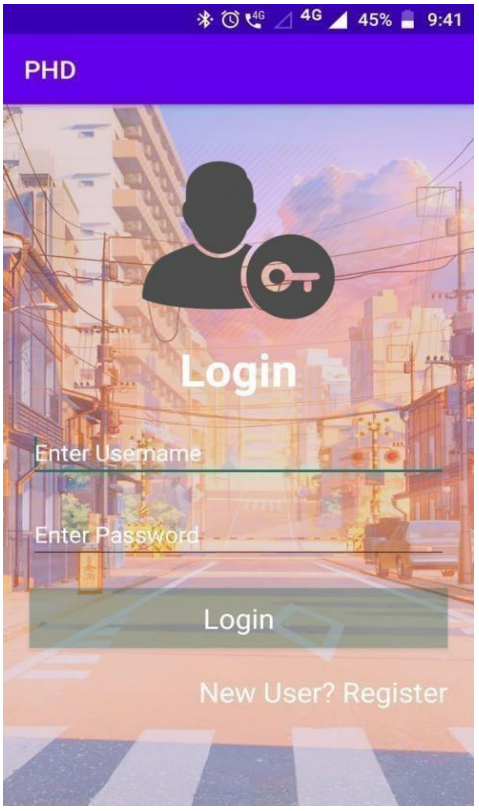
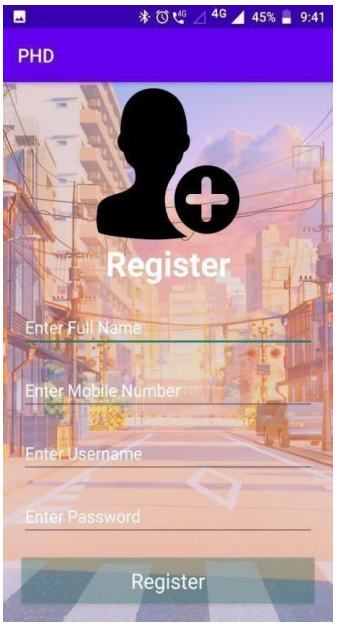


Fig 5.3

Register Page - After selecting Register option user will be directed to the Registration page, where user will asked for Full user name, mobile no, Username, password. By pressing register button user account will be created and data will be sent to the server. If user had already an account, there is a option "Existing user? Login", at right bottom corner of screen; which will direct user to the login page for login approval purpose.

Fig 5.4



Home Page – After the successful account registration and login; user will directed to the home page, where it will be showing buttons as Start, View History, About us, logout.

Fig 5.5

Start Button– After choosingthe start button option, user will be directed to the start page where a gif of running car will appear which will denote that the sensor has started capturing the readings. A timer will start running showing user that "how much time has passed" and below the timer a "**Stop**" button is situated which will stop the sensor from capturing the data and direct the user to the home page. Below stop button there is a section showing real time values of accelerometer, which prints the values of X, Y, Z axis of smart phone.

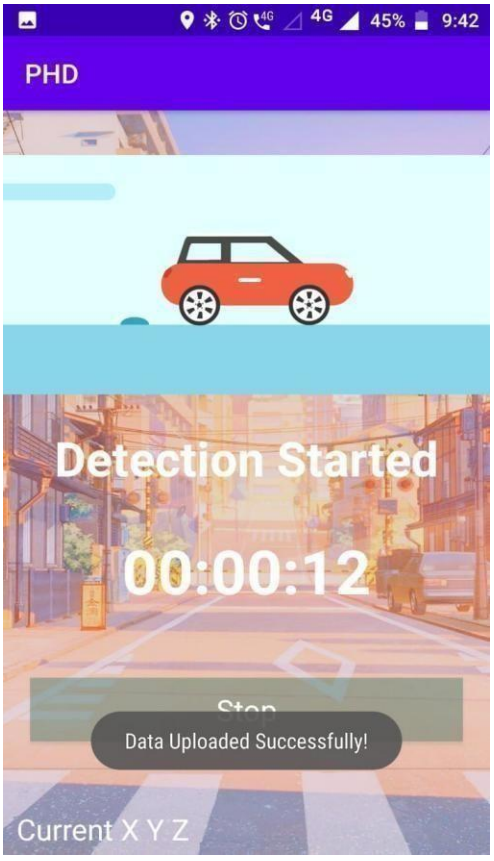


Fig 5.6

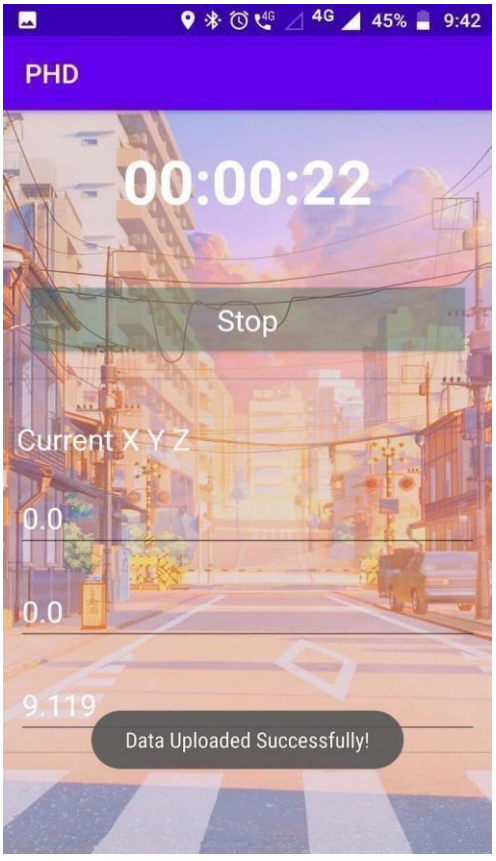


Fig 5.7

Stop Button – After pressing the stop button, the sensor will stop capturing data and user will be directed to the home page.

History Button – After choosing the option "View History" user will be directed to the history page where user will get to see all the logs of pothole in tabular format along with their location.

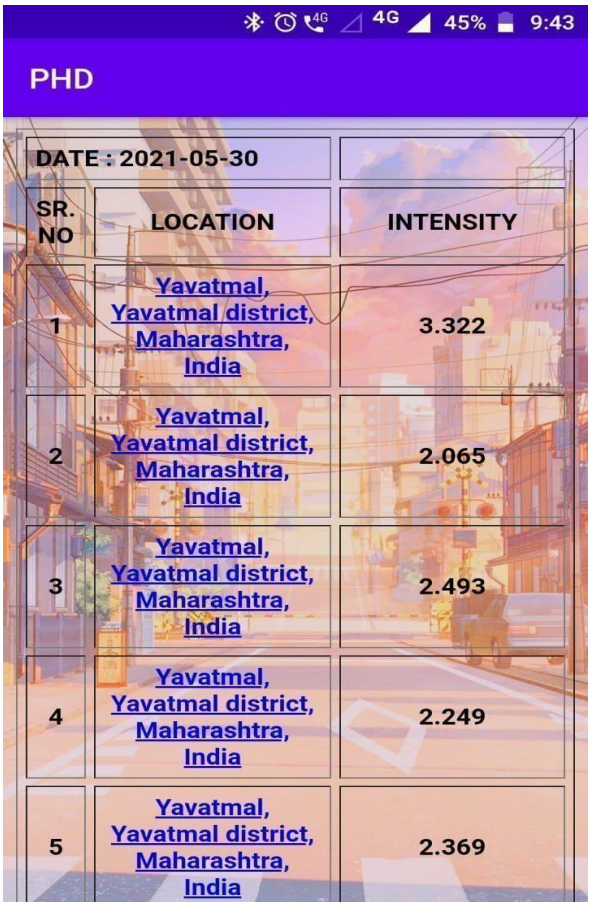


Fig 5.8

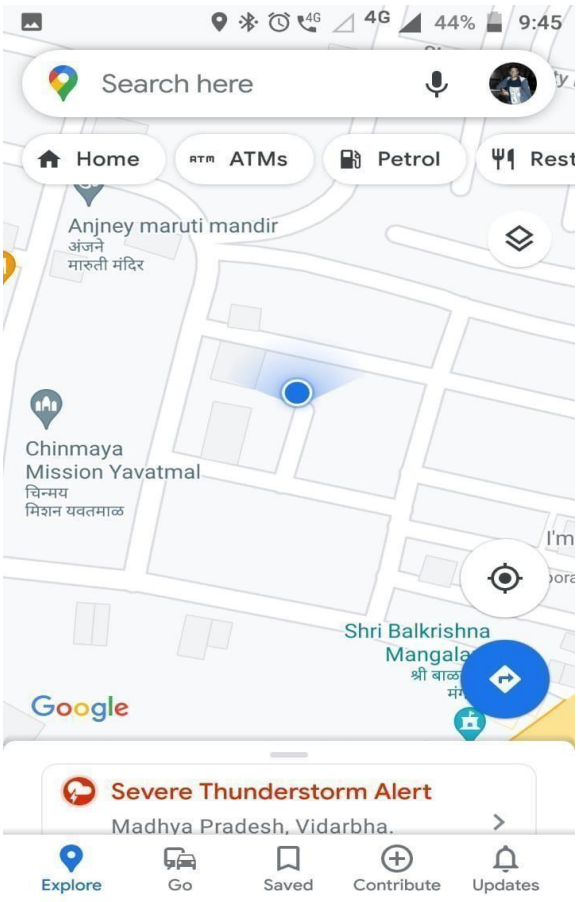


Fig 5.9

Location Of Pothole – After clicking on the Location of the Pothole from the History Table; user will be directed to the Google maps where the exact location of potholecan be seen. Blue Pointer denotes the exact location of the pothole.

About Us – At home Page there is a button showing about us data. If user press on about us option user will be directed to the about us page where it will be showing the information about the app and students.

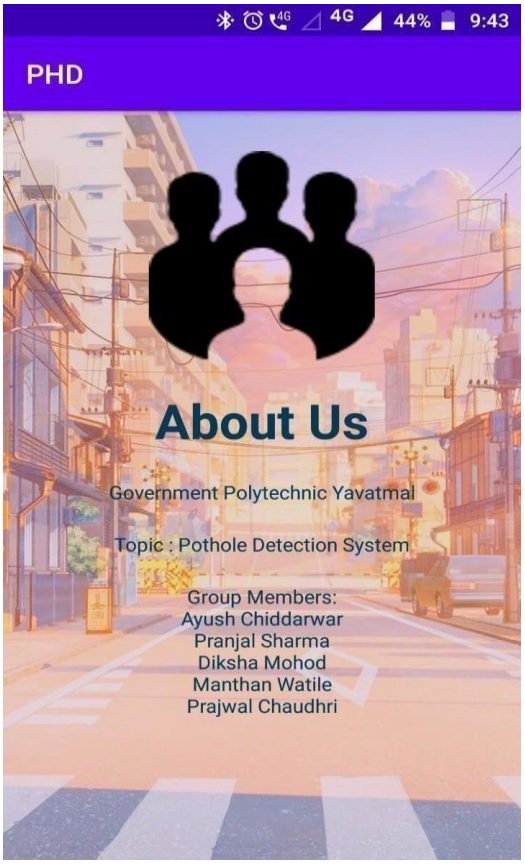


Fig 5.10

Logout button – There is a Button on home page showing option as "Logout" if user wish to logout from the application; user will be directed to the login/welcome page after choosing logout option, which denotes that the session has been ended.

Server Side:-

Server operation consist data processing, data gathering, database formation, login, registration, pothole data and location etc. Server asks new user to register so that it can store the data of potholes and location for that particular user. It also encrypts the password using Md5 to keep user credential safe. Server receives data from user application, it tests data for different parameter like – it checks whether the pothole detected has been already discovered by the same user a moment ago. This eliminates data redundancy and overlapping. After successful verifying data against some parameter, it stores the data into database. It also provide google map service to client for locating the pothole

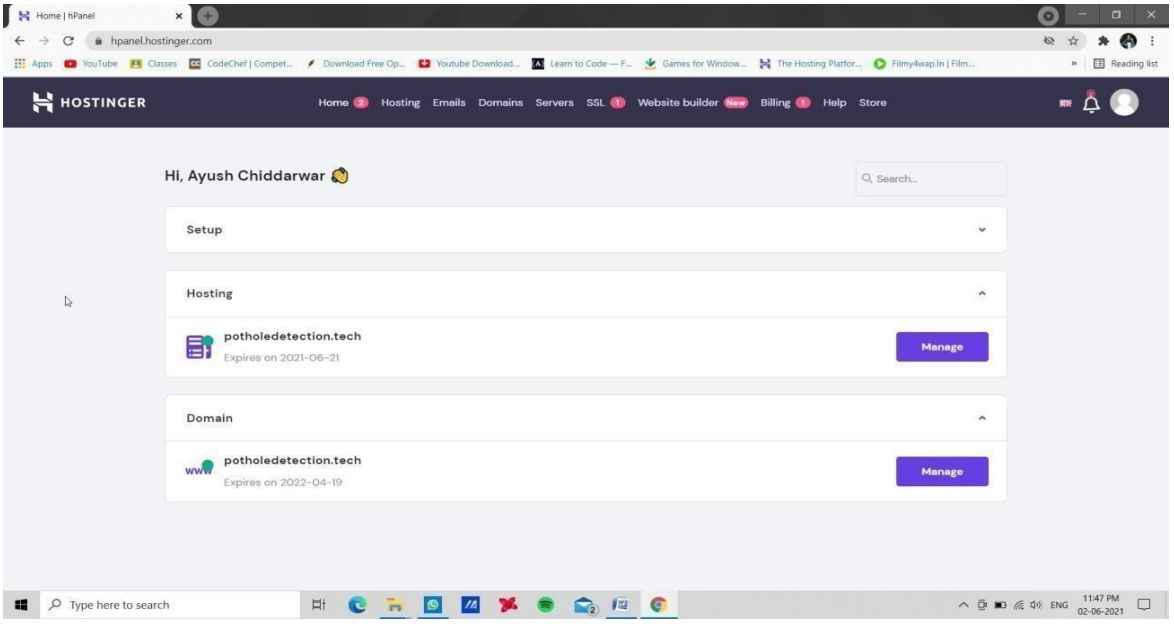


Fig 5.11

PHP files on Server:-

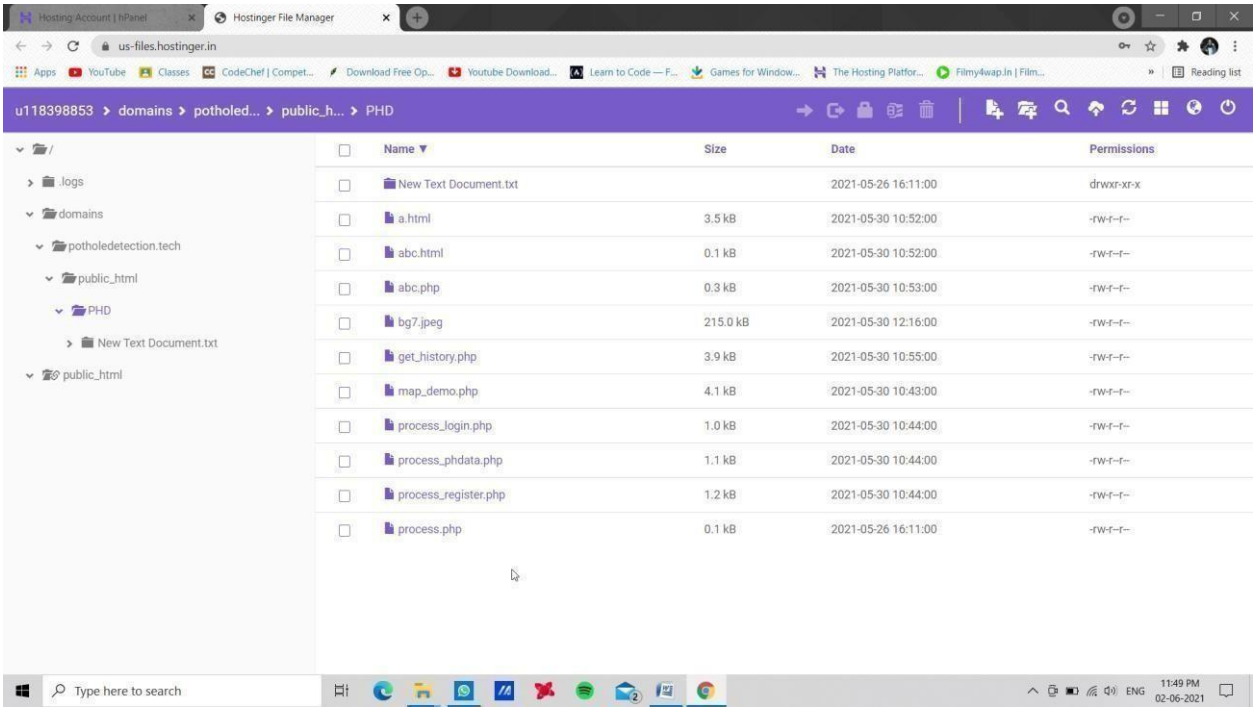


Fig 5.12

Database – MySQL database is used in our application to store the data. As it is one of the most popular and powerful database.

We have created two different tables to store data.

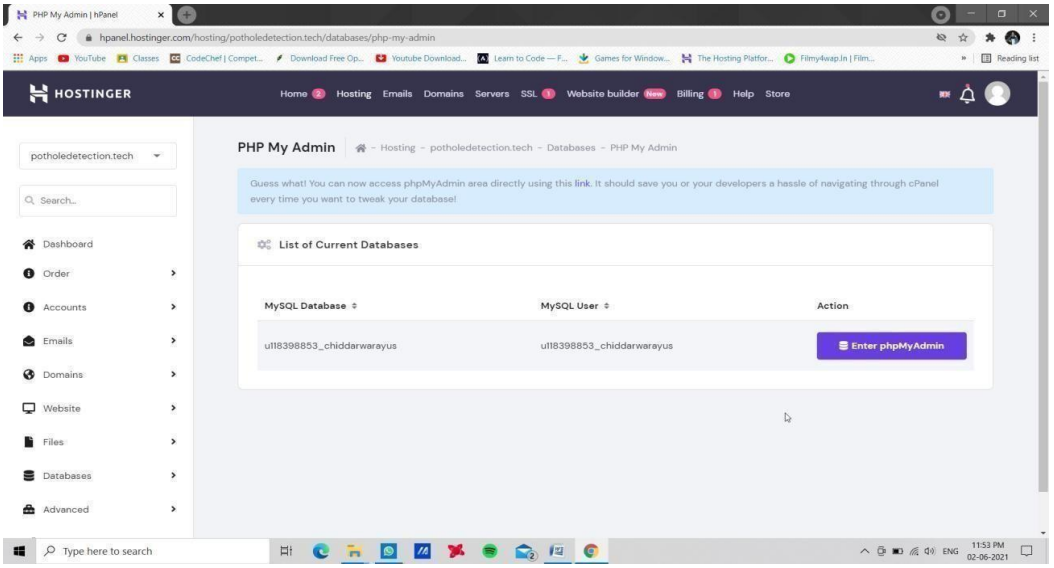


Fig 5.13

1. **User Data** – To store the information related to user such as full name, user name, mobile no. , password, user id.

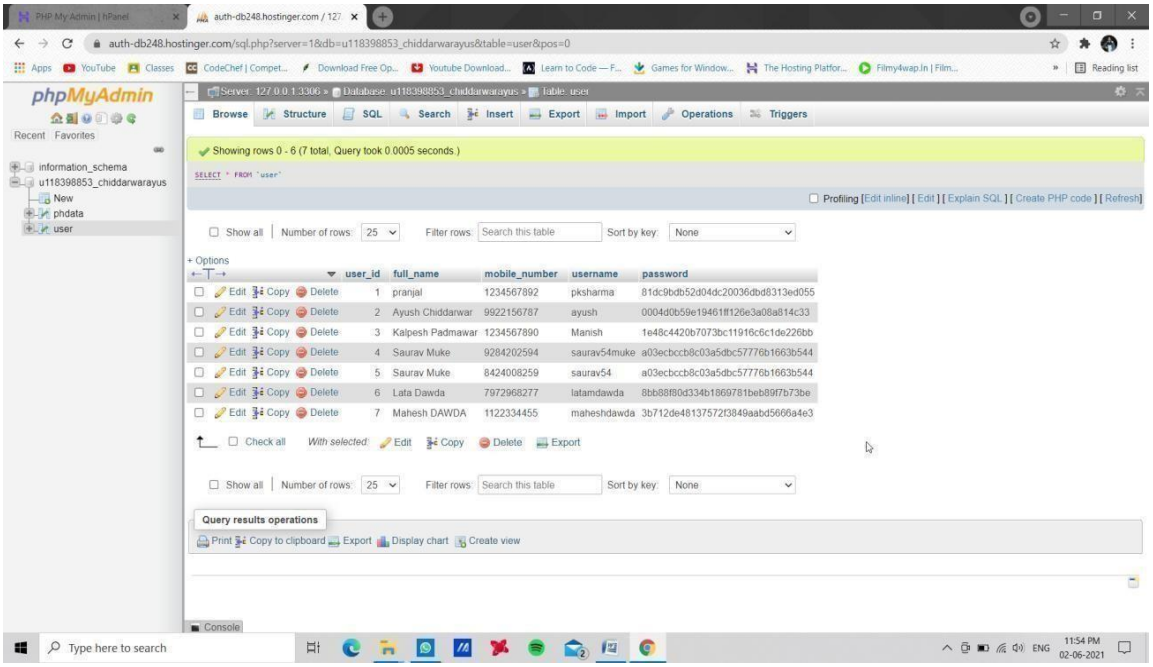


Fig 5.14

2. **Pothole Data** – To store the data of pothole, longitude, latitude, intensity, date and time.

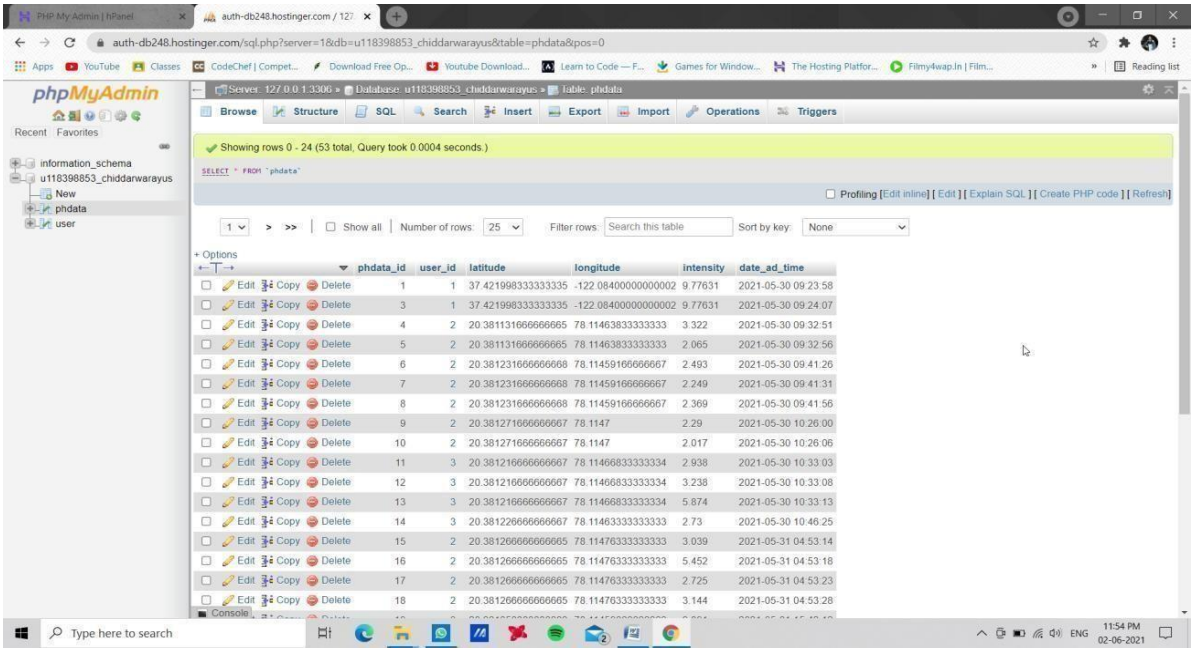


Fig 5.15

5.2 Working

As soon the sensor starts capturing the data it test every value captured to a pre-defined value. If the captured value is larger than the pre-defined value then it consider it as a pothole and will throw a message on the screen as " Data Uploaded Successfully " and it will upload data to the server at the same time creating a vibration effect to denote the operation has been done successfully.

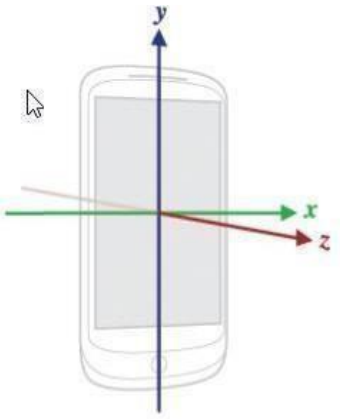


Fig 5.16 The Three Different Axis of Accelerometer

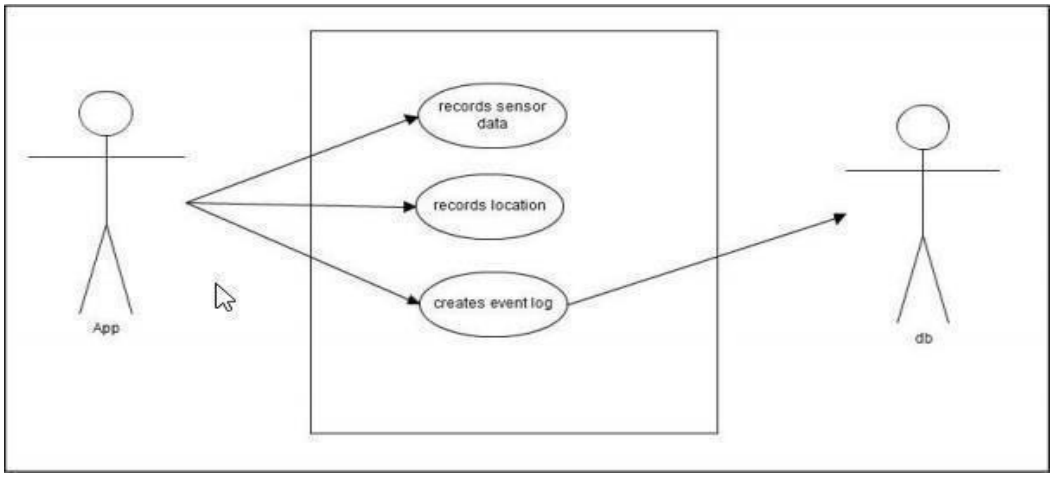


Fig 5.17 Case Diagram

Flowchart –

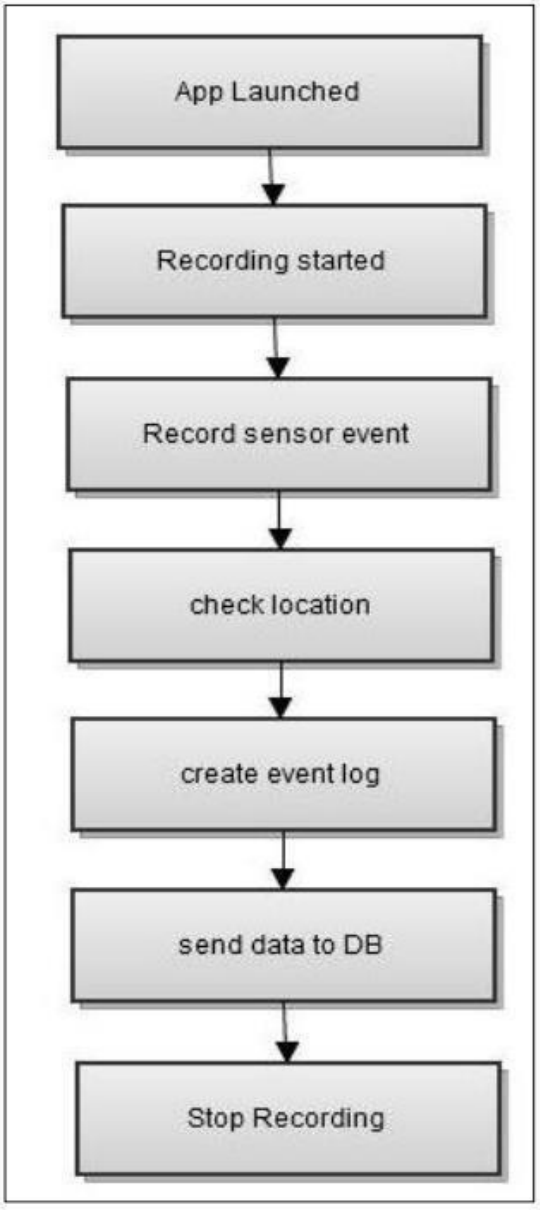


Fig 5.1 Application and User Overview

CHAPTER-6

6.1 Results

"Pothole Detection Application" uses accelerometer to detect any change in the acceleration. It detects pothole and send it to the server along with co-ordinates. This application is able to detect the pothole, get the exact location and send it to the server. This app has potential to save lot of resources like money, time, man power etc. It can be used as survey and study application for research purpose.

6.2 Application

This application can be used for:-

1. To detect and locate potholes.
2. To study the road health/condition in different weathers, regions, and states.
3. To take survey of road networks and the no. of potholes.
4. To collect the data for cost estimation of road repair and maintenance.
5. This application can be used to create a safer and enjoyable road journeys.
6. Data collected by this application is crucial for study purpose and help the government and local authority to use their resources in proper manner and take actions on potholes.
7. Data collected by this application can be used by MNC's and firms for business and marketing purpose.

CHAPTER-7

7.1 Conclusion

So far "Pothole Detection" works well and it achieve all the characteristic of an good application. It is easy to use it has simple and minimalistic GUI and decent performance. It successfully stores data into database and provides all the necessary services to user. A problem which can be seen in this application is that it's battery consumption is high as it uses GPS, accelerometer and vibration motor.

7.2 Future Scope:-

- This application can be integrated with google maps, so that user can get the information about the road condition, along with the traffic.
- Principles used in this application can be applied into the computer of cars and other vehicles, so that there will be no need of smartphones to detect the pothole.
- This application can be developed further to detect the unevenness, gravel road conditions and speed bumps.
- This application can be optimized to reduce the battery consumption.
- Currently this application works on Android Operating System but it can be developed for other Operating System users like IOS and Windows.
- Also, Gyroscope can be taken into consideration to sense the deviation in the road surface to along with other factors.
- This application can be modified to work without internet connection or in poor connectivity areas. This can be achieved by using array or stack to store data temporarily on the user device.

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