Pothole Detection System for Monitoring Road & Traffic Conditions using IoT

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Abstract

We propose style of "Pothole Detection System for observance Road and Traffic Conditions mistreatment IoT" observance road and traffic conditions in an exceedingly town could be a drawback wide studied. Many ways are projected towards addressing this drawback. Many projected techniques need dedicated hardware like GPS devices and accelerometers in vehicles or cameras on wayside and close to traffic signals. All such ways square measure expensive in terms of financial value and human effort needed. We tend to propose a non- intrusive methodology that uses sensors gift on smartphones. In propose system we tend to use measuring instrument, GPS detector readings for traffic and road conditions detection. The projected system contains 2 vital functions, initial is to discover the hollow that is finished through a multi-sensor scheme consisting of measuring instrument and gyro and second warn the motive force and store this info on a cloud base which might be accessed by different users which is able to facilitate them apprehend the potholes on their approach. Once the placement of the potholes is understood, Government authorities may be well-read regarding identical.

Keywords: Smartphones, Artificial Intelligence, C4.5 & KNN Algorithms, Vehicle, Android Application, IR Sensor

I. INTRODUCTION

INDIA, the second most developing Country in the World and a fast growing economy, is known to have the broad network of roads. Roads are most important part of the development of Country. They carry almost 90 percent of the country's passenger traffic and 65 percent of its cargo. Road is an essential part of people's day-to-day lives. It will beneficial for all sector like transporting, traveling, import, export, etc. When a road is put into use after construction, it will increase the quality of development. This will affect the quality of driving and transportation which increase the development level of Country. It was recorded as road accident mainly occurs due to the low quality of roads. Low quality of roads is a big problem for the vehicle as well as drivers. It will also decrease transportation ratio. It will directly strike on an economy of Country. In India, 80% of the economy will depend on transportation. However, most of the roads in India are narrow and cram-full with poor surface quality and road maintenance needs are not satisfactorily met.

The traffic conditions in developing countries, like India, are more complex owing to varied road conditions, a heterogeneous mix of vehicles and chaotic traffic. Since India is a developing country there is a constant requirement for good quality transportation, infrastructure, and services. Over the last two decades, there has been a tremendous increase in the vehicle population but as per records roads quality was not as suitable. To avoid road accidents it will necessary that to improve road quality but as per the political system in India it is no as a possible rapid development of road quality. But as a responsible citizen of India, we have to make a solution out of it. Roads in India normally have speed breakers so that the vehicle's speed can be controlled to avoid accidents, because of our system we also have undefined potholes (formed due to heavy rains and movement of heavy vehicles) which created immediately after of completion of the road. It is a major reason for traumatic accidents and loss of human lives.

Accordingly, road surface condition monitoring systems are very important solutions to improve traffic safety, reduce accidents and protect vehicles from damage due to bad roads.[1]

Smartphones and new technology have become the most important aspects of the 21st Century. As a Google introduce their MAPS, which indicates all the routes all over the world. But it cannot indicate any bumps, potholes, etc. Poor road quality also damages mechanical strain for vehicles, increasing the need for repairs, and also increase transportation cost because of an increase of a vehicles maintenances.

Pothole detection system using IoT we will able to detect any bumps and potholes and indicates vehicle drivers about it. One of the best solution to avoid road accidents not fully but it will surely decrease the ratio of accidents due to potholes. And save precious lives of people.

II. POTHOLE DETECTION SYSTEM

Pothole detection is nothing to detect a pothole on the road and indicates driver about it also show instruction to the driver about potholes, bumps, etc. using accelerometer, gyroscopes, and IR scanner integrated with Raspberry Pi. Sensor installs to the regular vehicles which cover all the area of a city. All devices are connected with a wireless network to a server and all the records are stored online server which is centralized all over the network. Sensors collect the data and send it to the middleware so that it can be analyzed against the specific threshold. Records are sets of location in latitude & longitude. Records also classified into multiple levels according to measures of an accelerometer in the different range which further classify the risk of potholes. When the sensor network detects a value that is higher or lower than the predefined threshold, it will indicate driver as notification while driving. All the activities such as detecting potholes, collecting potholes location, stored to middleware and analyzed a record and notified to the driver and it is done by the Android mobile application. The mobile application shows the navigation to a user and also notify to the user about the potholes and improve quality of driving and avoiding vehicles high maintenances. All system is under the control of Municipal Corporation authority which collects records and maintenances of roads.

III. SYSTEM ARCHITECTURE

Here, an approach of embedded system design sensor to collect various pothole location and provide navigation to the drivers using mobile application. Detection of potholes location as well as analyzed collected data and provide accurate navigation via mobile application to avoid accidents due to potholes. All monitored and controlled using Raspberry Pi, transmitted through the Wi-Fi. The development process of hardware is a structure imposed on the development which including Printed Circuit Board (PCB) design using DIPTRACE. In this system, python interpreter software is used for programming. This program can receive data with a microcontroller and stored in a database.

By using Python interpreter software, accelerometer, gyroscopes, and IR scanner sensor are interfaced with the microcontroller and build a new sensor. This program will start by collecting data from the sensor which we build our self. Then, the data were transmitted through Wi-Fi to a middleware and stored on server.

Overall, in the system, all the collected recorded are monitored and analyzed on a server then transmitted through wireless Wi-Fi and analyzed data reflect on a mobile application using Google maps API. Mobile application navigates and notifies to the user.

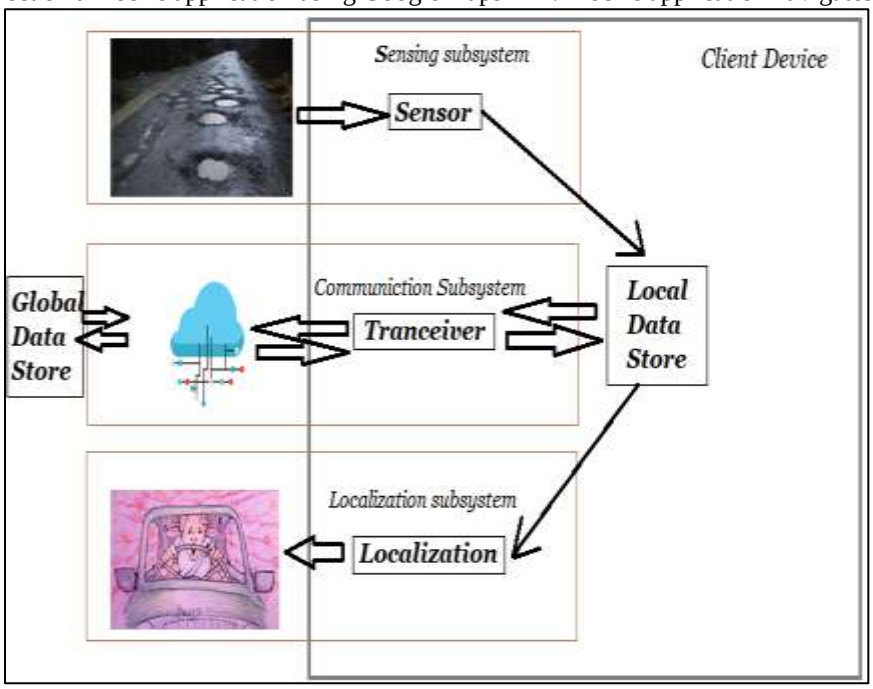

Fig. 1: Architecture Design

IV. ALGORITHMS

C4.5 builds decision trees from a collection of training information within the same approach as ID3, exploitation the conception of information entropy. The coaching information could be a set of already classified samples. Every sample consists of a p-

dimensional vector, wherever they represent attribute values or options of the sample, likewise because the category during which falls.

At every node of the tree, C4.5 chooses the attribute of the info that almost all effectively splits its set of samples into subsets enriched in one category or the opposite. The cacophonic criterion is that the normalized info gain (difference in entropy). The attribute with the very best normalized info gain is chosen to form the choice. The C4.5 formula then recourses on the divided sub lists.

V. IMPLEMENTATION

Propose system is period android Application that automatically predicts the standard of the road based on tri-axial accelerometer(measuring device) and gyroscope(rotating mechanism)sensors, show the road location trace on a geographic map using GPS and save all recorded travail entries. C4.5 decision tree classifier is applied to coaching data to classify road segments and to create our model. Our goal is to derive a road condition recognition a system that detects, analyzes, identifies and predicts the state of road segments exploitation smartphone sensors. Our system doesn't rely on any pre-deployed infrastructures and extra hardware. In our system, road conditions might be detected and known by smartphones according to readings from measuring device and rotating mechanism sensors.

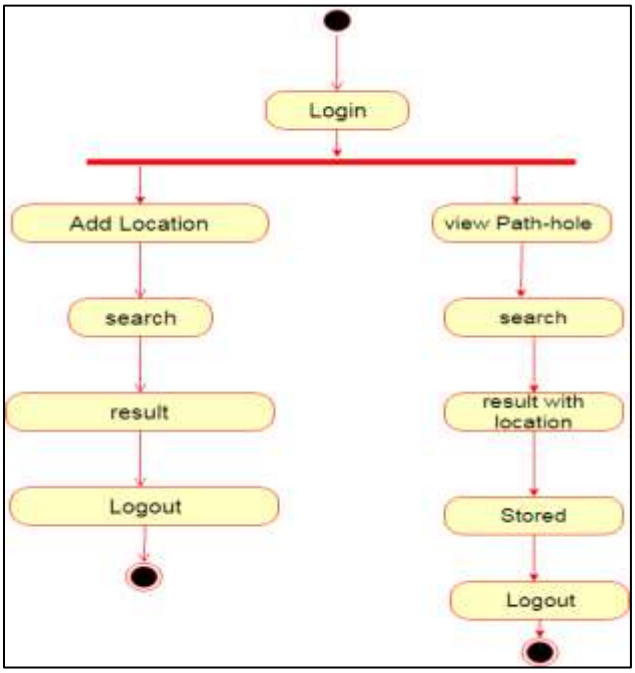

Fig. 2: User Activity

The life cycle of our system is split into a pair of phases: training and prediction. The existing system contains 2 vital functions, first is to discover the pothole that is finished through a multi-sensor scheme consisting of accelerometer and rotating mechanism and second warning the driver and store this info on a cloud the base which may be accessed by different users that will facilitate them apprehend the potholes on their way.

VI. MATHEMATICAL MODEL

1) Q1 = Sense the data (POTHOLES) by Sensors.
2) Q2 = Data send to server database online.
3) S1 = Online database server to store pothole location.
4) Q3 = Middleware analyzes the data by C4.5 and KNN algorithm.
5) Q4 = Data (Location coordinates) after analyze.
6) Q5 = Access data from database and navigate to the user by using Android application (Google MapAPI).
7) Q6 = Send ALERT notification to user via popup message on Application.
8) Q7 = Data use by Maintenance Authority for recovering road quality and data resend to server database for updating after recover damage.

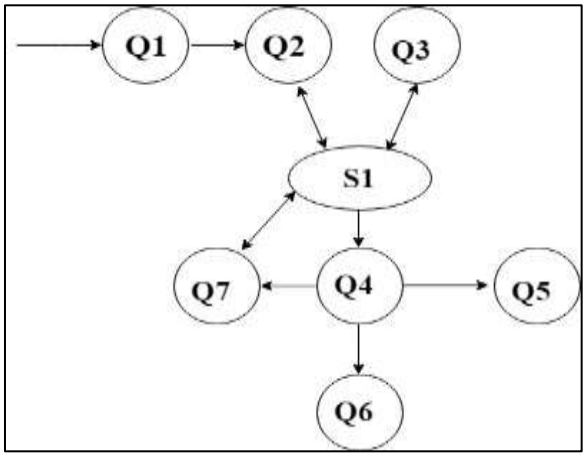

Fig. 3: Mathematical Design

VII. CONCLUSION

In this Paper, we have presented the concept of Pothole Detection System using IoT for Monitoring Road and Traffic Condition using various sensors. To overcome traditional methods monitoring like by Camera and visiting to road by a road authority. It will take huge time as well as the cost for monitoring. By applying Pothole Detection System road maintenance become easy and cost-efficient in a short time. And by using recorded data we can easily analyze the road quality of every road and deal with the corruption in road construction. Maintenance of road with minimum cost as well as time and also corruption which help our country to become a developed Nation worldwide. So, basically, it will play an important role in society towards the development of INDIA.

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