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Safe-Ride : Automatic Recognition of Potholes and Humps on Roads using Ultrasonic Sensor and Notifying the Same to the Drivers

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ABSTRACT

There have been humps and pit holes on a path from the day the road came into being. It was one of the main problems of road maintenance. Because of this many accidents and vehicle damages have occurred particularly in a metropolitan city where there are more vehicles. The solution to this problem is to develop a system which uses a beneficiary of regional structure to detect the topographical location of the potholes and protuberances.

Keywords : Potholes, Humps, Raspberry PI, Ultrasonic sensor, Database, Cloud, Android.

I. INTRODUCTION

India is considered one of the rapidly developing countries as of today. India's road network is gigantic and is the dominant means of transportation in India today, giving it a thought about the condition of the roads. Roads indirectly contribute to the economic growth of the country and the roads must be well built and strong. India has troubling street and traffic conditions as the bulk of India's streets are tight and clogged Nowadays street mishaps are a major issue in many provinces, with poor surface quality and uncomfortable street maintenance needs not being met. Road accident is due to the unevenness of the road surface and fast driving. Traffic jam, safety issues, rash driving, lawlessness and increasing load of vehicular traffic are decreasing the quality of the road.

Streets typically have bumps with the intention that the pace of the car can be managed to stay away from mishaps and potholes caused because of nil support of the street and downpour. To eradicate the potholes on the road, several types of research and studies have been done. These irregular road conditions may cause accidents, Reducing the quality of driving and consuming more fuel than required. Hence, in this paper, we have proposed a framework that catches the geological area directions of the potholes and mounds utilizing a worldwide situating framework beneficiary. Ultrasonic sensors are utilized to distinguish the pit openings and mounds and furthermore to gauge their profundity and tallness, separately. The detected information incorporates pothole profundity, the tallness of protuberance, and geographic area, which is put away in the database (cloud) for a specific street. so that the next Driver on the same road would have a pre-data about the road where humps and pit holes are recorded and can be used to give Voice notification to the driver within a given range say 100m away from it by keeping track of his GPS location. The main objective of making a pothole and hump detection system is to help drivers in many ways and thus assisting them in avoiding a future accident by helping drivers to drive safely.

II. RELATED WORK

This segment gives a total portrayal of the current arrangements and concentrates for recognizing potholes and mounds on streets. Yuquan [1] built up a model which utilizes optical imaging rule of 3-dimensional projection change to get generally data of pothole's virtual diagrammatic segment in pothole identification. The technique utilizes straight drove light and 2 CCD (Charge Coupled Gadget) cameras to get asphalt pictures. Numerous computerized picture preparing innovations, including binarization, picture handling, diminishing, three-dimensional recreation, blunder investigation, and pay are led in the arrangement of picture examinations, preparing to get the profundity of potholes yet results get influenced by the force of drove light and ecological components.

Lin and Liu [1] proposed a strategy for pothole location dependent on SVM (Bolster Vector Machine). Example measure dependent on the Histogram is removed as the properties of the picture locale, and the non-straight help vector machine is developed to distinguish whether an objective area is a pothole.

Moazzam [1] has built up a model in which a minimal effort Kinect sensor is utilized it gives the immediate profundity estimations, along these lines making less processing expenses. Cross sections are made for better representation of potholes. The region of the pothole is examined contrasted with profundity. The rough volume of pothole and protuberance is fathomed utilizing the trapezoidal guideline on territory profundity bends by means of asphalt picture investigation. Other than pothole's zone, length, and width are assessed. The paper likewise proposes an approach to describe pothole.

Samyak Kathane [1] have proposed a model which is Real-time pothole detection and vehicle accident detection and reporting system and Antitheft. In this system the wireless access point collects the information about potholes, it distributes this information to BMC using wireless broadcast. This system is used for accident detection too. Antitheft in the car can help to save millions of dollars. Sensor boards that we used for collecting the

environmental data also have an accelerometer that can measure both the vertical and the horizontal acceleration. for example, when a bus goes over the pothole there would be a significant change in the vertical component of the acceleration and for humps, there would be a horizontal component.

Gunjan Chugh [1] have developed a system in which the various road conditions are detected using a smartphone sensor. This system includes a set of sensors installed in vehicles. Using sensors for detecting road condition is one of the most common approaches and making GPS receiver to collect the data. This solution helps to detect the irregularities in roads such as potholes and humps.

III. PROBLEM STATEMENT

Poorly maintained roads are a part of our daily life in most developing countries including India. A well-maintained road network is a must for the development of any country. One of the increasing problem roads face is worsened road conditions such as potholes and humps. Unexpected hurdles or anomalies on the roads may cause a large number of accidents, also due to bad road conditions fuel consumption increases, resulting in wastage of limited fuel resource. All these reasons push us to face the fact that it is necessary to get information about such bad road conditions, collect and distribute it to all drivers on the road, which can warn the driver [4]. So, it is necessary to create an effective road surface monitoring system. Automated pothole and humps detection are the main goal in the system. The aim is to develop a system based on IoT to detect potholes and humps on the road which catches the geological area directions of the potholes and protuberances utilizing a worldwide situating framework recipient. give Voice notification to the driver within a given range say 100m away from it by keeping track of his GPS location via an Android application and update the information as required.

IV. OBJECTIVES

The significance of our paper is to provide the best utilisation of our system to protect the users from accidents by sending the information such as location of potholes and humps to users driving in a rod which data has been pre-recorded in the database from the initial user who travelled on that road. The two major objectives are:

- To capture the data from the proposed system, able to process the data and send it to the next person travelling on the same road using the navigation application for the humps and pit holes.
- Updating the data on the cloud or central server DB whenever a new pit holes or humps are formed from the first person's vehicle sensor travelling on the road using the navigation application.

V. PROPOSED METHODLOGY

This proposed system of detection and notification of potholes and humps to the drivers is a cost effective solution.

Raspberry Pi 4: Raspberry Pi 4 Model's speed and performance is a step up from earlier models. a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, up to 4GB of RAM, The higher bus speed that enables USB 3 support also allows the on-board Ethernet port to support true Gigabit connections (125 MBps) where the last-gen models had a theoretical maximum of just 41 MBps. The microSD card slot is also twice as fast, offering a theoretical maximum of 50 MBps versus 25 MBps on the 3B+. The dual-band wireless LAN, more and faster RAM, and Bluetooth have modular compliance certification, allowing the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market.

Ultrasonic Sensors: The HC-SR04 is a generally utilized ultrasonic sensor and contains a transmitter and a recipient. It is essentially used to gauge the separations between the item place before it and the sensor. The ultrasonic sensor transmits high-recurrence sound waves and trusts that the reflected wave will hit the beneficiary. The separation is to compute the time interim between the sending of the sign and the getting of reverberation. The working rule of this gadget is shown in figure 2. It chips away at the Doppler Impact. There are numerous sorts of ultrasonic sensors with fluctuating transmission ranges and points of location. This sensor gives about 2cm to 400cm of non-contact estimation include with an exact range that will reach up to 3mm with a 15° edge of location. It is utilized to quantify the separation at which mounds are available before it. Each HC-SR04 module incorporates an ultrasonic beneficiary, control circuit, and transmitter. The ultrasonic sensor is utilized for estimating the profundity of a pothole and stature of a mound and sending the timestamp of the information for figuring the scope and longitude [5].

GPS Receiver: Worldwide Situating Framework is a satellite route framework made up of at any rate 24 satellites and is utilized to catch geographic area and time, independent of the climate conditions. It is kept up by the US Government and is openly accessible to anybody it works in any climate conditions, anyplace on the planet, 24 hours every day, with no membership expenses or arrangement charges. It gets the GPS data from satellites in the National Marine Gadgets Affiliation (NMEA) position. The NMEA has characterized a standard organization for the GPS data. This is trailed by every one of the satellites. The standard characterizes different codes, for example, GLLLatitude/Longitude information, GSV – Point by point satellite information and RMC-Least Prescribed Information. A GPS tracking component is a device that uses the Global Positioning System for determining the location of a vehicle, person, or another asset to which it is attached or fixed. This position will be recorded at regular intervals. The obtained location data can be stored within the GPS unit, or it may be transmitted to a database(local system or central cloud), or internet-connected computer, using a

cellular may be SMS or GPRS, satellite or radio modem embedded in the unit.

Buzzer: A buzzer or beeper is an audio signalling device, buzzer used in this project is an alarming device, Buzzer is an integrated structure of electronic transducers, DC power supply, Active buzzer 5v rated power can be directly connected to a continues to sound.

VI. ARCHITECTURE

The system architecture of the pothole detection system is as shown in Fig 1. The system consists of a sensor, GPS receiver and a computer which processes the received data. The processed data is then used for a database creation of the latitudes and longitudes of potholes and humps. Then that data is shared to a cloud server where it is shared to all users in that road through a [2] Mobile application which gives voice notification to the users while they are few meters away from the potholes and humps guiding them to drive safely avoiding accidents.

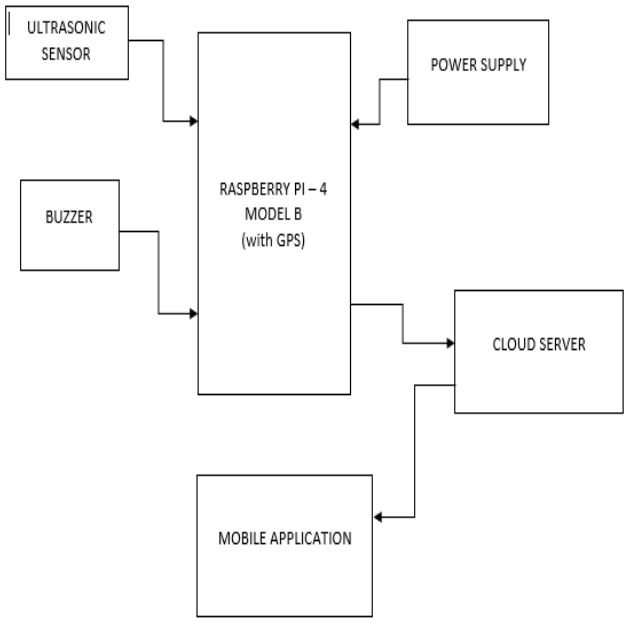

Fig. 1 Components Structure.

VII. DESIGN AND IMPLEMENTATION

The engineering of the proposed framework comprises 3 sections: Raspberry unit, cloud unit and client application unit as shown in Fig 2. is utilized to assemble data about potholes and bumps and their topographical areas and this data is sent to the server. The server module gets data from the microcontroller module, procedures, and stores in the database. The versatile application module gets the data put away in the cloud server database and gives auspicious alarms to the driver. The usage segment comprises of the flowchart for the working of the model is demonstrated as follows:

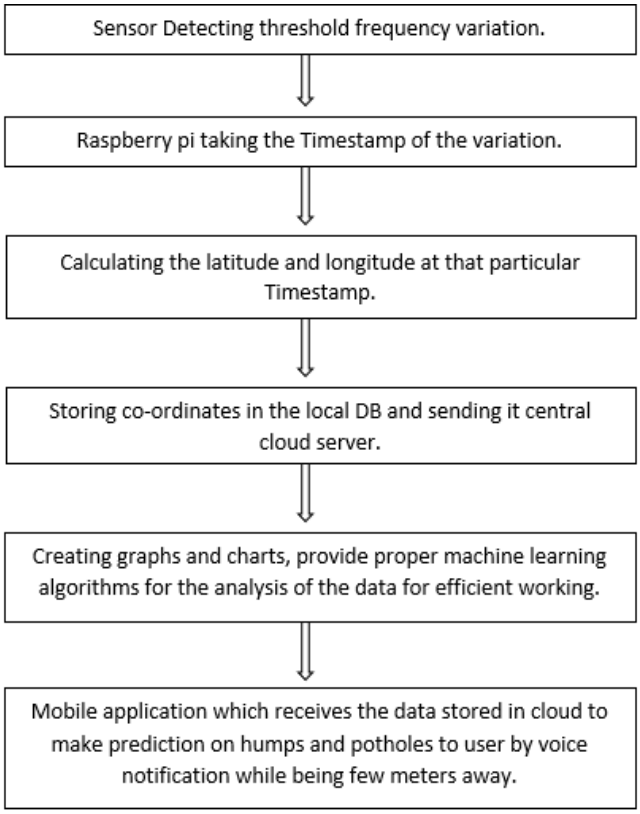

Fig. 2 Workflow of Model.

Raspberry pi module: Understanding the working of the sensor and its information with the proposed framework. sensors ought to have the option to Quantify the Limit separation for the vehicle and the street to identify the mounds and potholes. Getting a similar pattern of data for different sizes of humps and pit holes. Alternatively Making a proper detection with buzzer sound when the threshold is changed. Plotting of the graph from the data obtained for analysis and finding the exact timestamp when the humps or pit holes are detected. Threshold distance monitoring of the ultra-sonic senor for the hump and pit hole detection. Capturing the time stamp when there's a change in threshold distance. [3] Using the data from the GPS tracking and

matching its timestamp to the timestamp obtained from the sensor data and pointing the exact geographic location i.e. latitudes and longitudes. Tracking the GPS of the driver along all the time using any of GPS tracking devices. Matching the timestamp of the data with the time of his location at that time and acquiring the co-ordinates of the location on that time stamp.

Mobile Application module: Developing an Android mobile application or a Micro-service around the proposed cloud platform for mobile devices of the users. The mobile application can help users to monitor their location with also providing them the data stored in the cloud by tracking their location and its distance from an ahead hump or pit holes. Notifying the users through a voice message while they are some distance away from it. This proposed system of detection and notification of potholes and humps to the drivers is a cost-effective solution.

Cloud server module: Creating a Local database for storing the Timestamp values and co-ordinates where the data change has been detected. Sending the data to a Central server Database and sharing it to other devices connected through a common network. Sending an Acknowledgement to the back to device after receiving all data for the removing of data from local storage. Creating a Cloud account with proper infrastructure for the working of the device and storing its data with a standard citation. Moving all the data from the local storage to cloud and assuring of the exact precision of the data obtained to the generated. Sending the processed location coordinates to the cloud server where the data is shared to another driver through an Android application traveling in the same path next. Creating graphs and charts for the analysis of the data gathered and provide proper machine learning algorithms to process and the system efficient in working.

VIII. RESULTS

After Completion of the project we would be getting the following results as the output stored in the database for a user to access it via an application. Table 1 shows the data stored in the database in standard format.

SL NO	TYPE	TIME STAMP	LATITUDE	LONGITUDE
1	P	2019-08-14 03:15:30.15	12.9563	77.5544
2	H	2019-08-14 03:20:19.31	12.9406	77.5661
3	H	2019-08-14 03:24:12.21	12.9421	77.5668
4	P	2019-08-14 03:27:20.00	12.9434	77.5669
5	P	2019-08-14 03:35:33.07	12.9411	77.5654

IX. CONCLUSION

The model proposed in this paper fills 2 significant needs; programmed location of potholes and mounds and alarming vehicle drivers to avoid potential mishaps and vehicle harms. The system is developed that will be placed at the base of any two-wheeler/three-wheeler/four-wheeler vehicle. The system will consist of two sensors i.e. ultrasonic sensor and GPS receiver. The ultrasonic sensor will detect the pothole/hump and the timestamp of the detection is stored in the database along with the coordinates at that time in the form of latitude and longitude at the local and cloud database The proposed methodology is a monetary practical answer for recognize loathsome potholes and uneven protuberances, as it utilizes ease ultrasonic sensors. An android versatile application is utilized to alarm or inform drivers with the goal that fundamental measures can be taken to maintain a strategic distance from mishaps. Cautions are given as the voice message and furthermore make new identifications to refresh the cloud database helping different clients. The arrangement additionally works in the stormy season when potholes are loaded up with water as notices are given utilizing the data put away in the database. This fills in as a significant wellspring of data to the administration specialists assisting them in the support of street and vehicle drivers with driving securely.

FUTURE WORK

The Proposed project in a large scale can help solve many Real-World problems such as accidents due to new speed breaker on the old road, Reducing the vehicle damages during rainy season by avoiding the pit holes on the weak road. it would also help in notifying the Ministry in charge of the maintenance of roads to fix pit holes and help citizen travel secure, comfort and hassle free. The system is more useful in rainy season as the potholes and humps get covered with water. In future, a camera can be included in device to click a picture of detected pothole or hump. Also, a tracker can be included in device so as to improve security measurements.

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