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Potholes and Humps Detection for Vehicle Safety

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ABSTRACT
One of the major problems in developing countries is maintenance of roads. Well maintained roads contribute a major portion to the country's economy. Identification of potholes and humps not only helps drivers to avoid accidents or vehicle damages, but also helps authorities to maintain roads. This project discusses previous pothole detection methods that have been developed and proposes a cost-effective solution to identify the potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify the potholes and humps and also to measure their depth and height, respectively. The proposed system captures the geographical location coordinates of the potholes and humps using a global positioning system receiver. The sensed-data includes pothole depth, height of hump, and geographic location, which is stored in the database. This serves as a valuable source of information to the government authorities and vehicle drivers. An android application is used to alert drivers so that precautionary measures can be taken to evade accidents respectively. Information about depth of pothole, height of hump as well as location, which is sensed by the sensor, is stored in the database. This proposed system note the geographical location coordinates of potholes and humps using GPS receivers and store that information as complaint to the government sector. This serves as a valuable source of information to the concerned authorities and to vehicle drivers. To avoid accidents a web application is used to aware drivers so that safety measures.

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KEYWORDS: *IoT, ultrasonic sensor, Raspberry pi, Android App*

Introduction

India is considered one of the fastest developing countries as of today. India's road network is gigantic, giving it a thought about the condition of the roads. Roads indirectly contribute to the economic growth of the country and it is extremely essential that the roads are well built and strong. India is home to several bad roads be it the metropolitans, the cities or the villages.

Roads are normally placed with speed breakers that are used to control the speed of the vehicle. But these speed breakers have been a cause of accidents because a definite dimension is not followed throughout. Likewise, potholes are formed due to oil spills, heavy rains and also due to movement of heavy vehicles. These bad road conditions cause accidents, affect the quality of driving and also consumes more fuel. Hence, we have proposed a system that would notify the drivers regarding any hurdles such as potholes and humps and this information can be used by the Government to correct these roads effectively.

Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages, but also helps authorities to maintain roads. Ultrasonic sensors are used to identify the potholes and humps and also to measure their depth and height, respectively.

Many on-going projects in the field of vehicular networks are working in the direction of providing the driver with relevant information about roads and traffic movements. One of the major problems in developing countries is the maintenance of roads. Well maintained roads contribute a major

portion to the country's economy. And also many people are killed by unwanted potholes and humps on road. So Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages but also helps authorities to maintain roads.

Literature Survey

The technology is different i.e, using the camera with Ultrasonic sensors and with some wireless system so that the process is simple and fast as simultaneously. Potholes detection is the intriguing topic of research and researches have been working on the same to detect it automatically with many techniques, they have already developed the detection of potholes and humps using various techniques like IR sensors, Black Box camera, Digital Image Processing techniques [1].

The Government developed android application for sending the captured images of potholes and humps on the server son that necessary actions will be taken as soon as possible and the potholes will get repaired by the help of the android application for the interface [2].

Pascal and Ortiz presented some defect detection algorithms for full inspection using the morphological properties of cracks in steel surfaces. The crack location was identified using the corrosion [3].

Sachin Bharadwaj developed a system that detects potholes based on a vision based approach. The pictures of the road surface are captured using a properly mounted camera. The images are then processed using MATLAB to detect the occurrence of potholes. It is a 2D vision based solution and works only under uniform lighting conditions and also the system does not involve any kind of warning system. The above solutions are limited only to the identification of a pothole. These solutions do not provide any aid to the driver to avoid accidents due to potholes and humps[4].

Prachi More has proposed a system where sensors are mounted on public vehicles. These sensors record vertical and horizontal accelerations experienced by vehicles on their route. The installed GPS device logs its corresponding coordinates to locate potholes and the collected data is processed to locate potholes along the path traversed earlier by the vehicle. A Fire Bird V robot is used for experimenting with constant speed. The moving robot is mounted with a servo motor which rotates 0- 180 degrees along with IR Sharp sensors[5].

Venkatesh have proposed an intelligent system that has made use of laser line striper and a camera to detect and avoid potholes. This system maintains a centralized database of the location of potholes.It also sends warning messages to the nearby vehicles about the occurrence of potholes using Dedicated Short Range Communication protocol. It makes use of ultrasonic sensors to detect the presence of potholes[6].

Moazzam have proposed a low cost model for analysing 3D pavement distress images. It makes use of a low cost Kinect sensor, which gives the direct depth measurements, thereby reducing computing costs. The Kinect sensor consists of a RGB camera, and these cameras capture RGB images and depth images. These images are analysed using MATLAB environment, by extracting metrological and characteristic features, to determine the depth of potholes[7].

BLOCK DIAGRAM AND WORKING:

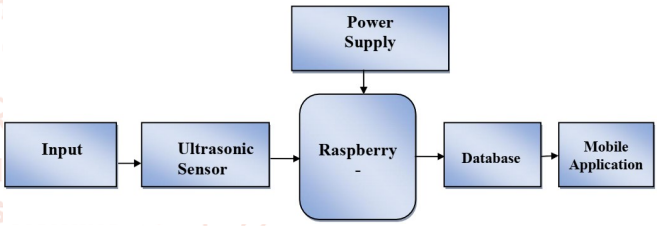


Fig. Block Diagram

In this Project, the Ultrasonic Sensor is used to find the Pothole and Humps on the roads. This Ultrasonic sensor emits the pulses at regular intervals of time; the receiver listens to the echo, and round-off time into the function of height. The Receiver detects the abrupt changes in the terrain, by comparing the round-off time. By default, the nature of the terrain has to be determined before. Thus when the Pothole is detected by the system it correspondingly sends the intimation to the Road Maintenance Authority, thus this may decrease the valuable time for them in finding the Potholes in the roads.

Raspberry Pi is a small size module like a small computer. The image captured by the camera is sent to the Raspberry Pi. Using open CV library, the image is processed and detected by the Raspberry Pi. We are using the Raspberry Pi B+.

Initially Raspberry pi controller which is the heart of system will get a supply which will further provide it to the input of the system.

Ultra sonic sensor is used to identify the potholes and humps and also to measure their depth and height respectively. The HC-SR04 is an active ultrasonic sensor and contains a transmitter and a

receiver. It is used to measure distance at which, objects are placed in front of it. The ultrasonic sensor transmits high frequency sound waves and waits for the reflected wave to hit the receiver. The distance is calculated based on the time taken by the ultrasonic pulse to travel a particular distance.

There are different types of ultrasonic sensors with different transmission ranges and angles of detection. The HC-SR04 sensor work at frequency of 40 KHz and can measure distances of the objects in the range 2 to 400 cm with a 15° angle of detection. The collected data is then sent to the Wi-Fi module by the Raspberry pi. Data then transmits the data to the server or device to maintain the database of potholes and humps. Android application is used to alert drivers so that precautionary measures can be taken to avoid accident and vehicle damage, alerts are given in the form of flash message and audio beep.

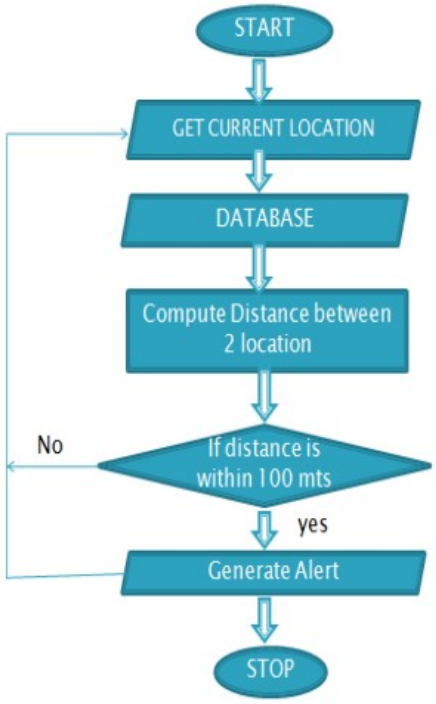


Fig. Flow chart

Methodology

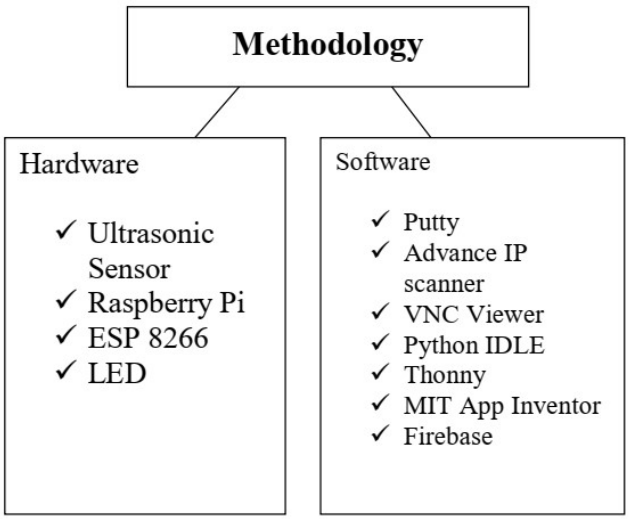


Fig. Methodology

HC-HR-01 and RASPBERRY PI 3B:

It is the interfacing between Node MCU and the Raspberry Pi. Node MCU will sends data to the Raspberry Pi.

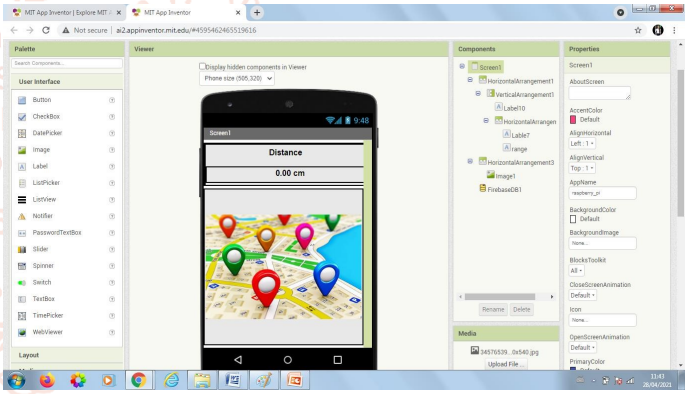


Fig. Software Display of Design Part

Customer mobile application and administrator mobile application is develop by using MIT APP Inventor .It consist block coding. In this simply drag the blocks for programming.

Customer Mobile Application:

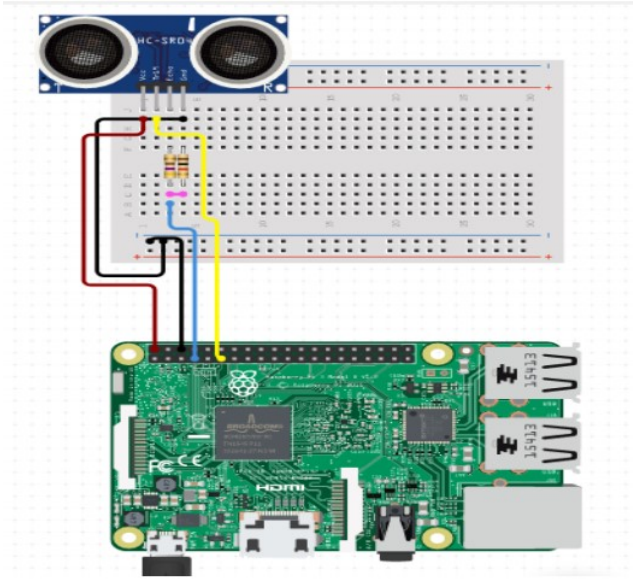


Fig. Circuit Diagram

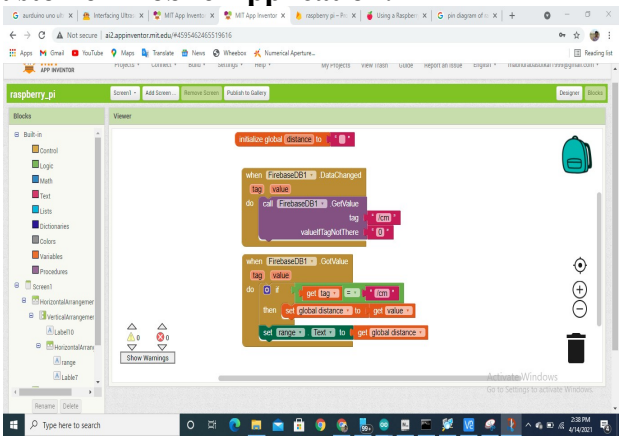
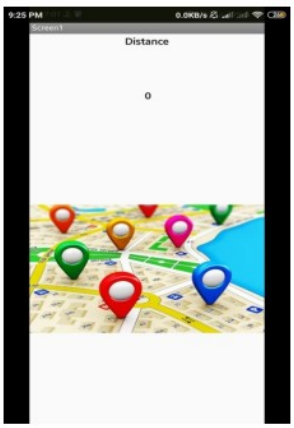


Fig. Software Display of Block Part



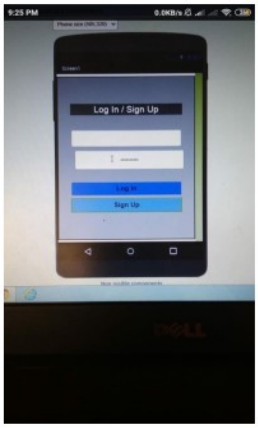


Fig. Home page and Login page

Advantages:

1. Accidents due to pothole can be avoided.
2. The sensing subsystem which senses the potholes encountered by it, about which it did not have the prior information.
3. Then communication subsystem which transfers the information between Wi-Fi access point and mobile node.
4. Access Point broadcasts the data about potholes in its area
5. Timely information helps recover the road as fast as possible.
6. Enhanced Safety and security provided.

Application

1. Well maintained roads contribute a major portion to the country's economy. Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages, but also helps authorities to maintain roads.
2. It makes use of ultrasonic sensors to detect the presence of potholes.
3. The system provides warnings after detecting the potholes which does not effectively help drivers to avoid potential accidents.
4. Although this method communicates traffic events with other drivers, it increases the cost and complexity of implementation

Conclusion:

The proposed system basically serves two purposes; it automatically detects the potholes and humps and sends the information regarding this to the vehicle drivers, so that they can avoid accidents. This is a cost efficient solution for detection of humps and potholes.

As the pothole is detected the demo model would gradually decrease the speed so that the accident cause will be less this system helps us to avoid dreadful potholes and humps and any tragic accidents due to bad road conditions the information is transmitted to the server of government authorities for the maintenance of the roads. The database of the recorded potholes could be observed over the server and access data through application.

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