

# An Intelligent Detection and Notification to Avoid Potholes on Road to Aid Drivers

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**Abstract** - This paper discusses about the pothole detection techniques that have been developed and proposes a cost reduced solution to identify pothole and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify pothole and also to measure their depth and height respectively. The proposed system captures images of potholes and the geographical location coordinates of potholes and humps using GPS receiver. The sensed-data includes pothole depth, height of hump and exact images and geographic location, which is stored in the database (cloud). This uses as a valuable source of information about road condition to the Government authorities and to vehicle drivers. An android application is used to alert drivers so that precautionary measures can be taken to avoid accidents. Alerts are given in the form of images and also with a flash messages on android app with an audio beep.

**Keywords** - Android application, GSM SIM900, GPS, Raspberry pi, Ultrasonic sensors, USB camera.

## I. INTRODUCTION

Concise, formed due to heavy rains and movement of heavy vehicles, also become a major reason for traumatic accidents and loss of human lives. According to the survey report "Road Accidents in India, 2011", by the ministry of road transport and highways, a total of 1,42,485 people had lost their lives due to fatal road accidents. Of these, nearly 1.5 per cent or nearly 2,200 fatalities were due to poor condition of roads.

Roads in India normally have speed breakers so that the vehicle's speed can be controlled to avoid accidents. However, these speed breakers are unevenly distributed with uneven and unscientific heights. Potholes, formed due to heavy rains and movement of heavy vehicles, also become a major reason for traumatic accidents and loss of human lives. Poor condition of roads. With the proposed system an attempt has been made to endorse drivers to ward off the accidents caused due to potholes and raised humps.

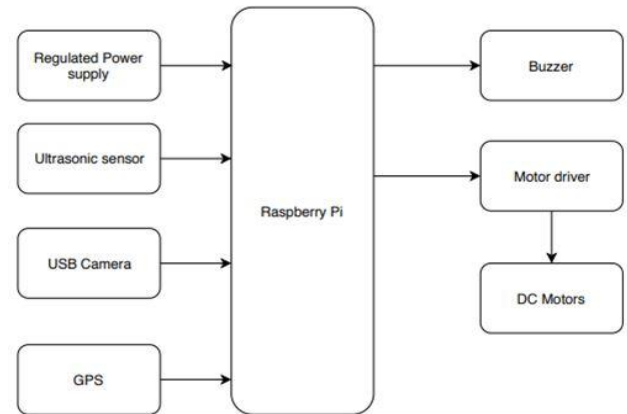


Figure 1: Proposed System Block Diagram



Figure 2: Condition of roads with potholes.

Figure 2 portrays the condition of roads with killer potholes. To address the above mentioned problems, a cost effective solution is needed that collects the information about the severity of potholes and humps and also helps drivers to drive safely.

## II. LITERATURE SURVEY

**Implementing Intelligent Control System for Congestion Control, Ambulance Clearance and Stolen Vehicle Detection** - Each individual vehicle is supplied with special RFID tag (placed at a strategic location), that makes it not possible to get rid of or destroy. We use RFID reader, NSK EDK-125-TTL and PIC16F877A system-on-chip to read the RFID tags attached to the vehicle. It counts range of vehicles that passes on a selected path throughout a given length. It additionally determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the taken vehicle, then a message is sent

using GSMSIM300 to the police control room. Also, once AN auto is approaching the junction, it will communicate to the traffic controller in the junction to turn on the green light. This module uses Sigsbee modules on CC2500 and PIC16F877A system-on-chip for wireless communications between the auto and traffic controller. The paradigm was tested below totally different combos of inputs in our wireless communication laboratory and experimental results were found needless to say.

**Metrology and Visualization of Potholes using the Microsoft Kinect Sensor** - Pavement distress and wear detection is of prime importance in transportation engineering. Due to degradation, potholes and different types of cracks are formed and they have to be detected and repaired in due course. Estimating the number of filler material that's required to fill a hole is of nice interest to forestall any shortage or excess, thereby wastage, of filler material that usually needs to be transported from a distinct location. Metrological and visualisation properties of a hole play a crucial role during this regard. Using an inexpensive Kinect sensing element, the pavement depth images are collected from concrete and asphalt roads. Meshes are generated for better visualization of potholes. Area of pothole is analysed with respect to depth. The approximate volume of hole is calculated mistreatment quadrilateral rule on area-depth curves through pavement image analysis. In addition whole space, length, and dimension square measure calculable.

### III. COMPONENTS OF PROPOSED SYSTEM

**Raspberry pi** - As well because the 'standard' Raspberry Pi, the Raspberry Pi two Model B, there's also a smaller version of the Raspberry Pi that you can use. The Raspberry Pi Model A+ may be a cut-down version of the initial Raspberry Pi, with a little less power at its disposal and fewer connections on it.also has just one USB port and no LAN port, making it slightly less useful to some.



Figure 3

**Ultrasonic Sensors HC-SR** - 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 15o angle of detection.

**GPS Receiver** - It obtains the GPS information from satellites in National Marine Electronics Association (NMEA) format. The NMEA has defined a standard format for the GPS information. This is followed by all thesatellites. The standard defines various codes such as GLL- Latitude/Longitude data, GSV – Detailed satellite data and RMC- Minimum Recommended Data.

**Camera** - Now a days we see a lot of advanced cameras that are used to capture motion as well as images from a very far distance. During the time of its invention images could be taken only in a room and could not be portable. The instrument should be kept in a dark chamber or box and the room should function as a real-time imaging system. Thus the camera was earlier called "camera-obscure" which meant "dark chamber".



Figure 4: (a) proposed model fixed on two wheeler bike for testing. (b) Detection of hump. (c) Detection of pothole

**GSM SIM 900** - Global Standards for Mobile Communication (GSM) is a set of standards for Second Generation (2G) cellular networks. The GSM SIM 900 module uses any network provider's SIM to cover too per communicate over the telecommunication network. This modem can be used to send and receive text messages and to make and receive voice calls. GSM SIM 900 is a quad-band GSM modem that functions at 850, 900, 1800 and 1900 MHz frequencies. This modem also supports features like transferring voice data, integrated support for GPRS and TCP/IP stack.

### IV. ARCHITECTURE & IMPLEMENTATION

The architecture of the proposed system consists of 3 parts Raspberry pi, server module and the mobile application module.

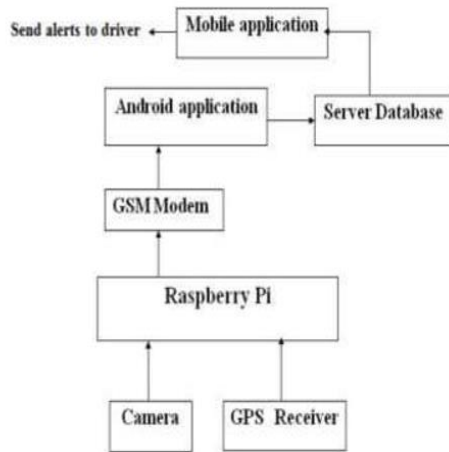


Figure 5: Architecture &amp; implementation diagram

**Raspberry Pi** - Potholes and Humps on the Road are detected using Image Processing and for that Raspberry PI is used in which a camera is attached to capture the images of the roads and side by side the potholes and humps are detected on the road and the data of the same is uploaded to the server. The GPS used will locate the exact longitudinal and latitudinal margin i.e. the exact longitude and latitude of the potholes and humps detected. Also one Beep will be turning ON whenever the humps of potholes are detected to Aid the driver.

We are designing cost efficient system. Ultrasonic sensors are used to identify the potholes and humps and also to measure their depth and height respectively. In this proposed system to overcome all the circumstances, ULTRASONIC SENSOR and GPS RECEIVER are placed at the bottom of vehicle were ULTRASONIC SENSOR is used to measure the distance between the road and the sensor and the data is received by the microcontroller. The GPS RECEIVER captures the location of the detected pothole or the hump and sends messages to the registered mobile SIM using GSM modem.

**Server Module** - This module consists of two parts; the android device and the database. It acts as an intermediary layer between the microcontroller module and the mobile application. The server module is implemented as an android application that runs on a device and is responsible for reading messages sent by the registered mobile SIM present in the microcontroller module. It processes the contents of this message and stores it in the database (cloud). Integrating sensor networks with cloud and Internet of Things, it is possible to allow broader access to sensor data.

**Mobile Application Module** - This module is implemented as an android application that is installed on the vehicle driver's mobile phone to provide timely alerts about the presence of potholes and humps .Figure 5 shows the

workflow of this application. The application continuously runs in the phone background. It first captures the current geographic location of the vehicle and then accesses the locations of potholes and humps stored in the server database. The distance between the vehicle location and the pothole location stored in database is computed. If the distance between the two is within 100meters, an alert message pops up on the mobile screen. This message is accompanied with an audio beep so that the driver can differentiate it from other flash messages.

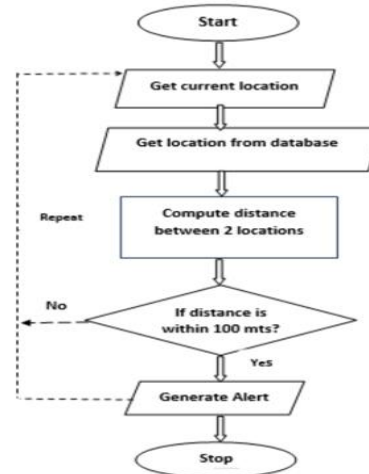


Figure 6: Workflow of mobile application.

## V. EXPERIMENTAL RESULTS

It was tested in a simulated environment with artificial potholes and humps. Tests were carried out in two phases. In the first phase, information about potholes and humps was received by the image processing and for that Raspberry PI is used in which a camera is attached to capture the images of the roads and side by side the potholes and humps are detected on the road and the data of the same is uploaded to the server. In second phase, alerts were generated based on the pothole and the hump information were given to the driver through Gsm, while testing in the simulated environment, The module is fixed on a toy car and the threshold value is configured to 5cms. During the tests it was found that the module was worked as expected to detect the potholes.

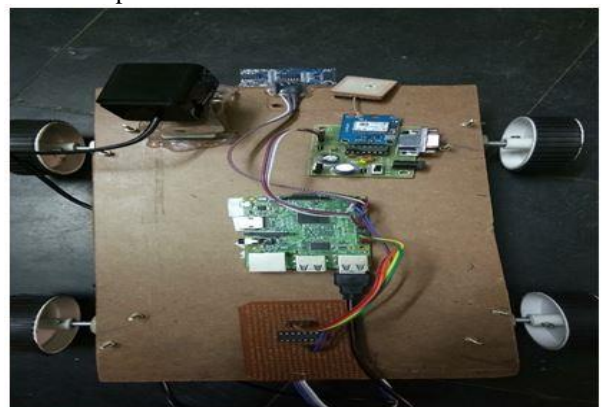


Figure 7: working model of proposed system



Table 1: formation about Potholes and Humps collected in Simulated Test Environment

Sr.No.	Obstacle Type	Height/Depth in cms	Latitude	Longitude
1	P	19.35	12.9563	77.5544
2	H	3.1	12.9406	77.5661
3	H	3.8	12.9421	77.5668
4	P	13.2	12.9434	77.5669
5	P	8.7	12.9411	77.5654

## VI. CONCLUSIONS

In this paper, we have proposed system which will detect the potholes on the road and save the information in the server. Due to the rains and oil spills potholes are generated which will cause the accidents. The potholes are detected and its height, depth and size are measured using ultrasonic sensor. The GPS is used to find the location of pothole. All the information is saved in the database. This timely information can help to recover the road as fast as possible. Hence the system will help road accidents. The mobile application used in this system is an additional advantage as it provides timely alerts about potholes and humps. This serves as a valuable source of information to the government authorities and to vehicle drivers. It will save many lives and ailing patients who suffer from tragic accidents. Well maintained roads contribute a major portion of the country's economy.

## VII. FUTURE SCOPE

In our project we are using single node. In future it may require one data base server. if we are using n number of nodes we have to make a cloud. It can be integrate in the proposed system to improve user experience. After successful completion of this project we can conclude that, Thus we have successfully made a working model of Automatic Detection and Notification of Potholes and humps on roads to aid drivers. This model is simple and less complex as compared to others it has very vast future development scope.

## VIII. REFERENCES

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