

Automatic Detection of Potholes

Akshatha P¹, Chaitra Paul², Lakshmi Suresh³, Richard Lincoln Paulraj⁴

^{1,2,3}Dept. of Electronics and Communication, The Oxford College of Engineering, Bangalore, India

⁴Assistant Professor, Dept. of Electronics and Communication, The Oxford College of Engineering, Bangalore, India

Abstract— The “pothole deaths” have stirred a debate on the inefficiency and the corruption in the municipal and road owning authorities. Vehicle population has tremendously increased over the last two decades. Nowadays traffic congestion and road accidents are increasing mainly due to the proliferation of vehicles. Owing to the increased death that are caused to the improper road maintenance creating solution that reduces such deaths and also to increase the quality of road maintenance is a must. Roads make up to the majority of means of transportation used as of today in India, regular maintenance of these roads is crucial as they are filled with unexpected hurdles such as potholes and humps. Potholes are basically areas of road surface that have ruptured, worn away, or eventually formed a hole.

Automatic detection of potholes is a human safety based project. This system provides cost effective solution for detection of potholes on the road by using ultrasonic sensors and indicates the road maintenance authority. The microcontroller fetches the location of the pothole using GPS and the GPS locations are sent with the help of GSM. The GSM at the vehicle part takes that location and sends the location to the concerned person and that person can see pothole on the map of that area.

Keywords—Automatic Detection, GPS, GSM, Ultrasonic, Pothole

I. INTRODUCTION

There is a huge risk of accidents on roads with big holes, bulges, improper roads and unexpected or sudden appearance of speed breakers. The major reason behind the potholes is use of low quality material for the construction of the roads; other reasons include climatic conditions etc. Thus, automatic detection of potholes helps us to detect these holes, and improper roads anywhere in the world through the use of GPS.

Potholes lead to unbalance while driving which can eventually lead to accident. According to the report of Global Road Safety, released by the World Health Organization (WHO), India reports for more than 200,000 deaths because of road accidents. These accidents can be due to over speeding, drunk and driving, jumping traffic signals and also due to humps, speed-breakers and potholes.

We have taken keen interest in building this project to improve the safety of human race and to achieve low maintenance. This system provides cost effective solution for detection of potholes on the road and indicate the road maintenance authority for maintenance. The distance sensor senses the pothole which is given to microcontroller. Microcontroller fetches the location of that pothole by using GPS and that GPS locations are sent with help of GSM. The

GSM at the vehicle part takes that locations and indicate pothole on the map of that area.

II. LITERATURE SURVEY

This section aims to shed light on the different implementations and ideas associated with this topic as well as those that have helped in the formulation of the idea.

Rajeshwari Sundar, Santhosh Hebbar, Varaprasad Golla[1] This paper presents an intelligent traffic control system to pass emergency vehicles smoothly. Each individual vehicle is equipped with special radio frequency identification (RFID) tag. If the RFID-tag-read belongs to the stolen vehicle, and then a message is sent using GSM SIM300 to the police control room. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light.

Sudarshan S Rode, Shonil Vijay, Prakhar Goyal, Purushottam Kulkarni, Kavi Arya [2] This paper proposes Wi-Fi based architecture for Pothole Detection and Warning System. The system consists of access points placed on the roadsides for broadcasting data, which can be received by Wi-Fi enabled vehicles as they enter. The mobile nodes can also broadcast their response as feedback.

Artis Mednis, Girts Strazdins, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo [3] The paper is describing a mobile sensing system for road irregularity detection using Android OS based smart-phones. Selected data processing algorithms are discussed and their evaluation presented with true positive rate as high as 90% using real world data. The optimal parameters for the algorithms are determined as well as recommendations for their application.

Rajeshwari Madil, Santosh Hebbar, Praveenraj Pattar[4] 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. An android application is used to update the pictures of location on the application. Alerts are given to the driver and simultaneously pictures are updated on application.

III. METHODOLOGY

This section shows the overview of the system. Fig1 shows the block diagram of the proposed system.

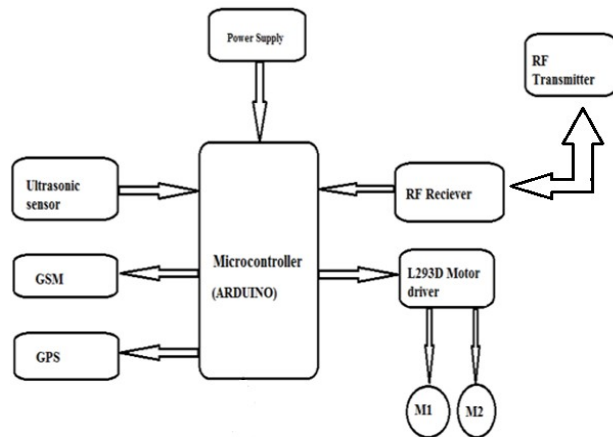


Fig 1: Block Diagram

The ATmega 328P (Arduino UNO) acts as the heart of the system. To this the ultrasonic sensor is interfaced to work as one unit. This Ultrasonic Sensor continuously measures the distance between it and the road. When there is a pothole, the distance increases and it is detected by the sensor. Then the buzzer will give the sound to indicate the pothole. The GPS modules has antenna for taking the location. This location is sent as an alter message to the driver via a GSM module.

The whole prototype is controlled by a remote. This remote incorporates an RF module. The RF module has an RF transmitter which has the buttons for left, right, forward and stop motions. The RF receiver takes the signal and sends it to the microcontroller which in turn controls the motor via a L293D motor driver.

A. Hardware Requirements

1. ATmega 328P: It is a high performance, pico-power, 8-bit AVR RISC based microcontroller that is capable of executing powerful instructions in a single clock cycle, hence approaching throughputs of 1MIPS per MHz.
2. Ultrasonic sensor: The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module. Ultrasonic sensor module provides 2cm - 400cm non-contact measurement function and the ranging accuracy can reach to 3mm.
3. GSM + GPS Module (SIM 808): At the heart is a powerful GSM cellular with integrated GPS. It is an all-in-one cellular phone module that lets us add location-tracking, voice, text, SMS and data as per our needs. Its quad-band 850/900/1800/1900MHz – allows one to connect onto any global GSM network.
4. Motor driver: L293D is a dual H-bridge motor driver integrated circuit(IC). Motor drivers act as current

amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. Motor driver act as an interface between Arduino and the motors.

5. RF transmitter receiver: An RF module (radio frequency module) is a small electronic device used to transmit and receive radio signals between two devices. It has a wide operating voltage range i.e. 3V to 12V. Basically the RF modules are 433 MHz RF transmitter and receiver modules.
6. 7805 Regulator IC: A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.
7. DC Motor: A DC motor converts direct current electrical energy into mechanical energy. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.
8. Power supply: A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load.

B. Software Requirements

- Arduino IDE: The Arduino integrated development environment or IDE for short, is a cross-platform application that is written in the programming Python. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

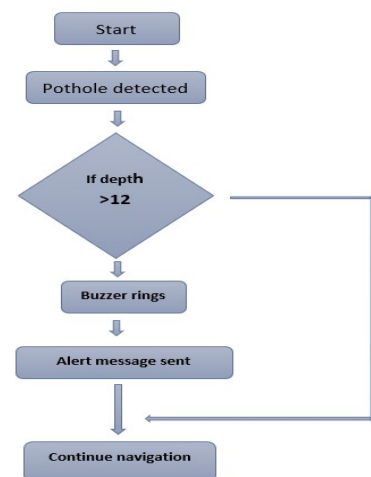


Fig 2: Flowchart of the system

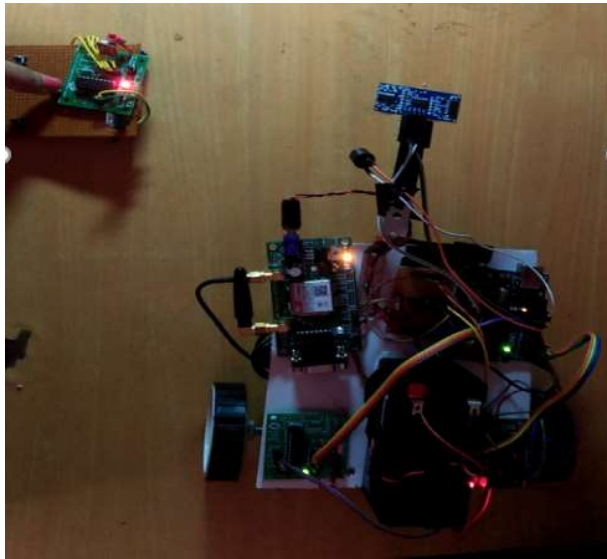


Fig 3: Hardware setup

IV. RESULT

In doing this project, we achieved our required outputs and a working prototype was implemented. The output of the system displayed using the Arduino IDE is shown.

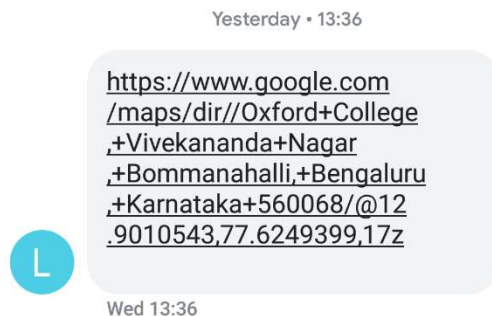


Fig 4: The message delivered

This shows the alert message along with the GPS coordinates.

V. CONCLUSION

This system provides cost effective solution for detection of potholes and humps on the road and indicate the road maintenance authority for maintenance. This system also provides the driver an indication that there is a pothole ahead and the desired action can be taken. This project helps with maintaining the proper condition of the roads and the accidents that are caused due to the potholes in unexpected

parts of the roads. Many enhancements can be made on this device like hump detection; adaptive speed control, obstacle avoidance and preventing drink and drive cases. The detection system that is proposed gives the driver an alert message whenever the pothole is detected. The potholes can be detected on any roads and the GSM and GPS system will immediately detect the location and an alert is sent to the driver that is driving the vehicle.

VI. FUTURE WORKS

On a larger scale, we can enhance this prototype for the betterment of the society. The locations that were detected by the vehicles will be stored in a database. This database will give us the depth and the exact location of the pothole in any given area. The municipal authorities can access this data and get the locations of the potholes that were detected. Furthermore, they can check the severity of the pothole by analysing the depth that was recorded in the database. They can send the assigned personals to repair the pothole in that given area. This will ensure safer roads and smooth navigation of traffic.

ACKNOWLEDGMENT

“Success is the abstract of hard work and perseverance but most important of all is the encouraging guidance”

So, I acknowledge all those whose guidance served as a beacon of light and crowned our efforts with success. I would like to express my heartfelt gratitude for the project guide Asst. Professor Richard Lincoln Paulraj for the continuous support and guidance given throughout the period of work.

Last but not the least I extend my heartfelt thanks to my parents and all my friends for their encouragement, moral support and affection throughout my period of study.

REFERENCES

- [1]. Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection. IEEE Sensors Journal (Volume: 15, Issue: 2, Feb. 2015)
- [2]. Pothole Detection and Warning System: Infrastructure Support and System Design. 2009 International Conference on Electronic Computer Technology, 27 February 2009
- [3]. Real Time Pothole Detection using Android Smart phones with Accelerometers. 2011 International Conference on Distributed Computing in Sensor Systems and Workshops (DCOSS), 12 August 2011.
- [4]. Automatic Detection of Potholes and Humps on Roads to Aid Driver. IEEE Sensors Journal, 30 March 2015.
- [5]. Speed Control of Vehicle by Detection of Potholes and Humps. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, March 2016.