

IOT BASED POTHOLE DETECTION USING ON-BOARD CAMERA AND GPS MODULE

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Abstract— One of the serious issues in creating nations is upkeep of streets. Very much kept up streets contribute a major bit to the nation's economy. For example, potholes and protuberances not just assistance drivers to dodge mishaps or vehicle harms, yet in addition encourages specialists to maintain streets. In this paper we discussed about past pothole identification techniques that have been created and proposes a savvy answer for recognize the potholes and mounds on streets and give auspicious alarms to drivers to keep away from mishaps or vehicle harms. Ultrasonic sensors are utilized to distinguish the potholes and mounds and furthermore to quantify their profundity and tallness, individually. The proposed framework catches the land area directions of the potholes and mounds utilizing a worldwide situating framework beneficiary. This framework catches the pictures with on-board camera (16MP min) and furthermore keeps track the geological area directions of the potholes utilizing a GPS beneficiary. This whole information and area facilitate are put away in the database. This database data fills in as an important wellspring of data to the administration and vehicle drivers for future hazard shirking. Notifications and images of pothole and breakers are sent to the user's email address to aid drivers. Cautions are given as blaze messages with a sound blare.

Keywords— *IOT, GPS, Raspberry Pi, LCD, Ultrasonic Sensors, On-Board Camera, Buzzer, L293D, RPS, DC Motor.*

1. INTRODUCTION

Embedded systems are used for some specific task, rather than be a normal computer for various tasks. Very few systems have real time performance issues which can be negotiated, such as safety and usability; others may have low or no performance problems, allowing the system hardware with low cost [1].

An embedded system is a controlling device. Embedded software's such as firmware is used for embedded systems. ROM and other storage units are used for the embedded systems. It runs on minimum computer storage resources with very minute memory.

Wireless communication is playing very prominent role in commercial products and a popular research topic in today's world [2]. There are more smartphone users than wired-line users. Initially, any one area of commercial interest has been cost efficiency, power efficiency, and wireless communication used for personal WAN's. Advancement in the technology is giving low cost and low most efficient systems for the users by providing various integrated processors and their functionalities. These embedded systems will be merged with applications to provide security and maintenance for various organizations [3]. They also ensure custom solutions to the end users by taking innovative measures for problem solving. The new advancements in the technology and also in devices made new business activities, and also the employment in every technological area [4]. Graduates and engineers who have enough knowledge about these embedded systems and wireless communications are in high demand in today's world. But very few are available for the development of the industrial purposes [5]. Therefore, every student needs to learn about these technologies during their lab exercises. The communication mediums were wireless radio, IR mediums, optical fiber, twisted pair, etc.



Fig 1. Example Pothole Condition

The organisation of the paper is as follows: Section 2 describes the literature review. Section 3 describes the components used in the research. Section 4 explains the architecture of the proposed system. Section 5 describes the experimentation results and Section 6 concludes the paper and provides the direction for future work.

2. RELATED WORK

Asphalt trouble discovery is a fascinating subject of research and specialists have been chipping away at pothole recognition systems. This segment gives a short depiction about the current answers for identifying potholes and protuberances on streets. Current pothole condition is showing in Fig 1. Moazzam et al. [3] have proposed a minimal effort model for breaking down 3D asphalt trouble pictures. It utilizes a minimal effort Kinect sensor, which gives the immediate profundity estimations, in this manner decreasing processing costs. The Kinect sensor comprises of a RGB camera and an IR camera, and these cameras catch RGB pictures and profundity pictures. These pictures are breaking down utilizing MATLAB condition, by separating metrological and trademark highlights, to decide the profundity of potholes. Yuquan [5] built up a model to recognize the three-dimensional cross area of asphalt pothole.

The technique utilizes LED straight light and two CCD (Charge Coupled Device) cameras to catch asphalt picture. It at that point utilizes different computerized picture preparing innovations including picture pre-handling, binarization, diminishing, three-dimensional reproduction, mistake examination and pay to get the profundity of potholes. Nonetheless, results get influenced by LED light power and natural elements. Lin and Liu [6], have proposed a strategy for pothole identification dependent on SVM (Support Vector Machine). This technique separates potholes from different imperfections, for example, breaks. The pictures are portioned by utilizing fractional differential conditions. So as to distinguish potholes, the strategy prepares the SVM with a lot of asphalt pictures. Be that as it may, the preparation model neglects to distinguish the asphalt deserts if the pictures are not appropriately lit up. Orhan and Eren [5], have proposed a work created on android stage to identify street risks. There are three segments right now viz, Sensing

segment, Analysis segment and Sharing part. The detecting part essentially works by gathering crude information from accelerometer and synchronizes with interface, subsequently prompting straightforward entry [6].

In investigation part, the qualities acquired from the sensors are utilized for creating examination modules [7]. The sharing segment functions as follows: the created structure is associated with the focal application, where it can legitimately speak with the informal community [9]. All the gathered information is put away at focal archive for additional handling [10]. Despite the fact that this technique conveys traffic occasions with different drivers, it expands the expense and multifaceted nature of usage.

3. COMPONENTS USED IN PROPOSED SYSTEM

Ultrasonic Sensor:

Ultrasonic sensors are modern control gadgets that utilization sound waves over 20,000 Hz, past the scope of human hearing, to quantify and ascertain good ways from the sensor to a predefined target object showing in Fig 2.



Fig 2. Ultrasonic Sensor

LCD:

LCD (Liquid Crystal Display) screen is an electronic showcase module and locate a wide scope of utilizations. A 16x2 LCD show is fundamental module and is usually utilized in different gadgets and circuits. These modules are used for more than seven portions and other multi fragment LEDs. The reasons being: LCDs are prudent; effectively programmable; have no constraint of showing extraordinary and even custom characters (not at all like in seven portions), activities, etc. A simple LCD is showing in Fig 3.

A 16x2 LCD means it will show 16 characters for every line and there are 2 such lines. Right now, character is shown in 5x7 pixel framework. This LCD contains two registers namely

Command and Data. The order register stores the order directions given to the LCD. An order is a guidance given to LCD to do a predefined task like introducing it, clearing its screen, setting the cursor position, controlling showcase and so forth. The IR register stores the information to be shown on the LCD. The information will be the ASCII estimation of the character to be shown on the LCD.

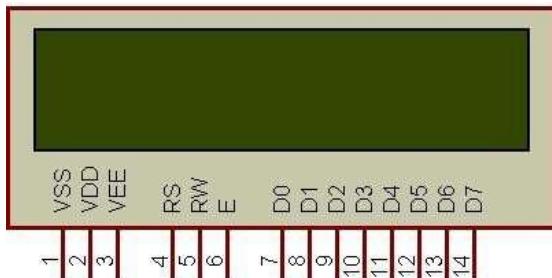


Fig 3. LCD

GPS:

The Global Positioning System (GPS) is a U.S. space-based radio route framework that gives solid situating, route, and timing administrations to non-military personnel clients on a persistent overall premise - unreservedly accessible to all. For anybody with a GPS recipient, the framework will give area and time. GPS gives precise area and time data for a boundless number of individuals in all climate, day and night, anyplace on the planet. GPS showing in Fig 4.

Raspberry Pi:

The Raspberry Pi is a Mastercard measured PC that connects to your TV and a console. It is an able little PC which can be utilized in gadgets ventures, and for a significant number of the things that your work area PC

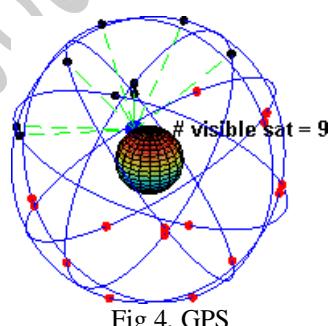


Fig 4. GPS

does, similar to spreadsheets, word-preparing and games. It additionally plays top notch video. We need to see it being utilized by kids everywhere

throughout the world to figure out how PCs work, how to control the electronic world around them, and how to program. Raspberry Pi model is showing in Fig 5.



Fig 5. Raspberry Pi

The Raspberry Pi is a minimal effort, Mastercard estimated PC that connects to a PC screen or TV, and utilizations a standard console and mouse. It is a competent little gadget that empowers individuals of any age to investigate figuring, and to figure out how to program in dialects like Scratch and Python. It can do all that you'd anticipate that a PC should do, from perusing the web and playing superior quality video, to making spreadsheets, word-handling, and messing around.

Also, the Raspberry Pi can interface with the outside world, and has been utilized in a wide exhibit of advanced creator ventures, from music machines and parent identifiers to climate stations and tweeting perch rooms with infra-red cameras. We need to see the Raspberry Pi being utilized by kids everywhere throughout the world to figure out how to program and see how PCs work.

There are as of now four Raspberry Pi models. They are the Model A, the Model B, the Model B+ and the Compute Module. All models utilize a similar CPU, the BCM2835, yet other equipment highlights contrast.

4. ARCHITECTURE & IMPLEMENTATION

The architecture of the proposed system is a structuring cost proficient framework showing in Fig 6. Ultrasonic sensors are utilized to distinguish the potholes and protuberances and furthermore to quantify their profundity and tallness individually. Right now, to conquer all the conditions, ultrasonic sensor and GPS recipient are put at the base of vehicle were

ultrasonic sensor is utilized to gauge the separation between the street and the sensor and the information is gotten by the microcontroller. The GPS beneficiary catches the area of the recognized pothole or the mound and sends E-mail to the enrolled E-mail.

Also, this proposed framework catches the pictures with on-board camera (16MP min) and furthermore keeps track the land area directions of the potholes utilizing a GPS collector. This whole information and area arrange are put away in the database.

This database data fills in as a significant wellspring of data to the legislature and vehicle drivers for future hazard evasion. An Android application is utilized to alarm drivers, with the goal that prudent steps can be taken to keep away from convenient mishaps. Alarms are given as glimmer messages with a sound blare.

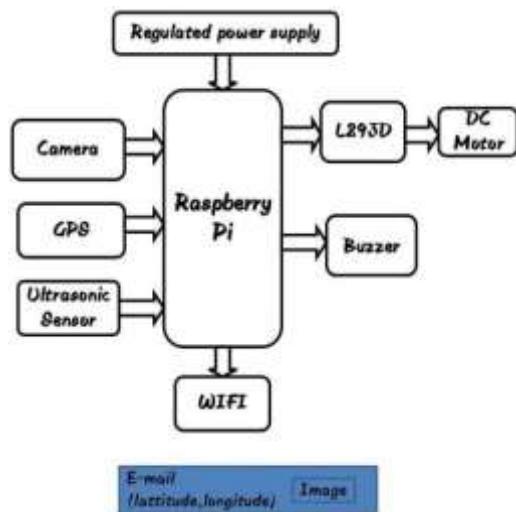


Fig 6. Block Diagram

5. EXPERIMENTAL RESULTS

This proposed framework catches the pictures with on-board camera (16MP min) and furthermore keeps track the geological area directions of the potholes utilizing a GPS beneficiary. This whole information and area organize are put away in the database.



Fig 7. Pothole Notification in LCD

Pothole notification in LCD is showing in Fig 7 for the captured pothole images in Fig 8. This database data fills in as an important wellspring of data to the legislature and vehicle drivers for future hazard evasion. Alarms are given as glimmer messages with a sound blare. Notifications and images of pothole and breakers are sent to the user's email address to aid drivers.

6. CONCLUSION & FUTURE WORK

The framework gives a two-path interface to refresh and get to the information in regards to any conceivable anomaly out and about. This will be a significant instrument to maintain a strategic distance from mishaps in where the danger of mishap or injury is considerable. Abnormalities are progressively hazardous in low perceptibility conditions, for example, evening time, or foggy conditions, downpour or day off. It likewise gives a novel strategy to have a solid database about the street conditions and clumsy territories and can be additionally used to redesign framework. The task can be reached out to improve the suspension frameworks of minimal effort vehicles and increment the solace of the driver. The significant advancement of this work is in nations like India, where the likelihood of anomalies out and about is more and state of the streets are inclined to changes. Right now, likewise propose a demo for Smartphone based street molding checking and ready framework. It is an application that can be of generous incentive to city specialists and drivers, particularly where the streets are risky for compensation.

The proposed framework thinks about the nearness of potholes and mounds. In any case, it doesn't consider the way that potholes or mounds get fixed by concerned specialists intermittently. This framework can be additionally improved to consider the above actuality and update server database in like

manner. Likewise, Google maps and GSM are coordinated in the proposed framework to improve client experience.

This project serves as a tool in monitoring issues related to road conditions by using more

upgraded sensors and better location coordinates system through IOT and also incorporating data analytics for future work.

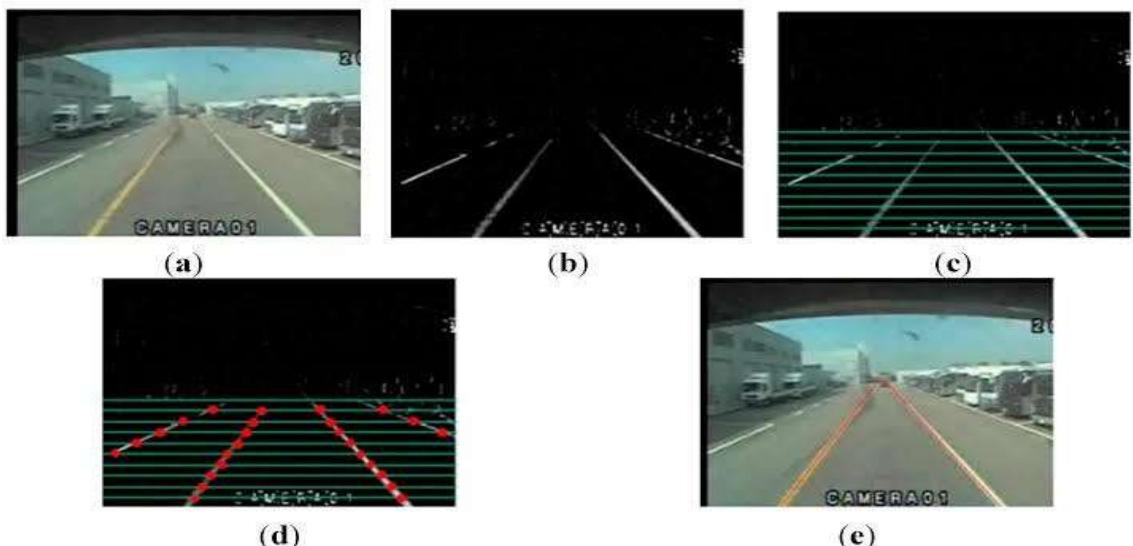


Fig 8. Example Pothole Image Capturing

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