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Pothole Dection Syatem in Vehicle

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Abstract*: *In India major road accident is based on potholes. To identify this potholes and humps in roads may reduces the road accident and also reduces the damages in cars and bike. To identify the holes and humps or speed breakers, the ultra sonic sensor, display board and buzzer also used in it. Project is mainly used in the prototype model of the vehicle which has the capable to find holes and humps in the road. When the vehicle identify the holes and hump it started showing the distance of obstacles, once the distance of obstacles reduced to 10m range the buzzer gives the alarm signals to drives that obstacles is near to vehicle so that they can reduces the speed of the vehicle and go slow through the obstacles or they can change the path. The display board given near the dash board that drivers can easily view the board and buzzer is given inside the vehicles and ultrasonic sensors given in the front of the bumper so it act efficiently. Here the arduino board is used for the power supply and programs, so this project reduces the accident occurs in the road due to holes and humps.

Keywords*: *Potholes, Buzzer, Ultra Sonic Sensor, Humps.

I. INTRODUCTION

India is fast developing country here the maintenances of the roads are difficult. In India more than 4 lakhs road accident taken place in a year and 0.5 percent increases per year according to WHO (world health organization). Over 16 accident taken place per minute in India as the statistic report says. Out of 4 lakhs accident 20% percent of road accident is based on potholes and humps in the roads by identifying the humps and potholes we can reduces the 20% of road accident, most of the accident are taken place only in nights because the headlight used in the vehicles are not much effective. By using this project in cars, bikes and even in large vehicles the accident can be controlled.

II. LITERATURE REVIEW

Carullo, Alessio., et al (2001)[1] says about the functioning principle of an Arduino board is investigated in this study, as well as its applications. It also looks at how it might be utilized as a research and study tool. The Arduino board can be used to quickly create VLSI test benches, particularly for sensors. Fast processing and a simple interface are two major benefits. With an expanding number of individuals utilizing open source software and hardware devices daily, technology is establishing a new dimension by making sophisticated tasks appear simple and engaging. These open sources offer technology that is either free or almost free, as well as extremely reliable and economical.

Hanif, Hadistian Muhammad, et al (2020) [2] says transportation technology is becoming increasingly vital in today's world, and it must be developed over time. There are so many road extensions throughout the development era to balance the substantial increases of motorized vehicles. The growing number of automobiles has resulted in issues such as road damage and a lack of road upkeep. The lack of awareness about the importance of repairing damaged roads, particularly potholes, makes it more difficult for riders to drive safely. Because of the rising number of accidents and deaths, this issue is becoming increasingly urgent. The pothole detection sensor can be used on the car system to prevent accidents. In this study, the invention of a pothole detection sensor was inspired by the proximity sensor system, which employs the camera and a digital image method. The advantages of our system, which we research and build, are that it is more user-friendly in terms of feasibility and cost. This work develops a low-cost sensor with the same quality as the present technology. Despite the use of low-cost sensors, maintenance is both low-cost and straightforward. As a result of this research and investigation, an inaccuracy was discovered between the distance that recognized the pothole and the sensor, which should be less than 4%.

. Jo, Youngtae., et al (2015) [3]says Potholes are caused by aging roads and insufficient road maintenance systems, which result in a significant number of potholes that grow in number over time. Road safety and transit efficiency are jeopardized by potholes. Furthermore, they are frequently a contributory factor in automobile accidents. Pothole locations and sizes must be determined rapidly to handle the problems connected with potholes. A pothole database can be used to design sophisticated road-maintenance strategies, but it requires a special pothole-detection technology that can collect pothole information at a low cost and over a large region. Pothole repair, on the other hand, has traditionally relied on manual detection. Due to the unreliable detection of vibration-based methods and the high prices of laser scanning-based methods, recent automatic detection systems, such as those based on vibrations or laser scanning, are insufficient to identify potholes reliably and economically. As a result, we provide a new pothole detecting system based on a commercial black-box camera in this work. Potholes are detected across a large region and at a reasonable cost using the suggested technology. We've created a new pothole detection method that's specially tailored for black-box cameras' embedded computing settings. The results of our suggested system's experiments suggest that potholes can be recognized properly in real-time.

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Kim, Taehyeong., et al (2014)[4] says that potholes, as one sort of pavement distress, are key indications suggesting structural problems in the asphalt road, and diagnosing these potholes effectively is one of the most significant responsibilities for defining effective asphalt-surfaced pavement maintenance and repair procedures. Manually discovering and evaluating methods, on the other hand, is costly and time-consuming. As a result, many efforts have been made to build technology that can automatically detect and recognize potholes, which could help increase survey efficiency and pavement condition by allowing for early detection and action. In this paper, we research and assess existing pothole detection methods, as well as suggest a potential approach for building a pothole detection system that is both accurate and efficient.

Koch.,et al (2011)[5] says that when creating road network maintenance strategies, it is critical to examine the condition of the pavement. The data collection method is automated to a significant extent in practice. However, most pavement distress identification (cracks, potholes, etc.) is done manually, which is time-consuming and labor-intensive. Existing methods rely on either complete 3D surface reconstruction, which requires expensive equipment and computation, or acceleration data, which can only offer preliminary and rough condition surveys. We offer a method for automatically detecting potholes in asphalt pavement photos in this research. Using histogram shape-based thresholding, an image is initially divided into a defect and non-defect regions in the proposed technique. Using morphological thinning and elliptic regression, the probable pothole shape is calculated based on the geometric features of a defect zone. Following that, the texture of a potential defect form is extracted and compared to the texture of the surrounding non-defect pavement to see if the region of interest is actually a pothole. This algorithm has been taught and validated on 120 pavement photos using a MATLAB prototype.

Louis, Leo (2016)[6] says that this study describes an ultrasonic sensor that can measure the distance between chosen places on a vehicle and the ground. The sensor is based on the detection of an ultrasonic pulse's time of flight as it is reflected by the ground. To create reflected pulses that can be easily detected using a threshold comparator, a limited optimization methodology is used. A sub-wavelength detection may be produced using this technology, which takes into account the frequency response of the ultrasonic transducers. Experiments with a 40 kHz piezoelectric-transducer-based sensor revealed a typical uncertainty of 1 mm at rest or at low speeds; the sensor can still work at speeds up to 30 m/s, but with a larger level of uncertainty. The sensor is made up of only low-cost components, making it suitable for use as first-car equipment in many circumstances, and it can self-adapt to various conditions to provide the optimum results.

Palanivel, N., et al [7] says about road upkeep is one of the biggest issues in developing countries. Well-maintained roads contribute significantly to the economy of the country. The detection of pavement distress, such as potholes and humps, not only aids drivers in avoiding accidents and car damage but also aids authorities in road maintenance. This study reviews prior pothole detection technologies and provides a cost-effective technique for detecting potholes and humps on roadways and alerting drivers in time to avert accidents or vehicle damage. Potholes and humps are detected using ultrasonic sensors, which can also be used to assess their depth and height.

RenugaDevi, S., et al (2021)[8] says that today's world, the majority of mishaps are caused by borewells that have been left open, trapping countless youngsters. For many children, the borewells are a living horror. Most of the innocent lives have been ruined by these borewells. The method of rescuing the children from the borewells is quite challenging. We must prevent children from slipping into borewells to avert this dangerous catastrophe. We came up with the concept to take precautions to spare the lives of numerous infants. The system's main goal is to place a Drone camera in a remote location and use it to locate any uncovered borewells. Following the discovery of borewells, we must determine whether the hole is a normal hole or a depth pothole. So, to detect the size of a hole, we mounted an ultrasonic sensor on the drone's bottom to recognize potholes as well as to measure the height and depth of a bore well. If the bore well's depth and height are significant, information will be sent to the appropriate officials so that the bore well can be appropriately closed. These particulars will be uploaded to the cloud to keep the information up to date. As a result, we can prevent a large number of youngsters from drowning in borewells.

Rode, Sudarshan S., et al (2007) [9] This position paper proposes a revolutionary Pothole Detection System that helps drivers avoid potholes on the road by providing advance warnings. The architectural design also presents a solution to this problem with a short response time, low maintenance, and inexpensive deployment costs. The challenges caused by traffic congestion throughout the world, as well as a synergy of new information technologies for simulation, real-time control, and communications networks, have sparked interest in Intelligent Vehicle Systems. Worsening road conditions are one of the growing difficulties that roadways face. Rain, oil spills, road accidents, and wear and tear are just some of the factors that make driving on the road tough. Also, while driving at night, the driver may not be able to rely solely on the headlights for support. Unexpected roadblocks may result in more accidents. Gasoline consumption of the vehicle also increases as a result of poor road conditions, resulting in waste of valuable fuel. For all of these reasons, it is critical to obtain information about hazardous road conditions, collect that information, and disseminate it to vehicles, which can then alert the driver.

Sharma ., et al (2020)[10] providing commuters with a smooth road infrastructure necessitates road surface monitoring. Using an ultrasonic sensor and image processing approach, this paper proposed an efficient road surface monitoring system. A revolutionary cost-effective system was created and suggested, which incorporates ultrasonic sensors sensing with GPS for the identification of road surface characteristics. To increase the classification and accuracy of road surface detecting circumstances, the dynamic time warping (DTW) methodology was used with ultrasonic sensors. HANUMAN is a revolutionary algorithm for automatically detecting and calculating potholes and speed bumps.

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To validate the results, a manual check was performed and a comparison was made. With a 95.50 percent detection rate for diverse road surface imperfections, the suggested method outperformed earlier technologies. Not only will the new framework identify road imperfections, but it will also assist in reducing the frequency of accidents by alerting drivers.

Tedeschi, Antonio., et al (2017)[11] says road safety has become a global concern as a result of the increasing proliferation of automobiles and traffic accidents caused by road pavement flaws. As a result, countries and federal states have begun to focus their resources on civil infrastructure studies to examine their safety and serviceability. Detailed reports on the discovered pavement distress and their magnitudes are provided by specialized teams of inspectors and structural engineers that manually evaluate road infrastructures. The goal of this project is to develop a novel system that can detect framed distress using only the computational resources available on a mobile device. An automatic pavement distress recognition system based on the OpenCV library is built and implemented in a mobile application to achieve this goal, allowing the recognition of three frequent pavement distresses: potholes, longitudinal-transversal cracks, and fatigue cracks. Our approach, which has been tested on numerous Android mobile platforms, is capable of recognizing the pavement distresses of interest with a Precision, Recall, Accuracy, and F Measure of more than 0.7. This program promises to improve inspectors' on-site work by reducing the time required to complete tasks.

III. COMPONENT DESCRIPTION

Road side pit detection projects holds some of the components as described below, with the help of this components the project functions successfully as expected.

A. Arduino Uno

The Arduino Uno is a microcontroller board which has ATmega328 from the AVR family. There are 14 computerized input/yield pins, 6 Analog pins, a 16 MHz fired resonator, USB association, power jack, and furthermore has a reset button. Its product upheld by various libraries that makes the programming simpler. Arduino is an open-source devices stage reliant upon easy to-use hardware and programming. Arduino sheets can get inputs - light on a sensor, a finger on a catch, or a Twitter message - and change it into a yield - inciting a motor, turning on a LED, circulating something on the web. Arduino code is written in C++ with an extension of phenomenal strategies and limits, which we'll determine later on. C++ is a clear programming language.

Fig 1: ARDUINO UNO

B. Ultrasonic Sensor

This sensor is used to measure the distance. It transmits ultrasonic waves and receives the reflected waves and measures the distance to the target by computing the time between the emission and reception. It has 4 pins TRIG, ECHO, GND & VCC. It emits the ultrasonic waves through the trig pin and receives the waves through echo pin when the waves get reflected back from the target. For measuring the distance: Distance= ½ (speed of sound * time taken). Ultrasonic transducers and ultrasonic sensors are gadgets that create or sense ultrasound energy. They can be partitioned into three general classes: transmitters, recipients and handsets. Ultrasonic sensors can quantify the distance to a wide scope of articles paying little mind to shape, shading or surface. They are likewise ready to gauge a drawing nearer or subsiding object.

Fig2. ULTRASONIC SENSOR

C. Buzzer

The buzzer mainly functions in producing the sound and alert the owner and others regarding the security breach in the home. The buzzer Figure 3.5 receives the data signal from the micro controller, as the micro controller receives the data from the vibration sensor the buzzer has to be activated according to the code. Therefore, the signal from the micro controller is received to the buzzer.

Fig3. Buzzer

D. Oled Display

An OLED show works without a backdrop illumination since it transmits noticeable light. Along these lines, it can show profound dark levels and can be more slender and lighter than a fluid crystal. The abbreviation 'OLED' represents Organic Light-Emitting Diode - an innovation that utilizations LEDs wherein the light is delivered by natural atoms. These natural LEDs are utilized to make what are viewed as the world's best showcase boards. OLED represents Organic Light-Emitting Diode, with "natural" alluding to the carbon film that sits inside the board before the glass screen. Since it's a light behind the LCD delivering the enlightenment as opposed to the LCD layer itself, the brightening isn't completely in-a state of harmony with the pixel before it.

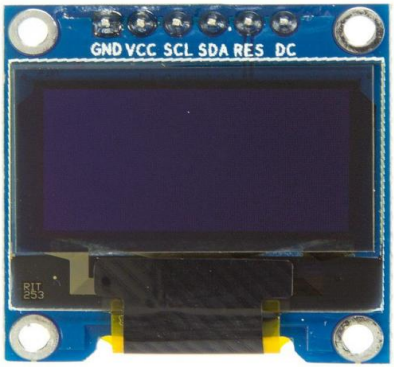

Fig 4. OLED Display

IV. EXPERIMENTAL SETUP AND POCEDURE

A. Proposed Solution

The solution proposed for the problem described is the smart on road pit detection system, which helps the drivers to have a smooth ride while travelling on roads. When wheels enter into the pit on roads that sudden impact will make some discomfort to the driver also the life of wheel will be decreased sometimes it can break when hits deeper in the pits. So in order to solve this problem our project will help in identifying the pit before getting closer to the pit with the help of ultrasonic sensor. The main purpose of ultrasonic sensor is to sense the distance of obstacles that crosses its path. The ultrasonic sensor will send the distance data to the micro controller and the transferred data will be displayed to the driver with an OLED Display.

The display helps in displaying the distance of the road and when a pit is identified it will display an alert message on the screen. At the same time of message displaying the micro controller will trigger the buzzer to ring the sound. The logic behind this is the ultrasonic sensor will sense the distance of the road and will display the distance in the OLED display but when the pit comes there will be deviation in the standard distance and as a result of this deviation alert message will be displayed in the OLED display and the buzzer is triggered to alert the driver. This helps in protecting the vehicle from entering into the pit and thus alerts the driver before entering near the pit. This project will also help in analysing the distance of speed brakers as well. The solution provided by the project satisfies the problem description.

B. Layout

The rough layout of the project is explained in the Fig 5.

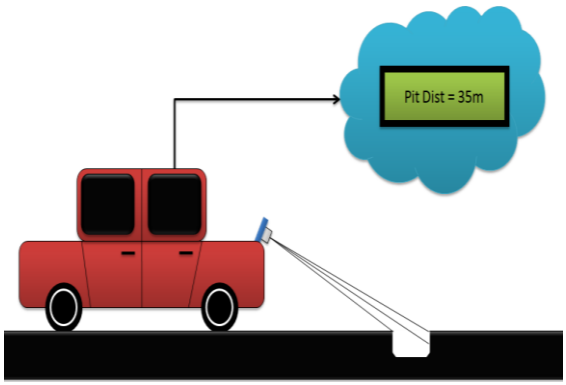

Fig 5. Layout

C. Circuit Diagram

The circuit diagram is given below in the Fig 6.

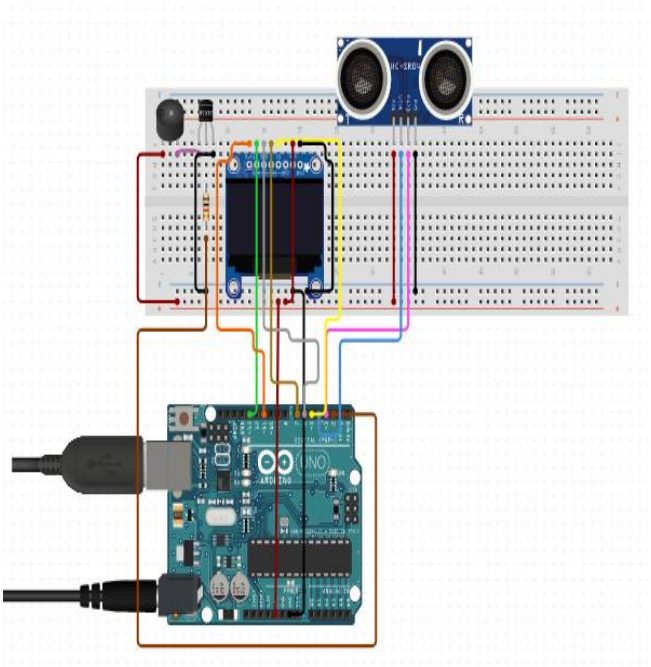

Fig 6. Circuit Diagram

D. Flow Chart

The flow chart of the project is explained below in the Fig 7.

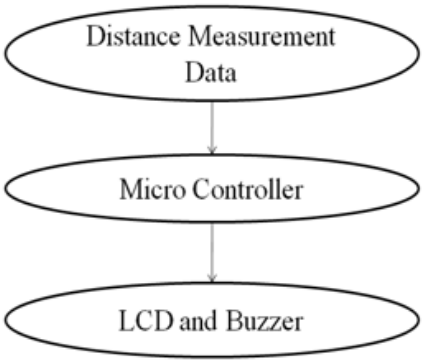

Fig 7 . Flow Chart

E. Cost Estimation

The total project cost is given below in the table1.

Table 1. Cost estimation

DESCRIPTION	COSTS (RS)
Micro Controller	750
Ultra Sonic Sensor	600
LCD Display	900
Buzzer	50
Jumpers	300
Total	2600

V. METHODOLOGY

The fundamental motivation behind ultrasonic sensor is to detect the distance of impediments that crosses its way. The ultrasonic sensor will send the distance information to the miniature regulator and the moved information will be shown to the driver with an OLED Display.

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The showcase helps in showing the distance of the street and when a pit is distinguished it will show an alarm message on the screen. Simultaneously of message showing the miniature regulator will trigger the ringer to ring the sound. The rationale behind this is the ultrasonic sensor will detect the distance of the street and will show the distance in the OLED show however when the pit comes there will be deviation in the standard distance and because of this deviation ready message will be shown in the OLED show and the bell is set off to caution the driver. This aides in shielding the vehicle from going into the pit and along these lines cautions the driver prior to entering close to the pit.

VI. RESULTS AND DISCUSSION

A. Result

Project helps the drivers to drive the vehicle easily in the evening time or in raining time they can easily judge the hump and hole in the road.

B. Advantages

- The detection of pits became an easy task for the driver.
- Alert system helps the driver to be alert always.
- The display helps in analyzing the distance from the road.

C. Disadvantages

- The angel of ultrasonic sensor determines the distance.
- If any vehicle or obstacle comes in contact with the ultrasonic waves it will affect the pit detection.

D. Future Scope

This project can be installed in smart cars in future. For example cars like Tesla will have all facility to analyze and indicate lanes and other obstacles for self driving but it cannot detect the pits over the road. This project will help in the advancement of automobile technologies.

VII. CONCLUSION

In this study, we suggest a system that will identify potholes on the road, save the information to a server, and, if necessary, reduce vehicle speed. Potholes are formed as a result of rain and oil spills, resulting in accidents. With the help of an ultrasonic sensor, potholes are detected and their height, depth, and size are measured. The position of a pothole is determined using GPS. The database contains all of the information. This timely information can aid in the quickest possible road recovery. We can control the rotation of the drive shaft using an IR Non-contact tachometer by adjusting the rate of fuel injection. When driving over a pothole, this helps to slow down the vehicle.

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