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Automatic Pothole and Humps Detection and Notification for Drivers

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Abstract:

In developing countries, road maintenance is a major problem. The country's economy relies significantly on public transit. Driving a vehicle on a badly maintained road is very dangerous. Rain causes the road's oil-spill quality to degrade. Car accidents may occur as a result of such obstacles. To solve this problem, we have developed a project that we believe would be of the most use to the public. The project's main aim is to automatically detect and report potholes. This article discusses a cost-effective method for detecting potholes and speed bumps on roadways, as well as giving timely warnings to drivers to assist them avoid accidents or vehicle damage. Potholes and humps are detected using ultrasonic sensors, which may also be utilised to assess their depth and height. A global positioning system receiver is used in the proposed system to record the geographic locations of potholes and speed bumps. Some of the discovered data in the database include pothole depth, hump height, and geographic location. This is a valuable resource for both government officials and motorists. As an alert, flash messages with an audible buzzer are used.

Keywords— Osteoarthritis, X-ray, Kallgren Lawrence (KL) Classification, SVM algorithm.

1. Introduction

In India, road transportation is very important. It has a far wider coverage area than rail transportation and can go to any region of the country. The agricultural and industrial sectors of the nation depend on good road access. They carry almost 90% of all passengers and 65% of all freight in the nation. Despite this, the most majority of Indian roads are unremarkable due to their size, density, and general condition. Getting behind the wheel in India is an adrenaline rush that requires constant checking of several mirrors. It's hard to overstate how many cars there are now compared to where we were 20 years ago. Car ownership is increasing, which means more traffic and more accidents. Congestion and accidents are caused in part by bad road conditions. The management of traffic congestion is an essential part of today's vehicular area networks, and researchers are working on it.

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Speed breakers are commonplace on Indian roads to help keep traffic safe. The speed bumps, on the other hand, are not all the same height. Pain and injury to the spine are both caused by these agents. participants in the transportation system, including drivers Rain-induced potholes and big vehicles are major contributors to serious accidents and deaths. 142 485 people lost their lives in road accidents in 2011, according to data from the Ministry of Transportation and Highways. Over 1.5% of these fatalities were the result of poor road conditions, which resulted in the deaths of nearly 2,200 people. Roads with dangerous potholes are shown in Figure 1. A low-cost system that collects data about potholes and humps and aids cars in travelling safely is needed to address the problems mentioned above. Drivers will be encouraged by this approach to avoid accidents that are caused by potholes and high humps.

Fig. 1potholes on roads that are a death trap

2. Literature Survey

In a study by Rode et al., cars equipped with Wi-Fi would gather road surface information and transmit it

to a Wi-Fi access point. The access point then sends out alerts to other nearby cars about the danger. It turns out, however, that the system is a costly one since Wi-Fi stations must be placed in all cars and additional access points must be set up.

Yu and Salari developed a method for identifying potholes using laser imaging. When the laser source distortion is shown in the recorded pictures, pavement distress such as potholes may be identified. Potholes may be detected using a variety of methods, including multi-window median filtering and tile partitioning. The intensity and form of these potholes are used to further categorise them. This is a good technique for identifying potholes, however because of the unevenness of the road surface, the cameras take unsteady pictures, reducing the effectiveness of pothole identification.

3. Components Used In Proposed the Proposed System

To identify potholes and humps on roadways and inform vehicles of their existence, the suggested system provides a cost-effective alternative. This is a list of materials utilised in the proposed project:

An 8K programme memory PIC 16F877A microcontroller has 40 pins and is a peripheral interface control (PIC 16F887A). Low cost, strong application support, and broad availability make it a popular choice. Ease of programming, high-speed Flash/EEPROM technology. Wide voltage range of operation (2.0V to 5.5V). An embedded microcontroller is a critical component of the proposed system, processing sensor inputs and notifying the driver among other things.

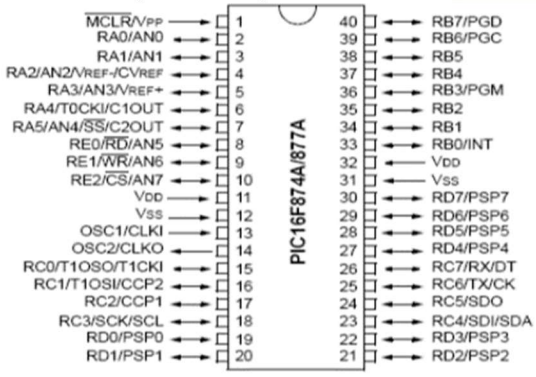

Fig.2. Pin diagram of PIC16F877A

HC-SR04 Ultrasonic Sensors:

One of the most popular ultrasonic sensors on the market today is the HC-SR04. It's used to gauge how far things are away from it while they're in front of it.

Fig.3. Ultrasonic sensor

A high-frequency sound wave is sent by the ultrasonic sensor, which waits for the reflected wave to reach the receiver before continuing on its journey. To figure out how far anything is, you have to know how long it takes an ultrasonic pulse to reach a certain distance. Ultrasonic sensors come in a variety of shapes and sizes, with varying transmission ranges and detecting angles. The HC-SR04 sensor operates at a 40 KHz frequency and has a 15° detection angle for measuring object distances between 2 and 400 cm.

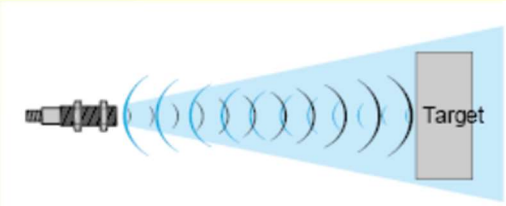

Fig.4. The ultrasonic sensor's mechanism of operation

GPS Receiver:

Geographic position and time may be recorded no matter what the weather conditions are using the Global Positioning System (GPS). The U.S. government maintains it and makes it accessible to anybody with a GPS receiver for free. Using satellites, it gathers GPS data in NMEA format from the National Marine Electronics Association. There is a standard format for GPS data established by the NMEA (National Mobile Electronics Association). All of the satellites follow suit. GLL Latitude/Longitude data, detailed satellite data, and RMC-Minimum Recommended Data are only a few of the codes defined by the standard.

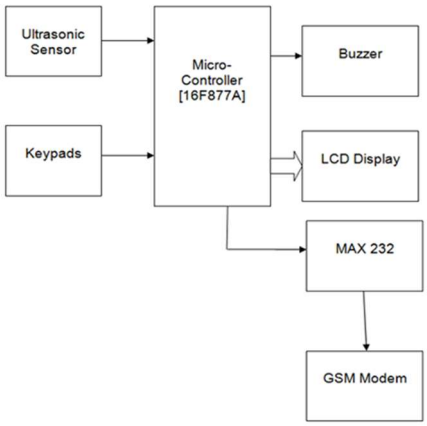

Fig.5. Architecture of the proposed system

MAX 232:

Data is sent one bit at a time over a single communication line using a serial transmitter. A PIC16F877 to GSM modem transmission is carried out using MAX232, which includes 2 RS232 receivers that convert it into TTL Logic and 2 drivers that do the opposite. This may be used for efficient transmission even at modest data transfer rates. Long-distance data transfer is possible using this method. All you need is a cable to connect, and you're good to go. Code protection that may be customised. Sleep mode, which consumes less energy. In-Circuit Serial Programming using a Single 5V Supply.

Modem for GSM (Global System for Mobile Communications)

A collection of standards for the Second Generation (2G) of cellular networks known as Global Standards for Mobile Communication (GSM). The GSM SIM 900 module communicates with the telecommunications network by using a SIM card from any network provider. Text messages and voice calls may both be made and received with this modem. This quad-band GSM modem operates at frequencies of 850, 900, 1800, and 1900 MHz. This modem also has integrated GPRS and TCP/IP stack capabilities, as well as the ability to transmit voice data.

GSM Modem Benefits: Small Data Size, Multiple Data Collection Points.

High availability. a large number of transactions

• Mobility

• Easy to set up and use • Easily accessible

C. Retouching and Restoring Images

Fig.6. GSM MODEM

LCD Display:

Displays having restricted viewing angles, such as LCDs, stand for Liquid Crystal Display. Due to its low cost of operation and superiority with alphabets over a 7-segment LED display, LCD was selected as the output device. There are so many different types of LCDs available nowadays, and our application needs one with two lines and 16 characters per line so that data from the microcontroller may be shown on the LCD. There are eight data lines, three control lines, a Vcc (+5v) supply, and a GND ground. Having this feature shows how much money is left on the card, which makes the entire thing more user-friendly. LEDs have been replaced by cards in general usage. For the reasons listed below: LCD screens are becoming more affordable because of this. The capacity to show numeric data, characters, and images. LEDs, on the other hand, can only display numbers and a limited number of characters. Incorporation of an LCD refresh controller to relieve the CPU of the responsibility of doing so. The Led, on the other hand, requires CPU refreshment in order to keep showing the data. Ease of character and graphic programming.

Buzzer:

Depending on its design, a Buzzer is one of many types of auditory signalling devices.

Fig. 8.Buzzer

Alarm devices, timers, and confirmation of user input, such as a mouse click or keyboard, are typical buzzer and beeper users.

4. ARCHITECTURE & IMPLEMENTATION

Figure.5 depicts the suggested system's design. Modules for the microcontroller, server, and mobile application are all included. a microcontroller module is used to collect data about potholes and speed bumps and to send that data to a server. When the microcontroller module sends data to the server module, the server module processes and saves the results in a database. The mobile application module

accesses data from the server database and sends notifications to the driver as needed.
Module with a microcontroller:
An ultrasonic sensor, GPS receiver, and GSM modem are all included in this module. It runs the PIC 16F877A microcontroller. Ultrasonic sensors on the car's body and the road's surface send distance readings to the CPU. A smooth road surface has a threshold distance of a car's body from the ground. Depending on the vehicle's ground clearance, threshold value may be customised. If the distance measured by an ultrasonic sensor is more than the threshold, it is a pothole; if it is lower, it is a bump; if it is not, the road surface is smooth.

The server module includes the android phone and the database. Between the mobile app and the microcontroller module, it acts as a connector on this board. The server module, which reads messages sent by the microcontroller module's registered mobile SIM, is built using Android. As a consequence, this message is analysed and added to the database (cloud). By combining sensor networks with cloud and Internet of Things technologies, we can make sensor data more widely available.

Module for Mobile Application:

Using an android application placed on the phone of the car driver, this module may provide timely warnings when potholes or speed bumps are detected. The application's process is shown in Figure 4. While you're using your phone, the app will be running in the background all the time. It begins by obtaining the vehicle's current position on the map, and then uses that information to locate potholes and speed bumps in the surrounding area. You calculate the distance between your car and the database's position of the pothole. An alarm message appears on the smartphone screen if the two devices are within 100 metres of one another. In order for the driver to distinguish this message from the others, it is accompanied by an audible beep.

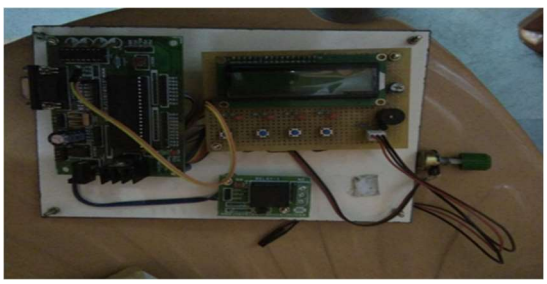

Fig.9.Working model of the proposed system

5. CONCLUSION

Our suggested system detects potholes on the road and stores the data about them in a server, as detailed in this article Potholes are created as a result of rain and oil spills, and these incidents will occur as a result. Ultrasonic sensors detect potholes and take their height, depth, and size into account. To locate a pothole, drivers use a GPS device. The database is where all of the data will be kept. This up-to-date information may aid in the speedy recovery of the road. As a result, the technology will go a long way toward reducing traffic accidents.

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