

Pothole Detection to Aid Drivers

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Abstract— This paper describes about the ‘Pothole Detecting System’ which aids the driver by avoiding potholes or humps on the roads, by alerting him prior warnings. Warnings can be like display in LCD or Buzzer. If the driver is nearer to the pothole, driver is warned in advance about the pothole. First, it is a sensing subsystem it includes an ultrasonic sensor which senses the potholes. Secondly, it gives the analog voltage or current output to the microcontroller and the data is processed and necessary alarm or signals sent to the Buzzer. Thus the driver can be alerted.

Key words: Pothole Detection, Aid Drivers

I. INTRODUCTION

INDIA, the most populous Country in the World and a fast growing economy, is known to a gigantic network of roads. Roads are the presiding means of transportation in India today. Most of the roads in India are narrow and congested because of poor road maintenance. Roads have been flooded with the vehicular traffic. It has become difficult to manage this traffic. The prime motivation is to make a vehicle intelligent enough to aid driver in various aspects. Over the last decades, there has been an enormous increase in the vehicle population. Pathetic condition of roads is a boosting factor for traffic congestion and accidents. One of the increasing problems the people facing are worsened road conditions. Because of reasons like rain, wear and tear makes the road difficult to drive and causes the expansion and contraction of ground water under the pavement. When water freezes, it expands the proliferation of vehicles has led to problems such as traffic congestion and increase in the number of road accidents. Unexpected hindrances on road may cause more accidents and also because of the bad road conditions, fuel consumption increases. It actually focuses on building a user-friendly device that specializes in detecting potholes. The sensor is mounted on the front of a vehicle and it looks for an obstacle and sends a signal to the user.

II. TECHNICAL DESCRIPTION

It was decided to develop a simple warning system instead of automatic avoidance. It consists of two distance sensors. There are four LEDs, one to display the status of the whole system (on/off), second to indicate the initialization of the system through blinking, other two are blinking during transmission and receiving the signal from the sensor.

Here we use the ultrasonic sensor to identify the road distress like potholes, humps or any obstacles. The sensed data is received on the Arduino UNO, and the command is send to the driver circuit to control the motors. Based on commands, the motors rotate accordingly.

III. LITERATURE SURVEY

Pavement distress detection is a fascinating topic of research and researchers who have been working on pothole detection techniques [2]. The following section gives a brief description about the existing solutions for detecting potholes.

Moazzam et al have proposed a low cost model for analysing 3D pavement distress images. It makes use of a Kinect sensor, which gives the direct depth measurements, and hence reduces computing costs.

Mednis et al have proposed a real time pothole detection model using Android smartphones using accelerometers. Today’s smart phones with android OS, have accelerometers which are inbuilt, they sense the movement and vibrations. The accelerometer data is used to detect potholes. Different algorithms such as Z-thresh, which measure the acceleration amplitude at Z-axis, Z-diff to measure the difference between the two amplitude values, STDEV to find the standard deviation of verticalaxis acceleration and G-Zero are used to identify potholes.

IV. PROBLEM STATEMENT

Pothole detection system aims at warning the driver about the obstacles in the path. We study the different ways in which solution of the problem can be identified. We justify the methods we have chosen in this paper. And then we give details about the working of the different subsystems. Potholes formed due to heavy rains and movement of heavy vehicles, also become a major reason for horrifying accidents and loss of human lives.

According to the survey “Road Accidents in India”, by the ministry of road transport and highways, a total of 1, 42,485 people have lost their lives due to fatal road accidents. Nearly 1.5 percent fatalities were due to poor road conditions. Thus for these fatal problems, a cost effective solution is needed that collects the information about the severity of potholes and humps which helps drivers to drive safely. With the proposed system an attempt has been made to provide approve drivers to ward off the accidents caused due to potholes and raised humps.

V. BLOCK DIAGRAM

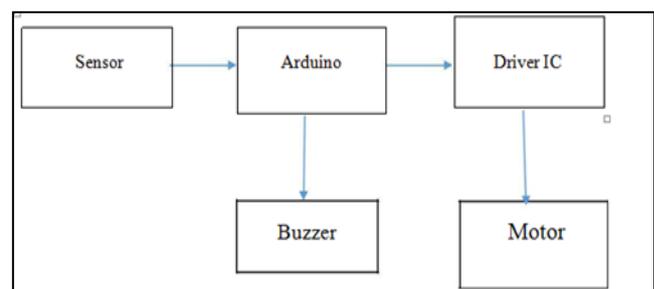


Fig. 1

VI. SENSOR

The presence of an object can be detected with proximity sensors [6]. Tracking objects can work using proximity sensors (ex: mobile phone), or for advanced applications generally it is used image sensors [3] (ex: webcams) and vision software

A. Ultrasonic Sensor

These sensors are designed to generate high frequency sound waves and receive the signals reflected by the pothole. These sensors are used in a wide range of applications [4].

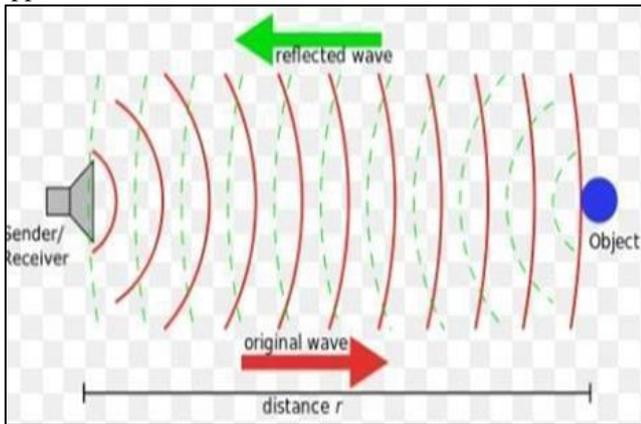


Fig. 2

B. Working Principle

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 [5]. The working principle of this sensor is shown above. Pavement distress such as pothole is detected when the laser source deformation is observed in the images that are captured. Techniques such as multi-window median filtering and tile partitioning are applied to detect the presence of potholes. These potholes are also classified based on their shapes and severity.

1) Specification of HC-SR04:

Electrical Parameters	HC-SR04 Ultrasonic Module
Operating Voltage	DC 5V
Operating Current	15mAmps
Operating Frequency	40KHz
Farthest Range	4m
Nearest Range	2cm
Measuring Angle	15 Degree
Input Trigger Signal	10us TTL Pulse
Output Echo Signal	Output TTL Level Signal, Proportional With Range
Dimensions	45*20*15mm

VII. DRIVER CIRCUIT

Driver IC's used in electronic circuits to control the motor efficiently. L293D is a motor driver employed with the Microcontroller. It drives two motors at a time in both

direction and it can provide drive currents up to 1A at voltages 4.5V to 36V.

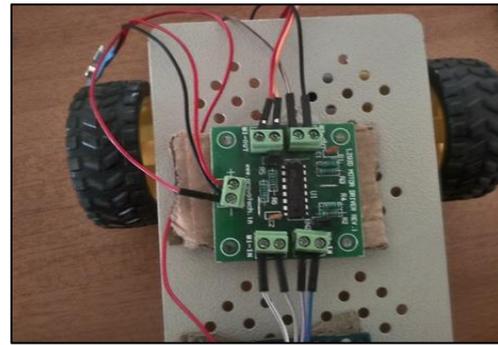


Fig. 3

Both the motors are used, the EN1 & EN2 are connected to high state. Since we are using a 12V motor Vss was supplied with 12V DC supply. Motors was connected along with diodes along each output pins for offering protection to the IC's from reverse current.

Motor inputs IN1, IN2, IN3, IN4 are the pins used to provide logic signals to drive the motor in desired direction. High in the IN1 pin and low in IN2 pin will make the Motor1 to rotate in Clockwise Direction. This circuit is capable of driving motors up to 1A provided with ideal power supply.

VIII. DC MOTOR WITH PLASTIC GEARED

A 12VDC motor with gear box attached to the shaft, which is mechanically commutated electric motor powered from direct current and shaft is controlled by driver circuit.

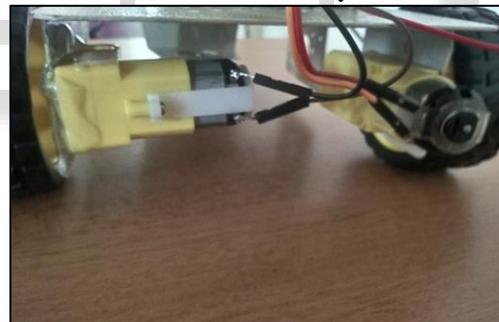


Fig. 4

IX. BLUETOOTH MODULE



Fig. 5

This Bluetooth transceiver module sends or receives the TTL data via Bluetooth technology [1] without connecting a serial cable. There are various commands used in the module such as L255\rR-255\r,H1\r,L-255\rR-120\r. In the MCU control, the program provides a timer that shuts off the motor connected with the shaft of the wheel if the last command was received from Android device.

X. ARDUINO SOFTWARE

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. A program written with the IDE for Arduino is called a sketch. [5][1] Sketches are saved as text files with the file extension .ino. The Arduino IDE supports the languages C and C++ using special rules of code structuring. This code generates a control on the motor through the Bluetooth module for changing the direction of the wheel.

```

sketch_oct12a | Arduino 1.8.3
File Edit Sketch Tools Help

sketch_oct12a
Serial.println("cm");
if(a<120||a>150)
{
digitalWrite(2,HIGH);
}
else
{
digitalWrite(2,LOW);
}

if(Serial.available()>0){ // lee el bluetooth y almacena en
estado = Serial.read();
Serial.println(estado);
}
if(estado=='a'){ // Forward
Serial.println(estado);
analogWrite(derB, 0);
analogWrite(izqB, 0);
analogWrite(derA, vel);
analogWrite(izqA, vel);
}
if(estado=='d'){ // right
Serial.println(estado);
analogWrite(derB, vel);
analogWrite(izqB, 0);
analogWrite(derA, 0);
analogWrite(izqA, vel);
}
}
    
```

XI. CONCLUSION

The model proposed in this paper serves important purpose of automatic detection of potholes and humps and alerting vehicle drivers to avoid potential accidents. The proposed approach is an economic solution as it uses low cost ultrasonic sensors. The sensor used also works in rainy season even the potholes are filled with water. The solution provided in this paper can save many lives and sick patients who suffer from tragic accidents.



Fig. 6

XII. FUTURE SCOPE

The proposed system considers the presence of potholes and humps. This can be further extended by generating the data and gets repaired by concerned authorities periodically. Also, Google maps and SATNAV can be integrated in the future system to improve user experience.

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