DRIVER ALERT SYSTEM FOR DETECTION OF POTHOLES AND HUMPS USING ULTRASONIC SENSOR

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ABSTRACT :

Natural occurrences that make driving hazardous, such as tropical rains and flooding, may result in hazardous road conditions. A road's and its surroundings' poor physical state can also lead to dangerous situations. It might result in auto accidents. Additionally, a driver may not need more aid than just their headlights when they are driving at night. Unexpected obstacles on the road could lead to more collisions. Additionally, poor road conditions increase a vehicle's fuel usage, wasting valuable gasoline. To alert the driver to a pothole or hump while regulating the speed of the vehicle, we presented this system, called "Pothole and hump Detection and vehicle speed control System." To detect potholes and humps, this technology uses ultrasonic sensors, which the goal of giving drivers pertinent information regarding the bumps and potholes on the roads. In this study, we suggest an Arduino-based pothole detection and warning system that helps drivers avoid potholes by issuing alerts in advance. The technology uses ultrasonic sensors mounted outside the car to transmit data, alerting the driver by sounding an alarm and showing the distance on the display (lcd panel). This will make it easier for the driver to make important left- or right-turn judgements. Preventing any significant harm or accidents. Identifying potholes on roads and taking prompt action to prevent accidents or vehicle damage are two goals of this research, which also reviews existing approaches. Here, we'll create a prototype model that will assist the driver of the car in avoiding or reducing speed when a pothole or hump is nearby.

Keywords : Accident, Potholes, Humps, Speed Control System, Ultrasonic Sensor, Arduino, and LCD Panel.

INTRODUCTION :

India is one of the maximum well- recognised international locations within side the world, and its financial system is one of the quickest expanding. In India nowadays, roads are the number one shape of transportation. However, the bulk of the roadways in India is cramped and narrow. It calls for minimum care and has negative floor quality. The quantity of cars has improved over years. One of the number one problems in growing kingdom is upkeep of roads. Properly maintained roads contribute to main part of monetary machine. Identification of pavement misery consisting of potholes and humps is the simplest technique that allow drivers to keep away from injuries or automobile damages, however, additionally facilitates authorities to hold roads. The pothole detection strategies which have been superior and proposes a price-powerful method to come to be aware of the potholes and humps on roads and provide well timed signs to drivers to avoid injuries or automobile damages. Ultrasonic sensors are used to understand the potholes and humps and moreover to degree their depth and peak, respectively. The proposed tool captures the geographical area coordinates of the potholes and humps through the usage of a worldwide positioning machine receiver. The sensed records include pothole depth, pinnacle of hump, and geographic vicinity, that`s saved withinside the database (cloud). This serves as a precious supply of facts to the authorities and vehicle drivers. An android software program is used to alert drivers in

order that precautionary measures can be taken to persuade clean of injuries. Signals are given in the shape of a flash messages with an audio beep.

LITERATURE SURVEY :

Vehicular traffic on highways increased significantly by Managing such heavy traffic has become very difficult. Another big problem is that of our roads are in poor condition. Potholes are caused by heavy rainfall and the movement of heavy vehicles. These potholes are the cause of traumatic accidents and deaths. Also, since the roads are in a very bad condition, the fuel consumption of vehicles increases, thus wasting precious fuel. For these reasons, it is very important to be informed about such bad road conditions collect this information and share it with other vehicles. which in turn can alert the driver. But it comes with several challenges. First, there are many ways to obtain information about road conditions. Second, this information must be properly collected and distributed to all vehicles that may need this information. Finally, the collected information must be communicated in a way that is easy for the driver to understand and use. The main purpose of this model is to create a system where a base station collects information about potholes and then distributes it to other vehicles via wireless transmission. n this technique, the sensor used the to record the vertical and horizontal climbs experienced by the vehicle while the GPS device independently records the related GPS of the and organizes the collected data. This data can then be processed to produce depressions and prominences. This model focuses on building a device that represents considerable authority in interrupt detection and little proximity blocking detection. To improve the safety of vehicles, a system can be developed that can predict an accident before it happens and thus gives extra time to inform about the progress of welfare. Warnings can be provided by signalling methods, when the driver moves towards a hole or obstacle the driver can be warned of what the road ahead contains. a pothole and warning system using a wireless network of sensors. The purpose of this application is to offer an innovative pothole detection system for the that helps drivers maintain a strategic distance from potholes on the streets through timely guidance. The build configuration also suggests low maintenance, response time, and submit a response to this problem. Our proposed model not only provides pothole frame with message warning, but also helps to control the speed of the vehicle.

The study was conducted in five phases namely: Phase 1: Selection of sensors and mechanical parts for the fabrication and working process; Phase 2: Proposed CAD and Solid Works model for the project; Phase 3: Collection of information data to sensors for its operation; Phase 4: Fabricating mechanical pneumatic braking system; Phase 5: Experimental calculation and real-time test results and report generation;

Phase 1: Selection of sensors and mechanical parts for the fabrication and working process:

Phase 2: Proposed CAD and Solid Works model for the project:

Phase 3: Collection of information data to sensors for its operation:

Phase 4: Fabricating mechanical pneumatic braking system:

Phase 5: Experimental calculation and real-time test results and report generation:

1. To detect the pot holes and humps in the roads and to prevent the accidents and ensure driver safety.

2. Collected review and journal papers according to the survey of the project

3. Selection of sensors and mechanical parts for the fabrication and working process

4. Proposed CAD and SOLIDWORKS model for the project

5.Collection of information data to sensors for its operation

6. Experimental calculation and real time test results and report generation

COMPONENTS

ARDUINO IDE

Arduino IDE is a GUI based Software that supports all the Arduino based microcontrollers. It is a cross platform Application written in the programming languages C, C++ & Java. It runs on various operating systems like Windows, Mac OS and Linux. To program the microcontroller you will need an ISP programmer. An Arduino As ISP works just fine Choose your ISP programmer in the Tools > Programmer menu. Then choose your AT mega microcontroller From Tools > Board and your choice of clock source and clock frequency from Tools > Clock. To set the AT mega configuration fuses, use the Tools > Burn Bootloader menu item. This doesn't actually Burn an Arduino bootloader onto the chip, it only sets the fuses for the chosen clock settings. To load programs into the microcontroller, use the Upload button as usual. The IDE will upload the code Using the selected ISP programmeThe microcontrollers can be programmed using the C and C++ programming

NODEMCU

The NodeMCU (Node Micro Controller Unit) is an open source software & hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. That makes it an excellent choice for IoT projects of all kinds. However, as a chip, the ESP8266 is also hard to access and use. One must solder wires with the appropriate Analog voltage to its PINs for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip and you must program it in low level machine instructions that can be interpreted by the chip hardware. While this level of integration is not a problem when the ESP8266 is used as an embedded controller chip in mass-produced electronics, it is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects.This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area.2. AES is a symmetric block encryption algorithm. The size of the encrypted block can be 128 bit, 192 bit or 256 bit.

ULTRASONIC SENSOR

HC-SR04 ultrasonic sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo & Ground respectively. It has two projections, one to transmit the ultrasonic waves, and the other receives the echo that is reflected back from an obstacle. The distance is calculated based on the time taken by the ultrasonic pulse to travel a particular distance as follows

Distance = (Time × 343m/s)/2

We power the Sensor using a regulated +5V through the Vcc and Ground pins of the sensor. The current consumed by the sensor is less than 15mA & hence can be directly powered by the on board 5V pins. The Trigger & the Echo pins are both I/O pins & hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS & then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return to the sensor. The amount of time during which the Echo pin stays high is measured by the MCU as it gives the information about the time taken for the wave to return to the sensor.

MOTOR DRIVE – IC

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction There are 4

input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.

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As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor.

DOUBLE ACTING PNEUMATIC CYLINDER

When looking for a device to move load in both directions, double acting cylinders are a useful application when your machine requires more than one movement. Unlike single acting air cylinders, double acting cylinders can extend and retract without the need of a spring. Instead of applying pressurized air into one port, double acting cylinders have two ports where air can enter in and out.

Air enters through one port moving the piston forward and then applies pressurized air into the other port retracting the piston back into the cylinder. Double acting cylinders are the most widely used pneumatic actuators compared to single acting cylinders given their ability to extend and retract within a shorter time period, thus, becoming more efficient and precise.

Double acting pneumatic cylinders are mostly used in industrial and robotics industries. They perform tasks such as opening/closing doors and lifting and moving merchandise off conveyor belts. Other uses include medical applications, earth-moving equipment and space programs.

ADVANTAGES OF DOUBLE ACTING CYLINDER :

1. More control over movement since pressurized air moves both ways

2. Faster, stronger and use less energy

3. Offer more design variation: stroke and bore sizes

PNEUMATIC BRAKING SYSTEM

The compressed air from the compressor at the pressure of 5 to 7bar is passedthrough a pipe connected to the Solenoid valve with one input. The Solenoid Valve is actuated with Control Timing Unit. The Solenoid valve has two outputs and one input. The air entering into the input goes out through the two outputs when the timing control unit is actuated. Due to the high air pressure at the bottom of the piston, the air pressure below the piston is more than the pressure above the piston. So these moves the piston rod upwards which move up the effort are, which is pivoted by control unit. This force acting is passed on to punch/rivet which also moves downwards. The IR TRANSMITTER circuit is to transmit the Infra-Red rays. If any obstacle is there in a path, the Infra-Red rays reflected. This reflected Infra-Red rays

are received by the receiver circuit is called “IR receiver”. The IR receiver circuit receives the reflected IR rays and giving the control signal to the control circuit. The control circuit is used to activate the solenoid valve.

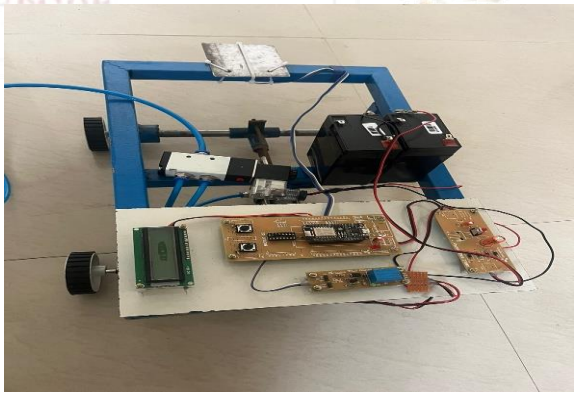

FIG 2 : CIRCUIT CONNECTION

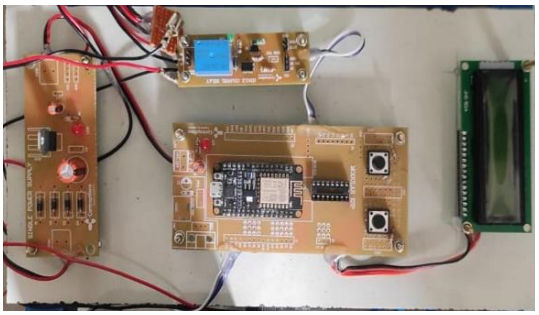

FIG 3 : DC MOTOR

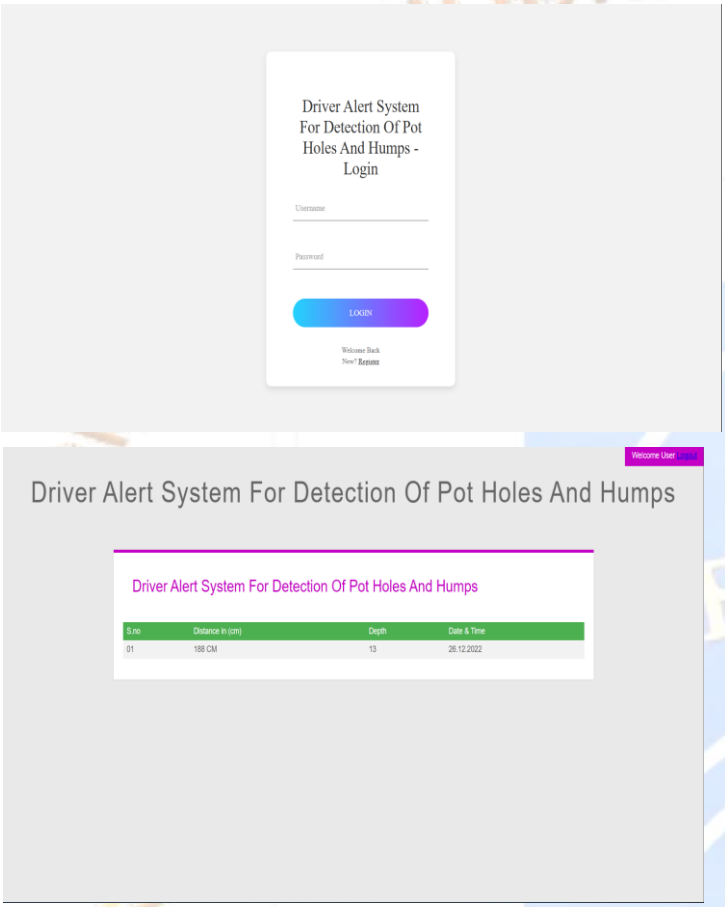

FIG 1 : FABRICATION OF POTHOLES DETECTION SYSTEM

IOT WEB PAGE

FIG 4 : IOT WEB LOGIN PORTAL

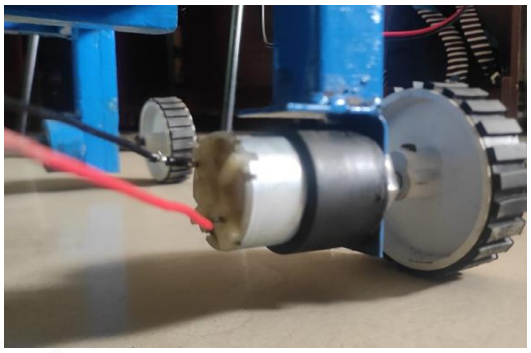

FIG 5 : PORTAL WEB PAGE

CONTROLLER CODING

```
#include <Wire.h>
#include <ESP8266WiFi.h>
#include <LiquidCrystal_I2C.h>
#include "iot_functions.h"
#include "nodemcu_arduino_pins.h"
#include "parse_message.h"

const char* host = "insourcetechnologies.org";

long duration;
const int trigPin = D5;
const int echoPin = D6;
int START_BUTTON = D7;
//int CONTINUE_BUTTON = A0;
int MOTOR_RELAY = D0;
int total_potholes, pothole_id, alert_buffer_time = 3;
int pothole_location[6] = {0, 0, 0, 0, 0, 0};
int pothole_depth[6] = {0, 0, 0, 0, 0, 0};
unsigned long driving_start_time = 0, total_driving_time;
String url, response;
LiquidCrystal_I2C lcd(0x3F, 16, 2);
```

```
int readDistance()
{       digitalWrite(trigPin, LOW);
        delayMicroseconds(2);
        // Sets the trigPin on HIGH state for 10 micro seconds
        digitalWrite(trigPin, HIGH);
        delayMicroseconds(10);
        digitalWrite(trigPin, LOW);
        // Reads the echoPin, returns the sound wave travel time in microseconds
        duration = pulseIn(echoPin, HIGH);
       // Calculate the distance
        return duration * 0.034/2;
                                } void setup()
{
        Serial.begin(9600);
        delay(10);
        pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
        pinMode(echoPin, INPUT); // Sets the echoPin as an Input
        pinMode(START_BUTTON, INPUT);pinMode(MOTOR_RELAY, OUTPUT);
initWiFi("PROJECT", "withlove", 1);

        lcd.begin(16,2);
        lcd.init();
        lcd.backlight();

        lcd.setCursor(0,0);
        lcd.print("IOT ROAD");
        lcd.setCursor(0,1);
        lcd.print("SAFETY SYSTEM");
        delay(2000);
        url = "/projects/her22146_iot_road_safety/getPotholes.php?total_potholes=1";

        total_potholes = requestURL(host, url).toInt();

        Serial.print("total_potholes:");
        Serial.println(total_potholes);

        pothole_id = 1;
        while(pothole_id <= total_potholes)
```

IOT CODING

```
<?php
        include('session.php');
?>
<!DOCTYPE html>
<html >
<head>
        <meta charset="UTF-8">
        <title>IoT Road Safety System</title>
        <linkrel="stylesheet"href="css/reset.min.css">
        <linkrel="stylesheet"href="css/style.php?theme=purple">
        <!-----------------------------------
        //Auto Reload Page using AJAX
        ----------------------------------->
        <script src="js/jquery.min.js"></script>
        <script type="text/javascript">
        function delay(ms){
          var start = new Date().getTime();
          var end = start;
          while(end < start + ms) {
                end = new Date().getTime();   }
```

EXPERIMENTALBREAKING CALCULATION

ABBREVIATIONS AND ACRONYMS

$D_{Braking}$= Braking distance
μ = coefficient of friction
g = acceleration due to gravity
V = Velocity before applying brakes
v = final velocity
u = initial velocity
a = acceleration
s = braking distance
F= Force

UNITS

$D_{Braking}$ = m = Meters
v = final velocity = m/sec =meter/sec
u = initial velocity= m/sec =meter/sec
a = acceleration = m/sec^2=meter/sec^2
s = braking distance = m= meter
F= Force = N = Newton

BREAKING CALCULATION

DBraking m

Where, V = Velocity before applying

brakes μ = coefficient of friction =0.7(for dry surfaces)

g = acceleration due to gravity

DBraking= Braking distance,

DBraking= 1.26 m

Here the human perception time and human reaction time are equal to "zero" because it is an automatic braking system.

Total stopping distance = 1.26 m

Total braking distance = 1.26

Bumper actuation length = 1.26 +0.100 = 1.36 m ,Hence the sensors sensing range is set at 1.5 m

Therefore the vehicle would stop in 1.78 second over a distance of 5.6 m

IMPACT FORCE CALCULATION

Mass of the vehicle = 22 kg

Velocity of the vehicle = 15km/h = 4.167m/sec

Braking distance = 1.26 m

By motion equation 2as =$v^2 - u^2$
Where,

Finalvelociy=

u =initialvelocity

a = acceleration

s= brakingdistance

$2\times a \times 1.26 = 0^2 - 4.167^2$

a = - 6.89 m/

Force, F = mass× acceleration

= 22× (-6.89)

F = 151.58 N

CONCLUSION

In this project we have proposed a system to be able to stumble on the potholes on the Street and store the information within the server and reduce the automobile pace if Wished. Due to the rains and oil spills potholes are generated a good way to reason the Accidents. The potholes are detected and its top, intensity and size are measured the use of Ultrasonic sensor. The GPS is used to discover the location of pothole. All of the records is Stored in the database. This well timed statistics can help to get better the street as fast as Feasible. By controlling the price of fuel injection we are able to manage the rotation of the Pressure shaft by using an IR Non-touch tachometer. This facilitates to lessen the car Speed whilst pothole or hump is detected. Hence the system will assist to keep away from Road accidents. The IOT webpage used in this system is an additional advantage as it provides Timely alerts about potholes and humps. The solution also works in rainy season when potholes Are filled with muddy water as alerts are generated

using the information stored in the database. We feel that the solution provided in this paper can save many lives and ailing patients who suffer From tragic accidents. The proposed system considers the presence of potholes and humps. However, it does not consider the fact that potholes or humps get repaired by concerned .Authorities periodically. This system can be further improved to consider the above fact and Update server database accordingly.

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