IOT BASED SPEED BREAKER AND POTHOLE DETECTION

CH. SURESH, *ASSISTANT PROFESSOR, DEPT. OF ECE IN SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE, GUDLAVALLERU, VIJAYAWADA, ANDHRA PRADESH 521356.*

G. VENKATA RAMARAJU, M. SRIYA, G. DURGA BHAVANI, L. AKHIL.

STUDENTS IN DEPT. OF ECE IN SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE, GUDLAVALLERU, VIJAYAWADA, ANDHRA PRADESH 521356.

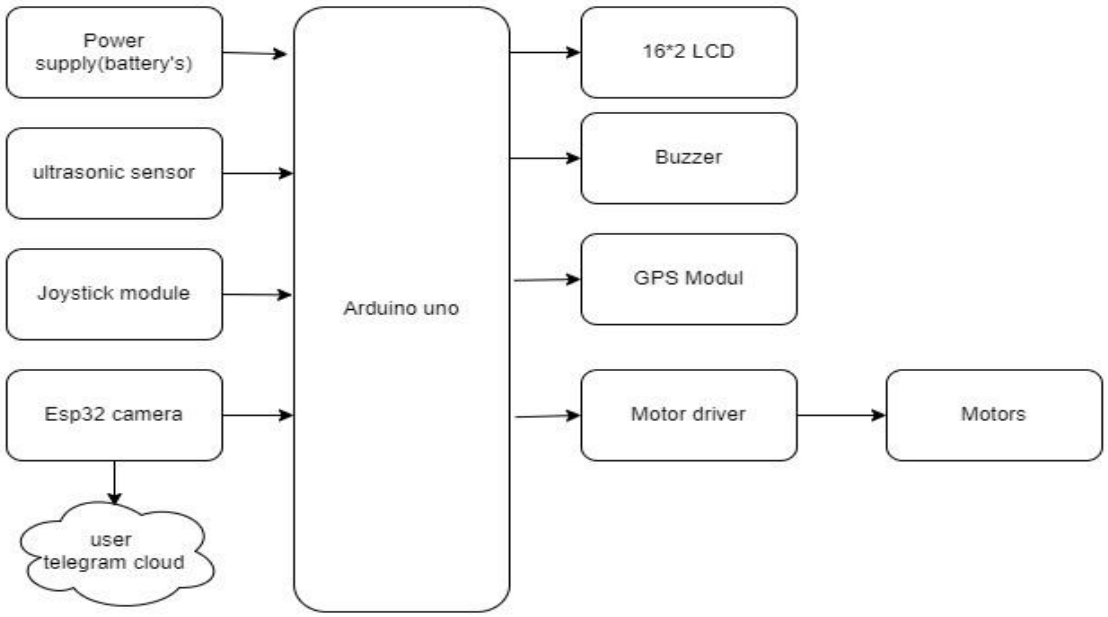
ABSTRACT:

To enhance road safety, an Internet of Things (IoT) system is being developed to identify and notify drivers in real-time of possible dangers, such as potholes and speed breakers, utilising GPS and an ESP32 camera connected to an Arduino. An ESP32 camera processes images, a GPS system keeps tabs on where the user is, and an Arduino system analyses data and generates alerts. Road accidents caused by speed breakers and potholes are a serious problem, and this initiative aims to solve it. Its goal is to improve road safety by reducing the likelihood of accidents and giving drivers timely notifications. The software and hardware parts of the system integrate perfectly to warn drivers of impending hazards like speed breakers and potholes. A driver-friendly interface, integrated image processing algorithms for danger identification, and system design and development are all part of the project's purview. The accuracy and reliability of the technology will be tested under different road conditions. There is a dearth of reliable real-time traffic warning systems at the moment. To address that, this project will use Internet of Things (IoT) technology to develop a preventative safety measure. The technology may save lives by letting drivers know about impending hazards like potholes and speed breakers. Finally, the Internet of Things (IoT)-based warning system for speed breakers and potholes might greatly enhance traffic safety. Cities and municipalities that are interested in improving their road infrastructure and reducing accidents may find it useful after further development and integration.

INTRODUCTION

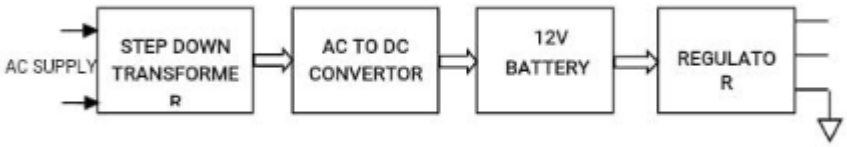
Because of hazards like speed breakers and potholes, road safety is an important issue on a worldwide scale. Because they are often unexpected and may cause serious accidents, especially while travelling at high speeds, these road hazards provide unique challenges. This project suggests an Internet of Things (IoT) system that uses GPS, an ESP32 camera, and Arduino to detect potholes and speed breakers and send out alerts when they are detected. In order to improve road safety, the system would notify drivers in real-time of impending hazards like potholes and speed breakers so that they may take appropriate measures. With the use of Internet of Things (IoT) technology, the system can identify dangers and have productive conversations with drivers, which might make roads safer for everyone. A global positioning system (GPS) module, an ESP32 camera (for image processing), and an Arduino (for data analysis and alert production) are the main components of the project. Images of the road are taken by the ESP32 camera and are analysed in real-time to identify speed breakers and potholes. Accurate location alerts based on the vehicle's position are made possible via the GPS module. Hardware component research and development, danger identification using image processing techniques, and an intuitive interface for drivers to see warnings are all part of the system's purview. To make sure the technology works and is reliable under different road conditions, we will test it thoroughly. Summarising, the Internet of Things (IoT)-based warning system for potholes and speed breakers is an innovative strategy for road safety that might drastically cut down on accidents caused by these issues. The technology may save lives and make roads safer by alerting drivers in a timely manner.

PROPOSED SYSTEM BLOCK DIAGRAM



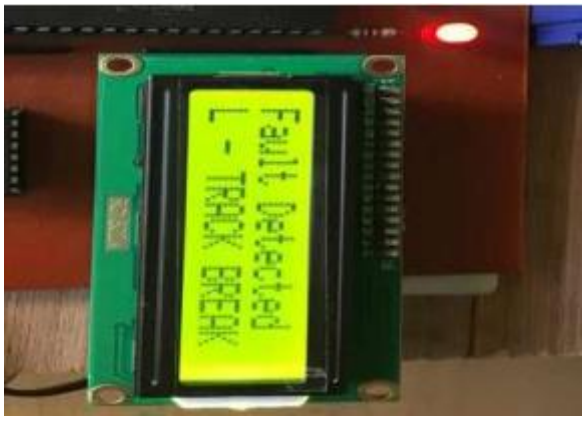
Power Supply:

An essential component of the project's execution is the power supply. Both the base unit and the charging unit get their DC power source from the mains line. A 12V-012V transformer with a center-tapped secondary is ideal for this application. We are receiving a 5V power supply from this transformer. The 7805 positive voltage regulator is used in its design to provide a controlled output of +5V. A maximum current of 800 milliamps may be supplied by this three-pin voltage regulator.



LCD STANDS FOR LIQUID CRYSTAL DISPLAY:

Reasons why liquid crystal displays (LCDs) are quickly replacing light-emitting diodes (LEDs) (seven segment LEDs and other multi segment LEDs) include: The falling cost of liquid crystal displays. Graphics, numbers, and text may all be shown. This is in contrast to light-emitting diodes, which can only display a few number of characters at most. The LCD's refreshing controller is integrated within the display, which frees up the CPU from that responsibility. On the other hand, in order for the LED to continue showing the data, the CPU has to update it. Character and graphic programming made easy. These parts are "specialised" for use with microcontrollers; regular IC circuits will not activate them. You may use them to write various messages on a small LCD. A model that is most often used in practice is one that is discussed here because of its inexpensive price and wide potential.



GPS: Worldwide Locating Locating an object with pinpoint accuracy is possible via system tracking. Vehicles, mobile phones, and specialised GPS units (which might be stationary or mobile) are all potential locations for a GPS tracking system. Position data is the key to how global positioning systems (GPS) function. Also, it may follow a person's or a car's whereabouts. One business may use a GPS monitoring device to keep tabs on a delivery truck's whereabouts, while another could use it to keep tabs on a child's whereabouts or even valuable assets while they're in transit. Multiple methods exist for using a GPS tracking system. From a business standpoint, GPS systems are often used to track the whereabouts of cars throughout their travels. Passive tracking involves storing the data inside the GPS system itself; active tracking, often called 2-Way GPS, involves regularly transmitting the data to a central database or system using a modem within the GPS system unit.

ULTRASONIC SENSOR

A device that uses ultrasonic sound waves to determine the distance to an object is known as an ultrasonic sensor. The transducer in an ultrasonic sensor allows it to transmit and receive ultrasonic pulses, which in turn provide data on the proximity of an item. To detect objects, ultrasonic sensors emit a sound wave at a frequency that is audible to humans but not to other animals. The sensor's transducer takes the role of a microphone, transmitting and receiving ultrasonic waves. Similar to other ultrasonic sensors, ours employ a single transducer to both transmit and receive the echo. By timing the transmission and reception of an ultrasonic pulse, the sensor may calculate the distance to an object.

This module operates on a very basic basis. At 40 kHz, it emits an ultrasonic pulse that, if it encounters an impediment or anything in its path, will return to the sensor. You can figure out how far something is by plugging in its travel time and the speed of sound.

For the purpose of detecting transparent objects, ultrasonic sensors are an excellent choice. Infrared sensor applications, for example, have difficulty with this use case because to target translucence while measuring liquid levels.

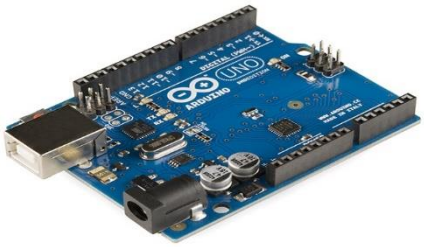
Unless the item is very fluffy, like wool, which would absorb sound, ultrasonic sensors can detect its existence regardless of its colour, surface, or composition.

Ultrasonic sensors are dependable alternatives to optical technology for detecting transparent and other types of materials.

ARDUINO UNO

Along with the AT-omega328, Arduino is an open-source microcontroller.It serves as the central nervous system or foundation of this undertaking. It has six analogue pins and fourteen input/output pins. These pins are used for connecting everything to the Arduino. The arduino processes the incoming signal and outputs the result as it gets it. The code has to be created on the computer, compiled in the programme, and then sent to the arduino via a cable after it's finished. Built on top of the Microchip ATmega328P microprocessor, the Arduino Uno is an open-source board that was created by the folks over at Arduino.cc.[2] inthe third Several expansion boards (shields) and other circuits may be interfaced with the board's sets of digital and analogue input/output (I/O) pins.[1] Utilising a type B USB connection, the board may be programmed with the Arduino IDE (Integrated Development Environment). It has 14 digital I/O pins, 6 of which are capable of PWM output, and 2 analogue I/O pins.This device may be powered using either the USB cable or an external 9-volt battery. It is compatible with voltages ranging from 7 to 20 volts. It resembles Leonardo and Arduino Nano. You can get the hardware reference design on the Arduino website; it's given under a Creative Commons Attribution Share-Alike 2.5 licence. Some hardware versions additionally provide layout and manufacturing files.

We picked the Italian word "uno"—meaning "one"—to commemorate the first release of the Arduino software.[1] Early versions of the Arduino IDE (version1.0) and the Uno board (the first in a series of USB-based Arduino boards) served as the foundation for subsequent versions of the software.[4] The on-board ATmega328 comes with a boot loader already written into it, so you may upload fresh code to it without using an external hardware programmer. Although it still uses the original STK500 protocol for communication, the Uno deviates from all previous boards by not using the FTDI USB-to-serial driver chip. The Atmega16U2 (or Atmega8U2 up to R2), which is a USB-to-serial converter, is instead used.

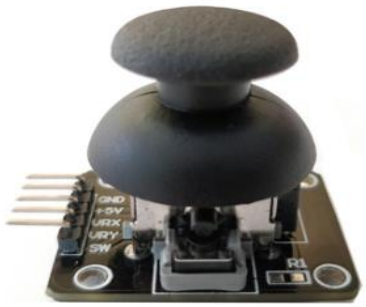


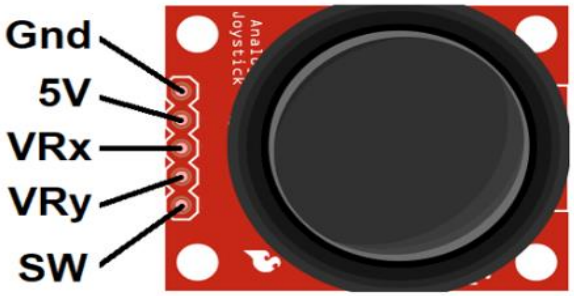
ELECTRIC BUZZER

You may find mechanical, electromechanical, or piezoelectric beepers, buzzers, and other devices that use sound to communicate. In its most basic form, this is a tool for making sound out of spoken word. Direct current (DC) powers a wide variety of electronic equipment, including computers, printers, alarms, timers, and more. Sounds like sirens, bells, music, and alarms are all within its capabilities.

JOYSTICK MODULE

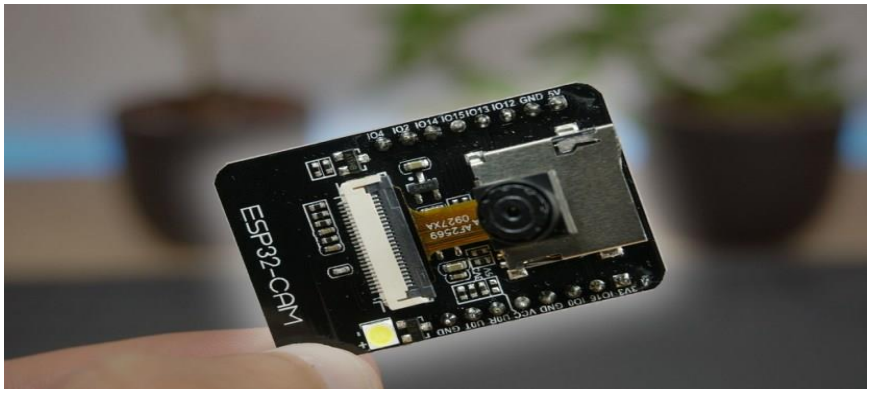
A joystick module is compatible with a wide variety of microcontrollers, including Raspberry Pi, Arduino, and many more. All that's needed is to link the microcontroller's ADC Pins to the axis pins VRx and VRy. To activate the switch, just plug it into the microcontroller's digital pin. To attach the joystick, follow the block diagram below. The phrase "joystick" conjures images of gaming controllers in our minds. The joystick has several practical uses in the realm of electronics. Robot control and do-it-yourself projects based on the Arduino platform make heavy use of these modules. We know that the module may be used to feed the analogue input depending on movement or direction since it produces analogue output. You may also control its movement by connecting it to a moveable camera.





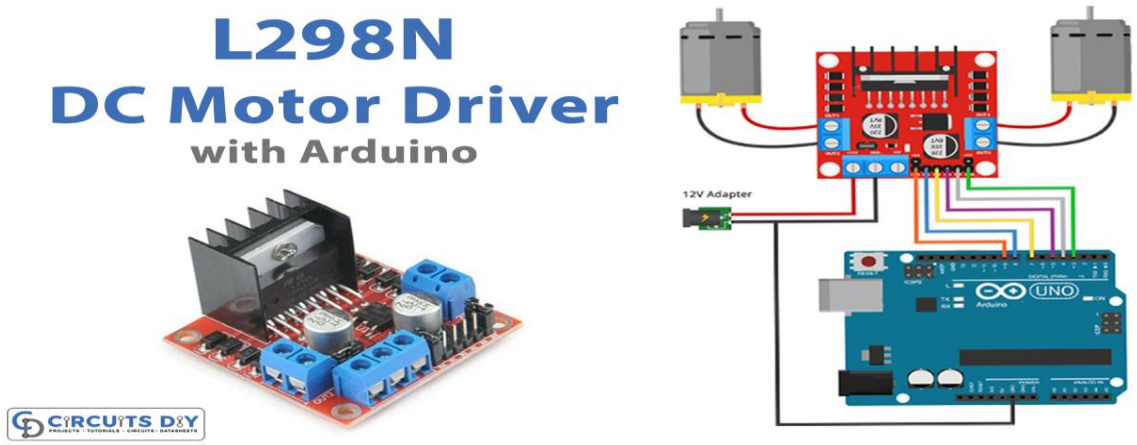
ESP32 CAMERA MODULE

As a bare-bones system, the ESP32-CAM's compact camera module can compete with the best of them. Many Internet of Things (IoT) applications may make use of ESP32-CAM. It works well with a wide variety of Internet of Things (IoT) applications, including smart home devices, industrial wireless control and monitoring, quick response (QR) wireless identification, and signals from the global positioning system. For Internet of Things (IoT) uses, it's perfect. To facilitate rapid manufacturing, the ESP32-CAM is available in a DIP package that allows for direct connection to the backplane. For a wide range of Internet of Things (IoT) hardware terminals, it offers a dependable connecting mechanism and is easy to use.



L293D MOTOR DRIVER

The L293 is a motor driver integrated circuit that can control two tiny motors in both directions at the same time. A little signifies a little. The L293 has a 600 mA maximum, but in practice, it can only manage very modest currents unless you've taken extreme measures to reduce the case temperature, in which case it will fail. Do you not know whether the L293 is compatible with your engine? Get your motor going by connecting the circuit and keeping your index finger on the chip. You shouldn't use it with your motor if it becomes too hot to handle. A common integrated circuit package for the L293 has 16 pins and is designed for dual-in-line operation. A part number L293 and a part number L293D are available. To reduce inductive voltage spikes, go with the "D" variant, which has built-in flyback diodes. For a price of around $2 to $3 per unit, you may buy the L293D from (PN 511-L293D) or (PN 296-9518-5-ND). For new designs, it is advised to use the TI SN754410NE motor driver, which is more current, has enhanced specifications, and is pin-for-pin compatible. Buy this Mouser component, 595-SN754410NE, from their online store at mouser.com. You can see the L293's pinout in top view below, along with the 16-pin packaging. When the package's notch is facing up, pin 1 is located at the upper left.



RESULTS

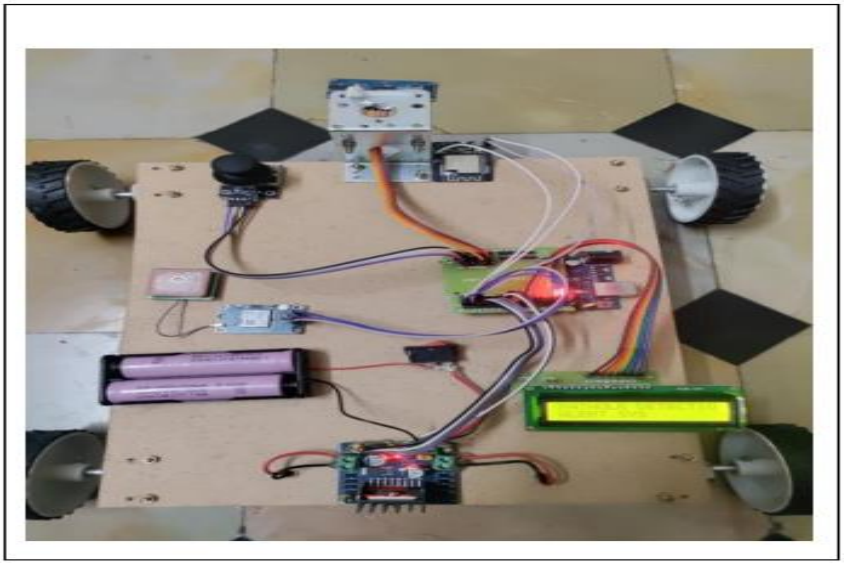


Fig.: Activate Ultrasonic Sensors & GPS

Fig.: Read GPS location

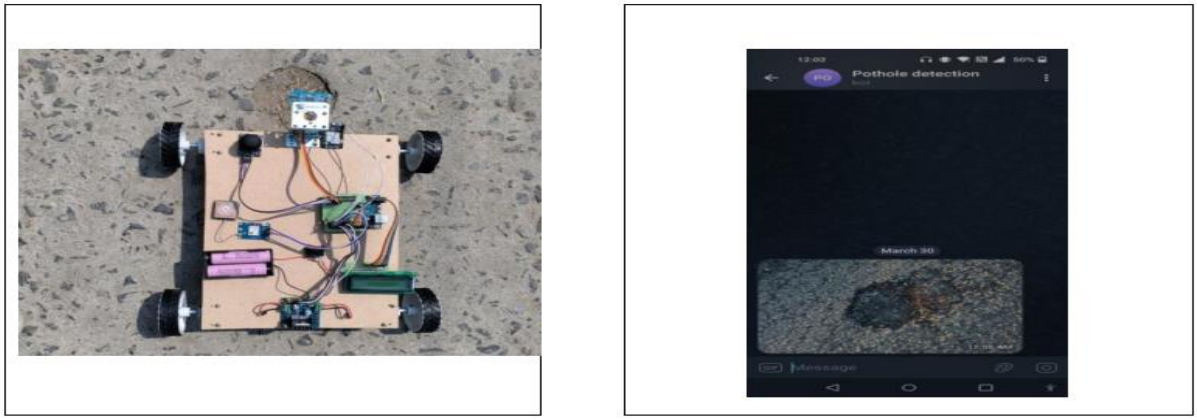


Fig.: Detect Potholes and Capture Pothole image

CONCLUSION AND FUTURE SCOPE

CONCLUSION

Potentially useful for improving road safety, the Internet of Things (IoT)-based pothole & speed breaker alarm system employs GPS and an ESP32 camera connected to an Arduino board. It may improve road conditions and help avoid accidents by alerting drivers in real-time.

FUTURE SCOPE

Adding more sensors to identify different types of traffic dangers is a potential future improvement. A more precise method of detecting speed breakers and potholes is to use machine learning techniques. To top it all off, the system may be expanded for city-wide deployment, resulting in a robust traffic safety network.

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