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Brake Alert: An Automated System for Detecting and Alerting Brake Failure in Vehicles

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Abstract—

Mishaps nowadays can occur for a variety of causes, the most common of which is brake failure, which is caused by bad maintenance as well as item deformation. To protect crucial human lives from disasters, it is necessary to observe slowing mechanisms in automobiles. Automobile security is the avoidance of car accidents or the reduction of the harmful effects of mishaps, particularly those involving human life and wellness. Unusual welfare features have been added with vehicle dwellers only, and some for the safety of others.

The automatic brake failure indicator is a system designed to detect and alert drivers of potential brake failures in vehicles. The system uses sensors to monitor the brake system and analyzes the data to determine if there is a potential brake failure. If a failure is detected, the system will immediately alert the driver through visual and audible warnings, allowing them to take immediate action and prevent accidents. The system is designed to be easy to install and can be integrated into a wide range of vehicles. By providing drivers with advanced warning of potential brake failures, the automatic brake failure indicator can help reduce the risk of accidents and save lives.

The purpose of this project is to develop a safe braking system with a brake failure signal. Most brake failures are caused by a cut in the lining and a worn out brake shoe. It is made up of two sensors, one attached to the brake shoe and the other to the brake lining. A microcontroller receives the signals from both sensors. When the brake shoe wears out or the brake lining is cut, the sensor sends a signal to the microcontroller. The signal is analyzed by the microcontroller, and the matching indicator is activated. If there is no flaw elsewhere, the green indication illuminates,

whereas the red indicator illuminates if there is a problem with the brake shoe or brake lining.

The goal of this project is to use IOT to develop a safe braking system with a brake failure signal. It is made up of the one that has the brake failure indication. The indicator's signal is sent to a microcontroller. When the brake lining is severed, the BFI sends a signal to the microcontroller through the LCD and IOT. The signal is analyzed by the microcontroller, and the matching indicator is activated. If there is no flaw elsewhere, the green indication illuminates, whereas the red indicator illuminates if there is an issue with the brake liner. This solution contributes significantly to safety by reducing avoidable accidents through the use of IOT. Our technology assists in signaling the state of the brake, allowing the user to recognize and reduce the likelihood of failure.

Keywords—ARDUINO UNO, BREAK FAILURE INDICATOR, IOT, TEMPERATURE SENSOR

INTRODUCTION

Machines are now commonly operated by automated control systems. To fulfill the needs of a rising population, inexpensive, effective, and dependable control of machines and their control systems is required. The primary goal of this project is to continually monitor the braking system at all times when the vehicle is in operation. Accidents occur for a variety of causes these days, one of which is brake failure, which is caused by inadequate maintenance, incorrect usage, and product defect. In order to protect the precious human for accident, accident monitoring of brake is a critical problem in automobiles. Today's mistakes arise for a variety of factors, one of which is brake disappointment, which is produced by insufficient support as well as item flaws, so as to keep a safe watchman the profitable human for mishaps. The blunder the importance of brake inspection in an automobile cannot be overstated. Automobile security is the avoidance of car accidents or the reduction of the harmful effects of mishaps, particularly as they relate to human life and well-being. Exceptional welfare features have been included with vehicle renters only, and some for the safety of others. We have joy in introducing our new initiative " Brake Alert: An Automated System for Detecting and Alerting Brake Failure in Vehicles"

Despite the fact that various techniques of energy conversion may be used, most brakes use friction between two surfaces pushed together to transform the form of the kinetic energy of the moving item into heat. Regenerative braking, for example, turns a considerable portion of the energy to electrical energy as well as thermal energy, which may be stored or returned to the source for later use. Some ways transform kinetic energy into potential energy in stored forms such as pressurized oil or compressed air. Magnetic fields are utilized in Eddy current brakes to transform kinetic energy into electric current, which is then turned into thermal energy in the brake disc, fin, or rail. Several braking mechanisms exist to convert kinetic energy into various forms.

A break failure indicator is a safety feature in vehicles that alerts the driver when there is a problem with the braking system. This warning system is designed to prevent accidents by providing an early warning to the driver that the brakes are not functioning correctly. The break failure indicator typically consists of a warning light on the dashboard that illuminates when there

is a problem with the brakes. The braking system is one of the most critical safety features of any vehicle, and it is essential to ensure that it is functioning correctly. Brake failure can occur due to a variety of reasons, such as worn brake pads, leaky brake lines, or a malfunctioning brake booster. If not detected early, brake failure can lead to serious accidents, injuries, and even fatalities. By having a break failure indicator, drivers can quickly identify any issues with the brakes and take appropriate action to prevent accidents. It is crucial to address any brake problems as soon as possible by taking the vehicle to a qualified mechanic or automotive service center to ensure that the braking system is functioning correctly.

The brake disc, fin, or rail of an eddy current brake uses magnetic fields to transform kinetic energy into an electric current, which is then transformed into heat. Some braking techniques even convert kinetic energy into various forms, for as by sending it to a flywheel that is revolving. This project made up of the one that has the brake failure indication. The indicator's signal is sent to a microcontroller. When the brake lining is severed, the Break Failure Indicator sends a signal to the microcontroller.

LITERATURE SURVEY

[1] This project when a vehicle meets with an accident, a sensor situated on the vehicle will detect it immediately and send a message to the microcontroller. The microcontroller then sends the alert message with the help of GSM modem to a police control room or rescue team which will include the location with the help of GPS. Also the alert message containing the location of accident will be send to the relatives of the victim.

[2] This project aims at finding the occurrence of any accident and reporting the location of accident to the previously coded numbers so that immediate help can be provided by ambulance or the relative's concerned. GSM technology is used to intimate the vehicle position in the form of latitude and longitude coordinates through sms.

[3] This good safety device for motorcycle is difficult to implement and very expensive. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology

[4] The purpose of the project is to find the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system, most of the times we may not be able to find accident location because we don't know where accident will happen. Project Automatic Accident Detection and Alerting System Based on IoT is designed to avoid such situation.

[5] The research proposes hardware design and implementation of controlling the angular speed of the DC motor in Arduino Uno as its embedded processor system, using a PID Controller. Some examinations and analysis are done in the research, such as open-loop test, step-response, and the effect of PID parameters and sample time to the system performance.

[6] This paper presents algorithms and a prototype system for hand tracking and hand posture recognition. Hand postures are represented in terms of hierarchies of multi-scale colour image features at different scales, with qualitative inter-relations in terms of scale, position and orientation. In each

image, detection of multi-scale colour features is performed.

[7] The research proposes controlling DC motor angular speed using the Proportional Integral Derivative (PID) controller and hardware implementation using a microcontroller. The microcontroller device is Arduino Uno as data processing, the encoder sensor is to calculate the angular speed, and the motor driver is L298.

[8] It detects unusual events through inertial sensing of sudden human driver reactions and rare visual events through a trained auto encoder deep neural network. We evaluate the system based on more than 120 hours real road driving data.

[9] In this paper, we propose Sentio1; a Reinforcement Learning based algorithm to enhance the Forward Collision Warning (FCW) system leading to Driver-in-the-Loop FCW system.

[10] Estimating a driver's lane-change (LC) intent is very important so as to avoid traffic accidents caused by improper LC maneuvers. This paper proposes a lane-change Bayesian network (LCBN) incorporated with a Gaussian mixture model (GMM), termed as LCBN-GMM, to estimate a driver's LC intent considering a driver's driving style over varying scenarios.

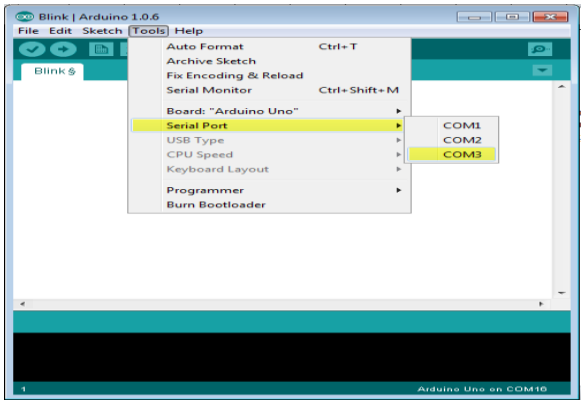
PROPOSED METHOD

The suggested system includes a brake failure warning, a buzzer, a relay, a DC motor, a temperature sensor, an IOT, and an LCD. When this system senses a brake failure state, the vehicle comes to a complete stop. Here's a brake failure indicator that continually checks the brake's state and provides an audio-visual alert. A temperature sensor is used to measure high temperatures. If the braking system fails, the buzzer will illuminate and show the LCD for about one second. Furthermore, messages sent to the IOT via another individual. It is made up of the one that has the brake failure indication. The indicator's signal is sent to a microcontroller. When the brake lining is severed, the Break Failure Indicator sends a signal to the microcontroller.

SOFTWARE DESCRIPTION

ARDUINO IDE

The Arduino integrated development environment (IDE) is a Java-based cross-platform (Windows, macOS, and Linux) tool. It is employed in the programming and uploading of Arduino boards. The source code for the IDE is available under the GNU General Public License, version 2. By utilizing unique code organization rules, the Arduino IDE supports the programming languages C and C++. The Arduino IDE includes the Wiring project's software library, which covers many common input and output tasks. User-written code simply requires two basic functions, which are constructed and linked into an executable cyclic executive program with the GNU tool chain, which is also provided with the IDE version, using a program stub main ().The Arduino IDE uses the contested program to turn executable code into a text file in hexadecimal format, which is subsequently loaded into the Arduino board by a loader program in the firmware of the board. A basic hardware and software platform for electronics, Arduino is free and open-source. A motor can be operated, an LED can be turned on, and anything can be posted online using an Arduino board, which can read inputs like a light on a sensor, a finger on a button, or a tweet from Twitter. You can operate your board by giving its microcontroller a set of instructions.



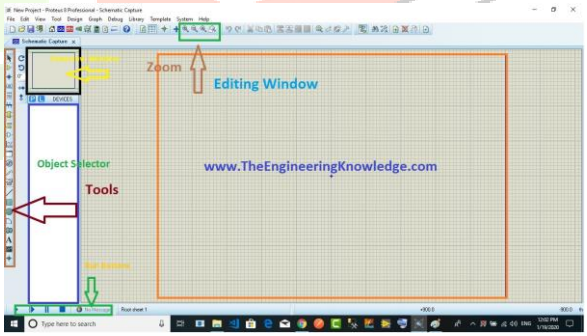
PROTEUS

The Proteus Design Suite is a proprietary software tool set that is mostly used for electrical design automation. The application is generally used by electrical design specialists and technicians to create schematics and electronic prints for the manufacture of printed circuit boards. Proteus is Lab center Electronics' electronic circuit modeling, schematic capture, and PCB design software. Its simplicity and ease of use made it popular among electronics enthusiasts. Proteus is often used to imitate digital devices like microcontrollers and microprocessors. It has the ability to simulate LED, LDR, and USB communication. Lab Center Electronics produced Proteus, a simulation and design software tool for electrical and electronic circuit design. It also offers the ability to sketch in 2D CAD. "From concept to completion" is an acceptable slogan.

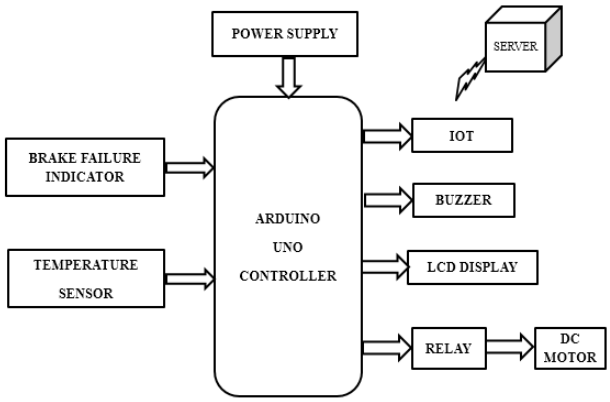
It is a software suite that contains schematic, simulation, and PCB design tools. • ISIS is a piece of software for creating schematics and simulating circuits in real time. Human participation is permitted throughout runtime, leading in real-time simulation. •ARES is a PCB design program. It allows you to see the result in 3D perspective of the built PCB as well as the components. The designer of the product can also produce 2D sketches. Features ISIS' library contains a wide range of components. Sources, signal generators, measurement and analysis equipment such as oscilloscopes, voltmeters, ammeters, and so on are included, as are probes for real-time monitoring of circuit properties, switches, displays, loads such as motors and lamps.

PROTEUS ISIS PROFESSIONAL BENEFITS:

- IT PROVIDES A CORRECT IDEA AND IMPLEMENTATION OF YOUR CODE AND CIRCUIT BEFORE IMPLEMENTING ON HARDWARE.
- IT SAVES TIME ON CONSTRUCTING HARDWARE AND IMMEDIATELY TESTING YOUR FAULTS ON HARDWARE. YOU MAY ANALYZE YOUR CIRCUIT AND CODE IN PROTEUS TO DETECT FLAWS BEFORE IMPLEMENTING ON HARDWARE.
- LOWERS PROJECT COSTS AND SOFTWARE RELIANCE.



HARDWARE BLOCK DIAGRAM



HARDWARE BLOCK DIAGRAM

HARDWARE EXPLANATION

In this project,to aim of indicate the breake failure through break failure indicator and the information displayed to the LCD and also message send to the IOT.Beep sound will be ON. the temperature sensor sense to the temperature and displayed to the LCD and also view on IOT in anywhere.if a temperature is high to indicate to the LCD and beep sound will be ON.And also message sent to the person through IOT indication

METHODS

MODULE LIST

- POWER SUPPLY
- ARDUINO UNO
- BRAKE FAILURE INDICATOR
- LCD
- BUZZER
- RELAY
- DC MOTOR
- TEMPERATURE SENSOR
- NODEMCU
-

MODULE DESCRIPTION

POWER SUPPLY

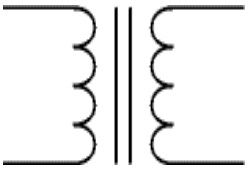
The phrase "power supply" refers to an electrical power source. A power supply unit, sometimes known as a PSU, is a device or system that delivers electrical or other kinds of energy to a load or collection of loads. The term is most commonly used to refer to electrical energy suppliers, less frequently to mechanical energy suppliers, and just rarely to others. Electrical device power supplies are categorised as either linear or switching power supplies. The linear supply is a reasonably simple design for high current devices that gets progressively bulky and heavy; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply with the same rating as a linear supply is more compact, efficient, and sophisticated.

LINEAR POWER SUPPLY:

A transformer is frequently used in an AC-driven linear power supply to convert the voltage from the mains to a different, generally lower voltage. If it is utilized to create direct current, a rectifier is used. A capacitor is used to dampen the pulsating current of the rectifier. When little periodic differences from smooth direct current remain, ripple arises. These pulsations have a frequency that is related to the frequency of alternating current power (for example, a multiple of 50 or 60 Hz).

TRANSFORMER

Transformers transmit alternating current (AC) electricity from one voltage to another with low power loss. Transformers can only operate with alternating current (AC), which is why mains electricity is alternating current. Step-up transformers increase voltage whereas step-down transformers decrease voltage. In most power supplies, a step-down transformer is used to reduce the dangerously high mains voltage (230V in the UK) to a safer low voltage. The primary coil serves as the input coil, while the secondary coil serves as the output coil. The two coils are not electrically connected; instead, an alternating magnetic field created in the soft-iron core of the transformer connects them. The two lines in the center of the circuit symbol symbolize the core.



Transformer

ARDUINO UNO

The Arduino UNO is a microcontroller board based on the Microchip ATmega328P microprocessor that was built by Arduino.cc. A variety of digital and analog input/output (I/O) pins on the board may be utilized to link to various expansion boards (shields) and other circuits. The board has 14 digital pins, 6 analog pins, and can be programmed using the Arduino IDE through a type B USB port (Integrated Development Environment). It may be powered by a USB connection or an external 9 volt battery, and it can handle voltages from 7 to 20 volts.

It is also similar to the Arduino Mini and Leonardo. The hardware reference design is licensed under a Creative Commons Attribution Share-Alike 2.5 license and is accessible on the Arduino website. There are also concept and production files for numerous hardware versions available. The name "Uno" translates to "one" in Italian and was chosen to honor the release of the Arduino Software (IDE) 1.0. The Uno board and Arduino Software (IDE) version 1.0 were the reference versions of Arduino, which have subsequently been updated. The Uno board is the platform's standard model and the first in a series of USB Arduino boards.

PINS General Pin functions

LED:

A built-in LED is powered by digital pin 13. When the pin is HIGH, the LED is turned on; when it is LOW, the LED is turned off.

VIN:

The input voltage to the Arduino/Genuino board when it is powered by an external source (as opposed to 5 volts from the USB connection or other regulated power source). This pin can be used to supply voltage or to access voltage if it is supplied via the power jack.

5V:

This pin outputs a controlled 5V from the board's regulator. Power may be provided to the board through the DC power jack (7 - 20V), the USB connection (5V), or the board's VIN pin (7-20V). Using the 5V or 3.3V pins to supply power bypasses the regulator and can harm the board.

3V3:

The on-board regulator generates a 3.3 volt supply. The maximum current draw is 50 milliamperes.

GND stands for ground pins.

IOREF:

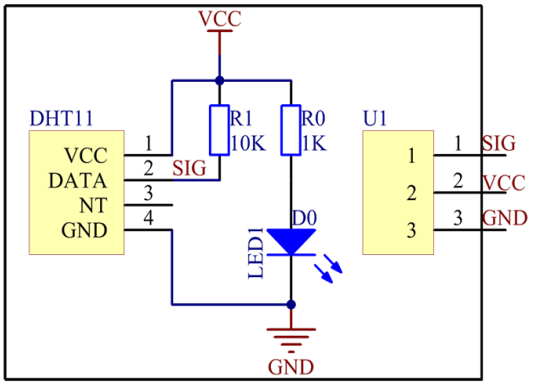
The voltage reference with which the microcontroller runs is provided by this pin on the Arduino/Genuino board. A correctly constructed shield may read the IOREF pin voltage and choose the right power source, or it can activate voltage translators on the outputs to function with 5V or 3.3V.

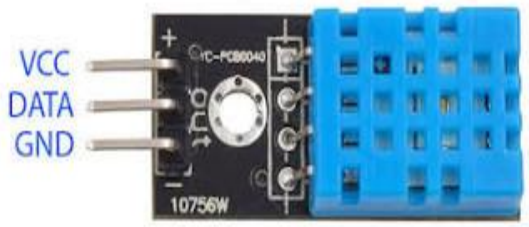
Reset:

Commonly used to add a reset button to shields that obstruct the board's reset button.

TEMPERATURE SENSOR (DH11)

A composite sensor with a calibrated digital temperature and humidity signal output is the DHT11 digital temperature and humidity sensor. Temperature and humidity sensors are employed along with specific digital module technology to guarantee the product's high reliability and long-term stability. The sensor is connected to a powerful 8-bit microcontroller and is made up of a resistive wet component and an NTC temperature measurement device. A schematic illustration of the human sensor module is shown below:

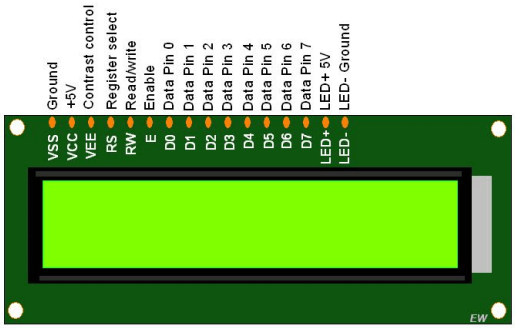




TEMPERATURE SENSOR

LIQUID CRYSTAL DISPLAY (LCD)

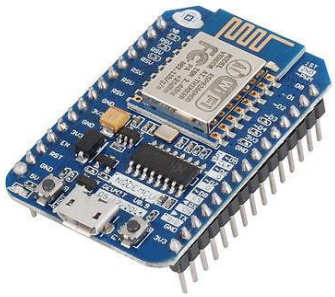
A flat panel display, electronic visual display, or video display that uses liquid crystals to modulate light is known as a liquid crystal display (LCD). Light is not directly emitted by liquid crystals. An LCD display can show random visuals (like a general-purpose computer monitor) or fixed pictures that can be seen or hidden, such pre-set text, numbers, and 7-segment displays like those used in digital clocks. They both use the same underlying technology, with the distinction that some displays have larger components and some displays have random graphics made up of a lot of tiny pixels. An LCD screen is a small, inexpensive display. It is straightforward to interface with a microcontroller because of the built-in controller (the black blob on the back of the board).



LCD display unit

NODEMCU

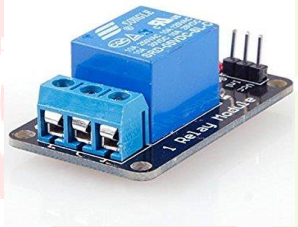
The ESP8266 Wi-Fi SOC from Espress if uses the on-module flash-based SPIFFS file system, and NodeMCU is an open source Lua-based firmware for it. NodeMCU was created using the Espress if NON-OS SDK and is written in C. The firmware may now be used on any ESP module and was initially developed as a companion project for the well-liked ESP8266-based NodeMCU development modules. Features: Programmable Interactive Free Software Low cheap, simple, smart, and WI-FI enabled. On a single board, the ESP8266 Development Kit combines GPIO, PWM, IIC, 1-Wire, and ADC. Integrate NodeMCU Firmware to speed up your development. • 10 GPIO, each of which can be PWM, I2C, or 1-wire; USB-TTL, plug-and-play WI-FI CERTIFIED MODULE BY FCC (COMING SOON)



NODEMCU

RELAY

A relay is an electrical switch that opens and closes in response to another electrical circuit's control. The switch is originally actuated by an electromagnet to open or close one or more sets of contacts. Joseph Henry created it in 1835. Because a relay may operate an output circuit with greater power than the input circuit, it can be thought of as a type of electrical amplifier in a broad sense.



RELAY CONTACT CONDITIONS:

Usually Open Contact (NO) –

A NO contact is also known as a make contact. When the relay is actuated, it shuts the circuit. When the relay is inactive, it disconnects the circuit**.**

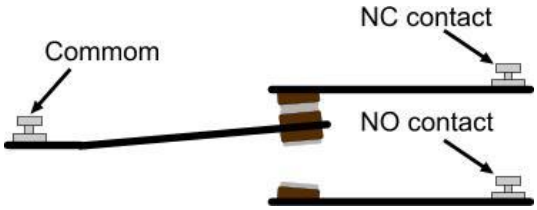
A Normal Open contact (NO)

Normally Closed Contact (NC) –

A break contact is a normally closed contact. This is the inverse of the NO contact. The circuit is disconnected when the relay is engaged. The circuit is connected when the relay is disengaged.

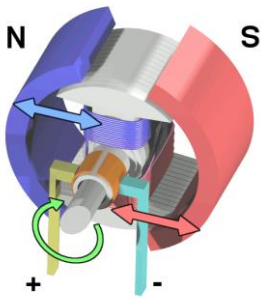
A Normal Closed contact (NC)

Contacts for change-over (CO) and double-throw (DT) - These contacts are used to regulate two types of circuits. They are used to control both a NO and an NC contact via a same terminal. They are known as break before make and make before breakcontacts according on their nature.



DC MOTOR

Direct current motors are continuous actuators that convert electrical energy into mechanical energy. The DC motor does this by producing a continuous angular rotation, which may be used to rotate pumps, fans, compressors, wheels, and other devices of a similar kind. In addition to standard rotary DC motors, linear motors with continuous liner movement are available. A direct current motor is composed of two parts: a "Stator" that remains stationary and a "Rotor" that rotates. As a result, three major types of DC motors are available. Motor with a brushed surface The motor is brushless. The servo motor The gear motor.



BUZZER

A buzzer or beeper is an electrical signaling device that is commonly seen in vehicles, domestic appliances such as microwave ovens, and game shows. It is typically composed of a number of switches or sensors connected to a control unit that determines if and which button was pushed or if a preset time has elapsed, and usually illuminates a light on the appropriate button or control panel, as well as sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Originally, this gadget was built on an electromechanical mechanism similar to an electric bell but lacking the metal gong (which makes the ringing noise). These devices were frequently fastened to a wall or ceiling and used the ceiling or wall as a support. Another approach with certain AC-connected gadgets was to build a circuit that converts the AC current into a loud enough noise to drive a loudspeaker and attach it to an inexpensive 8-ohm speaker. Currently, it is more common to utilize a high-pitched ceramic-based piezoelectric sounder, such as a Sonalert. They were typically connected to "driver" circuits that altered the pitch of the sound or pulsed the sound on and off. It is also known as a "lockout mechanism" in game shows because when one participant signals ("buzzes in"), all others are prevented from signaling. Plungers are huge buzzer buttons that appear on several game programs.

CONCLUSION

The proposed arrangement for smart braking system offers a wide variety of possible applications, particularly in industrialized nations where research into smart automobiles is gaining traction. This project has described in detail the smart brake monitoring system employing Flex sensor and brake failure indication for car vehicle. We enhance the braking system of traditional automobiles by integrating flex sensor controlled brakes. When we apply the brake percentage of the brake applied by front vehicle is presented to rear vehicle and back vehicle driver understands the brake percentage of front vehicle and applies the same amount of brake while driving. The major goal of this project is to give such a device to vehicle operators so that any hazardous damage and accidents caused by brake switch failure may be readily avoided by correct notification of brake switch operating state.

The project has an influence on minimizing accidents caused by brake failure. The majority of incidents may be avoided if the technology is used properly. The aforementioned drawbacks can be mitigated and regulated in the project's future expansion. The project's implementation in the car is also less expensive, making it accessible for any automobile business to apply in the automobiles.

ADVANTAGES

- Economical
- Circuit is very simple
- It is not dependent on Fuel level
- Very less power consumption

DISADVANTAGES

- The break switch stops functioning if there is any leakage of fluid as it is fluid operated
- As battery is used for both car and Brake Failure Indicator circuit, battery charge may reduce.
- This system can only be used for negatively grounded vehicle

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