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# EV BMS WITH CHARGE MONITOR & FIRE PROTECTION BY USING IOT

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**ABSTRACT:**

The "Electric Vehicle (EV) Battery Management System (BMS) with Charge Monitoring and Fire Protection using IoT" project aims to revolutionize the safety, efficiency, and remote monitoring capabilities of EV charging and discharging processes. In the era of sustainable transportation, the focus on the health and performance of EV batteries is paramount. This project integrates a robust BMS with advanced sensors, IoT connectivity, and a notification system to provide real-time insights, enabling users to make informed decisions and ensuring the safety of the EV battery system.

**Keywords—ESP32 , MOTOR, IOT, SENSORS, LCD DISPLAY**

## 1. INTRODUCTION

With the accelerating adoption of electric vehicles (EVs) as a sustainable mode of transportation, the attention to the safety, efficiency, and overall health of EV batteries becomes paramount. The transition towards electric mobility brings forth new challenges in managing battery systems, necessitating innovative solutions to optimize charging and discharging processes. The "EV BMS with Charge Monitoring and Fire Protection using IoT" project responds to these challenges by integrating cutting-edge technologies to monitor, regulate, and safeguard the EV battery ecosystem.

This project recognizes the pivotal role played by Battery Management Systems (BMS) in ensuring the longevity and reliability of EV batteries. Beyond conventional BMS functionalities, the incorporation of Internet of Things (IoT) technology establishes a real-time communication framework, allowing users to remotely access critical data. The introduction of comprehensive sensor arrays, including voltage, current, temperature, and power sensors, empowers the system to proactively monitor and respond to dynamic conditions during charging and discharging. The subsequent paragraphs delve into the project's objectives, methodology, and the anticipated benefits in addressing the intricate challenges associated with EV battery management.

## 2. LITERATURE SURVEY:

[1] Battery Energy Storage System (BESS) and Battery Management System (BMS) for Grid-Scale Applications Due to a discrepancy between the quantity of energy consumers use and the amount of energy generated by generation sources, the current electric grid is an inefficient system that wastes a considerable amount of the electricity it generates. In order to assure adequate power quality, power plants often produce more energy than is required. Many of these inefficiencies can be eliminated by making use of the energy storage that already exists inside the grid. To accurately monitor and regulate the storage system while using battery energy storage systems (BESS) for grid storage, comprehensive modelling is needed. The storage system is controlled by a battery management system (BMS), and a BMS that makes use of sophisticated physics-based models will enable considerably more reliable operation of the storage system.

The essay describes theMatthew T. Lawder; BharatkumarSuthar; Paul W. C. Northrop; Sumitava De; C. Michael Hoff; Olivia,2008

- [2] A Battery Modular Multilevel Management System (BMS) For Electric Vehicles And Stationary Energy Storage Systems. Although the reliance of energy systems on battery storage systems is constantly growing, there are still a number of issues that need to be resolved. Current battery systems are rigid; only cells with the same electrical characteristics may be coupled; and cell flaws significantly shorten the lifespan of the entire battery or even trigger a system blackout. Additionally, the system's weakest cell restricts the system's maximum useful capacity and maximum charging current. Current Battery Management Systems (BMS) are able to enhance the maximum useful charging current as well as the useable battery capacity to some extent. A very adaptable, fault-tolerant, and economical battery system can be developed with the help of the Battery Modular Multilevel Management System (BM3) described in this work. With the current setup,it Published in: 2014 M.Hesan in 16th European Conference on Power Electronics and Application

- 2.3 A Battery Modular Multilevel Management System (BMS) For Electric Vehicles And Stationary Energy Storage Systems The dependency of energy systems on battery storage systems is constantly increasing, but there are still several unsolved problems. Current battery systems are inflexible, only cells with the same electrical parameters can be combined, and cell defects cause a high reduction of the overall battery lifetime or even a system black out. In addition, the maximum usable capacity and the maximum charging curren

Published in: 2014 16th European Conference on Power Electronics and Applicationst are limited by the weakest cell in the system.

## 3. .PROPOSED METHOD

The system would include battery sensors that measure the voltage, current, temperature, and other relevant parameters of the battery. The sensors would transmit the data wirelessly to a central hub. Wireless network: The system would rely on a wireless network, such as Wi-Fi or cellular, to transmit the data from the sensors to the central hub. The central hub would receive and process the data from the battery sensors, using analytics and algorithms to identify any abnormalities or faults in the battery. The hub would also provide a user interface for the driver or user to monitor the battery's state and receive alerts or notifications. The system could also include a cloud-based platform that stores and analyzes the data generated by the battery sensors. The platform could provide additional analytics and insights into the battery's performance, as well as enable remote monitoring and control of the battery. Machine learning and artificial intelligence: The system could also incorporate machine learning and artificial intelligence (AI) algorithms to analyze the data from the battery sensors and identify patterns and anomalies that might indicate potential issues with the battery. The AI algorithms could also be used to predict the battery's remaining lifespan and optimize its performance. Mobile application: The system could also include a mobile application that provides a user interface for the driver or user to access the battery's data and receive alerts or notifications on their smartphone.

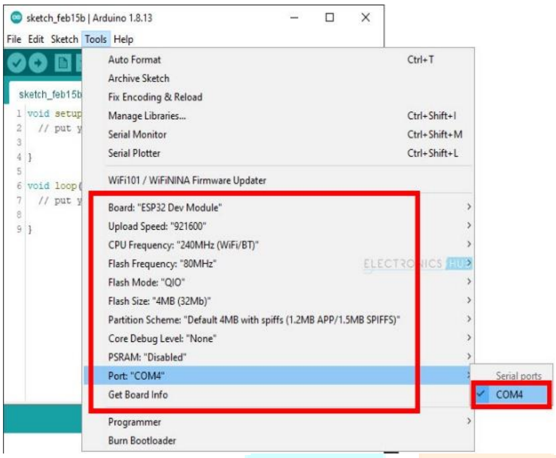
The suggested IOT-based battery management solution for electric vehicles. This system includes a voltage sensor that detects voltage and updates the IOT. The temperature sensor is used to detect the temperature of the battery; if the temperature rises, a buzzer alarm is sent and shown on the LCD. To ensure safety, the system is linked to a smoke sensor, which detects smoke in the battery and sounds an alert. When the voltage surpasses a specific level,

the overvoltage button illuminates. The measured parameters are updated in the IOT and shown on the LCD display.

## 4. SOFTWARE DESCRIPTION:

### 4.1. ARDUINO IDE

An Arduino program may be written in any programming language and processed via a compiler to create binary machine code for the target processor. AVR Studio and the upgraded Atmel Studio are Atmel microcontroller development environments. The Arduino project comprises the Arduino integrated development environment (IDE), a cross-platform Java program. It grew from the IDE for the Processing and Wiring programming languages. It includes a code editor with text cutting and copying, text finding and replacing, automatic indenting, brace matching, and syntax highlighting, as well as one-click compilation and uploading methods for Arduino boards. It also has a message area, a text terminal, a toolbar with buttons for common operations, and a hierarchy of operating menus. A sketch is a program that was generated using the Arduino IDE. Sketches are saved in the form of text files with the file extension. Arduino software (ide) pre-1.0 stored drawings with the extension, whereas ino on the development machine. pde. 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 activities. User-written code only requires two basic functions, which are compiled and linked into an executable cyclic executive program with the GNU tool chain, which is also provided with the IDE version. The Arduino IDE employs avrdude to convert executable code into a hexadecimal-encoded text file, which is subsequently loaded into the Arduino board through a loader program in the board's firmware. A simple Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consists of only two functions: setup: This function is called once when a sketch starts after a power-up or reset. It is used to configure variables, input and output pin modes, and other libraries that the sketch requires.




## 4.2. PROTEUS

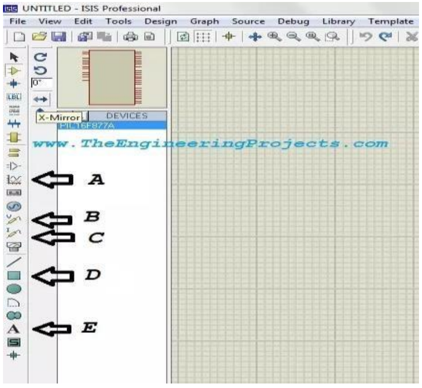
Proteus is an electronic circuit design, simulation, and PCB layout design software application. Electronic engineers, amateurs, and students frequently use it to create and simulate electronic circuits and devices. Proteus' major characteristics include:

Capabilities for simulation and design: Proteus allows users to create and model electronic circuits and devices such as microcontrollers, power supplies, and sensors. Proteus offers mixed-mode simulation, which allows for the modeling of analog, digital, and mixed-signal circuits.

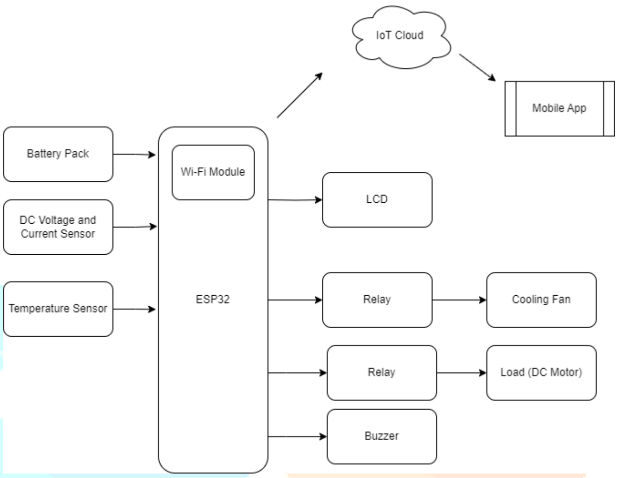
Virtual instrumentation: Proteus contains a number of virtual instruments for testing and debugging circuits, like as oscilloscopes, logic analyzers, and waveform generators.

PCB layout design: Proteus comes with a tool that lets users design PCB layouts, tweak them, and produce manufacturing files. Microcontrollers, sensors, and integrated circuits are just a few of the electronic parts that may be found in Proteus' extensive library and employed in circuit design.

Real-time simulation: Proteus can simulate circuits in real-time, enabling users to watch a circuit's operation in action. Interactive debugging: Proteus has a capability for interactive debugging that lets users find and correct mistakes in their circuit designs. The electronics industry, academia, and research all rely heavily on Proteus, a potent tool for electrical circuit design and modeling.




## 5. HARDWARE BLOCK DIAGRAM:




HARDWARE BLOCK DIAGRAM

### 5.1. HARDWARE EXPLANATION:

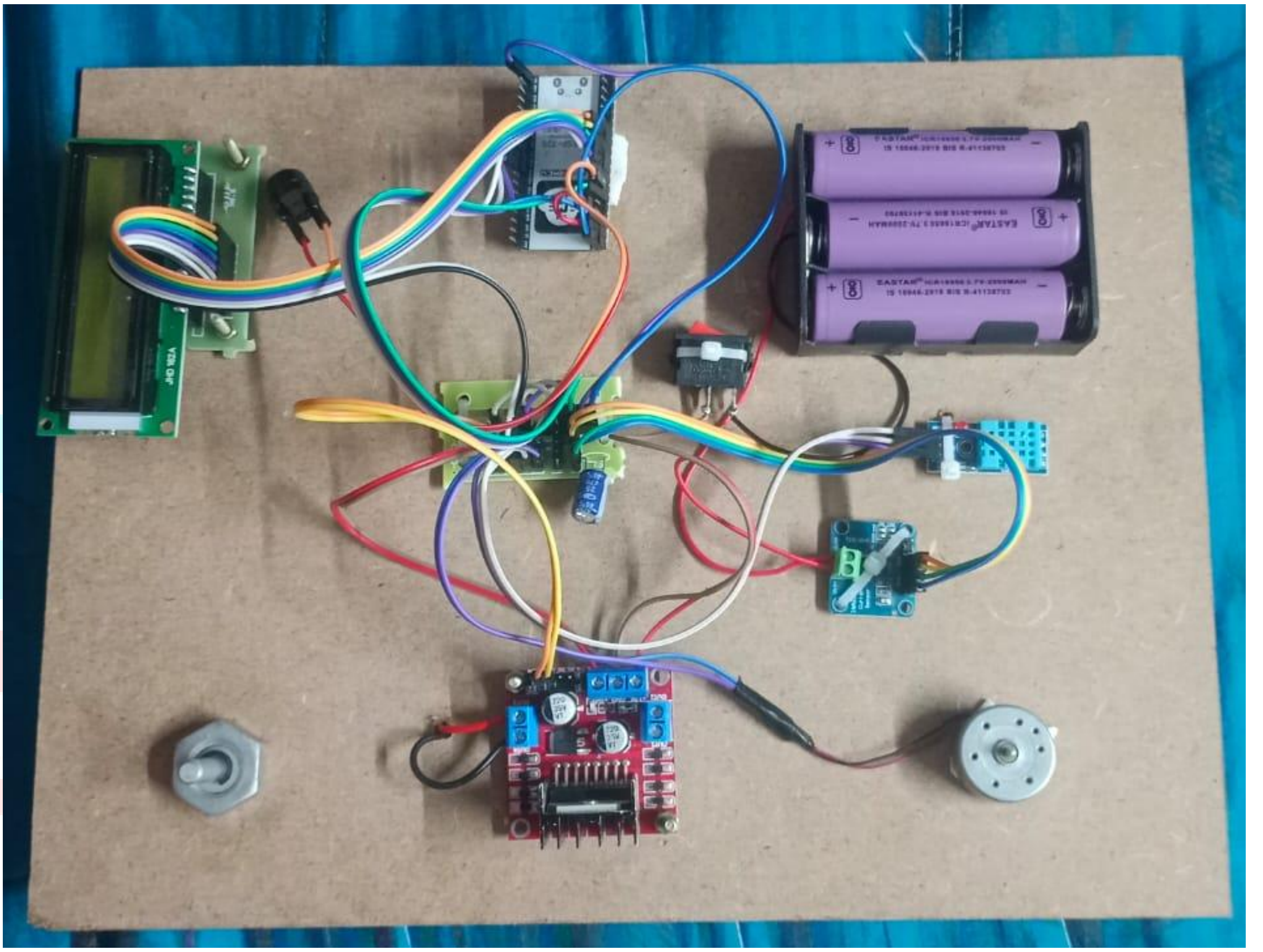
This project describe the electric vehicle setting. we are used in temperature sensor, voltage sensor. The voltage sensor sense the battery voltage, because battery condition monitor to the voltage sensor.the temperature sensor, sense the vehicle temperature condition and the DTH11 sensor sense the, if any person to drive the vehicle will stop automatically. The sensors win formation share to the LCD and IOT. The IOT monitor the vehicle condition in any where.if any sensor value are high the buzzer will be on to intimate the driving person.

**MODULE LIST**

- POWER SUPPLY
- ESP32
- BATTERY
- VOLTAGE SENSOR
- TEMPERATURE SENSOR
- RELAY
- DC MOTOR

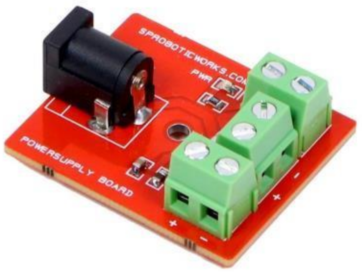
- LCD
- BUZZER

**PRATICAL VIEW OF:** EV BMS WITH CHARGE MONITOR & FIRE PROTECTION BY USING IOT



## 5.2. MODULE DESCRIPTION:

### POWER SUPPLY

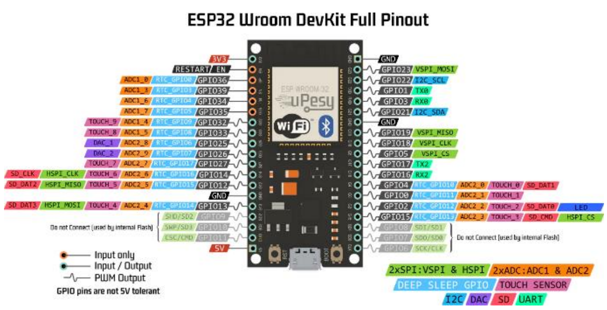



Electricity is the lifeblood of any electronic system, and the power supply is what keeps it running. Selecting the correct power source might be the difference between a gadget that performs optimally and one that produces inconsistent results. DC to DC converters are available in addition to alternating current (AC) to direct current (DC) power sources. If your system already has DC, a DC to DC converter may be a better design choice than the AC mentioned below. Unregulated or regulated direct current power supply are available. Regulated supplies are available in a variety of configurations, including linear, switching, and battery-based.

A power supply takes alternating current from a wall outlet, transforms it to unregulated direct current, and then steps it down to the voltage required by the load using an input power transformer. The transformer also isolates the output power supply from the mains input for safety reasons. There are two types of AC power supplies: uncontrolled and regulated. Unregulated power supplies are the most basic sort of power supply and cannot provide a stable voltage to a load, whereas regulated power supplies can and have many other design possibilities. Linear converters are the simplest but produce the greatest heat, whereas switched converters are more involved and produce less noise. Typically, batteries are switched converters.

## 5.3. ESP32

The ESP32 is a powerful microcontroller and system-on-chip (SoC) developed by Espressif Systems. It's widely used in IoT (Internet of Things) projects due to its versatility, low power consumption, and integrated Wi-Fi and Bluetooth capabilities. The ESP32 features a dual-core processor, which allows for multitasking and real-time processing, making it suitable for a wide range of applications including home automation, wearable devices, sensor networks, and more. Its popularity stems from its affordability, ease of use, and strong community support, which provides ample resources such as documentation, tutorials, and libraries for developers.



## 6. BATTERY:

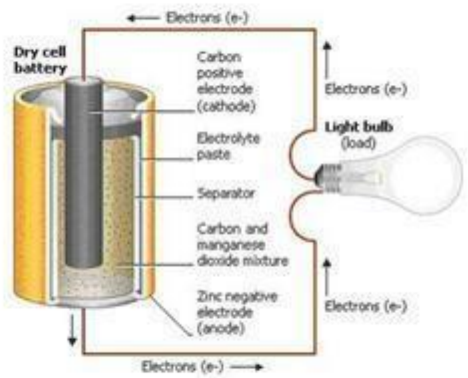
A battery is an electronic device that turns chemical energy into electrical energy. The chemical processes of a battery include the transfer of electrons from one substance (electrode) to another via an external circuit. The movement of electrons produces an electric current, which may be employed to do work. To balance the flow of electrons, charged ions pass through an electrolyte solution in contact with both electrodes. Various electrodes and electrolytes induce different chemical reactions, which influence how the battery operates, how much energy it can store, and how much voltage it can produce. A battery is defined as a collection of one or more electrochemical cells that are capable of turning stored chemical energy into electrical energy.

A useful battery must have the following characteristics:

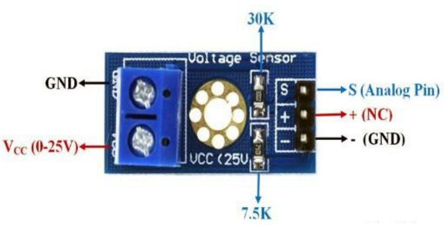
It should be light and compact in size

The cell or battery must have the ability to provide a steady voltage. Also, the battery or cell's voltage must not alter while in operation. A battery is a device composed of voltaic cells. Each voltaic cell consists of two half cells connected in series by a conductive electrolyte containing anions and cations.

. The electrolyte and the electrode to which anions migrate, known as the anode or negative electrode, are located in one half of the cell; the electrolyte and the electrode to which cations move, known as the cathode or positive electrode, are located in the other half of the cell.




## 6.1. VOLTAGE SENSOR

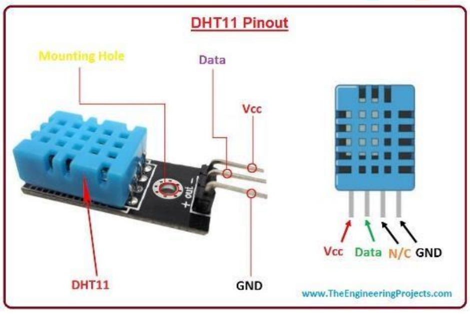



This sensor measures, calculates, and determines the voltage supply. This sensor can detect the amount of AC or DC voltage. This sensor's input can be voltage, and its output can be switches, analog voltage signals, current signals, audio signals, and so on. Some sensors produce sine waveforms or pulse waveforms, while others can produce AM (Amplitude Modulation), PWM (Pulse Width Modulation), or FM waveforms (Frequency Modulation). The voltage divider can affect the measurement of these sensors. This sensor has both input and output. The input side consists mostly of two pins, positive and negative. The device's two pins can be linked to the sensor's positive and negative pins.

This sensor's output primarily contains supply voltage (Vcc), ground (GND), and analog o/p data. Voltage Sensor Types These sensors are divided into two types: resistive sensors and capacitive sensors.

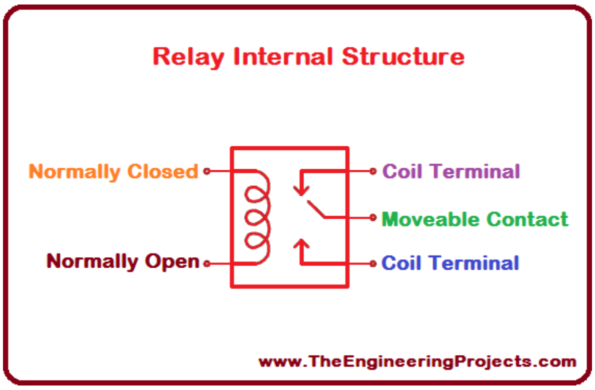
### 6.2. TEMPERATURE SENSOR

The temperature sensor is a sensor that detects temperature and converts it into a useful output signal, and it is the main component of a temperature measurement device. It is classified into five categories, each with its own set of operating principles. Also, several considerations must be made throughout the installation and use processes. Because temperature sensors correctly monitor ambient temperature, they are extensively employed in a variety of areas and provide convenience for people's production and daily lives. One of the most common sensors is the temperature sensor, which is found in computers, autos, kitchen appliances, air conditioners, and residential thermostats. The thermocouples, Thermistors, RTDs (Resistance Temperature Detectors), analog thermometer IC, and digital thermometer IC are the five most popular forms of temperature sensors.



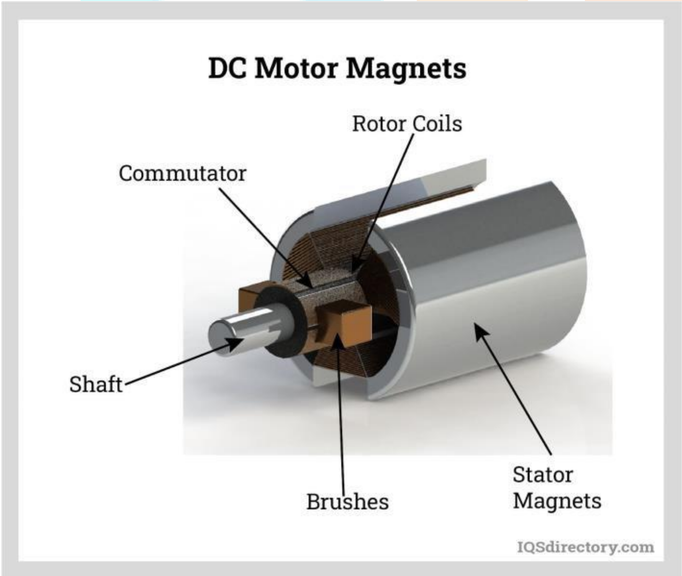

### 6.3. RELAY

A relay is an electromagnetic switch that can turn on or off a substantially greater electric current using a very tiny electric current. An electromagnet is at the core of a relay (a coil of wire that becomes a temporary magnet when electricity flows through it). Consider a relay to be an electric lever: turn it on with a little current, and it turns on (or "levers") another device with a much larger current. A relay, on the other hand, utilizes an electrical signal to drive an electromagnet, which in turn connects or disconnects another circuit, rather than a manual process. Several types of relays exist, such as electromechanical and solid state. Electromechanical relays are commonly employed. Let us first examine the internal components of this relay before learning how it works. Despite the presence of several types of relays, their operation is the same. Every electromechanical relay is madeup of an electromagnet. Contact that can be moved mechanically spring and switching points an electromagnet is made by winding a copper coil around a metal core. The coil's two ends are attached to the relay's two pins as illustrated. These two serve as DC power supply pins.



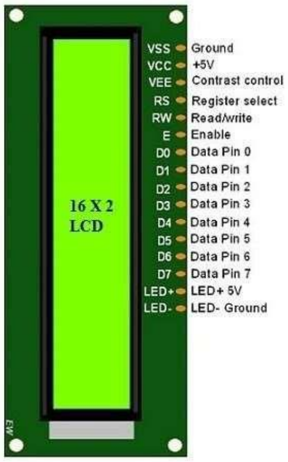

### 6.4. DC MOTOR

Continuous actuators that transform electrical energy into mechanical energy are known as direct current motors. The DC motor does this by providing a constant angular rotation, which may be used to rotate pumps, fans, compressors, wheels, and other similar devices. In addition to traditional rotary DC motors, linear motors capable of providing continuous liner movement are provided. A direct current motor is made up of two parts: a "Stator," which is stationary, and a "Rotor," which rotates. As a result, there are three primary types of DC motors available. Motor with a brushed finish the brushless motor the servo motor the gear motor.




### 6.5. LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that makes advantage of liquid crystals' light-modulating characteristics. Liquid crystals do not directly emit light. The command register holds the LCD's command instructions. A command is an order issued to an LCD to do a specific action such as initializing it, clearing its screen, setting the cursor location, managing the display, and so on. The data register saves the information that will be presented on the LCD. Computer monitors, TVs, instrument panels, aircraft cockpit displays, and signs are all examples of electronic displays. They are widespread in consumer gadgets such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have virtually completely replaced cathode ray tube (CRT) displays.


## 6.6. BUZZER


A buzzer, often known as a beeper, is a sound-producing signaling device. It might be mechanical, electromechanical, or piezoelectric in nature.

This Piezo buzzer is 23 mm in diameter and has mounting holes spaced 30 mm apart. It comes with a 100 mm lead and is suited for 3 - 20V. At 3Com, it generates a kHz tone at an 85 dB level. Specifications:

- Voltage of operation: 3-20V DC
- Current: 15 mA
- SPL: 85dBA/10cm
- Frequency: 3,300Hz
- Color: black
- Operating Temperature: -20° to +60° C.

Buzzers are available in a range of construction, size, and specification options. Buzzers of various shapes and sizes are used for a variety of purposes. Buzzers are classified into the following categories based on their construction:

- Piezoelectric buzzers.
- Magnetic buzzers.
- Electromagnetic buzzers.
- Mechanical buzzers.
- Electromechanical buzzers

**Conclusion**:

An IoT-based battery monitoring system in electric vehicles can provide numerous benefits, such as real-time monitoring, predictive maintenance, improved battery performance and longevity, enhanced user experience, and optimized charging patterns. The system can also enable remote monitoring and control of the battery, which is especially beneficial for fleet management. However, there are also potential demerits to consider, such as cost, data privacy and security, connectivity issues, false alerts, and integration with existing systems. It is important to carefully evaluate the feasibility and effectiveness of the system, and to implement appropriate security measures to protect the data transmitted wirelessly.

The study detailed the design and development of an IoT-based battery monitoring system for electric vehicles in order to monitor battery performance deterioration online. The goal is to demonstrate that the notion of the idea can be implemented. The system's development includes the creation of hardware for the battery monitoring device as well as a web-based battery monitoring user interface. A hardware event for the battery monitor and a web-based battery monitoring interface comprise the system's event. The system is capable of communicating information such as position, battery condition, and time through the internet by integrating an IOT system to identify the coordinate and display it on the mobile application.

## 7. ADVANTAGES AND DISADVANTAGES:

### 7.1. ADVANTAGES

- Real-time monitoring
- Improved battery performance
- Longer battery lifespan
- Enhanced safety
- Efficient journey planning
- Remote monitoring and
- Control

### 7.2. DISADVANTAGES

- Cost
- Data privacy and
- Security
- Connectivity issues
- False alerts

- Integration with existing systems

## 8. APPLICATION :

- Fleet management
- Predictive maintenance
- Charging optimization
- User interface
- Environmental monitoring
- Warranty tracking

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