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# Automatic Emergency Battery Shifter for EV's

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**Abstract -** Electric Vehicles (EVs) depend entirely on battery power for their operation, making battery reliability a critical factor for vehicle safety and performance. Sudden battery discharge or failure can cause unexpected vehicle stoppage, leading to inconvenience and potential safety hazards. This project presents an Automatic Emergency Battery Shifter for Electric Vehicles, designed to ensure uninterrupted power supply during emergency conditions. The system continuously monitors the voltage level of the main battery using a voltage sensing unit. When the battery voltage falls below a predefined safe threshold, a microcontroller automatically activates a switching mechanism to transfer the load from the main battery to a backup battery without requiring driver intervention. This seamless transition prevents sudden shutdown of the vehicle and allows continued operation until appropriate corrective action is taken.

***Key Words***: Automatic Emergency Battery Shifter, Emergency Response System, Battery Safety Unit.

## 1.INTRODUCTION

Electric Vehicles (EVs) are increasingly being adopted as an eco-friendly alternative to conventional fuelbased vehicles due to their low emissions and high energy efficiency. The performance and reliability of an EV depend primarily on its battery system, which acts as the sole source of power for propulsion and auxiliary systems. However, issues such as deep discharge, aging of batteries, unexpected faults, or improper charging can lead to sudden battery failure. Such situations may cause abrupt vehicle stoppage, creating safety risks and inconvenience for the user. To address this challenge, the Automatic Emergency Battery Shifter for Electric Vehicles is proposed as an effective solution. This system is designed to continuously monitor the voltage level of the main battery and automatically switch the power supply to a backup battery whenever the main battery voltage drops below a safe operating limit. The switching process occurs without manual intervention, ensuring uninterrupted power delivery to the vehicle during emergency conditions. By providing a reliable secondary power source, the automatic battery shifter enhances vehicle safety, prevents sudden breakdowns, and increases user confidence in EV technology. The system is simple, costeffective, and can be easily integrated into existing EV power architectures, making it suitable for practical implementation in electric two-wheelers, cars, and other battery-powered vehicles.

## 2. Body of Paper

The Automatic Emergency Battery Shifter consists of a primary battery, a secondary (backup) battery, voltage and current sensors, a control unit (microcontroller), and an automatic switching mechanism such as relays or solid-state switches. The system continuously monitors the state of charge (SOC) and voltage levels of the primary battery. When the primary battery voltage drops below a predefined threshold, the control unit triggers the switching mechanism to shift the load to the emergency battery without driver intervention.

### 2.1 Hardware Description

The hardware of the Automatic Emergency Battery Shifter for Electric Vehicles is designed to ensure reliable and automatic power transfer during battery failure conditions. The system primarily consists of a primary battery, secondary (emergency) battery, voltage and current sensing modules, a microcontroller unit (MCU), a switching mechanism, and protection circuits.

**1. Battery**


**Fig 1: Battery**

The primary battery serves as the main power source for the vehicle, while the secondary battery acts as a backup during emergency situations. Voltage sensors continuously monitor the battery voltage levels and provide real-time data to the microcontroller. In some implementations, current sensors are used to detect abnormal current flow or overload conditions.

**2. ESP8266 Node MCU.**

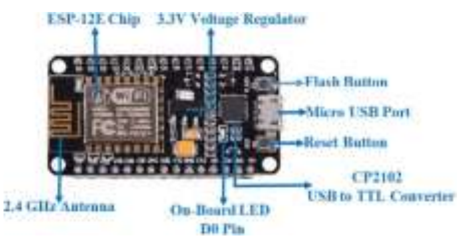


**Fig 2: ESP8266 Node MCU**

The ESP8266 NodeMCU is a low-cost, open-source development kit extensively used in IoT research due to its powerful processing and robust connectivity. At its core is the Espress if Systems ESP-12E module, powered by the Tensilica Xtensa 32-bit LX106 RISC microprocessor, which operates at an adjustable frequency of 80 MHz to 160 MHz. This architecture is supported by 4 MB of Flash memory and 128 KB of RAM (split between instruction and user data), providing ample resources for complex embedded protocols. Furthermore, the module includes a fully integrated TCP/IP protocol stack and supports IEEE 802.11 b/g/n Wi-Fi standards, enabling seamless wireless communication and efficient data transmission essential for networked applications.

In terms of interfacing and utility, the NodeMCU offers exceptional versatility for hardware prototyping. It features 17 GPIO pins capable of supporting PWM, I2C, SPI, and UART protocols, along with a built-in 10-bit Analog-to-Digital Converter (ADC). The board is designed for ease of use, operating at 3.3V and incorporating a voltage regulator and USB-to-UART bridge (typically CP2102 or CH340), which allows for direct USB connection and breadboard compatibility. This combination of extensive peripheral support and accessible power management makes the NodeMCU an ideal platform for scalable embedded designs and wireless sensor networks.

**3. LCD With I2C**


**Fig 3: LCD with I2C**

The LCD (Liquid Crystal Display) with I2C module is a widely used visual output device in embedded systems, typically consisting of a standard 16x2 character display driven by the industry-standard HD44780 controller. To optimize interfacing, the display is integrated with a "backpack" module based on the PCF8574 I/O expander chip. This architecture converts the parallel data signals required by the screen into a serial I2C (Inter-Integrated Circuit) protocol. This integration allows the display to render alphanumeric characters with an adjustable LED backlight while significantly simplifying the hardware architecture compared to traditional parallel connections.

From an interface perspective, the module connects to the host microcontroller using only two data lines: Serial Data (SDA) and Serial Clock (SCL), alongside VCC (typically 5V) and GND. This drastically reduces the GPIO requirement from the standard 6–12 pins down to just two, conserving valuable resources on microcontrollers like the ESP8266. The module often includes an onboard potentiometer for hardware contrast adjustment and supports distinct I2C addresses (commonly 0x27 or 0x3F), allowing multiple devices to coexist on the same bus without signal conflict.

**4. Buzzer.**

**Fig 4: Buzzer**

The buzzer serves as a vital audio alert system that enhances the robot’s functionality and reliability. Whenever the metal detector coil identifies the presence of ferrous or non-ferrous metals, the buzzer produces a distinct sound to immediately notify the operator of detection. Beyond metal sensing, the buzzer can also be programmed to provide warnings during obstacle encounters or system errors, offering quick feedback without relying solely on visual indicators.

**5. RED and GREEN LED’s**

**Fig 5: RED and GREEN LED’s**

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LED (Light Emitting Diode) is a semiconductor device that emits light when forward biased. Red and Green LEDs are commonly used as indicators in electronic circuits.
When voltage is applied in forward bias, electrons and holes recombine in the semiconductor material and release energy in the form of light. The color depends on the semiconductor material and band-gap energy.

### 6. Two Resistors 330 Ohm

**Fig 6: Two resistors of 330 Ohm**

Two 330-ohm resistors are commonly used electronic components that limit current and control voltage in a circuit. Each resistor has a resistance value of 330 Ω, typically identified by the color code orange–orange–brown (with gold or silver for tolerance). When two 330 Ω resistors are connected in series, the total resistance becomes 660 Ω, which further reduces current. When connected in parallel, the equivalent resistance becomes 165 Ω, allowing more current to flow. These resistors are widely used in LED circuits, voltage dividers, and current-limiting applications to protect components from damage.

### 7. Optocoupler PC817

**Fig 7: Optocoupler PC817**

The PC817 optocoupler is an electronic component used to provide electrical isolation between two circuits while allowing signal transfer using light. It consists of an infrared LED and a phototransistor enclosed in a single package. When current flows through the LED, it emits light that activates the phototransistor, enabling signal transmission without a direct electrical connection. The PC817 is commonly used to protect low-voltage control circuits (like microcontrollers) from high-voltage or noisy circuits. It is widely applied in SMPS, relay drivers, microcontroller interfacing, and industrial control circuits due to its reliability, safety, and low cost.

### 8. Relay HLM 5016C

**Fig 8: Relay HLM5016C**

The HLM-5016C relay is an electromechanical switching device used to control high-power circuits with a low-power control signal. It typically operates with a 12 V DC coil and is designed to switch AC or DC loads safely. When voltage is applied to the coil, an internal electromagnetic mechanism moves the contacts, allowing the circuit to open or close. The relay generally supports high current ratings (commonly around 10 A at 250 V AC, depending on the model). HLM-5016C relays are widely used in automation systems, power supplies, home appliances, motor control, and microcontroller-based projects to provide electrical isolation and safe load switching.

### 9. DC Motor

**Fig 9: DC Motor**

A DC motor is an electromechanical device that converts direct current (DC) electrical energy into mechanical (rotational) energy. It works on the principle that a current-carrying conductor placed in a magnetic field experiences a force, causing the motor shaft to rotate. The speed of a DC motor can be easily controlled by varying the applied voltage, while the direction of rotation can be changed by reversing the polarity. DC motors are widely used in fans, toys, robotics, electric vehicles, pumps, and automation systems because of their simple construction, high starting torque, and easy speed control.

### 10. Wires

**Fig10: Wires**

Wires are conductive paths used to carry electrical current and signals between components in a circuit. They are usually made of copper or aluminum due to their good conductivity and are covered with insulating materials like PVC or rubber to prevent short circuits and ensure safety. Wires come in different sizes (gauges), colors, and types depending on their application, such as solid or stranded wires. They are widely used in electrical circuits, power supply connections, electronic projects, and household wiring to provide reliable and safe electrical connections.

### 11. PCB

**Fig 11: PCB**

A PCB (Printed Circuit Board) is a flat board used to mount and electrically connect electronic components in a circuit. It is made of an insulating material (such as fiberglass or epoxy) with thin copper tracks etched on its surface to provide conductive paths instead of loose wires. PCBs improve circuit reliability, compactness, and neatness, and reduce wiring errors. They are widely used in electronic devices, computers, power supplies, communication systems, and control circuits.

## 3. Result

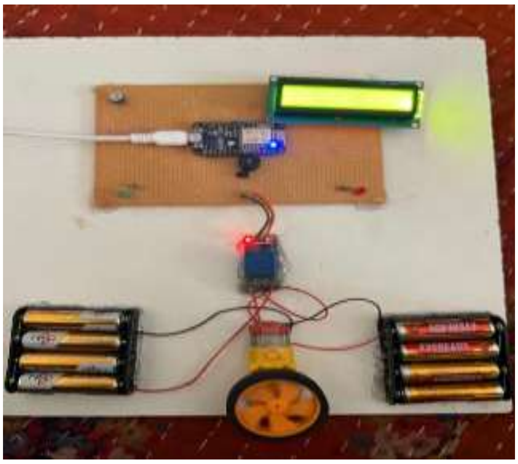

**Fig 7: Result of Project**

The Automatic Emergency Battery Shifter system was successfully designed and tested under various operating conditions. Experimental results demonstrate that the system accurately monitors the primary battery voltage and reliably detects undervoltage conditions. When the battery voltage falls below the predefined threshold, the system automatically switches the power supply to the emergency battery without manual intervention.

## 4. CONCLUSIONS

The Automatic Emergency Battery Shifter (AEBS) for Electric Vehicles is an effective solution to overcome the problem of sudden power loss when the main battery becomes discharged. By continuously monitoring the battery voltage and automatically switching to a backup battery, this system ensures uninterrupted vehicle operation, enhances safety, and prevents the rider from being stranded. The use of components such as Arduino, voltage and current sensors, relay modules, and a BMS makes the system reliable, efficient, and easy to integrate into various types of EVs. This project also supports the concept of sustainable and dependable electric mobility, especially in regions where charging stations are less available. Overall, AEBL improves the practical usability, reliability, and comfort of electric vehicles and contributes to making EVs a more trusted mode of transportation for everyday use.

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