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# Battery Monitoring System Using IOT

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**ABSTRACT:** One such example of an Internet of Things application is the "IOT BASED SMART STREET LIGHT SYSTEM" project. The main objective of the system is to create a smart street light controller system using Arduino. The system's main objective is to stop energy waste that results from street lights that come on automatically at nightfall and off at dawn. It uses an IR and LDR sensor in addition to an Arduino Uno board. Arduino is an open-source prototyping platform based on software and hardware that are easy to use. Arduino provides an easy-to-use, open-source programming tool for writing code that you can upload to your board. The Arduino IDE is another name for it. The LDR sensor controls the infrared sensor's brightness.

## I.INTRODUCTION

Definition of BMS in the context of IOT. Important of efficient battery management of various application explanation of how IOT is integrated into battery monitoring. Advantage of using IOT for real-time monitoring and control. Sensors: discuss the type of sensors used for current, sensors: discuss the type of sensors used for monitoring voltage, current, sensors.

### 1.1 SMART BATTERY MONITORING SYSTEM USING IOT:

This study outlines the use of the Internet of Things (IoT) to track the battery performance of electric vehicles. It is evident that an electric car is entirely reliant on its battery for power. Nevertheless, the vehicle's energy supply is progressively running less, which causes performance to deteriorate. For those that make batteries, this is a big worry. In order to enable direct monitoring, the concept of employing Internet of Things (IoT) approaches to track vehicle performance is put forth in this study. The monitoring device and the user interface are the two main components of the suggested Internet of Things-based battery monitoring system. Based on test findings, the system may identify decreased battery performance and notify the user for further

### 1.2 REVIEW:

Data transmission carried out and transmitted wirelessly is known as wireless communication. This is a general phrase that covers any process or way of connecting and exchanging data via a wireless signal between two or more devices utilising wireless communication devices and technology. A variety of technologies, including GSM, ZigBee, GPRS, Android, WIFI, and Bluetooth connectivity, have been employed in prior work to create wireless battery monitoring systems. Wireless communication systems like GSM (Global System for Mobile Communication) are widely used all over the world. Either the 900MHz or 1800MHz frequency band is its range. The GSM module comes with a few benefits and drawbacks. GSM has the benefit of being trouble-free when roaming internationally. It is also simple. Tablets and an expanding array of gadgets that include wearable computing and in-car entertainment. Android is an open-source, free software platform that runs on the Linux operating system. Since it is open source and Linux-based, anybody may develop it. Your operating system may notify you when there's a new message, SMS, email, or even the most recent items from an RSS reader. Regretfully, in order for the gadget to be ready to go online and meet people's requirements, it must constantly have an active internet connection, or at the very least, a GPRS internet connection, at that location. Moreover, the operating system uses a lot of background processes, which wastes batteries.

### 1.3 PROBLEM DESCRIPTION:

Monitoring period: The voltage, current, and temperature of the battery may be tracked by the system. This makes it possible to identify any anomaly or serious condition rapidly, guaranteeing prompt maintenance and action. Remote access: Users may obtain battery statistics from any location with a network connection by integrating

Arduino IoT Cloud. This eliminates the need for the remote to be physically close to the battery, making it simple to monitor and operate. Scalability: With the addition of other ESP8266s and sensors, the system can be made to monitor several batteries at once and is quite scalable. It may be scaled up or down to accommodate a huge battery or a single monitoring device, depending on the purpose.

Enhanced dependability: By averting issues before they arise, routine, ongoing battery monitoring lowers the chance of failure or malfunction. This level of attention.

#### **1.4 GOAL:**

Providing battery protection. Estimating the battery's operational state. Continually optimizing battery performance. Reporting operational status to external devices. The battery system's remaining charge is one of the most fundamental features of a battery monitor. A BMS gathers information and applies it to optimise every single battery. On the other hand, a battery monitor gathers data and shows it so that you can maximise the efficiency of the whole battery system.

#### **1.5 PERSPECTIVE:**

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## **II. SYSTEM SPECIFICATION**

### **2.1 HARDWARE REQUIREMENTS:**

- ESP8266MOD
- Lithium iron battery
- USB cable
- LED

### **2.2 SOFTWARE REQUIRMENTS:**

- Object system - Windows 10
- IDE – Arduino

## **III. BLOCK EXPLANATION**

### **3.1.1 Node MCU:**

An open-source development kit and firmware called NodeMCU is built around the ESP8266 WiFi module. The ESP8266 is an inexpensive, highly integrated wireless microcontroller that became well-known for its capacity to give several electronics projects WiFi connectivity. In order to facilitate communication between developers and enthusiasts and the ESP8266 module, the NodeMCU project offers an intuitive development environment and software.

Lua scripting: When NodeMCU first came out, it offered a scripting environment based on Lua, which let programmers use the Lua language to write code directly on the module. Because of this, people who were unfamiliar with embedded programming could understand it.

WiFi Connectivity: The NodeMCU firmware's primary goal is to make WiFi accessible for Internet of Things (IoT) applications. The module has internet-based communication capabilities and can establish connections with nearby WiFi networks.

### **3.1.2 BOARD ARCHITECTURE:**

Pulse Width Modulation (PWM) is supported on a number of pins on the NodeMCU v1.0 board, giving you precise control over the behaviour and intensity of different project components. PWM is supported via pins D1 (GPIO5), D2 (GPIO4), D3 (GPIO0), D5 (GPIO14), D6 (GPIO12), and D7 (GPIO13). This function lets you adjust the output signal's duty cycle, which enables you to accurately control gadgets like servos, motors, and LEDs. The on-off ratio of the PWM signal gives you control over brightness, speed, and position. These pins are therefore essential for developing responsive, dynamic projects with different output levels. In order to make the most effective use of these pins for PWM-based applications, don't forget to refer to the documentation and relevant programming libraries.



- GND (3): Short for 'The Arduino has multiple GND pins that you can utilize to ground your circuit.
- 3.3V (5): Provides an external component with a controlled 3.3V power source. This voltage is the operating level for several of the board's components.
- D0 (GPIO16): General-purpose digital I/O pin, usable for input or output tasks. Can also wake the ESP8266 from deep sleep.
- D1 (GPIO5, SCL): Serves as the clock (SCL) pin for I2C communication, a two-wire serial communication protocol used to connect sensors and devices.
- D2 (GPIO4, SDA): Acts as the data (SDA) pin for I2C communication, facilitating the exchange of data between devices.
- D3 (GPIO0): General-purpose digital I/O pin. During boot-up, it influences the boot mode of the ESP8266.
- D4 (GPIO2): General-purpose digital I/O pin. Also affects boot mode during the boot-up process.
- D5 (GPIO14, SCLK): Clock (SCLK) pin used in SPI communication for synchronizing data transfer between devices. It also supports PWM.
- D6 (GPIO12, MISO): Master In Slave Out (MISO) pin used in SPI communication for data transmission from the slave to the master. It also supports PWM.
- D7 (GPIO13, MOSI): Master Out Slave In (MOSI) pin used in SPI communication for data transmission from the master to the slave.
- D8 (GPIO15): General-purpose digital I/O pin. It supports PWM and can be used as an input or output.
- TX (GPIO1): Transmit pin for UART serial communication, allowing data to be sent from the board to other devices.

### 3.1.3 RESET BUTTON:

The Arduino's reset button (10) is the same as the one on the original Nintendo. By briefly connecting the reset pin to ground when you press it, all of the Arduino's running programmes will restart. This can be quite useful if you want to test your code more than once but it doesn't repeat. However, in contrast to the original Nintendo, problems are usually not fixed by blowing on the Arduino.

### 3.1.4 POWER LED INDICATOR:

There is a little LED next to the word "ON" (11) on your circuit board, directly beneath and to the right of the word "UNO." Every time you plug your Arduino into a power source, this LED ought to turn on. It's likely that there's a problem if this light doesn't turn on.

## 3.2 LITHIUM IRO BATTERY:

Broad Details. Numerous devices, including electronics, toys, wireless headphones, handheld power tools, small and big appliances, electric cars, and electrical energy storage systems, employ lithium-ion (Li-ion) batteries. Li-ion batteries, often known as lithium-ion batteries, are a kind of rechargeable battery that stores energy through the reversible intercalation of Li<sup>+</sup> ions into electronically conducting substances.

### 3.2.1 WORKING PRINCIPLE:

An electron flow occurs between the anode and cathode as a result of the anode releasing lithium ions to the latter during the battery's discharge and electric current provision. The converse occurs when the gadget is plugged in: the anode receives and releases lithium ions from the cathode.



Figure 3.3 - Lithium iron battery

### **3.3 Wireless Battery Monitoring System-Based Technology :**

For safety reasons, reliable battery management is required. Battery degradation and design flaws are two of the many factors that lead to battery failure. Similar to regular battery monitoring systems, manual battery monitoring systems do not store their data in a database. but simply display the real-time data that was gathered. Wireless technologies must so be used to remotely monitor battery systems. Numerous battery monitoring systems, including uninterruptible power supplies (UPS), have been created for the industry utilising wireless communication. These systems are crucial for maintaining power supply for both residential and commercial use during power outages. Suresh et al. suggested utilising GSM modules with SCADA to create a PLC-based battery health monitoring system for a UPS.

### **3.4. SUB:**

A user interface for battery monitoring and a GPRS data transmitter unit are included in an EV based on GPRS communication, along with an online monitoring terminal for measuring battery parameters (temperature and voltage) [12]. Rahman et al. suggested a ZigBee communication and point-to-point wireless topology battery management system for electric vehicles [13]. ZigBee was chosen because of its low data rates, excellent dependability, low power consumption, and low cost. They came to the conclusion that while wireless battery management systems are crucial for EVs, they are ineffective at controlling battery temperature. Instead, they are vital for balancing the charge to increase battery lifespan. In a more recent study, Menghua et al. introduced a lithium-ion battery monitoring system for electric vehicles (EVs) that uses WiFi connectivity to gather and display battery metrics such as temperature, voltage, and current on a smartphone.

### **3.5 EXPERIMENT AND ANALYSIS :**

The system analysis and experiment results are presented in this section. The experiment's procedures and findings on the voltage sensor and GSM module's features will first be discussed. This is to ensure the integrity of the circuits. Experiments and findings that confirm battery deterioration will next be discussed.

### **3.6 TEST TO FIND THE DEGRADED BATTERY**

Analyses that compare the battery's discharge rate with time have been performed to identify batteries that have degenerated. In essence, lithium ion batteries are used in large quantities by EVs. Thus, utilising two (2) 3.7V Li-MN batteries—one (1) in new condition and the other degraded—an experiment has been carried out in this research to ascertain battery degradation. An illustration of the 3.7V Li-MN battery is shown in Figure 10(a). A low cut-off voltage value is used to identify when a 3.7V Li-MN battery is completely depleted. The battery is at 100% Depth-of-Discharge (DOD) or 0% drained when IT hits the cut-off value. In this experiment, the length of time will decide the degraded battery.

## **IV. IMPLEMENTATION AND RESULT ANALYSIS**

### **4.1 STEPS TO CONNECT:**

#### **Connect IR Sensor With Node mcu**

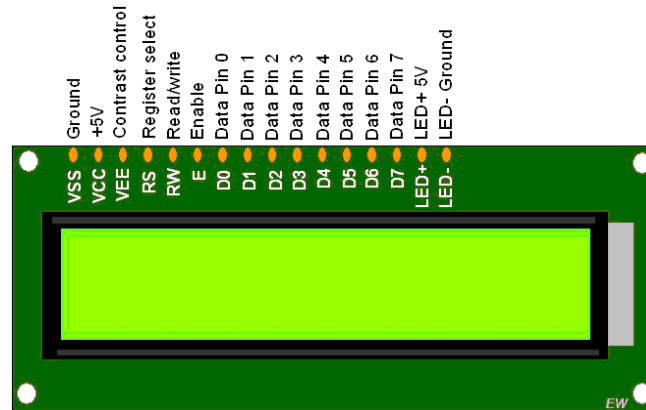
- Connect the pin 1- out in IR Sensor to pin 2 in NodeMCU
- Connect the GND pin IR Sensor in to GND pin in NodeMCU
- Connect the VCC pin in IR Sensor to 5.5 V in NodeMCU

#### **Connect LDR Sensor With Arduino**

- Connect the pin 1 in LDR Sensor to A0 in NodeMCU
- Connect the pin 2 in LDR Sensor to GND pin in NodeMCU
- Connect the pin 3 in LDR Sensor to +5V in NodeMCU

#### **Connect the LED to NODEMCU**

- Connect the two wires of the bulb to the two pins in the Nodemcu Board.



### V. RESULT ANALYSIS

The proposed IoT-based battery monitoring system consists of two major parts i) monitoring device and ii) user interface. Based on experimental results, the system is capable to detect degraded battery performance and sends notification messages to the user for further action.

In addition to measuring voltage and current, the user must also display and communicate the data that these sensors have collected. As a result, it features a Wi-Fi sensor module to send the data, where the user must register for a personal account before the data can be viewed. Numerous features are available, including monthly data analysis, data storage, and realtime monitoring.

Additionally, a screen will be available for users who are operating a vehicle, as it is inconvenient to constantly monitor the website. Measured quantities are shown on the display.

In addition to the client's estimation of the voltage and current, we also need to provide.

### BLOCK DIAGRAM:

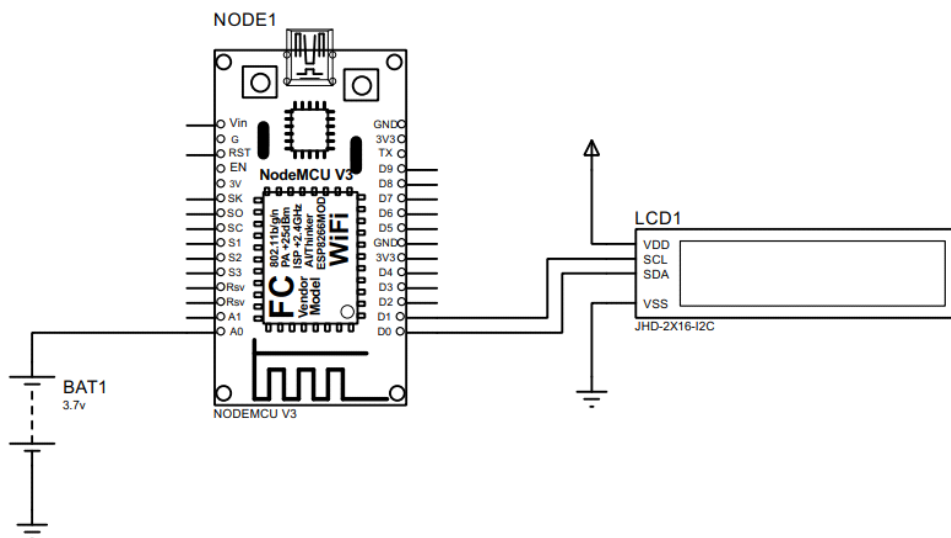
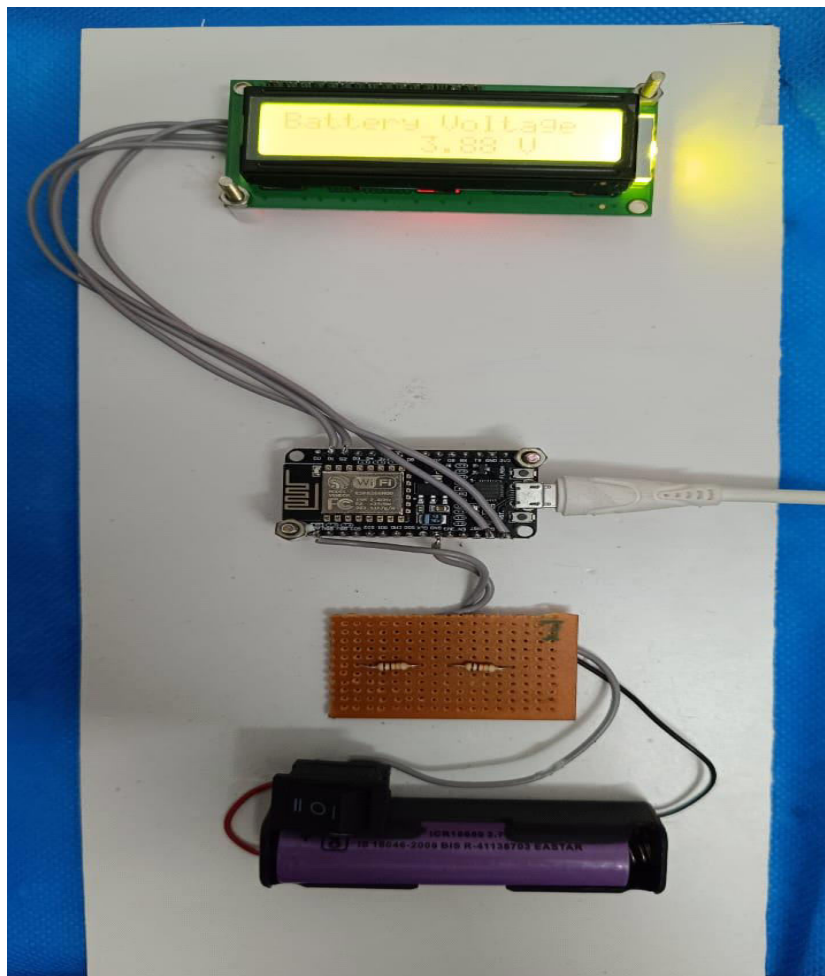


Figure - Block diagram

## VI. CONCLUSION

This work aims to fill in the knowledge gaps in the field of Internet of Things and ESP-based systems, particularly with regard to battery monitoring. We created a battery monitoring system using ESP and IoT cloud platforms like Arduino and Thing Speak after examining numerous research publications and methodologies. We have created an innovative method that tells customers that the oil has been correctly adjusted using percentage analysis by carefully analysing and integrating current technology. The Arduino IoT cloud platform is integrated with the ESP8266 or a comparable microcontroller for data transmission and collecting. This allows for seamless data visualisation and remote monitoring, resulting in effective and efficient solutions that are helpful in delving into battery issues. Leaving the System The system's goal is to give users immediate access to battery. In order to ensure that battery performance degradation can be tracked online, the study detailed the design and implementation of an Internet of Things-based battery monitoring system for electric vehicles. The goal is to demonstrate that the idea's notion is feasible. The hardware for the battery monitoring device and an online user interface for battery monitoring comprise the system development. The technology uses a GPS system to identify the coordinates and display them on the Google Maps application, allowing it to provide information via the internet about things like location, battery life, and time. By including more functionalities, the system can be further modified to make it better. By creating smartphone applications that may be utilised with the system,



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