

BATTERY MANAGEMENT AND MONITORING SYSTEM

Mohan¹, Kartik K Majjagi², Chandhan v³, Dilip M⁴, Rashmi R Deshpande⁵

¹ Student, Electronics and Communication Dept., AMCEC, Karnataka, India

² Student, Electronics and Communication Dept., AMCEC, Karnataka, India

³ Student, Electronics and Communication Dept., AMCEC, Karnataka, India

⁴ Student, Electronics and Communication Dept., AMCEC, Karnataka, India

⁵ Associate. Professor, Electronics and Communication Dept., AMCEC, Karnataka, India

ABSTRACT

A battery management system (BMS) is an essential component in any battery-powered application, as it ensures safe and efficient operation of the battery. The BMS monitors various battery parameters such as state of charge, temperature, and voltage, and uses this information to control the charging and discharging of the battery. This helps to maximize the battery's performance and extend its lifespan. The development of BMS technology has played a crucial role in the advancement of electric vehicles, renewable energy systems, and portable electronics. This paper provides an overview of the fundamental principles of BMS, including its key components, functions, and applications. It also presents a comprehensive review of the latest research and development trends in BMS technology, highlighting the challenges and opportunities for future innovations in this field.

Keyword : - BMMS -Battery management and monitoring system

1. INTRODUCTION

The widespread adoption of battery-powered devices in various industries, such as automotive, renewable energy, and portable electronics, has resulted in a growing demand for efficient and reliable battery management systems (BMS). A BMS is a critical component in any battery-powered application, as it helps to maximize the performance and lifespan of the battery, while also ensuring safe operation. In this paper, we provide a comprehensive overview of BMS technology, including its applications, key components, and challenges. BMS technology has played a crucial role in the advancement of electric vehicles (EVs), renewable energy systems, and portable electronics. In EVs, the BMS ensures that the battery is charged and discharged in a safe and efficient manner, while also maximizing its lifespan. The BMS monitors the battery's state of charge, temperature, and voltage and controls the charging and discharging of the battery accordingly.

This helps to prevent overcharging, over-discharging, and thermal runaway, which can result in battery damage and safety hazards. Similarly, in renewable energy systems, the BMS helps to store excess energy generated from solar panels or wind turbines, which can be used when the demand for electricity is high. In portable electronics, the BMS ensures that the battery is charged quickly and efficiently, while also preventing overcharging and over-discharging.

2. BLOCK DIAGRAM

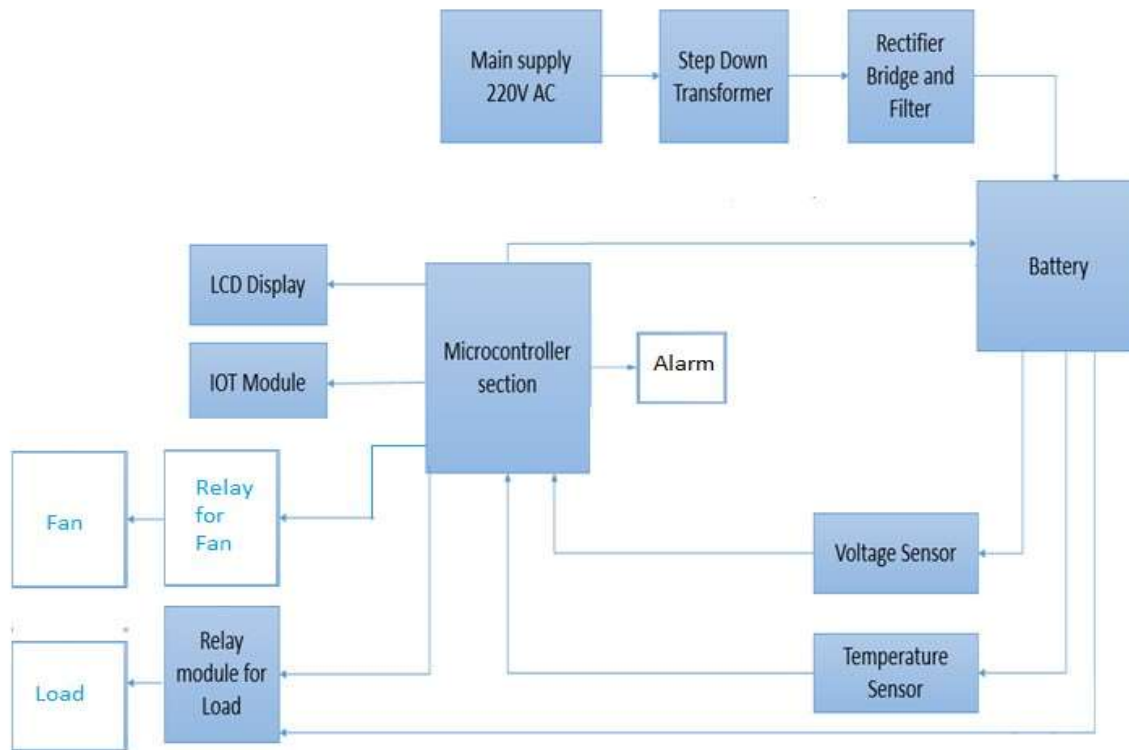


Fig -1: Block Diagram

2.1 MODULE EXPLANATION

Battery: - Batteries come in different shapes, sizes and differ in their uses. The 12V battery is one of such common batteries. However, what do you know about the 12-volt battery . A 12-volt battery is a kind of battery that is often used for various electrical gadgets and appliances. The 12-volt battery is distinct and different in its use, as it comes in different shapes and sizes. In some instances, they might be large and heavy or small and light. They may be cylindrical or square batteries. Furthermore, they are also used for transportation purposes in vehicles, boats and other gadgets. 12-volt battery sizes are often influenced by their uses and the amount of amp-hour they are built to produce.

Arduino uno: - The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

LCD(liquid crystal display) :- LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight.

A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840 x2160 or 4096x2160 pixels. A pixel is made up of three subpixels; a red, blue and green—commonly called RGB. When the subpixels in a pixel change color combination, a different color can be produced. With all the pixels on a display working together, the display can make millions of different colors. When the pixels are rapidly switched on and off, a picture is created.

Voltage sensor: - A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage and DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc.

Sensors are basically a device which can sense or identify and react to certain types of electrical or some optical signals. This sensor mainly includes voltage divider circuit. The resistor in the circuit works as a sensing element. The voltage can be separated into two resistors like a reference voltage & variable resistor to make a circuit of the voltage divider.

Temperature sensor: - The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). It can measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.

Rectifier: -A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The reverse operation (converting DC to AC) is performed by an inverter.

Rectifiers have many uses, but are often found serving as components of DC power supplies and high voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.

Relay :- Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

1N4007 Diode :-1N4007 is a PN junction rectifier diode. These types of diodes allow only the flow of electrical current in one direction only. So, it can be used for the conversion of AC power to DC. 1N 4007 is electrically compatible with other rectifier diodes and can be used instead of any of the diode belonging to 1N400X series. 1N-4007 has different real life applications e.g. freewheeling diodes applications, general purpose rectification of power supplies, inverters, converters etc.

Node MCU :-Node MCU is an excellent hardware, which provides just enough versatility for us to do a majority of our developments. It is Arduino compatible, has a Wi-Fi on board and has enough kick to power our IOT devices. Whether connecting to gateway or connecting to our cloud solutions.

Fan :- A DC 12V fan is a type of cooling fan that operates on a DC voltage of 12 volts. It is commonly used in electronic devices, computers, and other equipment that require cooling to prevent overheating.

DC 12V fans are available in various sizes, from small 40mm fans to large 120mm or 140mm fans. The airflow and noise levels of these fans can vary depending on the size and design. They can be powered by a direct connection to a 12V DC power source or by using a power supply unit (PSU).

3.1 Algorithm

1. converting ac to dc
2. read voltage sensor values
3. read temperature sensor value
4. temperature value is above 35degree celcius fan on
5. display values

4. CONCLUSIONS

The battery management system (BMS) is a critical component for ensuring the reliable and efficient operation of batteries. Through the integration of various components such as the voltage sensor, temperature sensor, microcontroller, LCD display, IoT module, relay module, fan, and load, the BMS provides an efficient and reliable solution for monitoring and managing the battery. The BMS accurately calculates the state of charge (SOC) and temperature of the battery, which are displayed in real-time on the LCD display, providing critical information for making informed decisions about the battery's operation. The BMS also includes an IoT module that enables remote monitoring and control of the battery, enhancing its flexibility and versatility. The relay module allows for automatic control of the load, while the fan helps to regulate the temperature of the battery, ensuring its optimal performance. Overall, the battery management system is an essential tool for managing batteries in various applications, providing a reliable and efficient solution for ensuring their reliable operation.

5. REFERENCES

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