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Electric Vehicle Battery Management System Built on the Internet of Things with Charge Monitor and Fire Alarm

[1]Ch. Surya Babu, [2]Marisetti Raja Rajeswari, [3]Nadimpalli Jahnavi Lakshmi,
[4]Medisetti Durga Bhulakshmi,
[1]Professor, Department of ECE, Rajamahendri Institute of Engineering & Technology.
[2,3,4]Student, Department of ECE, Rajamahendri Institute of Engineering & Technology.

ABSTRACT:

Electric vehicle (EV) battery management has been transformed by the incorporation of Internet of Things (IoT)-based systems for the monitoring of vital metrics including load, voltage, and current. To avoid fires and other dangers caused by overcharging or temperature problems, the suggested solution improves battery efficiency and monitors charges in real time. The reliability and security of lithium-ion batteries may be guaranteed with the use of Internet of Things (IoT) technology, which allows users to remotely monitor voltage changes, current flow, and load variations. Improved efficiency and dependability in EV battery management are outcomes of the system's capacity to provide automated warnings and preventative actions.

Introduction

notable breakthrough in the fight against climate change and for more environmentally friendly modes of transportation. The widespread use of electric vehicles has validated a paradigm change in the electrification of transportation. [1] The fundamental parts of the BMS that guarantee the electric vehicle's safe and effective use. An essential component of any electric car is the battery management system, which is responsible for keeping an eye on the battery pack, regulating its operations as needed, and ensuring its optimum conduction, permanence, and safety. The complex features of a BMS range from monitoring the parameters of individual cells in real-time to regulating the temperature of the battery as it charges and discharges. [2] The use of AI and ML algorithms for estimate analysis, allowing dynamic maintenance and increasing overall system efficiency, is making great strides in electric vehicle technology. Machine learning (ML) is concerned with improving data-trained systems, while artificial intelligence (AI) refers to computer models and algorithms that mimic human intellect. the third A battery management system, motor, inverter, DC-DC converter, onboard charger, and so on are the major components of an electric vehicle. Cells that store direct current electrical energy are the fundamental components of the Battery Management System. For this reason, you may find a variety of batteries on the market. Some of these types of batteries are lithium-ion, solid-state, lead-acid, ultracapacitor, and nickel-metal hydride. At the moment, we're using Lithium-ion batteries since they're the most popular and efficient kind. These batteries are more sensitive to changes in temperature. [4]

LITERATURE REVIEW

This article provides an outline of the cloud computing method for large-scale lithium-ion battery management systems (BLMS), and it talks about cloud-based health monitoring. [16] This article provides an introduction of hardware devices and primarily explains how to monitor voltage, current, and temperature using a cloud-based battery management system in real-time. This offers a method based on the internet of things (IoT) for venting li-ion batteries that have been overcharged. [17]

In addition to recommending the incorporation of a current-input device into the cell structure, it also enables the use of NDIR sensors for CO2 detection and has a built-in positive temperature coefficient. at [1] Information on the assessment of the network effect from electric cars during fast and slow charging was proposed. The network impact reveals that various areas or weak or strong grids might have varying affects during fast and slow charging. Take Norway as an example; even on the harshest winter days, they have Peak Load. [8] It goes over everything you need to know about BMS, how to apply an IoT-based approach with SOC estimate to propose a system that installs WBMS, or a wireless battery monitoring system, and how to integrate MQTT server into a packetcore network and middleware application server. [18] in This presents an adaptive approach to SOC estimation for BMS judgment, which yields a hybrid model combining

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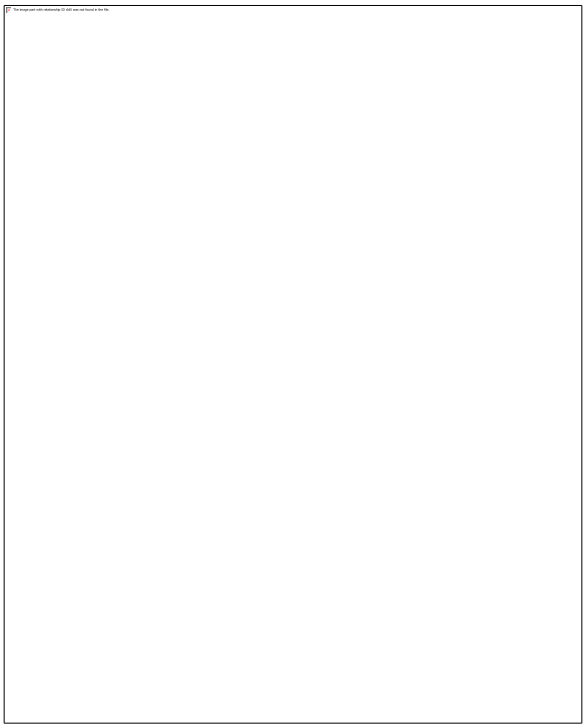
conventional coulomb counting with EKF correction. This allows for fast and dependable error monitoring and control, and it demonstrates a 2% error rate and 70% reduction in complexity when compared to the EKF method of SOC estimation [19].

Methodology



block diagram

Working

Integrating real-time data tracking with voltage, current, and load monitoring is the proposed Internet of Things (IoT)-based battery management system. It takes readings from electrical characteristics using sensors and sends them to a cloud-based interface via an Internet of Things module. View real-time data, get notifications for out-of-the-ordinary voltage levels, track fluctuations in current, and improve load distribution. This device improves battery safety by immediately disabling the load in the event of overheating or overcurrent, among other protective circumstances. The suggested solution makes use of IoT technologies to guarantee longer battery life, better energy efficiency, and predictive maintenance.

Arduino uno

A microcontroller board based on the Atmega328, the Arduino Uno is described in the datasheet. A 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

Because it forgoes the FTDI USB-to-serial driver chip, the Uno stands apart from all previous boards. In its place, you'll find the Atmega8U2 configured to convert USB to serial. "Uno" signifies "One" in Italian and is chosen to commemorate the impending release of Arduino 1.0. Going forward, the Uno and version 1.0 will serve as the reference versions of Arduino. See the index of Arduino boards for a comparison with earlier generations; the Uno is the newest in a series of USB Arduino boards and the platform's standard model.

The USB port or an external power source are both viable options for powering the Arduino Uno. It chooses the power source mechanically. You may use a battery or an AC-to-DC converter (wall-wart) to power it from the outside (not via USB). It is possible to attach the adapter by inserting a 2.1mm center-positive connector into the power port on the board. The POWER connector's Gnd and Vin pin headers are suitable for inserting battery leads. The board is compatible with power sources ranging from 6 to 20 volts. But if the voltage is lower than 7V, the 5V pin could not give 5V and the board might become unstable. The voltage regulator might become too hot and ruin the board if you use more than 12V. A voltage range of 7 to 12 volts is suggested.

LIQUID CRYSTAL DISPLAY

In front of a light source or reflector, a thin, flat display device called a liquid crystal display (LCD) arrays a large number of color or monochrome pixels. Pile of liquid crystal molecules held aloft by two transparent electrodes and two polarizing filters, whose polarity axes orthogonal to one another, make up each pixel. If there weren't liquid crystals interposed, one would block the other from light. Light that enters one filter is able to pass through the other because the liquid crystal bends its polarity.

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A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. The 16x1, 16x2, and 20x2 LCDs are among the most popular types of displays that are attached to the controllers. This equates to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line.

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.

ESP8266 Wi-Fi Module

This project revolves on this. The module plays a crucial role in the project as it is centered on WIFI control of appliances. A low-cost Wi-Fi chip with full TCP/IP capability, the ESP8266 Arduino compatible module has an amazing built-in MCU (Micro Controller Unit) that allows you to control I/O digital pins using a simple programming language that is almost pseudo-code like. The Chinese company Es press if Systems is situated in Shanghai and makes this gadget. In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. In his Many hackers and tech enthusiasts were interested in exploring and using it for a wide range of projects because to its tiny size and very inexpensive pricing (1.7$ to 3.5$). Since it has been so successful, Espressif has released other variants with varying proportions and technological specs. Among the following is the ESP32. Numerous projects and applications, such as home automation, may be found online.

RELAYS

Many household and commercial equipment, as well as industrial control systems, make use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board.The main characteristics are:

• Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more.
• The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board. • A separate device, known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks.

Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

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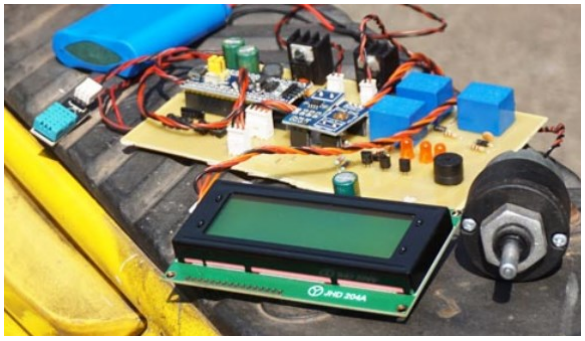
RESULTS



Model

CONCLUSION

A battery management system that relies on the internet of things (IoT) greatly enhances the ability to monitor and regulate electric vehicle voltage, current, and load. By offering real-time information and automatic safety features, it removes the limits of older systems. By incorporating IoT, energy management is improved, which in turn reduces battery deterioration and fire concerns. By improving EV dependability, this method helps create a transportation ecology that is both sustainable and safer. Improved decision-making and more optimization in battery management might be possible with the help of AI-driven predictive analytics in the future.

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