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Battery Management System to Find Accurate Timing

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Abstract: Any nation's financial growth is largely determined by its availability of energy. The rapid expansion of the manufacturing, automobile, and residential sectors over the preceding few decades led to an increase in global electricity consumption. For electrical vehicles to be safe, they need a Battery Management System (BMS), which controls the electronics of a chargeable battery. The consumer and the battery are both safeguarded by ensuring that the mobile phone operates within its safe operating parameters. The battery's State of Health (SOH) is displayed on the BMS video display, which also collects data, controls external factors that have an effect on the mobile phone, and balances them to maintain a consistent voltage across all cells. It might have more features and capabilities to provide information about the battery's energy state. The tool can intelligently conserve energy by utilizing these facts. In this project, work was done using a system learning method to find the voltage that was exceeded while the battery was being charged. Because it only has a battery and an electric motor rather than a combustion engine and gas tank, the structure of an electric car is simpler and easier to control at the factor level. Instead of charging the entire battery collection, we will identify the battery that needs to be charged. This will allow us to save you from having to replace dead batteries and may also prevent damage from occurring to them. We can ensure that the batteries are charging and discharging appropriately by anticipating the issue using the available datasets.
Keywords: Electric Vehicles, Battery Management System, IoT, Microcontroller.

I. INTRODUCTION

Electric vehicles (EVs) are among the alternatives to internal combustion engine (ICE) automobiles. In 2013, the Indian government published the National Electric Mobility Mission Plan (NEMMP) 2020 to establish requirements for the production of electric vehicles in that nation. In addition, India's modern transportation infrastructure may benefit from the use of electric vehicles to meet the requirements of the country's large and diverse population. Electric vehicles, or EVs for short, are powered by electric power re-assets like rechargeable batteries, as the name of the category suggests. The batteries the power storage system's technological readiness were the primary obstacle to EV mass production and market adoption. The battery will catch fire if it is subjected to unsafe operations like overcharging or over-discharging due to its volatility, flammability, and entropy change. These changes will significantly accelerate the aging of batteries and address serious safety issues that could result in an explosion or fire in electric vehicles [11]. Therefore, in order for the battery to be utilized effectively in EVs, it needs to now not only demonstrate favourable overall performance and dependable features but also be effectively monitored in situ to serve as a resource for operating and renovation decisions.

An effective battery control device is necessary in order for the battery to function safely, consistently, effectively, and always under a variety of usage and environmental conditions. A battery control device is a tracking and manipulating form that maintains battery operation within specified parameters and takes necessary safety precautions [12]. It uses the appropriate battery version to characterize the dynamic behaviour of the battery under various running conditions. This battery adaptation helps withinside the assessment of the vehicle's battery execution, life expectancy, and utilizing range. As a result, the subsequent version of the battery control device needs to be honest enough while still being able to access the essential battery features. Besides, the battery control gadget need to make the buyer aware of play out a foreordained remedial methodology if any curious conditions, alongside over-voltage, over-current, and cheating/over releasing, are seen simultaneously as EVs are in activity [13]. In order to address security concerns (RUL), battery control structures must appropriately determine the inner states of the battery, such as its State-of-Charge (SOC), State-of-Health (SOH), and Remaining Usable Life. The correct inner nation evaluation serves as an essential identifying factor for the EVs' power distribution and control structures. For the development of a green battery control device, it is necessary to have a suitable battery version and a precise estimation of the inner battery states. This encourages academics to develop modern battery control structures through online evaluation of EV-specific inner battery situations.

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II. EMBEDDED INTRODUCTION

An embedded system is a type of special-purpose computer system that is completely contained within the object it controls. Rather than a generalpurpose PC, an installed framework has explicit prerequisites and gets done with responsibilities that have been foreordained. An embedded system is a piece of hardware that has been programmed[1]. A chip that can be programmed with specific applications is the "raw material." This should be understood in relation to older systems with fully functional hardware or systems with general-purpose hardware and externally loaded software [1]. Embedded systems combine software and hardware, making it possible for a wide range of applications and mass production. a collection of computer software, hardware, and occasionally other mechanical or non-computer parts used for a particular purpose.

III. LITERATURE REVIEW

The creation of a video display that displays the battery's State of Health (SOH), collects data, controls external factors that have an effect on the cell, and balances them to maintain a consistent voltage across all cells is the primary objective of this mission[8]. Some of the research that was done led to the development of a robust battery control device that could video display units the temperature of the cells in all operating modes (drive, rate, etc.). and controls the heater, fans, and pump to control the battery's temperature. Our personal experience working on large-scale projects, including battery electricity garage systems (BESSs), informs our SOC and SOH estimation strategies[5].

They are essential for the proper operation of high-quality charging algorithms, rate- and thermal-balancing strategies, battery protection mechanisms, as well as for the accurate characterization, accurate estimation of battery states and parameters, and high-quality battery management strategies[6]. They stated that the responses we will cover here may be applicable to any device that requires a BMS and runs on a rechargeable battery. Prakash et al (2021) has proposed a work that lays out the compelling technique for distinguishing the battery maturing.

Battery Maturing gives the precise assessment of battery wellbeing through constant enactment. Still there might be an issue in timing right with the guide of utilizing foreseeing the utilization of the datasets to be had we can guarantee that the batteries are charging and releasing appropriately.

IV. SYSTEM METHODOLOGY

The various blocks in the projected system are interconnected to each other and represented in Figure 1.

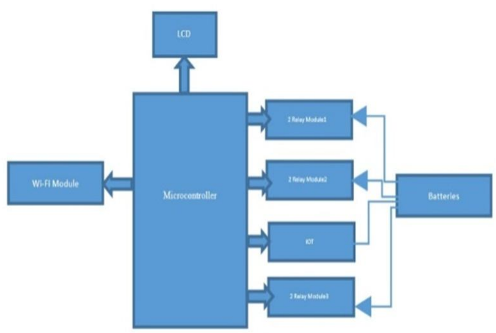

Fig 1: Block diagram of the Project System

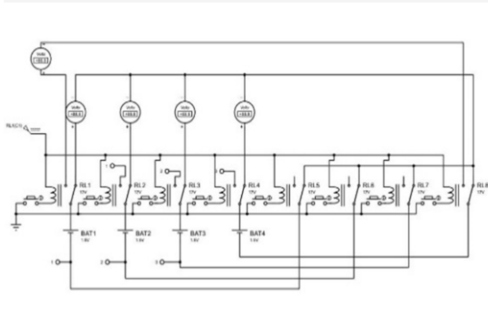

Fig 1.1. Circuit Diagram of the Project System

V. BATTERY MANAGEMENT SYSTEM

As a result, an essential component in ensuring the safety of electric vehicles is a Battery Management System (BMS), which manages the electronics of a rechargeable battery, whether it is a cell or a battery pack. By ensuring that the cell operates within its safe operating parameters, it protects both the user and the battery. To ensure optimal battery performance, a BMS monitors pack temperatures and opens and closes various valves to keep the battery's temperature within a narrow temperature range.

A. PIC16F877A Microcontroller

The PIC16F877A is the most widely used 8-bit microcontroller in the PIC family of MCUs. Albeit the PIC16F877A is still apparently one of the most generally involved microcontrollers on the planet, certain individuals think it is old and outdated. For novices interested in embedded development with PIC, it is regarded as the de facto microcontroller, and as they gain experience, it will become their preferred microcontroller.

Fig 2.1. PIC16F877A Microcontroller

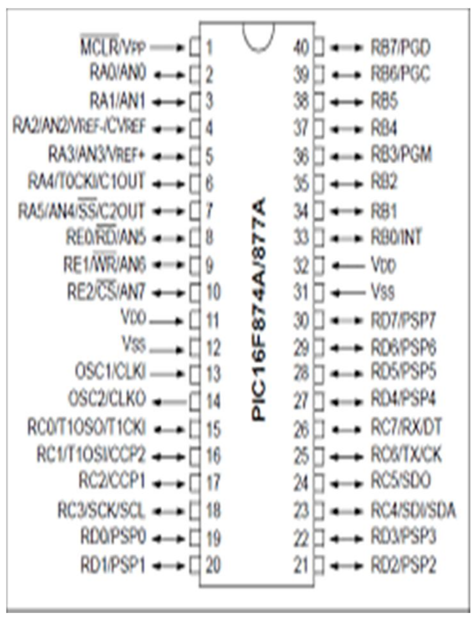

Fig 2.2. Pin Diagram

B. LCD Display

The I2C 1602 LCD module is a digital LCD display with two lines and sixteen individual displays that is immediately interfaced to an I2C daughter board [25]. It is used on this proposed machine to show customers the value of the parameters. There are two such lines, and it can display sixteen characters along each line. Every individual is displayed in a 5x7 pixel matrix on this LCD. There are a total of 224 unique characters and symbols that can be displayed by the sixteen x two wise alphanumeric dot matrix display. The Command and Data registers are present on this LCD.

Fig 2.3. 16x2 LCD display

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C. Relay

Relay is an electrically managed transfer. A lever is drawn and the transfer contacts are altered by a magnetic subject created by modern passing through the relay's coil. Transfers trademark move positions and are twofold toss (changeover) switches in light of the fact that the loop contemporary might be both on or off. It works with the guide of utilizing both laying out or extreme the circuit fundamentally founded absolutely on an electrical sign, conceding it the energy to oversee the float of solidarity to assorted electric hardware comprehensive of engines, lighting apparatuses and different electric parts. Because they provide control over high-energy devices through the use of low-energy signals, relays have become a common feature in automotive, industrial, and communication software. In addition, by keeping sensitive digital devices isolated from high-voltage and contemporary sources, they provide insulation and safety.

Fig 2.4. 12V Relay Module

D. Battery

At the point when various cells are connected in series, a battery is equipped for achieve the significant running voltage. The overall terminal voltage is determined through method of method for including the voltage possibilities of each and every cell. By collecting more ampere-hours (Ah), paralleling will improve ability. Here, you can learn about one-of-a-kind battery technology in addition to its benefits and drawbacks. Although lithium-ion batteries aren't resistant to extreme temperatures, they can function effectively between 10 and 40 degrees Celsius. Due to the reversible electrochemical reactions that can occasionally fix a battery's electrical rate, rechargeable batteries can be charged and discharged a few times.

Fig 2.5. Lithium-Ion Battery

E. Wi-Fi Module

An open-source LUA-based firmware for the ESP8266 wifi chip is known as Node MCU. Node MCU firmware is included with the ESP8266 Development board/kit, also known as the Node MCU Development board, to investigate functionality with the ESP8266 chip. Since the Node MCU platform is open source, their hardware design can be edited, modified, or built[2].

The ESP8266 wifi-enabled chip is included in the Node MCU Dev Kit and board. The Es press if Systems ESP8266 is a low-cost Wi-Fi chip that uses the TCP/IP protocol. You can refer to the ESP8266 WiFi Module for additional information about the ESP8266. Version 2 (also known as Node MCU Development Board v1.0 (Version2)), which typically comes in a black PCB[3], is available for the Node MCU Dev Kit.

Fig 2.6. ESP8266 Module

UART, SPI, I2C, and other serial communication protocols are supported. We can connect it to serial devices like an I2C-enabled LCD display, the Magnetometer HMC5883, the MPU-6050 Gyrometer + Accelerometer, RTC chips, GPS modules, touch screen displays, and SD cards, among others, using these serial protocols.

F. ATmega328P Microcontroller

The ATmega328P microcontroller is the sole foundation of Arduino UNO. When compared to other boards, such as the Arduino Mega board, etc., its application is simple. The board incorporates virtual and simple Information/Result pins (I/O), safeguards, and various circuits. Six analog pin inputs, fourteen virtual pins, a USB connector, an electricity jack, and an ICSP (In-Circuit Serial Programming) header make up the Arduino UNO. The Integrated Development Environment (IDE) is the sole foundation for its programming. It is compatible with offline and online platforms.

Fig 2.7. ATmega328P Microcontroller

VI. RESULTS

We have developed a system that provides precise timing for EV series battery life. It might help the proprietors of EVs to long haul use of the vehicle. We use a relay switch to easily convert the batteries from series to parallel so that we can read their voltages and then return them to series so that we can obtain the correct total voltage. For this situation we can likewise gain proficiency with the ongoing voltage of the every battery effectively , we can save the battery blast, warming .

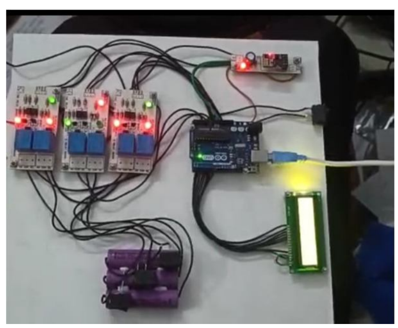

Fig 3.1. Hardware Connections

Fig 3.2.1. Experimental values of battery 1

Fig 3.2.2. Experimental values of battery 2

Fig 3.2.3. Experimental values of battery 3

Fig 3.3.1. Experimental values in LCD

Fig 3.3.2. Experimental values in LCD

VII. CONCLUSION

In this project, the transfer method was used to monitor the voltage as the battery was charged. Because it only has a battery and an electric motor rather than a combustion engine and gas tank, the structure of an electric vehicle is simpler and easier to control at the component level. By identifying the battery that needs to be charged rather than charging the entire battery series, we can avoid damaging batteries and preventing their deterioration. We can ensure that the batteries are charging and discharging correctly by anticipating the difficulty posed by the available datasets.

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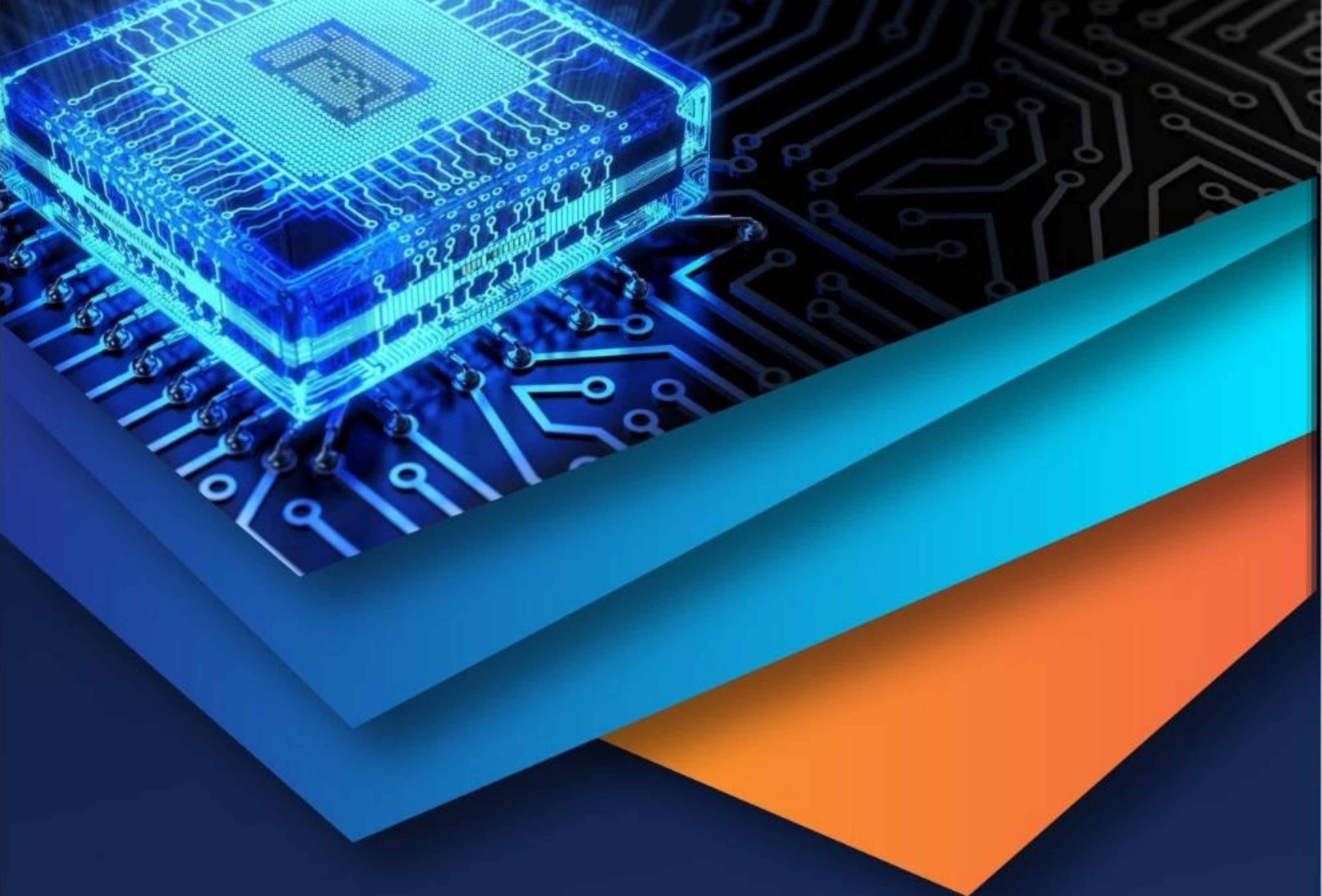

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