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IoT Based Battery Monitoring System for Electric Vehicle

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ABSTRACT: As electric vehicles become more popular, it's crucial to monitor the health and performance of their batteries to ensure optimal efficiency and longevity. In this project, we propose an IoT-based battery monitoring system that leverages wireless communication and cloud computing to collect and analyze battery data in real-time. Our system consists of three main components: battery sensors, a gateway device, and a cloud platform. The battery sensors are placed in each battery cell to measure key parameters such as voltage, current, temperature, and state of charge. These sensors transmit data wirelessly to the gateway device, which aggregates and processes the data before sending it to the cloud platform. Our system offers several benefits, including improved battery performance, reduced maintenance costs, and enhanced safety. By leveraging IoT and cloud technologies, we can provide real-time monitoring and analysis of battery data, enabling more informed decision-making and proactive maintenance. At the present time, the resources that we use for electricity are costly and inefficient. That is why we must rely on those that are of in the least harmful to the environment and inexpensive. There are also additional benefits: Photo voltaic panels and photovoltaic plants use the natural sunlight for additional lighting. photovoltaic cells are used in applications that allow the use of taking solar energy and expanding it into electricity most of the solar systems are situated in sparsely populated regions, large-scale agricultural communities, as well as in medium-sized farm sites and smaller, agricultural local agricultural production facilities that have power grids for a machine to function, it must be operated by a human.

KEYWORDS: ARDUINO, Battery, Voltage sensor, Temperature sensor, Fire sensor, Relay.

I. INTRODUCTION

Electric Vehicles (EV) are playing a key role because of its zero-emission of harmful gases and use of efficient energy. Electric Vehicles are equipped by a large number of battery cells which require an effective Battery Management System (BMS) while they are providing necessary power. The battery installed in electric vehicle should not only provide long lasting energy but also provide high power. Lead-acid, Lithium-ion, -metal hydride are the most commonly used traction batteries, of all these traction batteries lithium-ion is most commonly used because of its advantages and its performance. Battery Management System (BMS) makes decisions based on the battery charging and cell voltage, temperature, etc. To ensure safe operation of the battery pack, the Battery Management System (BMS) has to make sure the cells remain in this safety window. Electric Vehicles are becoming more commonplace as the technology matures and gas prices remain higher than in previous decades. While the internal combustion engine still dominates much of the world's roads, Electric Vehicles and Hybrids (vehicles with both an internal combustion engine and some form of electric motor) are more prevalent in urban areas than previous decades. Electric Vehicles do not have any on board power generation and rely solely on stored energy in batteries to power the electric motors during operation. This paper outlines a scalable method of determining the voltage across each battery in an electric vehicle charging and an eventual path for the development of a real-time battery monitoring for use in the Department Electric Vehicle.

II. EXISTING SYSTEM

In Electric Vehicles (EVs), Hybrid EVs (HEVs) and critical power backup systems, the cells are connected in series-parallel combination to build high voltage and large capacity battery packs. Factors causing cell voltage variation includes manufacturing methods, maintenance procedure and aging. In drive mode, these cells undergo electric and thermal treatment due to the unpredictable demands. In order to meet safety standards and to prevent deterioration of battery life, a Battery Monitoring System (BMS) which properly monitors and controls each cell at every instant is



mandatory. In the present system, a low cost, low power transceiver running on a 26MHz crystal is used to generate 2.432GHz carrier frequency and data rate of 250Kbps. Comparative study shows that 2.432GHz transmission is of less packet loss and very low interference with nearby frequency bands. A PCB mountable Chip Antenna, with additional impedance matching components, is used in the transmission side.

III. PROPOSED SYSTEM

Our proposed system consists of three main components: battery sensors, a gateway device, and a cloud platform. The battery sensors are placed in each battery cell to measure key parameters such as voltage, current, temperature, and state of charge. These sensors transmit data wirelessly to the gateway device, which aggregates and processes the data before sending it to the cloud platform. The cloud platform hosts a database and analytical tools to process the battery data and provide actionable insights to vehicle owners, manufacturers, and service providers. Users can monitor the health and performance of their batteries through a web or mobile application, receive alerts for potential issues, and access historical data for trend analysis and predictive maintenance. The IOT based Battery Management System for Electric Vehicle is proposed. This system consist of voltage sensor to detect the voltage and update in IOT. The temperature sensor is used to sense the battery temperature, if there is increase in temperature buzzer alert is given and displayed in LCD. For safety purpose the system is interfaced with fire sensor that detects the fire in the battery and give alarm. The overvoltage button indicates when the voltage exceeds certain level. The measured parameters are updated in IOT and displayed in LCD display. Previous battery monitoring system only monitor and detect the condition of the battery and alarmed the user via battery indicator inside the vehicle. Due to the advancement of the design of notification system, Internet of manufacturer and users regarding the battery status. In the present system, a low cost, low power transceiver running on a 26MHz crystal is used to generate 2.432GHz carrier frequency and data rate of 250Kbps. Mountable Chip Antenna, with additional impedance matching components, is used in the transmission side.

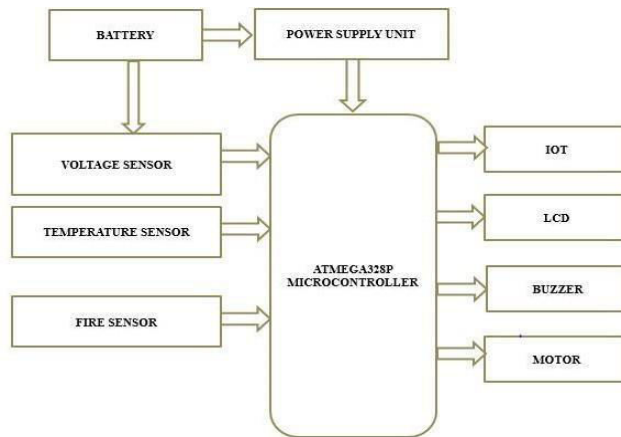


Figure.1. Block Diagram

Arduino

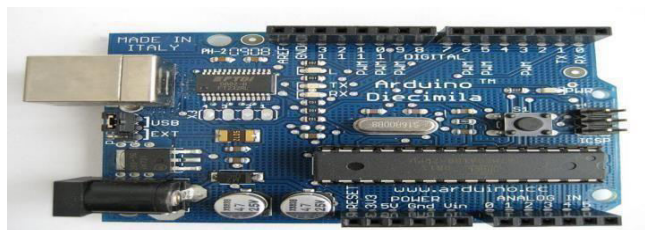


Figure.2. Arduino

Arduino is an open-source prototype platform based on easy-to-use hardware and software.



Battery



Figure.3. Battery

Lithium-ion batteries offer several advantages over other types of rechargeable batteries, including a high energy density, a long cycle life, and a low self-discharge rate.

Voltage Sensor



Figure.4. Voltage Sensor

A simple but very useful module which uses a potential divider to reduce any input voltage by a factor of 5. With a 0-5V analogue input range you are able to measure a voltage up to 25V.

Temperature Sensor

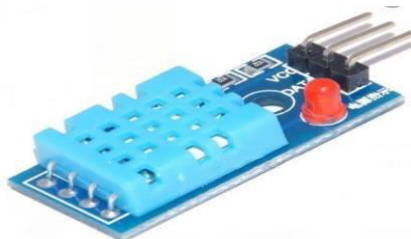


Figure.5. Temperature Sensor

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

Fire Sensor

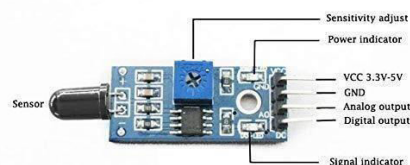


Figure 6 Fire Sensor

A fire detector is a device that senses fire, typically as an indicator of fire. Commercial security devices issue a signal



to a fire alarm control panel as part of a fire alarm system, while household fire detectors, also known as fire alarms. Generally issue a local audible or visual alarm from the detector itself or several detectors if there are multiple fire detectors interlinked.

IV. SIMULATION RESULT

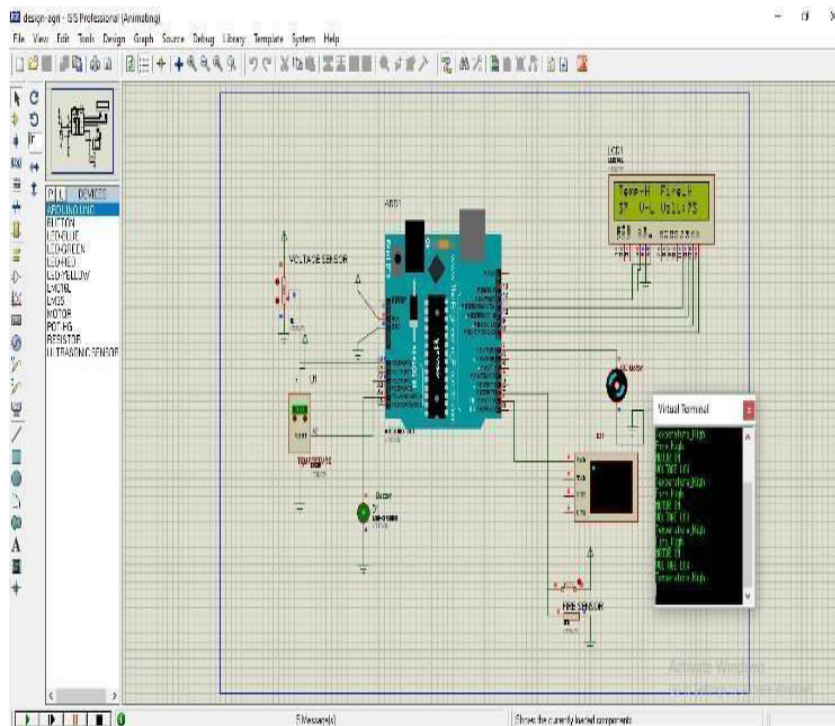


Figure.7.Simulation Result

We are using temperature, voltage and fire sensors to connect on the Arduino board with help code. We are writing on the code on Arduino software through upload on the Arduino uno microcontroller to run the code. The first we displayed on the project name on LCD. Then LCD display are clear and displayed on the sensors condition. i.e. sensor are low or high conditions displayed on the LCD and IOT. And battery voltage value is displayed. The temperature sensor value are raised the visual alerted on the LCD and IOT. And the buzzer model of LED are connected. The temperature are high LED is blinked. The voltage value are displayed on the LCD and the high or low condition also displayed on the LCD and IOT. The voltage and temperature value are high LED is blinked. The fire and temperature value are high alerted on the LCD and IOT, and buzzer will be on and the motor will be on condition. The fire value are low motor will be off condition. i.e. sensor are low or high conditions displayed on the LCD and IOT. And battery voltage value is displayed.



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V. HARDWARE MPLEMENTATION

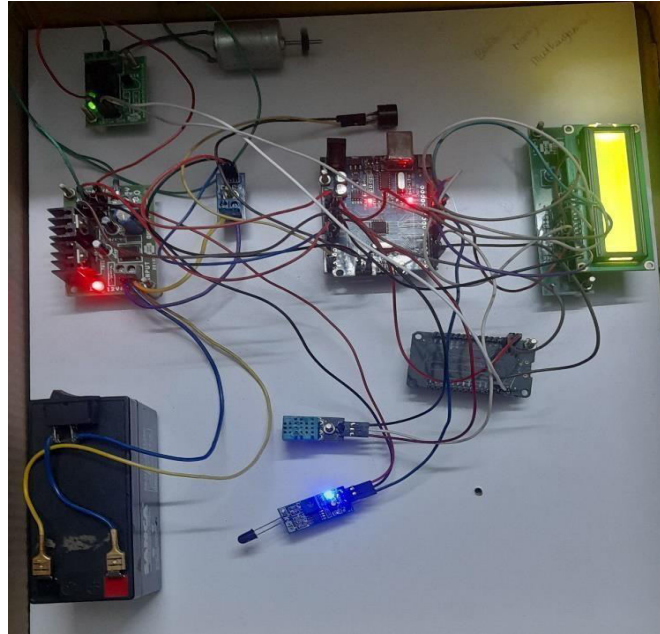


Figure.8. Hardware Result

Monitoring and managing battery systems in electricboats and ships to ensure safe and efficient maritime operations. The battery-powered medical devices, ensuring they operate reliably in critical healthcare settings. Monitoring battery health in electric bicycles and scooters used for urban transportation. An IoT-based Battery Monitoring System in Electric Vehicles is an essential aspect of ensuring efficient operation and prolonging the battery life of electric vehicles. IoT-based Battery Monitoring Systems can collect a significant amount of data related to battery usage and performance. By applying advanced data analytics, such as machine learning and artificial intelligence, to this data, the system can gain a deeper understanding of battery performance and predict potential issues before they occur. Integrating IoT based Battery Monitoring Systems with smart grids can enable better control and optimization of the energy flow between the vehicle and the grid. This can help to ensure that the battery is charged efficiently and at the optimal time. Wireless charging technology is becoming more prevalent and can be integrated with IoT-based Battery Monitoring Systems to provide a seamless and effortless charging experience for Electric Vehicle users. Multi-modal battery management is a system that can manage the performance of multiple batteries in an electric vehicle.

VI. CONCLUSION

In this paper, we have proposed an IoT-based Battery Monitoring System for electric vehicles that leverages wireless communication and cloud computing to collect and analyze battery data in real-time. Our system offers granular and accurate insights into battery health and performance, real-time monitoring and analysis capabilities, cloud-based analysis, and enhanced safety. Through our experiments and evaluations, we have demonstrated the effectiveness and reliability of our system in detecting potential issues and providing actionable insights to users. We have also shown that our system can be easily integrated into existing electric vehicle infrastructure and can scale to accommodate large fleets of vehicles. The paper described the design and development of an IoT-based Battery Monitoring System for electric vehicle to ensure the battery performance degradation. We are developing the system for battery management in electric vehicle by controlling the crucial parameters such as voltage and temperature.

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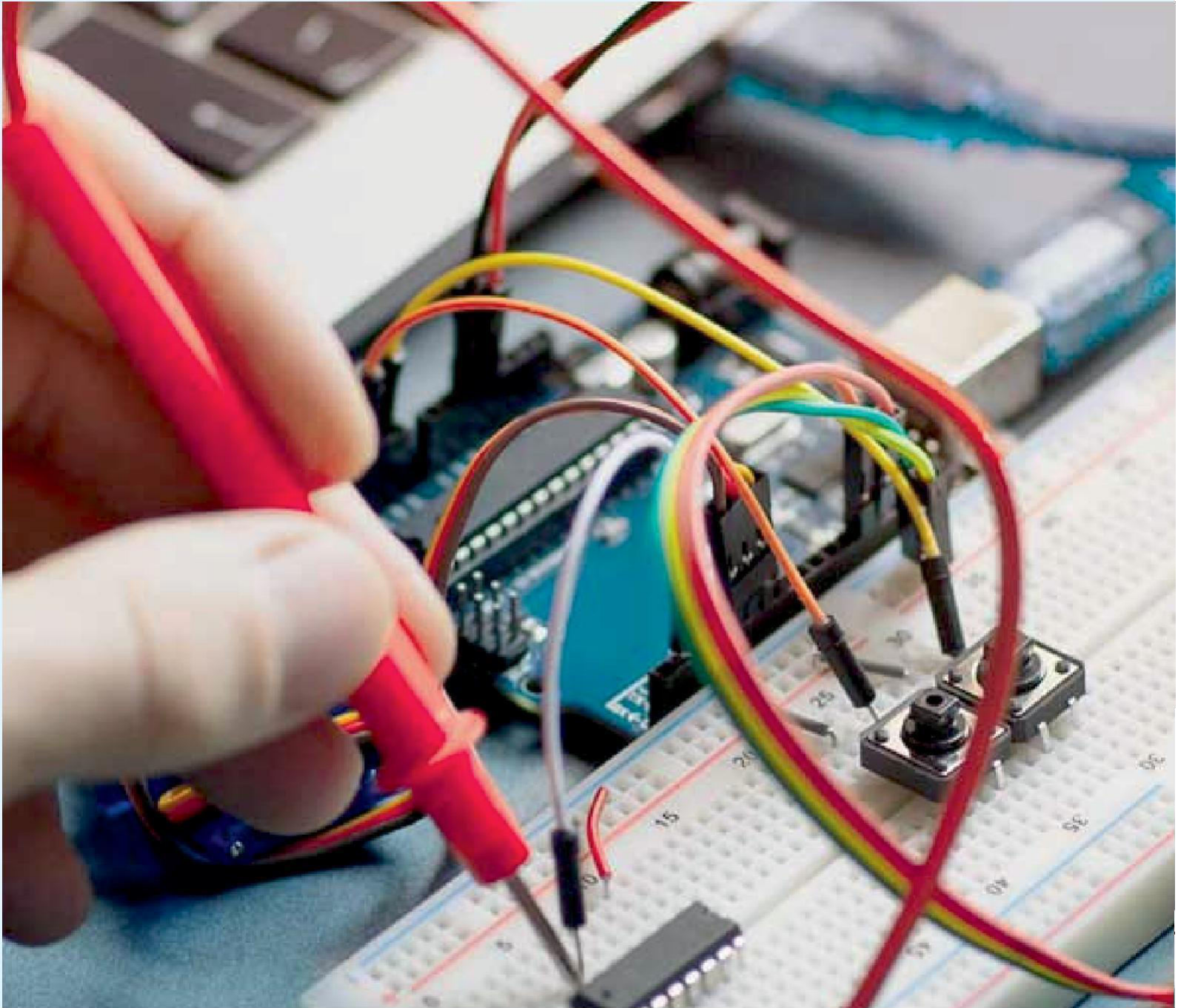
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