ARDUINO BASED BATTERY MANAGEMENT SYSTEM FOR ELECTRIC VEHICLES

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ABSTRACT

Electric vehicles have grown in recent years because of its zero-emission of harmful gases and use of efficient energy. However, the performance of an electric vehicle depends on the battery management system (BMS). The goal of this paper is to design an Arduino-based electric vehicle BMS to monitor and control the charging and discharging process of the battery. The BMS monitors the state of charge,temperature and voltage of each cell in the battery pack.. The system uses a variety of sensors and indicators to provide information about battery life and performance. The proposed BMS can help improve the performance and life of the battery pack, thus making the electric vehicle more reliable and efficient transportation.

Keyword : - *Battery Management System , Microcontroller and Electric Vehicle,*

1. INTRODUCTION

Electric vehicles (EVs) are becoming an increasingly popular mode of transportation due to their sustainability, efficiency, and reduced carbon footprint. The performance of an electric vehicle is highly dependent on its battery management system (BMS), which controls the charging and discharging processes of the battery pack. A well-designed BMS ensures optimal battery performance, safety, and longevity. This paper presents an Arduino-based BMS for electric vehicles, which provides real-time monitoring and control of the battery pack.

The proposed model aims to design a battery management system (BMS) for an electric vehicle (EV) that will ensure the safe and efficient operation of the vehicle's battery pack. The BMS will monitor the state of charge, temperature and voltage of each cell in the battery pack, as well as control the charging and discharging of the battery. It will also provide real-time data to the driver about the battery's health. The BMS will be designed with a modular architecture that will allow for easy integration into different EV models. The goal of this project is to improve the reliability and performance of EVs by ensuring the safe and efficient operation of their battery packs. The benefits of the BMS include improved reliability and performance of EVs, longer battery life, and increased safety for drivers and passengers. The BMS also helps to optimize the charging and discharging of the battery, which reduces the cost of ownership and improves the overall efficiency of the vehicle.

2. LITERATURE SURVEY

The literature survey revealed that the current state-of-the-art in BMS technology for electric vehicles is focused on improving battery performance, safety, and longevity. The survey identified various BMS architectures, including centralized, distributed, and modular BMS, each with its advantages and disadvantages. The survey also highlighted the use of various algorithms, such as the Kalman filter, fuzzy logic, and artificial neural networks, for battery state estimation and control. In terms of components, the survey identified the use of various sensors, such as current sensors, temperature sensors, and voltage sensors, for real-time monitoring of the battery status and performance.

On January 7, 2013, a Boeing 787 was being serviced and a mechanic noticed flames and smoke coming from the flight's auxiliary power unit (lithium fuel light pack) another battery failure causing an emergency at Japanese airport.After US-Japan joint investigation, B-787's lithium battery pack was checked by CT scan and found that 1 out of 8 lithium-ion batteries was damaged, causing short circuit, thermal operation and fire.

This event could be easily avoided if the battery management system of the Li-Ion battery pack is designed to detect/prevent short circuits.

2. METHODOLOGY

Hardware Used: Microcontroller-ATMEGA328P(Arduino Nano), Lithium Battery Protection Board(BMS), Li-ion Battery-12V/2.2A,Voltage Regulator(IC7805),Voltage Sensor, Temperature Sensor, LCD-16*2, L293D Motor Driver, DC Geared Motor, 1 Channel Relay, Resistor, Capacitor, PCB, etc.
Software Used: Arduino IDE, Proteus(for circuit diagram)
System Architecture:

The proposed model consists of Sensing device, Controller, Monitoring device and a Buzzer. The sensing devices are Voltage Sensor and Temperature Sensor. Arduino is used as monitoring and controlling device. The inputs of Arduino are Voltage Sensor and Temperature Sensor and outputs are LCD Display and Buzzer.

The voltage sensor and temperature sensor will sense the voltage and temperature of the battery respectively. Arduino will show it on the LCD Display also it will show the corresponding battery percentage(state of charge). When voltage of the battery falls down below set limit, it will show " BATTRY DOWN ". When the voltage of the battery goes beyond set limit it will show " VEHICLE CHARGED " and also gives an alarm signal . When the temperature of the battery increases upto set value, it will give the alarm signal and show " OVERTEMPERATURE ".

There is a relay which is used as overvoltage protection for the battery. When the battery is fully charged, the relay will prevent from overcharging of the battery.

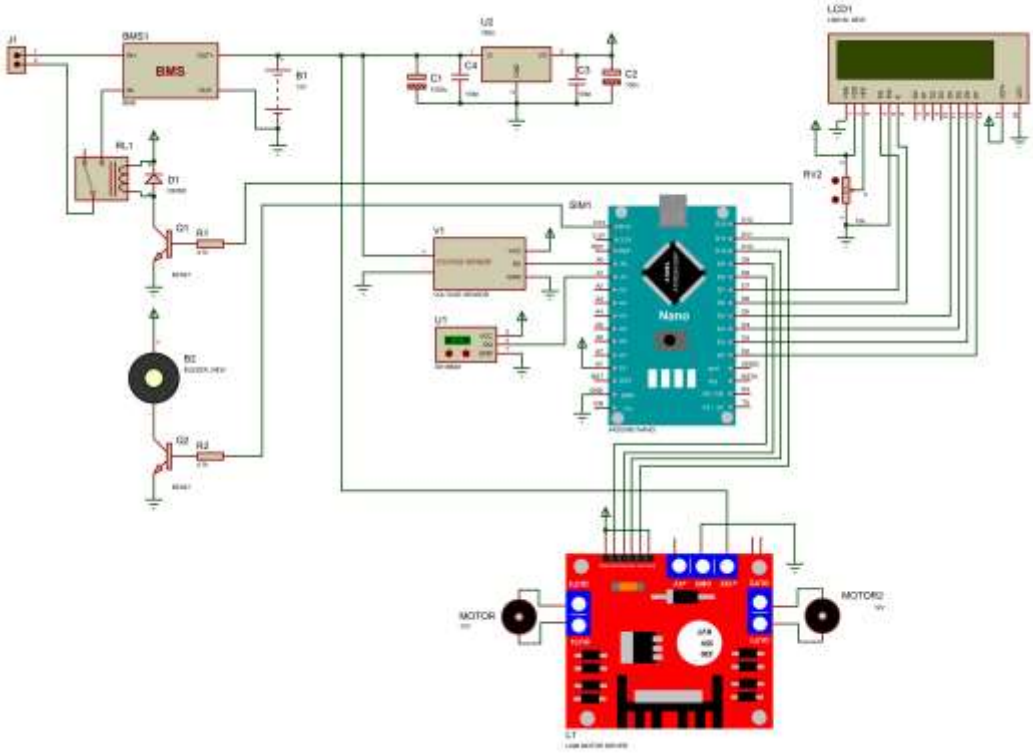

Fig (a): **Circuit Diagram**

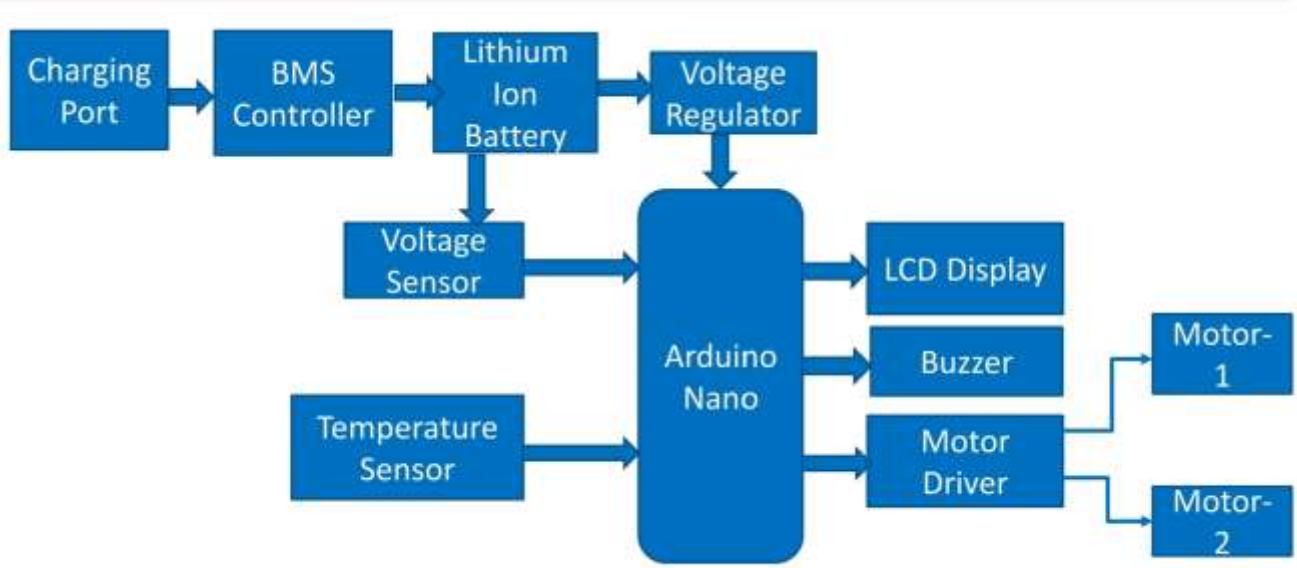

Fig (b): Block Diagram

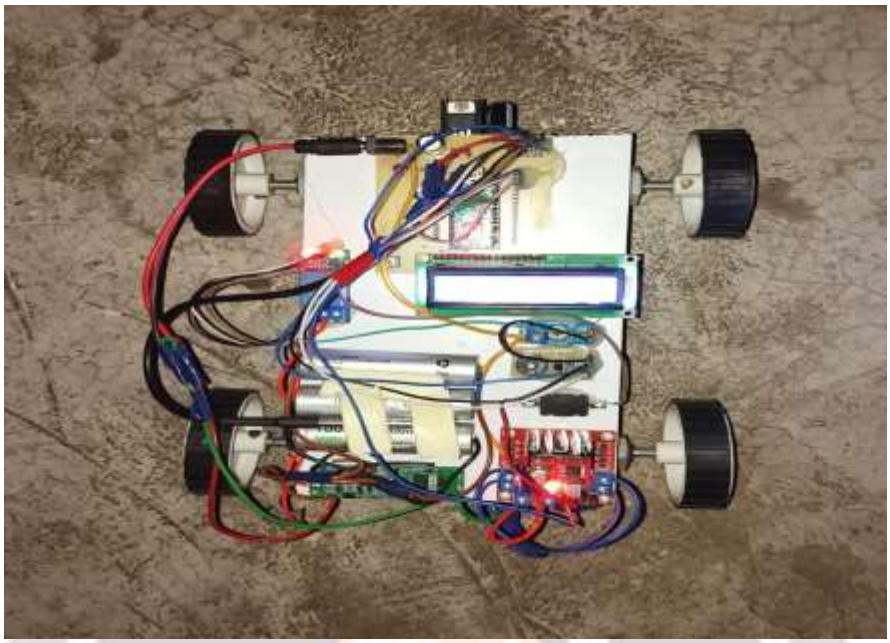

Fig (c): Implemented prototype of EV Battery management System

4. RESULT

The proposed BMS was tested on an electric vehicle prototype and the results showed that the system effectively monitors and controls the charging and discharging process of the battery pack. The system provides real-time information about the battery, such as voltage and current, which helps keep the battery safe and healthy. BMS also controls the charging and discharging of the battery pack, helping to extend battery life.

5. CONCLUSION

The proposed Arduino-based BMS provides an effective solution for monitoring and controlling the battery pack of an electric vehicle. The system provides real-time data on the battery status and performance, which can help in ensuring optimal battery performance and safety. The BMS can also effectively control the charging and discharging of the battery pack, which can help improve the battery's longevity. The proposed BMS can be easily integrated into existing electric vehicles, making it a practical and cost-effective solution for battery management. With further development and testing, the proposed BMS can help improve the performance and reliability of electric vehicles, thus contributing to a more sustainable transportation system.

6. REFERENCES

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