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EV BMS With Charger Monitor and Fire Protection

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ABSTRACT:

Battery Management Systems (BMS) are used in many industrial and commercial systems to make the battery operation more efficient and for the estimation to keep the battery state, as long as possible, away from destructive state, to increase battery life time. For this purpose, many monitoring techniques are used to monitor the battery state of charge, temperature and current. In the current paper, the monitoring system for battery powered Electric Vehicles (EV) has been implemented and tested. This system evaluates and displays the battery temperature, charging/discharging current and State Of Charge (SOC) for the considered model battery. For monitoring purpose, digital and analog sensors with microcontrollers are used. The battery information and the obtained results explaining the main characteristics of the system are presented by photographs and some experimental results are given by the LCD screen[1]

Keywords—Battery Management System, Temperature Sensor, Voltage Sensor,ATMega328p Microntroller

Introduction

Need An electric vehicle is one that is propelled by one or more electric motors or traction motors. An electric vehicle may be powered through non-renewable sources or self-contained batteries, solar panels, fuel cells to generate electricity which is a costly option. This system is useful not only for EVs but also for road and rail vehicles, surface and underwater vessels, electric aircraft, and electric spacecraft.[2] Electric vehicle (EV) is one that is made to run by an electric motor rather than an internal-combustion engine(IC) . It generates energy by burning a mixture of Petroleum and its other products. Due to Which , these vehicle are found out to be a one of the replacement for current-generation of vehicles in order to address challenges such as rising pollution, global warming, and natural resource depletion. Electrical vehicles are attracting customers due to its environment-friendly nature as it does not have an internal-combustion engine which creates harmful gases for the planet, also they have less cost of maintenance and they are potential to a tax credit as the customer is cutting down the impact on the environment by choosing a zero-emission system.[3]

BATTERY MANAGEMENT SYSTEMS (BMS):

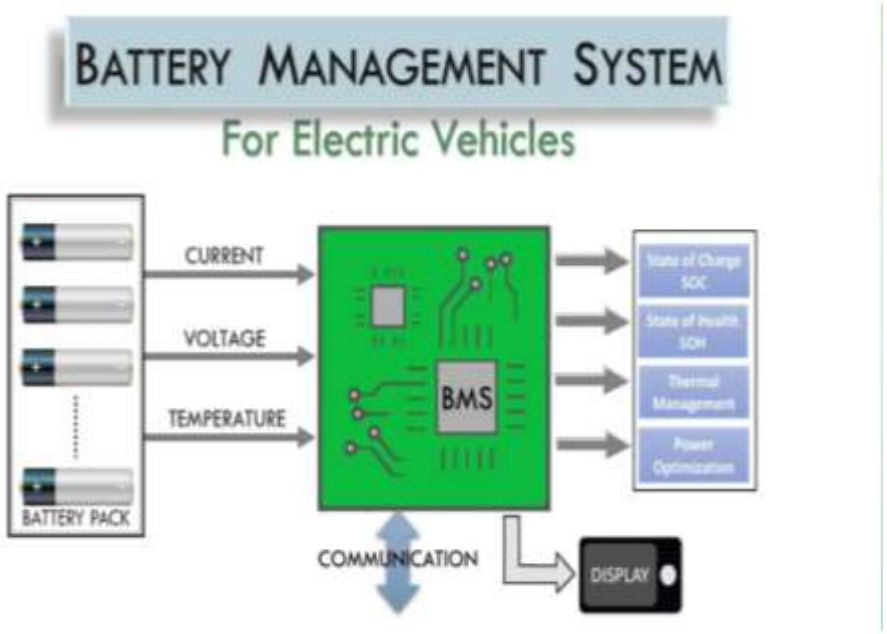
There are different types of BMSs that are used to avoid battery failures. The most common type is a battery monitoring system that records the key operational parameters such as voltage, current and the internal temperature of the battery along with the ambient temperature during charging and discharging. The system provides inputs to the protection devices so that the monitoring circuits could generate alarms and even disconnect the battery from the load or charger if any of the parameters exceed the values set by the safety zone. The battery is the only power source in pure electric vehicles. Therefore, the BMS in this type of application should include battery monitoring and protection systems, a system that keeps the battery ready to deliver full power when necessary and a system that can extend the life of the battery. The BMS should include systems that control the charging regime and those that manage thermal issues. In a vehicle, the BMS is part of a complex and fast-acting power management system. In addition, it must interface with other on-board systems such as the motor controller, the climate controller, the communications bus, the safety system and the vehicle controller. While the definition of a BMS could differ depending on the application, the basic task of the BMS could be defined in the following manner, :

- It should ensure that the energy of the battery is optimized to power the product;
- It should ensure that the risk of damaging the battery is minimal;
- It should monitor and control the charging and discharging process of the battery.[4]

Requirement Specifications:

The requirements specification is a technical description of the software needs. It is the first step in the requirements analysis process, and it enumerates all of the needs for a software system. includes criteria for functionality, performance, and security. The requirements also cover user, operational, and administrative usage situations. A software requirements specification's purpose is to provide a comprehensive overview of the software project, its parameters, and its goals. This section describes the target audience for the project, as well as the user interface, hardware, and software requirements. Hardware Requirement: Arduinouno, DC motors, Voltage Sensor, Battery. Software Requirement: C, C++ Compiler : Arduino IDE OS:WINDOWS[5]

Diagram



Key features and benefits of our BMS

- **One Stop Shop** for BMS: Infineon offers a complete BMS chipset, production-ready complex device drivers with integrated safety libraries and supports up to ASIL-D safety standards.
- **Enable Compact Design:** Infineon's highly integrated products significantly decrease the footprint, and help the customers to reduce costs by minimizing printed circuit board size.
- **Best-in-Class Robustness:** Infineon's best-in-class robustness substantially improves battery lifetime accuracy and performance.
- **Faster Time to Market:** The Interoperability between BMS devices and production-ready complex device drivers reduces design effort and speeds up time-to-market for customers.
- **Market Benchmark for Low PPM Rates**: Infineon's **Zero Defect Mindset i**s reflected in the lowest PPM rates in the market, and significantly reduces vehicle downtime and returns.[8]

Working Principle:

The system makes use of a li ion Battery, Battery charging and monitor system, Push Buttons, LCD Display, current sensor, voltage sensor, temperature sensor to develop this system. The system monitors as well as protects an EV battery at all times. We here develop the system as per a 3S li ion battery. The system we design will not only monitor the battery and charge it safely but also protect it to avoid accidents from occurring. The system when turned on uses its charging and monitoring circuitry that allows user to safety charge the 3S battery.

While charging the voltage sensor is used to check voltage and limit the flow of current too to the battery using charging circuitry. The LCD display also displays the current voltage level of battery. As soon as the battery is fully charged, the system cuts off the supply and displays Battery fully charged on LCD Display. When connected to a load the current sensor keeps track of current drawn from battery and displays the parameter on LCD Display. The temperature sensor is used to monitor temperature of battery while charging as well as discharging.

If the battery temperature is observed to deviate from standard values, the system automatically cuts off input as well as output supply and displays the temperature as well as a buzzer alert on the LCD display. Thus the system allows for a smart and efficient battery charging as well as protection system

Advantages:

It improves the battery performance

It enhances the life span of battery

It controls the charging, discharging and temperature ranges and keeps them with in their range.

It predicts the batteries capabilities in near future[9]

Conclusion:

Internet of Things (IoT) based battery sensor monitors the status of the battery as an energy storage management system. The IoT developed here uses a cloud platform for management purpose. The vehicle user can easily check to the destination to reach the charging station and can view the withdrawal of battery voltage from the system. The data stored in the Arduino can withstand until battery fails to charge. For the future use, multiple user for the e-vehicle who settles the station are stored and upgraded in the database so that the distribution to the different user can be monitored. The upcoming year will come more and more solar electric vehicle due to these reasons : Reduction of emission of fossil fuel for extracting power from renewable resources. Intelligent compliance to electronic requirements that facilitate the monitoring the availability of used power using IOT. Tracking of sun's radiation throughout a time. Electric vehicle confines the outlook of passenger a vehicle that draws current from the rechargeable battery.[10]

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