LITERATURE SURVEY ON EV BATTERY MANAGEMENT SYSTEM

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ABSTRACT

The operation of the electric vehicle is mostly dependent on the battery, which must be serviced on a timely and regular basis. Therefore, the design of the BMS is very important for the safe operation of the vehicle, thus extending the battery life and increasing driving safety. This article discusses the challenges and opportunities in implementing EV BMS and provides a comprehensive review of the available literature. The survey aims to gain an understanding of recent developments in electric vehicle BMS and future research directions in this field.

Keyword : - *Battery Management System and Electric Vehicle*

1. INTRODUCTION

The increase in environmental concern like global warming, depletion of fossil fuels and an increase in fuel price, automobile industries have shifted their attention towards clean vehicle technologies. Now a days, Electric vehicles are becoming popular due to advancements in battery technology and Battery Management system. In future, Electric Vehicles will almost replace the IC Engine based vehicles.EV will be emerged as a sustainable transportation system. The technology used in EVs are complex as compared to that of IC Engine based vehicles.

For the safe and reliable operation of vehicle, it is necessary to monitor various parameters of the battery. This is done by means of Battery Management System (BMS). Battery Management System monitors the voltage, current and temperature of the battery and gives corresponding State of Charge (SOC) and State of Health (SOH) of battery. The BMS provides the over-voltage, over-current ,over-temperature, etc. protection to battery. It also give signal to cooling system if the temperature exceed certain limit.As 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.

2. LITERATURE SURVEY

According to several literature studies, an effective BMS must performs the following operations

- **Cell Balancing:**
- Cell balancing is the process of equalizing the state of charge (SOC) of each cell in a battery pack to ensure its longevity and safety. Several techniques have been proposed to balance the cells, including passive and active balancing. Passive balancing is the simplest and most cost-effective technique that uses resistors to balance the

cells. Active balancing, on the other hand, uses a more complex circuitry that actively transfers charge between the cells. The choice of the balancing technique depends on several factors, such as the battery chemistry, the number of cells in the pack, and the desired balance accuracy.

- **SOC Estimation:**

- The SOC of the battery pack is a crucial parameter that needs to be accurately estimated for the BMS to perform its functions effectively. Several techniques have been proposed for SOC estimation, including open-circuit voltage (OCV) method, coulomb counting method, and model-based methods. The OCV method is the simplest and most widely used method, which estimates the SOC based on the battery's terminal voltage. The coulomb counting method estimates the SOC by integrating the current flow in and out of the battery over time. Model-based methods use mathematical models to estimate the SOC by taking into account various battery parameters such as temperature, internal resistance, and capacity.

- **Thermal Management:**

- The temperature of the battery pack plays a significant role in its performance and longevity. The BMS is responsible for monitoring the temperature of the cells and ensuring that it stays within a safe range. Several thermal management techniques have been proposed, including passive and active cooling. Passive cooling uses natural convection to remove the heat from the battery pack, while active cooling uses fans or liquid cooling to dissipate the heat. The choice of the thermal management technique depends on several factors such as the battery chemistry, the ambient temperature, and the power requirements.

- **Communication Protocols:**

- The BMS needs to communicate with other components of the EV such as the motor controller, charger, and vehicle management system. Several communication protocols have been proposed for BMS, including Controller Area Network (CAN), Local Interconnect Network (LIN), and FlexRay. The choice of the communication protocol depends on several factors such as the data transfer rate, the distance between the components, and the power requirements.

Review on Energy Management System of Electric Vehicles

In the literature, many solutions have been found for power distributing among different energy sources, ranging from rule-based through stochastic methods up to complex methods. However, none of the described methods improve the thermal stability and reliability of the batteries. Thus more focus should be given for the vehicle dynamics on the road and which can be satisfied by optimising the communication between power train components.

PARAMETERS TO BE ADDED IN FUTURE EMS

In the future, EMS should be designed and developed in such a way to take control of unpredictable changes in the

environment when the vehicles are on road. The parameters to be included in future EMS are

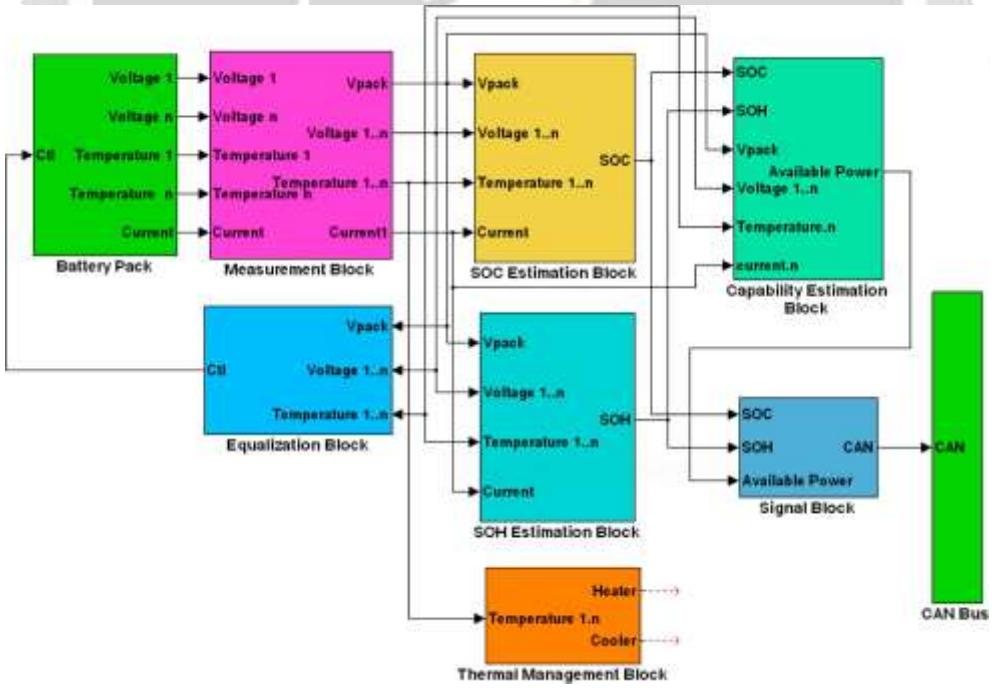
a. Predictive Maintenance: Predictive planning and scheduling of maintenance will optimize the maintenance processes, thereby increasing energy efficiency and life of EV. The required technologies are sensors for monitoring the conditions of batteries, power flow between motor controllers and batteries and data storage.

b. Smart Parameter Setting: The greater accuracy of the parameters enables higher energy density, leading to lower production costs per kWh.

c. Smart Inline Quality: Ageing of batteries can be reduced up to 80% through smart inline quality control. This advanced analytical method enables the consumers to find the micro short circuits of each cell without using any physical measurements.

d. Security Concerns: To avoid cyber-attacks, security concerns should also be taken into account in EMS development. Some basic principles include the use of encryption certification, separation of communication channels; conceivable checks for critical EMS control commands, as well as access an authorization mechanism that

blocks the unauthorized flashing of new EMS firmware.



3.CONCLUSION

The literature survey highlighted the key challenges in BMS development, including the need for accurate battery state estimation and control, optimization of battery performance and safety, and cost-effectiveness. The survey also identified the opportunities in BMS development, such as the use of advanced algorithms and components, and the integration of BMS with other vehicle systems, such as the powertrain and charging system. The survey concluded

that the development of BMS for electric vehicles requires multidisciplinary expertise and collaboration between academia, industry, and government agencies.

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