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# Battery Management System in E-Vehicles

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**ABSTRACT**

In the faster growing world, due to hike in price of fuels and reduced source of crude oils leads to vehicle manufacturing companies start concentrating on electric vehicles. Battery plays a major role in e-vehicles. One of the major issues occurring in e-vehicles is battery related issues. For that proper designing of battery management system is very important. In our project we proposed a Battery management system (BMS) is used in electric vehicle to monitor and control the charging and discharging of rechargeable batteries which makes the operation more economical. Battery management system keeps the battery safe, reliable and increases the senility without entering into damaging state. In order to maintain the state of the battery, voltage, current, ambient temperature different monitoring techniques are used. It safeguards both the user and the battery by ensuring that the cell operates within its safe operating parameters. The installation of this system helps improve business energy efficiency and reduce maintenance costs.

## INTRODUCTION

An electric vehicle generally contains the following major components: an electric motor, a motor controller, a traction battery, a battery management system, a plug-in charger that can be operated separately from the vehicle, a wiring system, a regenerative braking system, a vehicle body and a frame. The battery management system is one of the most important components, especially when using lithium-ion batteries.

Currently, three types of traction batteries are available: the lead-acid, nickel-metal hydride and lithium-ion batteries. Lithium-ion batteries have a number of advantages over the other two types of batteries, and they perform well if they are operated using an effective battery management system.

A Battery Management System (BMS), which **manages the electronics of a rechargeable battery, whether a cell or a battery pack**, thus becomes a crucial factor in ensuring electric vehicle safety. It safeguards **both the user and the battery** by ensuring that the cell operates within its safe operating parameters. If there is a secret ingredient in an electric vehicle, it is the battery management system. While the battery pack itself is of great importance and plays **a crucial role as the powerhouse** of the scooter, the management system determines how well that power gets utilized and translated to actual action on the road.

## PROBLEM DEFINITION

EV batteries typically degrade due to temperature, cycles and time. Storage and operating temperatures have a huge impact on EV battery longevity; in general, warmer climates negatively affect the lifespan of an EV battery.

Corrosion or damage to the positive and negative terminals. Broken internal connections as a result of corrosion. Broken plates due to corrosion and vibration. Damage to the battery case.

While charging, batteries expand a little, and when discharged, they compress which further creates pressure on the separator, and it may fail to function properly. If the separator fails the moment the anode and cathode make contact, it leads to a short circuit which further leads to an explosion.

## EXISTING METHODOLOGY

Most of the e-vehicles are manufactured without proper BMS in that one and it leads to the battery damages and issues. Only in some companies BMS is included for just display charging and show values and it is not effectively used for battery protection and safety measures. Still not proper design is fixed for BMS by the companies and they are upgrading day by day this field. Due to unproper design and unfixed BMS centralised control failures many accidental issues happening in the batteries.

## PROPOSED METHODOLOGY

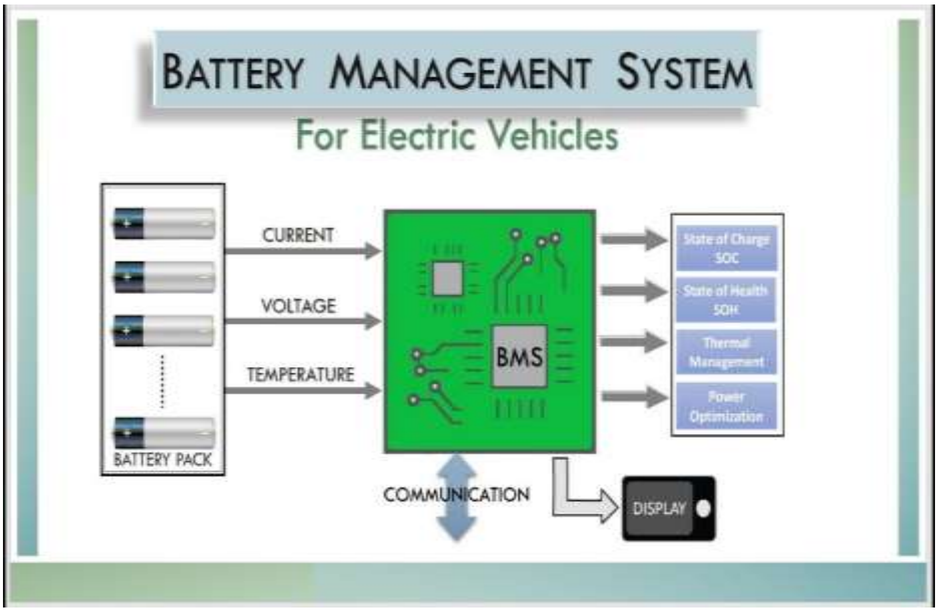
Battery Management System (BMS), which **manages the electronics of a rechargeable battery, whether a cell or a battery pack**, thus becomes a crucial factor in ensuring electric vehicle safety. It safeguards both the user and the battery by ensuring that the cell operates within its safe operating parameters.

The primary components of a battery management system are the **battery pack, BMS control unit, and display unit**. The BMS control unit is the brain of the system, responsible for monitoring and managing the battery pack. It consists of a microprocessor, voltage regulators, current sensors, and a communication interface.

Components used:

- 12v Lithium-ion battery
- Display unit
- Atmega 328p microcontroller
- Temperature sensor
- Voltage sensor
- Current sensor
- C program
- 12v transformer
- Relay module
- Cooling fan

Mainly it consists of three units battery unit, IC unit and display unit .In battery unit , battery and sensors are attached to it. In IC unit mainly atmega mc comes with other chips that are required to control and accept the values and store the values for to indicate the normal and abnormal level of batteries.



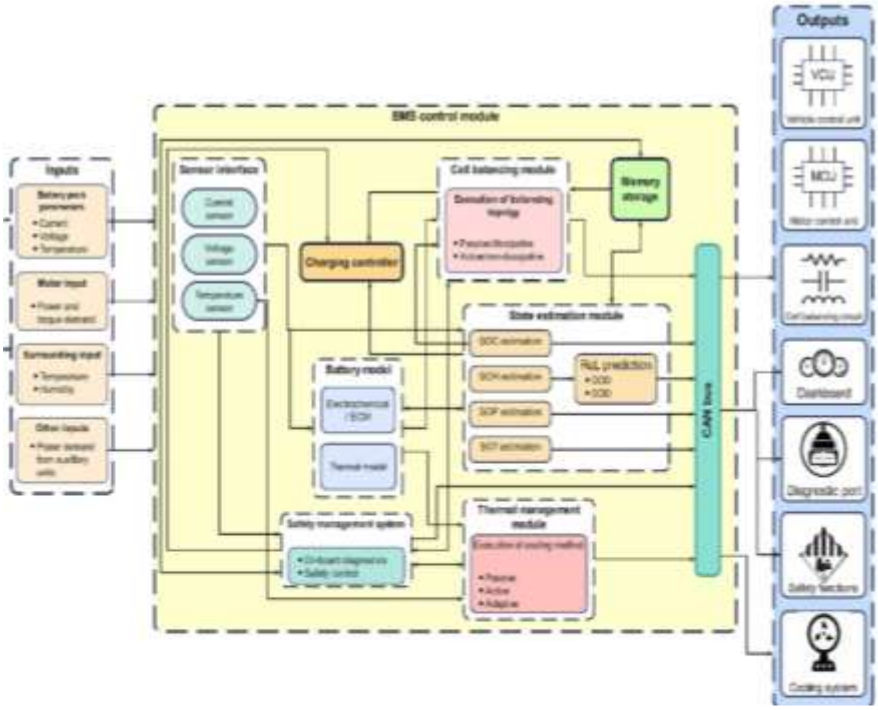

## BMS BLOCK DIAGRAM

Then it sent the values to the display unit. Finally, the display unit consists of LCD display and light indicator and buzzers. If any changes in normal values then the message is sent to the display unit it shows a warning light and the cooling fan automatically turns on. After that also continuely if the short circuit or the temperature increases means then the circuit is automatically cut of the supply from the battery source to the load, it reduces the chances of battery blast and other firing incidents which is stopped by these precautions. The battery is well managed from these steps. The values from the battery supply is completely monitored under this process and this method is used both in charging and discharging mode.

In charging mode, basically it cannot consist any loads so the high voltage and low voltage levels are only monitored and indicated by the unit. If the voltage is high then also it is indicated by the unit. Current values are not mostly change in unload condition. So, it does not affect the unit very much.

In discharging mode, both the battery and loads are getting monitored closely to avoid the incidents . if due to high load the battery heated means then also the circuit gets cutoff from the circuit automatically. Other than that, the current and voltage passing to the load also get monitored any changes in that also will leads to the short circuit. So it also closely noted. This are all the main safety measures which is proposed in this paper.

Separate controllers are fixed in all units and they regularly update and monitor the temperatures and current voltage values correctly due to this we try to get maximum efficiency of the battery by implementing proper BMS in the system. Without proper BMS this datas are able to collect by the system so there is a need of monitoring process is necessary and unavoidable. It improves the battery life, battery efficiency and health condition of battery also.




## EXPECTED OUTCOMES

This work first introduced the background of electric vehicles, lithium-ion batteries and the BMS. The details of the BMS, including its definition, objectives, functions and topologies were then discussed. The literature on battery modeling and BMS hardware system design were reviewed in the following section. The limitations of early battery models and the disadvantages of other BMS hardware systems were also reviewed. The objectives and outline of this thesis were then presented.

An improved battery model was proposed in this work by considering the self- discharging effect, the temperature effect and the fading-capacity effect observed in all batteries. The model was simulated using Matlab/Simulink, and the simulation results were discussed. A novel BMS hardware system based on the design of a TI BMS was introduced. It improved the original system by adding a user interface, a thermal management system and a current-monitoring function. The experimental results of this improved system were subsequently discussed. Finally, the results from a simulation based on an actual Thunder sky battery were compared with the results from the experiments on the BMS hardware system.

Many battery models do not simulate of the discharging behavior of actual batteries. When batteries are nearly fully discharged, and the load is removed from the battery, the voltage of the battery will increase; when the load is connected to the battery, and the current resumes, the voltage of the battery will drop to the nominal value. Such discharging behavior should be simulated in future battery models. In addition, the performance of battery models could be further improved.

To improve BMS hardware systems, a method could be created to allow the BMS to communicate with vehicle controllers and other sub-systems in the vehicle, such as the motor controller. In addition, a protection device could be added to the system to switch off the battery pack when it operates out of its SOA. Furthermore, the cell-balancing function could be improved. A BMS could then be developed for use in electric vehicles.

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