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# BATTERY MONITORING SYSTEM

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***Abstract*—A battery management system (BMS) is a crucial component in battery-powered systems that ensures safe and efficient operation of the battery pack. The primary function of a BMS is to monitor and control the charging and discharging of the battery cells to maintain their optimal performance and prevent damage to the battery. The BMS also provides real-time information on the state of the battery pack, such as its voltage, current, and temperature, to prevent overcharging, over-discharging, or overheating of the battery. With the increasing use of batteries in various applications, including electric vehicles and renewable energy systems, the importance of a reliable and efficient BMS cannot be overstated.**

***Keywords*—Battery management system (BMS),Lithium-ion batteries,State of charge (SoC),State of health (SoH),Overcharging,Cell balancing**

## I. INTRODUCTION (*HEADING 1*)

These days, many industrial applications and power generating stations depend on the battery. They are using it as one of their important sources to power up their equipment or to store energy output and to back up their power system equipment in times of need.

Batteries are striving hard to provide environment friendly resources and to provide uninterrupted supply of power with reliability. Therefore, undoubtedly, we can say that batteries play a prominent role in our day-to-day life.

As the green movement increases in popularity, more and more electric vehicles (EVs) of all kinds—such as electric scooters, cars, buses and cargo truck. Power designers will be challenged to provide systems that can be adapted to a wide variety of different types of batteries and vehicles with vastly diverse performance requirements. This white paper examines the key considerations that are best suited to meeting the challenges of including battery performance, lifespan and, of course, safety while designing intelligent battery management and charging systems

We are going to use Arduino based system to monitor the batter parameters like Voltage Temperature and Current to check the battery performance so we could know the battery status and according to that we can maintain the system and take care of it. The present system just shows us battery voltage current and etc. data but that data we can see only on battery management system display also there is no such feature to collect this data to analysis the battery performance we are designing such system that can store time to time data to study later what happens with battery so we can identify the issue easily.

The development of BMS has been driven by the increasing demand for reliable and efficient battery-powered systems, as well as the need to reduce the environmental impact of energy consumption. The use of BMS has significantly improved the performance, lifespan, and safety of batteries, leading to the widespread adoption of electric vehicles and renewable energy systems.

## II. OBJECTIVES

The thesis is basically focused on the Battery Health and its parameters to be continuously monitored and data should be stored for future references

To Monitor Battery health :- Any kind of Battery have some specific life cycle and after that it start losing its original power storing capacity hence to minimize these losses and improve efficiency of that device it is important to monitor battery health.

Prevent Accidents :- Sometimes when battery get overheated or due to short circuit problem there are chances of fire which can cause dangerous accidents this system will minimize the chances of accidents.

Safety :- Under any circumstances if device/vehicle catches fire it will interrupt battery supply and give warning alarm.

Minimize the losses :- Once battery complete it's life cycle and takes too much time for changing so this will increase loses so this system will count the charging time taken by battery and will show notify the user that it's time to change the battery.

## III. LITERATURE REVIEW

I) There are two different categories of battery cells namely Primary cells and Secondary cells. In case of primary cells, the electrochemical reaction that occurs during the discharge is not reversible. If we try to recharge a primary battery, the compounds that have been formed during discharge will not recombine into the original compounds that were present before discharge and therefore it′s not rechargeable. This is the principle reason that primary cells are meant for only one- time use. Secondary cells are special in the sense that their chemical reaction has been designed in such a way that it is completely reversible [1].From this article we understand why primary cells cannot be recharged.

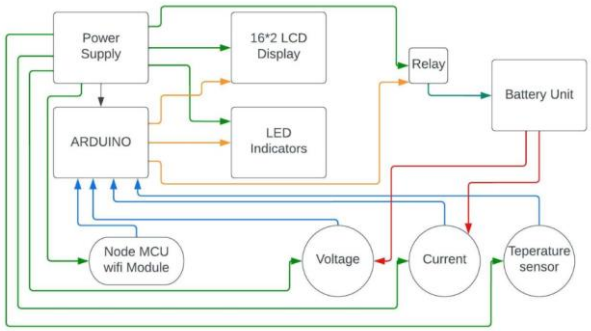
II) Battery management system (BMS) is the crucial system in electric vehicle because batteries used in electric vehicle should not be get overcharged or over discharged. If that happens, it leads to the damage of the battery, rise in temperature, reducing the life span of the battery, and sometimes also to the persons using it. It is also used to maximize the range of vehicle by properly using the amount of energy stored in it. [2] From this article we understand why BMS is required.

III) A battery management system (BMS) ensures the safety, efficiency and reliability of a battery powered system. Research on BMS has been very intense in the last two decades and significant improvements were achieved in the safety, efficiency and reliability of battery systems. However, there are challenges remaining and in this we describe a list of challenges and outline possible solutions. [3] From this article we understand the challenges and some solution on making of BMS.

IV) BMoS on the market is very expensive and not suitable for low cost embedded systems. As the Arduino Uno is widely used for low cost microcontroller boards, easy programming environment, and open-source platforms for building electronic projects, therefore, this study focuses on Arduino Uno BMoS based system

## IV. METHODOLOGY AND WORKING

This project mainly focused on battery health we are going to monitor every parameter of battery like voltage current temperature and state of charge. As we know day by day battery operated equipment′s are increasing it is important to make sure that it does not harm any human life caused by battery explosion.
In this system we are using Arduino for monitoring the battery health and also we are using various sensors and a Wi-Fi network module to send this over internet so user can keep eye on system from anywhere and we are using LED′s as indicators for various purpose like battery full, low battery. Etc




(fig-1 Block Diagram)

As this is a prototype we are using 5v DC supply for our system which is actually 230v AC but we have stepped down it and converted to 5v Dc. This power supply is given to a power distributor circuit which provides provide external power to all our equipment which need external power supply to run.

As you can in fig 1 power supply is given to all sensors, indicators, LCD display and our Arduino Uno board through the power distribution circuit. When the system is turned on sensors starts and measures the battery values voltage and temperature it also measures current when load is connected to the system all these values are in analog in nature and to be converted in digital form to show on LCD display so all these analog values are sent to Arduino which will process on these values and convert it to the digital values then these set of values will be sent to LCD display and Wi-Fi module the LCD display will show this values directly on screen so anyone see it. The Wi-Fi module Node MCU will collect this all data given by Arduino and sent over internet when its have active internet connection so you don′t need to go and check the system by self-visiting the system every time you can see the all data of battery parameters on any device which have active internet connection like mobile laptop or desktop only you need user id and password to see the all data even you can save this all data on your computer.

## V. HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENT
230V AC to 12V DC Converter
Power Distributor
Arduino UNO

16*2 LCD Display
LED Indicators
Node MCU
Breadboard
Current sensor
Voltage sensor
Temperature sensor
Relay switch
Battery

SOFTWARE REQUIREMENT
Arduino Program

## VI. CONCLUSION AND FUTURE SCOPE

In conclusion, the battery management system (BMS) plays a critical role in ensuring the safe and efficient operation of battery-powered devices. It monitors and controls various battery parameters, such as voltage, current, temperature, and state of charge, to prevent potential safety hazards and prolong the lifespan of the battery pack.

The development of BMS has been driven by the increasing demand for reliable and efficient battery-powered systems, as well as the need to reduce the environmental impact of energy consumption. The use of BMS has significantly improved the performance, lifespan, and safety of batteries, leading to the widespread adoption of electric vehicles and renewable energy systems.

Looking to the future, there are promising developments and applications of BMS, such as integration with IoT, development of smart batteries, use of advanced materials, implementation of blockchain technology, adoption of wireless charging, and development of hybrid battery systems. These advancements will further enhance the efficiency and reliability of battery-powered devices and contribute to the global efforts to transition to a more sustainable and renewable energy system.

Overall, the battery management system is a crucial component in the future of energy storage and consumption and will continue to evolve and advance alongside the changing technological landscape.

### Future Scope

The project monitors battery health very well making some more changes and after designing a perfect PCB it will become more efficient and can be used for heavy duty equipment′s .

The future of battery management system (BMS) looks promising, as there is a growing demand for efficient and reliable battery-powered devices across various industries, including automotive, renewable energy, aerospace, and consumer electronics.

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