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BATTERY MANAGEMENT SYSTEM FOR ELECTRIC TROLLY APPLICATION

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Abstract **:- In electric vehicles, batteries are the primary source of power. The battery we use in electric vehicles are not that efficient andrequires charging after few miles. So here isthe idea of New battery management system. This study presents a comprehensive overview of this relatively revolutionary and gratifying solution for battery difficulties in electric vehicles, as well as an in-depth investigation of it. In this new battery management system, we divide the battery in two half. One half is for charging and the other half is for discharging. For charging, we use renewable energy sources such as solar panels, regenerative braking, regenerative suspension, and so on. While one half is charging, the other half is discharging simultaneously. When the other half is dischargedcompletely, we use the charged portion of the battery, and a discharged portion is kept for charging. Due to this management, we don't require external charging and the vehiclebecomes autonomous itself for charging and we are not usingtwo different batteries, so there will be no space problem. This paper aims at highlighting the construction and analyzing this battery management system in detail; So study its advantage, potential applications. Also, it's capacity in solving the inclination problem of the electric vehicle.**

Keywords—Battery, Battery Management System,Autonomous Vehicles, Electric Vehicles

I. INTRODUCTION

A. 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.

Nowadays, the modern world demands high technology which can solve our current and future problems. If we particularly see the problems of India, then we can realize that scarcity of fossil fuels is the main problem. As we all know, the rates of fuels (petrol & diesel) are increasing day by day. Because of fossil fuels, there is so much pollution produced all over the world. So, we have to move towards Electric vehicles where we can use renewable energy sources instead of these conventional sources. By using renewable energy sources such as solar energy, wind energy we can get electrical energyfor further use. In electric vehicles, battery management systems monitor and control the charging and discharging of rechargeable batteries, making the operation more cost-effective. The battery management system keeps the battery safe and reliable while also increasing senility without harming it. Different monitoring techniques are employed to maintain the state of the battery, including voltage, current, and ambient temperature. This addresses the state of charge, health, life, and also the maximu m capacity of a battery. Electric vehicles play an important role because they emit no hazardous emissions and use energy efficiently. Electric vehicles are equipped with a large number of battery cells which require an effective battery management system while they are providing necessary power. The battery installed in an electric vehicle should not only provide long-lasting energybut also provide high power. The most widely used traction batteries are lead-acid, lithium-ion, and lithium-metal hydride. Of these traction batteries, lithium-ion is the most commonly utilized because of its advantages and performance. The battery capacity range for an electric vehicle is about 30 to 100 kWh or more. Battery charging and discharging rates, state of charge estimation, state of health estimation, cell voltage, temperature, current, and other parameters are used by the battery management system to make decisions.

II. LITERATURE REVIEW

Governments all across the world are enacting electric car legislation to reduce reliance on oil, cut greenhouse gas emissions, and improve air quality. Annual global electric car sales have risen steadily in recent years, from just a few hundred in 2010 to over 500,000 in 2015 and over 750,000 in 2016. In September 2015, the global market for electric vehicles hit 1 million units, fast increasing to 2 million units in January 2017. The early market growth for electric vehicles continues, but several barriers prevent their more widespread uptake. The new technology's higher cost, relative convenience in terms of range and charge periods, and customer awareness of the technology's availability and feasibility are among these obstacles. This final criterion,often known as "customer awareness," is critical. The widespread awareness and comprehension of the potential benefits of electric vehicles is crucial to the growth of electric vehicle markets.

Governments at various levels, automakers and dealers, electric utilities, and other groups are all engaging in a variety of programmes to raise customer awareness of electric vehicles. These communication efforts include developing print and online information and tools, organizing public events and workshops, increasing exposure to electric vehicles from the fleet and car-sharing services, developing actionplans for electric vehicle readiness, executing highly visible technology demonstration projects, conducting social media marketing campaigns, and more. These actions are essential because many prospective consumers generally lack a strong understanding of what electric vehicles are, what benefits they offer, the available models, and the associated incentives.

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III. OVERVIEW

A. *Definations*

A battery is a device that converts chemical energy into electrical energy. In electric vehicles mostly lithium-ion batteries are used, as it is a rechargeable battery. They're employed in electronic devices and electric cars.

A battery Management System is an electronic system that is used to obtain maximu m efficiency, Also it protects the battery from operating outside its safe operating area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it, and/or balancing it.

The autonomous vehicle is an electric vehicle that does not require external charging from charging stations.

Electric Vehicles are vehicles that use electrical energy as a primary Fuel.

B. *Properties of Lithium-ion battery:-*

- high-power density
- long life
- low self-discharge
- low maintenance costs
- low environmental impact
- high reactivity

C. *Features of Battery Management System*

- State of charge calculations
- Cell over-voltage and under-voltage protection
- Intelligent battery balancing (passive)
- Battery charger control
- Pack temperature monitoring
- Monitors health of battery pack

IV. COSTRUCTION AND WORKING

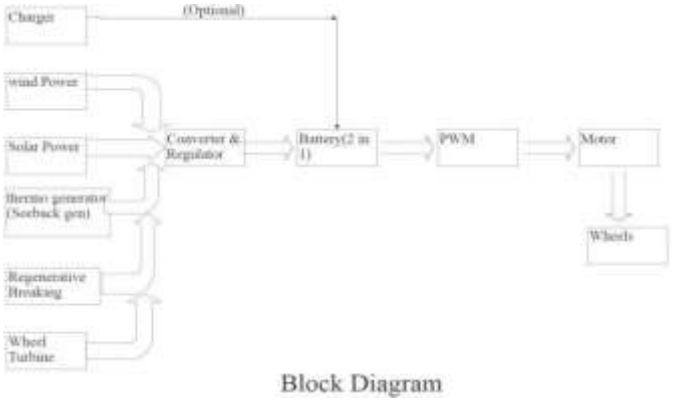

fig.1 Block Diagram of new battery management System

A. *Explanation of Blocks in fig.1.*

- Wind Power- Two blade fans (low solidity), a generator is coupled, aerodynamic resistance, drag force.
- Solar Power - In solar power, the PV panels are connected on the rooftop of the vehicle. By using the solar system, we charge the battery.
- Thermo- Generator - It is also called a see-back generator. It converts the heat energy into electrical energy directing heat in the alternator and rotating parts.
- Regenerative Braking- Regenerative braking (also known as regen) is the conversion of the vehicle's kinetic energy into electrical energy that is stored in the battery and can be used to move the vehicle as well as charge the battery. It can also be utilized to slow down the vehicle by acting as brakes.
- Wheel Turbine - The alternator is coupled to the wheel turbine which generates electricity.
- Converters and Regulators - The AC is converted to DC via the bridge circuit. It's a bridge rectifier that's being employed. The regulator regulated the voltage and current up to a certain limit for charging the battery.
- Battery -Two lithium-ion batteries are combined and form one battery (Automatic continuous chargingand discharging cycles are maintained)
- PWM- The PWM stands for pulse width modulator. The PWM is used for speed control of the motor. By using PWM, high torque can be obtained and the inclination problem can be overcome.
- Motor- Today, majority of the electric cars are utilizing DC motors (4 kW and less power). The induction motor is a well-known type of AC motor. Induction Motors are used in a large number of high-power electric vehicles (above 5kW). In most cases, a vector drive is used to control torque and acceleration.
- Wheels- The motor's power is then transferred to the crankshaft via Wheels, allowing the automobile to travel down steep, winding mountain routes.
- Charging Port- Indian electric cars use the IEC 60309 Industrial Blue connectors and Bharat EV specifications recommend using this plug. The IEC 62196 Type 2 connector is used by all global EVs (commonly referred to as Mennekes). This connector has been designated as an official charging plug throughout the European Union by the European Commission. In our electric vehicle, this charging port is an optional feature.

B. *Construction & Working of Battery Management System*

In this new battery management system, we divide the battery in two half. One half is for charging and the other half is for discharging. For charging, we use renewable energy sources such as solar panels, regenerative braking,regenerative suspension, and so on. While one half is charging, the other half is discharging simultaneously. When the other half is discharged completely, we use the charged portion of the battery, and a discharged portion is kept for charging. Due to this management, we don't require external charging and the vehicle becomes autonomous itself for charging and we are not using two different batteries, so the space problem is not arising. The charging port provided in fig.1. is only if all renewable system fails. At such an incident, we may use charging stations. Also using this system we mayget plenty of power to overcome all the inclination problems of electrical vehicles.

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C. MATLAB Simulation

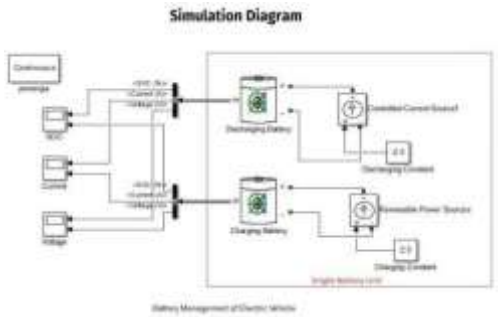

Fig.2.Simulation Model of MATLAB

In this MATLAB Simulation, We combine two batteries according to new battery management System. In this Simulation, We tested its State of Current(SOC), Voltage and Current.

D. Simulation Results

1) State Of Charging (SOC)

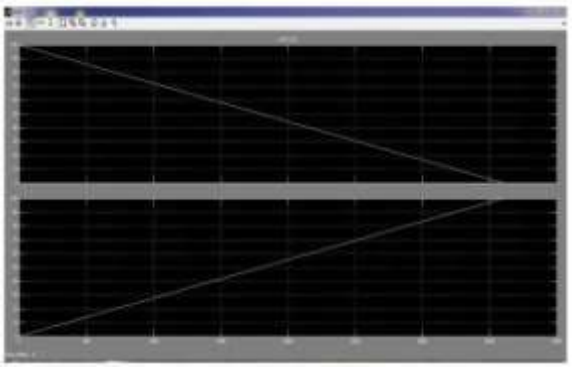

Fig.3.State Of Charging (SOC)

The SOC (State of Charge), current, voltages are the important terms in the battery management system of the electric vehicle. SOC is the presently available capacity in the battery. SOC depends upon the charging and discharging rate.

The upper graph shows the soc of discharging a battery, which decreases from 100% to 0%, while the lower graph shows the soc of charging a battery, which increases from 0% to 100%. We can deduce from the preceding graph that the charging and discharging rates in charging and discharging batteries are the same throughout time.

2) Current

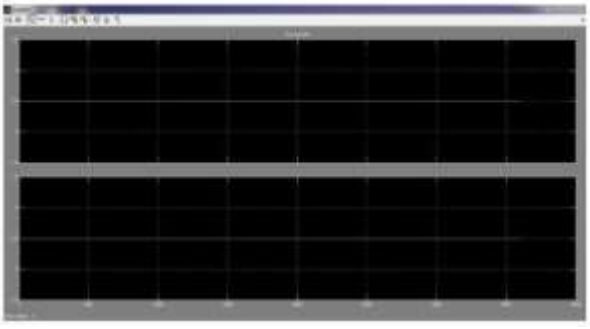

Fig.4.Output Current

The upper graph in the current graph depicts the current during battery charging, whereas the lower graph depicts the current during battery discharge. We may deduce from the graph above that the current used to charge and discharge the battery is the same.

3) Voltage

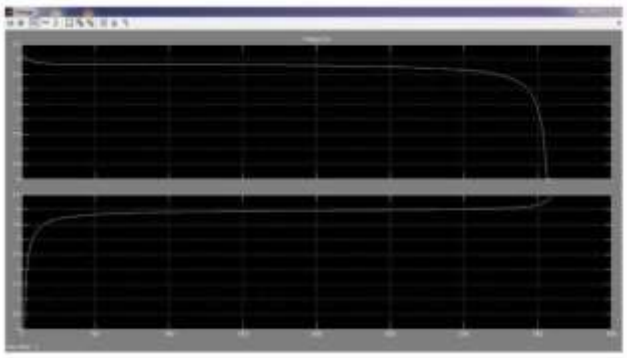

Fig.5.Output Voltage

The upper graph in the Voltage graph depicts the voltage during battery charging, while the lower graph depicts the voltage during battery discharge. The voltage for charging and discharging the battery is the same, as seen in the graph above.

V. ADVANTAGES OF NEW BATTERY MANAGEMENT SYSTEM

1. No need for external charging
2. Not required extra space in Vehicle
3. Efficient Power delivery throughout the system
4. The best way on Inclination problems
5. Makes the vehicle completely autonomous
6. Saves excessive money of charging stations
7. No need to pay extra charges for charging purpose.
8. This is a system that will persist for a long time.
9. Eliminates the need for unnecessary electricity generation, lowering costs.
10. Reduces the use of non-renewable fuel.
11. Environmental and eco-friendly system.

VI. RESULT AND CONCLUSION

We convert normal vehicles into the electrical vehicle because it is pollution-free and it has a low running cost as compared to other types of vehicle. By using a battery management system, we improve the efficiency of the battery. In the battery management system, we combine 2 batteries and form a new battery for the vehicles.

The advanced battery management system can significantly improve the performance of the electric vehicle. The battery management system is a critical component of electric vehicles that promotes guaranteed safety, efficiency, and reliable battery operation. Also, they provide solutions for inclination, Power, and heating problems for electric vehicles.

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