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BMS FOR LI-ION BATTERY PACK USED IN EV

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Abstract— *Battery is that the heart of electrical vehicle and a way of improving the battery life is to equalize the energy of its cells. This will be done by charging the low voltage cells through high voltage cells (active cell balancing). This paper presents a practical approach of active cell balancing along side a quick comparative study of passive and active cell balancing techniques. To enhance the inconsistency present within the series connected lithium ion (Li-Ion) cells, a cell balancing scheme supported forward converter. This cell balancing scheme is predicated on transferring the energy from the over-charged cell to auxiliary battery and from auxiliary battery to less charged cell. The balancing takes place for one cell at a time and therefore the balancing current are often continuously monitored. The proposed battery management system can be used for communicating the faults generated in the battery pack to the controller and correct actions can be taken to avoid the damage to the battery.*

Keywords— battery management system, inverter, lithium ion cells

I. INTRODUCTION

A battery management system (BMS) is any electronic system that manages a chargeable battery (cell or battery pack), like by protecting the battery from operating outside its safe operating area, monitoring its state, calculating secondary data, reporting that data, controlling its environment and balancing it. A battery pack built alongside a battery management system with an external communication data bus may be a smart battery pack. A sensible battery pack must be charged by a sensible charger. Lithium- ion batteries have variety of benefits over the opposite two sorts of batteries, and that they perform well if they're operated using an efficient battery management system.

The purpose of BMS is to make sure that every cell within the series connection has maximum 4.2V across itself in order that the cells remain in healthy and charged condition. This energy balancing is completed using the microcontroller and therefore the algorithm written inside it. The ADC module is employed to sense the analogue voltages on the cells and it's fed to the microcontroller. Inverters are utilized and outsized number of power applications. The function of an inverter is to convert DC power to AC, these are mentioned as Voltage Source Inverters (VSI). A voltage source inverter (VSI) is one that takes during a fixed voltage from a tool, like a dc power supply, and converts it to a variable-frequency AC supply.

II. Literature Survey

2.1 Review of battery management system

In the automotive industry, reducing greenhouse emissions is that the most vital issue. By using electric vehicles, greenhouse emission might be reduced; furthermore, the electricity distribution system would even be affected. One among of the central

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components in an electric vehicle is that the battery, which stores an outsized amount of energy and enables functions like regenerative braking. Additionally, it releases electricity when necessary and supplements slow dynamic energy sources like fuel cells. The most goal for the BMS is to make sure that the battery is usually charged. To realize this goal, an in deapth simulation of the traction system within the electric vehicle and an in death battery model is required to style the BMS.

[1] Yang wenrong et.al:-
The paper describes a sort of BMS aimed toward power Lithium battery within electric vehicle to avoid the issues like energy crisis and environmental pollution, electric vehicles powered by lithium ion batteries are being developed. The battery faces the issues like overcharge, over discharge, without being solved in time this problem not only effect the battery life but also cause accident therefore BMS is important. The test result shows us that the system function smoothly with correct status and Measurement data and software is stable and robust.

[2] J.X. Qiang
The purpose of this is often paper to undertake a review of literature on battery Technology M battery powered electrical vehicle, Hybrid electric vehicles an advance in hardware in loop. Technology and battery management systems has been studied. During this paper, an account of varied topics of battery i.e. batteries for Electrical cars, power backup calculations, etc. Has been taken. The literature review as provided has provided a foundation for secondary data to validate the research obtained during the initial experimentation. The main challenges within the electrical vehicles and Hybrid electric vehicle also are studied and undertaken survey. This survey also describe various battery model like electrochemical model, equipment. Circuit model, simple battery model, superior simple model etc. For better management of performance parameters. This paper provides background for studying battery performance parameters, its management for optimum utilisation and used for electric vehicles.

[3] Mr.Rohit Dhigude
The paper shows review of battery management system in electric vehicle. BMS in an electronic regulator that monitors and controls the charging and discharging of rechargeable batteries. There's operational parameter during charging and discharging like voltage, current and therefore the battery internal and ambient temperature. The necessity of battery utilized in EV shouldn't be overcharged or over-discharged to avoid damage the battery, shorting the battery life and causing fire or explosion. The BMS with the function of battery modelling, battery state estimation, battery balancing, etc. the perfect optimum temperature of EV is 45 degree. In EV there basically used micro-controller for the operation of various parts. It's possible to create complex and effective product at a less expensive price. The appliance of an equivalent for various sort of hybrid vehicle and other battery using application. The BMS utilized in automation industries, automotive industry etc.

III. BLOCK DIAGRAM

The Battery Management System consists of 4 basic blocks mainly the battery pack, MOSFET block, Microcontroller, Inverter,LCD Display,ADC Converter. A battery management system is actually the "brain" of A battery pack; it measures and reports crucial information for the operation of the battery and also protects the battery from damage during a wide selection of operating conditions. They manage the output, charging and discharging and supply notifications on the status of the battery pack. They also provide critical safeguards to guard the batteries from damage. Lithium ion battery cells have two critical design issues; if you overcharge them you'll damage them and cause overheating and even explosion or flame so it is vital to possess A battery management system to supply overvoltage protection Lithium ion battery cells have two critical design issues; if you overcharge them you'll damage them and cause overheating and even explosion or flame so it is vital to possess A battery management system to supply overvoltage protection. Lithium ion cells also can be damaged if they're discharged below a particular threshold, approximately 5 percent of total capacity. Batteries utilized in EVs shouldn't be overcharged or over-discharged to avoid damaging the battery, shortening the battery life, and causing fire or explosions. The battery management system (BMS), with the functions of

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battery modeling, battery state estimation, battery balancing, etc is one among the key points to guard the battery and optimize the use of the battery in EVs. electric battery is a crucial role in electric to stay happening the road, thus the electrical automobile battery pack must be secure from damage due to uneven temperature. counting on the electrochemical utilized in battery, the optimum range is different, but the perfect optimum temperature of electrical automobile battery is 45°C so as to stay the performance and life for the battery.

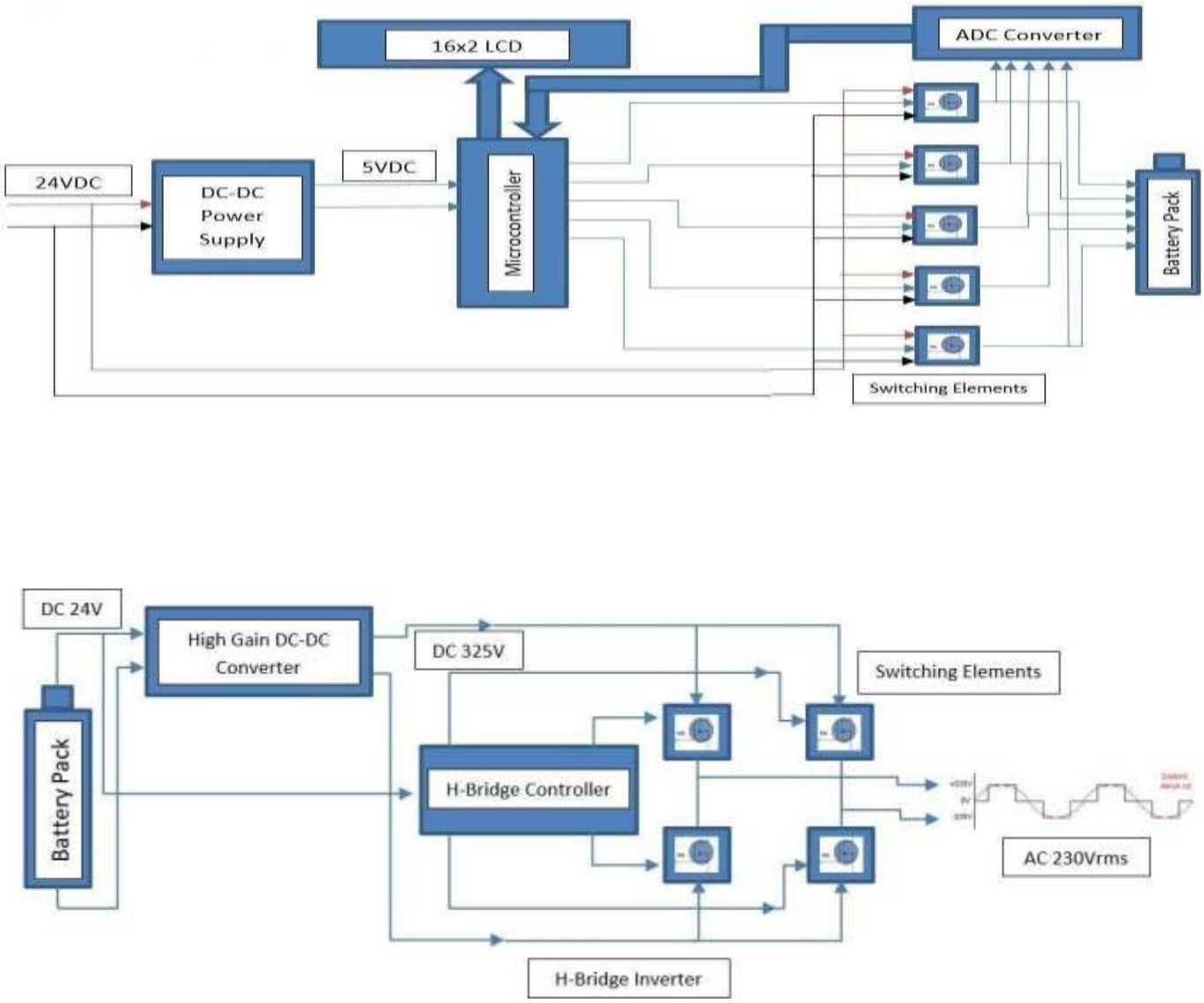

FIGURE 1: Block Diagram of BMS for lithium Battery Pack Used in EV

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IV. CIRCUIT DIAGRAM

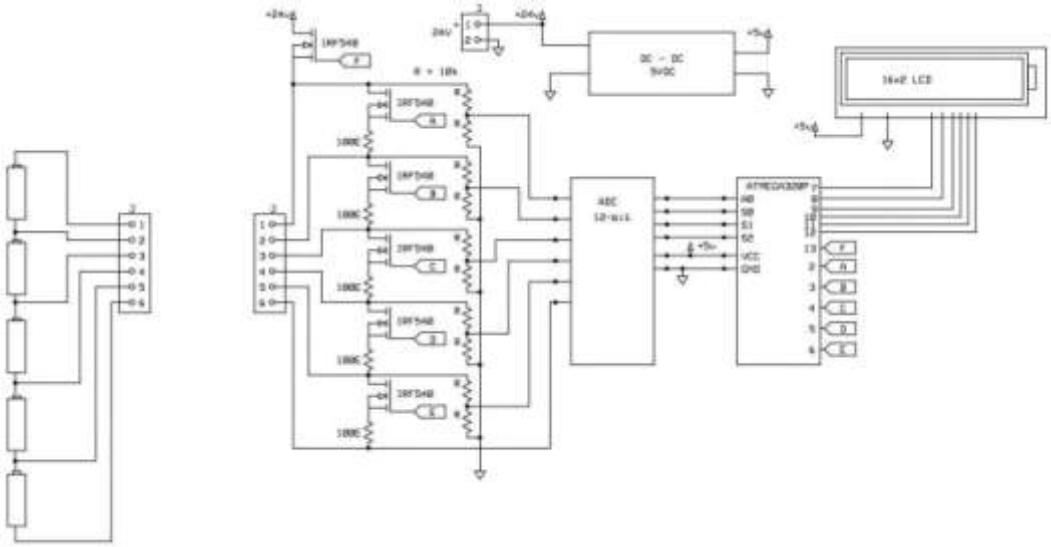

FIGURE 2: Circuit Diagram of Battery Management System

V. WORKING

The above Circuit diagram shows BMS using ATMEGA28P microcontroller .The supply may be a DC to DC converter and converts the available 30V to 5V DC for the microcontroller operation. The aim of BMS is to make sure that every cell within the series connection has maximum 4.2V across itself in order that the cells remain in healthy and charged condition. This energy balancing is completed using the microcontroller and therefore the algorithm written inside it. The ADC module is employed to sense the analogue voltages on the cells and it's fed to the microcontroller. The 5 Li-ion Cells are connected serial and therefore the power MOSFET may be a solid state switch won't to close up the charging. The centre MOSFET are interconnected serial with the 5 cells. 16x2 LCD Display is employed to point the voltages of all cells within the battery pack. The diagram B shows us H- bridge inverter connected to lithium- ion battery pack with high gain DC-DC converter.

VI. COMPONENTS DESCRIPTION

6.1 ATMEGA328P Microcontroller

ATMEGA328P Microcontroller The controller is just like the brain of auto managing all of its parameters. Its controls the speed of charge using information from the battery. The Charge balancing Algorithm is written into this controller which reads the cell voltage levels and switch ON-OFF Middle MOSFET depending upon the algorithm. The Charge balancing Algorithm is written into this controller which reads the cell voltage level and switch ON-OFF Middle MOSFET depending upon the algorithm ATmega-328 is essentially a complicated Virtual RISC (AVR) micro-controller. It supports the info up to eight (8) bits. ATmega-328 has 32KB internal inbuilt memory. This micro-controller features a lot of other characteristics. you ought to even have a glance at Introduction to PIC16F877a (it's a PIC Microcontroller) then compare functions of those two Microcontrollers

6.2 Power Supply

This is a DC-DC Converter and converts the available 30V to 5VDC for the microcontroller operations. The battery pack is charged using external 24VDC source. 5V is formed using this external Source and DC-DC supply block.

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6.3 LCD Display

Since the cells are serial connection their analogue voltage must be converted to the digital equivalent values, this is often done by the ADC module.

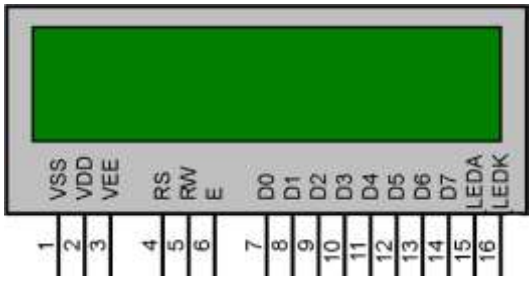

FIGURE 4: 2*16 LCD Display

16x2 LCD Display is employed to point the voltages of all cells within the battery pack. LCD (Liquid Crystal Display) is that the technology used for displays in notebook, TV & other appliances. Like LED and gas-plasma technologies, LCDs allow displays to be much thinner than beam tube (CRT) technology. It displays the Energy Meter reading units and balance.

6.4 Inverter

In this model we used H-BRIDGE inverter with rating 24V input DC with output of (150W/230V).The DC power (24V) given to the battery pack (4.2 x5) connected to high gain DC-DC converter. This high gain DC-DC converter is interconnected with HBRIDGE inverter which provides AC output.

FIGURE 5: Inverter

6.5 ADC 12bit

The number of binary digits (bits) that represents the digital number determines the ADC resolution. For example, a 12-bit. ADC features a resolution of 1 part in 4,096, where 212 = 4,096. Thus, a 12-bit ADC with a maximum input of 10 VDC can resolve the measurement into 10 VDC/4096 = 0.00244 VDC = 2.44 mV. Similarly, for an equivalent 0 to 10 VDC range, a 16-bit ADC resolution is 10/216 = 10/65,536 = 0.153 mV.

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VII. ADVANTAGES

1. High efficiency
2. Lithium-ion battery is compatible for electric vehicles because its self-discharge rate is a smaller amount than half the discharge rate of lead-acid and NiMH batteries.
3. These batteries should never be over charged or under discharge at any circumstance which brings within the got to monitorits voltage and current.
4. Lithium-ion batteries have high charge density and low weight.

VIII. APPLICATIONS

1. Data
2. Hospitals
3. Emergency Lighting
4. Manufacturing Operations
5. Telecommunication
6. Power Utilities
7. Generators

IX. CONCLUSION

In this way, we are developing A battery Management System and controlling supported parameters voltage and current by using ATMEGA28P and Battery monitoring Ic using embedded processing. This project makes it possible to create complex and effective products at a less expensive price. Application of an equivalent for various sorts of hybrid vehicles and other battery using applications. The battery management system are often utilized in automation industries, automotive industries etc. By protecting the battery from operating outside its safe operating area,, monitoring its state, calculating secondary data, reporting that data, controlling its environment, and balancing it. This work first introduced the background of electrical vehicles, lithium-ion batteries and therefore the BMS. the small print of the BMS, including its definition, objectives, functions and topologies were then discussed. The literature on battery modelling and BMS hardware system design were reviewed within the following section. the restrictions of early battery models and therefore the disadvantages of other BMS hardware systems were also reviewed. The objectives and description of this thesis were then presented.

X. FUTURE SCOPE

Many battery models don't simulate of the discharging behaviour of actual batteries. When batteries are nearly fully discharged, and therefore the load is faraway from the battery, the voltage of the battery will increase; when the load is connected to the battery, and therefore the current resumes, the voltage of the battery will drop to the par value. Such discharging behaviour should be simulated in future battery models. In addition, the performance of battery models might be further improved. to enhance BMS hardware systems, a way might be created to permit the BMS to speak with vehicle controllers and other sub-systems within the vehicle, like the motor controller. additionally, a protection device might be added to the system to modify off the battery pack when it operates out of its SOA. Furthermore, the cell-balancing function might be improved. A BMS could then be developed to be used in electric vehicles.

XI. ANALYSIS AND RESULT

This work first introduced the background of electrical vehicles, lithium-ion batteries and therefore the BMS. the small print of the BMS, including its definition, objectives, functions and topologies were then discussed. The literature on battery modelling and BMS hardware system design were reviewed within the following section. The limitations of early battery models and therefore the disadvantages of other BMS hardware systems were also reviewed. The objectives and description of this thesis were then presented.

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