Smart Impact Assessment of Hybrid And Battery Management System For Electric Vehicles

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Abstract- *Electric Vehicle technology plays an important role in greenhouse gas limitation and carbon pollutions. Rechargeable batteries are used to deliver power to the auxiliary systems and motor in the electric vehicle applications. Various classifications of rechargeable batteries are available nowadays, for electric vehicle applications. Among all rechargeable batteries, Batteries will give high efficiency for electric mobility because It have low self-discharge rate, wide operating range, maximum energy density and high life cycle. To improve the quality of battery and safe operation, battery management system is employed and it plays a vital role in application of Electric Mobility. This project reviews the attributes of battery management system and its technology with advantages and disadvantages for electric vehicle application. This project includes the battery voltage monitoring, state estimation, fault analysis, data acquisition and solar panel charging to improve the performance of battery for EV applications.*

Keywords: Electric vehicle, Batteries, IoT, Self-discharge, battery management.

I. INTRODUCTION

In the most recent decade, two critical issues developed in the wording of vitality all through the world. The first one is running out of limited petroleum in the near future and the other one is carbon discharge result in a worldwide temperature alteration. Numerous nations at this time rely vigorously on oil, coal and aerosolized gasoline for its energy source. Petroleum derivatives are non-renewable. Non-renewable energy sources are non-sustainable, they draw on restricted assets which will, within the future, diminish, turning into expensive or too earth harming, creating it not possible to recover Charging these electric vehicles causes an additional load on the national power grid and, as a result, an enormous load shadow experience for the people of the country. It is, therefore, necessary to recharge these EVs from an alternative energy source such as the country's renewable energy resources. Of all renewable energy sources in Bangladesh, solar energy has the highest potential. Therefore, Solar Charge Station (SCS) is a sound solution to this problem.

II. LITERATURE SURVEY

M.. Senthilkumar; K.P. Suresh; T.Guna Sekar; C. Pazhanimuthu proposed on efficient battery monitoring system for e-vehicles Battery monitoring system for E-vehicles is an emerging area in the field of automobiles and electricity. The BMS will also order the reviving of the battery by readdressing the improved energy back into the battery pack. It is used rummage-sale only for dealing the charging and discharging of battery. With our proposed system, the battery management system can be integrated with the monitoring structure which is capable of both managing, monitoring and logging the data to an online database.

Matteo Corno; Gabriele Pozzato proposed on active adaptive battery aging management for electric vehicles The battery pack accounts for a large share of an electric vehicle cost. In this context, making sure that the battery pack life matches the lifetime of the vehicle is critical. The present work proposes a battery aging management framework which is capable of controlling the battery capacity degradation while guaranteeing acceptable vehicle performance in terms of driving range, recharge time, and drivability. Extensive simulations demonstrate the advantages of the proposed strategy against a trivial strategy and an offline benchmark policy over a life of 200 000 (km).

Chaladi S Ganga Bhavani; D Ravi Kishore proposed on Battery protection scheme integrated with demand side management in standalone hybrid micro Energy produced from conventional sources like coal and diesel is inadequate due to ever increasing demand for power. Generation of power from renewable energy sources to meet the gap of supply and demand is intermittent in nature. Hence there is need for storage of energy from renewable sources to ensure continuity of supplyEnergy management involves coordination of sources and loads for maximum utilization of available power. This thesis deals with some aspects of monitoring, charging and source/load management, of a BMS. In particular,

monitoring of battery from the source side is examined for online determination of SOC and SOH.

Akihiko Kawashima; Tatsuya Suzuki, Shinkichi Inagaki proposed on Model predictive charging control of in-vehicle batteries for home energy management based on vehicle state prediction, this paper presents an integrated strategy for charging control of in-vehicle batteries that optimizes the charge/discharge of in-vehicle batteries in a receding horizon manner exploiting the predicted information on home power load and future vehicle state in the household. The prediction algorithm of future vehicle state is developed based on semi-Markov model and dynamic programming. Effectiveness of the proposed charging control is demonstrated by using an experimental test bed.

Moga Natha Shankar Kumar; Karthikeyan Balakrishnan proposed on Functional safety development of battery management system for electric vehicles Here Functional safety plays a very important role to design a BMS system and mitigate those hazards to make a trouble free BMS systems.Since BMS is a critical safety E/E system in automobile, this paper discuss an options for developing trouble free BMS systems in accordance to ISO 26262 methodologies, how hazards are differed from gasoline power trains to electrical systems and its risk assessments, higher level and lower level safety requirements and its implementations. And also a higher level architecture for battery management systems, assumptions, warning and degradation concept and conclusions made based on the requirements and application.

III. METHODOLOGY

The process will be equipped with one small electronics unit which consists of Micro Controller, power supply, battery, solar panel, voltage sensor, relay, motor and IOT module. By using voltage sensor we can monitor the voltage level of the batteries. This EV contains two batteries. When the main battery drains, this system will use the backup battery through relay. Solar panel is used as a source for backup battery. If two batteries get drain or fault, this intimation and location will update to webpage via IOT module, then the alert message will sent to family member.

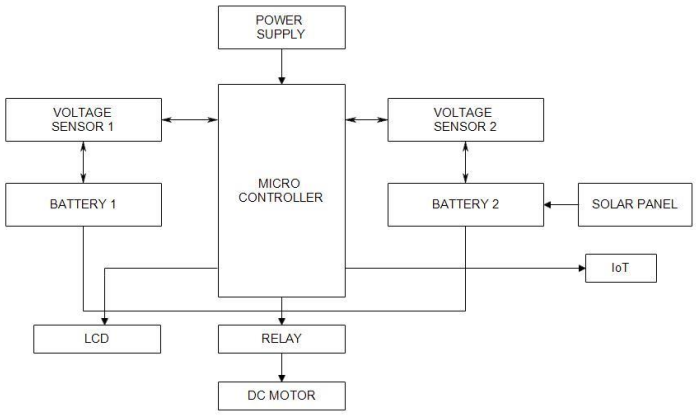

Fig.1 Block Diagram

IV. WORKING

In this system a microcontroller is connected to batteries through a voltage sensor. Each battery has separate voltage sensors which is used to monitor and measure the voltage which is then sent to the MC and displayed in LCD. The basic information of location and the level of charge in battery are updated in the webpage via IoT. Alert message is sent to family member.When the battery drains backup battery is connected automatically through relay. Solar panel is used as a source for backup battery

V. HARDWARE DESCRIPTION

1) ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules.

Fig.2 ESP32

2) DC VOLTAGE SENSOR

DC Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This can be used to measure the DC voltage in the circuits. The sensor is mechanically fixed by soldering the secondary circuit pins to the PCB. The primary connection can also be integrated in the sensor. Pulsating voltage with a galvanic insulation between primary and secondary circuits. The voltage detector indicates the presence of a voltage higher than a limit. The Voltage Sensors are equipped with a micro controller that greatly improves the sensor accuracy, precision and consistency of the readings.

Fig3. DC voltage sensor

3) RELAY BOARD

Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. They were used to switch the signal coming from one source to another destination. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

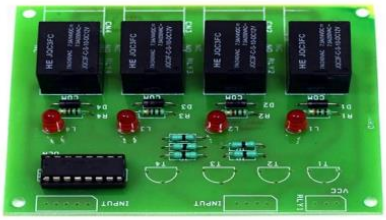

Fig4. Relay board

4) LCD DISPLAY

A 2*16 LCD means it can display 2rows and 16columns. In this LCD each character is displayed in 5*7pixel matrix. The 2*16 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD used to display the results of conditions.

Fig.5 LCD Display

5) DC MOTOR

Geared dc motors can be defined as an extension of dc motors. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. A DC motor can be used at a voltage lower than the rated voltage. But, below 1000 rpm, the speed becomes unstable, and the motor will not run smoothly.

Fig.6 DC Motor

6) BATTERY

A battery is a device that converts chemical energy directly to electrical energy. Batteries are classified into two broad categories, each type with advantages and disadvantages.

- Primary batteries irreversibly (within limits of practicality) transform chemical energy to electrical energy. When the initial supply of reactants is exhausted, energy cannot be readily restored to the battery by electrical means.
- Secondary batteries can be recharged; that is, they can have their chemical reactions reversed by supplying electrical energy to the cell, restoring their original composition. Some types of primary batteries used, for example, for telegraph circuits, were restored to operation by replacing the components of the battery consumed by the chemical reaction. Secondary batteries are not

indefinitely rechargeable due to dissipation of the active materials, loss of electrolyte and internal corrosion.

Fig.7 Battery

7) IoT

The Internet of things (IoT) is the network of everyday objects — physical things embedded with electronics, software, sensors, and connectivity enabling data exchange. Basically, a little networked computer is attached to a thing, allowing information exchange to and from that thing. Be it lightbulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, automobiles, or anything else around you, a little networked computer can be combined with it to accept input (especially object control) or to gather and generate informational output (typically object status or other sensory data). This means computers will be permeating everything around us — ubiquitous embedded computing devices, uniquely identifiable, interconnected across the Internet. Because of low-cost, networkable microcontroller modules, the Internet of things is really starting to take off.

8) SOLAR PANEL

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Solar panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions. Solar modules use light energy from the sun to generate 5W power through the photovoltaic effect. Efficiencies of solar panel can be calculated by MPP (Maximum power point) value of solar panels. It is a capacity of the solar panel and the higher value can make higher MPP. These panels are designed for the most rugged off grid applications.

Fig.8 Solar panel

V. SOFTWARE DESCRIPTION

1) Arduino Software (IDE)

The Arduino UNO can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.They differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the programmed as a USB-to-serial converter.

2) Embeded C

Embedded C is designed to bridge the performance mismatch between Standard C and the embedded hardware and application architecture. It extends the C language with the primitives that are needed by signal-processing applications and that are commonly provided by DSP processors. The design of the support for fixed-point data types and named address spaces in Embedded C is based on DSP-C. The Embedded C specification extends the C language to support freestanding embedded processors in exploiting the multiple address space functionality, user-defined named address spaces, and direct access to processor and I/O registers. These features are common for the small, embedded processors used in most consumer products. The features introduced by Embedded C are fixed-point and saturated arithmetic, segmented memory spaces, and hardware I/O addressing. The description we present here addresses the extensions from a language-design perspective, as opposed to the programmer or processor architecture perspective.

VI. VERIFICATION AND RESULTS

The main aim of our project is to assess the impact caused while switching the batteries in Electric Vehicles.V1 and V2 refers the voltage of battery 1 and battery 2 .Initially the load operates with battery 1, when the voltage of battery 1 gets drained fully the load is then operated through battery 2 ,the switching between the batteries is done automatically with the help of relay. The level of both the batteries and the location will be updated in IoT web page .Real time sensor values are stored and can be downloaded.

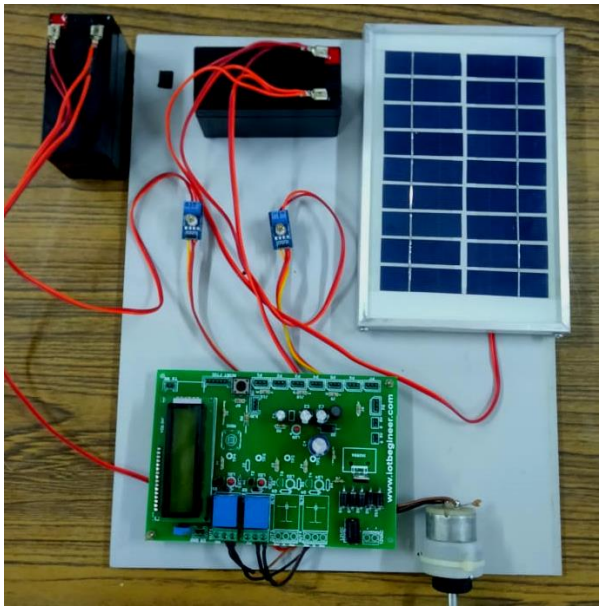

Fig.9 Hardware Prototype

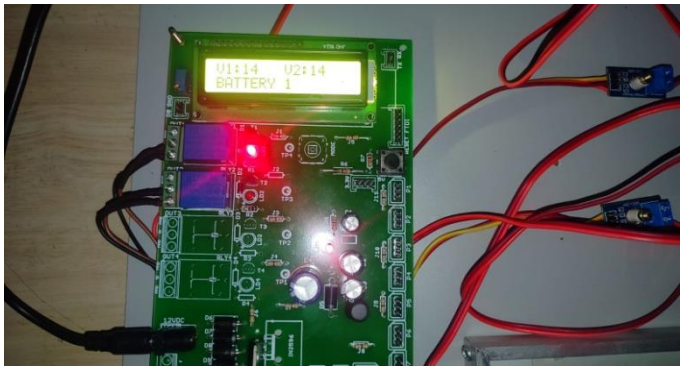

Fig.10 LCD Display Output when battery 1 is ON condition

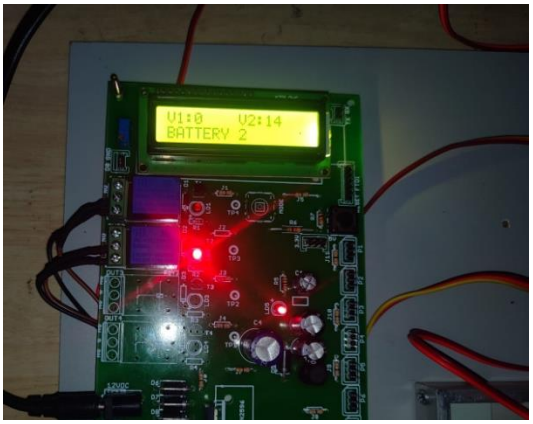

Fig.11 LCD Display Output when battery 2 is ON condition

WEB SERVER RESULT

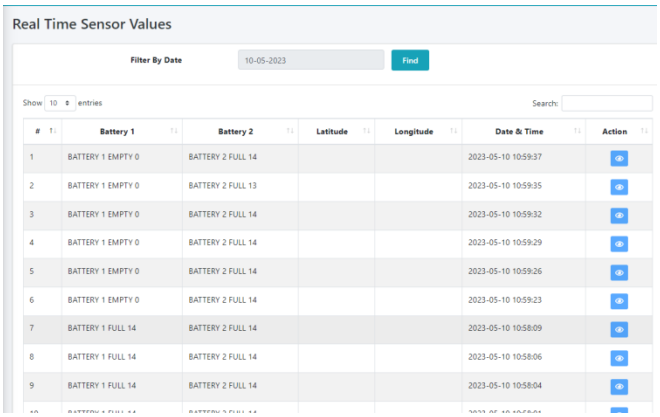

Fig.12 Real time sensor values

VII. CONCLUSION AND FUTURE ENHANCEMENT

These systems providing useful solution while making the Battery management system for Electric vehicle by using IOT. The cost of the system is less and it gives the reliable output as compared to another system which useful for society. To have safe and It is mainly implemented on a long scale for the better results and problem free solutions in the future.

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