

A Review on Internet of Things Based Battery Monitoring System for Electric Vehicle

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Abstract: Due to high electricity density and lengthy lifestyles, lithium-ion batteries are in general desired for electric automobiles. Lithium ion battery existence cycle may be shortened by means of a few reasons consisting of overcharging and deep discharges. Overcharging battery now not only ought to considerably shorten the existence of the battery, however also cause a critical injuries which includes fire. Therefore, a battery tracking machine for EV that can notify the consumer approximately battery circumstance is vital to save you the issues. This context is primarily based on one-of-a-kind strategies of battery monitoring such as ESP Module Method, Coulomb Counting Method, RTC Module, Bluetooth Module.

Keywords: Lithium ion battery; Battery monitoring; State of Charge; Wi-Fi Module; Electric Vehicle.

I. INTRODUCTION

In the early 20th century the usage of the electric batteries to power the automobile became famous. The fossil fuel created large pollutants because of the carbon emissions. And additionally they're non-renewable and are depleting. And as a consequence at the start of 21st century humans are looking for trade energy assets to power the automobiles [1]. Nowadays, electric automobile (EV) is becoming famous for the reason that gas prices becoming extra high priced [2]. As these electric automobiles are free from pollution emission the arena is seeking to make transportation discipline electrified [3]. EV produces excellent benefits in phrases of electricity saving and environmental safety. Most EVs used rechargeable battery that is lithium ion battery [2].

Lithium-ion (Li-ion) batteries are great energy supply and strength storage gadgets because of excessive strength density, energy density, low renovation requirement, low self-discharge, and no reminiscence impact [4]. According to the buyer of EV, the main problem with EVs is the restricted potential of battery and charging infrastructure availability, which leads to a diffusion of issues like drivers are afraid to pressure an electric vehicle for some distance distances [3]. Some present electric vehicle battery tracking structures can't be controlled in real time, such as their actual vicinity, external temperature situations, physical damage, battery temperature, battery discharge voltage, discharge present day, State of Charge (SOC) [5]. Battery monitoring gadget is an software platform for the monitoring the batteries performance and expected time for charging and discharging battery for at gift load situations. It is used for real time tracking the overall performance of batteries. The battery control device is used to look the repute of charging and discharging activities of batteries regularly and additionally having ancient data concerning batteries overall performance. By using historical facts clean to analyses the situation of batteries [6].

There are several techniques to estimate the fitness of battery by using voltage, current, temperature. In maximum of the instances, State of Charge (SoC) of battery is envisioned and via the usage of predication algorithms, health situation is forecasted. A prototype to degree voltage, temperature and SoC of the battery by means of using ESP8266 module is proposed in [1]. The characteristic of the SIM808 GSM/GPRS/GPS module turned into tested to decide the accuracy of the GPS coordinate to reveal the battery status is developed in [2]. An wise manipulate mechanism proposed in [3] to lessen motive force's variety anxiety. With the help of coulomb counting based controller, battery charging overall performance is advanced. A novel cloud-primarily based battery circumstance monitoring platform for large-scale lithium-ion (Li-ion) battery systems [4].

The essential controller STM32F103C8T6, there are positioning and statistics transmission modules with AIR800E because the core, voltage tracking and energy balance module with LTC6804 envisioned in [5]. Intelligent device learning algorithms may be used to are expecting the existence cycle of the battery this proposed in [6]. The IOT structure, which became developed the use of a Firebase platform in [7]. A prototype for 88 lithium-ion battery cells is optimally designed and carried out in [8].

IoT sensors can also be used to decide the State-of-Charge (SoC) in EVs by using facts-pushed methods and cloud computing services [9]. For tracking rechargeable Li-ion batteries with Wi-Fi conversation structure is proposed [10]. The layout and development of Power saver that is used for battery monitoring and analysis of an android primarily based system is proposed in [11]. The evidence of the small size of message information by the use of the MQTT protocol on IoT-based communications in [12]. The facts of battery monitoring are displayed on Personal Computer (PC) with LabVIEW programme and android phone is developed in [13]. The hardware prototype of the proposed system has been developed and examined with a lead acid SMF battery [14]. Battery tracking gadget based on net of things (IoT) has been evolved to monitor the operational and performance of batteries in a smart microgrid device [15].

II. BATTERY MONITORING METHODS

- 1) ESP Module Method
- 2) Coulomb Counting Method
- 3) RTC Module
- 4) Bluetooth Module

1. ESP Module Method

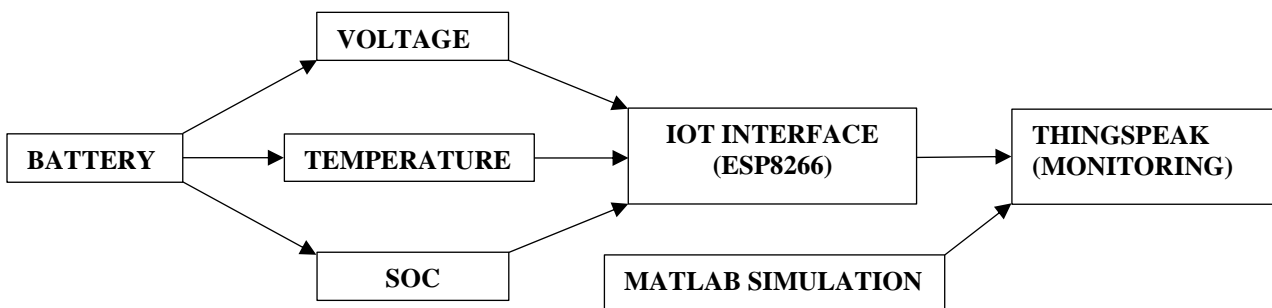


Fig.1 Block Diagram for Battery Management System

Figure 1 explains block diagram for battery control machine. In the battery control device the voltage, state of price (SoC) and temperature of a lead acid battery is measured. The measured values are sending to the IoT platform Thingspeak. This IoT connection is finished by means of using the ESP8266 module. The program to this module is fed by means of the usage of the arduino software. To degree the voltage a voltage division circuit is used, 12V from the lead acid battery is split as 8.7V and three.3V. This 3.3V is fed to the ESP8266 module.

The SoC is discovered out by way of converting the voltage to percent, because the SoC is continually stated in percent. The temperature measured is the outside temperature of the battery, due to the fact the internal temperature may be very tedious technique. Temperature is measured by means of the use of the DHT sensor; it consists of a thermistor in it. Finally a majority of these parameters are monitored with the aid of the use of Thingspeak, the real time values get up to date for each 15 seconds [1].

2. Coulomb Counting Method

Fig. 2 clearly describes the running method of controller. In present day device, coulomb counting method is used, because of its low complexity and simplicity. Primarily, coulomb counting calculation method is primarily based on included cutting-edge and quantity of charge that must be delivered by using sensing enter and output of the battery. It operates by using introducing an energetic glide through the years to achieve the whole amount of electricity that goes into or out of the battery. As a result, there is a kaoticism measured in ampere hours. Obviously, if the contemporary size is correct, the technique is dependable. It applies to all batteries used in the EV utility [3].

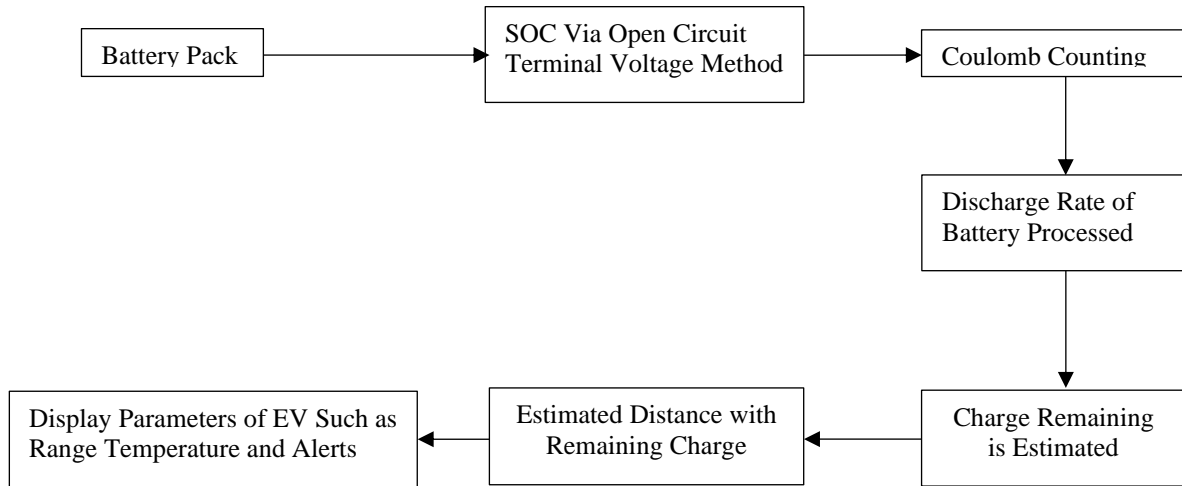


Fig. 2 Coulomb Counting Method

3. RTC Module

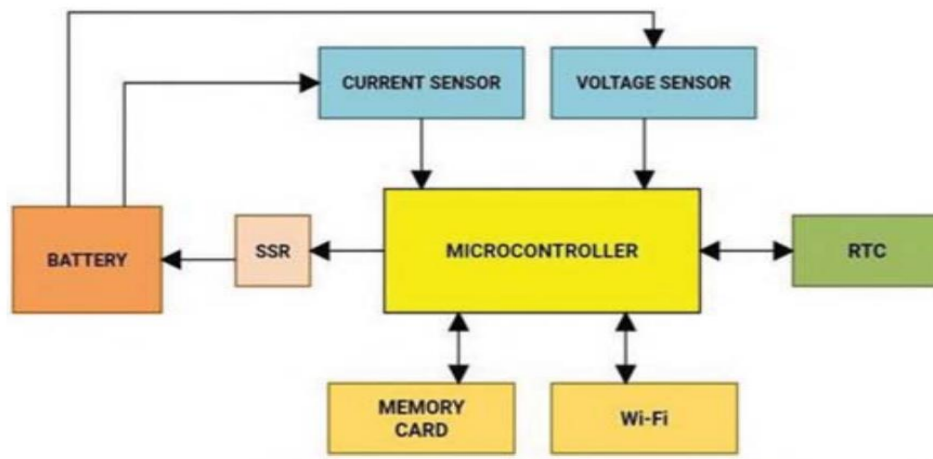


Fig. 3 Block Diagram of Battery Monitoring System

The block diagram includes a strength deliver (and the unit being monitored), tracking segment logging section and manage section. The monitoring segment includes a Voltage sensor and a Current sensor which measures the voltage of the battery and the present day flowing from/to the battery whilst linked to a closed circuit. The output of those sensors is an analog information which is then transformed into a virtual records using the microcontroller’s analog to virtual convertor. 250 samples are taken and common is observed. The common information is processed within the microcontroller and logged. Wi-Fi module is used to connect to to be had predefined SSIDs. The RTC module is used to find the time in order that Wi-Fi networks can be searched every. A hours therefore saving electricity usage. The control segment is a relay circuit which is tripped when the consumer fails to pay the monthly lease [6].

4. Bluetooth Module

The advanced wireless battery monitoring machine is consisted some components and software program, i.e., sensors, microcontroller ATMEGA 328 (Arduino Uno), Bluetooth module, PC, Android Smartphone, LabVIEW Progaming and App Inventor. Fig 4 suggests experimental layout of WBMS for battery trying out.

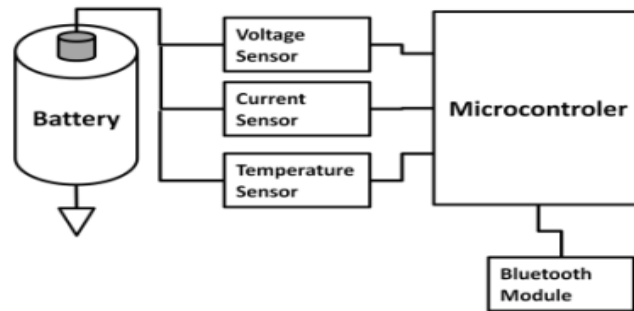


Fig. 4 Layout of Wireless Battery Monitoring System

A. Sensor

A voltage divider module (DFR0051) changed into decided on as voltage sensor. The DF-Robot voltage divider module is constructed based totally on resistor divider precept. The DFR0051 can discover the supply voltage up to twenty-five V. Current Sensor (ACS712- 05B) operates based at the principle of Hall-Effect. It gives output sensitivity of 185mV/A (at +5V power supply), and might degree modern-day up to $\pm 5A$ [13].

B. Microcontroller

Microcontroller ATMEGA 328 (Arduino UNO) changed into used to expand this machine. It has 14 digital enter/output pins (of which 6 may be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a energy jack, an ICSP header, and a reset button. It carries the whole thing needed to guide the microcontroller; without a doubt join it to a pc with a USB cable or energy it using an adapter (AC-DC converter) or battery to get started out [13].

C. Bluetooth Module

Bluetooth community is one of the maximum critical player on wireless conversation. It has a quick-variety wireless era that operates inside the 2.4GHz band, low cost and low energy generation. A Bluetooth module HC-06 became selected for this test. It can be linked to 3.3 to 5 VDC energy deliver and with TX and RX for controlling [13].

III.CONCLUSION

Internet-of-the-Things (IoT) enabled monitoring and manipulate of ESSs for EVs is look at. Battery monitoring system for electric powered automobiles can be used to monitor the actual time fitness of the batteries present in electric powered automobiles, bikes or trucks. It paves a manner via aggregating records from batteries and other such resources to a common place for analysis and applications. This may be further prolonged to houses and industries which use large batteries for backup power and other industrial applications to expect the existence of batteries and improve it. By understanding the lifestyles in advance, it would better be for well timed substitute of the components with out disrupting the every day work of someone/industry.

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