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# Android Based Battery Monitoring System for Lithium Ion Batteries Used in Electric Vehicles

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**ABSTRACT**: For safe and reliable operation of lithium-ion batteries on electric vehicles (EVs), the online monitoringof the batteries is necessary. To make it convenient for owner of the vehicle to monitor the battery status of their vehicles anytime and anywhere, here in this paper a real-time Android-based monitoring system for lithium-ion batteries on Electric Vehicles is designed, which achieves an integration monitoring system of batteries, phones, computers for owners and repairs. The system is composed of an on-board monitoring device, android phone client, web based application. Web based application collects and displays the batteries operation parameters through Cloud Server Link. To verify the feasibility of the real-time monitoring system we present Prototype. Results show that the batteries data is transmitted to owner's phone and displayed on it through web based Application, which could help users monitor the batteries status conveniently.

**KEYWORDS:**Electric Vehicles, Web Based Application, Lithium ion batteries, On-board monitoring device.

## I.INTRODUCTION

With the problems of energy and environment becoming more and more serious, electric vehicle becomes a kind of new, fast-developing vehicle in the latest years. As the core of developing EVs, the power battery packs are getting more and more important. Lithium-ion battery has been a preferred choice for the packs because of its merits in the power characteristics. However, the power lithium-ion battery on EVs have high capacity and large serial-parallel numbers, which, coupled with such problems as safety, durability, uniformity and cost, imposes limitations on its wide application. For reliable and safe operation of lithium-ion batteries on EVs, the battery management system plays a vital role with the functions of states estimation, cell balancing, thermal management etc.

In our system, battery operating parameters, such as voltage, current and temperature, was collected and displayed on the android phone by an on-board monitoring device with Web Based Application. The android phone displayed the data in user-friendly interactive interfaces. By this way, users could access the batteries information almost everywhere in time only by a phone. Meanwhile, with the design of the Web Based Application, the data could be uploaded to the cloud and analysed for estimating the battery states, which helps the repairers remotely monitor and maintenance, and thus reduces the occurrence of accident.

## II. LITERATURE SURVEY

Many Researches has been done on Battery Management System(BMS) and Battery Monitoring System. Compared to Battery Management System Battery Monitoring System is software design based on BMS. Rahimi-Eichi and Habiballah[1] in their paper gave a brief introduction to the composition of the battery management system (BMS).They says BMS in vehicles is comprised of kinds of sensors, actuators, controllers which have various algorithms and signal wires. Their main task is to protect the cells and battery packs from being damaged and to make the batteries operate within the proper voltage and temperature, but here the key issue is battery cell voltage

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measurement. Small drop in each cell voltage gives larger voltage drop in the entire battery pack, so accurate values of battery parameters cannot be obtained by this method hence this method is not appropriate one.

Karmore, Swapnili P, A.R.Mahajan[2] proposed battery monitoring system which is capable of sensing and monitoring capability of battery of mobile phone, which is used to indicate the battery conditions in any numbers of standby powers. The main aim behind the research work is the design and development of Power saver. It consists of two modules that is Start profiler and Installed application list. Start profiler starts the application and gives the Stat, pie, chart view of the battery voltage and installed application gives the list of all the applications in the device with percentage battery usage. Powers aver is used for calculation of battery consumption. Luo,Min,et al[3] Proposed a novel online battery monitoring system based on GPRS for electric vehicles. It divided the traditional battery management system into two parts. One part is the online monitoring terminal with GPRS date transmitter unit settled in the EVs to measure the voltage, current and temperature, and the other one is an upper computer with a battery online monitoring system software but in this system, the monitoring software is designed on a fixed PC, which restricts applied range of monitoring system. Besides, the batteries information is transmitted to an upper computer through the GPRS communication in a slow rate.
Thus,to solve the above problems, this paper proposed a novel real-time monitoring system for the power lithium-ion battery used on EVs based on android smart Phone.

## III.METHODOLOGY

The system is composed of four parts: an on-board monitoring device with various sensors for collecting and sending batteries data, an android phone to be a monitoring centre for receiving and displaying batteries information, a Web based application for analysing these data by complex algorithm to estimate battery states and thus give accurate advice for repairers to maintenance or change, and the wireless communication network. The system structure is shown in Figure 1. Between the on-board monitoring device and the android phone, a Web based application is designed to transport real-time batteries information. This Web based application is easily accessible on android phone. Android client collects and directly displays the batteries information through the Web Based Application.

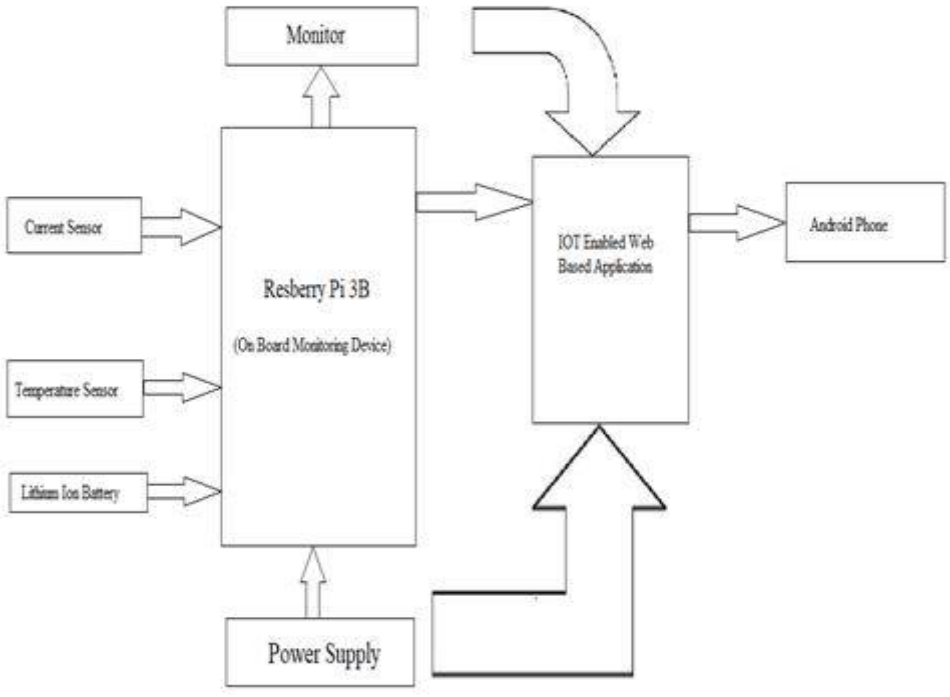


Fig 1. System Structure

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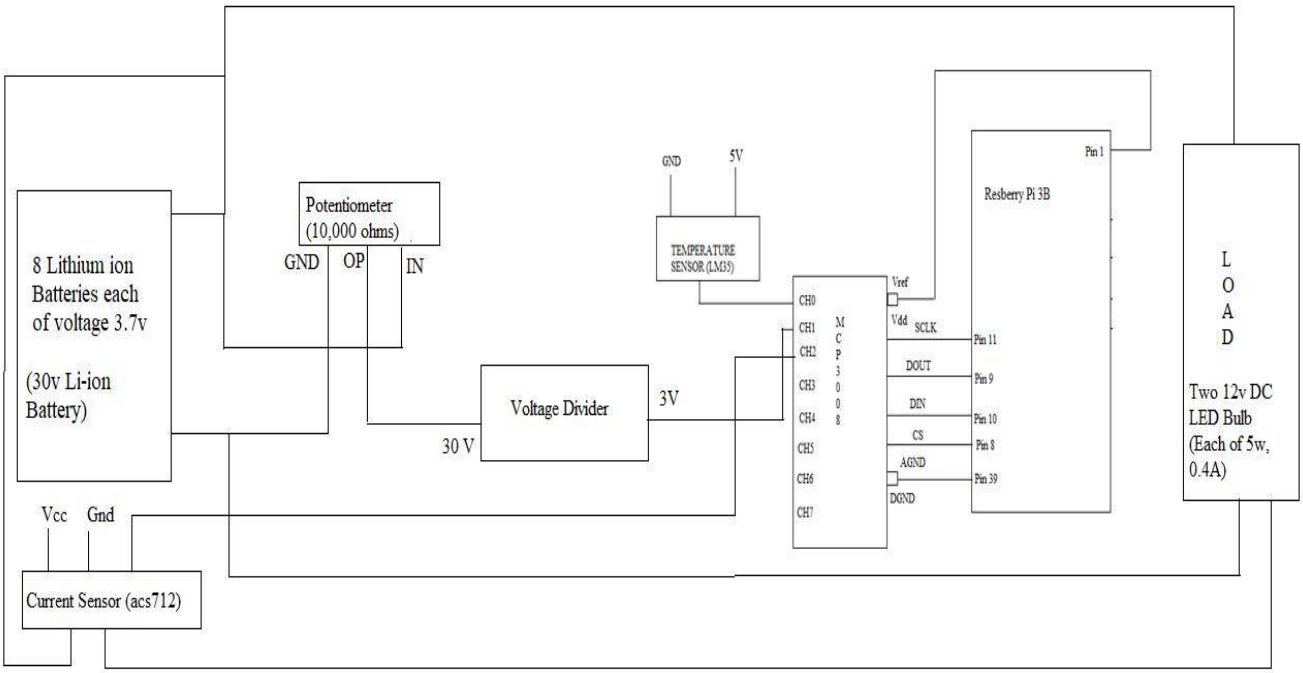


Fig 2. Circuit Diagramof Proposed System

In the Proposed System we are using 8 Series Lithium ion batteries each of 3.7 V nominal Voltage. Voltage Divider Circuit step down the voltage of Lithium ion Battery. Various Sensors such as temperature Sensor (LM35) and Current Sensor(acs712) are used to measure Battery temperature and current. Analog To Digital Converter(MCP3008) is used to convert Analog battery parameter values such as Voltage, Temperature, Current to Digital Values and these values Collected on On-board monitoring Device that is Raspberry Pi 3B through interfacing of ADC with the Raspberry Pi.

Potentiometer (10K) is used to Control the battery Voltage. Web Based Application is designed to display the Battery Information. Load is connected to Collect Battery Information when it is in use. Python language is used to display the battery Parameters and to design the web Based Application.

## IV. RESULT AND DISCUSSION

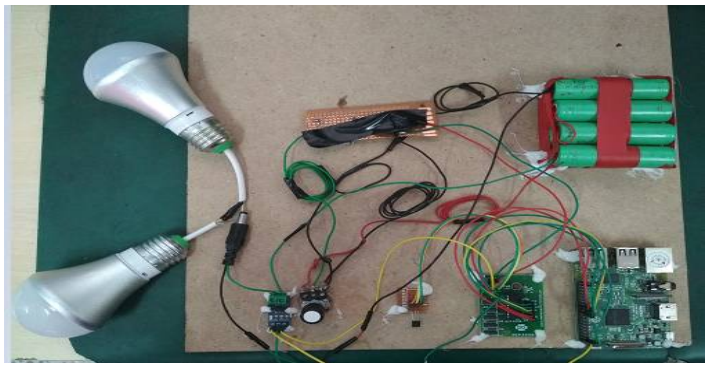

Fig 3 Implemented Prototype

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In the fig 3, it shows Implemented Prototype with all the hardware assembled and Fig 4 Shows Values of Voltage, Current and Temperature of Lithium ion battery When it is Connected to Load.

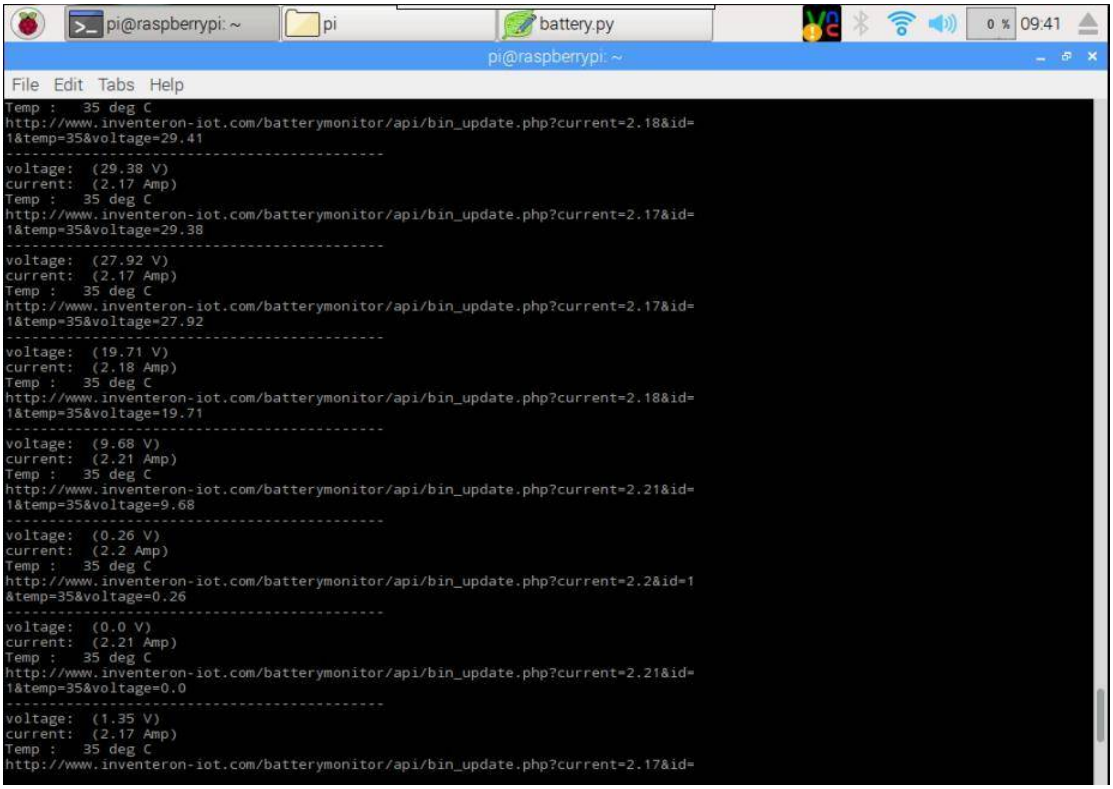


Fig. 4 Battery parameter Values Without Load

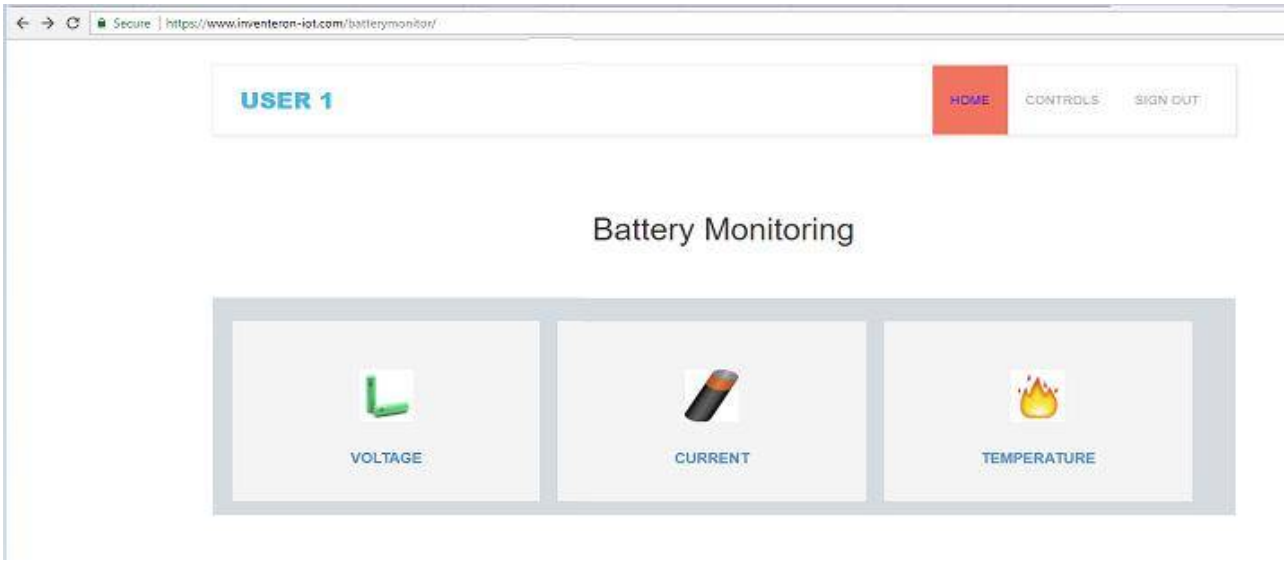

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Fig. 5 Web Based Application

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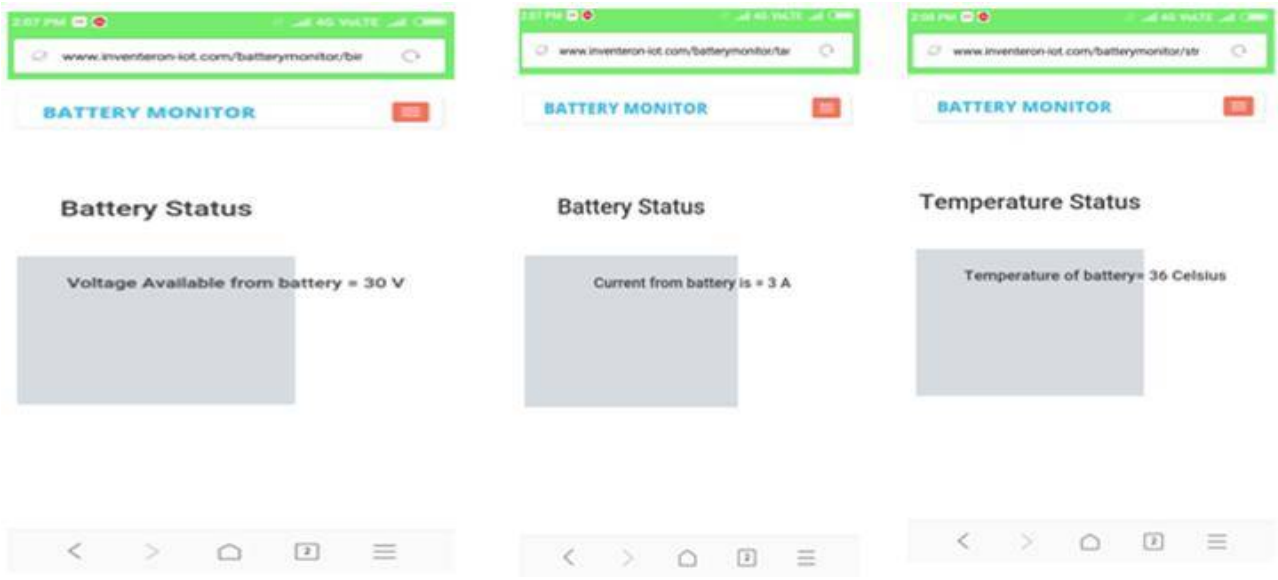


Fig. 6 Battery Parameter Values from Web based application

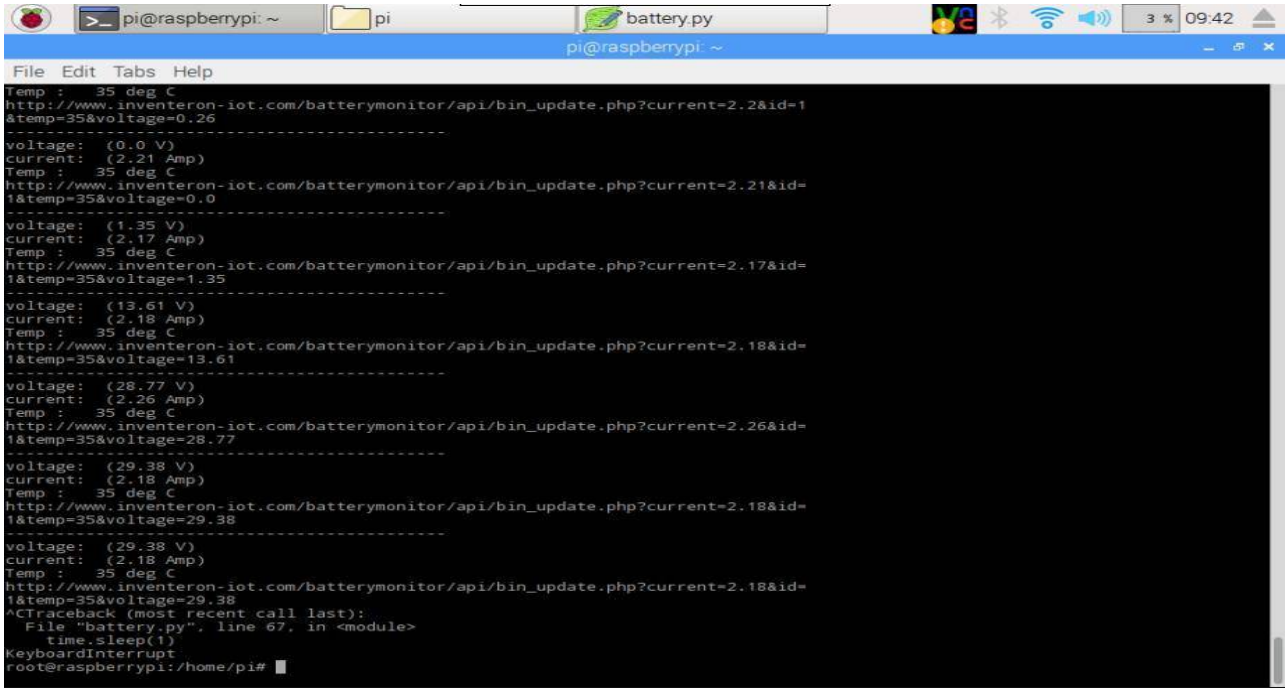


Fig. 7 Battery Values With Load

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Fig 5 shows the Web based Application designed window consisting of status of Voltage, Current and Temperature of Lithium-ion batteries. Fig 6 shows status of each parameter separately and Fig 7 shows battery Parameter values when it is not driving any load.

## V.CONCLUSION

A Lithium-ion batteries real-time monitoring system was proposed based on the on-board monitoring device with various Sensors connected to it, android smart phone with Web based Application displays Battery Parameter Values with and Without Load. It can collect and display the voltage, current, temperature parameters of batteries by a phone. An actual Prototype was designed and has proved the system being feasible. Future work of this will be done on exact determination of the batteries states through data analyses on the cloud server, which will help repairers diagnose and maintenance remotely.

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