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IOT Based EV Battery Health Monitoring System

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Abstract: This thesis presents an overview of issues and technologies related to the proper design of charging infrastructures for road electric vehicles. The analysis is carried out taking into account that the recharging stations of electric vehicles might be integrated in smart grids, which interconnect the main grid with distributed power plants, different kinds of renewable energy sources, stationary electrical storage systems and electric loads. The study is introduced by an analysis of the main characteristics concerning different kinds of storage systems to be used for stationary and on-board applications. Then, different charging devices, discharging modes and architectures are presented and described showing their characteristics and potentialities. It is necessary to monitor battery behaviour and accordingly utilise it. Range anxiety is the predominant desolation among the electric vehicles (EV's) possessors that caused by driver's ambiguity in relation to vehicle's energy needed to arrive at targeted place and state of charge (SoC). This project proposes an intelligent control algorithm for real time range estimation, indication of various parameters and generates alerts in the smart phone using Internet of Things (IoT). This algorithm determines the amount of charge present in battery and how much distance can an electric vehicle move with the remaining power available. Intelligent controller also improves the battery performance and lifetime. Thereby the integrated system of range estimator and crash detector will make the electric vehicles smarter. The objective of the project is to promote green power and to improve the smartness of electric vehicles by integrating the range estimator and crash detection units alongside to make use of IoT. This makes the generation of alerts when any abnormalities occur and display the parameters in the virtual dash board.

Keywords: ESP8266, Battery, Voltage sensor, LCD Display, ADC, Diode, Resistor, Capacitor.

I. INTRODUCTION

To meet the unprecedented challenges on environmental protection and climate change, electric vehicles (EVs) and hybrid electric vehicles (HEVs) are developing rapidly in recent years. Compared with conventional internal combustion engine (ICE) based vehicles, EVs are powered by batteries that may be charged from renewable power generated from the wind, solar or other forms of renewable sources. Among all batteries types, Lithium-ion (Li-ion) batteries are preferable power supplies for EVs due to a number of favourable characteristics such as power density, less pollution, and long service life. For Li-ion batteries, a proper battery charging strategy is essential in ensuring efficient and safe operations. The charging strategy is a key issue in the battery management system (BMS) of EVs. An optimal charging operation will protect batteries from damage, prolong the service life as well as improve the performance. On the one hand, long charging time will inevitably affect the convenience of EV usage and limit its acceptance by customers . However, too fast charging will lead to significant energy loss and battery performance degradation. It is therefore rational to consider the charging time as one of the key factors in designing the EVs charging control. Secondly, large energy loss implies low

efficiency of energy conversion in battery charging, which needs to be addressed. Finally, both the battery surface and internal temperatures may exceed permissible level when it is charged with high current, and the overheating temperatures may intensify battery aging process and even cause explosion or fire in severe situations. Thus, the battery charging time, energy loss, and temperature rises are important factors to be considered in designing the battery charging Process. Electric vehicles becoming the influential means in the field of transport day by day. As these electric vehicles are free from pollution emission the world is looking to make transportation field electrified. World need renewable source-based energy supply. The major encumbrance for possessors of electric vehicles is Range Anxiety, the fear that arises to electric vehicles driver whether he might reach the destination makes the buyers back step to buy electric vehicles. Various methods and strategies are implemented to determine range of an electric vehicle. A lot of sensory data is to be collected and could be applied to estimate range. Multiple variables have to be considered to provide a more accurate prediction of consumed power. There is a lack of system communication in between driver of electric vehicle and vehicle battery tracking system.

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According to the buyer of EV, the main problem with EVs is the limited capacity of battery and charging infrastructure availability, which leads to a variety of concerns like drivers are afraid to drive an electric vehicle for far distances. These issues have importance comparatively cost of batteries and vehicles. Even with development of new battery batteries for electric vehicles, various concerns can limit the use of electric vehicles. In recent days, great efforts have been made to study range reduction concerns by improvising SoC / range evaluation techniques in automotive battery tracking systems with low-cost microcontrollers. This project presents an easy way to represent the range in the vehicle's virtual dashboard. This paper proposes a solution that makes the electric vehicles smarter by display the parameter like range, speed, battery cycle, location in the mobile phone. This requires a lot of sensory data to be acquired and send to the cloud. This sensory data is analyzed at different levels. This project is to promote green power and to improve the smartness of electric vehicles by integrating the range. This makes the generation of alerts when any abnormalities occur and display the parameters in the virtual dash board.

II. METHODOLOGY

A. Hardware

i. Block diagram:

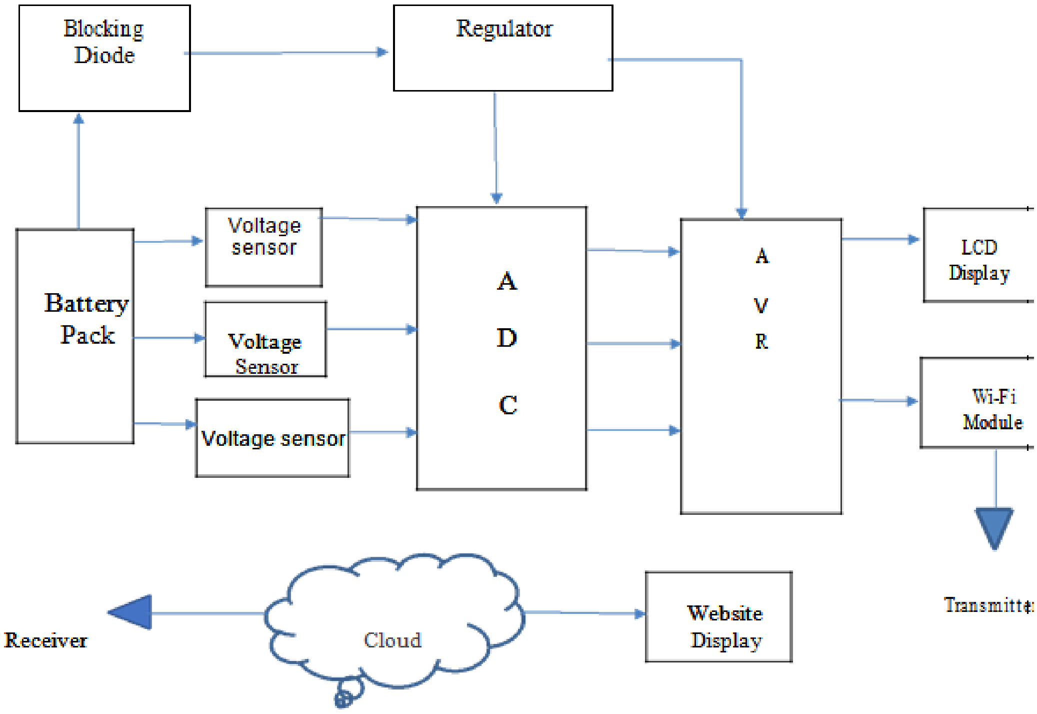

Fig: Block diagram of Internet of things Based Battery Monitoring System

Here, the Arduino (Atmega328) is the main part of our project. Arduino code is analyzed in Proteus 8 profession software. Logic mainly includes 4 modules. Such as battery cooling system, range estimation, alerting mechanism, auxiliary load control. In battery cooling system, temperature sensor continuously monitors the battery temperature and activates the cooling fan automatically when threshold is reached. Control logic considers energy available with battery, past state of vehicle, current state of vehicle whether it is in standstill or running condition. Based on all the received data algorithm estimates the available distance that vehicle can go further.

Alerting mechanism generates timely alert messages at local as well as remotely based on the signals received from all the sensors. This Intelligent controller has intelligent mode, under which vehicle is run with optimal energy consumption by controlling the auxilia.

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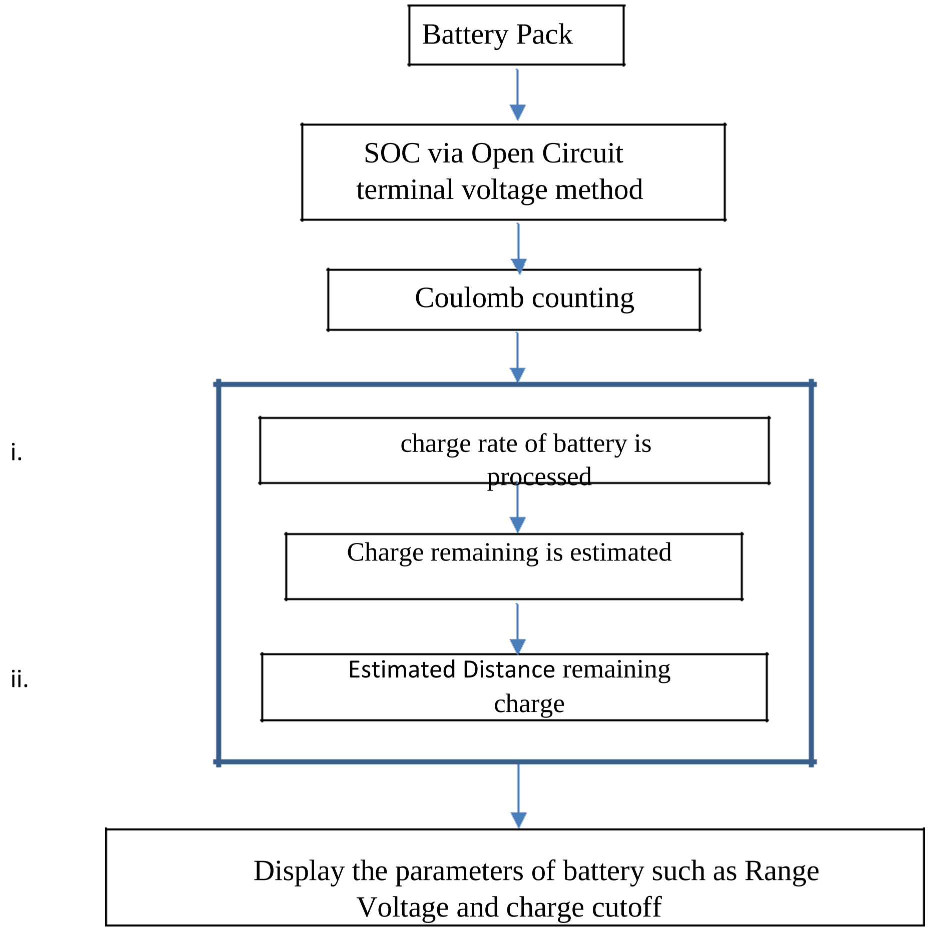
ii. Flowchart:



clearly describes the working process of controller. In current system, coulomb counting method is used, due to its low complexity and simplicity. Primarily, coulomb counting calculation technique is based on integrated current and amount of charge that has to be delivered by sensing input and output of the battery.

It operates by introducing an active flow over time to obtain the total amount of energy that goes into or out of the battery. As a result, measured in ampere hours. Obviously, if the current measurement is accurate, the method is reliable. It applies to all batteries used in the EV application.

1. Begin coulomb counter in Arduino
2. Set voltage value to zero
3. Establishing communication in between the Arduino and system.
4. Insert load and operate with battery
5. Coulomb counter transmits the results to Arduino.
6. Transform and save results to digital from analog format.
7. Display the outputs.
8. Notify the user when the battery reaches a safe SOC.
9. If the battery is plugged in for charging, the Coulomb counter stops until it is charged, or if it is not plugged in, the battery sends regular alerts to stop the charging and to stop the connection.
10. Post battery charging, coulomb counter transforms its state to running state from idle.

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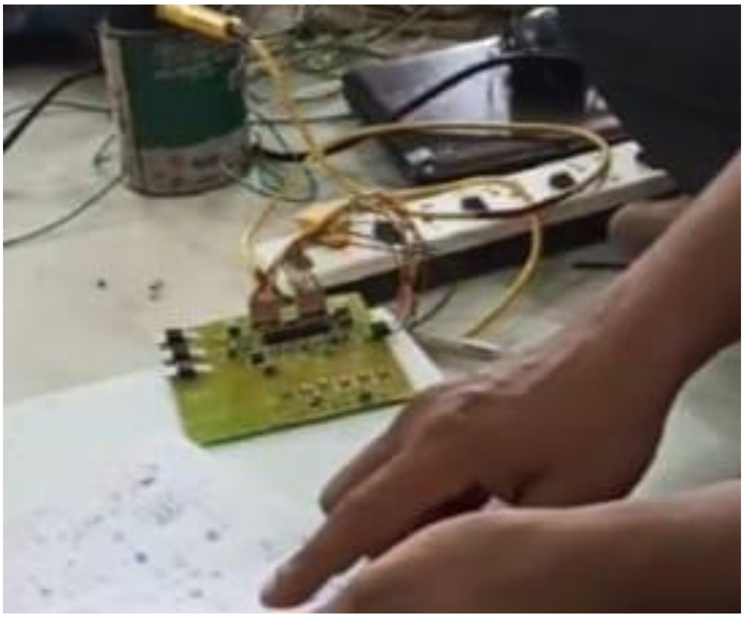
III. RESULT



IV. CONCLUSION

In conclusion, an IoT-based EV battery health monitoring system offers significant benefits for electric vehicle owners and manufacturers alike. By continuously monitoring crucial parameters such as temperature, voltage, and charging cycles, this system enables real-time assessment of battery health. Predictive maintenance can be performed, ensuring optimal performance and longevity of the batteries. Additionally, insights gained from data analysis can inform future design improvements and enhance overall EV reliability. Ultimately, such a system contributes to a more sustainable and efficient transportation ecosystem.

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