ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 9| Issue: 2| February 2023|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2023: 8.224 || ISI Value: 1.188

A NOVEL E-VEHICLE BATTERY MANAGEMENT SYSTEMS

Ayyappa Srinivasan M G[1], Karthik Raja.B[2], Kasi Viswanath.T[3], Stewak.J[4], Raj.J[5]

ABSTRACT

Electric vehicles employ battery management systems (BMS) to monitor and regulate the charging and draining of rechargeable batteries, which increases efficiency. Battery management technology keeps the battery secure, dependable, and senile without going into a destructive state. Different monitoring approaches are employed to maintain the battery's level of charge, including voltage, current, and ambient temperature. Different analog/digital sensors with microcontrollers are utilised for monitoring purposes. This work discusses a battery's maximum capacity as well as its state of charge, health, and longevity. Reviewing all of these approaches can help identify potential problems in the future and remedies.

I. INTRODUCTION

The significant difficulty of problems with electric car recharging is brought on by the widespread use of electric vehicles (EV). Given that actual EV field excursions are gaining an increasing amount of attention from researchers, we need to provide electrical energy as well as battery management and charging technology of electric vehicles. To reduce the power demand of the framework, battery management system structures must be developed. Sustainable power sources then appear as innovation continues to grow.

One of the most significant sectors of the global economy, the automobile industry also ranks highly in terms of development and research. Nowadays, a lot of technical components are being added to automobiles in order to increase the safety of both passengers and pedestrians. In addition, there are more cars on the road, which makes it possible for us to move pleasantly and quickly.

However, this could have caused air pollution levels, particularly in metropolitan areas, to rise dramatically. This includes pollutants like nitrogen oxides (NOX), carbon monoxide (CO), sulphur dioxide (SO2), and particulate matter (PM), among others. A total of 70% of the emissions from the transport sector are attributed to road transportation, which also accounts for about 28% of the sector's overall carbon dioxide (CO2) emissions. However, to avoid air pollutants, carbon dioxide CO2, and other greenhouse gases, the government of the majority of developed nations is supporting the use of electric vehicles (EVs). Therefore, an electronic vehicle is the greatest solution to these problems. However, battery management for electrical vehicle charging and use is still another novel task. In order to address the battery's charging and utilisation issues, we are implementing a battery management system in this project.

II.LITERATURE REVIEW

1. NURUL FITRIYAH ROSLANOcean Informatics and Engineering Technology , universitiy of Malaysia Terengganu, 21030 Kuala Terengganu at Malaysia.

This paper examines the development and implementation of the BMS (battery management system) using the Arduino Uno microcontroller. The voltage sensor, current sensor, and LCD in this circuit were created for monitoring purposes. In order to prevent excessive use or overcharging, it is successfully utilised to monitor the battery's state of charge (SOC).

2. Anurag Busha, VakeeshKannaJournal of a Emerging Technologies and Network Communications (JNCET) Volume 8, Issue.

This project aims to solve the issue of battery overheating while protecting the battery, device, and charger. As soon as the batteries in the devices are full, they emit a signal that is transmitted to the Arduino board. When the Arduino board gets the signal, the connection between the Arduino and the extension cable is interrupted, cutting off the power to the devices. This prevents additional damage and ensures that they are safe for usage.

3. Dr.Viswanath& Dr. M. Rajaram Narayana Department of EEE (Electrical and Electronics Engineering), Shadan College of Engineering and Technology HYDRABAD,TELANGA,INDIA.

The purpose of this work is to use a mobile application called MQTT to check or monitor a battery's temperature, over voltage protection, and general health state. The performance of an electric car will be greatly influenced by the battery, which essentially determines the driving range. The primary goal of this work is to describe how hardware modules like NODEMCU and overvoltage protection circuits are used.

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 9| Issue: 2| February 2023|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2023: 8.224 || ISI Value: 1.188

4. P.Dharani, T.NandhiniDepartment of EEE, Sengunthar Engineering College (Autonomous), Tiruchengode .SurajPunj Journal for Multidisciplinary Research

The project's goal is to extend battery life and safeguard battery cells from harm. The electrical parameters of the battery in our suggested system are measured simultaneously with LCD display. any unusual battery condition. It means, parameter values are differ from the normal value sound notification should be ON condition, for alerts the personnel.

5. VikasBhandare, DangePrachi, EEE Department, Sanjay Ghodawat Group of Institutions, Kolhapur The International journal of analytical and experimental modal analysis

This work seeks to develop a model of a battery management system for lead acid batteries required in electrical cars, which continuously checks the operational characteristics of the battery and takes necessary measures, such as battery protection, information display, etc. This BMS model has several goals in mind. Numerous battery parameters, including voltage, current, and temperature, will be continuously monitored.

III.BLOCK DIAGRAM

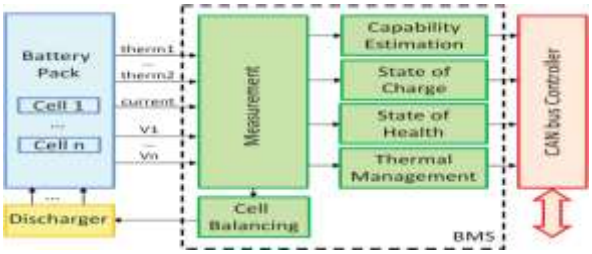

Figure 1 BMS block diagram

IV.ESTIMATION OF STATE OF CHARGE

The quantity of battery that is readily available as a proportion of the battery's rated capacity is referred to as the state of charge. By controlling charging and discharging, the battery management system is able to assess the battery's state of charge and determine whether it is running within the safe operating range. The battery's lifespan is also extended by it. State of charge cannot be easily estimated. The equation is used to calculate it is given below:

$$SOC = 1 - \frac{\int idt}{C_n}$$

I=current
Cn=maximum capacity of the battery

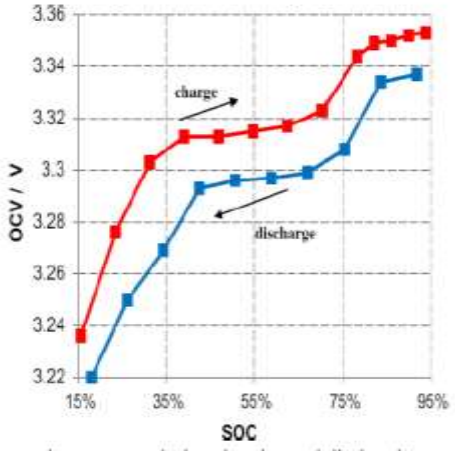

Figure 2 SOC during charging and discharging

The status of charge can be estimated using a variety of techniques.The methods for estimating the status of charge are listed below.

1. Coulomb counting SOC estimation method
2. Fuzzy logic SOC estimation method
3. Impedance spectroscopy SOC estimation method
4. Kalman filtering SOC estimation method
5. Open circuit voltage SOC estimation method

The Kalman filtering method, among all these other approaches, has been effective in estimating SOC for EV'S.

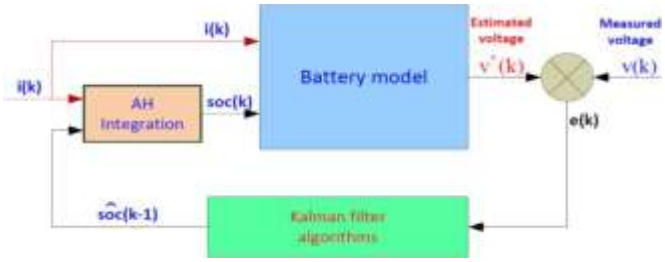

Figure 3 Kalman filtering SOC estimation model

V.STATE OF HEALTH ESTIMATION

Estimated state of health describes the battery's condition in relation to a battery that has just been produced. It provides details on the quantity of available discharge capacity over the course of its lifetime. The term "ability to drive the specified distance" (SOH) is used in electric vehicles (EV).

Pattipati et al. classified capacity deterioration and power decline as health characteristics. With a fully charged battery, capacity fade refers to decreased driving range, and power fade refers to decreased acceleration capability. Power fading happens when a cell's resistance rises with ageing. Total impedance is as a result (RHF+Rtc=R). RHF and Rtc stand for frequency resistance and transfer resistance, respectively.

VI.ESTIMATION OF MAXIMUM BATTERY CAPACITY

The battery's maximum capacity gives an idea of its capabilities and expected lifespan.

$$\text{Capacity} = \int Idt$$

can be used to calculate a battery's maximum available capacity.

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 9| Issue: 2| February 2023|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2023: 8.224 || ISI Value: 1.188

Battery capacity estimation on Varying Loads:

The performance and remaining life of the battery are described by its maximum capacity. This formula can be used to determine a battery's maximum capacity.

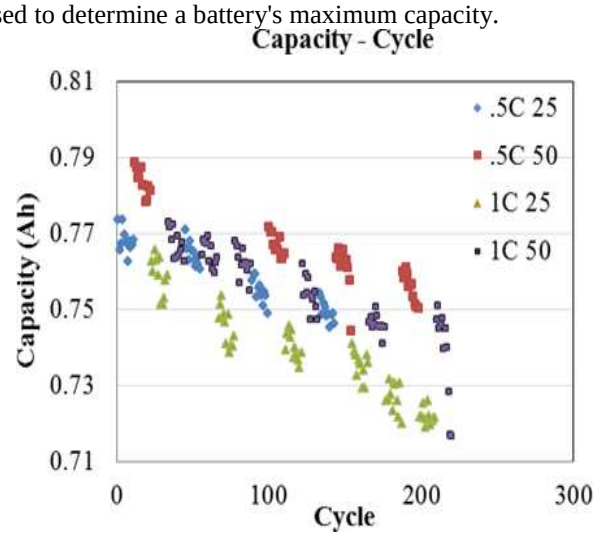

Figure4. Discharging capability alternating at different discharge rates and at different temp

VII.LI-ION CELL BMS CHARGING AND DISCHARGING:

High energy density, low weight, and high reactivity are all characteristics of lithium-ion batteries. Lithium-ion batteries charge and discharge much more quickly than traditional batteries.

To prevent a chain reaction of numerous chemical reactions, a rise in temperature that causes cell venting, and the ignition of fire, lithium-ion batteries should not be operated within their safe operating voltage range. As a result, the battery can run within its safety zone thanks to the Battery Management System (BMS).

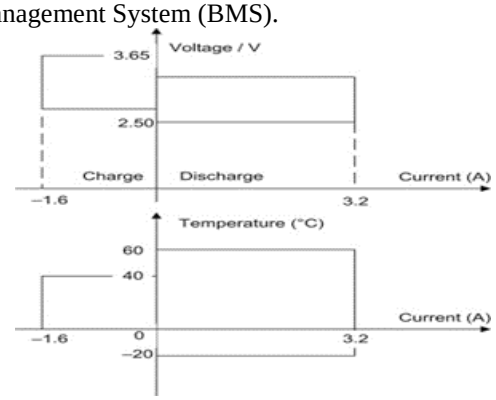

Figure 5 Safe operating area charging and discharging

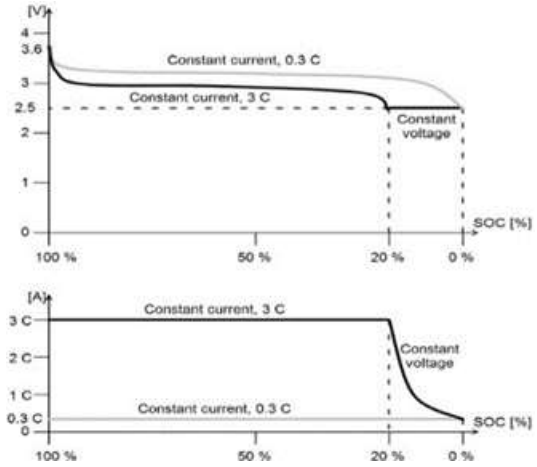

Figure6. Charging and discharging of lithium-ion batteries

VIII.CONCLUSION

By adjusting the vital characteristics such as voltage, current, status of charge, state of health, state of life, and temperature, we are able to construct the system model for battery management in electric vehicles. It is crucial that the BMS is kept up to date to ensure battery dependability and safety. This research optimises the power performances of electric vehicles while concentrating on the study of BMS.

IX.REFERRENCES

1. *H.J. Bergveld, Battery Management Systems Design by Modeling, 2001, ISBN 9074445-51-9*
2. *D. Bell, "A battery management system," Master's thesis, School Eng., Univ. Queensland, St. Lucia, Australia, 2000.*
3. *Sandeep Dhameja, Electric Vehicle Battery Systems, 2002, ISBN 0-7506-9916-7.*
4. *K. Shimitzu, N. Shirai, and M. Nihei, "On-board battery management system with SOC indicator," in Proc. Int. Electric Vehicle Symp., vol. 2, 1996, pp. 99–104.*
5. *Ng, K.S.; Moo, C.S.; Chen, Y.P.; Hsieh, Y.C. Enhanced coulomb counting method for estimating state-of-charge and state-of-health of lithium-ion batteries. Appl. Energy* ***2009****, 86, 1506–1511.*
6. *Pattipati, B.; Pattipati, K.; Christopherson, J.P.; Namburu, S.M.; Prokhorov, D.V.; Qiao, L. Automotive Battery Management System. In Proceedings of IEEE AUTOTESTCON, Salt Lake City, UT, USA, 8–11 September 2008; pp. 581–586.*