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DESIGNING AND PROTOTYPING OF BATTERY MANAGEMENT SYSTEM

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Abstract— **the gadget is designed to continuously monitor the batteries' voltage, temperature, and current. If any issues are detected, it will immediately cut off the input or the output. These settings have the advantage of automatic shutdown in response to temperature fluctuations, charging based on predetermined input parameters, and ongoing battery state monitoring and display.**

This research paper discusses the development of a Battery Management System (BMS) as a capstone project. The BMS regularly checks and safeguards the device's battery. Parts of the system include the lithium-ion battery, buttons, LCD display, voltage, current, and temperature sensors, as well as a battery charging and management module. The project's objective is to provide a solution for a 3S lithium-ion battery design. Furthermore, our proposed method ensures safe battery monitoring and charging while preventing mishaps.

Keywords— **LCD-Liquid Crystal Display, Li-Lithium**

I. INTRODUCTION

The efficiency and reliability of energy-saving technology have been shown by the increasing usage of clean energy sources, electric vehicles, and portable devices in recent years. These days, rechargeable batteries are a necessary part of many devices, from cell phones to grid energy storage systems. However, a variety of factors, including as operating circumstances, battery charge cycles, and environmental exposure, affect battery longevity and performance. Beyond these barriers, modern battery management systems (BMS) are now required to extend battery life and improve battery efficiency.

The main responsibility of the battery management system is to monitor and regulate the charging and discharging processes for each battery cell set. to ensure continuous functioning. To ensure optimal performance and safe operation while avoiding overcharging or over discharge, and thermal runaway. The BMS continuously checks vital parameters including voltage, current, temperature, and status of charge to prevent thermal runaway.

For this project, we devised a 3S Li-ion battery configuration. Our proposed method not only monitors and charges batteries, but also protects them from any hazards. Upon activation, the system employs a charging and monitoring circuit to safely charge the 3S battery. While the battery is being charged, a voltage sensor keeps track of its voltage and the charging circuit limits how much current can pass through it. On the LCD panel, the battery's voltage level is shown. When the battery is fully charged, the LCD displays "Battery complete" and the system turns-off.

The output current is monitored by the electrical current sensor and displays this value on the LCD screen. A temperature sensor continuously monitors the battery's temperature whether it is being charged or depleted. The system sounds a warning when the battery temperature drops below the safe limit, automatically turns off the input and output power, and displays the battery temperature using an LCD panel. Performance and safety are improved by this technology, which provides intelligent and efficient battery charging.

II. EMBEDDED SYSTEM

An embedded system is distinct from general-purpose computer systems primarily used for processing tasks, software systems on PCs. Reliability, productivity, and immediate results define the internal architecture. Household electronics, automobile systems, industrial machinery, medical gadgets, and communication tools are among the many products that frequently contain it. Telephone systems, operating systems for home appliance software, and automobile control systems are a few examples Key features of embedded systems include: Dedicated Function: Intended to carry out a particular job or group of related duties. Real-Time performance: Frequently necessary for data management and prompt action. Durability and Dependability: It need to be utilized consistently and dependably over an extended length of time. Resource efficiency: built to function with constrained processor and memory resources.

III. SENSORS

The Battery Management System can perceive and comprehend its environment thanks to its sensors and controller. Among the sensors that allow the system to recognise and measure a variety of preset properties are the

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voltage, temperature, and current sensors. The controller integrates all of the sensors, allowing for efficient operation throughout the environment:

A. Temperature Sensor-
We included the DHT 11 temperature and humidity sensor in our development to obtain data from the battery pack so that we could assess the situation and take appropriate action against the places. After that, we transmitted the data to an LED display, which acted as a controller or control system's visual interface and retrieved data.

B. Current Sensor:
The current parameter in the ACS712 project is measured, and the current value is controlled by the controller and displayed to the viewer on an LED display.

C. Voltage Sensor:
In this project, an LED display is used to show the viewer the voltage of the battery pack, which is measured by a voltage sensor.

D. An essential part of the project is managing batteries using regulators. The LM7812 voltage regulator provides safety against short circuit and thermal overload in addition to helping to regulate the system's input supply voltage.

IV. CONTROLLER

The Arduino Nano is a popular microcontroller board for embedded systems and electronics that is small and flexible. It offers an amazing assortment of functions in a tiny form factor and has been built to give a stable platform appropriate for both experts and enthusiasts. The ATmega328P microprocessor, renowned for its dependability and efficiency, powers the Arduino Nano. It runs at a frequency of 16 MHz These requirements guarantee that the Arduino Nano has sufficient storage capacity for programmed data and can perform a variety 6 of computer activities. The Arduino Nano's design has been modified to make it easier to use and integrate into a variety of applications. With a mere 18 x 45 mm size, because of its compact size, which makes it perfect for wearable and portable uses. It has eight analogue input pins that offer a wide range of connection possibilities for sensors, actuators, and other electrical components, The board also has a mini-USB connection that enables simple programming and serial computer connectivity, which facilitates code uploading and debugging.

V. EXPERIMENT AND RESULT

1. DISCHARGING OF BATTERY

Table -1: Discharging of Battery

Discharging Time (min)	Voltages(Volts)	Current(Ampere)

2. SLOW CHARGING OF BATTERY

Table -2: slow charging of battery

Charging Time (minutes)	Voltage (volts)	Current (Ampere)
0	9.4	0.35
15	9.54	0.36
30	9.61	0.34
45	9.73	0.35
60	9.85	0.57
75	10.1	0.36
90	10.16	0.37

Above table shows the reading obtained during the slow charging of the battery.

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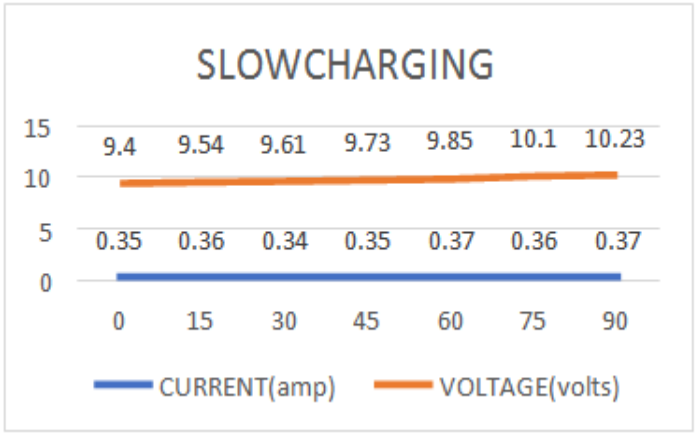

Fig. 2. Slow Charging charaterstics of 12v li-ion battery

3. FAST CHARGING OF BATTERY

Table-2:Fast charging of battery

Charging Time(minutes)	Voltages(volt)	Current(Ampere)
0	9.78	2.12
5	9.89	2.09
10	10.02	2.11
15	10.17	2.10

Above table shows the reading obtained during the fast charging of the battery.

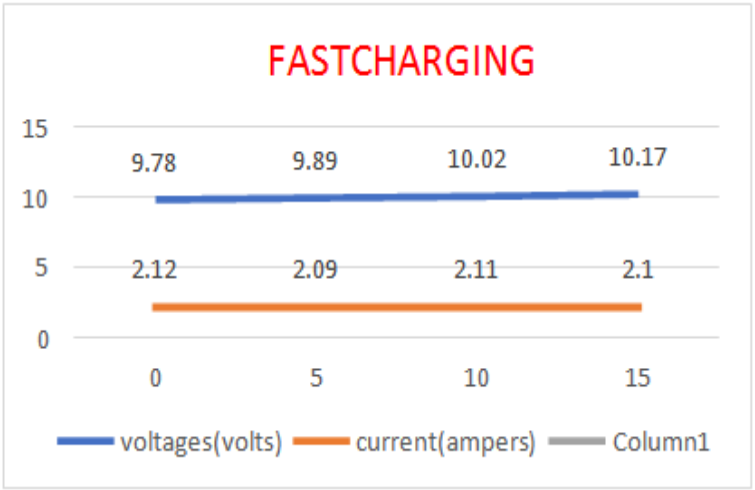

Fig 3. Fast Charging charaterstics of 12v li-ion battery

VI. CONCLUSION

In over experiment we monitor the charging voltage and current ratings and discharging current and voltage rating using our BMS and plot the graph of these using ratings. In our experiments we found that our BMS does the overcharging protection of li-ion battery by cutting off the charging when the battery voltage reaches 10.16 V in slow charging and 10.17 V in case of fast charging. Our BMS also did the over discharging protection but disconnecting the load when the battery voltage reaches 9.58 V. Hence, we verify that our BMS works properly

VII. REFERENCE

[1]. Bergveld, H.J.(2001)'. Battery Management Systems Design by Modeling, ISBN 9074445-51-9

[2]. Bell D. (2000)'. A battery management system," Master's thesis,School Eng., Univ. Queensland, St. Lucia, Australia.

[3]. Dhameja Sandeep (2002)'. Electric Vehicle Battery Systems, ISBN 0-7506-9916-7.

[4]. Shimitzu K., Shirai N. and Nihei M. (2020)'. "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 (2009)'. Enhanced coulomb counting method for estimating state-of-charge and state-of-health of lithium-ion batteries. Appl. Energy,(pp 1506–1511).

[6]. Pattipati, B.; Pattipati, K.; Christopherson, J.P.; Namburu, S.M.; Prokhorov, D.V.; Qiao, L (2008)'. Automotive Battery Management System. In Proceedings of IEEE AUTOTESTCON, Salt Lake City, UT, USA, (pp. 581– 586).

[7]. Dhameja Sandeep, (2002);. Electric Vehicle Battery Systems, ISBN 0-7506-9916-7.

[8]. Wei Xuezhe, Zechang Sun and Zou Guangnan, (2004)'. " A Modularized Li-ion Battery Management System for HEVs", Automotive Engineering, vol. 26, no. 6, (pp. 629- 631).

[9]. Tremblay O., L. A. Dessaint L. A., Dekkiche A. I. (2007)'. "A generic battery model for the dynamic simulation of hybrid electric vehicles," IEEE Vehicle Power and Propulsion Conference, VPPC, (pp.284-289).

[10]. Han S. B., Jeong M. L., Hyung S. M. and Gyu H. C. (2001)'. "Load sharing improvement in parallel-operated lead acid batteries," in Proc IEEE ISIE'01, Vol. 2, (pp. 1026-1031).

[11]. Benini L., Bruni D., Macii A., Macii E., and Poncino M., (2003)'. "Discharge current steering for battery lifetime optimization," IEEE Trans. Computer, Vol. 52, No.8,(pp. 985-995).

[12]. Benini L., Macii A., Macii E., Poncino M., and Scarsi R., (2003)'. "Scheduling battery usage in mobile systems," IEEE Trans. VLSI, Vol. 11, No. 6, (pp. 1136- 1143).