NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH
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DEPARTMENT OF ELECTRICAL ENGINEERING
सत्यमेव जयते
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BATTERY MANAGEMENT SYSTEM OF ELECTRIC VEHICLES WITH HYBRID CHARGING USING ARDUINO IOT CLOUD

ABSTRACT

The increasing adoption of electric vehicles (EVs) has highlighted the need for efficient and reliable battery management systems (BMS) to ensure the optimal performance and longevity of EV batteries. This paper presents a novel approach for an intelligent BMS that integrates hybrid charging techniques, Arduino-based control, and IoT cloud connectivity for real-time monitoring and management. The proposed system combines the advantages of both grid and solar power sources to efficiently charge the EV battery, ensuring reduced energy consumption and environmental impact. The IoT cloud platform facilitates real-time data monitoring and control, allowing users to track battery status and health remotely through mobile or web interfaces. The hybrid charging feature enhances charging flexibility, while IoT connectivity offers predictive maintenance capabilities, enabling data analytics for proactive battery management. This system provides a sustainable, cost-effective solution for EV battery management, offering scalability and improving overall efficiency in electric vehicle charging.

KEYWORDS: Arduino IOT Cloud, Buzzer,ESP8266, Li-ion Battery, Relay, SOC.

INTRODUCTION

The evolution of electric vehicles (EVs) has revolutionized the transportation sector, offering a cleaner and more sustainable alternative to traditional fuel-based vehicles. Central to the performance and safety of EVs is the Battery Management System (BMS), which ensures optimal operation, protection, and longevity of the battery pack. The efficient management of battery charge, health, and temperature is critical in preventing issues like overcharging, and overheating, which can compromise the safety and lifespan of the battery. This project focuses on developing a BMS for EVs with a hybrid charging system, utilizing Arduino IoT Cloud for real-time monitoring.

PROPOSED METHODOLOGY

The BMS for EVs with Hybrid Charging uses Arduino Uno, sensors to monitor SOC and manage charging sources via a relay module. It connects to the Arduino IoT cloud

BLOCK DIAGRAM

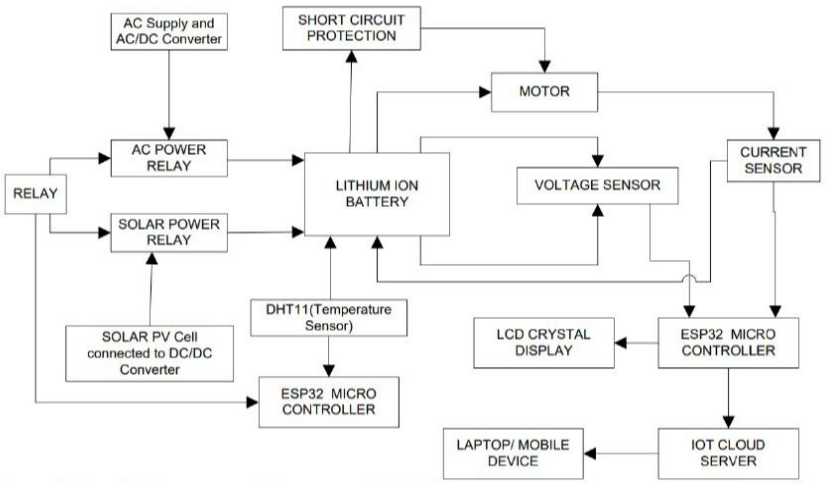

Fig. 1:Block Diagram of Proposed BMS

RESULTS AND DISCUSSION

The Battery Management System (BMS) for electric vehicles (EVs) integrates a Hybrid Charging solution using Arduino IoT Cloud. It monitors battery health through , current, and temperature sensors while optimizing energy flow between various power sources via a relay module. The system enables real-time tracking and connected to the cloud for remote access and alerts. A smart algorithm ensures efficient charging, safety, and the management of SOC.

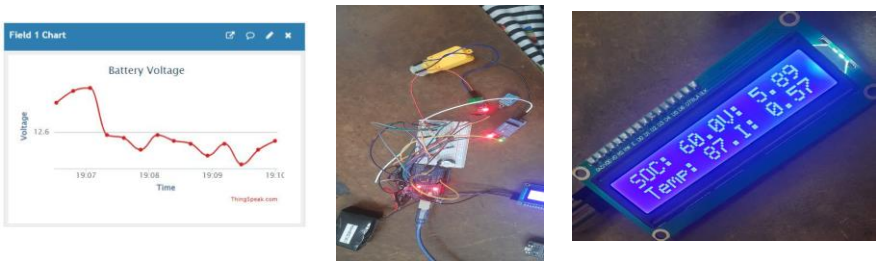

Fig. 2: Example of a Battery Voltage and Hardware setup

TABLE I. NORMAL WORKING CONDITION

Time	Temp	Voltage	Current	SoH	SoC
2024-05-02	31.6875	10.57531	1.005337	88%	85%
2024-05-02	31.75	10.59532	-0.11666	88%	84%
2024-05-02	31.6875	10.65035	-0.05789	88%	83%
2024-05-02	31.75	10.80543	-0.10789	88%	80%
2024-05-02	31.6875	10.56531	-0.15614	88%	80%
2024-05-02	31.75	10.61033	-0.15789	88%	80%

TABLE II. OVER TEMPERATURE ALERT

Time	Temp	Voltage	Current	SoH	SoC	Display
2024-05-02	41.8125	10.57531	1.005337	88%	85%	Problem Detected
2024-05-02	53	10.59532	-0.11666	88%	84%	Over Temperature
2024-05-02	51.8125	10.65035	- 0.05789	88%	83%	Problem Detected
2024-05-02	53	10.80543	-0.10789	88%	80%	Over Temperature

Table I: Examples of BMS

CONCLUSIONS

In conclusion, our IoT-based Battery Monitoring System project aims to optimize battery durability and efficiency while reducing energy waste. By designing an effective, scalable solution that integrates real-time monitoring, we are committed to ensuring the reliability and longevity of batteries across diverse applications. Overall, the BMS offers a holistic solution that enhances battery operation, prolongs its lifespan, and safeguards user safety. This project exemplifies the effective integration of numerous components and algorithms to develop an efficient and reliable Battery Monitoring System for lithium-ion batteries.

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References

1. R. Ranjith Kumar, C. Bharatiraja, K. Udhayakumar, S.Devakirubakaran, K. S. Sekar, and L. Mihet-Popa, “Advances in Batteries, Battery Modeling, Battery Management System ,Battery Thermal Management, SOC, SOH, and Charge/Discharge Characteristics in EV Applications,” IEEE Access, vol. 11, pp.105761–105809, 2023, doi: 10.1109/ACCESS.2023.3318121.
2. G. R. Sylvestrin, H. F. Scherer, and O. Hideo Ando Junior, “Hardware and Software Development of an Open Source Battery Management System,” IEEE Lat. Am. Trans., vol. 19, no. 7, pp. 1153–1163, 2021,doi: 10.1109/TLA.2021.946184

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