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PULSE CHARGER WITH SAMRT BATTERY MANAGEMENT SYSTEM FOR FAST CHARGING OF ELECTRIC VEHICLE

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ABSTRACT

Electrical vehicle (E Vs) are the important part of the automotive industry for decreasing reliance on oil and reduced air pollution. EV buyers observe the charging time, battery charging/discharging security, life span charged rate , capability and temperature increases. The new pulse charging technology is proposed for better charging stability and efficiency of lithium-ion battery needs protective mechanism to control overcharged or undercharged. The control model needs to develop to enhance battery protection i.e. Battery Management System (BMS)

It is used in Electric Vehicle to monitor and control the charging and discharging of rechargeable batteries. The purpose monitoring is to maintain the battery health within the safety operation area.

The design consist of battery of 25Ah, Arduino UNO, Transformer,Temperature Sensor, Liquid- Crystal displays (LCD), cooling fan, relay etc .

Keywords: Battery Management System; Protection And Optimization.

I. INTRODUCTION

Li-ion battery is used most widely in today's EV'S for its low self-rate and high energy density. It is difficult to maintain the safety of EV which caused by degradation and concern by the heat generated during charging and discharging and mainly due to the fast charging process.

It can be minimized by the interfacing the Battery Management System.Electric Vehicle plays the key role because of it's zero-emission of harmful gasses and use of efficient energy electric vehicles are equipped by a large number of battery cells which requires a effective battery management system. While they are providing power.

The battery installed in a electric vehicle should not provide high power. Lithium ion battery is most commonly used because of it's advantages and it's performance.

Battery management System (BMS) makes decision based on state of charge estimation , state of health estimation , temperature and current.

Another important function of a BMS is ensure that the battery is operating within safe temperature range . if the battery gets to hot ,the BMS may reduce the charging rate or shut down the battery gets too cold , the BMS may increase the charging rate to the help warm up the battery.

It remember that overcharging of Li-ion battery may cause hazards, which could cause a fire or explosion .As a result is important to pay close attention to charging process and prevent leaving the battery alone while it's being charged

In our project we keep an eye on battery voltage ,temperature and detect the presence of fire .If battery temperature rises beyond a certain threshold, the power to the lithium -ion battery is automatically shut off.

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II. METHODOLOGY

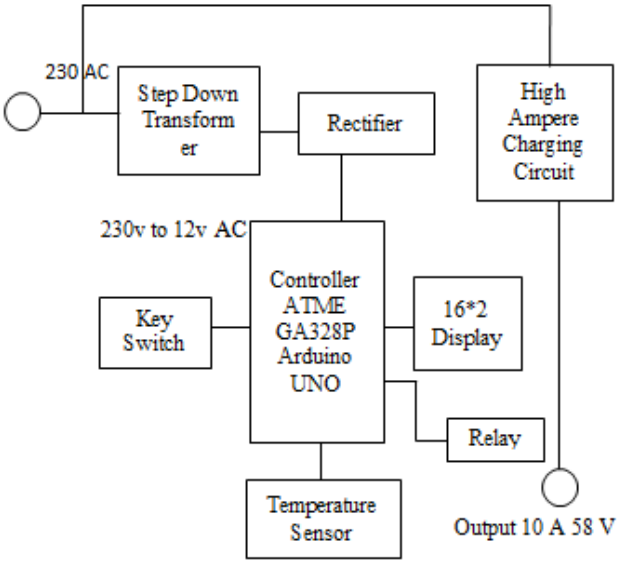

Figure 1. Block Diagram Of Pulse Charger With Smart Battery Management System For Fast Charging Of Electric Vehicle

The project will follow a structured methodology to ensure the successful development and implementation of the pulse charger with a smart battery management system (BMS).The methodology can be divided into several key phase Hardware based on the design specifications.

Develop software algorithms for the BMS, including charging profiles and safety protocols Integrate user interface components for real-time monitoring.

Testing and Validation Conduct laboratory testing to evaluate charging speed, efficiency, and temperature control. Perform safety tests, including overload and short-circuit scenarios. Validate the smart BMS's capability to manage battery health and charging cycles.

1. Data Analysis Compare charging times against traditional charging methods.

Assess battery health retention and degradation patterns. Identify any areas for improvement in the charger or BMS.

2. Optimization Adjust charging algorithms to enhance performance and safety.

Upgrade hardware components if necessary to improve reliability Incorporate user feedback from initial tests to improve the user interface.

3. Reporting and Dissemination Compile a comprehensive project report detailing design, testing, and outcomes.

Present findings at industry conferences and workshops. Publish articles in relevant journals to contribute to the body of knowledge in EV technology.

By following this methodology, the project aims to systematically develop a cutting-edge pulse charger with an integrated smart battery management system that addresses current challenges in the electric vehicle charging landscape.

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Circuit Diagram:

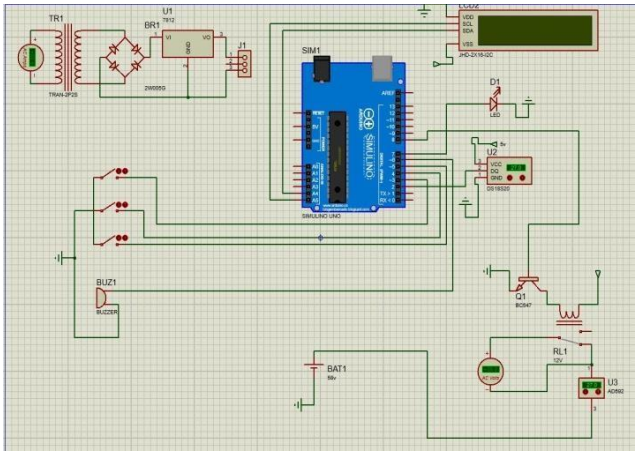

Figure 2. Circuit Diagram Of Pulse Charger With Smart Battery Management System For Fast Charging Of Electric Vehicle

III. MODELING AND ANALYSIS

Software Details :

Arduino UNO Controller – At mega 328P Uno The ATmega328P is a popular 8-bit microcontroller from Atmel (now part of Microchip Technology). It's widely used in Various applications, particularly in the Arduino platform.

Hardware Details:

1. High Ampere Charger Circuit:

A high-amperage charger circuit is designed to provide a large current to charge high-capacity batteries such as those used in electric vehicles (EVs), large battery banks, or high-performance power tools. Designing such a circuit involves several key components and considerations, including the power source, control systems, safety features, and protection mechanisms.

2. AC-DC Converter:

The AC-DC converter you're describing is a common component in many electronic devices. It takes in alternating current (AC) power from the mains supply and converts it to direct current (DC) power that can be used to power various components within the device.

3. 16X2 Display:

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multisegment light-emitting diodes and seven segments .The main benefits of using this module

4. Temperature sensor (DS18B20) :

The DS18B20 is one type of temperature sensor and it supplies 9-bit to 12-bit readings of temperature. These values show the temperature of a particular device.

5. DC fan (12 Volt 3 Inch):

12-volt 3-inch DC fan is a small cooling fan commonly used in various applications like electronics, automotive, and computer cooling

6. relay (SPST):

A Single Pole Single Throw (SPST) relay is the simplest type of relay. It has two positions, which can either open or close a circuit.

Single Pole: This refers to the fact that the relay has only one switch (pole) that can either make or break a connection.

Single Throw: This refers to the fact that the relay has only one set of contacts: either open (disconnected) or

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closed (connected).

7. Key switches (For temperature setting):

Key switches can be used to control or adjust the temperature. Key switches can provide a more secure method of temperature setting, often used in situations where restricted access is required or when preventing unauthorized users from making adjustments is important.

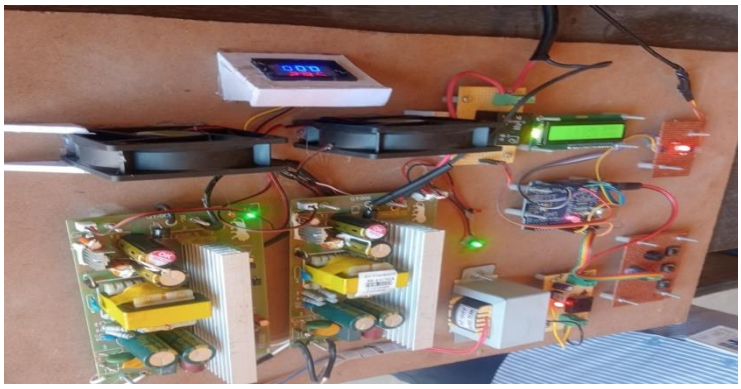

Figure 3. Design Of Pulse Charger With Smart Battery Management System For Fast Charging Of Electric Vehicle circuitry

FLOW CHART OF BMS

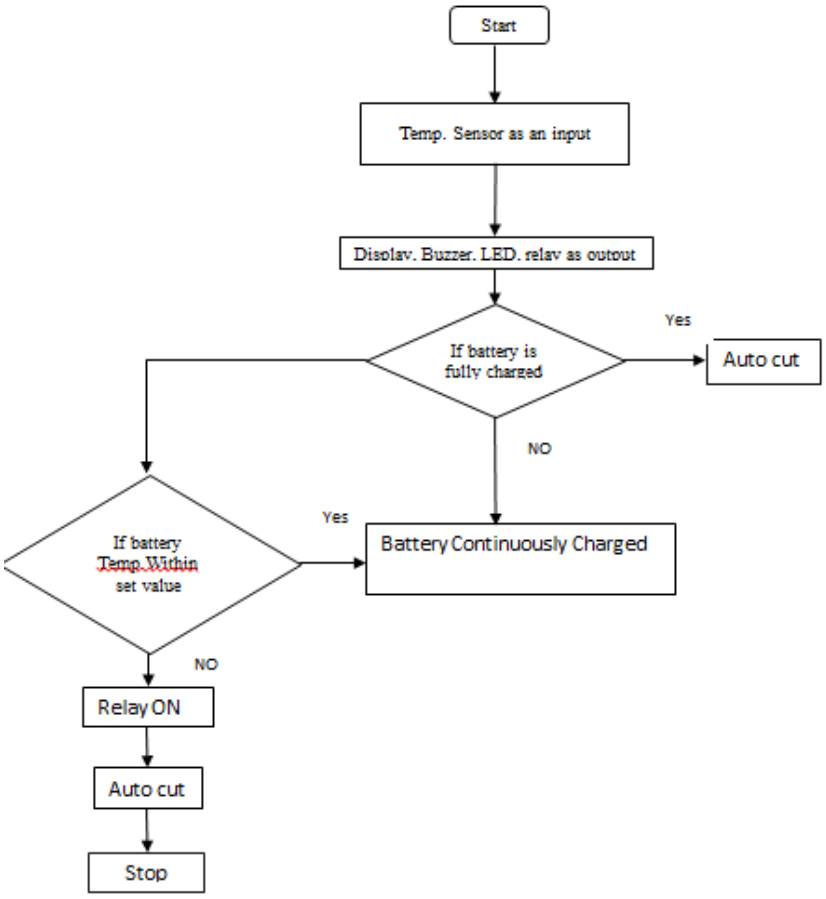

Figure 4. Flow Chart Of Battery Management system

IV. RESULTS AND DISCUSSION

Pulse charger with a smart battery management system offers significant benefits for EV fast charging, including improved efficiency, enhanced battery longevity as compare with the conventional way of charging it performs the vital role.

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A better overall charging experience. Addressing the potential challenges and considerations will be essential for realizing the full potential of this technology.

A pulse charger with Battery Management System (BMS) is a type of charger designed to charge batteries using pulse charging technology, with an integrated BMS to ensure optimal battery performance and safety

Table 1. Comparison Of Charging Time Conventional and Fast charger

Sr.No	Charging Levels	Conventional Charger (min)	Fast Charger (min)
1	0-25%	45	25
2	25-50%	75	40
3	50-75%	110	80
4	75-100%	160	130

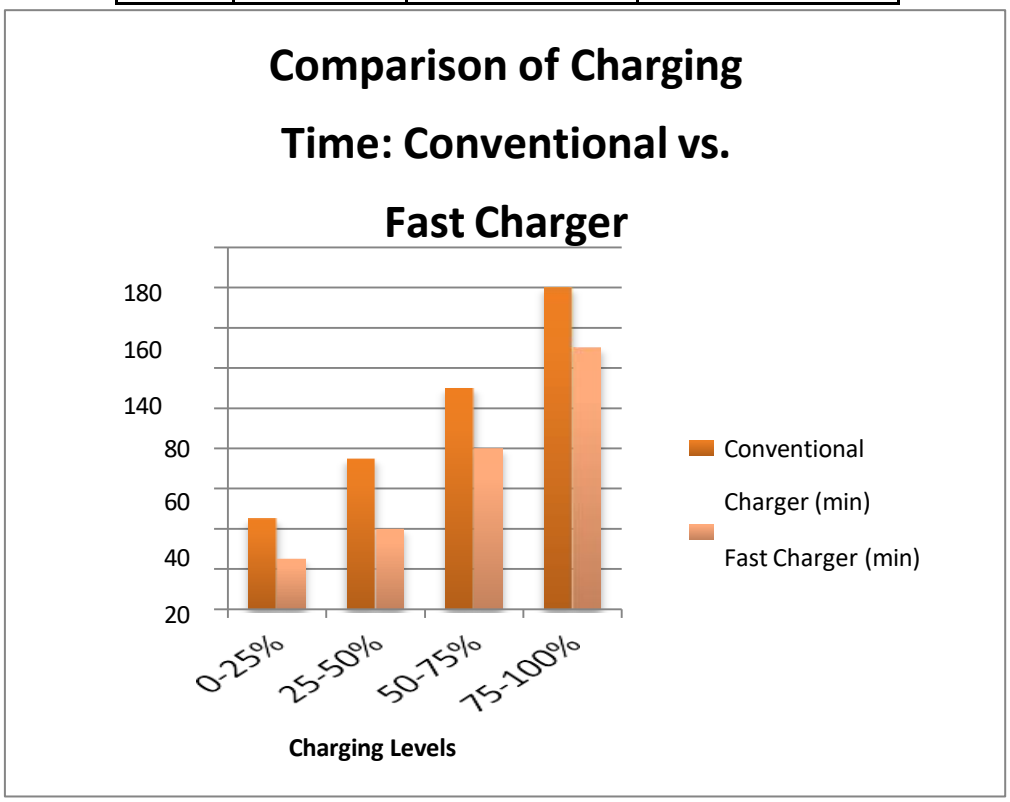

Figure 5: Comparison Of Charging Time Conventional and Fast charger

V. CONCLUSION

Battery technology and related systems continue to be a central challenge in vehicle electrification. Many manufacturers have targeted fast charging capability as a key design characteristic for EV battery packs to decrease anxiety as well as meet customer requirements.

Proposing an optimal charging design such that provides benefits such as reduced charging time and increased efficiency while preserving battery life is critical.

The pulse charging technique handles the detailed control and monitoring of charge current pulses while charging the battery. It automatically adjusts the frequency of charge pulse occurrence to optimize charging time.

Lower charging time and greater charge, as well as energy efficiencies, are the key benefits provided by pulse charging, which are both desired.

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