

BATTERY SAFETY, COOLING AND HEALTH MONITORING SYSTEM

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I. ABSTRACT

The rapid adoption of electric vehicles has created the need for safe, efficient, and robust battery charging stations. Existing battery charging technologies primarily concentrate on charging the batteries without considering any appropriate measures for ensuring safety, checking battery health, and cooling. This may cause reduction in battery lifetime and create safety risks.

The proposed survey discusses the development of a Smart Electric Vehicle Charging Station that considers the parameters of safety, battery cooling, and health monitoring. The system constantly monitors important parameters of the batteries, including the voltage, current, and temperature. According to the information received from the battery monitoring process, charging can be done efficiently, and any safety risk can be eliminated.

Additionally, the system utilizes IoT monitoring so that one can monitor the battery through any mobile device.

II. INTRODUCTION

Electric vehicles have emerged as one of the crucial components of modern transport owing to increasing fuel prices and environmental issues. The battery is one of the major components in an electric vehicle, whose performance affects the life span, range, and even safety of the vehicle. Improper methods of charging the battery can lead to battery degeneration and inefficiency, and in some cases, overheating or short circuiting.

Conventional EV charging stations tend to be concerned about just one thing, providing the power supply to the

EV batteries. However, such stations lack advanced facilities like battery health monitoring, thermal management, and automatic protective features against battery failures. Therefore, the emergence of intelligent EV charging stations is a necessary step for ensuring battery safety.

Recent advancements in technologies like microcontrollers, sensors, and the Internet of Things allow designing a highly-efficient charging station. Using these components, a conventional charging station can be turned into an intelligent station. In this survey, various methods of charging have been analyzed to find out their drawbacks and limitations. Moreover, a proposed intelligent EV charging station will be studied.

III. EASE OF USE

Ease of use and user-friendly interface

The recommended smart EV charging station has been developed in a manner that is simple to operate by both its operator and users. The battery status including voltage, current, temperature, and charging status is shown via the LCD screen in a way that makes it easy to determine if the battery is charging, full, or has any fault. With IoT technology, one can control the charging process remotely using their smartphone and web panel, without having to supervise it physically. The process is automated and does not require human labor.

IV. EXISTING WORK

Several charging mechanisms for EVs are available today. The simple charging mechanism provides the electrical charge to the battery irrespective of the battery condition. This type of charging mechanism might cause the battery to overcharge or overheat. Advanced charging systems have voltage and current control capability; however, they do not have any other form of monitoring system for battery conditions and do not offer any security feature.

Battery Management System is being used in modern-day cars; however, there is no provision for charging stations to give the battery health status to users. Charging stations based on IoT allow remote monitoring

of the charging process. Nevertheless, they do not have any security feature to cut off the charging when there is an irregularity in charging. Therefore, existing systems have concentrated either on charging or monitoring of the battery.

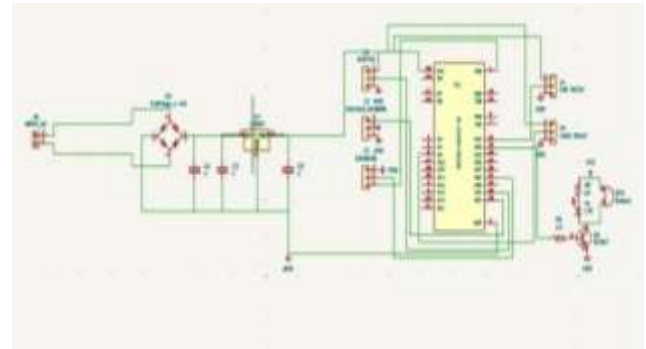


Fig 1: Block Diagram for Existing System connected to devices like a fan and a second device as well as driving a buzzer through transistor switches.

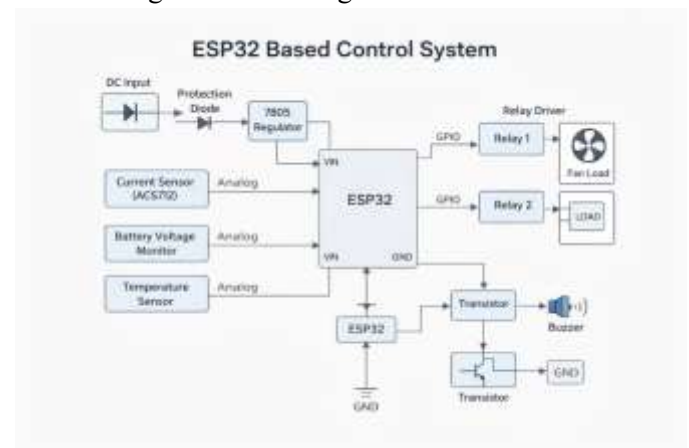


Fig8: Block Diagram for proposed system

V. PROBLEM STATEMENT

The EV battery system is vulnerable to voltage stress and temperature stress. Overvoltage, overcurrent, and overtemperature may lead to deterioration of the battery's performance and its overall lifespan. The current charging infrastructure does not adequately protect against these stresses.

Currently, there is no intelligent charging solution available at affordable prices for charging batteries safely by keeping track of their condition. The lack of such a solution increases potential hazards for both the vehicle and its users.

VI. PROPOSED WORK

This project aims at designing a smart electric vehicle charging station with safety measures incorporated for the battery. A microcontroller is used to constantly monitor the voltage, current, and temperature of the battery by connecting it to the respective sensors.

While charging, should any of the parameters be out of the limit, the charger will automatically disconnect from the charging unit with the help of a relay. In case the battery overheats, a cooling system comes into play.

The Internet of Things technology can be employed to transfer information regarding the battery to a distant dashboard, thus enabling the user to keep track of the charging process.

VII. BLOCK DIAGRAM

The above figure is a schematic diagram illustrating a control system using ESP32. This design involves the use of DC voltage that gets converted to a regulated voltage using ports such as relay driver controlling relay switches

VIII. METHODOLOGY

Step 1: The power supply sends the regulated voltage to the charging system and controller.

Step 2: Voltage, current, and temperature of the battery are measured using respective sensors.

Step 3: The sensor measurements are analyzed in real-time through microcontroller.

Step 4: Control signal to charging relay is generated according to operating limits.

Step 5: The cooling fan turns on if battery temperature crosses the threshold limit.

Step 6: Any fault condition triggers the buzzer and LEDs for alerts.

Step 7: Parameters of battery are transferred to the cloud through IoT platform.

Step 8: Automatic termination of charging occurs once battery gets fully charged.

a diode and 7805 regulator to provide steady voltage output of 5V to power the ESP32 chip. The ESP32 chip receives analog signals as input from the ACS712 current sensor, battery voltage sensor, and the temperature sensor to evaluate the environmental conditions. Depending on these inputs, the ESP32 chip regulates the output from the GPIO

IX. RESULTS



The proposed system ensures a safe and reliable charge by continuously monitoring the state of the battery. The automatic cut-off and cooling system help avoid cases of overheating and overcharging.

With the inclusion of safety, cooling, and real-time monitoring using IoT, battery efficiency and longevity are improved. This project proves to be an effective and affordable solution for smart electric vehicle chargers.

X. CONCLUSION

This survey conducts an exhaustive analysis of Smart EV Charging Station along with battery safety, cooling, and health monitoring system. With the help of embedded systems, sensors, and Internet of Things (IoT), the proposed system tries to overcome the shortcomings present in traditional charging stations.

Smart charging station plays a crucial role in ensuring safety, extending battery life, and developing smart infrastructures for electric vehicles.

XI. REFERENCES

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