Innovative Journal for Opportunities and Development in Science & Technology,
Volume 6, Issue 4, March 2026
Paper Id: – IJ2023V6I4 -1 A-E
ISSN 2582-6026

ELECTRICAL VEHICLE CHARGING STATION WITH SMART MANAGEMENT

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ABSTRACT-The goal of the cutting-edge and environmentally responsible Electrical Vehicle Charging Station with Smart Management project is to offer effective, secure, and intelligent charging options for electric cars (EVs). The need for smart charging infrastructure that can efficiently manage energy and lessen strain on the power grid is growing due to the quick expansion of electric mobility. The suggested system employs sensors and a microcontroller-based control unit to monitor electrical parameters, including voltage, current, and power usage, during the charging process. The system may be combined with renewable energy sources, such as solar panels, to enhance sustainable and eco-friendly energy. The paper offers a sophisticated, such as solar panels, to improve environmentally friendly and sustainable energy.

I. INTRODUCTION

Efficient and sophisticated charging systems are now necessary due to the growing demand for electrical energy and the quick uptake of electric cars. Grid overloading, power waste, and battery damage can result from conventional EV charging stations' frequent lack of adequate monitoring, power management, and safety features. By integrating sophisticated control and monitoring technologies, the Electrical Vehicle Charging Station with Smart Management is intended to address these issues. The method maximizes energy use while guaranteeing safe and regulated charging. The project's main goal is to employ sensors to track important electrical factors including voltage, current, and power usage. After processing this information, a microcontroller adjusts the charging procedure. Load balancing, avoiding overcharging, and effective power distribution across several charging stations are all made possible by smart management capabilities. The integration of renewable energy sources such as solar power further enhances sustainability and reduces dependency on conventional power generation. Thus, this project supports the development of eco-friendly transportation infrastructure and contributes to sustainable energy management.

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II. METHODOLOGY

The methodology of the Electrical Vehicle Charging Station with Smart Management focuses on controlled energy distribution and intelligent monitoring. The working procedure is explained step by step below:

1. Power Supply Integration
   The main AC grid supply or renewable energy sources like solar panels provide the charging station with electricity. Stable DC output for charging is ensured by an appropriate power conditioning device.
2. Input Parameter Monitoring
   During charging, sensors for voltage and current are attached to continually monitor electrical parameters. The control unit receives data from these sensors in real time.
3. Microcontroller-Based Control
   Based on battery requirements and available power, a microcontroller (such as an Arduino or comparable controller) evaluates the sensor data and chooses the proper charging current and voltage.
4. Smart Power Management
   The technology intelligently distributes available power among one or more charging stations. Load balancing strategies are used to prevent grid overload and ensure efficient energy consumption.
5. Automatic Charging Control
   To avoid overcharging and battery deterioration, the microprocessor automatically turns off the power supply when the EV battery achieves full charge.
6. Display and IoT Monitoring
   Charging parameters such as voltage, current, power consumption, and charging status are displayed on an LCD screen. Additionally, IoT modules can transmit data to a mobile application or web dashboard for remote monitoring and control.
7. Safety and Protection Mechanisms

The system incorporates protection features such as:
Overcurrent protection
Short-circuit protection
Overvoltage protection
Emergency shutdown system

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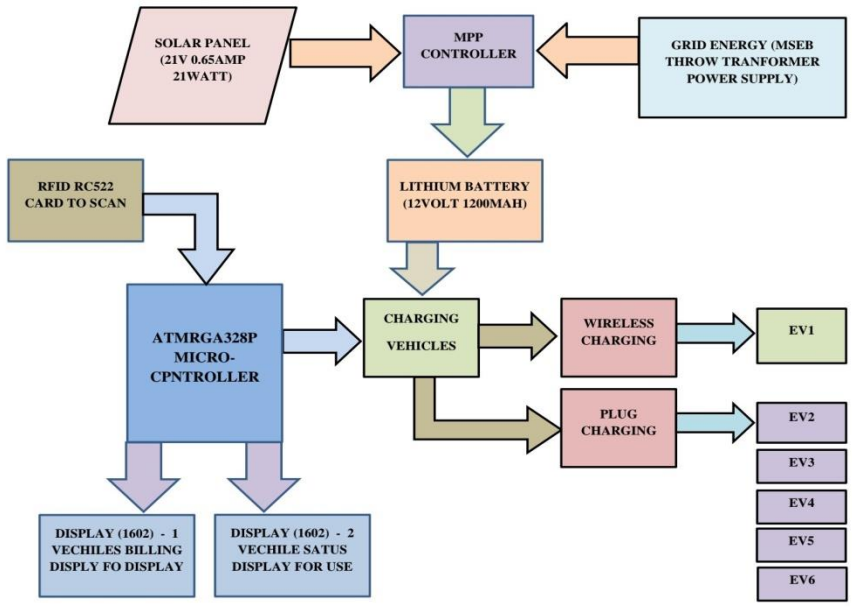
These safety measures ensure reliable and secure operation of both the charging station and the connected vehicle.



III. RESULTS AND DISCUSSION

The created smart EV charging station's experimental assessment shows that voltage and current are effectively regulated during the charging process, guaranteeing steady and regulated power delivery to the car battery. In order to prevent overcharging and improve battery safety, the microcontroller effectively evaluated sensor data and developed an automated cutoff when the battery achieved full charge. By effectively distributing available electricity across charging stations, load management functions reduce the possibility of grid overload and enhance system dependability. Protection mechanisms responded promptly under simulated fault conditions, confirming safe operation. The monitoring system improved user awareness and operational transparency by precisely displaying real-time metrics including voltage, current, and energy usage. Overall, the findings confirm that the suggested method enhances safety, intelligent power control, and energy efficiency, making it appropriate for use in contemporary EV charging infrastructure..

IV. CONCLUSION

The suggested technique offers a clever and environmentally friendly way to charge electric cars A dependable and environmentally friendly power supply is ensured by integrating solar energy with grid backup.Automated operations and effective system management are made possible by

microcontroller-based control. Automated billing and RFID authentication improve consumer ease and security.The system is flexible enough to accommodate different EV customers since it allows many charging modes.Institutions, public spaces, and commercial stations can all successfully use it. Overall, the project contributes to green transportation and energy-efficient infrastructure.

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