Solar Electric Vehicle Charging Station with Current and Voltage Monitoring and Smart Card as a Payment Mode

Tejal Kumbhar[1] Saurav Manekar[2] Navtej Lokhande[3] Aboli Sawale[4] Prof. Mr. J.A. Gurav[5]
[1,2,3,4]UG Student [5]Assistant Professor
[1,2,3,4,5]Department of Electrical Engineering
[1,2,3,4,5]Zeal College of Engineering and Research, Pune, India

Abstract — Electric vehicles are a relatively recent technology that is seeking for its place in the market. It has several advantages, such as the reduced greenhouse emissions, fuel savings and its ease of use. But to charge that vehicle there is a need of EV charging station and we need lot of power for that so we decided to develop charging station with some upgraded changes in it. Our Project as a prototype project, for developing it. we used different types of sensors current sensors, voltage sensors, temperature sensor and we also used Smart card system. While charging the car there are lot of accidents, so to avoid this, we have used different kind of sensors. This paper present main consideration of charging station with renewable source of energy.

Keywords: Solar Electric Vehicle, Charging Station, Current and Voltage Monitoring, Smart Card, Payment Mode

I. Introduction

As the world continues to face the challenges of climate change, renewable energy sources are becoming increasingly important. One area where renewable energy can make a significant impact is in the transportation sector, particularly with the development of electric vehicles. However, the widespread adoption of electric vehicles is hindered by the lack of convenient charging infrastructure. This research paper focuses on the design and components of a solar electric vehicle charging station with an RF ID payment mode and current and voltage regulators. The paper will explore the key components of the charging station, how the RF ID payment mode works, and the role of current and voltage regulators in the charging process. By investigating these aspects, this paper aims to provide insights into the development of a sustainable and efficient charging infrastructure for electric vehicles.

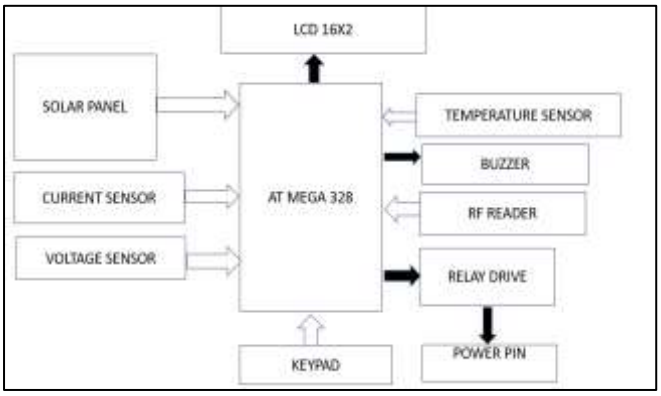

Fig. 1: System Diagram

A solar electric vehicle charging station has several key components that work together to convert sunlight into electricity and charge electric vehicles.

II. Construction

The main components of a solar charging station include a solar panel, inverter and battery bank.

- Solar panel: It converts solar energy in electrical energy.
  1) Voltage- 12V
  2) Current- 1.1A
  3) Power- 10W
- Battery: 12V Lead acid battery used for storing electrical energy that is converted from solar energy by PV panel.
- DC-DC Converter: This converter is a buck converter that steps down, 12V to 5V DC.
- Microcontroller: ATMEGA328 Microcontroller is used in the model. It is used to control the whole circuit.
- RF Reader: The RF Reader is used for payment purpose. The Card is scanned by the RF reader, the money is deducted and the timer starts.
- Current Sensor: Current sensor INA219, is used to monitor current and voltage of the charging battery.
- Temperature Sensor: Temperature sensor DS18B20, is used for sensing temperature of the battery in the electric vehicle. If the temperature is exceeded over 35 degrees Celsius, the temperature sensor sends signal to the microcontroller and the charging is stopped.
- Rating: -50 degree Celsius to +35 degree Celsius.
- Relay: Relay is used for signal sensing.
- Rating: 5V Relay Module.
- LCD: LCD used is of the dimensions of 16X2, used for the display of output current, time and payment status.
- DC Port: DC port is used for external battery charging.

The charging stations are equipped with current and voltage regulators to ensure that the EVs are charged safely and efficiently. These regulators help to manage the flow of electricity from the PV panels to the batteries in the EVs, ensuring that the batteries are not overcharged or undercharged. Overall, the current and voltage regulators play a crucial role in ensuring that the charging station functions effectively and that the EVs are charged safely.

III. Literature Survey

Numerous papers have been published on solar charging stations, use of RF ID as a payment mode, outcomes of solar charging stations. These paper haves detailed information related to particular domain and applications. All research papers, as per the application, have been reviewed and useful information has been extracted from them.

Bugatha Ram Vara Prasad, et al. [1] studies the design of solar powered charging station for charging of electric vehicle describes design of solar powered charging station for charging of electric vehicle that solves the key downside of fuel and pollution. This paper examines the

possibility of creating an electric vehicle charging infrastructure using PV panels.

Dr. Manoj Dhondiram Patil, et al. [2] studies RFID (radio frequency identification) technology, which allows users to be automatically identified. This method reduces operation time by incorporating an RFID system at the charging station, which allows for automatic user authorization. This system will have a long operating range due to the RF transmitter and receiver.

Stephen Lee, et al. [3] studies explored the benefits of integrating renewable solar energy with EV charging infrastructure placed at car-sharing service's parking lot. They demonstrated the feasibility of a grid-isolated solar-powered charging station and show that a PV system proportional to the size of a parking lot adequately apportions available solar energy generated to the EVs service.

Samir M. Sharif, et al. [4] studies practical design considerations for a universal input EV battery charger to be used in a plug-in hybrid vehicle. Stringent operating conditions were imposed on the charger for applications in a solar-powered plug-in EV.

Goldin, et al. [5] studies about the Nissan leaf with solar powered charging stations as it has the lowest cost over 10 years and the lowest greenhouse gas emissions compared to the other alternatives that were investigated. Its impact on urban air quality is also small. Because it has limited range, the opportunity to charge the vehicle at work has significant value.

G.R. Chandra Mouli, et al. [6] studies the possibility of charging battery electric vehicles at workplace in Netherlands using solar energy. Two scenarios are considered – one where the EVs have to be charged only on weekdays and the second case where EV have to be charged all 7 days/week. A priority mechanism is proposed to facilitate the charging of multiple EV from a single EV–PV charger. The feasibility of integrating a local storage to the EV–PV charger to make it grid independent is evaluated.

IV. WORKING

When a car approaches the charging station, the IR sensor senses the presence of the car and sends the signal to the microcontroller. Then the car owner has to set the amount of time he wants to charge the vehicle. After setting the time, he will have to pay for the charging by the smart card. Once the payment is done, the plug is inserted in the battery of the vehicle and then the charging starts. Once the charging is done, the timer will stop and the owner will get to know by the LCD display. If by chance the owner wants to stop the charging before the set time, then there would be a stop button by which he can stop the charging. All of this works on solar energy.

Fig. 2: Solar EV Charging Station

V. RESULTS

Case 1: When no charging is taking place.

Fig 3: No charging is taking place

Case 2: When charging starts

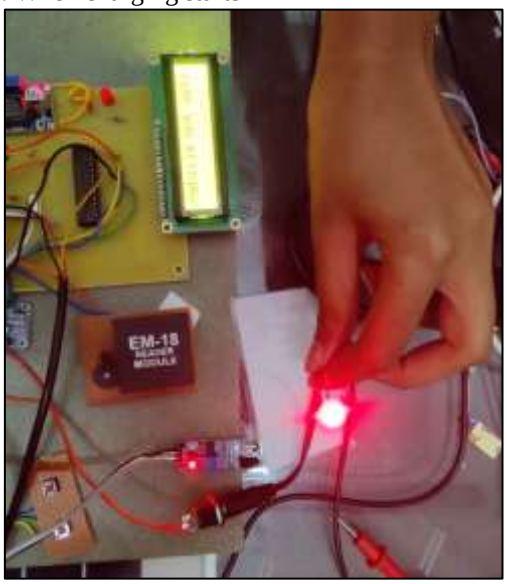

Fig 4: Charging takes place

VI. CONCLUSION

The research paper titled "Solar Electric Vehicle Charging Station with current and voltage monitoring and smart card as a payment mode", presents an innovative approach to charging electric vehicles using solar energy. The paper highlights the key components of a solar EV charging station, including the PV array, inverter and battery bank. The RF ID payment mode is a convenient and efficient method for payment transactions, which can reduce the time and effort required for payment processing. The findings of the study suggest that solar EV charging stations can provide a sustainable and cost-effective alternative to traditional charging methods. Overall, this research paper contributes to the advancement of knowledge in the field of sustainable transportation and renewable energy, and highlights the potential of solar EV charging stations to reduce greenhouse gas emissions and enhance energy security.

REFERENCES

[1] G.R. Chandra Mouli, research paper: System design for a solar powered electric vehicle charging station for workplaces
[2] Erica Goldin, Larry Erickson, Bala Natarajan, research paper: Solar Powered Charge Stations for Electric Vehicles
[3] Mika Mantyla, research paper: Smart card and risk scenarios
[4] Stephen lee, Srinivas Iyenger, Dravid Irwin, research paper: Shared solar powered EV charging stations.
[5] Bo wang, Javier Hernandez Feranandez and Ahmed Massoud, conference paper: A wireless Battery Temperature Monitoring System for Electric Vehicle Charging
[6] Samir M. Sharif, Mohammad Saad Alam, research paper: System Design and Realization of Solar Powered Electric Vehicle Charging Station.

