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Monitoring And Tracking Of PV Based Portable Electrical Charging To Find The Optimum Tilt Angle For Maximum Power Generation

[1*]Dr.C. Gnana Kousalya,[2]T.S.Valarmathi,[3]Dr.Saurabh Gupta,[4]Dr.Saumitra Chattopadhyay, [5]R.Sreenivasan, [6]Dr.S.Govinda Rao, [7]G.G.Raja Sekhar

[1]Professor, Department of Electronics and Communication Engineering, Chennai Institute of Technology, Chennai, Tamilnadu, India

[2]Assistant Professor, Department of Electronics and Communication Engineering, S.A. Engineering College,Chennai,Tamilnadu,India.

[3]Associate Professor, Department of Electrical and Electronics Engineering, Technocrats Institute of Technology,Bhopal, Madhyapradesh,India.

[4]Assistant Professor, Department of Computer Science and Engineering, Graphic Era Hill University, Dehradun,India.

[5]Research Scholar, Department of Electrical and Electronics Engineering, School of Engineering and Technology, Dhanalakshmi Srinivasan University, Tiruchirappalli, Tamil Nadu, India.

[6]Professor, Department of Data Science,Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad, Telangana,India.

[7]Associate Professor, Department of Electrical and Electronics Engineering, Koneru Lakshmaiah Education Foundation, Guntur, Andhra Pradesh, India.

drcgnanakousalya.sjitece@gmail.com[1], valarmathi@saec.ac.in[2], saurabhgupta.sgsits@gmail.com[3], saumitroc@gmail.com[4], srini.vasan256@gmail.com[5], govindsampathirao@gmail.com[6], rsgg73@gmail.com[7]

Abstract. *The present power system has face huge instabilities with wide spread of EVs and this project named 'solar powered portable Electrical vehicle charging station' uses hybrid power system. The processing of solar energy is converted to electrical and used to charge the lead acid battery, which in turn charges the battery of the EVs connected to this station. In order to make this more user-friendly a set of facilities are attached along with this station like user authentication, LCD display, audio interaction and GSM platform. The main objective of this paper "Solar Based Charging Station for Vehicle" is to generate maximum power from the solar panel by tilting its angle based on the intensity of the light that falls on the solar panel. [1-7] Also, the amount of power available in the charge station is continually monitored locally and from the remote area. This work suggests the maximum power tracking and monitoring of PV based electric charging station.*

Keywords: *Electric vehicle, battery charger, charging station, solar panel.*

INTRODUCTION

E-vehicle re-energizing station or EVchargingstation, consists of a power charger, chargingstation,electriccharging station (ECS), and electric vehicle supplier (EVSE) which is employed inhybridbuses,neighborhood electric cars. The aim of this research "SolarBasedChargingStationfor E-Vehicle isto extract maximum solar energy by adjusting rotation angle in par with the intensity of light incident on it. This process enables in obtaining maximum solar energy by determining the tilt angle of the solar panel based on the available solar energy [21]. The quantity of solar panel's generated energy and load consumed at the charging station is monitored continuously by the GSM. Different angle of movement yields in obtaining highest energy mark form the solar panel when compared to fixed position of the panel. Every electric car is dependent on a charging station. [8-11] To make charging easily accessible for public charging channels are given to standard separation range. A constant monitoring of charging the electric batteries is unavoidable. It's very difficult to set an E-car charging station from a remote end with the existing systems scalability. Only one angle inclination is prevailing in the present system for energy production. [12-15] This will lead to limited power generation because of the lack of various tilt angles usage. Single tilt angle will result in the variation of energy generated during different quarters of a day since its angle of tilt cast be adjusted based on the fall of sunlight. Single axis tilt angle generates lesser electrical energy due to the wrong incidence of sunlight on the axis. This problem can be overcome by the microcontroller PIC16F877A.In the proposed work, due to different tilt angle the energy generated is higher than a fixed [16,17,18]. This reduces the energy consumption form the grid and saved energy.

Block diagram Description

Figure 1 shows the Conventional AC on-board charger configuration:

- Consumers are bound to charge their EVs via residential mains due to the lack of charging infrastructure.
- These residential chargers are referred to as level-1 (120 V) and level-2 (240 V) chargers as per SAEJ1772 standards.
- In such cases, the vehicles should be equipped with dedicated on-board chargers that are capable of drawing a power of 1.92 kW (level-1) and 19.2 kW (level-2) from the mains [10,11]. Typically, these
- chargers take more than 8 h to add 200 miles of driving range on the EV.

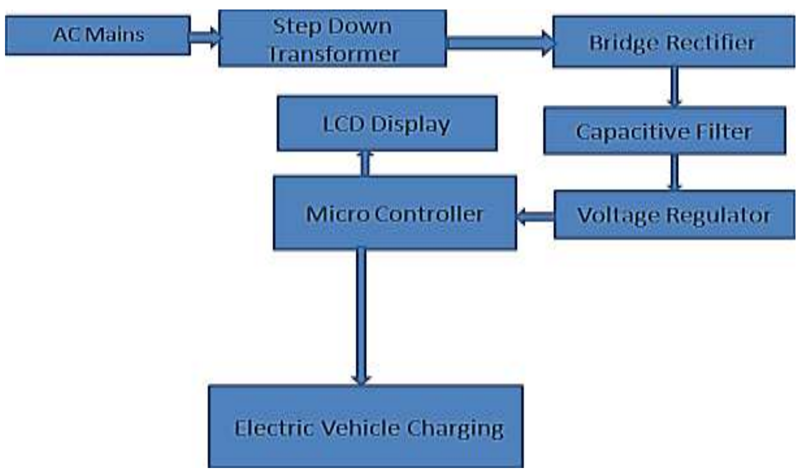

Fig.1 Conventional on-board charger

Conventional DC OFF-board charger Configuration

An alternative is the development of off-board chargers and the corresponding infrastructure that can mimic the functionality of a gasoline refueling station. The off-board chargers are located outside the EV that can deliver the DC power to the EV battery through a power conditioning unit PCU shown in figure.2and 3.

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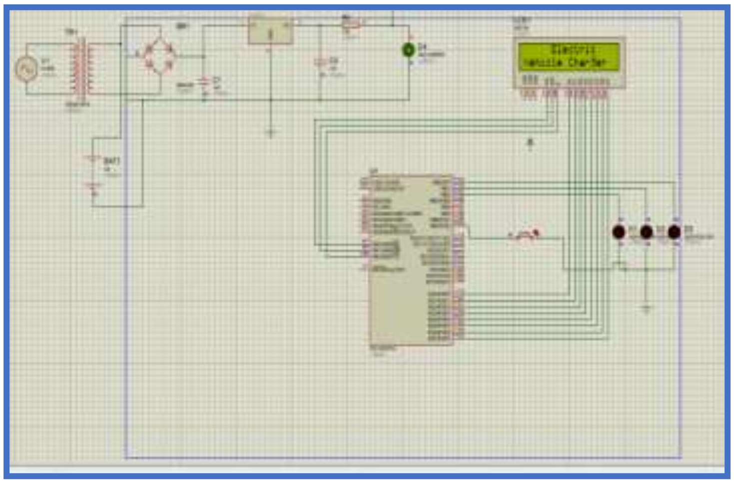

Fig.2 Simulation circuit for existing system

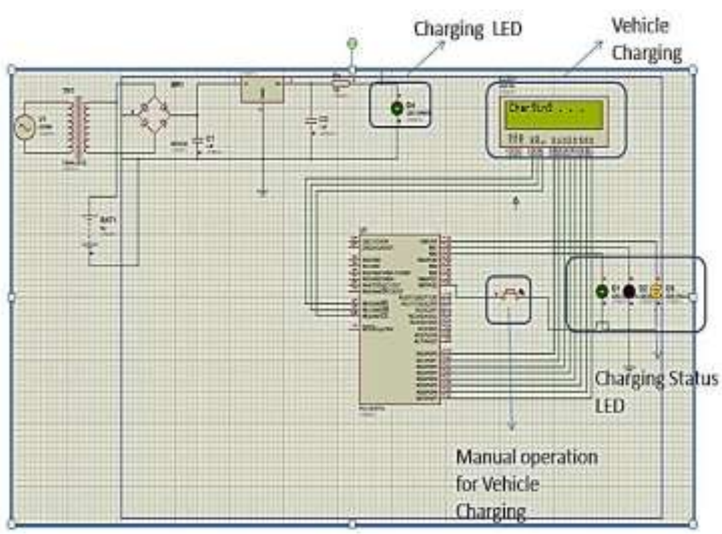

Fig.3 Simulation circuit highlighting manual vehicle charging

Disadvantages of existing system

- which is undesirable for highway driving and long trips.
- Manual Operation [3]
- Taking more time for charging
- Power consumption High
- Electricity charges high
- One-way method.
- Not able to measure the Battery charging level indication.

Proposed topology of E-vehicle Charger

The above figure 4 shows the systematic block diagram of "Solar Based Charging Station for E- Vehicle "Here, AC power is stepped down by a transformer and converted to dc by a bridge rectifier in order to power the microcontroller [19-21]. The unregulated dc is rippled and hence we need a capacitive filter and 7805 voltage regulators for a regulated dc power suitable for the microcontroller operation. LDRs are deployed in both North and South Direction to have a track of sunlight is shown in the figure5,6&7. Solar panel tilt motor

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rotates in North direction if the amount of sunlight falling in North LDR is more than the south LDRand vice versa in the opposite direction.[22]
Data transfer to the internet and status of station as shown in figure 5,6 &7can be got from The SIMCOM GSM modem network connectivity.

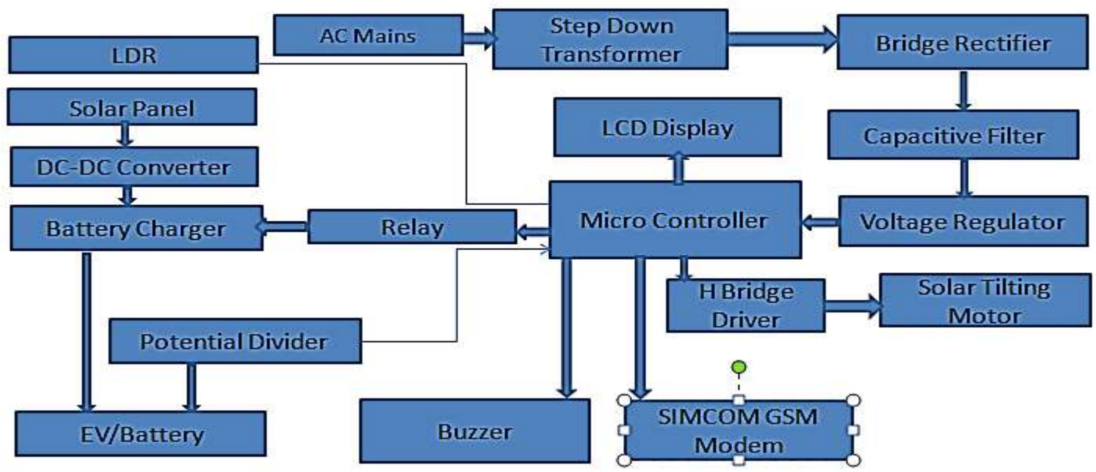

Fig.4 Proposed block diagram of solar based e-vehicle charger

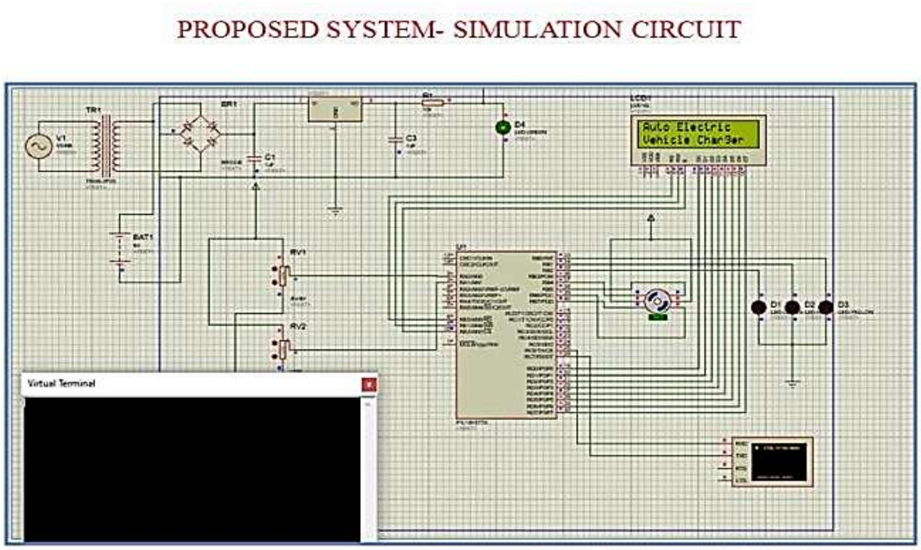

Fig.5 Simulation circuit of proposed system
Solar based electric vehicle charging station we using 5W/21V O/P solar panel, it produces the 21V DC, the DC-DC converter accepts DC input power and delivers the output as DC power to the next level or lower or higher depending on the output power to match the electrical power required in the module. [5,6,7]

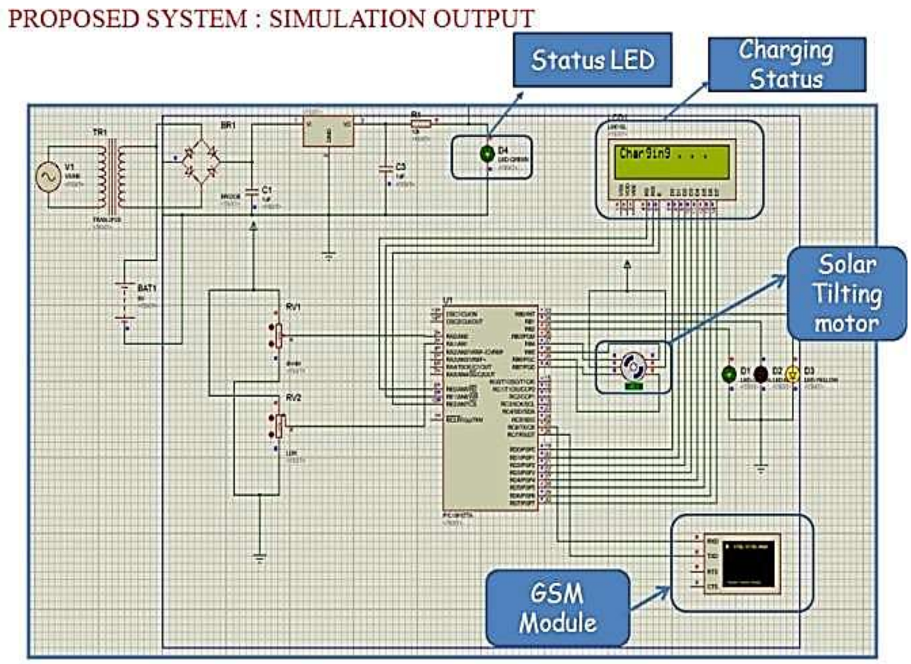

Fig.6 Simulated output of proposed system

Fig.7 Hardware prototype

Regulated 21VDC output from AC mains and solar Panel is charged in12V/7.5Ah battery connected to the system makes use of a Relay for switching the devices and Micro controller, which is programmed, with the help of embedded C instructions.[23]

When the sunlight falls on LDR it senses the sunlight and provides the information to the controller for continuous operation and when the sunlight direction changes the LDR sense and changing the direction Solar panel to right direction using Tilting motor.[21]

Fig.8 Hardware output

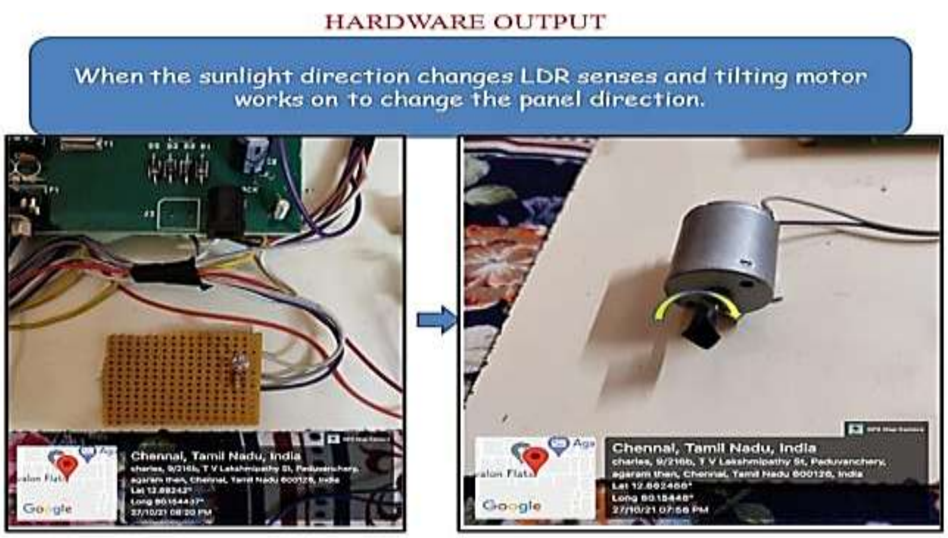

Fig.9 Output of proposed topology

The 16x2 LCD display the information of the charging status when the Battery or Electricvehicle connected to the station.
Figure 8,9 shows that the hardware results of the proposed topology. Auto electric vehicle charger displays in LCD when the system ready to charge the vehicle. When the sunlight direction changes LDR senses and tilting motor works on to change the panel direction.
When the relay coil switches the supply when the charging is completed the GSM message will send.

Table 1 Comparison of simulation and Hardware Results

Input voltage (Vin)	Output Voltage (Vo)	
	Simulation	Hardware
18V	20V	21V
20V	20V	21V
21V	20V	21V

Table 1 shows that the comparison of simulation and hardware results. The various values of voltage are compared with simulation and hardware results.

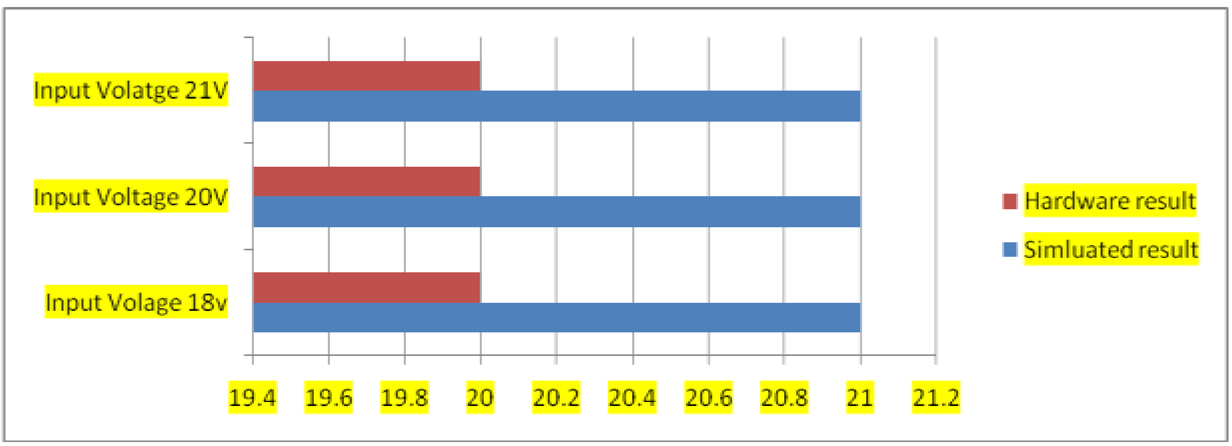

Fig.10 Comparative chart of simulation and hardware results

Figure 10 shows that the comparative chart of the simulation and hardware results for various values of the applied voltage.

Comparison between existing and proposed system

Existing system

- Input Power :240V/15A
- Maximum Power: 2.5Kw
- Time Required for charging: 7hrs
- Total Kwh : 17.5Kwh
- Total Kwh consumption in year: 6387.5Kwh
- Kwh unit cost: Rs.3.00
- Total cost: 6387.5 x 3=19162.5 Rs
- Energy consumption cost for 15yrs: Rs.287437.5

Proposed system

- Solar panel watts: 250watts
- Max Voltage: 29.95V
- Max Power current: 8.35A
- Avg hours of sunlight: 8hrs
- Daily Watt hours: Solar Panel watts x Avg hours of sunlight x 0.75= 1500whrs
- For a 12V Battery it may require 1200-watt hours to fully operate.

- As standard electric vehicle required 2.5Kwh
- In this project using 12V batteryx3nos = 48V,7Ah in series connection.
- Total Approx. cost of the Project: 2Lac.

CONCLUSION

In this work photovoltaic powered portable Electric vehicle charging system was proposed. This work extracts maximum powerfrom the solar panel through multiple axis and hence the power utilized from the grid source is reduced drastically in order to save nonrenewable power source. Additionally, the power generated from the solar panel and power consumption of the solar charge station is made available in the cloud server for monitoring and tracking purposes. The results are verified with the simulation tool and prototype model.

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