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Electric Vehicle Charging Station Design by using NI-Labview

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Abstract: ***Global environmental concerns and the escalating demand for energy, coupled with steady progress in renewable energy technologies, are opening up new opportunities for utilization of renewable energy resources. Solar energy is the most abundant, inexhaustible and clean of all the renewable energy resources till date. Global warming has led to the large adoption of Electric Vehicles (EVs) which appear to be the best replacement to IC engines.***
Due to increased number of EVs on road, charging of the vehicles with conventional fossil fuel based grid is not economical and efficient.
Thus, a renewable energy based charging station finds immense potential and control for electric vehicle charging. An electric vehicle charging station integrating solar power and a battery energy storage system (BEES) is designed for current scenario. For uninterrupted power in the charging station an additional grid support is also considered without becoming an extra burden to the grid. By taking dynamic charging needs of EVs, the design of charging station is formulated and validated in LAB VIEW software.
Keywords: Charging Station, Electric Vehicles, Solar, State Of Charge, Battery Energy Storage System and IOT.

I. INTRODUCTION

The electric vehicles (EVs) has recently become the most popular form of green transportation. EVs have many advantages including that they are most eco-friendly, economical, energy efficient and comfortable than conventional gasoline vehicles.
Batteries are known to play an important role in EVs because they serve the purpose of being either the primary energy source or the backup source in hybrid EVs[1]. Battery performance is dependent on certain factors such as temperature ,chemical composition, age, and rate of charge/discharge[2][3].In EVs, it is important to monitor the battery's state of charge (SoC) although this is not always easy due to the characteristics of the battery itself. A battery's SoC can be defined as its residual capacity with respect to its normal capacity[4].
As SoC is an important parameter that reflects performance, so accurate estimation of the SoC can not only protect the battery, prevent over discharge, and improve battery life but can also enables rational control strategies that save energy [5].
Measurement of battery charge or SoC can be performed in various ways, one of which is to calculate the open circuit voltage in the battery cell according to below equation:
SoC(%)= 100x(Vm-Vmin / Vmax-Vmin) (1)
This is a simple method, but the accuracy of voltage based SoC measurements tends to be low because the temperature in the battery when operating can affect the results [4].
In the proposed work, an optimal approach for design and power management of Electrical Vehicle charging station powered by solar PV and a Battery Energy Storage System is explained. The unreliability of solar and dynamic charging requirements of EVs in the charging place. Since the power from PV at night is not there, a battery as an energy storage device is provided to charge the EVs connected in the charging station. The proposed system is formulated, designed and validated using LAB VIEW software of National Instrumentation.

A. Objectives

1) To charge the e-vehicles by utilizing solar energy.
2) To reduce the pollution by using renewable resources.
3) To design such system which is less harmful to the natural being.

II. DESIGN OF CHARGING STATION:

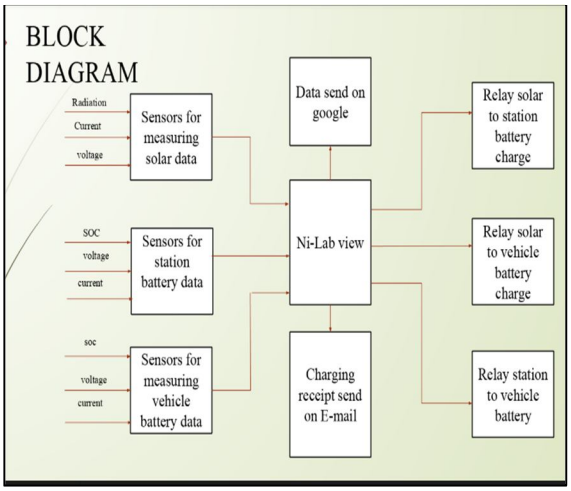

Fig.2 Block Diagram

Fig.2 gives the block diagram of the proposed EV charging station. In this paper we have considered the EVs of 6V DC. The whole system is design with the help of NI-LAB VIEW software.

A. Lab View

It is a laboratory virtual instrument engineering workbench, created by National Instruments (www.ni.com) is a graphical programming language that uses icons instead of lines of text to create applications. LabVIEW is used for Data acquisition, signal processing and hardware control and image processing.

LabVIEW consisted of;

1) *Front Panel window of Proposed Work:* It consists of controls and indicators. In this front panel the graphical representation is shown of power , voltage, current, temperature , state of charge and radiations. the green buttons are provided to ON-OFF the graphical response. Below the switch display is provided to indicate the change in readings took from sensors. The fig. a has three waveform charts for solar data, station battery data and vehicle battery data. On this chart we can see the variations of different quantities like voltage, radiations, current and temperature , etc.

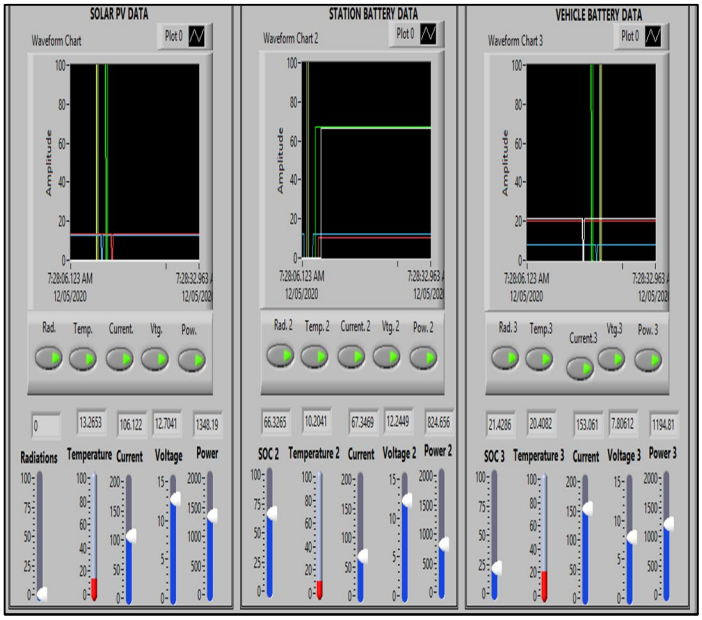

Fig.a front panel window

2) *Block Diagram Window:* Terminals corresponding to front panel controls and indicators, as well as constants, function, SubVIs, structure, and wires that connect data from one object to another.

The components of a block diagram belong to one of the three classes:

a) *Nodes:* program execution elements.

b) *Terminals:* ports through which data passes between the block diagram and the front panel, and between nodes. Terminal is any point to which you can attached a wire to pass data.

c) *Wires:* data paths between terminals.

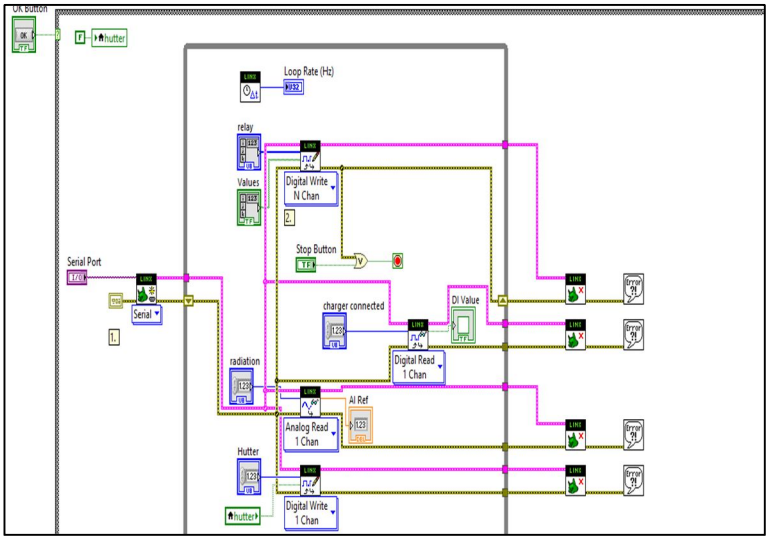

Fig.b Block diagram window

III. RELATED WORK

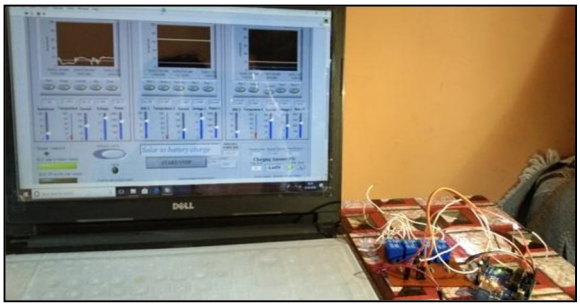

Fig. 3 experimental setup

In this paper work we have done the design of EVs charging station with the help of LabVIEW software. Here four step work takes places:

1) *Solar to Station Battery:* In this mode of operation the station battery get charge when the sun radiations are available. This process is indicated by first indicator lamp. when it becomes green the solar to station battery is connected.

2) *Solar to Vehicle Battery:* When sun radiations are also available and vehicle is also connected to charge with the help of charger then the solar to station battery relay get tripped and the solar to vehicle battery charging get start with the help of another relay.

3) *Station Battery to Vehicle Battery:* In this mode when vehicle is connected to charger for charging but sun radiations are not available then the vehicle battery is charged by station battery.

4) *Fault Condition:* This condition takes places when the sun radiations are absent as well as station battery is not charged and also charger is not connected to vehicle battery.

In this paper we have also used the Internet of Things (IoT) which help us out to send the information of respective vehicle battery consumption and amount of vehicle charging to its owner through Email. It happens on the bases of real time clock (RTC), so both consumer as well as customer have the record of system.

IV. ADVANTAGES and DISADVANTAGES

A. *Advantages*

1) It provides the billing receipts to customers as well as owner for backup through email .
2) Save charging time.
3) Ecofriendly to environment.
4) Reduction in fossil fuel usage.
5) Use of renewable energy.
6) Reduces carbon dioxide emission up to 90%.
7) It is a driver support system.
8) It is flexible, safe, and cost-effective.

B. *Disadvantages*

1) The implementation of this project is difficult.
2) We should choose appropriate components to match different size of vehicles.

V. CONCLUSION

With increase of EVs on the road, charging of EVs possess as a critical issue. A charging station with solar, battery storage system with additional IOT (internet of things) support gives a promising solution for satisfying charging requirements of all EVs throughout the day. The design and its power management of the proposed station is explained and validated in LABVIEW. In this paper we have also focused on email receipts which provides actual power consumption by vehicle, this is done with the help of IoT. This study provides value for the design and performance of charging station through LABVIEW.

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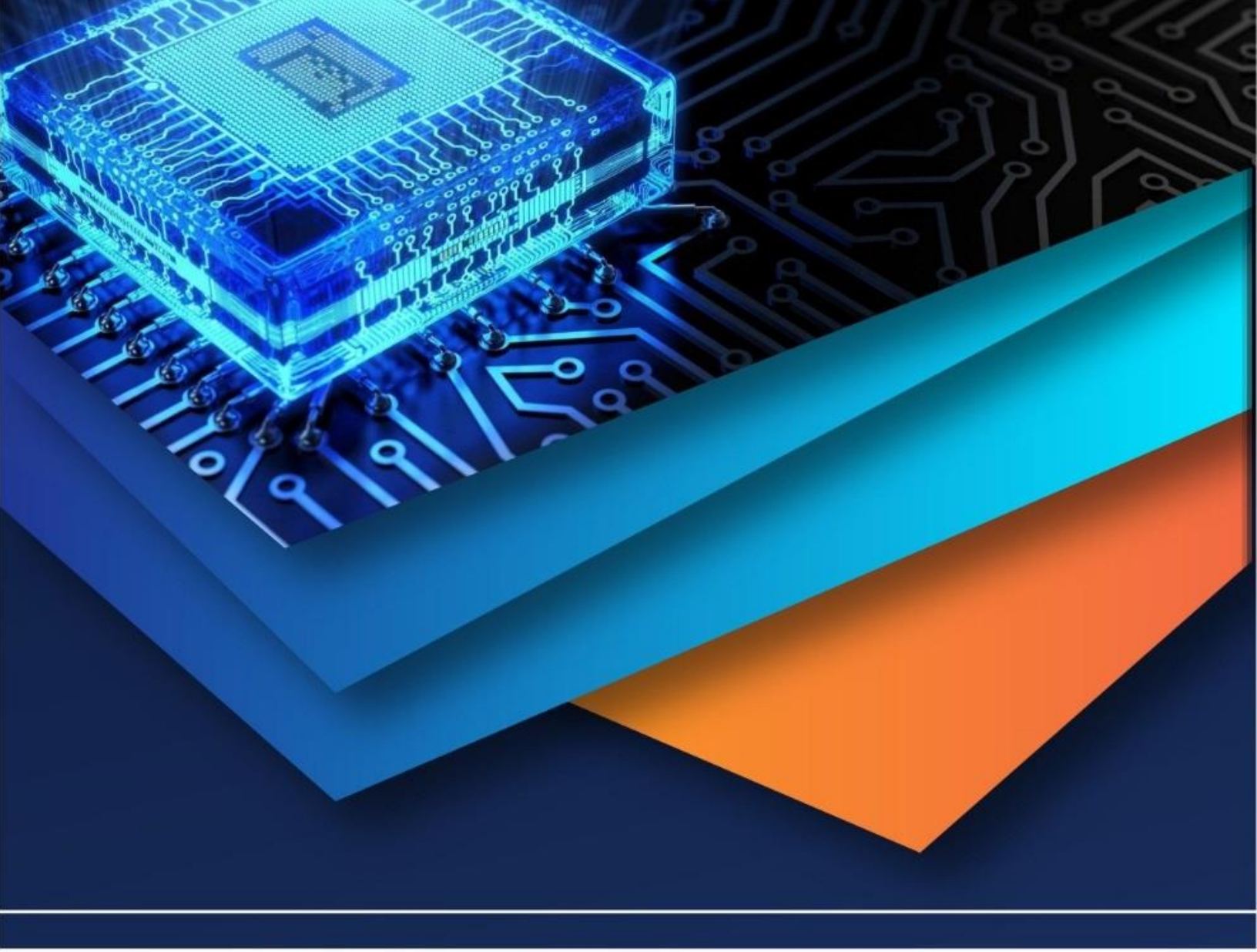

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