Solar with IOT Enabled Charging Stations for Electrical Vehicle

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ABSTRACT

The main idea of this paper is to reduce greenhouse gas emission and fossil fuel. This paper is about charging E-vehicle module using the Solar panel, availability of maximum power is viewed by IOT(internet of things) device and the maximum power generated by the solar is being tracked using the MPPT(maximum power point tracking) controller. The whole setup is connected to the Arduino uno, the battery level generated and distributed amount of the battery is viewed using an LCD (liquid crystal display). This set up can charge multiple vehicles using solar cell. GSM (global system for mobile) modem is used to get an alert message for any reduction and access of power occurred in the system. A web page is used to check the availability status of charge, keep track the power transferred to the charging module and also displays the available location of the charging station.

Keywords: Arduino UNO R3, Solar panel, MPPT controller, DC-DC converter, Modem, Servo motor, Battery, GSM, LDR sensors.

INTRODUCTION:

As the demand for conventional energy like coal, natural gas, and oil is raised, so that the researchers forced towards the development of renewable resources or non-conventional energy resources. In the last couple of years, there has been a lot of discussion around the prices of fuel apart from the deregulation of petrol and fossil fuel prices. Moreover, these threats of disruption of supplies have brought the focus on to alternate drive train technologies. In further years there will be more solar electric vehicle will be introduced due to these reasons: (1)Reduction of emission of fossil fuel for extracting power from renewable resources. (2) Intelligent compliance to electronic requirements that facilitate the monitoring the availability of used power using IOT. (3) Tracking of sun's radiation throughout a time. Electric vehicle confines the outlook of passenger a vehicle that draws current from the rechargeable battery. There are three types of electric vehicle: hybrid electric vehicle (HEV), plug-in hybrid (PHEV), battery electric vehicle (BEV) and extended range electric vehicle(EREV). The main objective of the paper is to provide power from solar PV cell to the charging station in which the vehicle can be charged through the rechargeable battery and also with the help of IOT, the charging station can be monitored frequently at any moment and stored in the cloud in a graph pattern (think speak).

LITERATURE SURVEY:

Paper: 1
Title: Optimization of Solar Energy System for the Electric Vehicle **Year:** 2018
Abstract: The incorporation of renewable energy and the transportation system can be significantly beneficial for the economy and environment of Bangladesh. The main energy source for vehicles in Bangladesh is the country's natural gas and fuel. However, due to the rapid depletion of the gas reserve, soaring gas prices and global warming, alongside the environmental pollution caused by burning fuel, this raises concerns about these energy sources. Renewable energy offers a plausible solution to these problems.
Conclusion: Has been proposed a complete new use for the existing installed solar PV panels at the selected location, which will optimize the uses of the installed system.

Paper: 2
Title: Design and Simulation of Romanian Solar Energy Charging Station for Electric Vehicles **Year:** 2018
Abstract: Petrol consumption in the transport sector has increased at a higher rate than in other sectors. The transport sector generates 35% of the total CO2 emissions. In this context, strategies have been adopted to use clean energy, with electro mobility being the main directive. This paper is about charging E-vehicle module using the Solar panel, availability of maximum power is viewed by IOT device and the maximum power generated by the solar is being tracked using the MPPT controller.
Conclusion: It is examined the possibility of using solar energy resources to provide energy support for an EV charging station, as a starting point to demonstrate the usefulness of the technology presented in mobile applications.

Paper: 3
Title: Charging Station for E-Vehicle using Solar with IOT **Year:** 2019
Abstract: This paper is about charging E-vehicle module using the Solar panel, availability of maximum power is viewed by IOT device and the maximum power generated by the solar is being tracked using the MPPT controller.
Conclusion: Internet of Things (IOT) based battery sensor monitors the real-time status of the battery as an energy storage management system. The IOT developed here uses a cloud platform for management purpose.

Paper: 4
Title: IOT Enabled smart charging stations for Electric Vehicle
Abstract: As more countries are moving towards pollution free traffic, EVs are gaining more popularity across the globe. As the number of EVs increases, EV charging infrastructure will be also a basic need. A system with IOT will definitely streamline the performance of EV charging and looks the impacts. This method is helpful for transportation systems, and V2G systems. This proposed system will improve the city planning and makes the city life easy. With IOT we can easily manage the whole V2G system which will definitely saves time and money. This work is to make a smart application to connect with the grid and to know the different tariff rates of the grid. The tariff rates will have both the rate for power delivery to the grid and tariff rate for taking power from the grid. If the user is having the car battery fully charged, he can deliver some power to the grid and can earn some money. SoC is measured using the ARM Mbed controller and transmitted to cloud. The application will also displays the battery status(SoC) of the user when he comes to the grid.
Conclusion: Internet of Things (IOT) based smart grid has been developed to monitor status of batteries in smart grid systems. The IOT which is developed here uses a cloud platform and Android Apps for communication purposes. The car user can easily check the health of his car battery and he can easily make a decision whether to take power from grid or to sell power to grid. The data stored in the Adafruit IO lasts for 30 days. For future work, handling of multiple users could be implemented so as to compare the status of different users.

Paper: 5
Title: IOT and Block chain Paradigms for EV Charging System
Abstract: In this research work, we apply the Internet of Things (IOT) paradigm with a decentralized block chain approach to handle the electric vehicle (EV) charging process in shared spaces, such as condominiums. A mobile app handles the user authentication mechanism to initiate the EV charging process, where a set of sensors are used for measuring energy consumption, and based on a microcontroller, establish data communication with the mobile app. A block chain handles financial transitions, and this approach can be replicated to other EV charging scenarios, such as public charging systems in a city, where the mobile device provides an authentication mechanism. A user interface was developed to visualize transactions, gather users' preferences, and handle power charging limitations due to the usage of a shared infrastructure. The developed approach was tested in a shared space with three EVs using a charging infrastructure for a period of 3.5 months.
Conclusion: The work presented in this paper explores different approaches based on IOT, mobile devices and block chain to create a novel solution for the EV charging process in shared spaces with authentication and security features, accounts and a transaction system. This approach can contribute to the proliferation of EVs, because one of their current barriers is the charging process at condominiums and rented houses. Moreover, from this solution, it is possible to identify EV charging profiles, create patterns to handle power limitations and share services without the need for new individual services. This approach can also be applied to handle energy transactions in other application scenarios, such as micro-generation without a central supervision control

mechanism, although the use of open public cryptocurrency platforms like Bitcoin or Ethereum, due to high transaction costs, can create some barriers to the acceptance of the model.

Paper: 6
Title: Design and Implementation of Grid Connected Solar/Wind/Diesel Generator Powered Charging Station for Electric Vehicles with Vehicle to Grid Technology Using IOT
Abstract: In this paper grid connected Solar/Wind/Diesel generator powered Electric Vehicle (EV) charging station with Vehicle to Grid (V2G) is designed. Solar/Wind/Diesel generator powered charging station consists of a Photovoltaic array and Wind Energy system, three unidirectional converters, Maximum Power Point Tracker(MPPT), Raspberry Pi controller, 20 Bidirectional DC/DC converter associated with 20 Electric Vehicle charging station. Three phase bidirectional DC/AC (Direct Current/Alternating Current) converter is connected to the grid. The main contribution of this work is to design EV charging station, in addition to charging priority set with respect to State of Charge (SOC) level of EV's battery. If the availability of Solar/Wind power is sufficient to charge the connected EV's, then they are charged with Solar/Wind. If the demand is increased, power is extracted from the Diesel at peak load time and from the grid at base load time. Once the vehicle is plugged in charging station the customer can either buy or sell the power.
Conclusion: In this paper, grid-connected solar, wind and diesel powered EV charging station with V2G technology was designed. Solar, wind and diesel generator produces power to charge EVs. Charging of EVs is done by setting priority with respect to SOC level of EVs battery. Due to this, all customers are satisfied with their charging and Energy Management is effectively done. The whole control process is done by Raspberry pi controller, thereby accomplishing the prototype model.

PROPOSED METHODOLOGY AND DISCUSSION:

PROPOSED SYSTEM:

In realization of the present work, actual relevant studies have been identified regarding the design, the optimization, the simulation of solar charging stations for electrical vehicles, different approaches being critically analyzed, but also the current state of the global implementation of these energy generating systems, technique based upon the green charging solar station concept for green electrical vehicles.

METHODOLOGY:

As a solar PV array plays a vital role in a project, the model with LDR sensor to track the position for generating power from the source which helps the continuous flow of energy. And will charge the solar cell and save charging in battery after that we can use charging for cars. The entire output from the cell and it should unbiased output when it exceeds the expected result in order to avoid a hysteresis loss. Initially, DC-DC converter accepts the DC input voltage and also provides output as DC voltage in next level whether lower or higher depends on the requirement such that converter output voltage matches the power supply required to the module. These are the few module set up are done.

- Modelling for tracking position.
- Modelling of DC-DC converter.
- Modelling of motor drives.
- Modelling of arduino UNO R3.
- Battery voltage sensor.
- Modelling of LCD.
- Description of the regulator.
- Modelling of IOT device.

Voltage sensor will check the voltages of coming from the battery. If voltages are out of range then send the message using GSM module. And we will print on LCD display and uploading data on cloud using thing speak.

DISCUSSION:

This paper focuses on IoT to engage information of charge station availability to the vehicle user through the webpage. The webpage is designed using normal HTML method for the clear and easy usage of information provided. The webpage may consider the graph of battery voltage and time and also the location tracked for

charging station as similar to the Google map. With webpage IoT designed user can able to collect the appropriate data of battery charge details. It simply requires a 24/7 network and browser to load data using a URL address. The information such as the capacity of battery voltage, time of charging, related location is updated regularly. These are open source data and anyone can view the status of this webpage using link address with secured internet availability.

EXPERIMENTAL RESULTS WITH FIGURES / GRAPH:

As a solar PV array plays a vital role in a project, the model simply uses torches with LDR sensor to track the position for generating power from the source which helps the continuous flow of energy. Since the tilting angle of the sun varies from 0 o to 180o, two sensors should be built for either direction i.e., one in the left and other in the right. Then, the collected electric source from the PV cell is transferred to the converter together with the buck regulator which stabilizes the power.

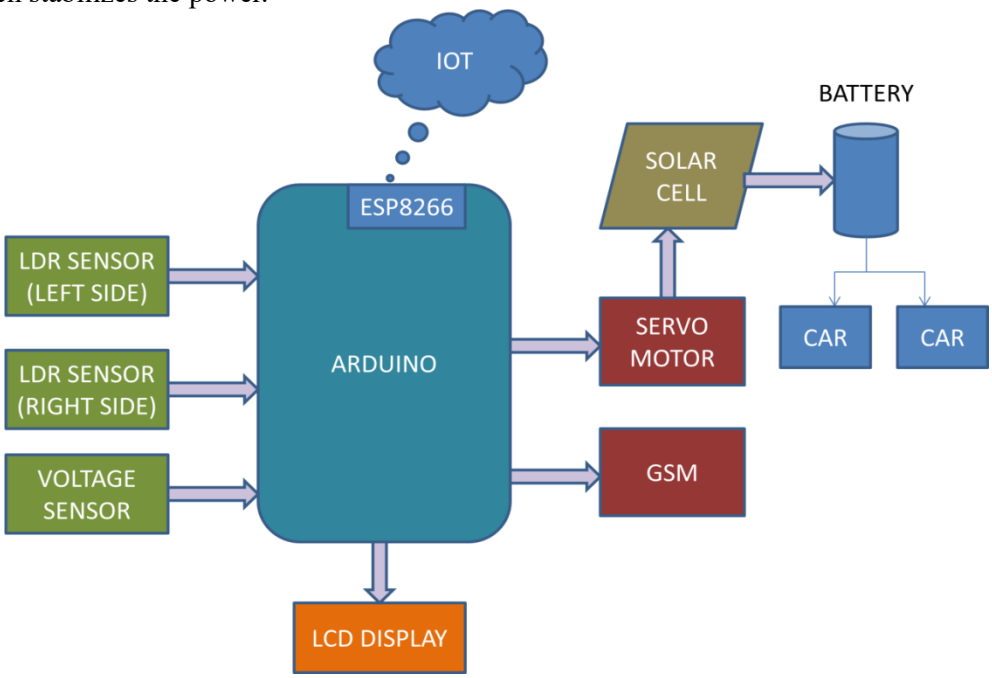

Figure 1: Block diagram of Charging Module.

The entire DC-DC converter setup maintains the reliability of output from the cell and it should unbiased output when it exceeds the expected result in order to avoid a hysteresis loss. Initially, DC-DC converter accepts the DC input voltage and also provide s output as DC voltage in next level whether lower or higher depends on the requirement such that converter output voltage matches the power supply required to the module.

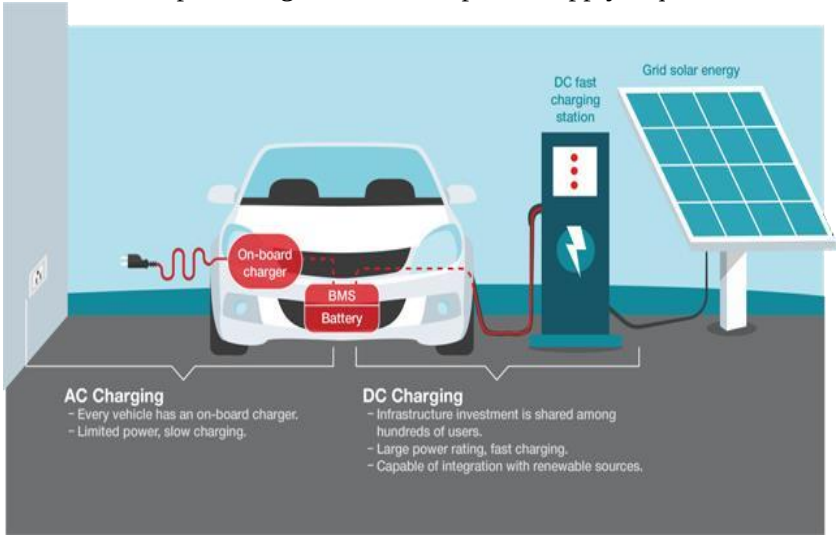

Figure 2: Architecture of Charging Module

The regulated constant voltage is delivered to an analog input of ARDUINO to avoid the complexity of the operation. The meter should help to monitor the constant voltage. ARDUINO UNO is a microcontroller board with digital input and six can be used as an analog input. Program for tracking, delivering and displaying the required power output supply can be loaded on it as follows from the easy-to-use ARDUINO computer program. In IOT we will upload the voltage data on thing speak and sending message using GSM module to mobile. Voltage sensor will check the how many voltages are coming. If it is more or less it will send message to mobile.

GRAPH OF CONTINOUS OPERATION:

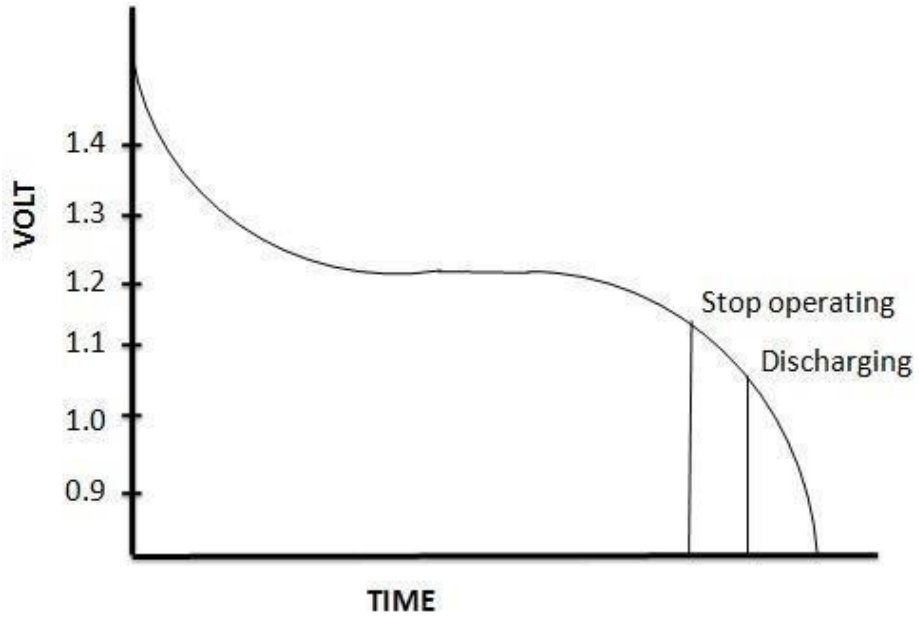

Figure 3: Continuous Operation

RESULTS & CONCLUSION:

Internet of Things (IOT) based battery sensor monitors the real-time status of the battery as an energy storage management system. The IOT developed here uses a cloud platform for management purpose. The vehicle user can easily check to the destination to reach the charging station and can view the withdrawal of battery voltage from the system. The data stored in the ARDUINO can withstand until battery fails to charge. For the future use, multiple user for the e- vehicle who settles the station are stored and upgraded in the database so that the distribution to the different user can be monitored.

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