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Solar Battery Charger with Over Charging and Deep Charging Protection

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***Abstract*—The internet of things has many applications; one of those is Smart BATTERY Power Monitoring and Control Systems. Energy efficient devices can be designed in IoT, which can reduce both, the power consumption and the human effort required to do so. This work has been designed in to implement a smart charging system that automatically controls its behaviour using the webserver and the phone which is being charged. The device being used is a ESP8266, the Webserver which will be stored on the ESP8266 module acts as the IoT platform. As the webserver is platform independent, it can be used on any device, like mobiles and laptops, these devices relay commands, and in turn the web server toggles the charger through the ESP8266 module. This project helps in automatic monitoring of the device and sends notifications to the phone, which is necessary if we want to reduce both the energy and time needed to maintain said devices. This system would be capable of turning on and off only when the device is connected and charge only when needed, and can be further improved to monitor other appliances. There are various modules available, which when paired up with the charging circuit will turn the charger into an IoT based device, like ESP8266, Particle Photon, and other Arduino based modules, but ESP8266 is the most cost effective and also has low power consumption.**

I. INTRODUCTION

The internet of things is a futuristic technology by which an object could be sensed, monitored and controlled remotely using the cloud server network. By using this technology machines can communicate with themselves and be controlled without requiring humans. In the past decade of years there is increase in demand for reliable and abundant electrical energy derived from renewable energy sources renewable energy plays important role in energy crisis of country. The government started to decrease the usage of conventional energy sources and encouraging people to use renewable energy sources like hydro and solar. One such example of renewable energy is solar power. Solar energy is a very large, inexhaustible source of energy. Each hour the earth receives 430 quintillion joules of solar energy which is more than enough to power the whole world for an year. But the problem here is it is tough to utilize this much of energy efficiently. The solar panels nowadays are installed everywhere but they are not monitored so we do not know how much they generate and moreover the solar panels operates at its maximum efficiency for an hour or 2 hours but these can be overcome by monitoring and controlling the solar panel using IoT. An IOT Based Solar Power charging system monitors different parameters like solar panel voltage battery voltage over a Web server using internet . The system will show the battery voltage, and power generated by solar panel on the LCD and as well as on a webpage so that it can be monitored very easily. ATMEGA 328p (ardiuno) is used as the microcontroller. In this IoT project the solar panel can be monitored from anywhere using computer or smart phone

II-PROPOSED SYSTEM

A deep depleted battery will be broken if a high modern is supplied to it. And if we leave a battery charging for an extended period of time (overcharging), hydrogen and oxygen gassing occurs at the electrode plates, clearing away the active material coated on the plates, resulting in battery failure. As a result, a practical battery

charging system is required to address these issues. A low-cost solar powered battery charger for DC hundreds (DC lighting fixtures such as LEDs, DC devices such as laptops, cell phones, satellite TV for computer TV controllers, and so on.) has been invented and advanced in this work.

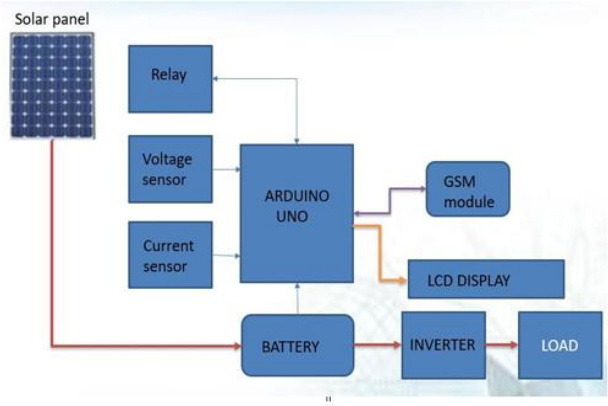

Fig 1. Proposed Solar PV System

The advanced equipment has the capability of logging and storing data for some distance off observation, with the primary goal of improving battery safety and therefore battery life. The suggested system is depicted in Figure 1 as a block diagram. The typical solar PV standalone device consists of a solar panel, an Arduino interfaced MPPT charge controller, a GSM module battery bank, and a load to provide useful power to the stop user.

III. EXISTING SYSTEM

IoT is widespread and popular nowadays, is prevalent in research, the design includes Wi-Fi module, power supply and remote-control plug [1]. The remote-control plug is a part of the IoT which connects the mobile phone to other appliances and can be controlled from any place at any-time. The design used in this research has remote plug along with the Wi-Fi and power supply module. The control strategy is depicted with the help of the comfortable design which consists of the 220V – Input and 5V, 6W – Output power supply. This research design contains the STC 15L 204EA as the core control chip to manage the device's electrical relay functions and the control signals are transmitted in two diverged paths during the connection establishment. Also, the mobile phone can control the plug through remote access by means of TCP port in the same Wi-Fi environment. This work gives an overview of functionality of the ESP8266 Wi-Fi module. Putta Sindhuja and Balamurugan [2] has projected a home automation system in which the user can be able to control and monitor appliances with the help of the IoT to minimize the energy usage. The appliances are connected via an Ethernet to a router and uses m-bed microcontroller and sensor-actuator units to control the power utilization. The designed system enables client to monitor and control the appliances at home from anywhere availing the IoT features of the designed system thereby reducing the wastage of energy. The interesting part of the hardware for this system comprises of the Hall effect sensor, Ethernet break outboard, Appliances such as 10W bulb – 12V fan, two channel relay, m-bed microcontroller – LPC 1768 and Ethernet modem. The Relay needs 12v power supply, groove Electricity Sensor is employed to measure the energy consumption in each appliance. Xively is software which enables the cloud data storage and its used to analyse the usage. This work gives the direction to be followed while designing systems that analyse the power consumption of devices. Krupal Kachhia Patel et. al. [3] proposes a system that implements MQTT (Message Queuing Telemetry Transport) and TCP in ESP8266 Wi-Fi module to control appliances and interfaces them with proximity, PIR sensors. In his paper, they have described the architecture and implementation of home automation system. To reduce the development cost, this system utilizes the electronic boards. Apart from the low cost, the smartness of the automation system can be justified with the automation scripts that can be customized by the user, even at runtime. The complete system efficiently utilizes the existing network infrastructure with the help of MQTT protocol and TCP protocol. This work helps understanding how the ESP8266 can be interfaces with appliances, and automation of appliances. The four-tier architecture is proposed in this system applied using smart parking, votlDB, vehicle data sets, spark and storm for real time processing which has the Hadoop framework to make it more scalable and efficient [4]. The execution of architecture has the process of decision making, filtration, preprocessing, aggregation, computing, collection and classification. In this proposed research, the

implementation is carried out by means of Hadoop with Storm or S4, Spark, voltDB to process the real-time IoT data and produce results. The analysis with Hadoop with MapReduce programming is done for future developments and further enhancements. This work gives an overview on creating scalable power monitoring systems. Mohammad Abdur Razzaque et. al [5] proposed in, a Middleware technology for an ultra large scale internet of things, a system for connecting heterogeneous devices like smart-phones, TVs, etc. to IoT with an event based, service based and VM based middleware technologies, as it will save traffic and power consumption in IoT devices. The final results portray that the improvement in the entity interconnectivity issues and the reduction in the energy costs of the industrial management systems. This works shows the need for middleware in IoT devices. Manar Jaradata et. al. [6] have proposed a system which comprises of an IoT based energy management platform that runs a DR algorithm to manage the industrial based tasks. The authors focus on the future of the Internet of Things and smart grid related applications. They also exploit the various applications of the smart power grid domain networks in the different aspects of sensor networks. The meters and sensors for these applications also were discussed with the help of the techniques in the Big Data. This work shows the need for monitoring of energy consumption in appliances of all scales, small or large.

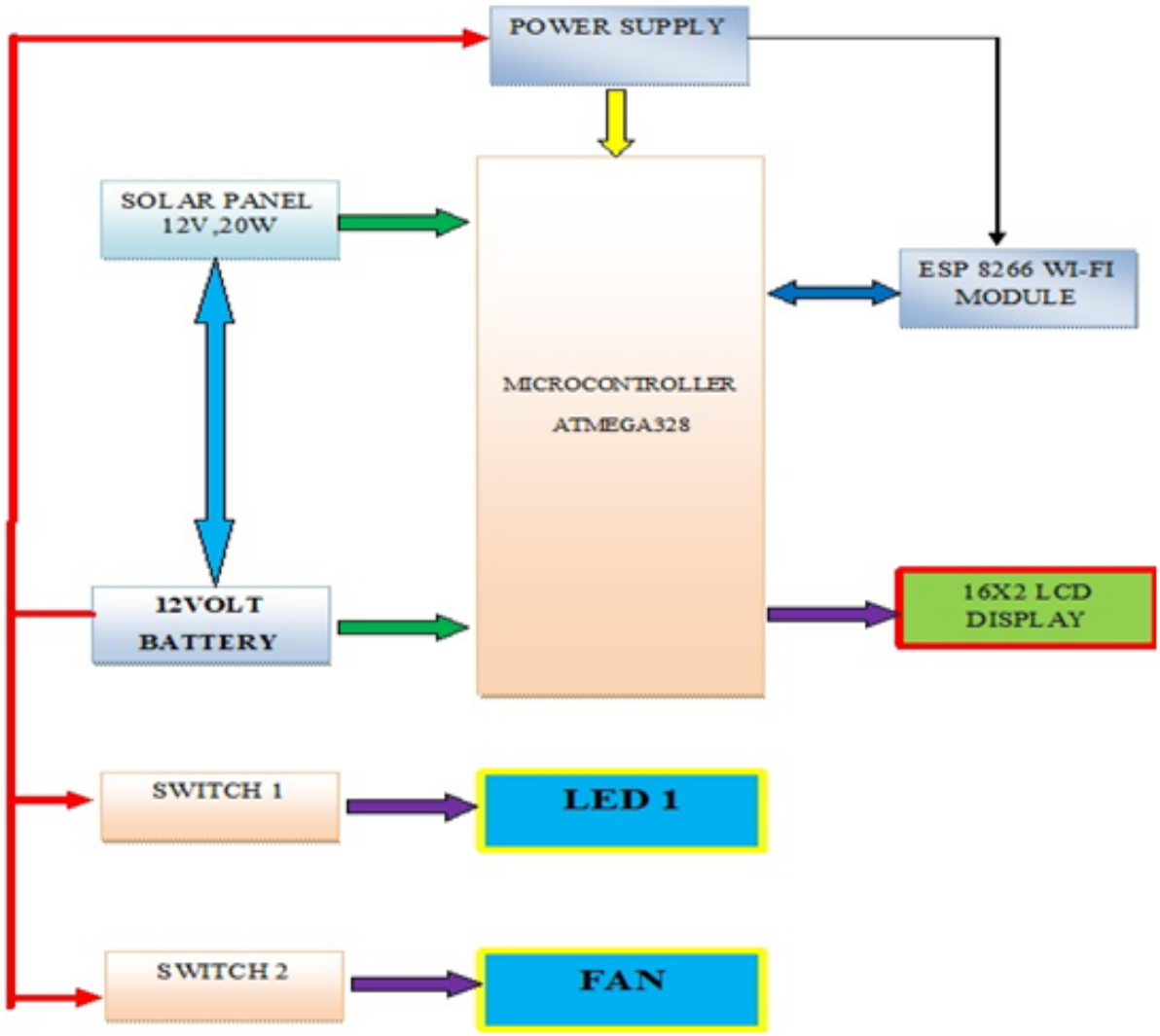

Fig.2. Block Diagram of Solar battery Charger

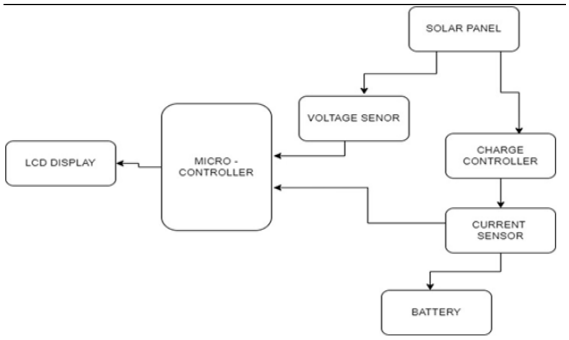

Fig.3 Solar power battery charger assembly.

An IoT-enabled Battery Management System (BMS) preserves system reliability by consistently tracking critical battery metrics, including voltage, current, temperature, State of Charge (SoC), and State of Health (SoH), in real time. Through the use of advanced sensors and embedded control units, the system ensures that battery operation remains within established safety thresholds and performance standards.

We have used lead acid battery because it has large current capability to store electric power. Another reason to choose lead-acid battery cause it is tolerant for overcharging. We used 2 batteries of 35 Amp hour whose voltages are 12 volts. A battery is a device that stores chemical energy within its active materials and converts it directly into electric energy with the help convertor circuit by means of an electrochemical oxidation-reduction (redox) reaction. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

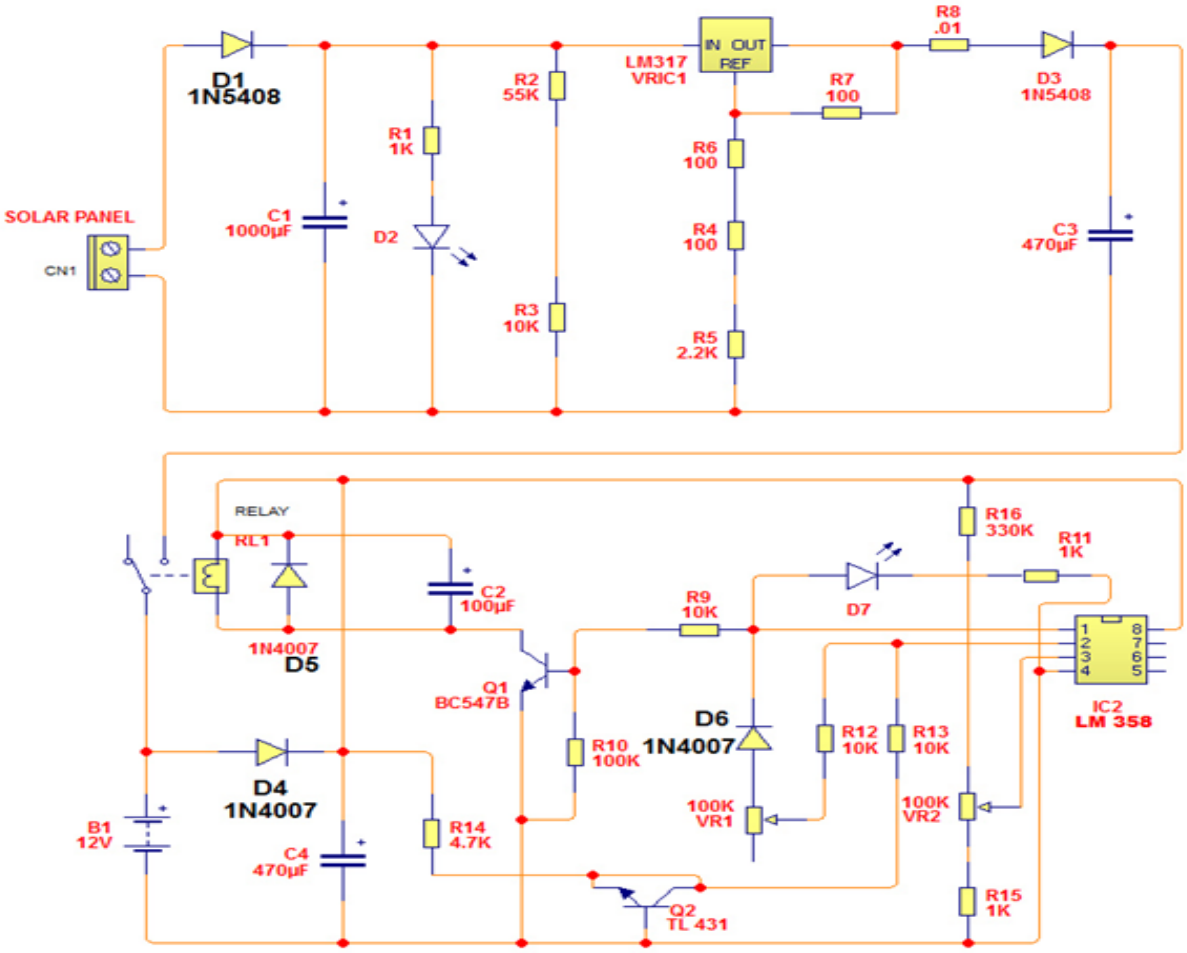

Fig.4. Circuit diagram of battery charging controller

The design of a battery protection system for the Off-Grid solar power system was conducted using a design method. The study involved analyzing the data obtained from testing the device using the power equation for DC electricity, as outlined in the following equation.

This research was conducted by testing the protection system that has been created by connecting the battery protection module with the Off-Grid solar power system. The testing of the protection system was carried out during the day when the solar panels received sunlight. In the tests conducted, there were 5 trials, each lasting 20 minutes

When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

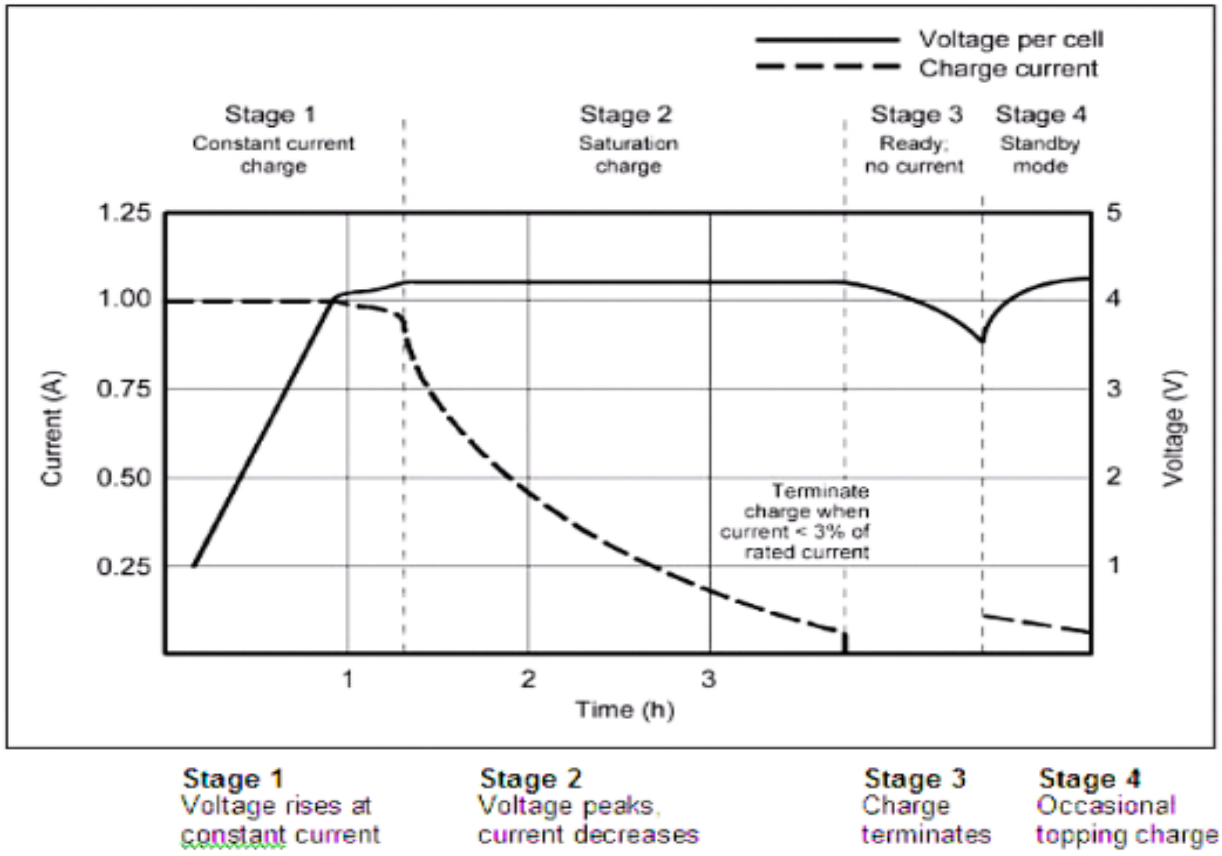

Fig.5. Battery Charging characteristics

The power value is obtained from the multiplication of current and voltage, based on the readings from the current sensor outputting from the battery and the voltage reading of the battery. This gives the power consumption used from the battery.

III. CONCLUSION

The solar battery charger system designed around the ATmega328 demonstrates an efficient, flexible, and cost-effective solution for renewable energy applications. By integrating voltage and current sensing with PWM-controlled DC-DC conversion, the microcontroller enables intelligent charging control tailored to the battery type.

The implementation of charging algorithmssuch as Bulk, Absorption, and Float stages for lead-acid batteries or CC-CV control for lithium batteries ensures safe and optimized energy storage. When Maximum Power Point Tracking (MPPT) techniques like Perturb & Observe are

incorporated, the system significantly improves energy harvesting efficiency from the solar panel under varying environmental conditions.

This project provides a comprehensive design and implementation details of pv based battery charger system which is used to charge lead-acid battery in float charge mode as well as in bulk charge mode. Mathematical model of pv module, synchronous buck converter and battery has been provided. Experimental prototype of pv based battery charging module has been developed which is then tested in outdoor environment. It has been observed that the battery is charged in bulk mode and in the said charging mode. Experimental results demonstrate the charging of the battery. In this project solar battery connect to the supply line parallel of the solar battery charge.it is controls the power supply by using atmega 328p microcontroller .this system provides portable, reliable power anywhere it is needed .From off-grid construction sites, to remote locations where power is not accessible or affordable without associated with traditional fuel-driven generators.

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