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Smart Solar Charging Meter

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ABSTRACT

A Smart solar charging meter is designed so that other devices can be charged outdoors and eco-friendly. This system converts solar energy into electricity and stores in a battery bank. The purpose of this project is to design and develop a proof of concept of solar charging station capable of delivering power. This project will further reduce our dependence on fossil fuels as a means to generate electricity. By using this system, we can charge devices without drawing power from the grid; it will be able to reduce some of the demand for energy resulting in less fuel used to generate electricity overtime. The main feature of this project will be to measure the voltage, current, power and we can also generate bill for the solar energy used is displayed on LCD display. In this project we are designing the meter using ARDUNO (AT MEGA 328P), ACS712, LM317. Not only we want a successful project, but we also want to make sure it is ethical and safe for all.

Keywords : solar charging meter, ARDUNO (AT MEGA 328P), ACS712, LM317, voltage, current, power, solar energy

I. INTRODUCTION

In this project we are using the renewable energy source such as solar energy to produce electricity in an eco friendly manner. we are designing the solar charging meter using Solar panel, ARDUNO (AT MEGA 328P), ACS712, LM317. This is used to measure the electrical parameters like voltage, current, power. And also we are calculating the tariff for the energy consumed/charged the device. The DC electrical energy that is stored in the battery will be utilized. We are using the charge control for controlling the charging fron over voltage, under voltage and charging the battery.

II. DESCRIPTION

In this project we are doing smart solar charging meter. In this we are calculating the rate of energy consumption. We are using the 12 volts solar panel for producing electricity in eco friendly manner. From solar panel we are directly connected to the battery through charge controller. By using LM317 to regulate the voltage up to 12v for constant output. The charge controller gives constant voltage when there are distortions like over voltage and under voltage; Because of this the device connected to the load is protected and gives good efficiency. In this controller there is some of special features like auto cut off and on. The auto cut off and on can be done by using high value capacitors at the load it compensates when the battery limits are crossed by varying through potentiometer sets upto the given values. The led indicates when it is on(red) and off(green). To know the condition of the battery we are indicating the led for charging and fully charged condition.

In this we are measuring voltage, current, and power. The measuring of voltage by voltage divide rule through varying potentiometer the voltage will be measured. And measuring of current is through current sensor ACS712 30A, the voltage measured by the current sensor is converted through coding written in arduino and through that we are measuring current. The product of voltage and current gives us power it will be done in code and displays in lcd. The power consumption in required time gives us a rate of energy consumption. we calculate the price for the energy consumption.

By using this smart solar charging meter, we can calculate the price for the energy consumed by the customer. Solar enegy is free source, it is renewable source. That's why the cost/kwh less than the normal electricity. It is free from pollution and environmental free.

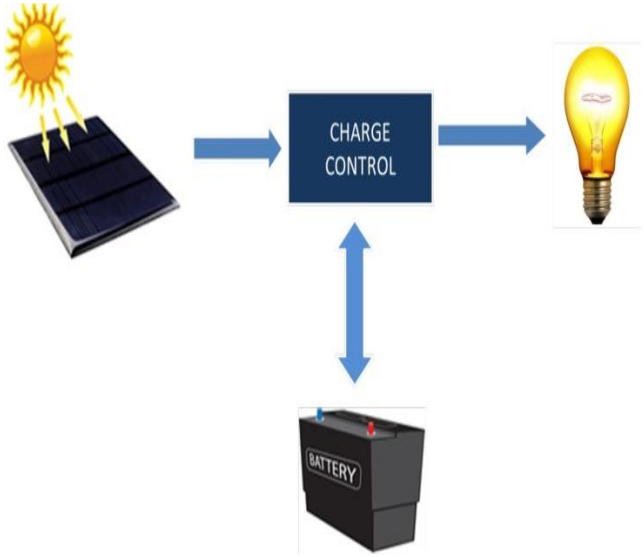

Fig.1 Block Diagram of smart solar charging meter

It is the start up project because most of the companies doing work on charging stations for e-vehicles.

A.SMART SOLAR CHARGING METER:

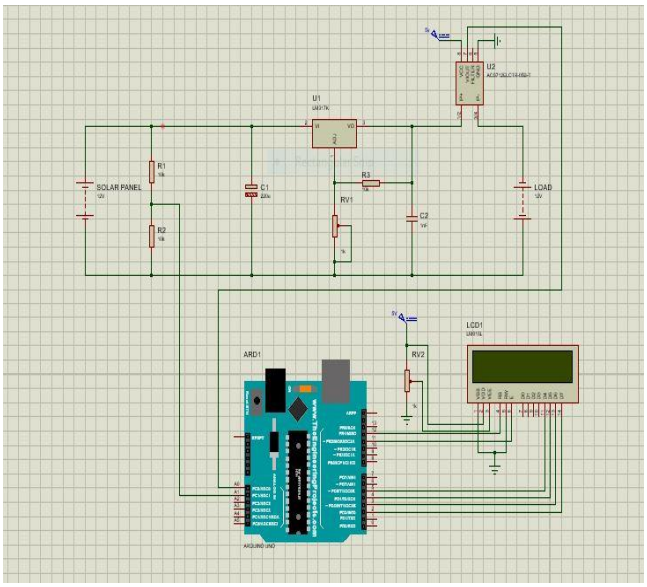

Fig. 2 proteus circuit diagram

Components: ARDUINO (AT MEGA 328P), ACS712,30A, LM317/7812,solar panel 20Watt/12V, 12v dc battery

B.OPERATION:

Initially we are connecting the solar panel to the charge circuit and battery to the charge controller for storing the electricity in the battery. It is charged with constant voltage of 12v for the purpose of increasing the battery life and efficiency. From the battery we are taking the load to charge the devices, due to taking load from battery it is un-interrupted. And then the voltage is measured by using voltage divide rule and the current is measured by ACS712 current sensor it measures the voltage and then we convert that into current. Then we measure the power by multiplying both voltage and current i.e., P=VxI. And then calculate the energy. And finally calculate the price for energy consumed.

All the values are displayed on the lcd display to watchable the data for both seller and consumer.

IV. HARDWARE IMPLEMENTATION

A.ARDUINO:

Here we are using ATMEGA328P arduino.The Atmel 8-bit AVR RISC-based microcontroller

combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/Dconverter (8-channels), programmable watch timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

B.LM317:

The lm317 is a adjustable 3 terminal voltage regulator capable of supply the output range of lm317 adjustable from 1.25V to 37V. It requires two resistors to set the output voltage

- Typical line regulation of 0.01%
- Typical load regulation is 0.1%

It includes internal short circuit current limiting, thermal overload protection and safe area compensation. The output current greater than 1.5A

C. ACS712 CURRENT SENSOR:

The ACS712 provides precise solutions for AC and DC current sensing in industrial, commercial and communication systems. The device consists of precise, low offset, linear hall sensor circuit with a copper conduction path. Applied current flowing through the copper conduction path generates magnetic field which is sensed by integrated HALL IC and converted into proportional voltage. Total output error 1.5% at T_A = 25^{O}C. Its internal conductor resistance is 1.2 milli amperes. Supply voltage of 3-5V for operating the sensor.

Fig.3 display of voltage and current

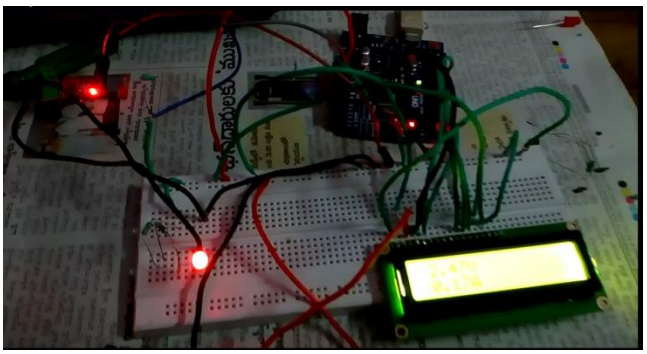

Fig.4 overall circuit of smart solar charging meter

D.THEORITICAL CALCULATIONS:

Power P = 20 watt

Voltage V_{dc}= 12v

Current I_{dc}= P/V_{dc} = 20/12 = 1.6667A.

Output values:Voltage V_s = 12 v

Battery bank required: 12v, 7AH

Time for charging the battery

T = 7AH/1.6667A = 4.2 hours

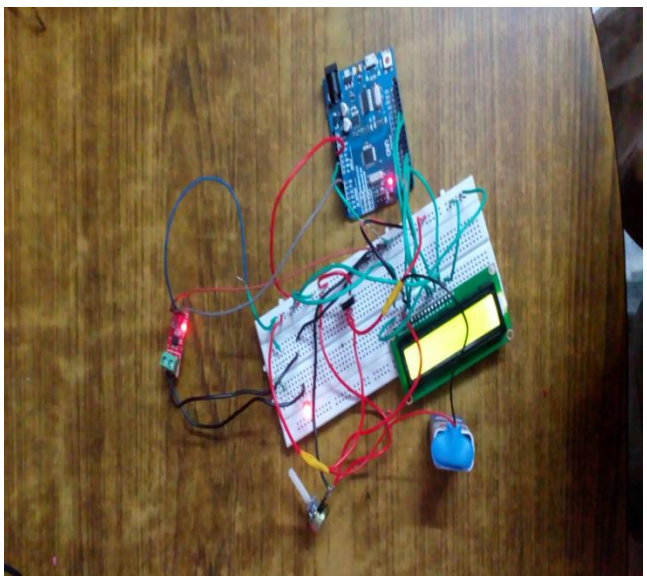

Fig. 5 smart solar charging circuit

In this kit we have used the 20 Watt, 12V Solar panel, 12V, 7AH LEAD Acid battery, 12-0-12V charge controller

V. RESULTS & CONCLUSION

This Solar charger designed for Industrial and Commercial purpose, It can charge the battery within 4 hours and used upto 28 hours. This smart solar charge meter designed with low cost and it is installed in any location with compact size.

In this project, we are measuring the voltage, current, power and energy consumed and displayed on the lcd display. It is useful for industrial and commercial purpose to the energy consumed.

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