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IoT Based Smart Grid to Remotely Monitor and Control Renewable Energy Source

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ABSTRACT

We have used two different Energy sources, one is the main power the other one is from Renewable energy source i.e. from photovoltaic cell and by and making use of this renewable energy source provides the reliable power supplies to the consumers. As Relay will switch between the two power sources according to the consumption by monitoring the power consumption by different loads at home. The power generated using renewable energy sources, i.e. photovoltaic (PV) solar panels, is variable. Depend upon the season and weather conditions of day. CT Coil current sensors are used to sense current flow of the individual supply which can be measured. This can effectively reduce power loss, low operating temperature, increase reliability

KEYWORDS: IOT of things, Smart Grid, Power control and manage, modernization of electricity.

INTRODUCTION

The Smart grid is a technology that makes electric grid control, automate and manage the growing demands and needs of electricity, allowing two-way communication between the utility and the customers. Smart grid improves power quality, provides efficient transmission, quicker rerouting when equipment fails or when outages occur and reduces peak demand. An essential feature of a smart grid is to improve the efficiency, economics, and sustainability of the generation, transmission, and distribution of electricity by the use of information and communications technology. The smart grid, being a vast system, utilizes various communications and networking technologies with its applications, which include both wired and wireless communications. “Web of Things” refers to the general idea of things, especially everyday objects, which are readable, recognizable, locatable, addressable, and/or controllable via the Internet, irrespective of the communication means (whether via RFID, wireless LAN, wide- area networks, or other means).

EXISTING SYSTEM

The existing system which was already in use is to solar monitoring and share information through IOT . It consists of a charge controller with an ESP32 module , a voltage sensor , and a current sensor . When the ESP32 module is a controller integrated with Wi – Fi and Bluetooth support , where the sensor checks the conditions that are programmed and detects the voltage and current .

PROPOSED SYSTEM

This project is proposed a smart grid system of renewable energy source based on Internet of things. The smart grid evokes the application of digital technology and information management practices and is a core ingredient in the ongoing modernization of the electricity delivery infrastructure. IoT technology can effectively combine the infrastructure resources in increase the quality of power system information, and increases the utilization efficiency of infrastructures in the existing power system

BLOCK DIAGRAM

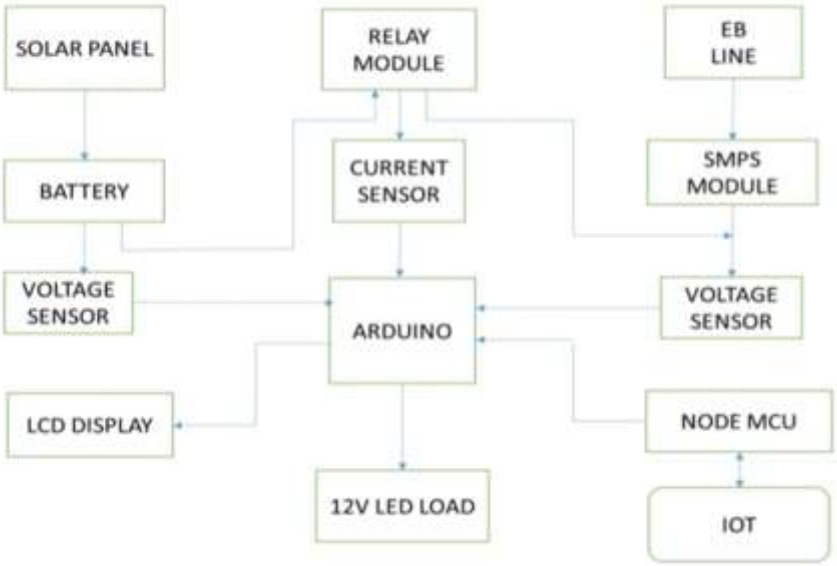

Figure 1.1 Block diagram

BLOCK DIAGRAM DESCRIPTION

In this project, we have to use two different energy source one is main supply and another is Renewable energy source Solar. Current and Voltage can be sensed by current and voltage sensor and it displayed in LCD display. Relay is used to switch any one the power source Node MCU is a open source IOT development board and it is used for update the data to internet .This can be shown in Figure 1.1 Block diagram

COMPONENT USED

SOLAR PANEL:

This solar panel is made of single-crystal material that performs high solar energy transformation efficiency at 17%. These are waterproof, scratch resistant, and UV resistant. They use a high efficiency monocrystalline cell. They output12V at 300mA. The substrate is a plastic composite, specifically designed to be strong and lightweight. They can easily stand up to typical outdoor use including being dropped and leaned on. They're very high quality and suggested for projects that will be exposed to the outdoors.

BATTERY MODULE:

This battery module is made up of ICR 18650 1500mAh Lithium-Ion Batteries of the highest quality with a BMS circuit. In comparison to Ni-Cd, Ni-MH, and lead-acid batteries, it is compact and light. The battery pack may be directly charged with the DC power adapter thanks to the inbuilt charge protection circuit, eliminating the need for specialized battery chargers and the risk of overcharging. This battery pack is incredibly simple to recharge and integrate into your project**.**

RELAY MODULE:

5.0 volts A 1-Channel relay module is an interface board that is compatible with Arduino, AVR, PIC, ARM, and other microcontrollers. This module can operate at high currents such as AC250V 10A or DC30V 10A. It uses digital outputs from controllers and processors to control larger loads and devices such as DC motors, AC motors, and other AC and DC devices

VOLTAGE SENSOR:

ZMPT101B a voltage transform ideal to measure the AC voltage. It has high accuracy, good consistency for voltage and power measurement up to 250V AC. Easy to use and comes with a multi turn trim potentiometer for adjusting the AC and DC output , output Signal: Analog ,0-5V.

CURRENT SENSOR:

Sensing and controlling current flow is a fundamental requirement in a wide variety of applications including, over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc. This ACS721 current module is based on ACS712 sensor, which can accurately detect AC or DC current. The maximum AC or DC that can be detected can reach 5A, and the present current signal can be read via analog I / O port of Arduino.

SMPS MODULE:

This switching mode power supply for the isolation industrial-grade built-in power supply module, with temperature protection, over current protection and short circuit full protection, AC110 ~ 240V wide voltage input, high and low voltage isolation, DC12V/1000mA and DC5V/500mA dual isolated output voltage, with input and output EMI filter circuit, with mounting holes. This SMPS is especially designed to interface directly with arduino and sensors.

NODE MCU:

Node MCU is an open source firmware for which open source prototyping board designs are available. The name "Node MCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "Node MCU" refers to the firmware rather than the associated development kits.

ARDUINO UNO ATMEGE328p:

A microcontroller board called the Arduino Uno is based on the ATmega328 from Atmel. It contains 6 analogue inputs, 14 digital input output pins, 6 of which can be utilised as PWM outputs. Both an external power supply and a USB connection are options for powering the Arduino Uno. With a 3.3-5V operating voltage, it has 32KB of programmable FLASH memory, 1KB of EEPROM, and 2KB of SRAM. Six analogue input pins are present on the PCB of the Arduino atmega-328 microcontroller. The names of these analogue inputs range from A0 to A5. We may do the process utilising these 6 analogue input pins. Inputs with an analogue signal can be used in the 0 to 5V working range. The 12 digital input pins of the Arduino Atmega328 microcontroller are also included. You can write it out as D0 to D11. Applications requiring digital input/output can use over 12 inputs. The discrete input pulses can be triggered and provided to the digital input ports during the course of their operation. This microcontroller is used in this instance to create pulses with pulse width modulation.

LCD Display:

This 16X2 LCD Display Module is used to interface with any kind of microcontroller target boards like 8051, AVR, Arduino and any other processors. The module comes with 4-bit data and 3-bit control pins. The LCD Contrast can be varied with the potentiometer provided on board.

WORKING

An IoT-based smart grid for remotely monitoring and controlling renewable energy sources works by collecting data from sensors installed on the sources and transmitting it over a network to a centralized control system or cloud-based platform. The data is processed to generate real-time insights into the performance of the sources, and remote control actions are taken to optimize their performance. The system continuously monitors the performance of the sources to identify any issues or maintenance needs and generates alerts when maintenance is required. Overall, an IoT-based smart grid provides a powerful platform for optimizing the performance of renewable energy sources, reducing energy costs, and minimizing downtime.

OBSERVATION AND RESULT

The prototype model was successfully implemented and tested. An IOT – based smart grid can be an excellent solution for remotely monitoring and controlling renewable energy sources. By incorporating various sensors and devices, it can collect data on energy generation, consumption, and storage. By using IOT monitor the both main and renewable energy source Figure 1.2 IOT Output shows the output of IOT Output.

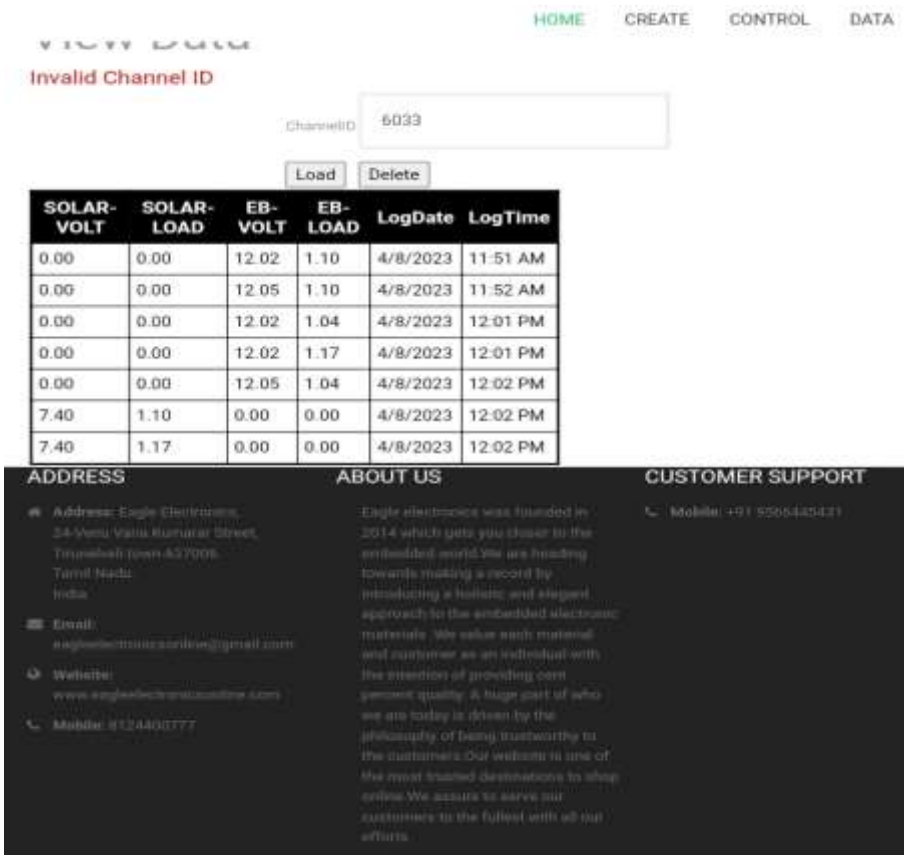

Figure 1.2 IOT Output

HARDWARE PICTURE FOR PROPOSED SYSTEM

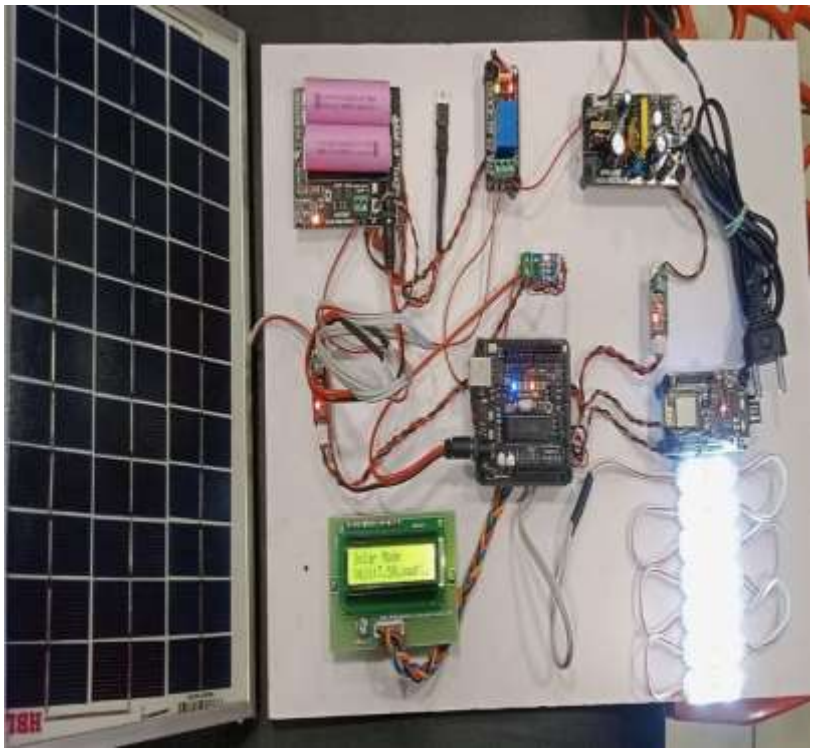

Figure 1.3 Hardware Picture for Proposed system

CONCLUSION

In conclusion, implementing an IOT-based smart grid system for remotely monitoring and controlling renewable energy sources has significant benefits. It provides real-time monitoring and analysis of energy generation and consumption, improves energy efficiency and reliability, reduces costs and carbon footprint, and increases the integration of renewable energy sources into the grid. Additionally, it enables grid operators to remotely manage and control energy production, storage, and distribution, improving grid stability and reliability. However, the implementation of such a system requires careful planning, design, and deployment, and adequate security measures to prevent cyber threats and protect user privacy. Figure 1.3 shows the hardware for proposed system. Overall, IoT-based smart grid technology holds great promise for transforming the energy sector and promoting sustainable development.

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