SMART HYBRID POWER SWITCHING SYSTEM

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Abstract: This project presents a system based on IoT. It consists of a set of loads controlled wirelessly using Wi-Fi based communication which has a dedicated power supply which can be selected using IoT. Main idea is to control the operation of the loads by using any smartphone with an android app designed to be used as a master controller and at the same time select the type of energy source required to run the loads efficiently, and conserve power. This project consists of a mechanism wherein the power supply board or user can select the renewable or non-renewable energy source that needs to be connected to the load for carrying out various operations.

Keywords— IoT, Wi-Fi, Android app, Energy source, Power supply board.

I. INTRODUCTION

As we know, there is a deficit in power supply due to the ever increasing energy demand in developed and developing countries which has resulted in Energy crisis. Therefore, use of renewable sources of energy for household electrification is one way of solving this energy crisis.

The use of renewable energy sources in household electrification has always been the most powerful means of reducing the amount of carbon emissions we add to this planet earth's total carbon emissions and thus reducing the loss of the ozone layer. The use of alternatives such as solar water heaters helps reduce the impact of individual carbon emissions footprint upon the environment. But using those alternatives is based on location and environment.

For most of the Appliances in our homes, the power grid supply to our homes is still the primary energy source. If the users have an inexpensive process to configure their home's power supply as needed, the use of renewable energy produced can be maximized. This will potentially affect the overall carbon emissions due to the cycle of generating power from non-renewable sources of energy.

The Web of Things or the Internet of Things comprises a number of internet-enabled Embedded devices that provide the user with such an interface through Web services. Any computer with an Internet connection can do this by the end user via a web browser.

In this project, solar panel is considered to be renewable energy source and the conventional AC supply is considered to be non-renewable source of energy. The load section consists of dc lights connected to the renewable source of energy and light bulb and adapter connected to non-renewable source of energy.

This project is implemented domestically to conserve power. When used in smart grid system the solar panels can be used to provide supply to all lighting systems of a house and conventional power source can be used for heavier loads, thus preventing wastage of power significantly.

II. LITERATURE REVIEW

R.Vidhya[1] et.al proposed 'IoT-based hybrid energy system using NodeMCU module' to address hybrid power system control using IoT. The main criteria are to move between the two energy sources, i.e. solar and wind energy, using NodeMCU Wi-Fi unit, without any hassle through a website.

The hardware part is made up of four key hardware components: Solar Panel, Wind Mill, Switching unit, Wi-Fi module NodeMCU. Part of the code consists of an integrated development environment (IDE) for Arduino. This system helps the user monitor energy sources by using smartphone or personal computer manually and remotely. The device is guarded by any client or intruder for entry.

Users are expected to obtain pairing IP Address to access the hybrid energy system for the Arduino IDE and the smart ph one. It provides a protection against unauthorized users.

D.Nagalaxmi[2] et.al proposed 'Remotely Track and Control Renewable Energy Sources Web of Things Based Smart Grid' which outlines a Smart Grid architecture implemented with the aid of the Web of Things. The Web browser of any device will serve as an interface to the services offered by the Internet of Things. The Embedded computers are machines based on raspberry pi processors, based on Ethernet. Real Time Operating System is used for process control on any of these embedded devices. Web interfaces give us real-time information about each of the on-site mounted energy meters and communicate with Embedded Internet devices via MODBUS communication protocol. Real Time energy source preparation, energy source option, power link and disconnection are some of the services that an authenticated online customer provides.

Vignesh[3] et.al suggested 'A Smart Monitoring Device for Hybrid Energy Device Using IoT.' The key emphasis is to move between two energy sources, i.e. solar and wind power, through the Android app. The data is transmitted wirelessly to the ESP 32 module which controls the energy sources through the Android App. Using IoT the transmitted data is remotely controlled.It allows users to remotely have a versatile control mechanism via a secure Mobile App. This system is running very effectively, reliably and flexibly.

Prakhar Srivastava[4] et.al suggested ' IOT-based control of the hybrid energy system using ESP8266'. The main purpose of this paper is to control the Internet of Things (IOT)-based hybrid energy system. In this writer, two solar and wind energy sources that are powered by IOT using ESP8266 are combined. The data input is transmitted wirelessly to the ESP8266 wi-fi module via a website and the IOT manages the data remotely. This device operation is very simple, the user can manually and remotely control the system using smartphones or personal computers via the internet.

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Dr. K.Sampathkumar[5] et.al suggested 'Hybrid System Tracking and Monitoring using IoT Industrial Automation Technology'. This focuses on a range of energy types, all of which are alternatives to one another, such as solar, wind, biofuel, etc. The main criteria is to switch between the two energy sources I e. Solar power and wind power. The data is transmitted wirelessly to the NodeMCU module that controls the energy sources through the mobile app. Different loads used in industries are connected to various sources of energy. It is controlled by smartphone or personal computer manually and remotely. There is not much need for consumers to work within the industry.

III. BLOCK DIAGRAM

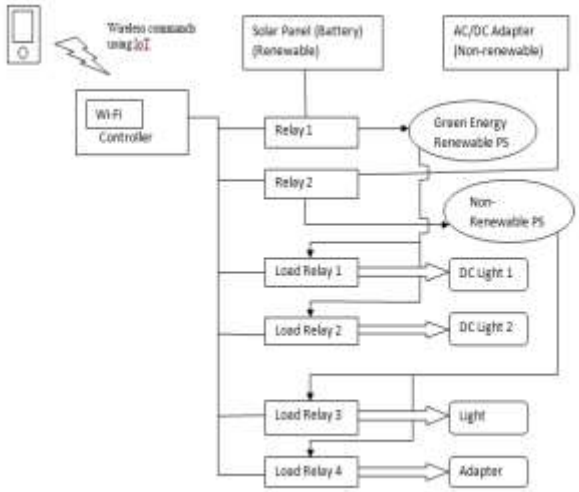

Fig. 1 Block Diagram of Proposed System

IV. WORKING

Control commands will be sent from a smartphone having an android app specially designed for this project. The app will have two segments, the first part -Power Source selection and the second part- Load control. The app will be designed based on the requirement and made sharable by just scanning the QR code. Any smart phone with the app and IP address of the system can control the entire system. Thus, making this system very easy to implement and user friendly.

In this project NodeMCU microcontroller is been used which has inbuilt Wi-Fi module. This Wi-Fi based controller will receive data input from the user and perform the desired operation.

The controller is interfaced to relay drivers which is used for selection of renewable and non-renewable source of energy as well as used for selecting loads connected to respective energy sources.

Fig. 2 Experimental setup

When renewable source of energy is selected from the smartphone by accessing the IP address of the system, the user will be able to control only the operation of the dc lights. In this part the loads connected to non-renewable energy source will not be working, thus the power supply board can make the best use of this system for controlled load shedding instead of the traditional fixed schedule load shedding. Similarly the non-renewable power source can be selected to supply power to the loads which run on regular AC supply can be remotely controlled by the user.

When the user clicks on Renewable energy button, the power supply provided by the Solar panels will be supplied to the load side. When control signals like light ON, light OFF is sent from the user's smartphone over the internet, the corresponding loads will work by utilizing the energy supplied by the battery which will be charged using Solar Energy.

When the user wants to switch onto Non-Renewable energy then user need to click on Non-Renewable energy button, the power supply provided by the AC/DC Adapter representing conventional power source will be supplied to the load side.

When control signals like load ON, load OFF is sent from the user's smartphone over the internet, the corresponding loads will work by utilizing the energy supplied directly from the power socket representing regular power supply.

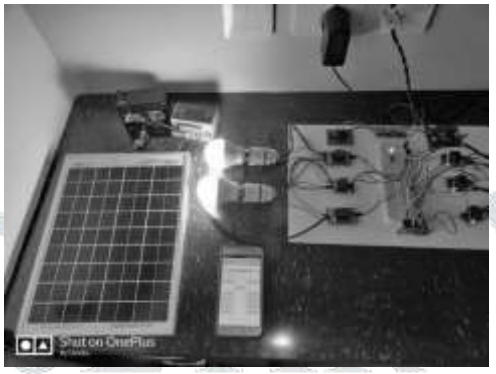

Fig. 3 DC Lights operation using solar energy

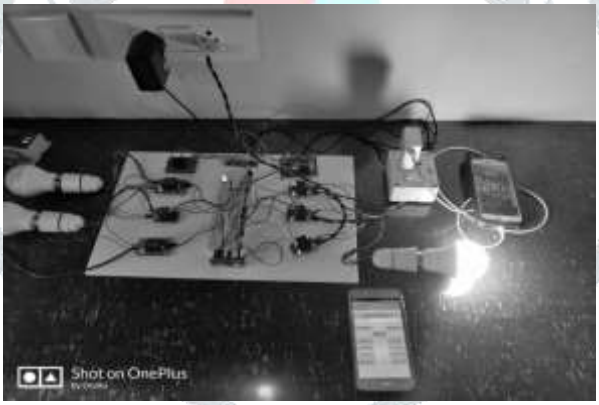

Fig.4 Loads operating using AC power supply

V. COMPONENTS

HARDWARE REQUIREMENTS

i. NodeMCU- microcontroller
ii. Solar panel
iii. Relays
iv. DC lights
v. Light bulb
vi. AC/DC adapter
vii. Solar charge controller
viii. Battery

SOFTWARE REQUIREMENTS

i. Embedded C
ii. Arduino IDE
iii. MIT App Inventor- Android app designing
iv. Wireless communication- WiFi server setup

VI. CONCLUSION

By implementing concept of renewable energy in smart grid results in effective method to minimize the amount of carbon emissions and also conserve power by adequately using required energy sources. Also this system is user friendly.

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