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Energy management using Internet of Things Based in Smart Grid to Remotely Monitor and Control Renewable Energy Sources

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ABSTRACT

Use of Renewable Energy Sources in Household electrification has always been the most effective method to minimize the amount of carbon emissions that we contribute towards the cumulative carbon emissions of this planet earth. These carbon emissions have given rise to global warming due to depletion of the ozone layer. Use of alternatives like solar water heaters helps to reduce individual carbon emission footprint upon the environment. But the use of these alternatives is location and climate dependent. The power grid supply to our homes still remains the primary source of energy for most of the Appliances in our homes. Also the reconfiguration of the electrical circuitry of the entire home is a cumbersome process for the end user. If the users are provided with an inexpensive process to configure the power supply of their GRID as per requirement, the use of generated solar energy can be maximized. This would eventually put an impact on the total carbon emissions due to the generation process of power from non-renewable energy sources. The Internet of Things comprise of a number of Internet enabled Embedded devices which provide such an interface to the user by means of Internet services. The end user can access this through an Internet browser of any computer with an Internet connection. The Internet of Things (IOT) is a term used to describe approaches, software architectural styles and programming patterns that allow real-world objects to be part of the World Wide Internet. The designed system is easy to implement and very customizable according to needs. It provides very effective techniques of using our renewable energy resources which would otherwise have been underutilized. Finally it gives a very effective method for implementing green energy concept on a larger scale .The integration of Internet of Things with existing power grid architecture will provide us numerous opportunities for improvement in our energy saving techniques.

Keywords: IoT, Renewable Energy Sources, Green Energy

I.INTRODUCTION

Use of Renewable Energy Sources in Household electrification has always been the most effective method to minimize the amount of carbon emissions that we contribute towards the cumulative carbon emissions of this planet earth. These carbon emissions have given rise to global warming due to depletion of the ozone layer.

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II. EXSTING METHOD

In present Energy management system there are so many draw backs they are :

1) Inflexibility: As countries develop, the share of the population using in Renewable Energy Sources(RES) is declining. While more than two-thirds of the population in poor countries depends not on RES, less than 5% of the population does in rich countries. It is predominantly the huge productivity increase that makes this reduction in labour possible.

2) Labour : Labour is one of the most important components out of four factors of Industry production (Land, labour, capital and knowledge). The labour as a person who works on somebody else's land as labourer for wage in cash or share such as share of produce.

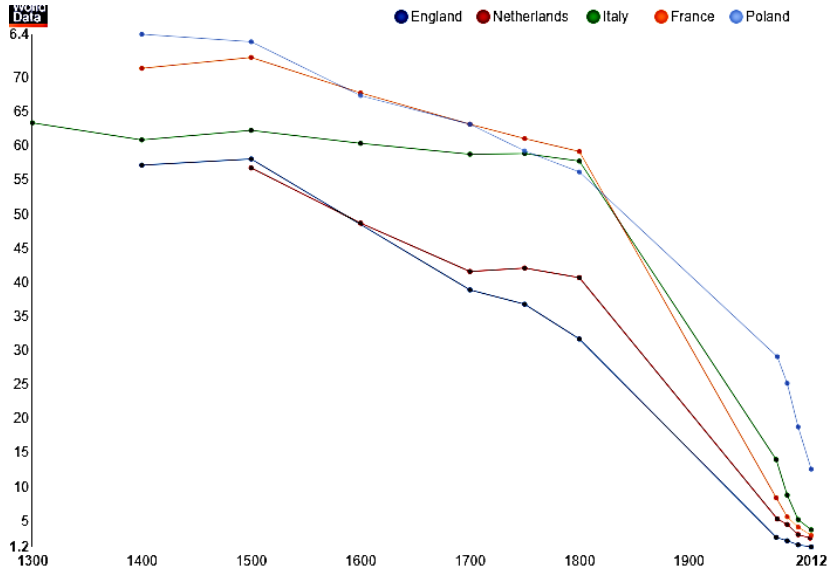

Figure 1: Shows Share of the Labour force Working

3) High Power Consumption: Here, we need intelligent energy management software control system is designed to reduce energy consumption, improve the utilization of the system, increase reliability, predict electrical system performance, and optimize energy usage to reduce cost.

III.PROPOSED METHOD

To overcome all above problems we are designing an IOT based system in which we can monitor the parameters power grid.

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Block Diagram:

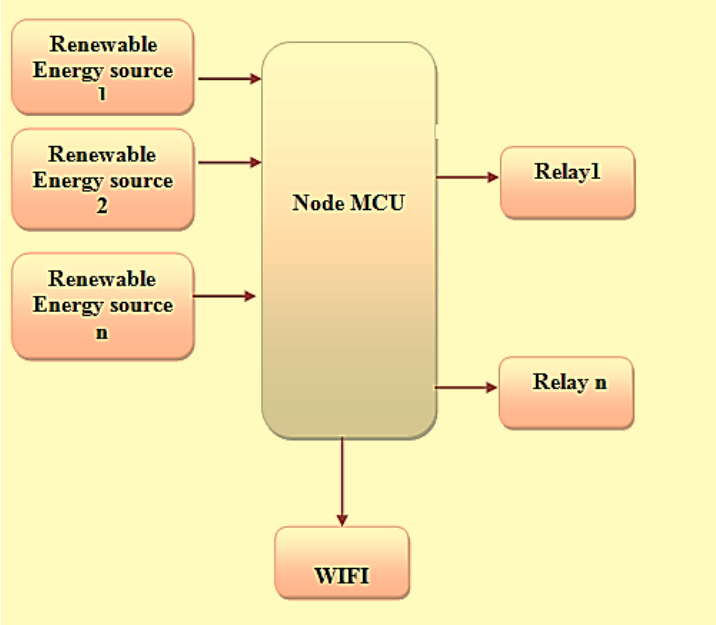

Figure 2: Shows the Complete Block Diagram of the EM IoT System

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If the users are provided with an inexpensive process to configure the power supply of their homes as per requirement, the use of generated renewable energy can be maximized. This would eventually put an impact on the total carbon emissions due to the generation process of power from non-renewable energy sources.

The Internet of Things comprise of a number of Internet enabled Embedded devices which provide such an interface to the user by means of Internet services. The end user can access this through an Internet browser of any computer with an Internet connection.

A) WORKING PROCEDURE:

The project intends to interface the NodeMCU module with power grid . In this a voltage sensor form solar panel is connected to NodeMCU module so the it will monitor voltage coming from solar panel and the voltage value is sent to network . The generated solar panel voltage is give in battery it act as storage element. Different loads are connected to the grid which can be controlled through a website. Using the network we can control any device with in the cloud network.

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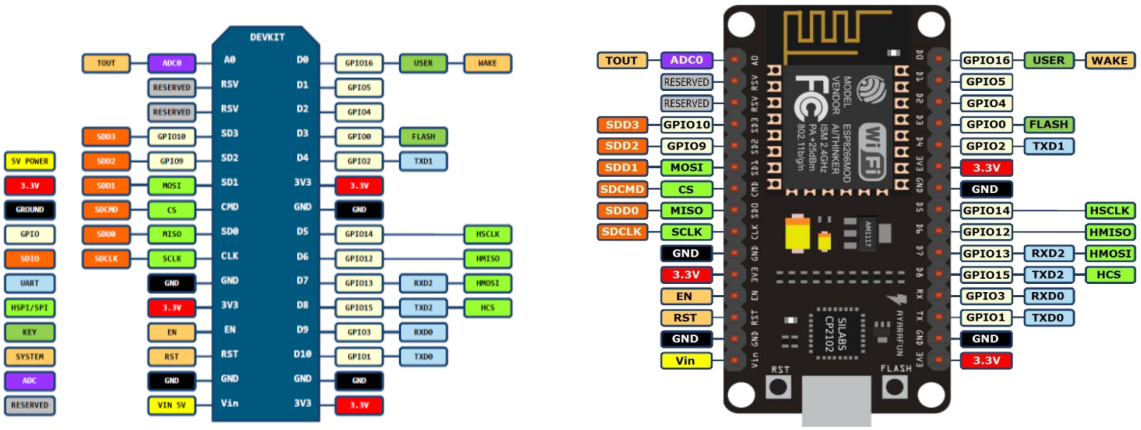
B) HARDWARE DESCRIPTION:

Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from Es press if Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espress if Non-OS SDK for ESP8266. The ESP8266 is a Wi-Fi SOC integrated with a Tensilica Xtensa LX106 core, widely used in IOT applications.

NodeMCU started on 13 Oct 2014, when Hong committed the first file of NodeMCU firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SOC platform, and committed to NodeMCU project, then NodeMCU was able to support the MQTT IOT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to Node MCU project, enabling Node MCU to easily drive LCD, Screen, OLED, even VGA displays as shown in Figure.3.

The name Node MCU refers to two separate components: The Node MCU firmware which provides a Lua development and execution environment which can run on anyESP8266 module with a minimum of 512Kb Flash Memory. The Node MCU Inc manufactured development kits. These are low-cost breadboard-friendly modules which are aimed at providing a simple to configure and set up, hardware platform for developing ESP8266-based LuaIoT applications.



(a) (b)

Figure 3:Shows (a) Pin Description (b) Physical view of NodeMCU

Applications: Major Fields of NODEMCU applications to Internet-of-Things include

- Home Appliances
- Home Automation
- Smart Plug and lights
- Mesh Network
- Industrial Wireless Control
- Baby Monitors
- IP Cameras

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- Sensor Networks
- Wearable Electronics Wi-Fi Location-aware Devices
- Security ID Tags
- Wi-Fi Position System Beacons

C) RELAY BOARD:

It's an electrical switch which is used to open and close an electrical circuit. It can be used to control high power output as we have low power input.

Figure 4: Shows the Relay Coil

Whenever electric current flows through a conductor it will produce a magnetic field. A neutral relay is used for ac current through coil.

D) ARDUINO IDE:

The Arduino project provides the Arduino integrated development environment (IDE) which is a cross-platform application written in the programming language java. It originated from the IDE for the languages processing and wiring. it includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

Figure 5: Shows the Arduino IDE Environment

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IV RESULTS AND DISCUSSIONS

The simulation and Hardware part are given below:

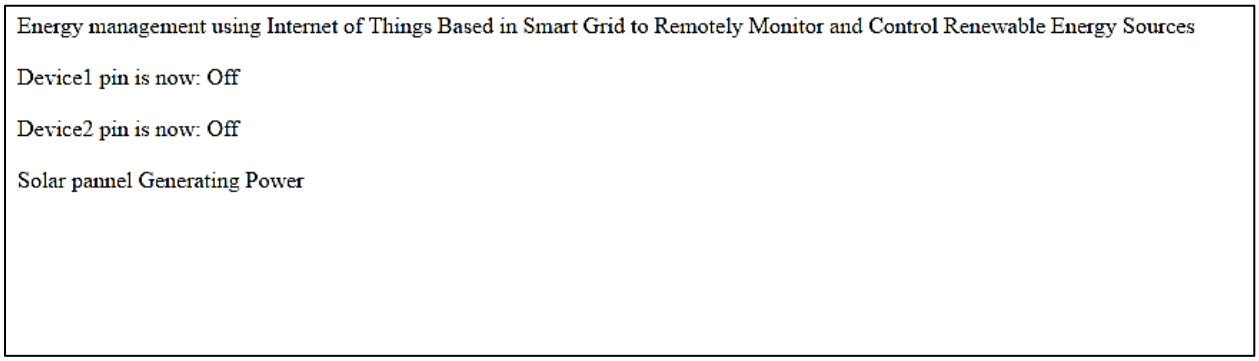

Figure 6: Shows two Devices are connected

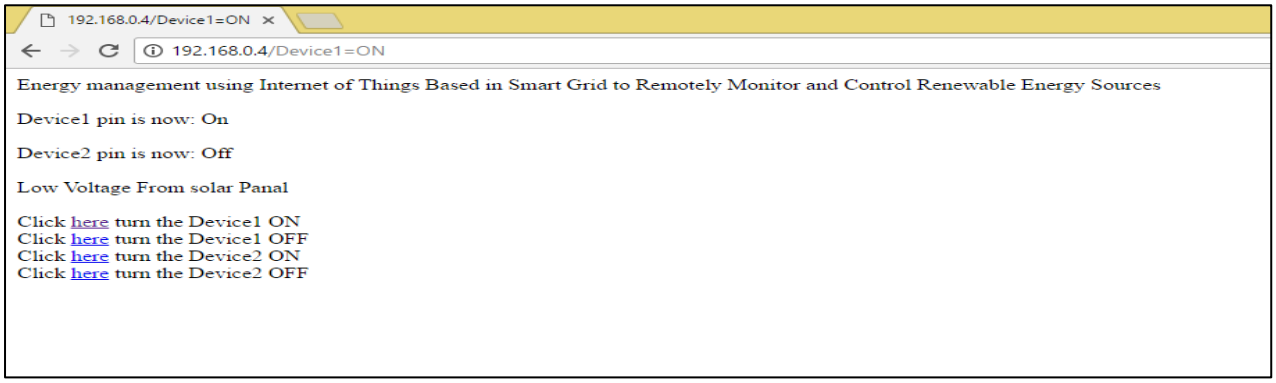

Figure 7: Shows two Devices 1 is connected and Device 2 Not Connected

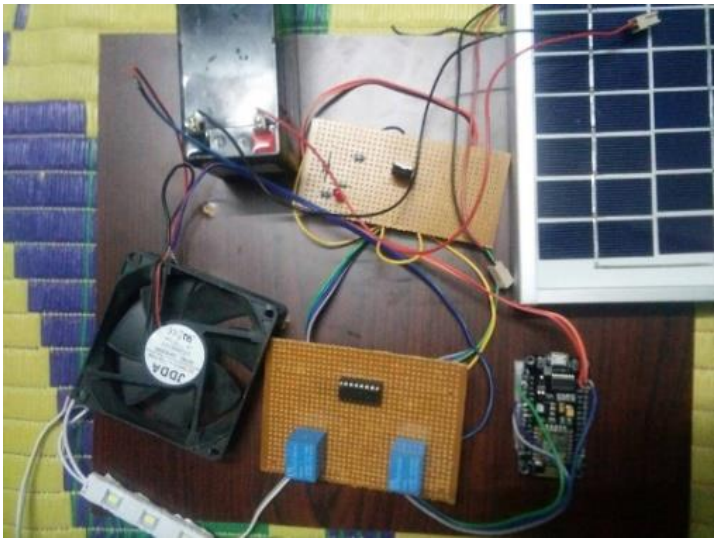

Figure 8: Shows That the Device 2 is Connected and It Can Be Operated Through IOT Using Hardware Part as Arduino

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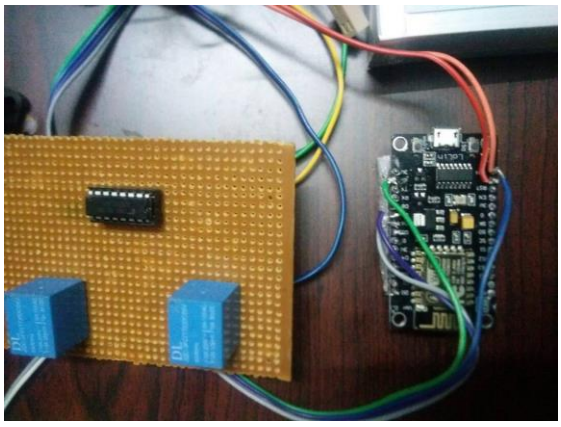
Figure 9: Shows That the Device 1 is Connected and It Can Be Operated through IOT Using Hardware Part as Arduino

(a)



(b)

Figure 10: Shows the Solar Panel and Relay Connections

The designed system is easy to implement and very customizable according to needs. It provides very effective techniques of using our renewable energy resources which would otherwise have been underutilized.

Finally it gives a very effective method for implementing green energy concept on a larger scale .The integration of Internet of Things with existing power grid architecture will provide us numerous opportunities for improvements in our energy saving techniques.

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