SMART GRID SYSTEM USING WEB OF THINGS

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ABSTRACT

In the present era the electricity has become an important commodity in the human life. The centralized transmission grid system is the backbone of the electricity distribution system. To obtain the reliability, security and resiliency characteristics in the power system, the Smart Grid concept came into picture. Smart Grids is the integration of information and communication technology in the existing electric transmission and distribution system. Smart grid delivers electricity to consumer using two way digital communication technologies that enables the more efficient electricity management of the consumer's end uses. This paper describes a Smart Grid architecture implemented with the help of Web of Things. The goal of the Smart Grid architecture using Web of Things (WoT) is to provide the reliable power supplies to the consumers by making maximum use of solar energy source. Web of Things comprise of a set of Web services, that provides to the number of Internet enabled embedded devices .The Web browser on computer act as an interface between services provider and consumer. In a proposed system embedded devices used are PIC18F452, raspberry pi device with Ethernet capabilities. CMSIS Real Time Operating System is used for process control on each of these embedded devices. LwIP Protocol Stack is implemented on top of each of these devices so that IP connectivity can be established. All the meters installed on site are interfaced with Web interface and communicate with the Embedded Internet devices using MODBUS communication protocol. The system can be provided the services like Real Time energy source scheduling, energy source selection, power connection and disconnection etc. of an on-line authenticated user.

Keyword - *Web of Thing (WoT), PIC18F452, Smart Grid, raspberry pi, energy source scheduling.*

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1. Introduction

Renewable Energy Sources are used in Household electrification has always been very effective method for reducing the amount of carbon emissions. Largely carbon emissions results in the depletion of the ozone layer, it's responsible for global warming. By implementation of renewable energy sources like solar water heaters helps to reduce individual carbon emission footprint on the environment. But the use of such alternatives are depends on location and climate change. In present situation most of the Appliances in our homes are fed by primary energy sources, which exert the extra stresses on grid system. To reduce the intensity of such problems, we need to reform

conventional system. It is necessary to reconfigure the electrical circuitry of entire home, but it is very cumbersome process for the end user. If the end-users are provided with an economical process to reconfigure the power supply as per their requirement, then the use of generated renewable energy can be maximized. This would eventually put positive impact on the total carbon emissions, which would results in reducing global warming. The WoT comprise of a number of Internet enabled Embedded devices which provide an interface to the user by means of Web services [2]. The end user can access these sources through a web browser of any computer with Internet connectivity. It introduces the new concept of Web of Things (WoT). The applications of WoT can be implemented using hardware components at user level. The different hardware component with internet connectivity supports data acquisition from energy meters, which helps to communicate within prescribed modules. The Web services comprise of authentication of subscriber, power scheduling monitoring of power consumption from different power sources, and graphical representation of data [1].

2. OBJECTIVES

The objectives of the paper are as follows:

- To develop the control circuitry consisting of internet enabled devices and RASPBERRY pi.
- To maintain the energy consumption of various Renewable energy sources provided to different house.
- To control the home appliances through web services.
- The reads the energy meter using data acquisition devices.
- To transmit the household appliances trough either ETHERNET protocol or Zig Bee protocol.
- To use Web of Things (WoT) for precise and reliable communication.

3. METHODOLOGY

3.1 Block Diagram

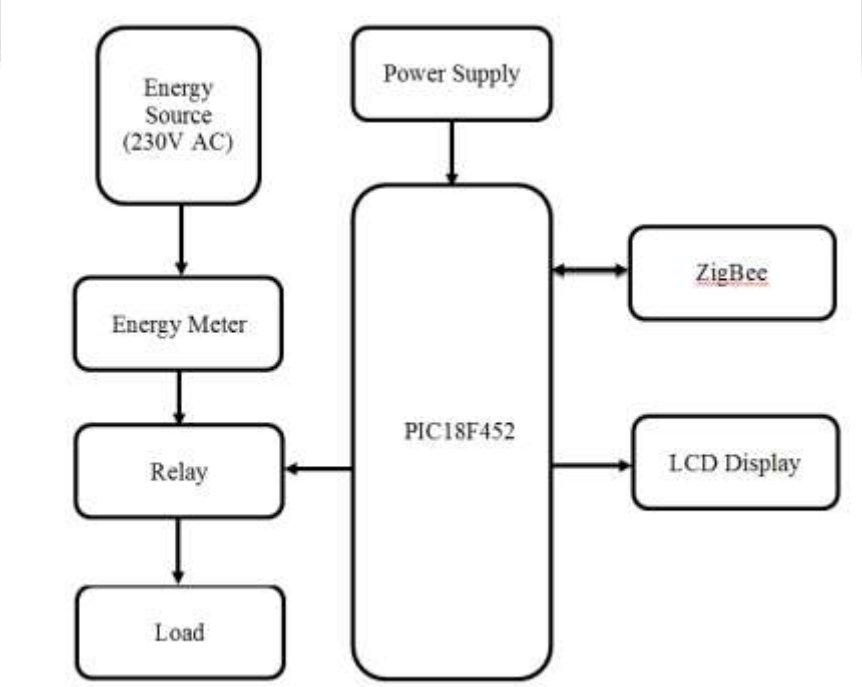

Fig -1: Node section

The Smart Grid architecture implemented has two kinds of energy sources. The first kind of energy sources used is non-renewable energy source i.e. 230 VAC that leaves a significant carbon emission footprint on the environment. The second kind of energy source is renewable energy source i.e. solar energy source which is environment friendly. The choice of energy sources in smart grid architecture should be based on the particular demands of the application and also availability of energy sources. The renewable energy sources used in the smart grid are location and climate dependent. The deciding factor in choosing energy sources can be based on ease of availability of renewable energy source.

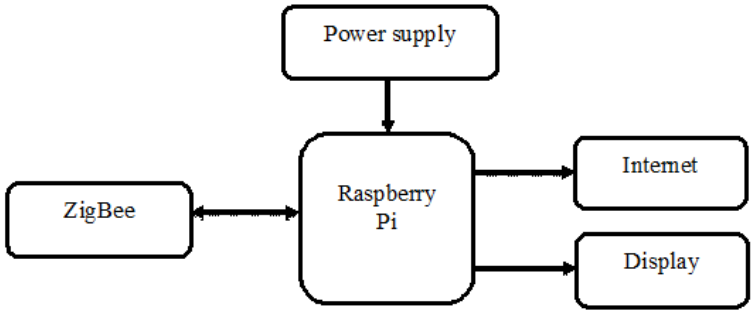

Fig -2: Monitoring section

4. IMPLEMENTATION OF WEB OF THINGS

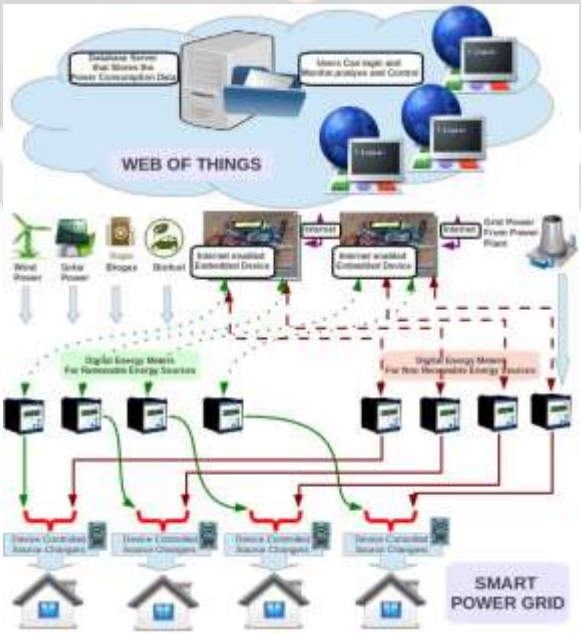

Fig 3: Implementation of smart grid

The smart grid[4] architecture shown in fig (1) .There are two types of sources which are used by Smart grid system in this first source is non-renewable energy sources that leaves a significant carbon emission footprint on the environment. The second type of energy sources that we used is a number of Renewable energy sources that were environment friendly .Our aim is to maximize the utilization of renewable energy sources .But the final choice of the Energy Source that is user dependent of the services that are provided by the implemented Web of Things. The Non-Renewable energy sources consist of primary energy source i.e. 230 VAC [1]. The Renewable energy sources consist of wind energy, solar energy .The Energy sources are connected to individual digital energy meters of industrial standard A user only needs a username or login id and password to gain access to these services from any computer connected to the Internet. The graphical user interface webpage screen is shown in fig: 4.

Fig 4: Webpage of User authentication

The control of the energy sources is done by for by the help of source changers. These source changers are controlled by embedded devices. The embedded devices wait for the instruction from the server which is furthermore instructed by the authenticated user to switch the energy sources. The user is able to select either auto mode or manual mode and also able to choose the energy source i.e. solar energy source or primary energy source, as shown in fig: 5.

Fig 5: Webpage of Power selection

5. RESULTS

The variations of the power supply are as shown in below chart 1.

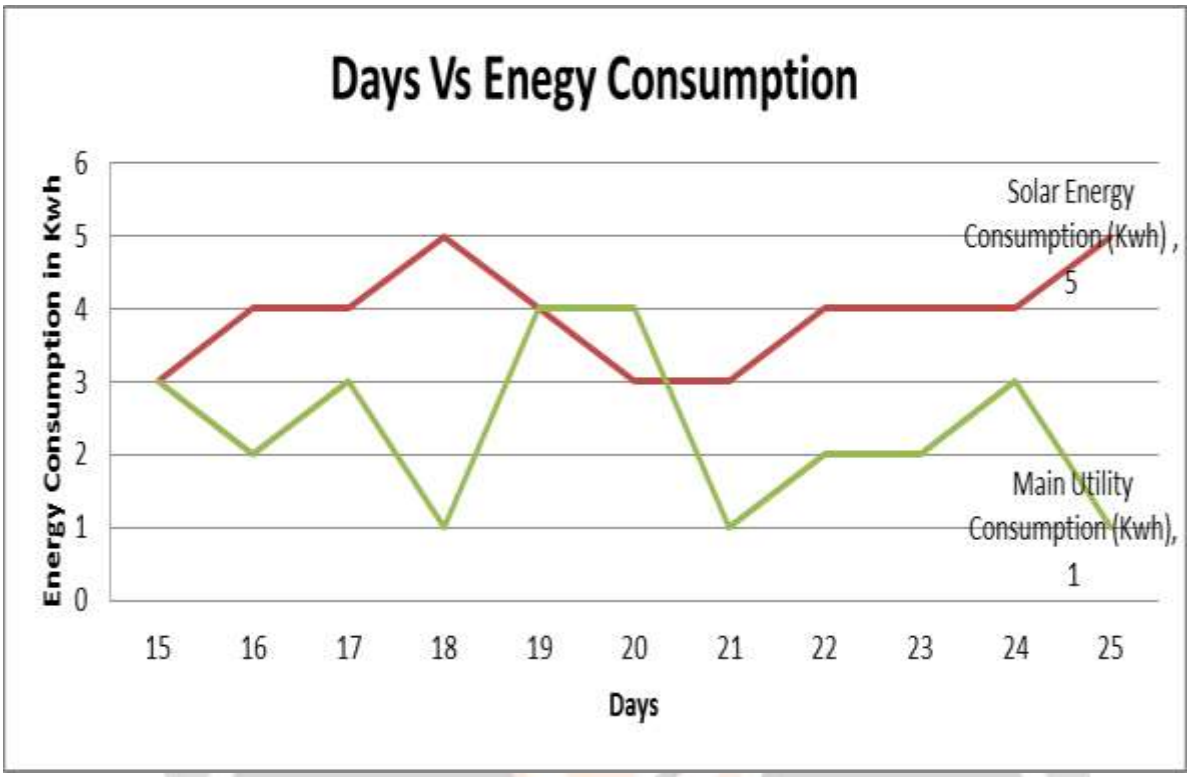

Chart 1: Energy consumption varition for 15 days

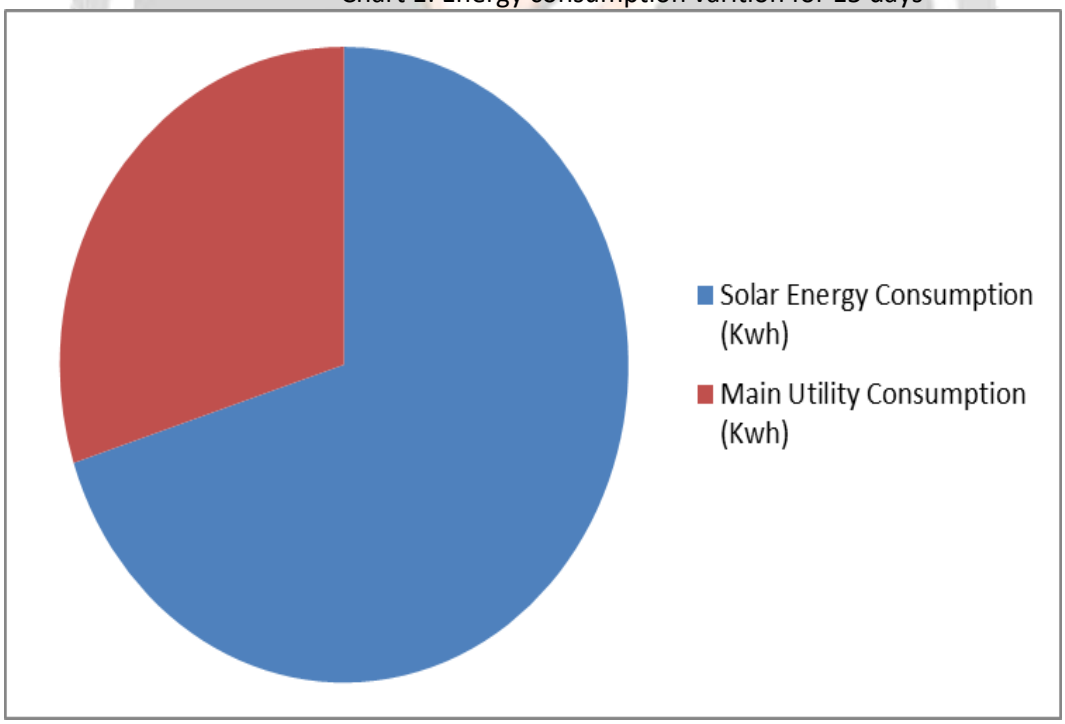

Chart 2: Energy consumption of 24 hours

5. CONCLUSIONS

The system which is design by us is easy to implement and very customizable with respect to the consumer need. It provides such technique that widely promotes effective use of renewable energy resources. The smart grid system

using web of things gives various opportunities to increase utilization of renewable energy sources and increase power saving techniques. Finally it gives a very effective method for implementing green energy concept on a larger scale

6. REFERENCES

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