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Renewable Energy using smart Grid Embedded System in an Internet of Things

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ABSTRACT: The customer domain of the smart grid naturally blends with smart home and smart building systems, but typical proposed approaches are "distributor-centric" rather than "customer-centric," undermining user acceptance, and are often poorly scalable. To solve this problem, we propose a detailed architecture and an implementation of a "last-meter" smart grid—the portion of the smart grid on customer premises—embedded in an internet-of-things (IoT) platform. Our system determines both the fraction of power to consume from the grid versus onsite battery based energy storage, as well as when and how much to charge battery-based storage using grid energy. The primary inputs to our control algorithm are 1) the battery's current energy level, 2) a prediction of future solar/wind energy generation, 3) a prediction of future energy consumption patterns, and 4) market-based electricity prices. The output is the amount of power to consume from the grid, as well as the power to discharge or charge the battery from renewable or the grid, over each rate period. Energy budget extends our initial work on Smart Charge in multiple ways. We implement our innovative system using IOT and Smart grid concept.

KEYWORDS: Internet of Things, Renewable Energy, Sensors, Smart Grid, Wireless transmission.

I.INTRODUCTION

India is fast growing country in the world. In recent years the electricity demand in India is increasing rapidly because of fast growing industry. 1.4 billion Still have no access to electricity (87% of whom live in the rural areas) and 1 billion that only has access to unreliable electricity networks. We need smart and practical approaches because energy, as a driver of development, plays a central role in both fighting poverty and addressing climate change. The government of India's make in India campaign will introduce more industry in India then there will be acute demand for more and more reliable power supplies. The energy sources in India are mainly Coal (56.65%), hydro (19.13%), Gas (9.2%), Nuclear (2.32%), Oil (0.58%) and other renewable sources (12.9%). The existing system has several disadvantages like solar energy and wind energy that are being in the system as an energy source can supply the load only for a particular period of time. A major drawback of the existing system is the charging of energy from the solar and wind is not always available.

The principle objective of this project is to utilize energy in home by monitoring different conditions using different sensor as well as calculate the generated energy using renewable energy sources. Then calculate the total energy consumes and expends will lead to energy budget. It's a very easy way to save energy and cost in your home. Energy budget system helps you easily, comfortably control your heating, ventilation, and air conditioning systems as well as lights, blinds, and many other devices around your home with generation of energy as well. For you, that can mean up to 30% less heating energy used and lower CO emissions for your home. The innovative system design not only makes it especially simple automate room conditions, but also harmoniously blends in into environmentally surroundings, even into exclusive interiors.

The rule target of this task is to use vitality in home by observing distinctive conditions utilizing diverse sensor and additionally compute the produced vitality utilizing sustainable power sources. Then calculate the total

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energy consumption and the expenses will lead to the energy balance. It is a very simple way to save energy and costs in your home. The energy balance system helps you easily and comfortably control your heating, ventilation and air conditioning systems, as well as lights, blinds and many other devices in your home with power generation. For you, this can mean up to 30% less energy for the heating used and lower CO2 emissions for your home. The result is the amount of energy that must be consumed by the network, as well as the ability to discharge or charge the battery from the electricity grid or renewable during each tariff period. In order to improve the battery life cycle is implemented in this project, to control the operation mode of the battery. This design concept is primarily for increasing the useful life of lithium batteries and includes a mechanism of protection from charging and excessive discharge. The innovative design of the system not only makes the automation of environmental conditions particularly easy, but also integrates harmoniously into environmental environments, even in exclusive interiors. In this system, the energy comes from the sun and the wind that is stored in the battery. This renewable energy can be used at home. All data such as current, voltage are displayed on the LCD and sent wirelessly to the server (PC).

With the development of country's economy and the improvement of national power, the power requirement is still ever increasing due to use of improper power management systems and the conventional energy metering system. The existing system has several disadvantages like solar energy and wind energy that are being in the system as an energy source can supply the load only for a particular period of time. A major drawback of the existing system is the charging of energy from the solar and wind is not always available. We propose architecture of system and a control calculation called green charge for the organization of in situ renovations. Our framework decides both the division of energy devoured by the system contrasted with the vitality stockpiling in view of the battery in the site, and when and the amount to charge the battery-based capacity utilizing the energy of the system. This system is designed to estimate the electrical parameters of familiar devices. The essential features for the framework are the simplicity of viewing, configuration and use. From the point of view of the buyer, the use of electricity from different appliances in a house together with the voltage and current supply is the key parameter. The sensor execution signals are incorporated and associated with the ZigBee module to transmit data. These parameters will be stored in a database and analyzed. The collected data will be displayed on the computer via the graphical user interface (GUI) and will be updated to the web page. Rest of paper explains the following points such as: in Section II give the literature survey, Section III provides proposed system and explain the actual system. Finally, Section IV, V gives the result and conclusion.

II.LITERATURE SURVEY

Distributed generation (DG) utilizes numerous little on location vitality gathering intercessions in singular structures to produce power. The DG can possibly make age more proficient by lessening transmission and dissemination misfortunes, carbon discharges. Be that as it may, since sustainable power sources are irregular and wild, structures still need to depend, to some degree, on the power network. This venture proposes a few approaches to decrease power charges by investigating an elective approach that consolidates advertise based power estimating models with inexhaustible sources (sun based vitality) and unassuming vitality stockpiling (as batteries) from of a framework engineering called Green Charge [1].

In this paper, they explore an alternative approach that combines market-based electricity pricing models with on-site renewable and modest energy storage (in the form of batteries) to incentivize DG. We propose a system architecture and optimization algorithm, called Green Charge, to efficiently manage the renewable energy and storage to reduce a building's electric bill. To determine when to charge and discharge the battery each day, the algorithm leverages prediction models for forecasting both future energy demand and future energy harvesting [2].

The use of renewable energy sources are increased because of the depletion of natural resources and the increasing pollution level from energy production. The wind energy and the solar energy are most widely used among the renewable energy sources. In this paper, overview of wind and photovoltaic energy systems are introduced. Next, the power electronic circuits behind the most common wind and photovoltaic configurations are discussed. Finally, their controls and important requirements for grid connection are explained [3].

This paper focuses on the IOT elements, protocols, and the test bed setup for IOT environments along with the protocols and software designs that have been used to monitor and control consumers' energy usage patterns. We have deployed smart home technology in a real world scenario with each housing unit with 3 bed rooms and a living room

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that can accommodate 6-9 consumers. Each of these smart devices communicates with the UHG through a different communication protocol. The UHG, on the other hand, interacts with cloud server where most of the processing is done. The implemented system can control and manage energy based on published dynamic pricing information, and can act as an energy management system [4].

The development of smart grids makes possible the introduction of dynamic electricity rates, with prices changing each hour. They present a simulation model that studies the electricity demand for heating and cooling modern office buildings in the context of dynamic electricity prices. The model permits the simulation of scenarios in which existing thermal energy reservoirs (warm and cold water tanks) are used for the smart grid integration by means of adapted control strategies. The adaptation to dynamic electricity rates – and thus indirectly to the fluctuating supply of wind and solar power – is achieved solely by changing the control of the existing infrastructure without changing the infrastructure itself [5].

III.PROPOSED METHODOLOGY

3.1 Block Diagram:

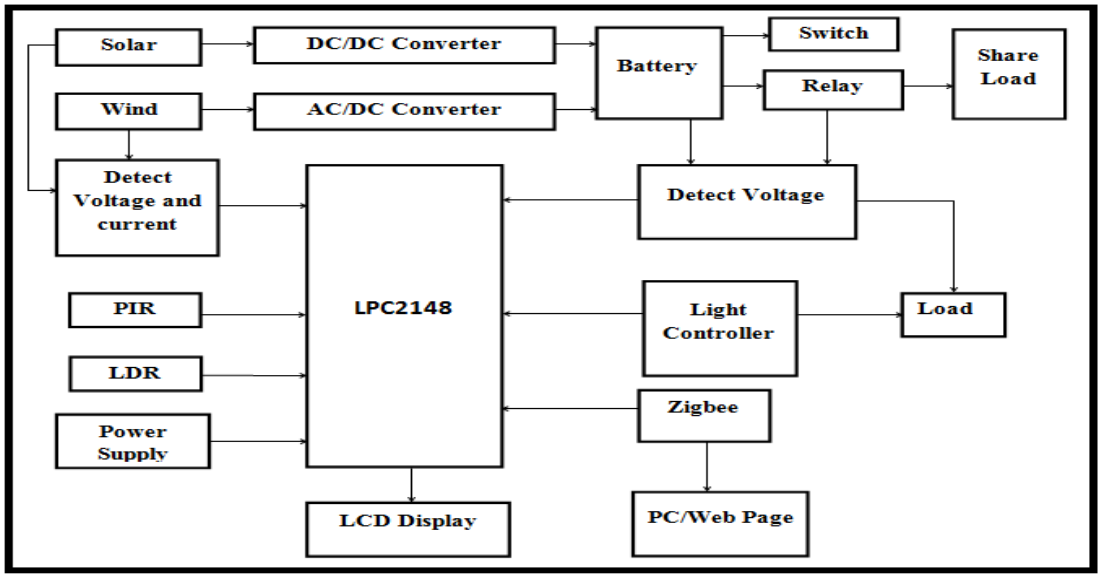

Fig 3.1.1 Block Diagram of System Node

Figure 1 demonstrates the block diagram of proposed framework. The networked meter-reading system consists of terminal measure solar & wind energy and devices work on that energy remaining energy will provided to another home (load). As per provided energy they will pay the bill from her account automatically. The least complex approach to quantify utilization and power age is to wrap the present transducers (CT) around the links in the building's electrical panel. For this situation, two CTs are required to measure current from solar and wind energy. And this information sends to the ARM controller to take some definite action. If the battery storage level is high as threshold value then that energy will be share with another load (as a home) through relay. We used ARM controller LPC2148. Current sensor is interfaced to ARM controller, it sense the current from load (solar and wind). PIR sensor used to detect the motion (Person), if detected then light will be ON. All information will be send to Server (PC) through Zigbee. All this information will display on web page and also automatically updating on the internet using IOT. As per definition of smart grid, it permits simple sparing through meter perusing, more noteworthy information precision; enhance charging velocity and purchaser benefit.

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3.2Elements of Block Diagram:

1. LPC2148:-

The LPC2141/2142/2144/2146/2148 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high speed Flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

2. PIR Sensor:

HC-SR501 is based on infrared technology, automatic control module, using Germany imported LHI778 probe design, high sensitivity, high reliability, ultra-low-voltage operating mode, widely used in various auto-sensing electrical equipment, especially for battery-powered automatic controlled products. This sensor used to detect motion.

3. Current Sensor:

The Allegro® ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. The device consists of a precise, low-offset, linear Hall sensor circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage.

4. Relay:

Relay is just a small electrical switch consisting of an electromagnet, a switch and a spring, that opens and closes beneath the control of another electrical circuit. The spring holds the switch in a solitary position, until the point that a current is gone through the loop; the coil produces an attractive field which moves the switch. As the relay has the capacity to control an output circuit of higher power compared to input circuit, it's often used to automatically switch large electrical energy appliances.

5. ZigBee:

For transmitting real-time sensed data over the internet from the collected computer system, the ZigBee packet information is to be transformed to the Internet Protocol Version 6(IPv6). The main part of data transformation for ZigBee packet is address translation. This is implemented at application gateway, a program used for determining the destination or source address of any packet that essentially encapsulates the payload of the ZigBee packet. The equivalent program for application gateway achieves this address transformation for Zig-Bee to address non-ZigBee nodes. ZigBee is built upon the IEEE 802.14.5 protocol, which employs a 64-bit address for each point (node) on a PAN (Personal Area Network) and 16 bit address to recognize the PAN ID.

6. Solar panel:

A Solar Panel is basically a module that converts light energy (photons) from the sun to generate electricity in direct current (DC) form. There are two types of solar panels, mainly crystalline and thin-film types. Solar panels generate free power from the sun by converting sunlight to electricity with no moving parts, zero emissions, and no maintenance. The solar panel, the first component of an electric solar energy system, is a collection of individual silicon cells that generate electricity from sunlight.

7. Battery:

Batteries are used to store the electricity generated by the solar panel. During the day, electricity generated by the solar panels is supplied to the battery and/or the load. When the load demand is higher than the energy received from the solar panels, these batteries will provide stable energy to the load. Solar power applications typically use deep-cycle batteries because they can persist repeated and deep discharges.

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IV. RESULT

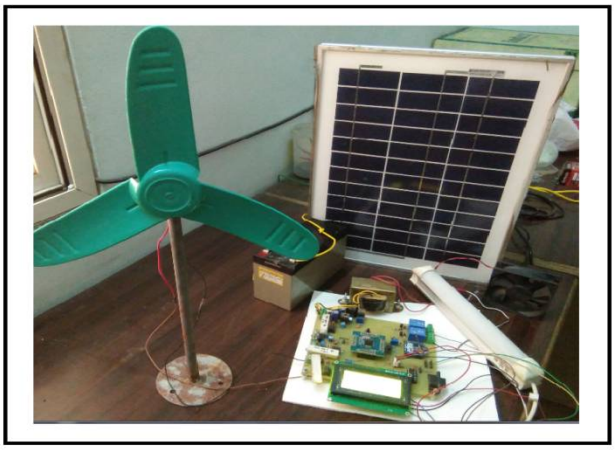

Fig. 4.1.1 System Model

Figure 4.1.1 shows the actual hardware model of system. In that system Sensors such as PIR and LDR are interfaced to ARM controller LPC 2148. Also current sensor is connected to the solar panel and wind energy source. It sense the current and this values are send to ARM controller. Controller will take action as per generating energy from renewable resource. If our system save same energy then that energy will be we share with another user. In such way that the user can share energy can as per amount of energy it will be take charges from share user. Such data should be updated on webpage by sending from zigbee wirelessly. And also PIR senor is used to sense the motion and LDR tells the light information in our home. If light is not in home then automatically our system will be ON the light. And this all data also updated on the webpage.

V.CONCLUSION

We have presented the architecture, implementation, and a demonstration of the Customer Domain of the smart grid, based on a platform for the IoT that can host a broad range of smart home applications using renewable energy (solar and wind). In this sense, our proposal has unique advantages and elements of novelty with respect to the state of the art: it is customer centric, it minimizes the deployment of particular smart grid framework, and it use conceivably accessible shrewd home applications, sensors, and systems. We can share the saving energy to another user. In such way that we can plot the graph of sharing energy (current and voltage) and which can display on LCD also on web page through Zigbee. Thus, by the Green charge have numerous benefits over Distributed generation in the case of cost, the efficiency, the power usage. We investigate how to bring down electric bills utilizing Green Charge by putting away minimal effort vitality for use amid high cost periods.

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