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Implementation of Smart Grid to Remotely Monitor and Control Renewable Energy Sources

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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: Energy sources

I. INTRODUCTION

The growing demand for clean and sustainable energy sources necessitates advancements in grid structure. This project explores the potential of an IOT-based smart grid to remotely monitor and lcontrol renewable energy sources. In this, we use solar energy as a renewable energy source, and with the help of cloud computing, we monitor and control different types of loads. The paper highlights the key components, functionalities, and benefits of such a system.The increasing demand for sustainable

energy solutions fuels the development of smart grid technologies. This project proposes an IOT (Internet of Things)-enabled smart grid architecture for remote monitoring and control of renewable energy sources. The core concept involves integrating sensors with renewable energy sources like solar or wind turbines. These sensors collect real-time data on energy generation, environmental conditions, and system health. This data is then transmitted over a network to a central control system or a cloud platform for further analysis. By implementing remote control capabilities, grid operators can: regulate energy production based on demand; integrate storage solutions for surplus energy; and improve overall grid stability and reliability. The project concludes by outlining the benefits of this approach, including a reduced carbon footprint, cost savings, and a more sustainable energy future. 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).[1-5]

Merits of renewable energy sources:-

1. Project offers a significant advancement in the way we manage our power infrastructure its offers a powerful solution for optimizing renewable energy use.
2. It promotes efficient and reliable power distribution, cost reduction and significant shift towards a more sustainable energy future.

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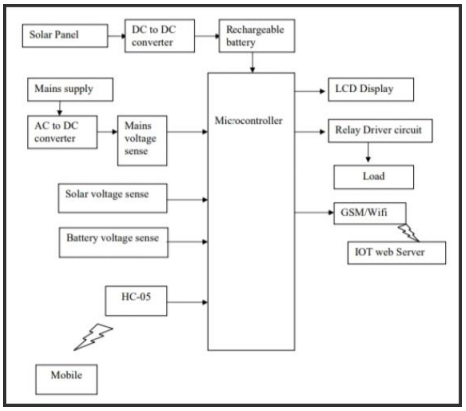
3. The project is reliable to implement and very customizable according to requirement.
4. It provides very efficient methods of monitoring and controlling our renewable (solar) energy resources.
5. Enhanced grid stability and resilience.
6. Optimized use of renewable energy, reducing reliance on fossil fuels.
7. Reduced costs through automation and reduced manual intervention.
8. Ability to integrate more renewable sources without compromising grid reliability.

II. LITERATURE REVIEW

The growing reliance on renewable energy sources like solar, wind, and hydro presents a significant opportunity for reducing carbon emissions and promoting sustainable energy. However, these sources are inherently variable and can be difficult to predict due to weather changes and other environmental factors, leading to challenges in ensuring a reliable and stable energy supply. Existing power grid infrastructure is often ill-equipped to handle the fluctuating nature of renewable energy. Without real-time monitoring, remote control, and advanced data analytics, grid operators face difficulties in balancing supply and demand, maintaining grid stability, and optimizing energy distribution. This limitation results in inefficiencies, potential energy waste, and an increased dependence on backup power from non-renewable sources.[2-3]

Block diagram and explanation:-



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.[7]

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 PIC microcontroller is use to upload data over IOT. This can be shown in Figure 1.1 Block diagram.[8]

The proposed smart grid system has Contains o f energysources mainly non renewable Energy Sources that leave asignificant carbon emission footprint on the surroundingenvironment and the second energy sources that we usedwhich comprised number of Renewable energy sources thatwere echo friendly here the main task achieved is tomaximize the utilization of the latter. But the overall EnergySource which is used is taken by the end user of theservices that are provided by the implemented Web of Thingsarchitecture. In the proposed system the Energy sources are connected to individual digital energy meters of industrialstandard having for the purpose. Which are derived fromeach of these energy meters by means of RS 485(wirelessconnections). Which is controlled by Internet enabled embedded devices which are in Continuous Constantcommunication with the meters. The meters data

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isperiodically updated into a server. The server provides theweb services that make up the web of thing on top of theseembedded system devices. The m a i n server providesservices which include display on meter for grab the mostadequate information, current working status of load,scheduling of the power sources for each individual fromhandling setup area and remote location control over theenergy sources by switching the source controllers bymeans of the embedded devices.User can access services from any computer link to theInternet in this system these source changers are controlled byembedded devices. This embedded devices stand by for theinstruction from the server which is moreover instructed bythe true user to switch the energy sources. If the users areprovided with a cost -effective process to configure the powersupply of their homes as per provide or given requirement, theuse of generated renewable energy can be maximized or it'sdistribute to required further Process. This would eventuallyput an impact on the total carbon emissions due to the creationprocess of power from non-renewable energy sources. TheWeb of Things comprise of a number of Internet enabledEmbedded devices which furnish such an interface to the userby means of Web services. The end user can access thisthrough a web browser of any computer with an Internetconnection.Only a Valid Customer needs a username and password togain access to these services from any computer connected tothe Internet. Sources availability is useful may at defaultCondition it may switch over soon. These source changers arecontrolled by embedded devices, such devices stand theinstruction from the server which is furthermore instructed bythe authenticated user to switch the energy sources.

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