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A Smart Grid System Using Renewable Energy Resources to Power Electric Vehicle Charging Station

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Abstract -The proposed effort is on monitoring and managing energy consumption using the Internet of Things (IoT). Electricity is an essential component of human survival on Earth. Saving power is crucial as we rely heavily on it for our job. Without electricity, life would be like a heart without beats. Saving energy is a daily task. Energy savings can only be achieved if the energy spent by the load is monitored. Monitoring the load allows for optimal control approaches to conserve energy. The Internet of Things technology has been presented as a solution for monitoring and controlling energy use in homes and industries, in addition to other current technologies. The project aims to create an Internet of Things-based Energy Management System that collects data from smart energy meters over GPRS network and displays it on a website. The suggested system effectively collects data and manages load in an Internet of Things environment.

Key Words: Electric Vehicle, IOT , Smart Grid , Solar , Wind.

1. INTRODUCTION

Start your smart grid automation adventure by communicating with devices using smart Smartphone applications or a wireless gateway. Start with Wi-Fi smart plugs for the plug-and-play market. A smart plug transforms a standard power socket into a smart one with no installation required.
Begin by automating a single device or power outlet and gradually expand your automation network. From your Smartphone, you may do actions such as turning on and off devices and setting rules to automate their operation. Smart Plugs are available at low prices, making them accessible to novices and enthusiasts interested in home automation.
There are several service providers, including start-ups, home security firms, and digital entrepreneurs, that can develop and install a customized system for your house.

Professional installation is especially useful for retrofitting older homes that do not have basic plug-and-play setups. Major home automation systems rely on a gateway or hub. Hubs serve as a command centre for communication between controllers and controlled devices, such as computers or mobile devices, for monitoring and control.

Stand-alone hubs are widely accessible in the market. Choose a hub depending on the items you use and the tasks you want to do.
Home automation systems often have their own hub, allowing for easy configuration and installation by either the user or a professional specialist. A home automation system comprises of a device that connects with a gateway or hub. The number of devices needed for home management varies based on your desired level.

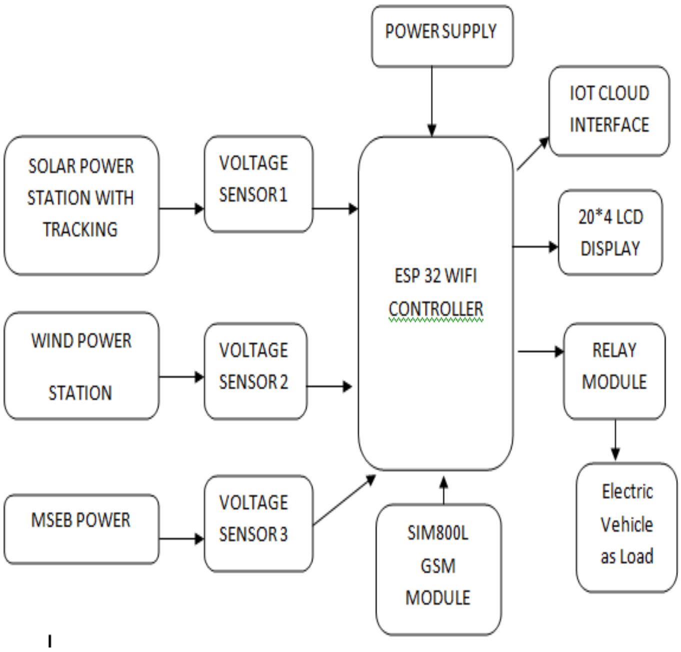

Fig -1: Block Diagram Of Proposed System

As electricity costs rise and Global Warming initiatives aim to cut usage, there's a rising interest in evaluating domestic power consumption.
Analyzing each appliance's power use allows for more precise judgments on efficiency and replacement needs. This may also establish if an appliance is using excessive power while switched off, indicating the need to disconnect it. This leads to lower power use and costs. Prepaid power meters in houses often only show real-time power usage and available electricity.

2. Literature survey

Purusothaman, SRR Dhiwaakar, et al.Explain the focus on DG, grid, and Mu agents. DG agents include DERs, load, storage, and grid agents. The Mu agent facilitates communication between the DG agents and higher-level agents, including the control agent. The system was implemented using an Arduino microcontroller.

Kabalci, Ersan, Alper Gorgun, and Yasin introduce An immediate monitoring infrastructure for a renewable energy producing system consisting of wind turbines and solar panels. The monitoring platform relies on current and voltage readings from each renewable source. Sensing circuits are built to measure relevant variables, which are then processed by a Microchip 18F4450 microcontroller. The processed parameters are transferred to a PC via USB and kept in a database, allowing quick system monitoring. Monitoring software's visual interface allows for daily, weekly, and monthly analysis of individual measurements.

Jiju et al. developed an online monitoring and control system for distributed renewable energy sources (RES) using the Android platform. This approach uses an Android tablet or mobile phone's Bluetooth interface to exchange data with the digital hardware of a Power Conditioning Unit (PCU).

According to Goto, Yoshihiro, et al [4], an integrated system for remotely monitoring and managing telecoms power plants is now operational. The system manages over 200,000 communications power plants, including rectifiers, inverters, and UPSs, as well as air-conditioning systems in around 8,000 telecommunication buildings. The system integrates administration and remote monitoring capabilities and offers better user interfaces using web technologies.

Suzdalenko, Alexander, and Ilya Galkin identify a difficulty with non-intrusive load monitoring and disaggregation into distinct appliances. Connecting local renewable energy generators to the same grid may result in mismatched loads over time.

Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula discuss their recent work on developing a wireless remote monitoring system for renewable energy facilities in Malawi. The objective was to create a cost-effective data collecting system that continually displays remote energy yields and performance metrics.
The initiative provides rural sites with immediate access to produce electricity using wireless sensor boards and SMS delivery over a cellular network. Preliminary experimental results show that renewable energy systems in remote rural areas may be assessed efficiently at a minimal cost.

Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula present a real-time monitoring and control system for a hybrid 'wind PV battery' used in renewable energy systems. The proposed SCADA system integrates National Cheng Kung University's campus network, a programmable logic controller (PLC), and digital power meters. The suggested system measures electrical data in real-time and transfers it to a distant monitoring centre via intranet. The theoretical and practical findings show that the proposed monitoring and control system can provide real-time supervisory control and data collecting for remote renewable energy systems.

3. Proposed Methodologies

The usage of two energy sources, one from the grid and one from renewable, ensures reliable power supply for users. The WoT design monitors household power use and switches between two power sources accordingly. Renewable energy sources like photovoltaic (PV) solar panels and wind turbines create varied amounts of power based on season, weather, and time of day. CT Coil current sensors monitor the current flow of separate supplies. This can significantly minimize power loss, lower operating temperatures, and improve dependability.
The acquired data will be continually updated in the cloud using the GPRS/GSM modem. The Web of Things platform includes early applications for energy insight and control. Authenticated users can access cloud-stored data from anywhere in the globe and analyze power use with only an internet connection (no data required).After verifying the appropriate documentation, a specialist will install the smart grid in the residence. The user may follow the status of their application processing on the login screen using WoT. The application data on this page can be printed once the application has been processed.
After logging in, the user is sent to an index page with several options available. One of the advantages is that there are choices for determining a home's typical power use. Users receive assistance in assessing their energy requirements and arranging power sources accordingly. The user may track their intake daily, monthly, or annually. Compare consumption statistics to historical data using average consumption data. The user uses power usage statistics to plan when and how to use their energy source.

The web services user can set the switching of energy sources based on a predefined schedule.
Only one user may have access at a time. All used data is shown on IoT, separated into renewable and non-renewable categories.

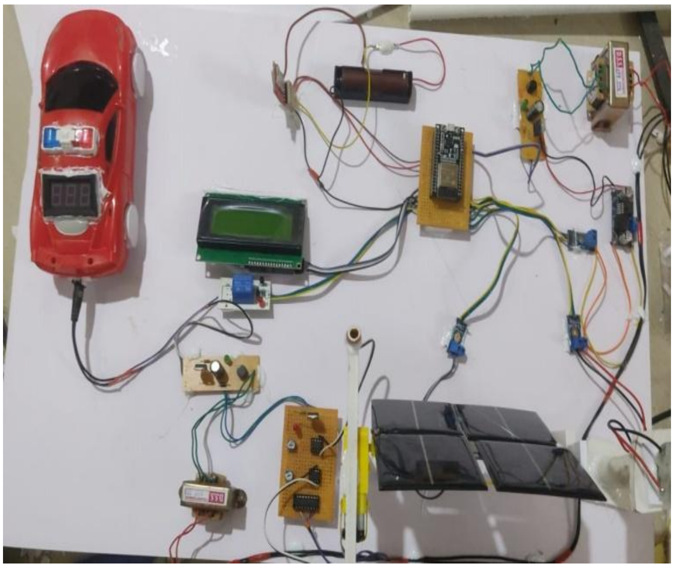

Fig -2: Hardware of the Proposed system

4. RESULT DISCUSSION:

In the following fig, we can see the outpost of the each supply voltage is shown in the lcd display. Also at the time of voltage increasing in the given source such as solar, wind. The load is shifted to the respective voltage source and can be clearly seen on the lcd display. In that case the relay module connected across the controller is triggered and the load is worked on the shifted voltage.

Fig -3: Outputs of system on lcd display

Only one user may have access at a time. All used data is shown on IoT, separated into renewable and non-renewable categories. MSEB's power consumption is billed online via the Internet of Things.
Only one user can access at a time. This arrangement connects directly to the integrated boards via IOT. The embedded control system changes the source by manipulating source changers attached to individual load' smart grid power supply.
As the lcd display shows the each source voltage data, likely the IOT server can shows the same data with the delay of 10 to 20 sec .

Fig -4: Outputs of system on lcd display

Following fig shows the text message is receiver end with the current situation of shifted load with the help of gsm module is attached to the controller. The user mobile number is placed in the coding to receive the current data of shifted load.

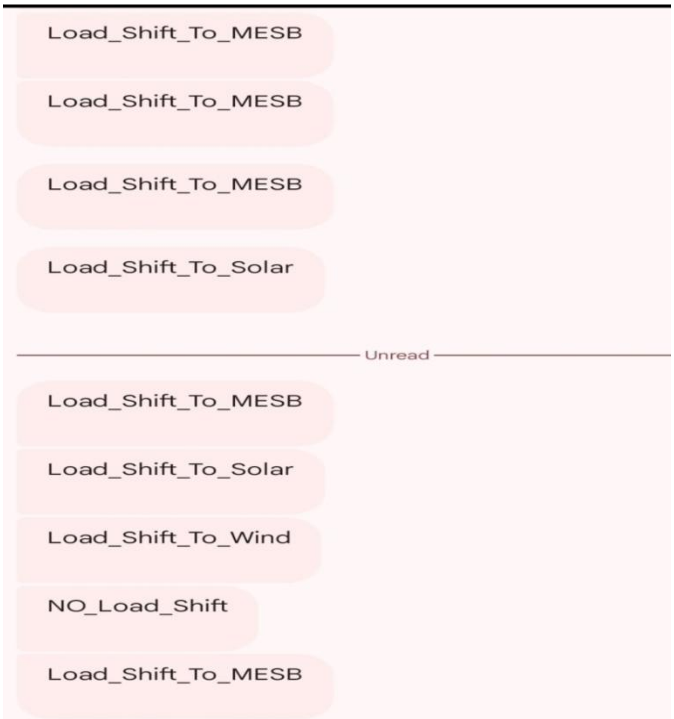

Fig -5: Outputs of system on lcd display

3. CONCLUSIONS

In this proposed project, we successfully developed a system based on microcontroller, a solar PV panel, voltage sensors, a battery charger module, and iot based system for monitoring real-time solar power. The system was able to acquire real-time data from places outside of the control centre and utilize a GUI to continually track the voltage, current, temperature, and light output of PV panels, among other environmental conditions. Real-time data may be continuously monitored and recorded with IoT. This information may then be used to forecast and evaluate future power generating potential, revenue output, and other elements. The adoption of an IoT-based system will thereby expedite and improve recorded data analysis, shorten intervention and monitoring times, streamline network administration, and eliminate the need for periodic PV system maintenance. Because the range of solar radiation varies depending on location and time. To make the best use of the most solar radiation and get the maximum output, we may manage the PV panel by installing a Solar Power Tracking System. If any system component develops a problem, the Solar Power Monitoring system will be useful.

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