Smart Home Solar System Monitoring and Load Balancing

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***Abstract*— The existing system does not focus on energy loss and excessive costs, there will be a lot of challenges. As a result, this plan reduces power waste by using solar energy and also helps to reduce the cost of consuming electric power. The Monitoring and Control Unit can track and control the most home appliances at once with the help of controller based appliance monitoring. This approach could be implemented in the future to advance society. Individuals are progressively seeking more comfort by keeping numerous appliances in their homes that are left on throughout the day. They also occasionally leave their homes without turning off lights, heaters, or TVs. The design and deployment of a home energy management system is recommended in this work so that households can continuously track their energy usage and make energy-saving decisions. The project's goal is to build and execute a home energy management system that gives customers detailed information about their energy use and permits using renewable energy as a source of electricity at home while also enabling sensing, control, and smart algorithms**

I. INTRODUCTION

The concept "smart grid" refers to the use of technologies and tools that assist electric utilities in more effectively monitoring power usage demand and system conditions on a nearly realtime basis in order to better satisfy consumers' needs reliably and economically. Additionally, it enables utilities to track consumer electricity use over a range of time frames and give customers information on their energy consumption. We want to design a system that can use solar electricity while taking into account the issue with the generation of the ac supply. The grid's power will be lowered when more home appliances are powered by solar energy. Using this technology, renewable energy is used effectively This method will be utilised to solve the load shedding issue and lower electricity costs. The solar micro grid inverter can convert the solarpowered system's dc power to ac power. The microcontroller receives the synchronised output, and based on the load needs and the status of the sources, automatically chooses a source of a supply.

2. LITERATURE REVIEW AND OBJECTIVE

The objective of this project is to implement a low cost, reliable and scalable solar base home automation system that can be used to automatically control the Light , Fan appliances connected to it, using a micro-controller Esp8266 achieve hardware simplicity Low cost

Siddiqui et al.[1] Proposed a personalized appliance recommendation system based on NonIntrusive Load Monitoring (NILM) the uses a DL approach to recommend consumption patterns for the appliances. Zou et al.[2] Proposed a deep learning-based human activity recognition scheme for smart building to identify human activities using only Wi-Fi enabled IoT devices. Le et al.[3] Proposed use the Transfer Learning concept to develop a framework for multiple electric energy consumption forecasting of a smart building. Moreno et al.[4] Proposed define predictive models of energy consumption and save energy for building based on the Radial Basis Function (RBF) techniques. Hadri et al.[5] Proposed develop several energy consumption -forecasting approaches by integrating the occupancy prediction and the context - driven control of building's appliances. Gonzalez-Vidal et al.[6] Proposed ML and grey-box approaches to predict the energy consumption to test if the prior information on the physics of the building heat transfer is currently redundant because of the completeness of the system data .Sadeghi et al.[7] Proposed present a state-of-a-art of existing research works focusing on the planning problems of energy system in energy hubs. Silva,Khan & Han et al. [8] Proposed analyses recent literature reports on the peak load shaving and demand response for EMS. Hern`andez et al.[9] Proposed a review of management strategies for

BEMSs for the improving energy efficiency .They review the existing studies for building types,building subsystem, and used techniques. Himeur et al.[10] Proposed presets a survey about energy efficiency recommendation systems in building , and a taxonomy of these systems based on the nature .Chinchero et al.[11] Proposed present a review about control methodologies for BEMS, specifically studying the impact of LED Lighting smart buildings. Schmidt et al.[12] Proposed presents several recent works about predictive control strategies for the daily operation of buildings. Hameed et al.[13] Proposed present a state-of- the-art in intelligent control systems for energy and comfort management in smart building. Lazarova et al.[14] Proposed review the methods that can be utilized for the discovery and diagnosis of faults in buildings, in order to identify the existing gaps. Plageras et al.[15] Proposed a survey on the Internet of Things(IoT),Big Data,Cloud Computing ,and other topics in the field of sensor data collection & management in smart .Glenson Toney et al. performed [16] propose a system initiated by a human action. It is also given with an option of switch button and a fall detector to activate the system. The armband would have a controller with GSM/GPS kit interfaced. An alert, the person can be tracked. The system is designed also to be used as an alert system during medical emergency. Fathima Jabeen et al. learn performed [17] The armband incorporates a switch as an option to turn ON the system when one feels threatened. A switch can also be used during medical emergency and a Reset button too. The prototype also includes a fall detection sensor in the armband. Puneeth S et al. performed [18] . Say detect a fall and send message or alert on turning ON the app. Another drawback here is that most of these have to be initiated manually, If the victim has a degree of freedom to turn ON the system, then a simple switch can be used to turn the system ON. When a person is attacked or in a dangerous 978-1-4799-8371-1/15/$31.00 c 2015 IEEE 3008 support to move around. With the help of advanced technology individuals can make use of a simple gadget which can be 9 used whenever they are in unpredictable circumstances to establish connectivity between police and family The device designed is a portable one which can be activated as per the requirement of the individual which will locate the victim using GPS and with the help of GSM emergency messages can be sent to the respective locations asper the design. Basavaraj Chougula et al. performed [20] This paper suggests a new perspective to use technology to protect women. The system resembles a normal belt which when activated, tracks the location of the victim using GPS (Global Positioning System) and sends emergency messages using GSM (Global System for Mobile communication), to three emergency contacts and the police control room.

3. MATERIALS AND METHODS

3.1 ARDUINO:

Fig 3.1. Arduino nano

An open-source electronics platform called Arduino is built on simple hardware and software. A motor can be started, an LED can be turned on, and something may be published online by using an Arduino board to receive inputs like light on a sensor, a finger on a button, or a tweet. Sending a set of instructions to the board's microcontroller will instruct your board what to do. You achieve this by using the Arduino Software (IDE), which is based on Processing, and the Wiring-based Arduino Programming Language. A compact Arduino board called the Nano is built around an ATmega328P or ATmega628 microcontroller. The Arduino UNO board has the same connection. A sustainable, compact, dependable, and The Nano board is an adaptable microcontroller. The Arduino (IDE), which is available for a few operating systems, is used to organise the Arduino 17 Nano. Integrated Development Environment is referred to in this sentence. The Arduino IDE and micro-USB are the tools needed to get our projects running on the Arduino Nano board. On the aforementioned laptop or desktop, the Arduino IDE programme needs to be installed. The Arduino Nano board receives the code

from the computer via the mini-USB connector. The Arduino Nano board's technical specs are as follows: o The Nano board's working voltage ranges from 5V to 12V. Nano has a total of 22 input/output pins. o There are 8 analogue pins and 14 digital pins. The 14 digital pins include 6 PWM (Pulse Width Modulation) pins. The Arduino Nano's 6 PWM pins are used to translate digital signals into analogue impulses. The conversion is accomplished by changing the pulse's width. · The Arduino Nano's crystal oscillator operates at a 16MHz frequency. o The Arduino Nano is employed in a number of different fields, including robotics, embedded systems, instrumentation, automation, and control systems. o Examples of projects made with an Arduino Nano include a DIY pedometer and a QR code scanner. The Arduino Nano can also be Wi-Fi connected.

3.2 Solar Cell:

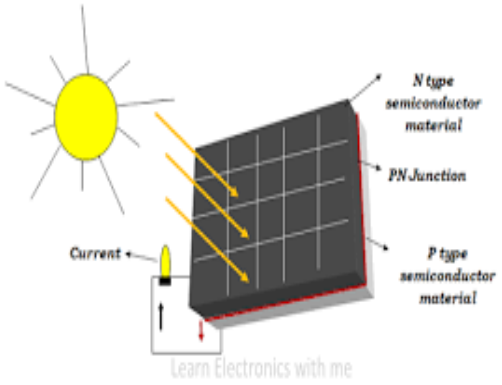


Fig:Solar Cell

A solar cell, or photovoltaic cell, is an electronic device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.[1] It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devices are often the electrical building blocks of photovoltaic modules, known colloquially as solar panels. The common single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 volts to 0.6volts.Solar cells are described as being photovoltaic, irrespective of whether the source is sunlight or an artificial light. In addition to producing energy, they can be used as a photo-detector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity.The operation of a photovoltaic (PV) cell requires three basic attributes:The absorption of light, generating exciton s (bound electron-hole pairs), unbound electron-hole pairs (via exciton s), or plasmon s.The separation of charge carriers of opposite types.The separate extraction of those carriers to an external circuit.In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat. A "photo electrolytic cell" (photoelectrochemical cell), on the other hand, refers either to a type of photovoltaic cell (like that developed by Edmond Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen using only solar illumination.Photovoltaic cells and solar collectors are the two means of producing solar power.

3.3 :Light Sensor:

Fig:Light Sensor

Light Sensors are photoelectric devices that convert light energy (photons) whether visible or infra-red light into an electrical (electrons) signal.A Light Sensor generates an output signal indicating the intensity of light by measuring the radiant energy that exists in a very narrow range of frequencies basically called “light”, and which ranges in frequency from “Infra-red” to “Visible” up to “Ultraviolet” light spectrum.The light sensor is a passive devices that convert this “light energy” whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly known as “Photoelectric Devices” or “Photo Sensors” because

the convert light energy (photons) into electricity (electrons).Photoelectric devices can be grouped into two main categories, those which generate electricity when illuminated, such as Photo-voltaic or Photo-e missives etc, and those which change their electrical properties in some way such as Photo-resistors or Photo-conductors.

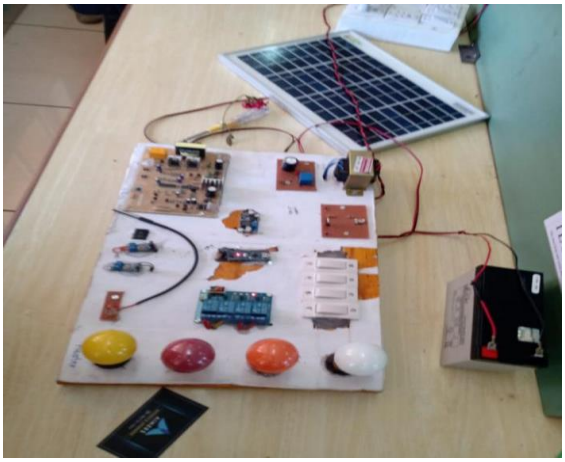
3.4 Battery 12 V:

Fig:Battery 12 V

A 12 volt battery is an irregular battery used in specific electronic applications. Of all the types of batteries, the 12 volt battery is one that looks very different depending on its use. In some ways, it is one of the most diverse of all batteries. It can be large or small, heavy or light. In some cases, they may look nearly like regular AA batteries. One of the most common uses of a 12 volt battery is for transportation applications, such as in cars and boats. In these cases, the battery may be able to be recharged as current is only needed to start the vehicle. After that, the alternator takes over and runs the electrical system, if it is functioning properly. The alternator also puts a charge back into the battery. The sizes of 12 volt batteries vary widely based on the amp hours they are designed to produce. They can be very heavy and large, such as those found in cars. They can also be relatively small, such as batteries found in some electrical children's the battery may be able to be recharged as current is only needed to start the vehicle. After that, the alternator takes over and runs the electrical system, if it is functioning properly. The alternator also puts a charge back into the battery. The sizes of 12 volt batteries vary widely based on the amp hours they are designed to produce. They can be very heavy and large, such as those found in cars. They can also be relatively small, such as batteries found in some electrical children's vehicles that run in the front yard.

4.RESULT

The usage of Renewable Energy technology is one recommended approach of reducing environmental consequences. Because of the frequent power outages, using renewable energy and keeping track of it is crucial. The user is taken through the process of monitoring renewable energy consumption. This strategy is cost-effective. The system\'s efficiency is estimated to be approximately 95%. This allows for more efficient utilization of renewable energy. The temperature sensor is useful for research into solar energy storage. As a result, the electrical issue becomes less of an issue. We presented work on the design and building of a solar panel parameter reading node for environmental monitoring using Arduino; the node is capable of providing information on temperature, voltage, and light intensity.



5.CONCLUSION

Solar energy is trustworthy and sustainable hence the utilization of this smart solar system is reliable, adequate and cost-efficient. The proposed smart solar system comprises both Monitoring and Prediction. We have used the Internet of Things (IoT) for monitoring by considering parameters like Temperature, Humidity and Solar Power. Internet of Things is providing practically expert methods that offers required outcome. The designed system monitors panel level PCU and anticipates the error findings. We can analyze the weekly or monthly performance of panels. On the other hand, Prediction uses Hidden Markov Model for forecasting the solar

power. We have developed an hourly prediction system. Considering historical records, the proposed model is able to predict accurate power generation in time- series method. Numerical results show that the proposed model achieves better prediction accuracy than the simple Linear Regression model.

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