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Solar Panel and Main Line Distribution System Control and Monitoring with IOT

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Abstract: ***Energy plays a pivotal role in our daily activities. The degree of development and civilization of a country ismeasured by the amount of utilization of energy by human beings. Energy demand is increasing day by day due to increase in population, urbanization and industrialization. The rate of energy consumption is increasing; supply is depleting resulting in inflation and energy shortage.***

The biggest crisis we are handling into is the climate change due to excessive use of fossil fuels and to overcome these issues, we have only one solution that is utilizing renewable Energy. One of the most prominent kinds of renewable energy is solar energy.

The goal of this thesis was to develop a laboratory prototype of a solar tracking system, which is able to enhance the performance of the photovoltaic modules in a solar energy system. The operating principle of the device is to keep the photovoltaic modules constantly aligned with the sunbeams, which maximizes the exposure of solar panel to the Sun's radiation. As a result, more output power can be produced bythe solar panel.

Index Terms: Wireless Communication, Global positioning system Mechanical Switch(realy), Internet of things

I. INTRODUCTION

Energy plays a pivotal role in our daily activities. The degree of development and civilization of a country is measured by the amount of utilization of energy by human beings. Energy demand is increasing day by day due to increase in population, urbanization and industrialization. The rate of energy consumption is increasing; supply is depleting resulting in inflationand energy shortage. This is called energy crisis. These are the energy sources that we are using which cannot create in a short periodof time. Hence alternative or renewable sources of energy have to be developed to meet future energy requirement. Now the point is what renewable and non-renewable energy are.

1) *Non-Renewable Source*- we get most of our energy from non- renewable energy sources, which include the fossil fuels – oil, natural gas, and coal They're called fossil fuels because theywere formed over millions and millions of years by the action ofheat from the Earth's core and pressure from rock and soil in the remains of dead plants and animals. Renewable Energy These are the energy source that can be used over again renewable energy source, which include fossil fule-oil, natural gas, and coal They're called fossil fuels because they were formed over millions and millions of years by the action of heat from the Earth's core and pressure from rock and soil in the remains of dead plants and animals. Renewable Energy These are the energy sources that we can use over and over again
2) *Renewable Source*- These sources include solar energy, which comes from the sun and can be turned into electricity and heat. Wind, geothermal energy from inside the earth, biomass from plants, and hydropower and ocean energy from water are also renewable energy sources power as the best renewable source of energy in India due to its proximity to the equator, India abundant sunlight through the year. Solar PV solution has the potential to transform the lives of 450 million. Renewable energy is a type of energy used in nature without any harmful impact on the environment. Solar radiation from the sun is collected on solar panels and converted into electrical energy. The output electrical energy depends on the amount of sunlight. Falls on a solar cell. In this project, a functional systemfor sun tracking is implemented. He could hold the solar panels in line with the sun or light source, respectively. The project's solar tracker design is also a starting point for developing better systems in the future. The main solution of this proposed work is to Power of the system can be monitor using the current and voltage value sensed by the arduino. The monitor of the solar energy system shows the power and energy usage. This system helps to implement in smart grid for efficient usage. The proposed system is for monitoring of solar energy using IOT. Solar panel helps to store the energy in the battery. Battery has the energy which is useful for the electrical appliances. Battery is connected to the Arduino. Arduino is a micro controller which is used to read the sensor values.

Current sensor and voltage divider are connecting to the Ardunio Power outages are common in India. Because of this problem, it is important to use control renewable energy. Homes and communities that use solar energy by controlling energy projections. Consumer products, such as hot water systems, solar home lighting system solar light, solar pumps, solar mobile chargers, solar cookers, LED solar light, reverse osmosis solar power plant, solar fans, solar inverter, etc. You can control it as a project. Commercial product such as solar traffic lights and solar road pole/flashing light canalso be controlled by this proposed system. A solar tracking systemis implemented in this project. Here we use a dual axis SolarTracker which is a device which senses the light and positions towards the maximum intensity of light. It is made in such a way totrack the light coming from any direction. To simulate the general scenario of the Sun's movement, the total coverage of the movement of the tracker is considered as 120˚ in both the directions. The position of the tracker ascends or descends only when the threshold value is above the tolerance limit.A solar tracking system is implemented in this project. Here we use a dual axis Solar Tracker which is a device which senses the light and positions towards the maximum intensity of light. It is made in such a way to track the light coming from any direction. To simulate the general scenario of the Sun's movement, the total coverage of the movement of the tracker is considered as 120˚ in both the directions. The position of the tracker ascends or descends only when the threshold value is above the tolerance limit.

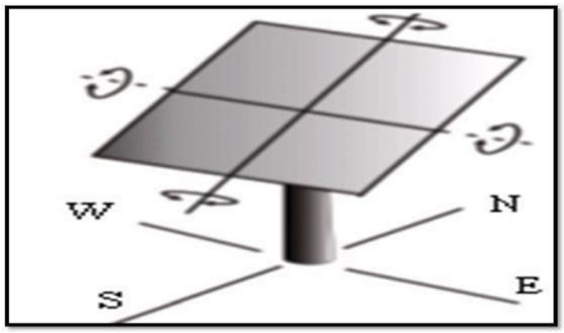
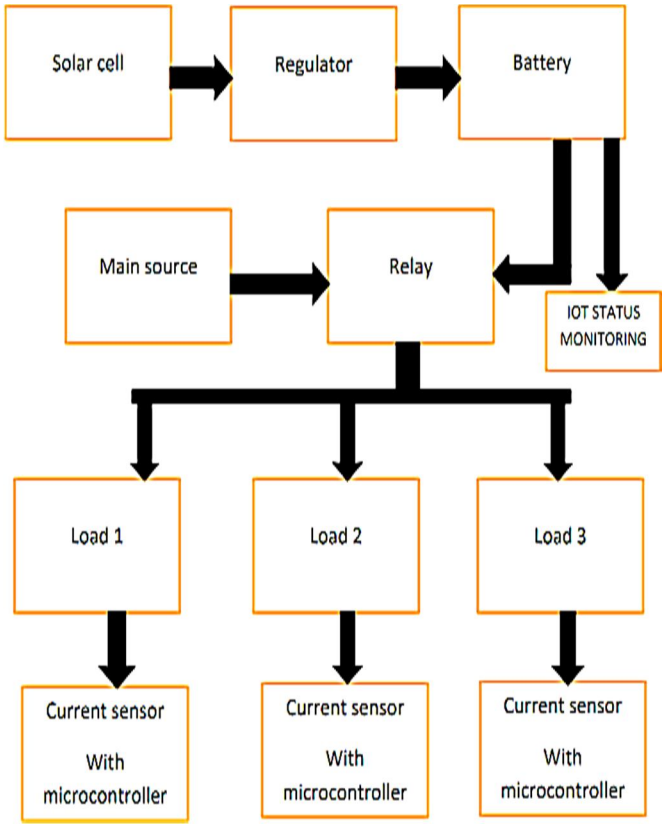


Figure 1-Dual axis solar panel

II. FLOW CHART



A solar panel is installed first with servo motor and LDR in connection then a battery is connected to store the solar energy a regulator is used to convert the AC current in DC current to be used. A relay is connected to the main line which act as a switch . Three different equipments are placed with a connection divided in three load. All the status are being monitored with IOT based system using GSM model on or mobile phone.

III. LITERATURE SURVEY

Purusothaman SRR Dhiwaakar, et ala, [2012], explain about the focus is on the DG agents, grid agent and Mu agents. DG agents like the distributed energy resources (DERs), load, storage and the grid agents. The Mu agent acts as the communication channel between the DG agents to the higher level agents such as the controlagent.

Goto, Yoshihiro, et al [4] explained about an integrated system that manages and remotely monitors telecommunications power plants has been developed and has started operations. The system is used to operate and maintain more than 200,000 telecommunication power plants, which including devices such as rectifiers, inverters, and UPSs, and air-conditioning plants installed in about 8,000 telecommunication buildings. Features of the system are the integrate the management and remote monitoring functions, into one system and improved user interfaces, which use information and communication technology such as web technology. K.S. Madhu, et al, [2012]

,states that a single axis tracker tracks the sun east to west, and a two-axis tracker tracks the daily east to west movement of the sun and the seasonal declination movement of the sun. Concentrates solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect. Solar power is the conversion of sunlight into electricity. Test results indicate that the increase in power efficiency of tracking solar plate in normal days is 26 to 38% compared to fixed plate. And during cloudy or rainy days it's varies at any level.

Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula,[2011],proposes a novel monitoring, control system for achieving real time monitoring and control of a hybrid 'wind PV battery' for renewable energy system. This paper describes recent work on the development of a wireless based remote monitoring system for renewable energy plants in Malawi.

The main goal was to develop a cost effective data acquisition system that continuously presents remote energy yields and performance measures. A test bed comprising of a solar photovoltaic (PV) power plant has been set up at Malavi Primary School and a central management system at Malawi Polytechnic. The project output gives direct access to generated electric power at the rural site through the use of wirelesssensor boards and text message (SMS) transmission over cellular network. The SMS recipient at the central site houses an intelligent management system based on Frontline SMS for hosting SMSs and publishing remote measurement trends over the Internet. Preliminary experimental results reveal that the performance of renewable energy systems in remote rural sites can be evaluated efficiently at low cost.

Hossein Mousazadeh,et al, [2011], studied and investigated maximization of collected energy from an on-board PV array, on a solar assist plug-in hybrid electric tractor (SAPHT). Using four light dependent resistive sensors a suntracking system on a mobile structure was constructed and evaluated. Four LDR sensors were used to sense the direct beams of sun. Each pair of LDRs was separated by an obstruction as a shading device. A microcontroller based electronic drive board was used as an interface between the hardware and the software. For driving of each motor, a power MOSFET was used to control the actuators. The experimental results indicated that the designed.

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Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci, [2013], introduces an instant monitoring infrastructure of a renewable energy generation system that is constituted with a wind turbine and solar panel arrays. The monitoring platform is based on current and voltage measurements of each renewable source.

The related values are measured with the developed sensing circuits and processed by an 18F4450 microcontroller of Microchip. The processed parameters are then transmitted to a personal computer (PC) over universal serial bus (USB) to be saved in a database and to observe the system instantly. The coded visual interface of monitoring software can manage the saved data to analyze daily, weekly and monthly values of each measurement separately.

IV. PROPOSED SYSTEM

The proposed system is a distributed system that connects the system to the GSM module composed of SIM cards. This allows users to control their equipment regardless of distance from home. Now, you might be wondering why someone away from home could choose to control their appliances. There are devices that can operate without human presence. This means that no manual intervention is required during operation. For example, consider the air conditioner in your home. The function of an air conditioner is to change the atmosphere of a room from warm to cool. This process can take at least 45 minutes, and we assume the same amount of time it would take a user to travel home from an office or other location. Now, it is a system that helps you turn on the air conditioner even when you are in the office so that you can experience fresh air immediately after returning home without waiting time.Now the idea of operating an electronic device using his/her mobile phone by just sending an operational command through an SMS service makes the user to control his AC machine prior he reaches his home and can experience a room temperature that he is Wishing to have without any waiting time. Similarly, the user can control his various electronic home appliances like washing machine and get his clothes dry right before he reaches his home and save time, can save electricity by switching off any electrical appliances if he was been notified to be ON. An automated system in which an electric appliance can be turned on or off remotely by sending an SMS from a mobile phone.

Figure 3- Block diagram of implemented system

The user sends the command from his mobile network, then the message travels through intermediate bus stations and finally reaches the base station for which the GSM has been already connected wirelessly. The GSM converts the analog signal to digital signal and transmits it to the Arduino. Here in my project the Equipments are turned ON when the message with the character "*" is sent through SMS. The equipments are turned off when the message with the character"#" is sent through SMS.

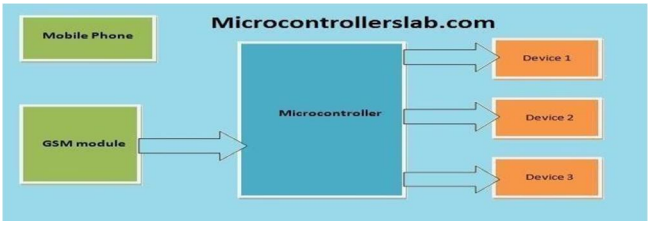
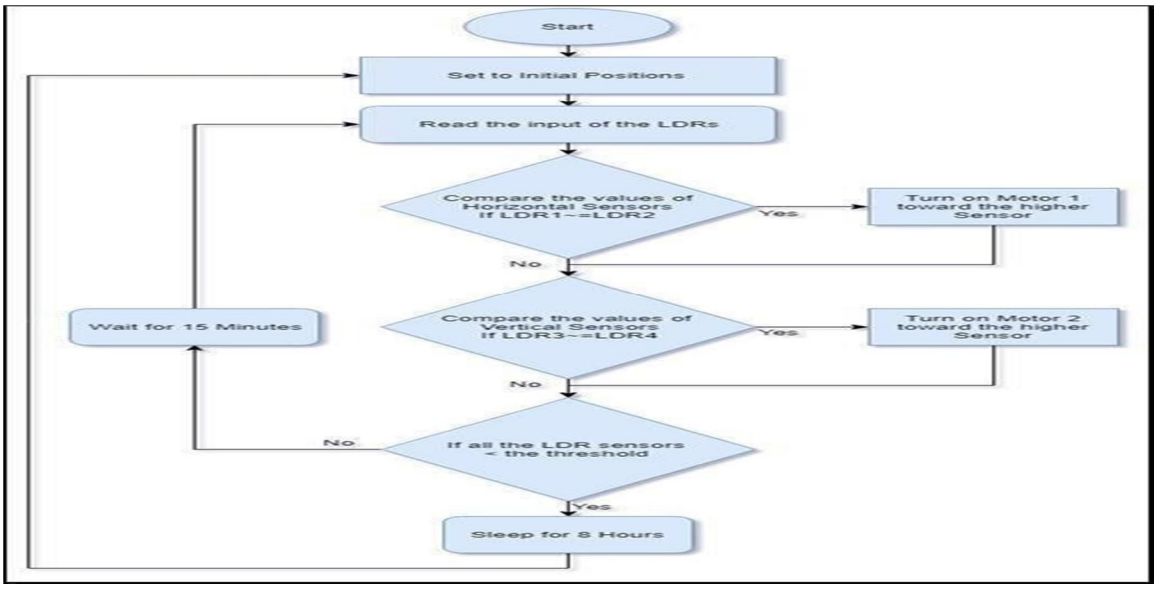


Figure 4--Block diagram of devices control system using GSM

V. METHODOLOGY RELATED TO THE PROJECT



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Light dependent resistor (LDR) is a variable resistor whose resistance depends on the amount of light falling on its surface.LDR resistance changes according to the intensity of light falling on its surface. So, as the LDR increases its resistance decreases and vice versa.

VI. SOLAR TRACKER SYSTEM

One of the most prominent kind of renewable energy is solar energy. Solar radiation from the sun is collected by the solar panelsand converted into electrical energy. The output electrical energy depends on the amount of sunlight falling on the solar panel. Home Automation System is a wireless technology that is used to control home appliances remotely. This system is allow to control your home appliances using a computer, phone, or remote.

A. Working

We measure the intensity of light with LDRs using Arduino and compare the intensity of light falling on both LDRs. The LDRs are placed on the edges of the solar panel. The GSM Based Distribution system is used to control home appliances by sending SMS from your Phone. This project is consists of Arduino, GSM SIM900 Module, and Relay Module. Where Arduino is the main microcontroller which controls the entire system. GSM Module is used to wireless communication with the phone, for controlling home appliance.

B. Dual axis Solar System

Solar panel is placed at the top and connected to a load directly. The load may a led or a voltmeter which could be connected to get the exact voltage which depends on the intensity of light falling on the panel and the position of the tracker. Concentrated solar photovoltaics' and have optics that directly accept sunlight, so solar trackers must be angled correctly to collect energy. All concentrated solar systems have trackers because the systems do not produce energy unless directed correctly toward the sun. The solar panel is just a mere device to accept the light radiation which is purely controlled by LDR sensors and the load connected depends upon the rating of the panel used.

VII. LANGUAGE USED

Arduino is the hardware platform used to teach the C programming language as Arduino boards are available worldwide and contain the popular AVR microcontrollers from Atmel. Atmel Studio is used as the development environment for writing C programs for AVR microcontrollers.

Arduino is based on c programming. C is a general-purpose programming language created by Dennis Ritchie at the Bell Laboratories in 1972.

It is a very popular language, despite being old.

C is very fast, compared to other programming languages, like Javaand Python.

C is very versatile; it can be used in both applications and technologies.

VIII. CONCLUSION

In this project, the Internet of Things (IoT) based platform aims to get an ideal power output from solar panels, and different solar panel parameters such as voltage, current and temperature are displayed on an LCD using this IOT technology. Daily, weekly, and monthly analysis of the system is simple and effective as the system continuously monitors the solar power plant. This analysis allows you to determine any problems encountered in the power plant. This is because there is a discrepancy in the information generated by the system.

In this project, Dual Axis Solar Tracker, we've developed a demodulation of solar tracker to track the maximum intensity point of light source so that the voltage given atthat point by the solar panel is maximum. After a lot of trial and errors we've successfully completed our project and we are proud to invest some effort for our society. Now, like every other experiment, this project has couple of imperfections.

1) Our panel senses the light in a sensing zone, beyond which itfails to respond.
2) If multiple sources of light (i.e. diffused light source)appear on panel, it calculates the vector sum of light sources & moves the panel in that point. This project was implemented with minimal resources. The circuitry was kept simple.

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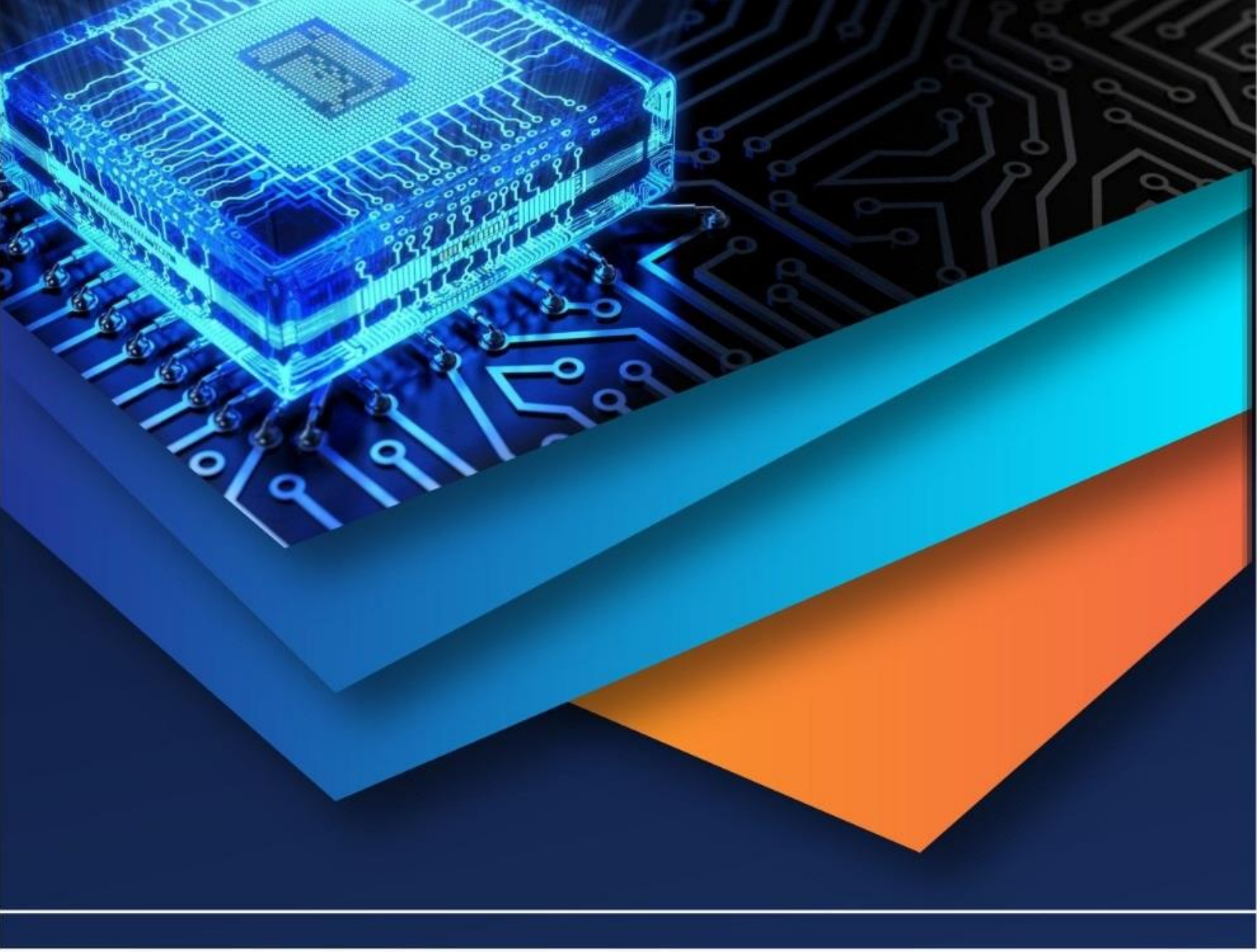

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