IoT Based Solar Power Plant Automation

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1.Abstract:

Solar power plants need to be monitored for optimum power output. This helps retrieve efficient power output from power plants.

Use of nonconventional energy sources is increasing day by day the most favourite way is to generate and energy using cell solar rays by making use of solar panels so we need and monitoring system which will monitor the generation as well as security and controlling of the Solar generation stations and for this purpose we were going to develop the system this system is basically and internet based system over which we can monitor and control the Solar.

Keywords: Solar Plate, NodeMCU , Servo Motor , Blynk app , Voltage ,Temperature , Current and PIR Sensor.

2.Introduction:- In this modern world, electricity is also added to the most basic needs in everyone life .The graph

of energy consumption is getting increased day by day whereas the energy resources are diminishing parallel. In order to balance the scarcity for electricity, various sources are used to generate electricity. For the generation of electricity, there are two ways one is by conventional method and other one is non-conventional method.

Some of the energy carriers like fossil fuels and nuclear fuel are also used, but they are not renewable resources (i.e. They are not 'refilled' by nature) and it is said to be non-conventional. In its broadest

sense, sustainable power sources can be achieved by using the solar power as source. Solar energy has the wide availability throughout the world.

Even the sun has produced energy for billions of years. The sun's rays may cat as an important source for the generation of electricity by converting it into a electric power. Such application is called solar thermal energy , which is convention. Even though various sustainable sources are available such as wind, rain ,tides and geothermal , natural based bio fuels and conventional bio mass, solar power have huge benefits . Now days in India, frequent power cut is very common.

For that it is primary to use the renewable energy and monitoring it secondarily. The rapid growth in renewable energy application have been empowered by a critical drop in cost over the earlier decades and specialized change in their productivity, unwavering quality and life time. And by means of monitoring the energy forecasting, household and communities, the productivity gets increased . In case of India's development and economic growth, electricity plays a vital role .

Internet of things (IoT) is playing a major and crucial role in the daily life of humans by enabling connectivity of many and most of the physical devices through internet to exchange the data for monitoring and controlling the devices from a remote location, where are the devices becomes intelligent. This technology can connect a wide range and varieties of things such as animals, humans, smart transport, smart grids, virtual power grids, smart cities, vehicles, heart monitoring system, environmental sensing, shopping systems, automated homes, energy management, assistance for disable and elderly individuals, cochlear implants, tracking of things, equipment manufacturing, agriculture, emergency monitoring system, electronics tool collection system vehicle control etc., according to the survey there is a increases of 31% i.e., 8.4 billion internet connected devices from 2016-2017. The connected devices may increase to 30 billion by 2020. By using the IoT we can enable the machine to machine communication or device to device communication without human intervention.

To produce huge electricity for the commercial and business purpose number of panels are placed in arrays which are called as solar plants. Always the output power of the solar panels depends on the radiation reached to the solar cell that convert into electric energy. If the dust is more on the panel, then less electricity is produced where the effectiveness of the solar panel decreases.

To increase the efficiency of the solar panels some improvement must be done. In paper we propose a system that monitors the dust formed on the panels. The controllers check the predefined conditions that are programmed and detects whether dust is from through the output voltage and give the alerts to the users or the maintenance in a charge. Internet of things (IoT) is playing a major and crucial role in the daily life of humans by enabling connectivity of many and most of the physical devices through internet to exchange the data for monitoring and controlling the devices from a remote location, where are the devices becomes intelligent. This technology can connect a wide range and varieties of things such as animals, humans, smart transport, smart grids, virtual power grids, smart cities, vehicles, heart monitoring system, environmental sensing, shopping systems, automated homes, energy management, assistance for disable and elderly individuals, cochlear implants, tracking of things, equipment manufacturing, agriculture, emergency monitoring system, electronics tool collection system vehicle control etc., according to the survey there is a increases of

31% i.e., 8.4 billion internet connected devices from 2016-2017. The connected devices may increase to 30 billion by 2020. By using the IoT we can enable the machine to machine communication or device to device communication without human intervention. To produce huge electricity for the commercial and business purpose number of panels are placed in arrays which are called as solar plants. Always the output power of the solar panels depends on the radiation reached to the solar cell that convert into electric energy. If the dust is more on the panel, then less electricity is produced where the effectiveness of the solar panel decreases. In a big solar installation facility, there are arrays where hundreds and sometimes thousands of solar panels are tied together. These modules are then wired back to a midline, where direct current (DC) electricity from the panels This smart online monitoring and troubleshooting system is integrated with automated IoT devices and can be login through either PC or an Android application. Users can gather real-time information, analyse the past data, compare the trends based on multiple parameters and export the graphs as well. Not just that, users will be notified through SMS/email in case the platform observes any fault, problem areas and breakdown. A low-cost solar panel monitoring is developed based on IoT for online visualization and improving the performance. This helps to take preventive maintenance and tracking the fault location. An IoT based cloud monitoring system is proposed and developed using the Raspberry pi for remote PV plant. The basic characteristics of a PV system are analysed using NodeMcu tool for real-time measurement to study the fault diagnosis in PV plant. A smart monitoring system is developed with a NodeMcu to gain the maximum efficiency with the use of sun trackers. A remote Solar monitoring and control system is proposed for implementation at the plant level and promotes the decisional process for central control station which has the crucial role for processing, storage, warning and displaying. PV monitoring system is developed based on wired and wireless networks to transmit the parameters to a remote coordinator that offers a web-based application for remote access . A practical graphical user

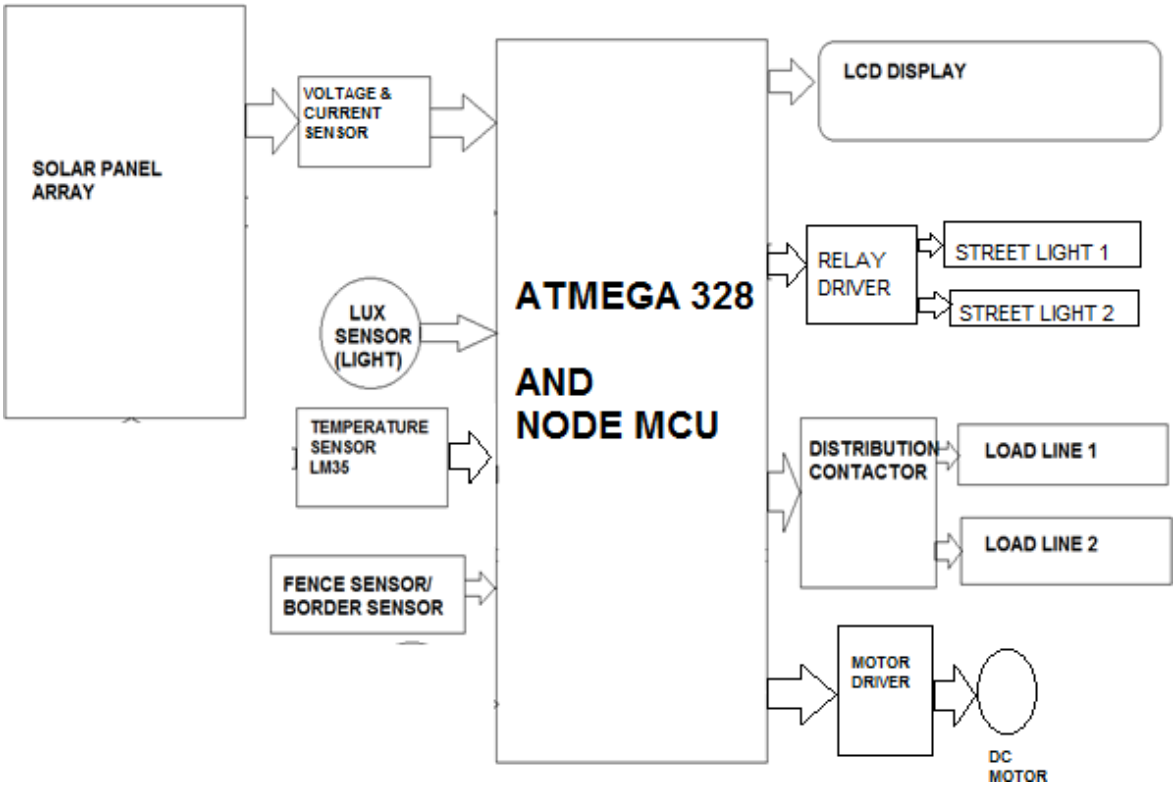

Figure2.1: Block Diagram of IoT Based Solar Power Plant Automation.

3. System Design

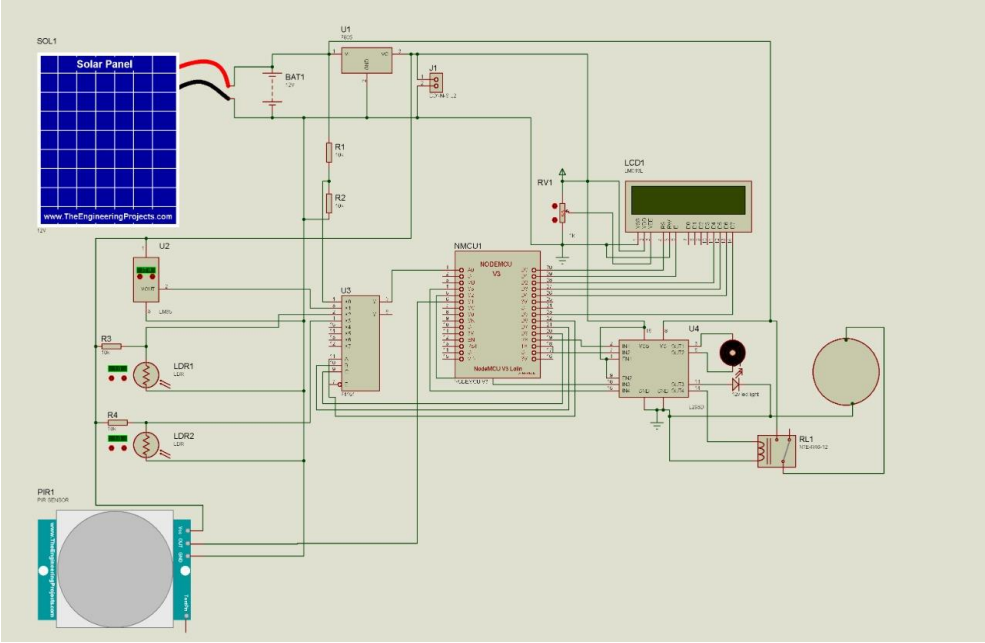

Fig. 3.1 Circuit Diagram of IoT Based Solar Power Plant Automation.

3.1 Working: above figure shows a circuit diagram of IoT based Solar Plant automation system This system is IOT based so it is going to be connected with internet so to connect it with the internet and send the detail data to the internet we have used here and ESP 12E module this model basically having an IoT connectivity function this is going to be connected with the internet and we can send the data collected by our sensors to internet through this module this module is basically a Wi-Fi device so it is going to be connected with the wireless internet provider or hotspot through which it will access the internet this is a serial operated device so it is connected to the serial port of the main microcontroller here we have used an ESP12E board to collect all the data from the sensor and to manipulate and calculate the data and then this data is sent to the internet server, this board is having an USB programming facility through which we can a program this device directly from our computer so we have used this board for this facilities.

To measure temperature we have used in lm35 temperature sensor who is having a range of - 55 degree 2 + 150 degree centigrade so it will measure the temperature and generate the output at this sensor generates an output of 10 mV per degree centigrade resolution The generated output is an analogue output so it is to be connected to the analogue to digital converter so that a microcontroller can read that for that purpose we have connected output of this sensor to the age Hero analogue to digital pins 0 of Arduino UNO board it will internally convert that data into the digital signal and that digital data is then processed and displayed on to the display also to measure light intensity we need and sensor which will convert light intensity into an electrical signal this is done by the light dependent resistor or we called it as a LDR will convert the light data into the resistance because it is light dependent resistor so it will

convert light intensity in to change in resistance but a microcontroller cannot Read the change in resistance so we have connected and register of 10 km between VCC and LDR to the ground So it becomes and voltage divided circuit So now the resistor of 10 case constant but the change on LDR resistance is there due to the light intensity and because of that output voltage of this voltage divider get changed and this change in the voltage is an analogy signal so this analogy signal is given to the analogy to digital wind of Arduino Uno so it will get converted into the digital and this digital data is then calculated and displayed as a looks or lighting density into the LCD display. In this system all the data measured by the sensors is get displayed onto the display to display these we have used and 16 to alphanumeric display over here to display all the data from the sensors as well as we need to control the distribution of the generated energy for that purpose we have used two relays to control the contractors of distribution and we will signal that release as per the signal coming from the IoT platform more IOT app and also to measure the electricity generated by the Solar Panel we have used and voltage sensor and current sensor in our system so this voltage sensor with and measure the generated voltage and that voltage get displayed on to the LCD also the current sensor will measure the current generated by the solar panel it is also get displayed on to the LCD and the power is being calculated from this generated voltage and current and The generated power will be shown in to the display all the data which is measured by the Arduino UNO is calculated and converted and then it is filled to IoT device and through which this data is transferred to an IoT app for IoT server where we can login in a from anywhere in the world and we can watch the data or read the sensor this data is also get stored into the web server so whenever we want we can download the data and we can analyse the data as well for this purpose we have connected the system to the internet for purpose we have used and motion sensor in the system which is motion sensor so whenever there is a Movement in front of motion sensor it will detect that an immediate alert will be generated to the IoT device and IoT device will give the notification to any internet app which is on mobile and we will get the notification

3.2 Simulation:

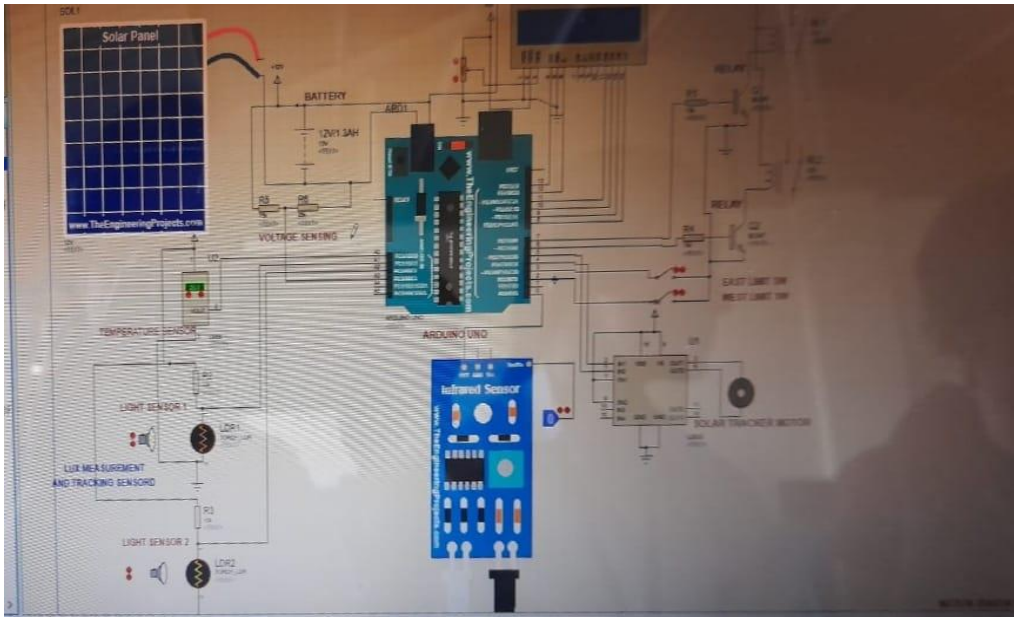

FIG 3.2 Simulation Circuit of IoT based solar power plant automation.

4.Result:

Experiment Result: - The result for the project were gotten from LDRs for the solar tracking system and the panel that has fixed position . The results were recorded for two days, recorded and tabulated . The outputs of LDRs, were dependent on the light intensity falling on their surface. The solar panel connect to the battery as well as the NodeMCU and this NodeMCU connect to the LCD to print the output on the LCD screen to measure the light intensity as well as voltage and temperature.

Analysis: - Following the table shows the result , it can be seen that the maximum sunlight occurs at around midday, with maximum value obtained between 12 pm to 4 pm . In the morning and the late evening intensity of sunlight Diminishes and the values obtained are less that those obtained during the day. After sunset, tracking system Is switch off save energy. It is switched back on the morning. For the panel fitted with the tracking system, the values of LDRs are expected two close. This is because whenever they are in different position there is an error generated that enables its movement. the motion of panel is stopped when the values are the same, meaning the LDRs a fixed position. Therefore, at the most time the LDRs are not facing the sun at the same inclination. This is apart from midday when they are both almost perpendicular to the sun.

5.Conclusion:

The integration of renewable energies into the electricity distribution network has become a necessity and consequently the search for new and effective solution for remote monitoring and control is required. In this project, an IOT-based solar panel remote monitoring system has been proposed to collect data on important parameters of solar panels. The continuous record of performance data and failure data enable by IOT, so that it can be used for analytic for predicting and forecasting the future power Generation possibilities, income production etc. The frequent maintains of the photovoltaic system also gets prevented by it. IOT will play a major role in accessing the control over the photovoltaic system installed at remote location or far away from the control centre. IOT-based monitoring will improve the energy efficiency of the system, reduce intervention and supervision time, and facilitate network management. Considering the very fundamental from the sun, are process from which such are been produced through the burning of various materials, involving emission of a large amount of pollution, causing behavioural visibility , where easy access of every sphere of life is in need of the acute comfortability, Every day is new challenge of hatching something new and unique which makes an energy to be the ultimatum sources behind all the hard work exist . In that regards it would be worthier to reveal that commercialization has boomed it’s the pool of acute ignorance of the world’s resources scarcity, in

Consequence of which the world is wounded . Healing the world is the basis cultivation with which the hour clock is calling and this project present the eye, therefore, to open the corridors of reducing the amount of pollution in storing of energy culled out from the sun and also to make the pace of advancement revved around.

6.Future Scope:

 The very embodiment through which the futuristic conundrum by set aside, is the project called “IoT Based Solar Power Plant Automation”. A trailblazer by its spirit, this system works in its utmost efficiency, whether that be in terms of its pecuniary ability or in term of its accessibility . In the smoke of the darkness where pollution engulfing every spheres of advancement and development by flushing out the pollution at large.

 By using robotic assembly we can create automatic solar panel cleaning system.

 Automatic preventive maintenance can also be possible.

 The coming years, technology improvements will ensure that solar becomes even cheaper. It could well be that by 2030, solar will have become the most important source of energy for electricity production in a large part of the world. This will also have a positive impact on the environment and climate change.

 It is roughly equivalent to 1400-1800 peak capacity operating hours in a year with the present, commercially-stated technology. With non-renewable resources lagging to keep up with the rising population, our immediate and best solution is to switch to solar energy

7.References:

1. Chiras, D.D., 2002. The solar house: passive heating and cooling. Chelsea Green Publishing. Eldin, A.H., Refaey, M. and Farghly, A., A Review on Photovoltaic Solar Energy Technology and its Efficiency.

2. Solarmap.uom.ac.mu. (2018). Online Solar Map - Introduction. [online] Available at: http://solarmap.uom.ac.mu/proj.html [Accessed 19 Sep. 2018].

3.Chummun, J., 2013. The Potential for Using Renewable Sources of Energy in Mauritius. Climate Smart Technologies: Integrating Renewable Energy and Energy Efficiency in Mitigation and Adaptation Responses, p.207.

4. Vikas Reddy, Sai Preetham Sata, Sateesh Kumar Reddy and Bandi Jaswanth Babu (2016). Solar Energy Analytics Using Internet of Things. International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 7 (2016) pp 4803-4806

5. Shrihariprasath, B. and Vimalathithan Rathinasabapathy (2016). A smart IoT system for monitoring solar PV power conditioning unit, in Proc. of the International Conference Futuristic Trends in Research and Innovation for Social Welfare (Startup Conclave), Coimbatore, India 29 Feb.-1 March 2016.

6. Expressif Systems (2019). The Internet of Things with ESP32. [online] Esp32.net. Available at: http://esp32.net/ [Accessed 15 Jul. 2019].

7. Hongbin Chen," Application of Internet of Things in Power-Line Monitoring",2012 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery (CyberC),978- 1-4673-2624-7.