

A Review Paper on Solar Power Monitoring System using an IoT

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Abstract—The solar power monitoring system is used the Internet of Things for the purpose, to overcome the drawbacks of previous solar systems. An IoT is a joint network of the connected devices together and shares the data about how they are used in the environment in which they are operated. The solar power monitoring system is used for generating the electricity by using the energy of sunlight. This system is uses the Arduino Uno for enhancement of the solar systems. This solar power monitoring system uses the Arduino Uno. The Arduino Uno is microcontroller board, this microcontroller used the ATmega328p. ATmega328p is also a microcontroller chip which is developed by Atmel. By using Arduino Uno the solar panel is capable of moving in the direction where sunlight is moves , this is the additional feature of this solar system. This paper shows the working, architecture and connections of the solar power monitoring system using an IoT.

Keywords- Internet of Things(IoT), Arduino Uno, ATmega328p, solar panel.

I. INTRODUCTION

The solar power monitoring system is the most important system which is used for renewable energy of sunlight. This system has the large future scope because the electricity is the most important need of the humans, they are used the electricity in their daily life. The solar power monitoring system used the Arduino Uno which is the microcontroller board. The solar energy is the renewable energy which is generated by sunlight. The sun is the main source of the solar system. The solar system uses the solar panels, which are used to generate the electricity. The solar panels are made up of pure silicon by creating some reactions on the carbon, silicon and hydrogen. Firstly, to generate the pure silicon it means that to generate the polycrystallin the carbon is added to the silicon and it forms the gases silicon then the pure silicon means polycrystallin. Then the hydrogen is added to that gases silicon then it forms the pure polycrystallin, then it separated in the number of plates that plates are called as the silicon wafers that silicon wafers are added to the solar panels ,with the help of that panels the electricity is generated. We are used the Internet of Things which is the best technology to use the solar systems properly. By using the Internet of Things our solar power monitoring system is work quickly or fast,and also it is more secure than other systems.

Also another main component in our system is an Arduino Uno. This is one of the most important example of an Internet of Things (IoT). The Arduino uno is the microcontroller board, it used the ATmega328 on the circuit.

The ATmega328 is the microcontroller chip which is developed by an Atmel. There are 14 pins which are placed on the Arduino Uno , these pins are used to connect the devices like LCD, LED, Relay etc. The Arduino Uno has the 6 analog pins which are mainly used to connect the input sensors , there are four pins to provide the power supply for the input and output components. Also there is one reset button which is used to reset the task. The Arduino Uno has one USB port which is used to upload the program. There is also a power jack , it is used to give the power to the system. The Arduino Uno is main component in the solar power monitoring system[3]. The solar system is available in the all over world, each and everyone is using this solar system, but in that system we used the Internet of Things which is more useful to getting the output of the energy system. The power which is generated by other systems are cheaper than our solar system. In our daily life the electricity is the main need because all devices or things are used the electricity, it increases day by day it is not decreases. We can easily generates the large amount of electricity for any business purpose, in that system the solar panels are placed in a line to generate the electricity for their business use.

The previous solar systems are not good than the newest solar systems because they are not used the IoT in their system. We are focusing on that we have to collect more energy of the sunlight because in our solar power monitoring system we used the IoT, with the help of IoT our solar system is capable of rotating in the direction of sunlight it means that the sun is moving in which direction the solar system is rotating in this direction. The solar system is have

the capability of taking large amount of power from sunlight to generate the electricity[8].

II. LITERATURE SURVEY

The term Internet of Things was likely invented by Kevin Ashton of Procter and Gamble, MTS'Auto-ID Center in 1999, though he refers the phrase "Internet of Things". At that point he viewed Radio Frequency Identification (RFID) essential to the Internet of Things. This will allow computers to manage all individual things. In June 2002, the research article mentioned Internet of Things which was submitted to the conference for Nordic Researchers in Norway, which was preceded by an article published in Finnish in January 2002. The implementation described there was developed by Kary Farmling and his team at Helsinki University of Technology and more closely matches the modern one, i. e. an information system infrastructure for implementing smart devices or connected objects. Defining the Internet of Things as "Simply when more 'things or objects' were connected to the internet by the peoples", Cisco systems estimated that the IoT was invented between 2008 and 2009 with the things or the peoples ratio is growing from 0.08 in 2003 to 1.84 in 2010[9].

The author Salim et al is said that the 32% of the solar energy is reduced by only the dust, he investigated on the dust. He proved that the energy will reduced in eight months by the dust. This is the experiment of Dirk Goosen, he is also an author The solar panels are not work properly the dust, it reduces the good performance. This is the major problem in this system because it is proved that the 50% of solar panels are not work by the dust, it does not give proper output. There is a loss of 4.7% average records which are saved in the system by the IoT. Due to that dust the energy will not generates that much, it is reduces by 30%. The solution on that problem is not very big or costly, it is simply to spread water on the solar panels to remove the dust from the solar panels[2].

According to the cisco, IoT is capable of transforming the solar energy to the companies. The solar systems are largely used in the industries they used the solar systems for the purpose of business, as their requirements they are used the solar systems. The peoples are also largely used the solar system because solar systems are the systems which are save the other resources for energy for generating electricity. An industry has a remote monitoring system which is used to plug in the inverter and to operate the solar system by using the remote, we can give an instruction with the help of remotes. The solar power monitoring system using IoT have a large future scope[3].

III. RELATED WORK

Manish Katyarmal1, Suyash Walkunde2, Arvind Sakhare3, Mrs. U.S.Rawandale4 "Solar power monitoring

system using IoT" This paper shows the Internet of Things Technology for supervising solar power generation can greatly enhance the performance, monitoring and maintenance of the plant.

R.L.R. Lokesh Babu1, D Rambabu2, A. Rajesh Naidu3, R. D. Prasad4, P. Gopi Krishna5 "IoT Enabled Solar Power Monitoring System" This paper proposes a solution and method to monitor the dust accumulated on the solar panels to get the maximum power from for effective utilization. Always the output power of the solar panel depends on the radiation reached to the solar cell.

SupritaM.Patil , Vijayalashmi M, Rakesh Tapaskar "IoT based Solar Energy Monitoring System" This paper shows the Internet of Things has a vision in which the internet extends into the real world, which incorporates everyday objects.

Andreas S. Spanias "Solar Energy Management as an Internet of Things (IoT) Application" This paper shows Photovoltaic (PV) array analytics and control have become necessary for remote solar farms and for intelligent fault detection and power optimization.

IV. ARCHITECTURE

The use of solar system is increased in the last two years. The objective of this system is to Power of the system can be monitor using the current and voltage value sensed by the arduino. This system helps to implement in solar system for efficient usage. The electricity generated by capturing the sun light is called as solar energy which is used for business and home purpose. The atoms lose the electrons when the photons hit the solar cells. A solar panel is made of multiple panels that wired together, more electricity is generated by the more panels we deploy. Silicon like semiconductors are used to make the PV photovoltaic solar panels as shown in figure. Direct Current is generated by the solar panels. Most of the electrical appliance works on AC supply can AC can be less expensive for transmit to long distances[1].

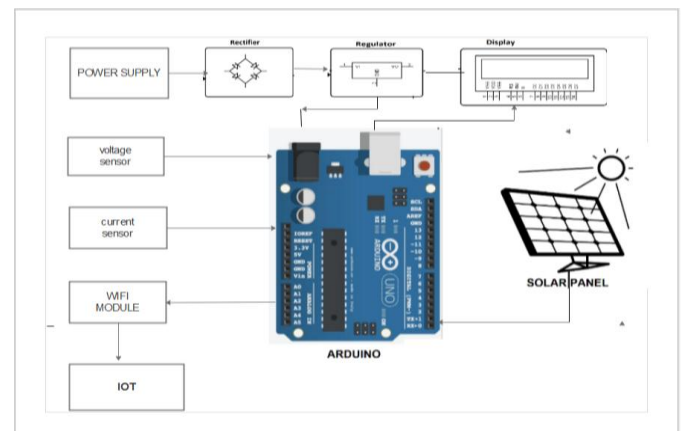


Figure 1: Block diagram of Solar Power Monitoring System using IoT

System Design

Battery is useful for the electrical appliances. Battery is connected to the Arduino. Arduino is a micro controller which is used in the solar system.

a) Arduino

The Arduino Uno is the microcontroller board. The solar energy is the renewable energy which is generated by sunlight. The sun is the main source of the solar system. The solar system uses the solar panels, which are used to generate the electricity. The solar panels are made up of pure silicon by creating some reactions on the carbon, silicon and hydrogen.

Firstly, to generate the pure silicon it means that to generate the polycrystalline the carbon is added to the silicon and it forms the gases silicon then the pure silicon means polycrystalline. Then the hydrogen is added to that gases silicon then it forms the pure polycrystalline, then it separated in the number of plates that plates are called as the silicon wafers[3][6].

b) Current and Voltage Acquisition Circuit

To protect the Arduino from short-circuits or unexpected voltage surges, we use resistor while connect to the 5V circuit. The circuit of voltage divider is shown in the Fig . Two resistors form a potential divider that helps to lower the voltage being measured to a level that the Arduino can read. Fig shows the voltage divider circuit. Analog pin of arduino gives the voltage value. Breadboard is used to build this circuit which actually extends the range that can be used. The formula for calculating values in a potential divider is: $V_{out} = [R2 / (R1 + R2)] * V_{in}$. Those values are used in the proposed system for calculating power. Battery is considered as the power supply. Other pins of sensor is connects to the Arduino[3].

c) Temperature sensor

Temperature sensor is used in this project to predict and monitor the solar energy storage. According to the temperature value, the energy storage modulates. Display the temperature values on the web page in the form of gauge[3].

d) Cloud Setup

After assigning the parameter the system upload the values to it. The cloud has built-in functions in it which represent the values in the form of graphs[3][6].

Thin-film semiconductor or crystalline silicon is used make the PV solar cell for many of the residential applications. The electrical devices are powered, or it is send to the grid when electrons are made free by solar energy in these materials. DC voltage current is generated when the Photovoltaic solar panels are exposed directly to the sunlight. Solar panels generate the DC were the home appliance works on the AC power, so the output of the panels is given as input to the inverter. All appliance works

through the inverter. The inverter consists of a battery. The battery gets charges when the appliance is not in used and battery gets discharged when requires the supply.

V. ADVANTAGES

Many energy companies are expanding to offer solar, which is among the most energy-efficient and lucrative sources of renewable electricity on the market. Harnessing the power of the IoT can resolve common challenges associated with complex energy grids and make it far easier to manage panels and energy output[8].

VI. APPLICATIONS

There are many practical applications for the use of solar panels or photovoltaics. It can first be used in agriculture as a power source for irrigation. In health care solar panels can be used to refrigerate medical supplies. It can also be used for infrastructure. PV modules are used in photovoltaic system and include a large variety of electric devices:

- Photovoltaic power stations
- Rooftop solar PV systems
- Standalone PV systems
- Solar hybrid power systems
- Concentrated photovoltaic
- Solar planes
- Solar pumped lasers
- Solar vehicles
- Solar panels on spacecrafts and space stations[8].

VII. CONCLUSION

In this paper, we have proposed the architecture how solar power system is implemented using IoT and how solar power is monitored using IoT. There is a large future scope in the solar power monitoring system using IoT. Also it consists of various application and advantages of the system.

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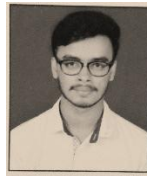
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