Review On Iot Based Solar Fault Detection, Tracking, Monitering And Cleaning System

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Abstract - Solar energy is fast becoming a very important renewable energy resource. With solar tracking, it will become possible to harvest more energy since the solar panel can maintain a perpendicular plane to the rays of the sun. An ATMega328P microcontroller has been used to perform various controlling and monitoring tasks. It has programmed to detect sunlight via the LDRs before actuating the servo to position the solar panel. As a result, most people are forced to either purchase several panels to meet their energy demands or purchase single systems with large outputs.

To increase the efficiency of solar panels while reducing costs we can track sun position to maintain plane of solar perpendicular to solar rays. While tracking, there will be increased exposure of the panel to the sun, making it have increased power output. Manual cleaning of solar panels takes extra efforts and man power and eventually it reduces energy to cost ratio. This type of cleaning is not efficient and it may cause health issues to the workers. This can be solved by fully automated solar cleaning system.

Key Words: LDR(Light Dependent Resistor), Solar, Tracking.

1. INTRODUCTION

Solar energy is clean and available in excess quantity. Solar technologies use the sun for heat, light and electricity. These are for industrial and domestic applications. With the alarming rate of depletion of major conventional energy sources like petroleum, coal and natural gas, coupled with environmental caused by the process of harvesting these energy sources, it is necessity of time to invest in renewable energy sources that can power the future precisely. The energy potential of the sun is unlimited. Despite the unlimited resource however, harvesting it is a challenge because of the limited efficiency of the array solar cells. The best efficiency of solar cell currently available is in between 10 to30 percent. This shows that there is scope for improvement. In this project we tried to identify a way of improving efficiency of solar panels. Solar tracking is used. The solar tracking mechanism moves and positions the solar array such that it is positioned for maximum power output.

When it comes to the development of a nation, energy is the main factor. There is a huge quantity of energy that gets extracted, distributed, converted and consumed every single day in the global society. Fossil fuels account for around 85 percent of energy that is produced. Fossil fuel resources are limited and using caused the global warming because of emission of harmful greenhouse gases. There is a rapidly growing need for energy from such sources as solar, wind, ocean tidal waves and geothermal for the provision of sustainable and power.

Solar panels take direct solar energy and convert it into an electrical energy without any harmful byproduct. The main material for manufacturing of solar cells is semiconductor materials, notably silicon with the efficiency of 24.5% on the higher side. Three ways of increasing the efficiency of the solar panels are through increase of cell efficiency, clean and dustless surface of panels and the use of a tracking system.

2. BACKGROUND

This literature study reveals the elaborate work on various strategies used for monitoring the solar panel position by using Internet of Things (IoT) for effective conversion of solar energy into electrical energy and automatic in solar panel's position tracking. Is the technology used for conversion of solar directly into electrical power. There is an increased use of solar panels as their efficiencies become higher. They are especially popular in remote areas where there is no connection to the grid.

Solar Panel Automated Cleaning (SPAC) System, Shajan K. Thomas, Shelvin Joseph,Sarrop T S, Sahad Bin Haris, Roopak R, 2018, Solar energy is the most commonly available source of renewable energy. Constant soling and wind storm further reduce the efficiency. Therefore it is very essential to have regular and proper cleaning of panel. In most of the parts the cleaning is done with human efforts. This type of cleaning is time consuming and it may cause health issues to the workers. This can be solved by fully automated permanent setup solar panel cleaning system .[1]

Fault Detection and Identification of Solar Panels using Bluetooth, Mrs.N.Padmavathi, Dr.A.Chilambuchelvan, 2017, When there is a crack in the cell then its output will become low. The microcontroller continuously checks the current sensor output to the threshold value. If the value is less than threshold then the microcontroller indicates that to the Android mobile through the Bluetooth[2]

Self-Cleaning and Tracking Solar Photovoltaic Panel for Improving Efficiency, Bandam Abhilash, Ashish K Panchal ,2017, This paper explains the efficient self-cleaning and tracking mechanism and obtains the results of the panel for the different conditions as further listed, cleaned panel without tracking, dusty panel without tracking, dusty panel with a tracking and cleaned panel with tracking, dusty panel without tracking, dusty panel with tracking and cleaned panel with tracking[3]

Electricity through PV module has become popular but overprice of cells and lower efficiency hinder its use in developing countries. To reduce high cost per unit electricity, one way is to improve the performance of PV systems. New cost effective mirror reflecting linear focusing solar concentrator may be a good solution [4].

3. TECHNOLGY

The system contains the Esp8266 module for wireless data communication. This system uses sensors:Voltage sensor, LDR sensor and interface LCD to display all the notifications and results from sensors.

The system which uses sensor module and ESP module with A/D converter is called u-node. The output data from sensors are in the form of voltage, or resistance, or pulse depending on the type pf sensors. The sensors output are analog in nature, which need to be converted to digital form. A/D converter is inbuilt in the processor. A/D converter receives the data from sensors and convert it into the digital form which is further processed by the processor and gives the result. This system uses a combination of wireless communication technology and sensor technology. LCD display is used for the protection as well as Esp system is used to send the data to server room.

For cleaning purpose DC motor is used to clean the solar Panel .

4. BLOCK DIAGRAM

Block diagram of the system is shown in Figure 1 In which we see 'Solar Tracking Monitoring" is automatic maintenance system. In this system there are several blocks namely Driver, Controller, Sensors, LCD.

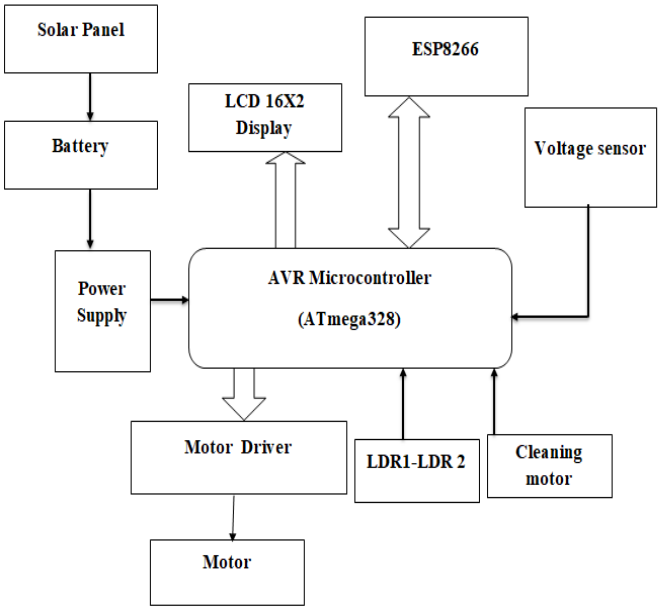

Figure 1: Block Diagram of The Solar tracking, Monitoring & Cleaning

Below is the detail information about the system:

4.1 ATMEGA 328

The main advantage of using ATmega 328 is its high functionality with simplicity and familiarity. ATmega 328 connects the solar system and IoT (Internet of Things). ATmega 328 is a high Performance, Low Power AVR® 8-Bit Microcontroller

- Advanced microcontroller with RISC Architecture.
- Up to 20 MIPS Throughput at 20 MHz .
- 32K Bytes of In-System Self-Programmable Flash program memory
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- Two 8-bit Timer/Counters
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture

4.2 LDR (Light Dependent Resistor):

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. This called as photo conductors, photo conductive cells or simply photocells.

4.3 Motor Driver L293D

Motor driver is basically a current amplifier which takes a low-current signal and gives higher current signal through microcontroller which can control and drive a motor. The L293D is quad push-pull drivers capable of delivering output currents to 1A or 600mA per channel respectively. It has High Noise Immunity and back EMF protection.

4.4 LCD display

A simple 16*2 liquid crystal has been used to provide a graphical user interface.

4.5 Power Supply

Most are designed to convert high AC to DC voltage supply for electronic circuits and other electronic circuits and other devices. A power supply can cut down into a series of blocks each of can performs a particular function. Lm7805 regulator has been used provide 5v regulated and up to 1 ampere current for microcontroller and sensors.

4.6 ESP8266 Wi-Fi Module:

ESP8266 offers a complete and self-contained Wi-Fi networking solution, which allow it to either host the application or to offload all Wi-Fi networking functions. When it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. The ESP8266EX microcontroller integrates a 32-bit RISC processor, which achieves extra-low power consumption and reaches a maximum clock speed of 160 MHz.

4.7 LCD Display:

This display contains two internal byte wise resisters, One for the commands (RS=0) and second for character to be displayed (RS=1). It also contains a user programmed RAM area (the character RAM) that can be programmed to generate any desired character that can form using a dot matrix. To distinguish between these two data areas, the hex command byte 80H will be used to signify that display RAM address 00H is chosen. Port 1 is used to furnish the command or data byte, and ports 3.2 to 3.4 furnish register select and read/write levels. The display takes varying amounts of time to accomplish the functions. LCD bit 7 is monitored for logic high (Busy) to ensure the display is not overwritten.

5. WORKING

The Flow of design is to minimize humen effort and get good output .We are using 10w 12v solar panel for the demonstration . In this system voltage sensor is used for the detection of voltage . also we conclude if votages ranges as per daily data monitoring and detection its fault of panel .We are used controller as dissision making devise which will control the other devices and sows information on LCD display and send data to server room using esp 8266.

6. APPLICATIONS

1. Protect Solar from dust.
2. Maximum solar energy utilization.
3. Lower manpower required.
4. Cost effective.
5. Live Data monitoring.

7. CONCLUSION

As this system keeps continues track of solar plant ,the daily weekly and monthly analysis becomes easy and efficient also with the help of this analysis it is possible to detect any fault occurred within power plant as the generated power may show some inappropriate in data of Solar power plant. In this project IoT based system is designed to get an optimum power output from the solar panels during dust is accumulated on it. And, a monitoring system is designed for any malfunctioning of the solar panels will be displayed on and we can also get information about whether the solar or battery connected for the loads or not. Hence by cleaning solar panels we improved energy efficiency.

8. REFRENCES

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