IoT Based Solar Panel Tracking System With Weather Monitoring

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Abstract- *In this World there are many renewable energies, among them Solar Energy tops the first and received its reputation very quickly. Using solar tracking system, we could generate utmost amount of energy which improves the solar panel's workability even more efficient. Perpendicular proportionality between the solar panel and the sun rays is the main reason for the efficiency. A dual axis tracker, tracks the sun rays by switching the solar panels in various direction. Solar panel rotates with help of motor setup and LDR has been used to sense the intensity of light at 30 degree each or 180 degree total and sends data to Arduino. Robot setup then moved to AC-DC converting circuit that converts the AC into DC then converted current is boosted and stored as strong DC current. The dual axis tracker can also sense Water level sensor, temperature and humidity sensor will be displayed in LCD as well as stored in IoT using Wi-Fi module.*

Keywords- Internet of Things (IoT), Dual axis solar tracking, temperature and humidity sensor, Wi-Fi module, Light Dependent Resistor (LDR).

I. INTRODUCTION

In 1839 French scientist Ealmond first invented Solar Photo-voltaic effect which is a process that produces voltage or current when exposed to sun or radiant energy. The first commercial solar panel was introduced in 1881 by Charles Fritts. Later in 2005 DIY solar panel became popular and this is the point where solar energy become more prevalent.

In this modern era the usage of energy by human have been tremendously increased. Hence there should be a endless energy in order the carry the population ahead. In day-to-day life the conventional source of energy like, coal, petroleum, natural gas and oil etc. are in the danger of extinction. And they also cause more pollution to the environment. Hence of all renewable energy generation Solar energy seems to be more advantageous and also expected to be the fastest in its growth from now to 2050. The present project is orchestrated with components like LDR, piezoelectric crystal, DC motor etc. and these are unlike conventional energies, they don't emit any pollutants. They will act a reservoir for the Solar energy. Using LDR the intensity of the sun rays is being measured and with the help of the DC motor the solar panel revolves around the proportionality with the movement of sun to grab the energy and store it in a battery for future uses. This is main objective for this project to come into existence.

When heat is the source of every creation, Sun produces the biggest ever energy in this solar system to produce and transcend life from one organism to the other taken from the Sun and to convert such energy into some other production. In the wake of technological advancement when the pace of time is at its best to pass by, this system is a time worthy production, produced to create the best of its kind. In a stretch, it could be signified that this project which is an extension of solar energy, is a renewable source of energy, never-ending phenomena. It's only 10 to 20 per cent of the solar cells that are being used commercially out of which the best potential of the cells gets reflected and therefore scope for better use of the solar cells exist.

In the world of pollution, this system is an eco-friendly alternative, hence a valuable asset. When the ocean of pollution is encumbering every corner of life, this system would be able to create ripples of hope in the midst of this bustling civilization. The survivability of this system lies upon its workability. In the trend of comparison with other mind-boggling systems, it could be a trailblazer.

II. LITERATURE REVIEW

1.Optimum Integration of Solar Energy with Battery Energy Storage Systems.

The authors of this paper are Yaze Li and Jingxian Wu. This paper has been published in March 2020 IEEE Transactions on Engineering Management.

This paper suggests the optimum designs of Photo-Voltaic (PV) system with Battery Energy Storage System (BESS). Through this we come to know the optimum size of PV panels, optimum capacity of BESS and the scheduling duration of battery charging/discharging. Overall, the cost of the system is minimized.

2.Simple Design and Implementation of Solar tracking System Two Axis with Four Sensors for Baghdad city.

Falah I. Mustafa, Sarmid Shakir and Faiz F. Mustafa and Athmar thamer naiyf published this paper in 9th International Renewable Energy Congress (IREC), May 2018.

The main motive of the project is to get the simple and cheap priced solar tracker system with two axes namely, azimuth angle and altitude angle using LDR. They have used two DC motors with gearboxes along with solar panel and LDR. The working of this system is truly based on the calculated values of two axes with the help of LDR.

This system is pointed to Iraq - Baghdad town climate due to the fact that they have approximates 10-15 wet days that each day have 2-4 hours cloudy and rain. When the climate is cloudy, dusty or rain, the monitoring device will forestall so the device remains withinside the role of the sun without circulates however in keeping with Kelly cosine relation the electricity will decrease. However, this system produces maximum power from the solar panel.

3.Novel Online Sensor Less Dual-Axis Sun Tracker.

This paper was by H. Fathabadi in IEEE/ASME Transactions on Mechatronics, Feb 2017.

In this paper, they focussed on the Maximum Power Point Tracking (MPPT) unit using a novel online sensor less dual-axis solar tracker to generate maximum power. The proposed system is a closed loop system as it tracks the suns direction accurately using the azimuth angles by following the actual sun's direction. This system works on both sensor less and sensor based dual-axis projects.

4.Automatic Solar Tracking System.

This paper was published in Oct 2014, International Journal of Core Engineering & Management by Mayank Kumar Lokhande.

We usually know that the solar panel extracts energy only when the sun rays fall perpendicular to the direction of solar panel. This system has an active sensor which follows the sunlight and rotates the panel accordingly to the intensity of sunlight. As they produce the maximum power at its output.

5.Performance comparison between fixed panel, single-axis and dual-axis sun tracking solar panel system.

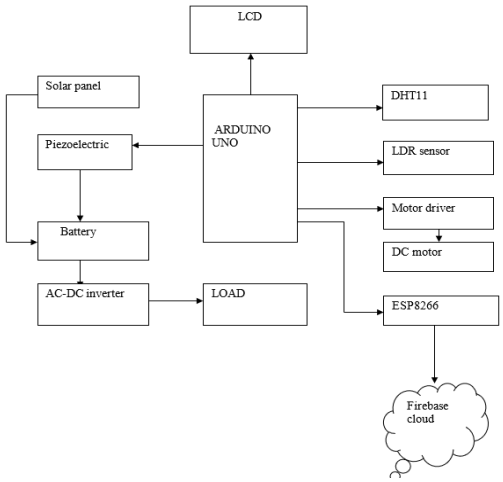
Kamrul Islam Chowdhury, Md. Iftekhar-ul-Alam, Promit Shams Bakshi proposed this paper in 2017, BRAC University, Department of Electrical and Electronic Engineering.

We already know that Photo-Voltaic cells converts the solar energy into electric energy, we need focus more on the efficiency of PV cells. Since the panels are fixed at a particular angle, its impossible to get the maximum power output. To overcome this method, solar tracker was proposed to extract more renewable source of energy. It rotates according to the sun's position along east to west and a seasonal basis.

III. PROPOSED SYSTEM

In our proposed model of Solar panel tracking system, Dual axis tracker is used **to** track the solar energy. the solar panel can change its position according to the position of the sunlight which can optimize the solar power generation. Also, humidity, temperature and water level sensors are used check the weather. All the information is updated in the IoT.

BLOCK DIAGRAM:



In this system, the hardware components are Power supply, solar input, LDR, Wi-Fi module, Arduino UNO, DC motor, DHT11, Voltage Sensor. The software components are Arduino-IDE and Embedded C.

The advantage of this system is high degree of accuracy and high energy output.

A. Arduino UNO:

Arduino UNO (ATmega328P) is a single chip microcontroller with 14 digital input/output pins, 6 analog inputs, a 16Hz ceramic resonator, a USB connection, a power jack, a ICSP header and a rest pin. It also has UART TTL

serial communication. It is a customized Harvard architecture with 8 bit RISC processor.A simple textual data can be received and transmitted to the Arduino Software (IDE) via a serial monitor.

B.LDR:

Light Dependent Resistor or Photoresistor is a non-linear electronic component, which detects light and changes the operation of the system accordingly. The resistance of the photoresistor increases with low light and decreases when the intensity of light is high. During night, the resistance of the LDR is high and it generates a small amount of current in it.

C. Solar Input:

The solar input comprises of the solar panel and two modules of photo sensors, each of which is joined to the solar panel along its length on either side of the panel. The solar panel is supported to the wooden base by the mechanical structure. The photo sensors are hence, connected to the controlling circuit.

D. Temperature and Humidity Sensor (DHT11):

DHT11 is a low-cost electronic component which measures the temperature and humidity. There is a inbuilt thermistor in this DHT11, which is used to calculate the temperature of the surroundings. It is a moisture holding substrate with the electrodes connected to the surface. Relative humidity is calculated by using the change in resistance between the two electrodes which is used.

E. Wi-Fi Module (ESP8266):

ESP8266 is a low-priced Wi-Fi microchip used for net connectivity. It has a microcontroller capability and it is capable of doing both hosting an application and offloading all Wi-Fi networking functions from another application.

F. DC motors:

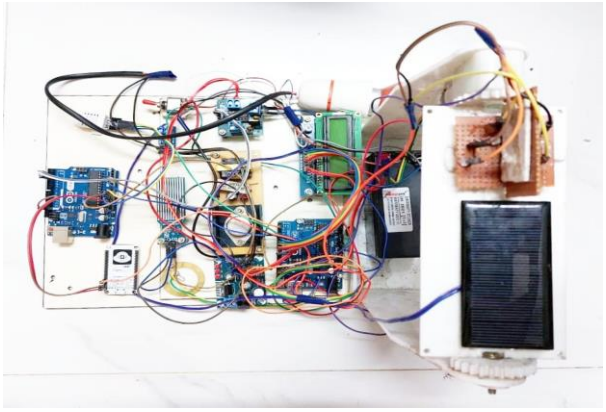
A DC motor converts direct current electrical power into mechanical power. DC motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences torque and has a tendency to move. This is known as motoring action.

G. Voltage Sensor:

Voltage sensor is used to measure the amount of voltage in the electronic circuit. Voltage is the input of the voltage sensor and the output may be switches, analog voltage signal or current signal. It is based on the principle of resistive voltage division rule. It is available at very low cost.

IV. EXPERIMENTATION

First the hardware components are tested separately and then are connected to each other accordingly. A program written on Arduino IDE is uploaded to the Arduino Board so that the module can transmit and receive data about the sensors from/to cloud. The Wi-Fi module is initialized and configure properly. The program includes reading the data from the allocating a threshold value for each parameter.



V. RESULT

The result is stored and can be displayed in firebase. The energy values change according to the direction of the solar panel. Also, the values of the temperature, water level and piezoelectric crystal values are also been showed, so that we could calculate the seasonal temperature and identify which season would be best. It is said that ‘Energy can neither be created nor destroyed’ in accordance to this statement it is evident that energy can be somehow stored. This project has been endeavoured towards the path of such objective.

VI. CONCLUSION & FUTURESCOPE

An IoT based Solar Tracker is successfully implemented which is quite effective in terms of performance and technology. But it is little expensive, hence in future the fabrication could be reduced and there could be development in design. Considering the very fundamental from the viewpoint of storing such energy, the project has been unravelled. Energies other than from the Sun, are the process from which such are been produced through the burning of various materials, involving emission of a large amount of pollution, causing the environment and the atmosphere sick

day by day. Fastness and smartness of the world's current behavioural visibility, where easy access of every sphere of life is in need of the acute comfortability, every day is a new challenge of hatching something new and unique which makes an energy to be the ultimatum source behind all the hard work exists.

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