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SOLAR TRACKING USING IOT

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Abstract- The renewable sources of energy are becoming one of the utmost priorities of the present-day world due to their innumerous advantages. In particular, solar energy is progressing as a potential inexhaustible and non-polluting energy source to suffice our ever-increasing energy requirements. However, the solar panels which are the fundamental solar-energy conversion components are fixed at a certain angle and are not able to track the sunlight direction with diurnal and seasonal changes. This limits the area of exposure of sunlight on solar panels and efficiency of the solar tracking system involving solar panels. We have developed a solar tracking system using a combination of Pic micro-controller, motor, sensors with the primary aim of improving the power efficiency of the solar panels. The main component of this tracker is PIC16f877A micro-controller which is programmed to detect the sunlight with the help of sensors and then the user actuates the motor to position the solar panel in such a way so that it gets the maximum sunlight. Thus, this system can achieve maximum illumination and can reduce the cost of electricity generation by requiring minimum number of solar panels with proper orientation with the sunlight.

I. INTRODUCTION

A Solar Tracker is a device onto which solar panels are fitted which tracks the motion of the sun across the sky ensuring that the maximum amount of sunlight strikes the panels throughout the day. The Solar Tracker will attempt to navigate to the best angle of exposure of light from the sun. But automatic tracker present can't obtain the maximum efficiency, as the module temperature is to considered in case of tropical and sub-tropical regions. In order to overcome this, we combine the IoT along with the tracker based on the single axis three positioning system. Basic the Solar Tracker is divided into two main categories, hardware and software. It is further subdivided into six main functionalities: Method of Tracker Mount, Drives, Sensors,Motors, and Power Supply of the Solar Tracker is also explained and explored. Then the IoT board is interfaced with the solar tracker

II. SOLAR TRACKING, ISSUES AND ITS CONSEQUENCES:

A.Institute of Electrical and Electronics Engineering.

The IEEE SCC21 oversees the development of standards in the areas of fuel cells, PV, dispersed generation, and energy storage and coordinates efforts in these fields among the various IEEE Societies and other affected organizations to ensure that all standards are consistent and properly reflect the views of all applicable disciplines. The IEEE SCC21 systems-level focus is on technology to grid interconnection, integration and impacts, and, Smart Grid interoperability including electric-sourced transportation and energy storage systems. PV-specific and systems-level IEEE SCC21 standards include the following

1)IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems.
2) IEEE 1562 - Guide for Array and Battery Sizing in Stand-Alone Photovoltaic Systems.

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3)IEEE 1526 - Recommended Practice for Testing the Performance of Stand-Alone Photovoltaic Systems.

B. MODULE TEMPERATURE

The module temperature is the important factor which determines the efficiency of the panel.The panel by default has its own temperature at which there will be maximum efficiency which is known as the module temperature. Even though the temperature is present there may not be compulsory reason that there must be maximum efficiency.This happens due to the mismatch in the environment temperature and the panel temperature.

C. Azimuth Angle

The azimuth is an angular measurement in a spherical coordinate system. The vector from an observer (origin) to a point of interest is projected perpendicularly onto a reference plane; the angle between the projected vector and a reference vector on the reference plane is called the azimuth.

This calculation of azimuth angle is really a tedious process as to calculate it we require the latitude of the panel, angle of inclination, angle of declination. This calculation must be done accurately for maximum efficiency. This is possible in case of fixed solar panel.

$$A'' = \cos^{-1}\left(\frac{\sin\delta\cos\varphi - \cos\delta\cos\omega\sin\varphi}{\cos\alpha}\right)$$

$$\text{where if } \omega \le 0 \text{ then } A = A''.$$

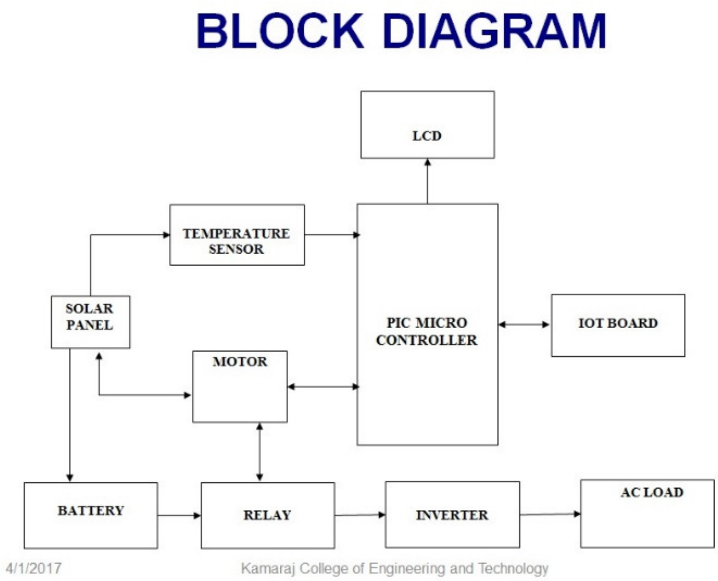
$$\text{Otherwise, } \omega > 0 \text{ and } A = 360° - A''.$$

Where αis the angle of elevation, ω is the hour angle at the observer's latitude ϕ and δ is the sun's angle of declination. But this angle needs to be calculated for every rotation which becomes quite tough. Hence to overcome this we follow single axis three positioning system.

III. SYSTEM OPERATION

The working is quite simple when compared to the automatic traction. We follow the single axis three positioning system in which we need to rotate the entire system only three times a day.

We initially give supply to the IOT board and the Pic IC. On the other hand, we get supply from the solar panel. A 12V battery is connected to this system to store the excess amount of energy and to supply the DC motor which is used to rotate the direction of the panel. A separate relay is provided for the forward and reverse rotation of the motor and a relay along with the converter system added with the step up transformer is provided to satisfy the load demand.



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IV.CONTROL SCHEME

The control methodology of the using IOTis the key element for its successful performance. It is implemented by:

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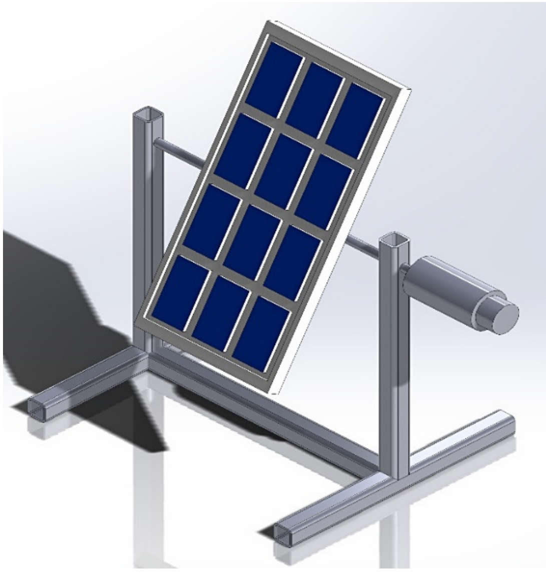
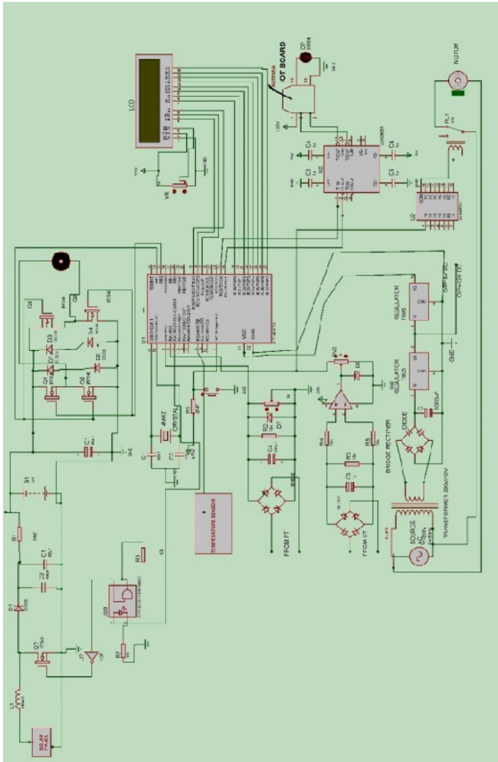
- First stage: The motor is turned either clockwise or anti-clockwise using IOT. The motor is predefined to rotate for 1 second only.
- Second stage: Based on the obtain voltage the motor's direction is changed.
- Third stage: The direction of the panel is fixed at the angle where there is maximum voltage which is irrespective of the direction of the sun.



CIRCUIT DIAGRAM:



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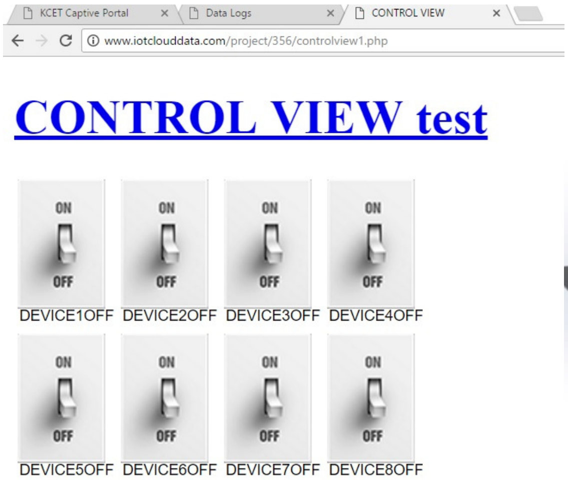
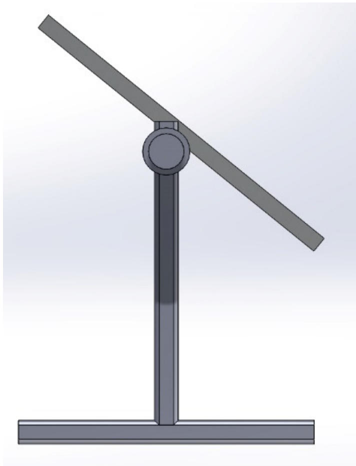
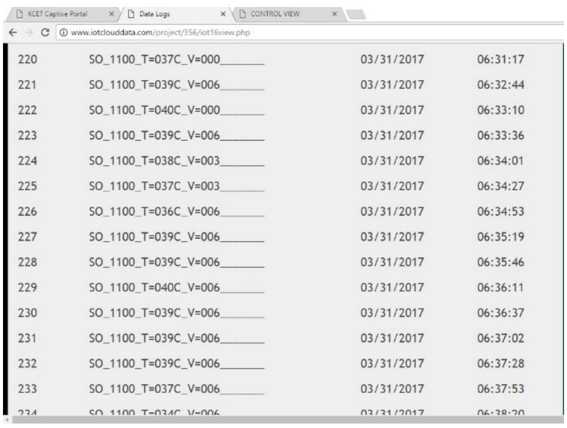




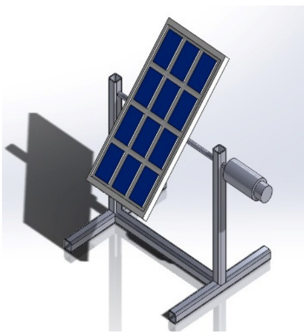


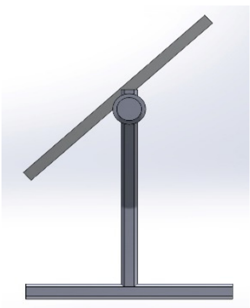
220	SO_1100_T=037C_V=000	03/31/2017	06:31:17
221	SO_1100_T=039C_V=006	03/31/2017	06:32:44
222	SO_1100_T=040C_V=000	03/31/2017	06:33:10
223	SO_1100_T=039C_V=006	03/31/2017	06:33:36
224	SO_1100_T=038C_V=003	03/31/2017	06:34:01
225	SO_1100_T=037C_V=003	03/31/2017	06:34:27
226	SO_1100_T=036C_V=006	03/31/2017	06:34:53
227	SO_1100_T=039C_V=006	03/31/2017	06:35:19
228	SO_1100_T=039C_V=006	03/31/2017	06:35:46
229	SO_1100_T=040C_V=006	03/31/2017	06:36:11
230	SO_1100_T=039C_V=006	03/31/2017	06:36:37
231	SO_1100_T=039C_V=006	03/31/2017	06:37:02
232	SO_1100_T=039C_V=006	03/31/2017	06:37:28
233	SO_1100_T=037C_V=006	03/31/2017	06:37:53

IV.SYSTEM PERFORMANCE

Based on the single phase three positioning system we observed that the positioning is variedthrice per day and the reports are as follows:

Morning:6.30am- 47˚





Afternoo-1.30 pm -51˚

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