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Design & Implementation of Sun Tracker System for Drying Pitch in Cricket Ground

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Abstract - *The aim of this paper is to describe the new idea for the design of solar tracker system that tracks the position of sun instead of a fixed solar panel system. This solar tracker system tilts according to the position of sun. The Energy generated by this system can be utilized for lighting and watering grass in cricket stadium. Another implementation is the use of heating element for drying the wet cricket pitch. This paper focuses on the heating coil which is used for drying the cricket pitch and also taking help of wifi to make it easier to control by Smartphone. A Microcontroller ARDUINO is used to control all operations.*

Key Words: Solar panel, stepper motor, ARDUINO, Heating coil, wifi.

1. INTRODUCTION:

This paper introduces a solar panel on which a time-programmed stepper motor is mounted to a track the direction of sun so that maximum sun rays can incident upon the solar panel during day time. This sun tracking system is better as compared to the light-sensing method that may not be correct always like during cloudy days or in rainy season.

The usage of solar panel to convert Sun energy into electrical energy is very popular, but due to the movement of sun from east to west, the fixed solar panel may not be able to capture whole sun rays for generating more energy. This system solves this problem by an arrangement for the solar panel to track the Sun. This tracking movement is achieved by fixing a stepper motor with the solar panel such that solar panel maintains its face continuously perpendicular to the sun to generate maximum amount of energy. This is achieved by using a program build to give signals by ARDUINO for the stepper motor to rotate the mounted solar panel in one direction and then return to the start point for next day as desired.

The ARDUINO used here is programmed to get the desired working output which gives the ON/OFF signals to both the motors. First stepper motor is used for the movement of solar panel in 180 degree from east to the west as per the time set in the program. This method maximizes the efficiency of the solar panel. Second motor is used to clean solar panel in every 3hours which is fixed on the solar panel. Sun tracking system gives more efficiency as compare to fixed tracking system. The Solar Tracking System is a hardware/software prototype, which automatically provides best adjustment of solar panel with sun. The power generated by the sun tracking system is stored in battery. This power is supplied to the lights and water pumps in stadium. The importance of sun tracking system arises due to the fact that for obtaining huge quantity of solar energy it is required that the sun rays should fall perpendicularly on solar panel throughout the day. Basically sun tracking system is a mixture of electronics, electrical and mechanical part that give support to the solar panel so that it can follow the position of sun rays.

2. Hardware used:

Solar panel, stepper motors, battery, heating coil, ARDIUNO, Smartphone.

2.1. Solar panel: Solar panel is of 12V, 10W rating which is capable to recharge 12V battery.

2.2. Stepper Motor: The stepper motors of 5v rating are used to rotate after minutes of delay. One is fixed with solar panel and second motor is used for cleaning solar plate.

2.3. Battery: Battery is used to provide supply to the stepper motors through ARDUINO. Here 12V battery is used.

2.4. Heating Coil: Heating element is placed below the cricket pitch to dry it very faster during rainy season.

2.5. ARDUINO: The ARDUINO is a main part of this project which can be connected to Smartphone by using WIFI.The ultimate advantage provided through ARDUINO is that it can be programmed according to the requirement of the system.

2.5 Motor Driver Module: It is a high power motor driver perfect for driving stepper motors. It has an onboard 5v regulator. It gives benefits like, current sense for each motor & heat sink for better performance.

2.6 Smartphone: The Smartphone is making this system's control easy. Here the Android Smartphone is used for watering grass and lights ON/OFF purpose which is connected to ARDUINO with WIFI.

3. Working:

The ARDIUNO kit is programmed to rotate both the stepper motors. Mainly the functioning of single axis tracker depends on the ARDUINO. There are many functions present in the software of ARDUINO which makes its coding so easy and fast. Implementation of program as per requirement is not a complex procedure and it does not require any extra codes. Wifi is also performing an important role in this project which performs all the work in less time and access the system using Smartphone. To increase the efficiency of a fixed solar panel it needs to make the solar panel tilt in east to west direction. Therefore, the 5v stepper motor is used which is coupled with solar panel. This motor works according to program installed in the ARDUINO. The program build like, it move the stepper motor 15 degree per hour. Here one more 5v stepper motor is used to clean the dust particles from the surface of solar panel, which is fixed above the solar panel and attached with rubber material which is act as a wiper. Because of all this, the solar panel can captures more energy from the sun and can generate more energy compared to fixed solar panel.

The Fig. 1 shows the block diagram of a Solar Tracker System having connections with various components.

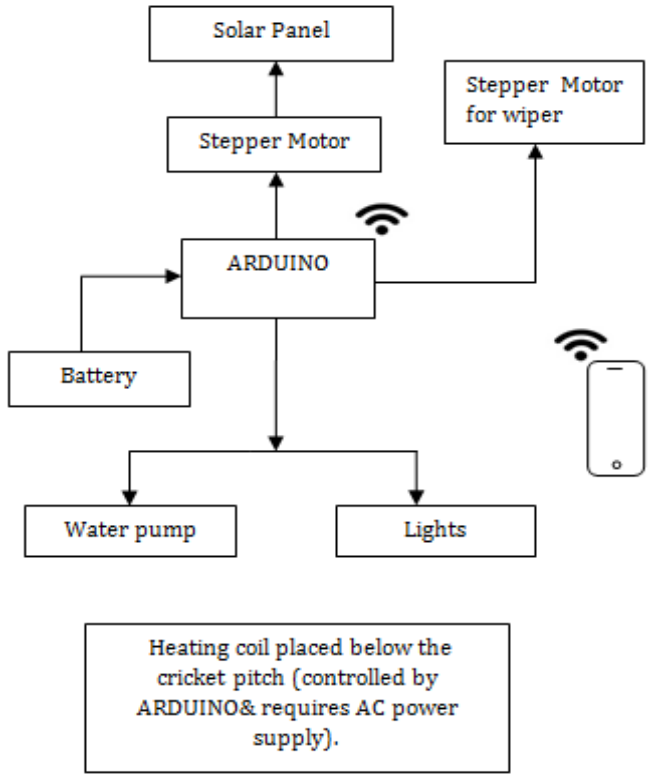

Fig. 1: Block Diagram

The Voltage production is compared in the Chart 1. The Chart 1 shown below is the observation of voltages produced from 06:00 AM to 06:00 PM of both type of solar panels which shows the single axis solar tracker is more efficient.

At 06:00 AM, solar panel faces the east direction and at the 6:00PM it changes the direction from east to west. After 6:00PM the solar panel automatically faces towards the east direction. At 12:00AM, the fixed solar panel and solar tracker system produces highest voltages which are 12.81V and 13.26V respectively .This is because the sun rays are perpendicular to the solar panels. All the power generated at the day time is stored in the 12v battery. The ARDUINO gets the power from the battery and supply to the motors according to their needs for working process. This is the simple and easy energy generation method and gives more output by capturing the more sun rays.

In the rainy season, before covering the cricket pitch with plastic carpet, rain falls on the pitch and make it wet. But, heating coil which is placed below the cricket pitch is able to dry cricket pitch faster after the rain stop.

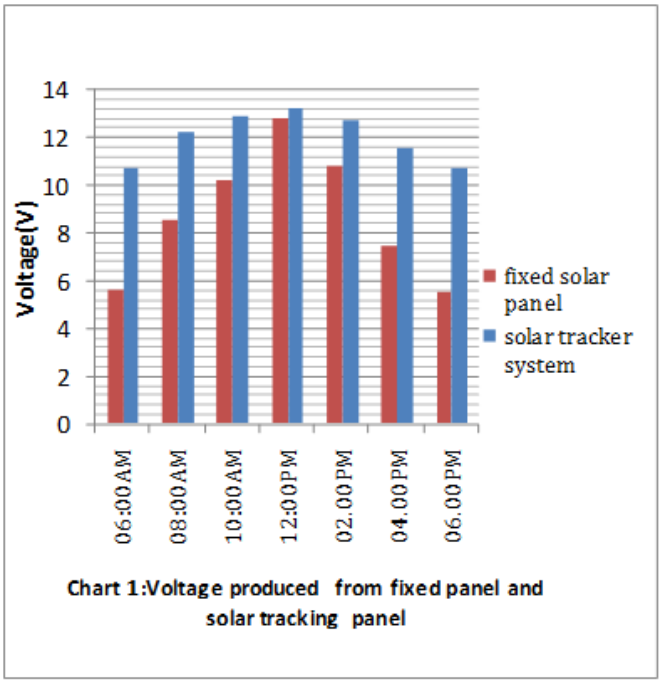

Chart 1:Voltage produced from fixed panel and solar tracking panel

The observation of a voltage produced from solar tracking system and fixed panel system from 06:00AM to 06:00 PM is shown in chart 1 as a graphical representation. Which shows the solar tracking system produced more power than fixed solar panel.

Here, the Table 1 shows the comparison between solar tracking system with fixed solar panel using various parameters which shows the solar tracker system is better than the fixed panel.

Table 1: Comparison between solar tracking system with fixed solar panel.

Parameters	Fixed Solar Panel	Solar Tracker Panel
Type of circuit	Simple	simple
Rotation in degree	No rotation	Rotates 180 degree in East to West.
Output power	Good	Better
Efficiency	Good	Better

4. Conclusion:

This circuit gives benefit for the purpose of watering grass using water pumps and lights in cricket stadium. This system is controlled by Smartphone connected to the ARDUINO with WIFI making this project time and money saver. Hence Human power requirement is less which reduces Human Errors. Its Installation is also easy and requires little maintenance after initial setup. All the efforts behind this system increase the overall efficiency of the system.

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