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SOLAR POWERED CRICKET STADIUM

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Abstract: In India cricket is the most popular sport. The required electricity for the stadium which is generated by conventional sources is very costly. So, making it more energy efficient and environmentally will be suitable for masses. This research paper focuses on the design and implementation of a solar tracking system for a cricket stadium which aims to maximize the energy output of the solar panels installed on the stadium roof by tracking the sun's movement throughout the day. The solar tracking system is powered by a combination of solar panels and batteries, ensuring that the system operates even during power outages. With the implementation of such solar tracking system, its output is 32% higher than fixed solar panel. The paper concludes by highlighting the potential for similar solar tracking systems to be implemented in other sports stadiums and large-scale facilities

Index Terms - Solar tracking system , Atmega328 Microcontroller, IoT Internet of things,

I. INTRODUCTION

Towards a more sustainable future, renewable energy sources like solar energy will become increasingly important and solar tracking powered cricket stadiums can play a significant role in this transition. The use of renewable energy sources such as solar energy will become increasingly important as the world moves toward a more sustainable future, and solar tracking powered cricket stadiums can play an essential role

The paper focuses on the implementation of solar tracking system and dc motor is installed to track the position of sun so that maximum sun’s rays can incident on the solar panel during the day time. The maximum solar energy can be captured due to movement of sun from east to west, fixed solar panel may not be able to capture whole sun rays during the sun as the sun rotates from east to west. This mechanism achieved by fixing a dc motor with solar so that solar panel faces continuously perpendicular to the sun to capture the maximum amount of energy.

This is achieved by programming a Microcontroller to give signals to DC motor for its rotation as per the direction of sun. The INA219 current sensor is used to measure the current, power and shunt voltage. The generated energy can be stored in a battery. The generated energy with the help of solar tracking system can be monitored with the help of Wi-Fi ESP8266 module which is connected to Microcontroller.

I. Material used:

The main components used are Solar Panel, LDR, DC Motor, Motor driver L298N, INA 219, Wi-Fi ESP 8266, Atmega328 Microcontroller, DC-DC Converter

Solar Panel: Solar Panel is of 12V, 10W rating is capable to recharge 12V battery. The solar panel is mounted on the rooftop of the solar.

Microcontroller: The AtMega328 Microcontroller is the main component in this project on which LDR is employed which senses the sun rays according to it and gives signal to MICROCONTROLLER which gives signal to motor driver which drives the DC motor. It works on 5v DC supply which is received by DC-DC regulator.

DC Motor: A 12V, 10W, 60 rpm DC Geared motor is used here. The current drawn by the motor is 300mA. The DC motor is drive by motor driver which adjust the position of solar panel.

Motor Driver Module: The Motor driver L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time.

INA 219: The INA219 Current Sensor can be easily used with Microcontroller to measure current, power and also shunt voltage. The INA219 Current Sensor can measure DC voltage up to +26V.

Wi-Fi ESP 8266: The ESP 8266 module is a microcontroller board with Wi-Fi capability which is designed to operate as a standalone device as well as slave device when it is connected to a microcontroller (master).

DC-DC Converter: It is 7805 DC to DC converter. It converts 12v to 5v dc which is require to power Atmega328 Microcontroller.

Working Principle

The main component in this project is Atmega328 Microcontroller which is programmed to rotate the DC Motor according to suns position. The single axis tracking system used here which captures maximum sun's energy during the day. The solar cells have huge potential to absorb maximum energy of sun and provide pure and clean energy. This absorbed energy is converted into the electrical energy and further it is stored in the battery. The LDR senses the light and according to that gives the signal to Microcontroller which gives signal to Motor driver which make the rotation of DC Motor. The functioning of single axis tracking system is depending on Microcontroller. The Microcontroller makes coding so easy and fast. The Sun's energy is captured by solar panel which converts light energy into electrical energy which is stored in 12v battery module. The Microcontroller receives 5v dc supply from DC-to-DC regulator which is connected in between solar panel and microcontroller. The single axis tracking system can capture more energy from the sun and can generate more energy compared to fixed solar panel. The INA219 current sensor measures current and voltage which receives signal from solar panel and gives signal to Microcontroller. The IoT implementation is done by using ESP8266 will accept the serial data from Microcontroller which will be sent to things speak platform via Wi-Fi connection.

Block diagram

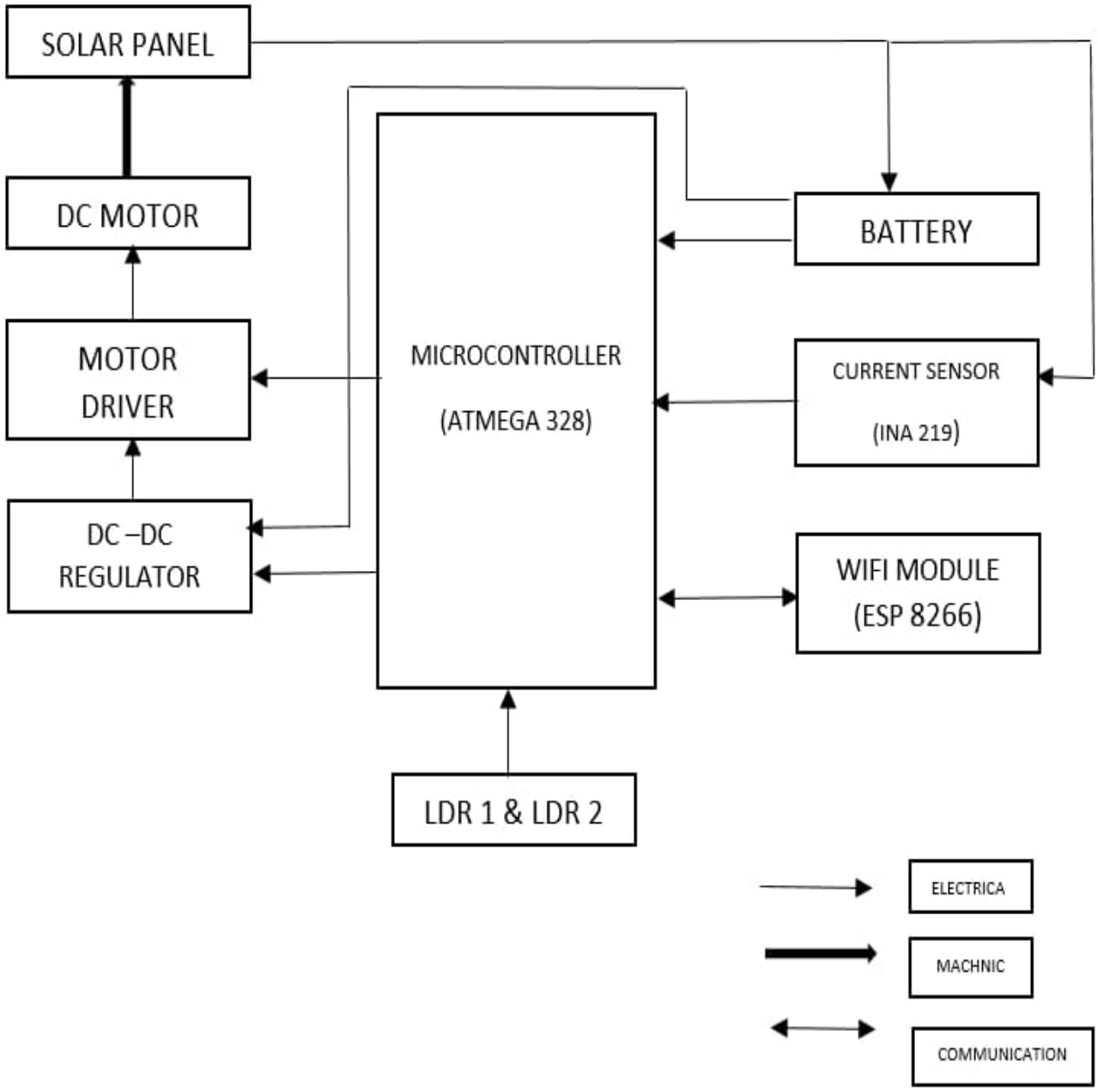

Fig 2: Block Diagram of Solar Tracking System

Fig 3 : Hardware Implementation
Of Solar Tracking System

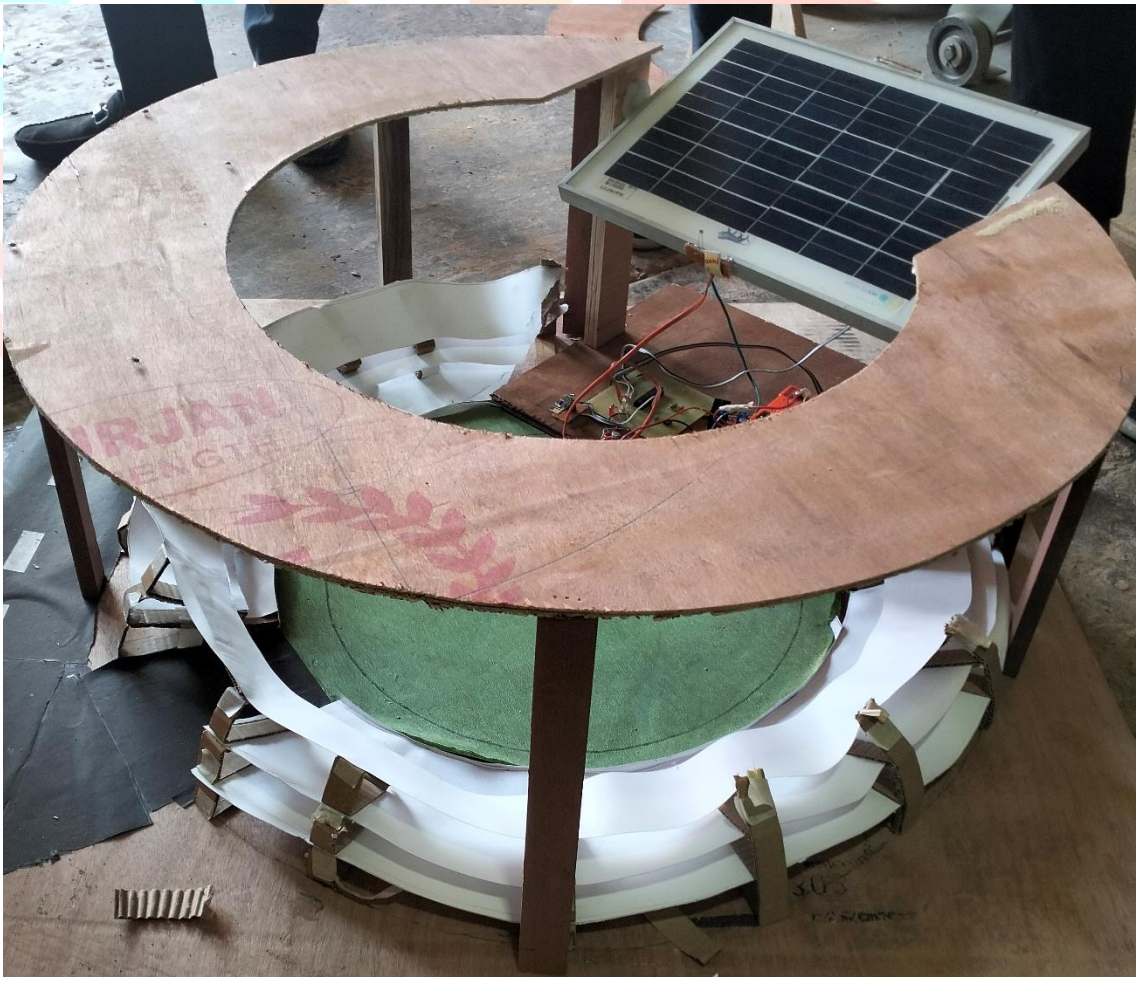

Fig 4: Complete Hardware Module Of Solar Powered Cricket Stadium

3. Result and Discussion

The Table 01 shows the different voltage readings od Fixed Solar Panel and Solar Tracking Panel that occurred during different times of the day.

TABLE : 01 Voltage Measured during different time .

Time	Output Voltage in volts	
	Fixed Panel	Solar Tracking Panel
6.15 am	0	0
7.15 am	5.44	7.33
8.15 am	8.44	9.45
9.15 am	11.44	12.23
10.15 am	12.07	12.41
11.15 am	12.33	12.66
12.15 pm	12.55	12.61
1.15 pm	12.01	12.68
2.15 pm	11.87	12.68
3.15 pm	9.31	12.67
4.15 pm	7.02	11.76
5.15 pm	6.09	9.01
6.15 pm	4.89	7.13
6.50 pm	2.12	5.05

From 8.15 am to 4.15 pm the output voltage produced by Solar Tracking Panel is more than fixed solar panel , it is varying from 8.44 volts to 12.55 volts. After afternoon the output voltage produced by fixed solar panel is started reducing (after 12.15pm) whereas the output voltage after afternoon started increasing as shown in table it is because we have used solar tracking system here in which the position of sun is track by LDR sensors which gives signal to microcontroller causing motor driver to move solar panel according to its position

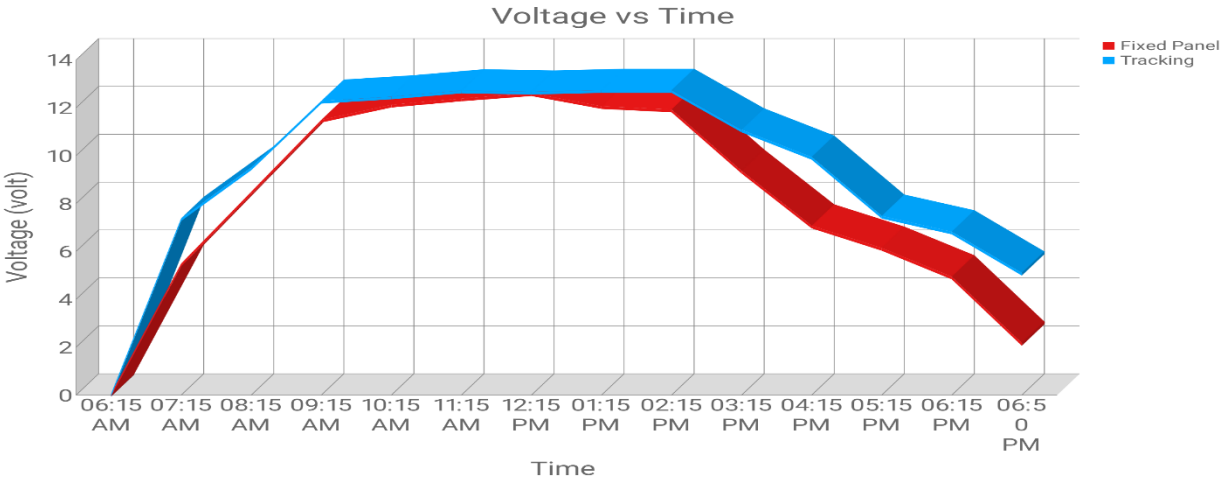

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Fig 5: Output Voltage Vs Time

From the graph which shows output voltage with respect to time of Fixed Solar Panel and Solar Tracking Panel , it has experienced that a Solar Tracking System collects maximum sun's energy than Fixed Solar Panel even during morning ,afternoon, evening.

Conclusion

The Solar power is an immense source of energy. It is clean, pollution free and renewable source of energy. To maximize the use od sun's energy is an important aspect. This paper focuses to generate and utilize maximum solar energy in a better manner . The efforts has been taken to develope a solar panel such that it captures maximum energy and generate electricity all the day . During the day time as sun moves from east to west this solar panel also tilts perpendicular to sun. So, Intensity of sun is high on the panel which can help to capture maximum energy. If we use more advance light sensors and two motor one is right side and other is left side , the solar tracking system will give high efficiency throughout the year.

In future as world started moving rapidly from conventional sources to use of renewable sources, This system will be helpful in upcoming years .

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