An Evaluation of Wireless Real Time Data of Solar Tracking System

M. A. S. M. Shabri\textsuperscript{1} and A. M. Yusop\textsuperscript{1}

\textsuperscript{1}Faculty of Electronic and Computer Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

Corresponding author: azdiana@utem.edu.my

ABSTRACT: Sunlight and heat are a natural source in our earth where can use a variety of continually changing techniques, including solar thermal and artificial photosynthesis. Solar energy from renewable sources is a major source of electricity. The trackers direct solar panels to the sun. These mechanisms shift their orientation during the day, as the sun maximises absorption of energy. In any solar system, the shift efficiency is increased by continuous adjustment of the tracking system at the best angle as sun goes through the sky. The project presents the development of the solar tracking system using Arduino UNO that allows the panel to move in any direction towards the high intensity of sunlight via four LDRs. The monitoring system is implemented in this tracking system to view in real time the data of solar energy parameter and factors affecting its deficiencies using Thing Speak platform interfacing with Wemos D1 R2. The result shows the tracking system has efficiencies of 55.38% higher than single-axis system. The monitoring system is practical to analyse the solar panel component environmental factor through real-time.

Keywords: Wireless Real Time Data, Solar Tracking, LDR

1. INTRODUCTION

Solar tracking system is the system to track the sun and generate the energy to store and there are two fundamental tracker categories which is are a single axis and a dual axis. Dual axis tracking system has two axis freedom, horizontal and vertical. Dual axis solar tracker is the solar panels moves according to the movement of the sun and get the radiation all day. There a variety of experiments have been performed to determine the optimal angle of tilt and orientation (azimuth) of PV system, solar collector, or any other application in some part of the world. Since the sun's direction varies from east to west and from north to west, several types of angles are required if the ideal angle of the sun is to be calculated\cite{1}\cite{2}. The monitoring system through wireless is more efficient where can store the data in cloud and monitor from far. The Internet of Things (IoT) platform combines data from various solar panels and uses analytics to communicate the most useful information with applications tied to specific needs. These advanced IoT platforms, such as Thingspeak, cloud platform, can pinpoint exactly which data is useful and which can be safely ignored. This data can be used to identify flaws, make recommendations, and predict potential issues before they arise\cite{3}. At this point, using digital technologies and more advanced computing facilities to leverage the power of IoT for monitoring solar power plants appears to be promising\cite{4}.

In this project, the prototype of dual axis solar tracker will be absorbing the energy form the sun to get the maximum power. Dual axis solar tracker consists of one Arduino uno to control the LDR light sensor and the servo motor to move the PV solar panel. Wireless module will control the data monitoring through IoT platform. Temperature and humidity sensor also being control by the microcontroller in this project.

2. METHODOLOGY

To develop the good tracking system features with weather condition in Malaysia, the solar panel will design into a dual-axis tracking system consist of two servo motor as dual-axis. Four LDR module sensors is using to track the sun intensity to sure the solar panel absorb highest energy. Arduino Uno use to operate the servo motor and LDR sensor as a dual axis solar tracker. While for data monitoring using Wemos D1 R2 Wi-Fi module to collect the data by wireless through the cloud using Thingspeak. The data collected will display in personal computer on Thingspeak platform. Figure 3 shows the block diagram of the solar panel was develop into dual-axis solar tracker.

![Figure 1: Hardware design for dual axis solar tracker](image_url)

Photovoltaic solar panel used for the project as a solar energy is 2 W 5 V solar panel where consists of monocrystalline cell material and has a power capacity is 2 W. The solar chosen has peak power maximum is 2.5 W and the voltage maximum capture is 5 V. While the
current in this solar panel is 500 mA during the operation.

Monitoring system for solar tracker system are used to help and improve the monitoring the data while to obtain energy efficiency from the solar panel and track the factor reduces the solar electricity and other problem with solar power. The solar power system is used to monitor the maximum performances produces by the solar panel. The project use INA219 component to get the bus voltage, current and power of the solar panel, while the DHT11 function to get the temperature and humidity surrounding the solar tracking system. The sensor uses which is INA219 and DHT11 will interfacing into WEMOS D1R2 ESP8266 Wi-Fi Module by sending the sensor data into the ThingSpeak platform.

Figure 2: Hardware design of the monitoring system

3. RESULTS AND DISCUSSION

The solar tracking system is the system to move the solar panel perpendicular to the sun according to the light intensity from the LDR sensor. Luminous intensity is the quantity of visible light that is emitted in unit time per unit solid angle. The outputs of the LDR depends on how much light was falling on the surfaces. The four LDR is used in the solar tracking system to distinguish the light intensity to makes the panel move to the right or left and rotate in 180 degree according to LDR that has a higher light intensity.

During the prototype been left under the sunlight to record the data, the values of each LDR light intensity has be read and recorded using a light meter where measure in lux. The output voltage from the solar panel been recorded and compare with the single axis data. Table 1 shows the light intensity and table 2 shows the output result.

Figure 3: LDR light intensity value in unit LUX

4. CONCLUSION

A solar tracker system that has been constructed and tested to track the sun, as well as a monitoring system that uses ThingSpeak to analyse the data and performance of the solar tracker system. A dual-axis solar tracker has been developed in this project along with single-axis solar tracker data uses to compare the result. Therefore, dual-axis solar tracking system shows more improvement and efficiency than single-axis by 55.38% since it more precious to track and detect sun intensity even been block by cloud still shows the best performance when there are two servo motor use. This system was created by combining all the hardware and software that were used.

5. ACKNOWLEDGEMENT

I would like to thank Universiti Teknikal Malaysia Melaka for supporting this works.

REFERENCES


