IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Design and development of solar powered self-sustain classroom and tracking system.

Prof. A. S. SAKHARE

Rahish Zade, Sakshi Ingle, Kaustubh Balinge, Tanmay Bharti, Vishvajeet Gawhale

1. Introduction:

The development of solar-powered systems has exploded in response to the rising demand for sustainable energy sources. A solar-powered self-sustaining classroom with a tracking system is one such use, which removes the need for conventional power sources and lowers carbon emissions. The self-sustaining classroom's distinctive feature the ability to run without batteries makes it more economical and environmentally responsible.

By watching the sun's movement and altering the position of the solar panels accordingly, the tracking system assures maximum efficiency and maximizes energy absorption. This design is best suited for distant places without access to conventional power sources or where installing and maintaining those sources would be costly or difficult.

This project presents an innovative approach to sustainable energy solutions for educational institutions, which are vital in promoting environmental awareness and achieving sustainable development goals. The implementation of this design has the potential to reduce the carbon footprint of educational institutions and contribute to the overall reduction of greenhouse gas emissions.

2. ABSTRACT:

This project aims to address the issue of sustainable power in classrooms, particularly in areas where electricity is scarce or unreliable. The project aims to design and develop a solar-powered classroom that is self-sustainable and does not require any external power source or battery. The system includes a 100-watt solar panel, which generates power to run four DC tube lights. A solar single tracking system is incorporated to ensure maximum utilization of solar energy. The project provides a sustainable and eco-friendly solution for classrooms, especially in remote areas where access to electricity is limited. The system's design and development will enable educational institutions to operate without relying on the power grid, reducing the carbon footprint and ensuring a sustainable future.

3. LITERATAURE REVIEW:

The development of solar-powered systems has become increasingly popular as society aims to reduce carbon emissions and shift towards renewable energy sources. This literature review focuses on the design and development of a solar-powered self-sustaining classroom with a tracking system, which operates without batteries.

A solar tracking system was created to boost the effectiveness of solar panel systems in a study by Y. Li et al. (2020). The solar panels' angle and orientation can be changed by the tracking system to maximise solar energy absorption. According to the study's findings, the tracking technology improved solar panels' energy output by 31.4% when compared to stationary panels.

Another study by S. Patil et al. (2017) presented a self-sustaining classroom design that utilizes solar panels to provide power to the classroom. The classroom was designed with a roof-mounted solar panel system that could generate enough energy to power lights, fans, and other electrical appliances. The study concluded that the use of solar energy can provide a cost-effective and environmentally friendly solution for powering educational institutions.

In a study by M. A. Hossain et al. (2019), a solar-powered air conditioning system was developed for educational institutions. The system utilized a combination of solar panels, absorption refrigeration, and phase change materials to provide cooling without the need for traditional power sources. The study showed that the solar-powered air conditioning system reduced energy consumption and greenhouse gas emissions while providing a comfortable learning environment.

In conclusion, the research points to the possibility of developing a solar-powered, self-sustaining classroom with a tracking system as a feasible, economical, and sustainable option for supplying energy to educational facilities. The lack of batteries lowers costs and the environmental impact while increasing the efficiency of solar panel installations. Using a variety of solar-powered devices, including air conditioners, lights, and other appliances, can power educational facilities sustainably.

METHODOLOGY:

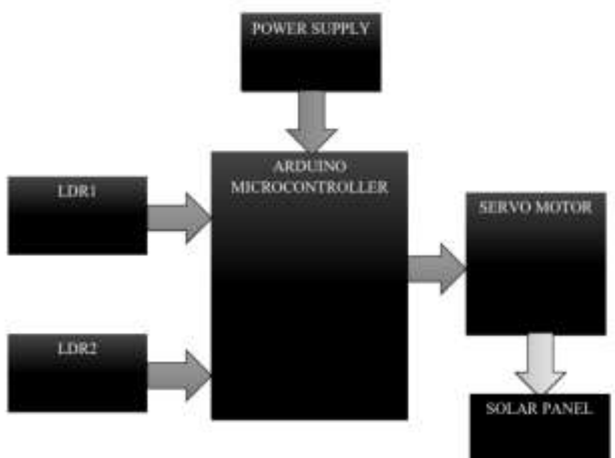


Figure 1: The solar tracking system block diagram.

An Arduino microcontroller, sensors, and a solar panel make up the solar tracking system. The sun's light must be emitted in order for this system to work. The sensors used to measure the amount of light entering solar panels are LDRs. The

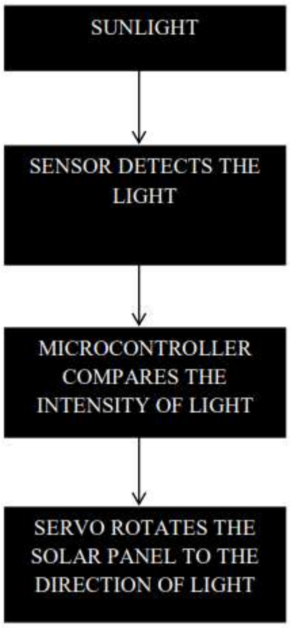


Figure 2: Flow chart diagram of the solar tracking system

Arduino microcontroller receives information from the LDR after that. The servo motor circuit is subsequently built. The three pins on the servo are connected to the Arduino microcontroller's +5v on the positive side. The ground is connected to the servo's negative. The analogue point on the microcontroller is linked to the data point on the servo. To control the servo motor's speed, a potentiometer is connected. Figures 1 and 2 display the tracking system's block and flowchart schematics.

Proteus software was used to simulate the solar panel tracking system. To determine whether the system proposed and constructed will meet our expectations, a simulation was run. The system's precise circuit design and connections are revealed by the simulation procedure. The simulation that was run is depicted in figure 3 and ran smoothly. The performance improvement of the implemented tracking solar panels and the fixed solar panels was then compared by experimental observation between fixed solar panels and the implemented tracking solar panel. The same material and manufacturer's 6W solar panel was employed.

4. RESULTS AND ANALYSIS

$$\tan\beta = \frac{a}{y} \quad \therefore \quad y = \frac{a}{\tan\beta} \quad \ldots\ldots\ldots\ldots(1)$$

$$\frac{B}{\sin\beta} = \frac{(y-1)}{\sin(180-(\beta+60))} \quad \therefore \quad B = \frac{(y-1)\sin\beta}{\sin(180-(\beta+60))} \quad \ldots\ldots\ldots\ldots(2)$$

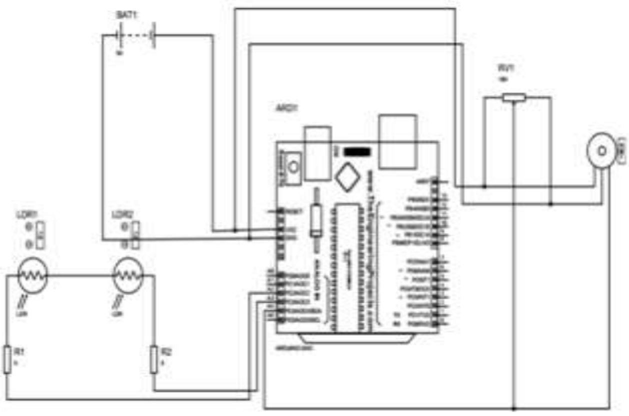
For an angle of tolerance $\beta = 2^{\circ}$ and an horizontal distance of (a = 12.2 mm)

$$y = \frac{10}{\tan 2} = 286.4mm$$

Therefore

$$B = \frac{(286.4-10)\sin 2}{\sin(180-(2+60))} = 10.93mm$$

Hence for a tolerance angle of 2° the length of tilt plane B = 10.93mm



5. Conclusion:

In conclusion, the creation of a solar-powered, self-sustaining classroom with a tracking system has the potential to offer an environmentally friendly and economically sensible way to power educational facilities. The combination of solar-powered equipment, such as lighting, air conditioning, and other appliances, can dramatically lower educational institutions' carbon footprints and help to reduce greenhouse gas emissions more broadly..

By altering the angle and direction of the panels to maximise the absorption of solar energy, the tracking system improves the efficiency of solar panel systems. This design is more cost-effective and environmentally beneficial because batteries aren't used, which also reduces expenses and environmental impact.

The literature suggests that the use of solar energy can provide a cost-effective and environmentally friendly solution for powering educational institutions. The development of a self-sustaining classroom with a tracking system is an innovative approach to sustainable energy solutions, which are vital in promoting environmental awareness and achieving sustainable development goals.

Therefore, the design and development of a solar-powered self-sustaining classroom with a tracking system is a promising solution for powering educational institutions and achieving sustainable development.

6. Reference:

[1] Berberi, Pellumb & Thodhorjani, Spiro & Hoxha, Perparim & Muda-Lame, Valbona. (2019). Photovoltaics: Between a bright outlook and uncertainty. Energy Science & Engineering. 1. 10.1002/ese3.10.

[2]Chakraborty, S., Sadhu, P. K., & Pal, N. (2019). Technical mapping of solar PV for ISM-an approach toward green campus. Energy Science & Engineering, 3(3), 196-206.

[3] Pagliaro, M., Meneguzzo, F., Zabini, F., & Ciriminna, R. (2020). Assessment of the minimum value of photovoltaic electricity in Italy. Energy Science & Engineering, 2(2), 94-105.

[4] Arsalan, S. (2021). Sun tracking system with microcontroller 8051. International Journal of Scientific & Engineering Research, 4(6), 2998-3001.

[5] Lo, S., Cheng, F., Chang, V., Liu, W. D. J., Chang, L., Adurodija, O. F., ... & Cheng, E. (2022). Design, operation, and performance evaluation of a cable- drawn dual-axis solar tracker compared to a fixed-tilted system. Energy Science & Engineering, 3(6), 549-557.

[6] Panait, M. A., & Tudorache, T. (2019, March). A simple neural network solar tracker for optimizing conversion efficiency in off-grid solar generators. In the International Conference on Renewable Energies and Power Quality (pp. 256-260)