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"ANALYSIS OF DIFFERENT METHODS IN SOLAR TRACKER MACHINING FOR SUSTAINABLE PRODUCTION"

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ABSTRACT

The purpose of this project is to investigate if it is possibleto get more energy out of a solar panel if the solarpanel is always directed towards the sun. Furthermore,two questions surrounding the plausibility of building anefficient tracking system, and the level of complexity for the required software and mechanism will be investigated.To be able to answer these questions a prototype was built. This project consists of three major parts, hardware, software and electronics. Stepper motors were used to rotate the solar panels and light dependent resistors (LDR) were used as light sensors. With the tracking system, the solar panels outputted 48 % more energy.

INTRODUCTION

Climate change is a subject that has been discussed profusely these recent years. The effects that fossil fuels, among other things, have had on the environment have led to many scientists trying to find alternatives, more environmentally friendly fuels and cleaner sources of energy. An example of a cleaner source of energy is the electricity generated by solar panels. The Swedish energy authority, Energimyndigheten, states that "*In two hours, the Earth receives as much energy from the sun as the whole world's population uses for a year. It is important to find ways to use the solar energy smartly, both in*

Sweden and other countries." [1]. This shows that there is great potential in solar energy and any improvements to solar panels could be of

great help for society. Solar panels work by absorbing the sunlight and converting it to electricity through the photovoltaic effect. The goal is to capture as much sun energy as possible. Theamount of energy that can be collected is determined by the amount of light intercepted by thepanel, or in other words, the area of the shadow from the solar panel on a perpendicular surfaceto the direct beam is equivalent to the energy intercepted [2]. Most solar panels are fixed and donot move. The angle and direction the solar panel should be pointing is determined by various calculations, and can vary depending on season and location of the panel. Solar panels with an automatic mechanism that can adjust the angle and the direction of the panel are able to capturemore sunlight, but also require energy to move the solar panel

Purpose

Kuldeep Randhawa et al. [10] proposed a technique using machine learning to detect credit card fraud detection. Initially, standard models were used after that hybrid models came into picture which made use of AdaBoost and majority voting methods. Publically available data set had been used to evaluate the model efficiency and another data set used from the financial institution and analyzed the fraud. Then the noise was added to the data sample through which the robustness of the algorithms could be measured. The experiments were conducted on the basis of the theoretical results which show that the majority of voting methods achieve good accuracy rates in order to detect the fraud in the credit cards. For further evaluation of the hybrid models noise of about 10% and 30% has been added to the sample data. Several voting methods have achieved a good score of 0.942 for 30% added noise. Thus, it was concluded that the voting method showed much stable performance in the presence ofnoise.

Scope

This project focuses on constructing a model mechanism which allows a solar panelto be able to follow a light source. In this project, the scope has been reduced due to time and resource mitations. Because of this, only a small scale version of the tracking solar panel will be built as a basis for the data collection. Due to the smaller area of the solar panel, this will affect the amountof electricity that can be generated, which is something that has to be considered when discussing the results of the project. The small size of the solar panel and the other involved partsalso means that the structure will not be subjected to big loads. Therefore, there will not be any major calculations for the strength of the structure. As a continuation for the project, a full-scale version could be built. For a full-scale version of the structure, strength calculations would have to be made. This project will only examine the amount of energy that is produced by the solar panel , and not how much energy is needed to power the mechanism. This is also something that can be examined in future work. Reliability and required maintenance are importantmissues, but this is also something that will not be examined during the project.

Theory

Stepper Motor

A stepper motor is a type of direct current (DC) motor that moves in small, equallysized steps. The stepper motor can be told what step it should position itself, and hold that position withoutany form of feedback

Demonstrator

This chapter will focus on how the different components of the build have been constructed andassembled. For the purchased components, product type and performance data will be reviewed. The two points of emphasis will be hardware and software.

Software

When started, the solar panels will be in their neutral state. Depending on the measured value over the LDRs, the stepper motors will rotate the panel so that the top side and the bottom side ofthe plate differ no more than the tolerance. If the top and bottom sides are not within the tolerance. The stepper motor will do 96 steps, where 6400 steps is equal to one revolution (due tothe microstepping in the

stepper motor drivers). The left and the right LDRs are then evaluated in the same way. Once leftversus right and top versus bottom have been compared, the process restarts. Figure 3.3 below shows the flow chart of this algorithm.

Discussion

According to Solar Power World, an online resource for news regarding solar power, solar trackers can increase energy production by as much as 40 % [13]. That means that the result of 48 % is slightly bigger than expected. Possible reasons for this will be discussed in the next sections.

Conclusion

Since the solar panels worked as expected, the answer to the question if LDRs can be used to track a light source's motion is yes. Even though the testing experienced some lack of preciseness, the overall shape of the curves in Figure 4.1 and 4.2 were in accordance with the expectations. These graphs helped show that solar tracking improved energy production by approximately 48 %, which is the answer to the second research question. On the third research question regarding software complexity, it seems the answer would be 'quite complex'. Since preprogrammed functions have been used for the measurements and to run the stepper motor, most parts of the software were prepared. However, if one considers the method of using preprogrammed functions satisfactory, combining them is not complicated. As the testing showed the solar tracking worked fine. The slightly earlier reach of peak power and a higher general power in the less energetic span of the day due to this tracking was the expected result.

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