

# Design and Implementation of a Solar Energy Measurement and Monitoring System

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## Abstract:

One of the challenges of unsatisfactory performance of solar powered equipment in Nigeria is the importation of substandard solar panels which in turns give rise to improper rating of the solar panels. Some of the equipment manufacturers are known for labeling the solar panels with arbitrary ratings in other to sell and make profit. Since the solar powered equipment depends on the Sun for its energy, there is need to monitor and measure the solar panel parameters like voltage, current, light intensity and temperature. This is necessary to confirm if the solar panel is performing to expectation and giving good readings. This work aims at developing a Solar Energy Measurement System that will aid in the measurement and monitoring of solar panel parameters like voltage, current, light intensity and temperature. The design work is divided into two main parts, hardware and software sections. The hardware involves the development of major units like the power supply unit, the control unit and the sensor units of the entire project by using solid state electronic components, integrated circuits and microcontroller. The software design involves the development of a program using C programming language to enable the arduino microcontroller to function and perform as desired. The basic inputs to the system are the sensor units. They sense the required variable that is to be measured and the measured values are then displayed. The results obtained from the display unit are then compared with the manufacturer's values that are found on the solar panel. It is observed that there are slight differences between the measured and the manufacturer's values, but still within a tolerable range (less than 5%).

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## Introduction

The use of solar power system as alternative source of power supply has continued to be advocated and embraced all over the world because of its ease of deployment and low or no maintenance [1]. However the high installation cost is still scaring a lot of people who would have wished to have their facilities powered by solar [2]. In most developing countries like Nigeria the story is becoming a sour experience because most of the installations don't perform as intended. Key factors that have been identified for non-performance of solar installation include wrong sizing, poor workmanship and lack of appropriate maintenance culture [3]. Also, there have been growing concerns on the challenges of unsatisfactory performance of solar powered equipment in Nigeria which has been linked to importation of sub-standards solar panels to the market. Most of these solar panels are not rated properly. Some manufacturers label the solar panels with arbitrary ratings in order to sell and make profit as seen in figure 1. This work is therefore necessary so as to assist both those who install solar system as well as consumers to confirm the manufacturer's specification claim on the imported solar panels in Nigeria. The Solar Energy Measurement System is a system designed to measure the rating of the solar panel by monitoring the Solar Panel Parameters - voltage, current, temperature and light intensity.

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