Innovative Smart Device for Testing the Conformity and Electrical Quality of Photovoltaic Solar Panels

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Introduction

In today's world, there is an increasing emphasis on investing in renewable energies, a challenge prompted by numerous compelling factors. This shift towards renewable energy investment has the potential to play a pivotal role in curbing greenhouse gas emissions and addressing the pressing concerns of climate change. Among the myriad clean energy sources, photovoltaic energy, with its widespread availability across various regions of the globe, emerges as one of the most significant.

Problematic

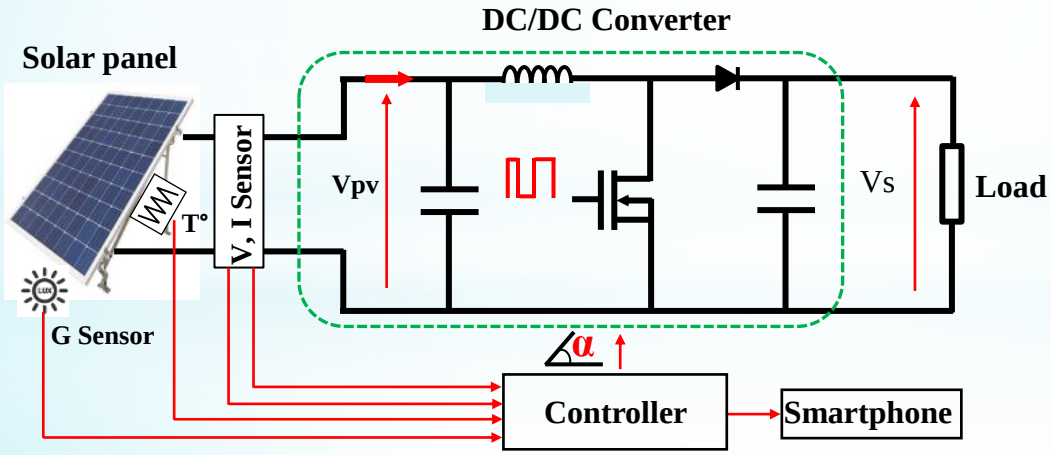
Evaluating the quality and conformity of solar panels with established standards and specifications is of paramount importance. It is crucial to assess the electrical characteristics of solar panels, including Voc (Open-Circuit Voltage), Pmax (Maximum Power Point), and Isc (Short-Circuit Current). These attributes can be influenced by environmental conditions, especially during high-temperature periods such as the summer months. Quality control in such scenarios becomes exceptionally important to ensure optimal performance and longevity.

Innovative Device

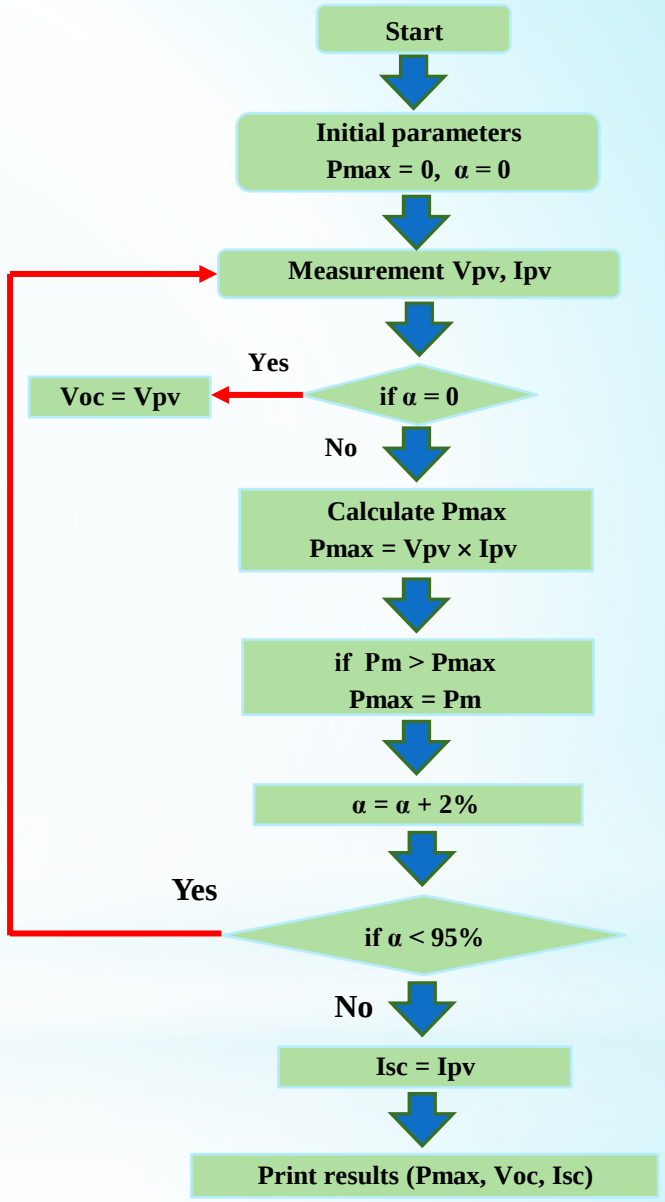
The innovative smart device offers advanced and precise solutions for assessing the quality of solar panels and their compliance with industry standards. This device leverages cutting-edge technologies to gauge electrical efficiency, analyze solar radiation distribution, and assess solar panel performance under varying operational conditions. It further furnishes users with precise and comprehensive data, simplifying the inspection and evaluation of solar panel quality. Additionally, the device is equipped with a Wi-Fi connectivity feature, enabling easy display of results on a smartphone.

Device Operation and Components

The device functions by utilizing a DC/DC converter alongside a suite of sensors, including current and voltage sensors, sunlight sensors, and a temperature sensor. It is also equipped with a microprocessor that incorporates a sophisticated algorithm responsible for controlling the DC/DC converter and managing the storage and transmission of data to a connected smartphone.



Principle diagram of the device



Execution process for extracting real parameters

Implementation Steps

The steps to implement the device are as follows:

1- Conduct theoretical and simulation studies to accurately identify the components.

2- Design the electronic board using ALTUIM Designer,

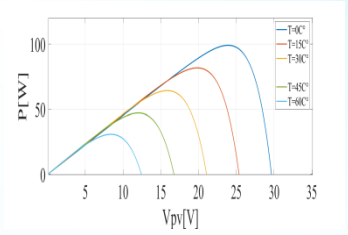
3- Print and develop the PCB (Printed Circuit Board).

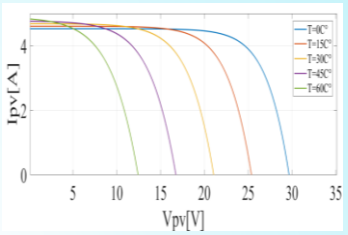
4- Install the electronic components.

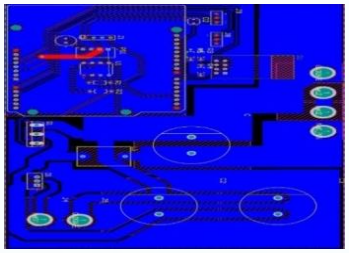
5- Program the microprocessor.

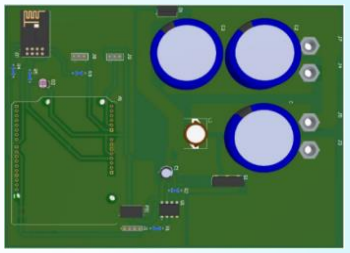
6- Conduct preliminary experiments in the laboratory to verify the device's operational accuracy.

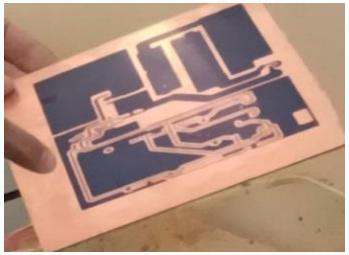
7- Create a smartphone application to control the device,





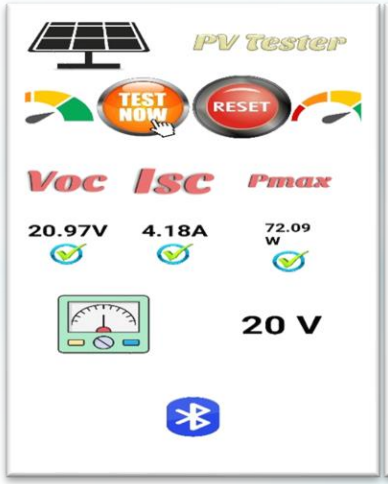


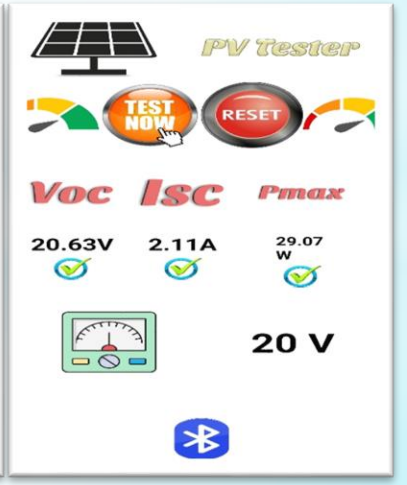




Real application Example, Conclusion

When testing the photovoltaic panel with a simple push of a button on a smartphone, the electrical characteristics Voc, Pmax and Isc of the panel are displayed within seconds.





Identical parameters **No Identical parameters**