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A preliminary study on the 2-axis hybrid solar tracking method for the smart photovoltaic blind

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Abstract

This study aimed to investigate a tracking system applicable to the SPB and determined an indirect tracking method. The slope of PV panel tracked the sun from 0° to 90°, which does not restrict the tracking. On the other hand, the azimuth of PV panel tracked the sun from -9° to 9° due to the limitation of the rotating angle of the vertical axis. The result of this study can be used to develop the 2-axis hybrid solar tracking system for the SPB which can be adopted in the building sector.

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Keywords: Solar tracking system; Hybrid solar tracking method; Indirect tracking method; Smart photovoltaic blind

1. Introduction

A photovoltaic (PV) system can reduce carbon emissions by using sustainable energy resources and substituting for the use of fossil fuel. In the building sector, a PV system is used in the form of a building integrated photovoltaic (BIPV) system. The smart photovoltaic blind (SPB) is a device that can satisfy both electricity generation and sun-shading function, it can be installed in windows of the buildings [1]. Thus, the SPB can be distinguished from the traditional PV in terms of those multiple functions and space uses.

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To improve the electricity generation of the SPB, methods to improve PV generation through solar tracking system as well as to improve the efficiency of the PV panel and the inverter should be considered. It is difficult to improve the efficiency of the PV panel and inverter in the short term, but it is possible to effectively improve the electricity generation by introducing a solar tracking system [2]. Therefore, as a preliminary study for the 2-axis hybrid solar tracking method for the SPB, this study reviewed various solar tracking systems and determined an indirect tracking method applicable to the SPB. This study was conducted in two steps. First, in step 1, the preliminary considerations (i.e., tracker type and tracking method) for the solar tracking system was examined. Second, in step 2, indirect tracking method was considered to calculate the hourly slope of panel (SoP) and the azimuth of panel (AoP).

Nomenclature

AoP	Azimuth of panel
BIPV	Building Integrated Photovoltaic
PV	Photovoltaic
SoP	Slope of panel
SPB	Smart photovoltaic blind

2. Preliminary considerations for the solar tracking system

2.1. Tracker types

As shown in Figure 1, the solar tracking system can be categorized into the 1-axis tracker and the 2-axis tracker, according to tracker types. First, the 1-axis tracker which tracks the daily east-west motion of the sun can be divided into horizontal 1-axis tracker (Type (A) in Figure 1) and vertical 1-axis tracker (Type (B) in Figure 1). The horizontal 1-axis tracker and vertical 1-axis tracker perform solar tracking centered on the horizontal and vertical axis of the PV panel, respectively.

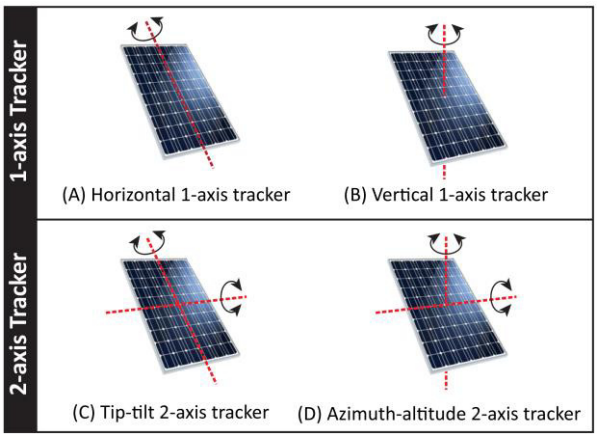

Fig. 1. Tracker types