INVESTIGATION OF M ꞏꞏꞏ KING (MPPT) FOR ACTIVE COOLING MO ꞏꞏꞏ TAIC PANEL USING FUZZY LOGIC CONTROLLER

NURUL AFIQAH BINTI ZAINAL

Thesis submitted in fulfillment of the requirements
for the award of the degree of
Master of Engineering (Mechatronic)

Faculty of Manufacturing Engineering
UNIVERSITI MALAYSIA PAHANG

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LIST OF SYMBOLS

%	Percentage
°C	Degree Celsius
Ω	Ohm
V	Voltage
A	Ampere
W	Watt

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
CV	Constant Voltage
DC	Direct Current
ETP	Economic Transformation Programme
FL	Fuzzy Logic
FLC	Fuzzy Logic Controller
GDP	Gross Domestic Product
IncCond	Incremental Conductance
MPP	Maximum Power Point Tracking
MPPT	Maximum Power Point Tracking
OV	Open Voltage
P&O	Perturb and Observe
PV	Photovoltaic
SC	Short-Current
UMP	University Malaysia Pahang

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ABSTRAK

Projek ini dilaksanakan seiring dengan kepentingan dalam menggalakkan penggunaan tenaga solar bagi melaksanakan sistem fotovoltan (PV) untuk menggantikan penggunaan gas dan arang batu dalam penghasilan tenaga elektrik. Walau bagaimanapun, disebabkan oleh jumlah sinaran suria yg diterima tidak menentu, penghasilan kuasa elektrik daripada panel fotovoltan juga tidak dapat dikawal. Bagi mencapai kuasa titik maksima (MPP) daripada panel PV, logik fuzzy (FL) berdasarkan voltan malar (CV) algoritma digunakan di dalam sistem. Tujuan utama projek ini adalah untuk membangunkan sistem PV yang berdiri sendiri yang cekap dengan sistem penyejukan. Sistem ini dibangunkan melalui simulasi dan eksperimen. Model panel PV direka berdasarkan model PV matematik yang menggunakan model sel diod tunggal. Simulasi ini dilakukan untuk menganalisis ciri-ciri panel PV terutamanya dalam perubahan suhu dan pendedahan kepada sinaran. Ciri-ciri ini digunakan sebagai input dalam membangunkan pengawal logik fuzzy (FL). Untuk mengawal dan mengekalkan suhu panel PV pada tahap optimum, sistem penyejukan dibangunkan ke dalam sistem. Sistem penyejukan membantu meningkatkan output voltan PV serta mengeluarkan kuasa. Dari simulasi, ciri-ciri I-V dan P-V panel PV diperolehi. Secara purata, pelaksanaan sistem penyejukan menunjukkan peningkatan 3.09% dan 1.96% pada bacaan V_{PV} dan V_{out} apabila suhu PV turun sabanyak 17.71%. Ini jelas menunjukkan hasil V_{PV} bergantung kepada suhu PV. Dengan melaksanakan FL algoritma berdasarkan CV kepada kaedah ini, sistem menjadi lebih mantap dan boleh dipercayai dari segi keberkesanan dan kecekapan. Kesimpulannya, sistem PV yang berdiri sendiri berjaya direka dan dianalisis dalam kedua-dua simulasi dan eksperimen bagi menentukan ciri-ciri panel PV dan meningkatkan prestasi sistem. Dengan melaksanakan sistem penyejukan untuk panel PV serta menggunakan pengawal FL dalam mengesan PV MPP prestasi sistem PV dapat dipertingkatkan dan mengurangkan masalah yang memberi kesan kepada penghasilan kuasa dari panel PV.

ABSTRACT

Interest promotion of solar energy to perform an efficient standalone PV system to replace the used of gas and coal as the main demand in producing electricity. Due to the nonlinearity of solar radiation and temperature, it leads to inconsistency in electricity production from the PV panel. To achieve the maximum power point (MPP) of PV panel, fuzzy logic (FL) based constant voltage (CV) algorithm is applied to the system. The aim of this project is to develop an efficient standalone PV system with cooling system. This system is develop in both simulation and experimental. A model of PV panel is designed based PV mathematical modelling by using single cell diode model. The simulation is done to analyze PV panel characteristics especially in variation of temperature and irradiations. These characteristics are used for the inputs in developing the Fuzzy Logic (FL) controller. As to control and maintain the temperature of PV panel on its optimum level, a cooling system is developed into the system. The cooling system helps to increase the PV voltage output as well as the power produce. From the simulation, I-V and P-V characteristics of PV panel are obtained. The implementation of cooling system results in 3.09% and 1.96% of V_{PV} and V_{OUT} percentage change increasing respectively when the PV temperature drop down to 17.71% averagely. This clearly shows the V_{PV} produce depends on the PV temperature. By implementing FL based CV algorithm into this method, it makes the system more robust and reliable in terms of effectiveness and efficiency. In conclusion, a standalone PV system is successfully designed and analyzed in both simulation and experimental set up to determine the PV panel characteristics and increase the system performances. By implementing the cooling system for PV panel as well as using FL controller in tracking PV MPP enhanced the performances of PV system and reduces the problems that affect the power generation from PV panel.

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