LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

Judul Jurnal Ilmiah (Artikel)	:	Pilot in the Loop Simulation for Quadrotor Flight Experiment
JumlahPenulis	:	3 orang (**Joga Dharma Setiawan,** Mochammad Ariyanto, Agus Mukhtar, Munadi)
Status Pengusul	:	Penulis ke-1
Identitas Jurnal Ilmiah	:	a. Nama Jurnal : Australian Journal of Basic and Applied Sciences
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Total = (100%)	**18,00**	**18,00**	**18,00**
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Semarang, 1 Juli 2021

Reviewer 2

Ojo Kurdi, S.T., M.T., Ph.D.
NIP. 197303171999031001
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Reviewer 1

Ir. Eflita Yohana, M.T., Ph.D.
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Unit Kerja : Teknik Mesin FT UNDIP

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2. **Ruang lingkup dan kedalaman pembahasan:**
   Artikel ini melakukan pengembangan hardware kendali drone berbasis *pilot in the loop* agar mengurangi resiko kegagalan dan biaya uji coba. Hasil penelitian telah disajikan dengan lengkap dan detail disertai dengan setting hardware yang lengkap.
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Semarang, 1 Juli 2021
Reviewer 1

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2. **Ruang lingkup dan kedalaman pembahasan:**
   Penelitian yang dibahas dalam artikel ini berisi tentang pengembangan kendali quadrotor berbasis *pilot in the loop*. Pengembangan sistem kendali ini diuji secara bersamaan *virtual* dan hardware sebenarnya dalam skala lab.
3. **Kecukupan dan kemutakhiran data/informasi dan metodologi:**
   Metode yang diusulkan oleh penulis yaitu dengan mengendalikan quadrotor yang dapat terbang berbasis *pilot in the loop* merupakan ide yang orisinil dan mutakhir dalam bidang penelitian robotika dan UAV. Similarity score dalam Turnitin cukup rendah yaitu 9%.
4. **Kelengkapan unsur dan kualitas terbitan:**
   Kualitas dan kelengkapan unsur dari artikel sudah cukup baik jika dilihat dari susunan jurnal dan telah terindeks di Google Scholar.

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January	February	Special ICCEIB	March
April	Special	May	Special iSTEM '17
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2016

January	Special	Special IPN (Jan.)	February
Special	March	Special IPN (Feb.)	April
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2015

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December	Special IPN (Dec.)		

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January	February	March	Special 1
Special iCBST	April	May	Special 3
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2013

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2012

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2011

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2010

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2009

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Pilot in the Loop Simulation for Quadrotor Flight Experiment

Joga Dharma Setiawan, Mochammad Ariyanto, Agus Mukhtar, Munadi

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Key words:
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ABSTRACT

The purpose of this research is to develop an experimental test bed for pilot in the loop (PIL) simulation of quadrotor dynamics. The simulator set-up includes two CPUs working in sync, a radio control transmitter, a DAQ card, a microcontroller, four brushless DC motors, and sensors for attitude, acceleration and altitude measurements. This paper shows simulation results of decentralized PD compensators applied in three attitude directions and the vertical axis. These results validate the stable performance of decentralized PD controllers and at the same time reveal that the simulation runs in real time as shown by the zero values of the missed ticks parameter at all time in MATLAB/Simulink environment. The simulator provides a very closed to reality flight situation that a pilot can experience; thus the simulator is very useful for researchers to understand the character of the quadrotor system being developed and for pilots to complete a mission using the quadrotor system.

To Cite This Article: Joga Dharma Setiawan, Mochammad Ariyanto, Agus Mukhtar, Munadi, Pilot in the Loop Simulation for Quadrotor Flight Experiment. ***Aust. J. Basic & Appl. Sci.,*** *8(4): 485-494, 2014*

INTRODUCTION

Quad rotor is one of the most active research topic in rotary wing unmanned aerial vehicles (UAVs) due to its mechanical design simplicity and human interaction safe characteristic (Mellinger, D., *et al.*, 2011) and (Pounds, P., *et al.*, 2011). However extra care in design and construction processes must be taken as the quad rotor at many times is loaded with expensive electronic equipment. This study proposes a real-time flight simulator as one of the tools used for designing quadrotor systems. The benefits of the simulator are to reduce risk of accident, design development time, cost, and the number of flight test.

Konkuk University (Putro, I.E., *et al.*, 2010) has developed real-time simulation of quadrotor. The real-time simulation was done in MATLAB/Simulink using xPC Target in which two host PCs and two PC targets were used. However the development of real-time simulation of quadrotor to be used for flight simulator has not been done yet. The closest flight simulator that has been developed is flight simulator for a small scale helicopter and fixed wing. Georgia Institute of Technology (Munzinger, C., 1998) and (Johnson, E.N., 2002) has developed a real-time flight simulator for a small scale helicopter. The flight simulator tools can provide real-time display of all flight data, including plotting, logging and modifying flight data. In reference (Jung, D. and Tsiotras, P., 2007), a realistic simulation based on MATLAB/Simulink with flight-gear for fixed wing UAV has been developed. The real-time simulator is equipped with hardware in the loop. Similarly, a real-time simulation has been conducted using LabVIEW software (Benrejeb, W. and Boubaker, O., 2012) for an inverted pendulum model.Control Systems and Robotics Lab, Diponegoro University, has developed a quadrotor equipped with a gripper for aerial object interaction/aerial grasping, as shown in Fig. 1 (Setiawan, J.D.,*et al.*, 2012). This paper deals with the development of real-time flight simulator and experiment of PIL simulation. In this research, PIL simulation is developed using hardware and software arrangement as shown in Fig. 1.The objective of this research is to develop an experimental test bed for PIL simulation of quadrotor dynamics. The PIL can be used for facilitating pilot training purpose and basic understanding of quadrotor flight dynamic. Proportional Derivative (PD) compensator is used to control the attitude and altitude of quadrotor.

A six degrees of freedom (6-DOF) nonlinear model of quadrotor dynamics is developed in MATLAB/Simulink environment. The PD compensator is utilized to control altitude and attitude at hover flight. PD compensator is capable of controlling the attitude of quadrotor as in (Wu, Y., 2009; Bresciani, T.,2008; Bouabdallah, S., 2007).

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PID based controller design for attitude stabilization of Quad-rotor

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Quad-rotor, Attitude Control, PID.

ABSTRACT

This article presents a PID based control approach for stabilizing the attitude of quad-rotor UAV during flying. To solve the stability problem of quad-rotor UAV, some suitable and easy feedback control algorithm can be used. In the standard Quad-rotor type UAV systems, controlling of attitude is one of the most critical tasks and appropriate controller for stabilization of attitude is essential and necessary. So, in order to validate the unwanted disturbance rejection operation, a robust PID controller with feedback compensation is derived in this research artical. The results proved the effectiveness of control method for stabilizing attitude of quad-rotor.

To Cite This Article: M. Hassan Tanveer, D. Hazry, S. Faiz Ahmed, M. Kamran Joyo, Faizan. A. Warsi, Zuradzman M. Razlan, Khairunizam Wan, A.T. Hussain., PID based controller design for attitude stabilization of Quad-rotor. ***Aust. J. Basic & Appl. Sci.,*** *8(4): 1-5, 2014*

INTRODUCTION

One of the prominent rotorcrafts, a UAV has been the area of interest among the researchers in recent years. The quad-rotor is an unmanned aerial vehicle (UAV) which has four propellers attached to four motors placed on a fixed body (Senkul, 2013). A quad-rotor UAV has exceptional advantages with its size, weight and its simple mechanical arrangement (Lee, 2011). This is the main reason that, nowadays these UAVs are wide used in various applications at minimal cost and without endangering any risk to human life (Burkle, 2011). UAVs are inherently suitable for military applications such as border patrolling, security intelligence, cartography, surveillance, cost guards, acquisition of targets (Hsu, 2010) and (Chao, 2010). UAVs have also penetrated in civilian applications such as search & rescue missions (Krerngkamjornkit, 2013), explorations (Caldeira, 2013), security & surveying of oil pipe lines (Zhang, 2013), forests on fire (Ferrell, 2013). As a result the research community has seen substantial improvements in the design of controllers for these types of vehicles (Stowers, 2011).

Plenty of technical & distinctive issues are associated to quad-rotor that opened a way to a massive research work. A quad-rotor system is a simple structure but nonlinear in nature which makes the controls very complex and difficult. Researchers have been facing issues with controlling the attitude and tackling to the air disturbances while flying which is the main concern in this article.

The contribution is organized as follows: the modeling of the quad-rotor and controller design is done in section 2. Simulations and experimental results for the system in closed-loop with the PID technique is presented in section 3. Concluding remarks are given in Section 4.

MATERIAL AND METHODS

Equation 1 is the overall dynamic system representation and orientation of quad-rotor UAV which is extracted from Newton-Eular method and discussed comprehensively in my previous article (M. Hassan Tanveer, 2013).

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