UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF HAND GESTURE CONTROL DRONE

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering Technology
(Industrial Automation & Robotics) with Honours.

by

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This report is submitted to the Faculty of Eletrical Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Pada masa kini, Drone menjadi semakin popular dari setiap perspektif dan ini telah menyebabkan harga drone menjadi lebih murah dan teknologi untuk drone bertambah baik dan drone telahpun menjadi lebih mudah diakses oleh orang awam. Drone biasanya dikawal dengan menggunakan joysticks, alat kawalan jauh atau aplikasi mudah alih. Beberapa isu penting yang berkaitan dengan pendekatan ini adalah bahawa kawalan drone agak rumit dengan menggunakan pengawal yang ada pada masa sekarang. Dalam kajian ini mencadangkan penggunaan gerakkan tangan sebagai kaedah untuk mengawal drone. Penggunaan Arduino diselidiki untuk mengadakan cara komunikasi yang dapat mengurangkan agen komunikasi antara drone dan operatornya. Rangka kerja yang dicadangkan melibatkan beberapa bahagian. Pertama ialah tindakan muktamad yang akan diambil di mana suatu pemancar berasaskan Arduino yang akan dipakai di tangan pengguna. Keduanya ialah penerima yang dapat menerima isyarat yang diberikan dari tangan pengguna dan akhirnya proses penukaran data yang diterima dari tangan pengguna ke dalam drone dan seterusnya drone dapat bertindak seperti berlepas, bergolek ke kiri dan kanan, melangkah ke hadapan dan ke belakang dan sebagainya. Satu siri eksperimen telah dijalankan untuk mengukur ketepatan data yang diberikan dari tangan pengguna. Ketepatan klasifikasi menunjukkan bahawa pemancar yang dipakai oleh pengguna dapat menghantar satu set nilai yang dikira tepat dalam tahap tertentu. Kesalahan peratusan adalah kurang daripada 1% untuk setiap kategori.

ABSTRACT

As hobby and commercial drones become ever more popular, their prices become cheaper, their technology improves and they become ever more accessible to people. Drones are conventionally controlled using joysticks, remote controllers, mobile applications, and embedded computers. A few significant issues with these approaches are that drone control is quite complicated by using the existing controller at present. In this study the use of hand gestures as a method to control drones is proposed. The used of Arduino is investigated to develop an intuitive way of agent-less communication between a drone and its operator. The proposed framework involves a few key parts toward an ultimate action to be taken where they are an Arduino based transmitter that will be wore on the users' hand, receiver that can receive the signal given from the users' hand and finally conversion of data received into actionable drone movement, such as takeoff, rolling to the left and right, pitching forward and backward and so on. A set of gestures are studied in this work. A series of experiments are conducted to measure the accuracies of data given by specific degree of users' hand. Classification accuracies show that the hand gesture transmitter gets to transmit a set of precise value within specific degree. The error of percentage is less than 1% for each category as well.

DEDICATION

I dedicate my dissertation work to my beloved guardian and relatives whose uplifting statements and conjointly for their unending affection, support and fortification all through the entire time of finishing my composed reports. I as well express a feeling of gratitude to my kind and strong, undertaking supervisor Madam Madiha Binti Zahari who has interminably and constantly upheld me, by listening to my problems all these times. I also dedicate this dissertation to my many friends who have supported me throughout the process. I will always appreciate all they have done. I confer this work and give exceptional due to all the general population that has helped me through the complete four year university education venture at direct or in a roundabout way.

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INTRODUCTION

1.0 Introduction

This particular chapter basically presenting about the idea of project and has briefly explaining about Hand Gesture Controlled Quad-copter. The contents in this chapter include background, problem statement, objective, project scope, project significance, thesis outline and expected result. Every single topic in this chapter leads to the basic idea of the project.

1.1 Background

UAV where it means Unmanned Aerial Vehicle, it is the aircraft that do not carry any human being while flying. These vehicles could be controlled automatically or simply by remote control for a long time with the condition of not exceeding the certain range of speed and height.

UAS meanwhile is being known as Unmanned Aircraft Systems, whereby is the aircraft that do not require a single instruction from the pilot to be functioned. Remotely Piloted Aircraft System, RPAS in short, is also known to be manipulated variable which includes piloted aircraft that has to be controlled remotely, the correlated remote pilot station, necessitated order and also the command links or several system elements are needed during operational. The operation of drone can be done by an organization or a person to be in charge. [1]

Dated back to the year which is in the mid of 18th century, development of drone has emerged. Hence, drones are no longer a current trend. However, the development of it in the market of civil is surprisingly latest. Drones are being one of the quickest developments and have been used widely especially in countries such as the European Aviation Safety Agency which is EASA in short. For examples, drones are to be used in inspection of infrastructure or monitoring wind energy. Moreover, they are being created by companies like the SME which is known as Small Medium Enterprise or the companies of classical aviation. Contemporarily, quad-copters have become the rather popular research in the UAV, where they adopt electronic control as well as sensors to balance the aircraft. The quad-copter can be function in both condition of indoor and outdoor due to the relatively tiny in size and agility. [2]

Quad-copters do not need mechanical linkages to adjust the motor blade tilt angle while spinning and this could simplify the maintenance and the design. Then, the application of four motors could allow smaller diameter and thus minimal kinetic while on board could be achieved. This could decrease the level of damage if the motors ever hit anything. Furthermore, there are frames to cover the motors for majority of the smaller size quad-copters and this allowed the quad-copter to function even through a rather harsh circumstance. Meanwhile, this incurred minimal risk of spoiling or destroying the quad-copter or the environment. [3]

1.2 Problem Statement

Quad-copter nowadays are more likely to be a hobby for some people, however quad-copter can be very useful if it is used under the right condition. Currently, numerous natural disasters such as floods and landslides can be very unpredictable and when it happens, the authorities have difficulty in carrying out the 'search and rescue' operation because they could not get the real picture behind the scene or situation.

However, with the help of the quad-copter, the authorities are able to overcome the problem of limited access of view as the quad-copter is able to fly to the scene and identify the actual situation and provide live aerial feedback video that can be seen on any screen. Besides, quad-copter has the potential to enter into a hazardous area which automatically will overcome the problem for human not being able to get near that area. Apart from that, quad-copter also has the potential in the field of private security, agricultural practices, products transport and others.

The issues that we are facing at the moment are quad-copter is hard to fly for inexperience user, and the consequences of not being to pilot the quad-copter properly are wasting a lot of time in order to act the required activities, bring damage to drone or the environment and most importantly safety to the pilot and the bystanders. In order to solve the problem, people start to create new easier version of controlling method such as hand gesture control method but the problem is hand gesture control system used more medium and a more complex system compare to existing control method.

Quad-copter that this project proposed is able to control by hand gesture or movement without many kind of medium and less complex system which is an easier

version of controlling method so that it will be more user friendly compare to the existing traditional controller and existing hand gesture control method and hence authorities can react faster in the process of observing specific area. Besides, the proposed method will be cheaper compare to the existing method as the proposed idea required less equipment and less complex system.

1.3 Objective

In the construction and completion of this project there are several objectives.

- To design and develop a hand gesture controlled drone.
- To analyze the performance of the hand gesture controlled drone

1.4 Project Scope

Several activities will be discussed individually such as understanding about the materials and components that will be used in the project. Then, develop the hardware and program the Arduino Nano. The project functions where the movement of the user's hand will become signal that being sent to receiver on the quad-copter. After that, once the receiver detects the signal sent by the transmitter on the controller, the system will decide every motor's job in order to let the quad-copter to move in required direction. The scopes of the project will be:

- Development of the controller that will be placed on the hand of the user.
- Program that will command the motor's movement and direction after receive signal that sent by user's hand gesture.

1.5 Project Significance

This project will be a significant endeavor in promoting hand gesture control method that can make our daily life easier and better. This project will be beneficial to all kind of controlling area.

1.6 Thesis outline

The thesis contains five chapters which include the introduction of this project, literature review which is known to be studies or research conducted previously that are relative with the project, the right ways that adopted to imply necessary knowledge into this project, data result get from testing the prototype and lastly conclusion and recommendation for overall of thesis.

Chapter 1: Chapter one focused on the introduction of the project, problem statement which could improvise the entire project outcome, the aims and the scope of project as well as the project significance and outline of the thesis.

Chapter 2: This chapter discussed about the studies of the literature review where the previous works or researches that were conducted by the other researchers. This chapter is important as the studies of other's work helps to understand more about concept and theory and hence obtain more specific knowledge about the project. This chapter also briefly discussed the development and evolution related with the project.

Chapter 3: This chapter discussed the methodology which consist of flowchart of whole project and the information about the component and materials that will be used in project developing in order to solve the problem statement.

Chapter 4: This chapter discussed the data collection from testing the prototype in the project developing process. Besides, there is comparison made between different product and prototype.

Chapter 5: This chapter consist the overall of the project discussion which included recommendation and improving steps that can be made in order to improve future works and innovation.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The chapter contained constructive information which is relevant towards the project which could help in further explaining and to enhance knowledge regarding to the Hand-Gesture Controlled Quad-copter. These references are generally based on reliable sources such as researches and studies conducted previously whereas every of these sources comprise contrasting method as well as concept in controlling the quad-copter. In order to obtain deeper understanding and knowledge in developing a prototype for the project, analysis is necessary to determine the optimum methods and materials that are to use. This study elements emphasis on journals and thesis conducted previously which are similar to the current project, to be used as an indication.

2.1 Related Previous Project Work

These are the chosen example of journals and thesis that are relative to the Hand-Gesture Controlled Quad-copter. There is variety of components, materials; concepts as well as ideas can be found in these references that put in sync with the project that is to be developed. Therefore, these have been chosen to use as the references for the project-Hand-Gesture Controlled Quad-copter.