

GLOVE CONTROL HELICOPTER

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Bachelor of Electrical Engineering

(Control, Instrumentation & Automation)

June 2013

“I hereby declare that I have read through this report entitle “*Glove Control Helicopter*” and in my opinion this thesis is sufficient in terms of scope and quality for awarding the degree of *Bachelor of Electrical Engineering (Control, Instrumentation & Automation)*”

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**A report submitted in partial fulfilment of the requirements for the degree
of Bachelor of Electrical Engineering (Control, Instrumentation & Automation)**

**Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

2013

I declare that this report entitle “Glove *Control Helicopter*” is the result of my own research and work, except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

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Date : 19 June 2013

To my beloved parent and family

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ABSTRACT

This project discusses on development of Glove Control Helicopter. Glove control helicopter basically is a prototype device that will replace the normal joystick controller that used to control remote control (RC) helicopter. The original controller operated using two hands to control two joysticks located on the controller in order to control the movement of helicopter. Common experience shows that normal joystick controller require more skill, familiarity and well know the joystick controller in order to control the RC helicopter. Not being able to handle it properly or mishandle it may damage the helicopter due to crashes. Crashed helicopter will cost a lot of losses. Glove Control Helicopter was introduced in order to reduce failure in controlling the helicopter. This project focuses on development of system that will capture human hand gesture as signal to interact with machine. Glove is the device that been used in this project to capture human hand gesture. It measures the movement of human wrist and finger and converted it into electrical signal. In this project sensor that been used to achieve measuring of human hand movement is accelerometer and flex sensor. Middle finger movement captured using flex sensor meanwhile wrist movement captured using accelerometer. A microcontroller is used in this project to interpret data receive from both sensor. The glove controller operated by converting hand-gesture signal into electrical signal and transmits it to the helicopter receiver. The project starts with research and study on RC helicopter joystick and hand gesture controller. Then it continues with designing, checking the design and constructing prototype of glove control helicopter. The last part is testing the prototype and finalizes it. The result of test conducted in this project prove that it meet the objective of the project which to convert hand-gesture signal into electrical signal.

ABSTRAK

Projek ini membincangkan tentang pembangunan “Glove Control Helicopter”. “Glove Control Helicopter” pada dasarnya adalah peranti prototaip yang akan menggantikan pengawal “joystick” biasa yang digunakan untuk mengawal helikopter kawalan jauh. Pengawal asal dikendalikan dengan menggunakan dua tangan untuk mengawal dua “joysticks” yang terletak pada pengawal untuk mengawal pergerakan helikopter. Hasil daripada pengalaman lepas menunjukkan bahawa pengawal “joysticks” memerlukan kemahiran yang tinggi, dan kebiasaan untuk mengawal pengawal “joysticks”. Tidak dapat mengendalikan dengan betul atau menyalahgunakan ia boleh merosakkan helikopter tersebut. “Glove Control Helicopter” diperkenalkan untuk mengurangkan kegagalan dalam mengawal helikopter. Projek ini menumpu kepada pembangunan sistem yang akan menggunakan isyarat tangan manusia sebagai isyarat untuk berinteraksi dengan mesin. Sarung tangan adalah alat yang telah digunakan dalam projek ini untuk menerima isyarat tangan manusia. Ia akan mengukur pergerakan pergelangan tangan dan jari manusia lalu ditukarkan ke isyarat elektrik. Dalam projek ini, sensor yang telah digunakan untuk mengukur pergerakan tangan manusia adalah sensor accelerometer dan juga sensor flex. Pergerakan jari tengah diambil menggunakan sensor flex sementara pergerakan pergelangan tangan diambil menggunakan sensor accelerometer. Mikropengawal digunakan dalam projek ini untuk mentafsir data yang diterima daripada kedua-dua sensor. Projek ini bermula dengan penyelidikan dan kajian mengenai “joysticks” helikopter kawalan jauh dan juga sistem kawalan menggunakan isyarat tangan. Kemudian projek diteruskan dengan membina rekaan, menyemak reka bentuk dan membina prototaip “Glove Control Helicopter”. Bahagian terakhir adalah ujian prototaip. Hasil ujian yang dijalankan dalam projek ini membuktikan bahawa ia memenuhi objektif projek dimana prototaip dapat menukar isyarat tangan kepada isyarat elektrik.

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LIST OF ABBREVIATIONS

- RC - Radio controlled
- PWM - Pulse width modulation
- V - Volt
- V_{noise} - Noise voltage
- PPM - Pulse-position modulation
- PCM - Pulse-code modulation
- V_{in} - Input voltage
- V_{out} - Output voltage
- R - Resistor
- C - Capacitor

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CHAPTER 1

INTRODUCTION

This chapter is an introductory opening on the project that had been designed, developed, implemented and tested. The project is to successfully develop Glove Control Helicopter which is a controller that used hand gesture to operate the radio-controlled (RC) helicopter. The chapter begins by explaining the fundamental of radio-controlled helicopter and follow by the problem statement which arises from the use of ordinary joy-stick remote control. The project objective is then laid. Finally the scope of the project is explained.

1.1 Introduction

There are currently many type of radio-controlled helicopter that been developed for many purpose such as remote observation or inspection, low altitude aerial photography, and filming. The radio-controlled (RC) helicopter is a small scale of actual helicopter and its performance can be equal to actual helicopter with differences in controlling method which using joy-stick remote control. The original joy-stick remote control operated using two hands to control two joy-sticks located on the controller in order to control the movement of helicopter. This joy-stick converted its movement into electrical signal and transmits it to the helicopter receiver to control the helicopter.

The motivating force behind the concept of this project design is based on the physical challenge faced by the user. Common experience shows that normal joystick controller require more skill, familiarity and well know the joystick controller in order to control the RC helicopter. Not being able to handle it properly or mishandle it may damage the helicopter due to crashes. This project is thus focus on finding solution to alleviate the physical challenge faced by the user.

1.2 Problem Statement

Remote control (RC) helicopter is a fun hobby that currently being popular in the society. In order to controls of the RC helicopter well, it takes a lot times and intuitive for a person to master it. Not being able to control it well or mishandle it may result damaging the RC helicopter. Although majority of the RC helicopter being made by metal, some parts may get damage from crashes. The spare parts are widely available but the replacement part costs are expensive in order to restore it.

Common experience shows that normal joystick controller require more skill, familiarity and well know of the joystick controller in order to control the RC helicopter without resulting crash or damaging the helicopter. Many user need to take short classes or flying some simulation of remote control helicopter before able to fly it. Therefore a controller that needs less skill and familiarity obviously wishes by user the eager to fly a remote control helicopter.

Throttle value indicate the level of each movement of the helicopter. As a matter of fact more throttles will make handling and keeping helicopter on track a lot easier then less throttle value. If a controller has less throttle value, the movement of helicopter will not move as user command because it may move less or more then what the user need.

1.3 Project Objective

An introductory study on the basic principles involved in hand-gesture to control movement of RC helicopter. This achieved by converting the hand-gesture signal into electrical signal. This electrical signal then used to control the RC helicopter which include throttle value to control the level of movement or speed that will transmitted to the receiver of RC helicopter. From the early designing stage until the final implementation, the project focuses on fulfilling the following objectives:

- To design and implement device that detect hand-gesture and turn it into electrical signal.
- To construct an electronic circuit that will gather and evaluate electrical signal from hand-gesture and produce throttle level.
- To develop an electronic circuit that will gather and transmit signal to RC helicopter.
- To perform an overall combination of hardware and software that enable to control RC helicopter.

1.4 Project Scope

In order to achieve the objective the scope of the project is narrowed down and focused on developing a glove that able sense movement of middle finger and wrist movement. The glove consist of sensory circuit to detect the bend angle of middle finger and turn it into electrical signal using flex sensor that will be place on middle finger of the glove. The glove also consists of sensory circuit to detect motion from hand wrist in 2 axes and turn it into electrical signal. Sensory circuit to detect motion from hand is done by placing accelerometer sensor on the upper side of the glove to measure the wrist movement. The prototype device should operate using a battery since it will be remotely control the helicopter and the final design usage must be able to be applied and user friendly.

CHAPTER 2

LITERATURE REVIEW

This chapter provides the review of present invention of remote controller that using hand gesture to control movement of desired mechanism in journals from various references. At the same time this chapter also reviews the component that been used in this project. Contain of this chapter focus on study of hand gesture mechanism and remote controlled helicopter related to its design, component and criteria need to be taken into consideration when evaluating gesture capture devices.

2.1 Remote-Controlled Helicopter

Radio-controlled or remote controlled (RC) helicopters are model of full-sized helicopter that capable to perform most of the same action as full-sized helicopter. In radio control model, the most challenging is probably controlling a radio controlled helicopter. This is due to its complicated mechanical design and need a lot of concentration during operation. The controls of helicopters are affected by servo motors that used to control the tail rotor and the main rotor rotation. The servo is controlled by radio signal that modulated in Pulse-position Modulation (PPM) or Pulse Code Modulation (PCM). The pattern of bit stream scheme is transmitted as digital encoded number to command the position of each servo and had been designed by the manufacturer with various level of precision.