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PC-based helicopter controller / Zainab Shahril.

## **PC- BASED HELICOPTER CONTROLLER**

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**Beke**

**2009**

# PC-BASED HELICOPTER CONTROLLER

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Degree of  
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April 2009

“I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)”

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Date

: 8 May 2009

“ I hereby declared that this report is a result of my own work expert for the excerpts  
that have been cited clearly in the references”

Signature

 .....

Name

: ZAINAB BINTI SHAHRIL

Date

: 8 May 2009

*Special dedicated to  
My beloved parents and siblings, who have encouraged, guided and supported me  
throughout my study life.*

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Thank you..

## ABSTRACT

This project describes a software environment for simulating and visualizing high-performance helicopter systems. The environment also accommodates data exchange with MATLAB. This can use MATLAB software on personal computer directly to the helicopter. The ability of this project is to control the helicopter by using the computer as well as remotely. This project is continued from the previous project. Which the previous project used the 4 channel transmitter to hanging in the air, up and down and moving forwards and backwards. According from the previous project, this project need to upgrade the helicopter by used control variable resistor to control DC motor movement. By control the speed of DC motor movement, the maximum and minimum height of helicopter flying can be controlled. The project has been divided into 2 main parts; helicopter model (hardware), and software (GUI). Parallel communication is used to interface with the computer.

## ABSTRAK

Projek ini menerangkan suatu persekitaran perisian untuk mensimulasi dan menvisual sistem helikopter berprestasi tinggi serta ia juga menempatkan pertukaran data dengan MATLAB. Perisian MATLAB digunakan secara langsung untuk helikopter ini. Projek ini berkeupayaan untuk mengawal helikopter menggunakan komputer. Projek ini merupakan projek yang diteruskan daripada projek lalu dimana projek yang lalu menggunakan 4 saluran pemancar iaitu berfungsi untuk terbang di udara, naik dan turun serta hadapan dan kebelakang. Projek yang dihasilkan ini merupakan peningkatan daripada projek yang lalu di mana litar yang berfungsi sebagai perintang boleh ubah digunakan untuk mengawal kelajuan pergerakan motor DC. Kelajuan maksimum dan minimum pergerakan motor DC dapat dikawal dengan menggunakan litar ini. Projek ini dibahagikan kepada 2 bahagian utama iaitu perkakasan helikopter dan perisian (GUI). Penggunaan 'parallel port' sebagai antaramuka dengan komputer digunakan dalam projek ini.



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**LIST OF SHORT FORM**

<b>PC</b>	-	Personnel computer
<b>DC</b>	-	Direct Current
<b>GUI</b>	-	Graphical User Interface

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.0 Project Introduction**

This project is continued from the previous project. Which the previous project used the 4 channel transmitter to hanging in the air, up and down and moving forwards and backwards. The project has been divided into four main parts; hardware (transmitter), helicopter model, remote control and software (MATLAB). The computer is interfaced to a transmitter on the helicopter by a parallel connection. This can use MATLAB software on personal computer directly to the helicopter compare to the use remote control. The ability to control the helicopter using by computer as well as remotely.

According from the previous project, this project need to upgrade the helicopter by used control variable resistor to control DC motor movement. By control the speed of DC motor movement, the maximum and minimum height of helicopter flying can be controlled. The project has been divided into 2 main parts; helicopter model (hardware), and software (GUI). The development of graphical user interface (GUI) will be implementing in this project by using Matlab Programming. Parallel communication is used to interface with the computer.



## 1.1 Objective of Project

To realize this project, the project objectives have been completed in the duration time given. The project objectives were:

- i. To design network resistor circuit that can communicates with PC.
- ii. To control the speed of DC motor.
- iii. To interface between helicopter and PC using parallel communication
- iv. To created user friendly graphical user interface (GUI)

## 1.2 Scope of the project

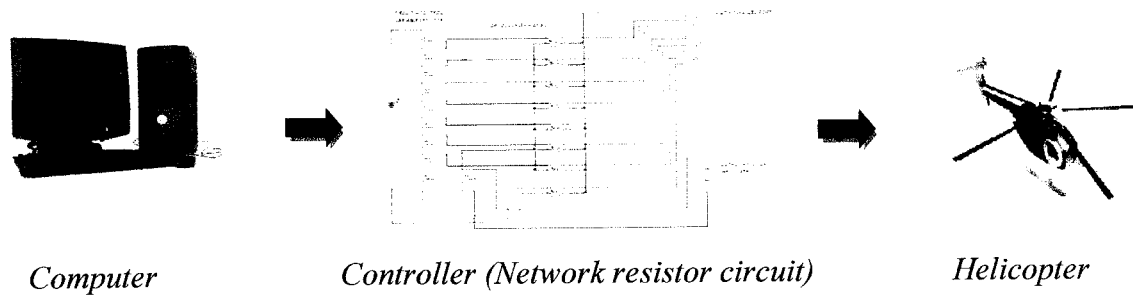


Figure 1.0 : Flowchart scope of project

This project will focus on the design network resistor circuit and graphical user interface (GUI). This project consists of 2 parts which a software part and hardware part. The ability of this project is to control the helicopter by using the computer as well as remotely. This can use MATLAB software on personal computer directly to the helicopter compare to the use remote control. A simple user interface runs on the target PC and displays information on the status of the target application while it runs. It also displays signal traces. A simple command-line interface to execute commands for control and parameter tuning directly from the target PC. Figure 1.0 shows that the flowchart scope of project.

Circuit of network resistor is designed which can communicate with PC purpose to control speed of DC motor movement, the maximum and minimum height of helicopter flying can be controlled. A parallel port will be used as the connection between the helicopter and computer. The development of graphical user interface (GUI) will be implementing in this project by using Matlab Programming.

### **1.3 Problem Statement**

This project is designed to assist human see the problem has happened at tower station before committing repair jobs. Besides that, this project is applicable in the military field namely as spy to see state something the area is in safe condition. This project can also help people to view the damage on something place of the yang difficult to be achieved before make reparation works if had been damage. Camera to be fitted to helicopter stated as surveillance.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Overview**

This chapter reviews existing project created to get an idea about the project design, conception and any information that related to improve the project. This chapter also explains and discuss about source or article that related to the project. It is consist of the products that have been appeared in the market nowadays. This chapter is also contained the theory of the components, equipments and programming languages that is used in the project.

#### **2.1 Review of Previous Design**

It is important to have a review on the past designs so that study can be done on advantages and disadvantages of the designs and its shortcomings can be improved. This will prevent the repetition of the same design process, and further modifications can be made in order to make the new design become more effective and interactive.

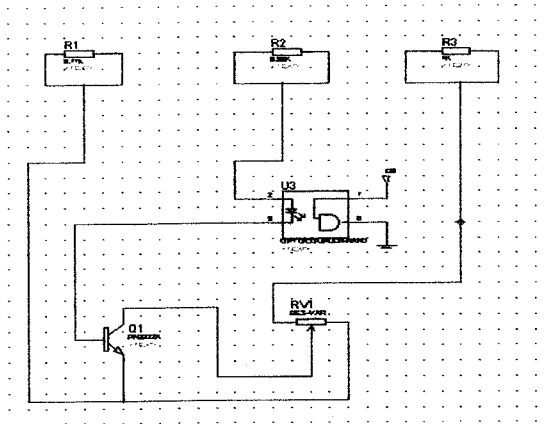
### **2.1.1 PC-Based Helicopter Controller.**

This article (Appendix A) is about design and implement of PC-Based Helicopter Controller. The movement of helicopter is controlled by the remote controller via standard radio frequency (RF) wireless communication. The remote controller is attached with servo motor to control the helicopter movement by adjusting the position of servo motor rotor as per user command using the MATLAB software. The digital camera is attached to the helicopter for purpose of image recording. The image signal is transmit through wireless communication using standard RF communication to the image acquisition device which is PCI TV tuner card for visualization. Although the helicopter is attached with wireless camera, however, the data transfer used is parallel port which only provided in personal computer.

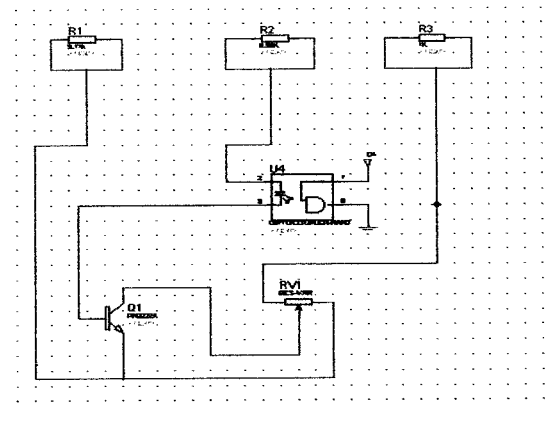
#### **2.1.1.0 Hardware Circuit Development**

The previous development circuits use 4 optocoupler because the model of the project is 4 channels helicopter. The circuits are moving up circuit, moving down circuit, move left and right circuit, and stop circuit as per Figure 2.0. The signals are measured against the power (+5V) supply from PC at PIN 1. If normal signal is high (against ground) it is low against power (+5V). The transmission is standard based at a transmission via current and not voltage. 0 means no current and 1 current flows. This is realized with a optocoupler . The normal current of an optocoupler is between 5 and 25mA. To guarantee this current (not more), in the lines are resistors of 220 Ohm. There is one at the OUT and one at the IN. Often there is also one at the second line PIN 4. So is a current of maximal 12mA guaranteed and a security against short-circuit. Normally the TTL (5V) logic is measured against the ground (-pol). So there is a high level (higher than 3V) and a low level (lower than 1V). This is in the language of the computer 1 or 0. For every step moving circuit all the same but different at resistor value.

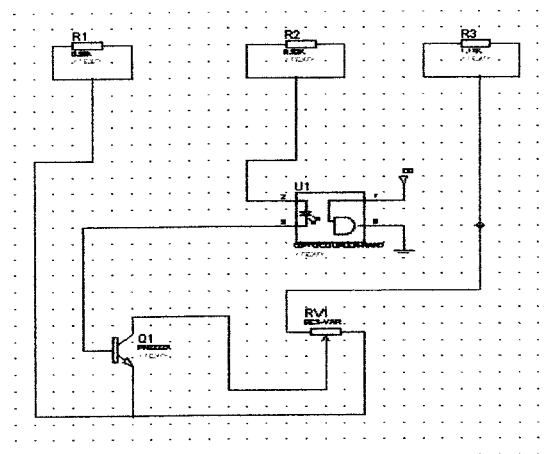
Moving up circuit and moving down circuit in Figure 2.0 are used as a reference to develop network resistor circuit. The network resistor circuit functions as control variable resistor to control speed of DC motor movement (maximum to minimum and minimum to maximum).



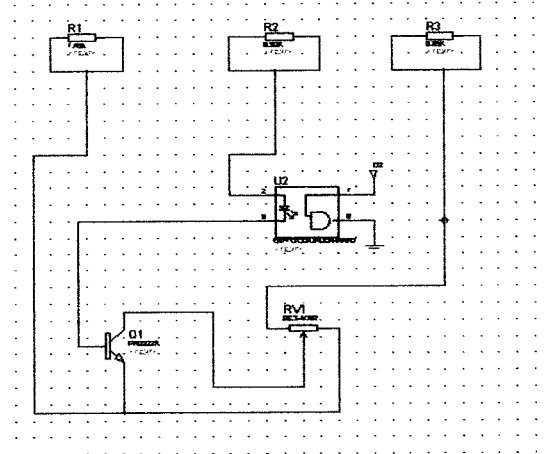
Moving up circuit



Move left and right circuit



Moving down circuit



Stop circuit

Figure 2.0 : Circuit of previous project

### 2.1.2 RCHeli: Infrastructure For PC-Controlled Micro Helicopter

The previous PC controlled micro helicopter project have done by Brown University to have a stable, extensible system that allows controller to control the micro helicopter and further become a basis of autonomous flights[1]. In this project, they use several commercially available components to set up a basic system that is capable of integrating controller and camera vision. The architecture consists of an RC helicopter, PCTx device, DX6 transmitter, a wireless camera, and a Wiimote controller. The architecture of RCHeli system is shown in Figure 2.1. This system is currently rather incomplete; however, it has great potential to be extended into many different capable directions, such as Unmanned Aerial Vehicle (UAV) project.

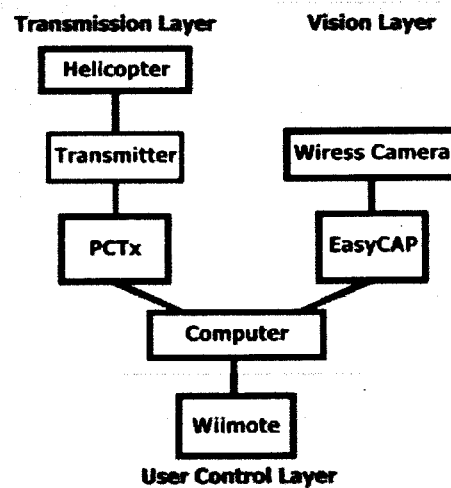


Figure 2.1: Architecture of RCHeli system

Different with PC based helicopter controller project, circuit of network resistor is designed to control DC motor speed (maximum to minimum and minimum to maximum). Matlab programming, Graphical User Interface (GUI) is use as interface between PC and helicopter. GUI used to control the circuit by using the parallel port and helicopter is controlled when command given.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.0 Introduction**

This chapter will discuss on the method that will be used to achieve the objectives of the project. Methodology is a part will explain about the project path from the beginning until it is completed. Every selection and action that has been done while implementing the project must be explains in stages. This methodology must be done to make sure the project that consists of hardware and software development will be developed systematically, smoothly and successfully.

#### **3.1 Methodology of the project**

There are several phases or methods to be used to achieve the objectives of the proposed project. The first method is literature review of the project. It is important to gain more information of the idea and concept of this project. The information that related to the project is found from journals, articles, books, internet, etc. The information is all about the helicopter concept, MATLAB software, control variable resistor to control DC motor movement, etc. Then, the second method is designed the hardware circuit to connect to PC. Finally, the last method is software development and implementation which is use MATLAB programming.

### 3.2 Project Flow

Figure 3.0 shows the workflow for completing the operation of PC- based Helicopter Controller.

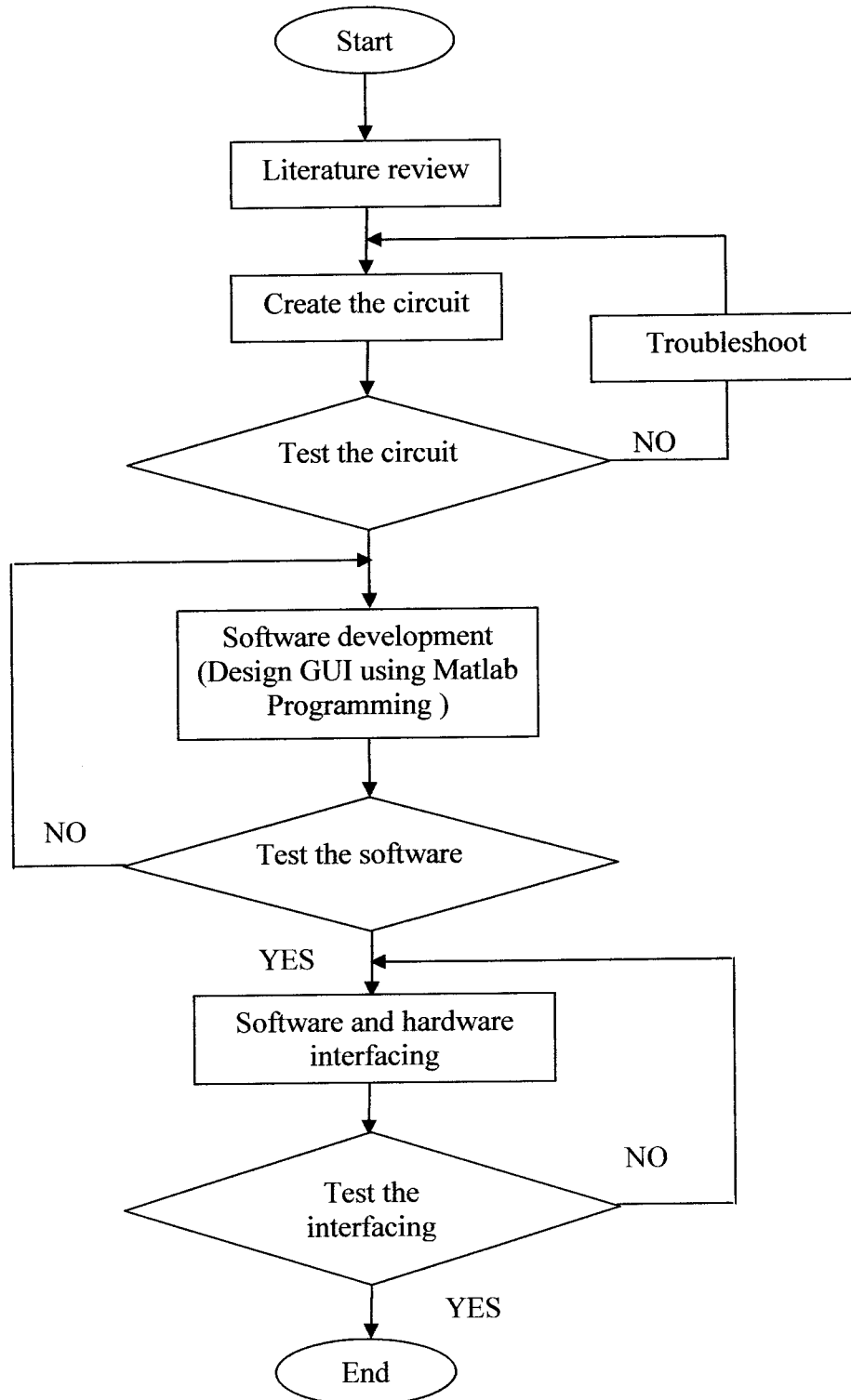


Figure 3.0: The Flow Chart Methodology