MOTORIZED PAN-AND-TILT CAMERA HEAD

NOR AZAM BIN CHE SOH

Final Year Project Report is submitted in partial fulfilment of the requirements for the degree of
Bachelor of Engineering (Hons) Electronics Engineering

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

ABSTRACT

The purpose of this project is to design and develop a motorized pan-and-tilt camera head that can be remote controlled using a joystick with the aim to help cameraman control the camera from a distance and produce fluid motion. This is done by using LabVIEW software and MyRio as microcontroller. The design of the pan-and-tilt camera head equipped with two servo motors which are for panning and tilting respectively. The servo motors are supported by servo brackets. The choice of servo motor used directly affects the stability of the pan-and-tilt movement, therefore an analysis of the selection of servo motor was done to determine the suitable servo motor based on the camera used. It is observed from the datasheet that MG995 is suitable for the prototype of this project. The pan-and-tilt camera head was able to pan-and-tilt from 0° to 180° respectively. It can be remotely controlled using a joystick which is connected wirelessly. The pan-and-tilt was successfully implemented in a smooth manner.

ACKNOWLEDGEMENT

Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this thesis. Special appreciation goes to my supervisor, Azraa A'fhzan Ab Rahim, for her supervision and constant support. Her invaluable help of constructive comments and suggestions throughout the experimental and thesis works have contributed to the success of this project.

I would like to express my appreciation to my brother, Mohd Norhisham Bin Che Soh for all the guides in making virtual instrument programs and also moral support.

Also, thanks to all my friends, those who have been contributed by supporting my work, giving ideas and help me during this project started till it is fully completed.

Last but not least, my deepest gratitude goes to my beloved parents; Mr. Che Soh Bin Che Wel and Mrs. Ramlah Binti Abdullah for their endless love, prayers and encouragement. To those who indirectly contributed in this research, your kindness means a lot to me. Thank you very much.

TABLE OF CONTENTS

		Page
AUTHOR'S DECLARATION		**ii**
ABSTRACT		**iii**
ACKNOWLEDGEMENT		**iv**
TABLE OF CONTENTS		**v**
LIST OF TABLES		**vii**
LIST OF FIGURES		**viii**
LIST OF SYMBOLS		**x**
LIST OF ABBREVIATIONS		**xi**
CHAPTER ONE INTRODUCTION		**1**
1.1	Research Background	1
1.2	Motivation	2
1.3	Problem Statement	2
1.4	Objectives	2
1.5	Scope of Work	3
1.6	Thesis Organization	3
CHAPTER TWO LITERATURE REVIEW		**4**
2.1	Introduction	4
2.2	Literature on Pan-Tilt Mechanism	4
2.3	The study of DC electric motor	6
2.3.1	Servo motor	7
2.3.2	Mechanical Overview of Servo Motors	10
2.3.3	Radial Vs Axial Flux Servo Motors	12
2.3.4	Electrical Overview of Servo Motors	12
2.3.5	Servo Motor Control Methods	15
CHAPTER THREE RESEARCH METHODOLOGY		**17**
3.1	Flowchart	17

CHAPTER ONE
INTRODUCTION

1.1 Research Background

The present innovation relates to a pan-tilt unit for basic positioning task or aiming a camera. In the film and television industry there are many situations that involve hazards, lack of space and conditions that force the camera to be controlled remotely, either via a remote control or even applications that eliminates the need for a cameraman to be physically holding the camera [1]. In some other instances, the cameraman might be unable to control the camera using the existing tripod.

These instances justify the incorporation of a new mechanism for the panning and tilting of the camera instead of the existing regular tripod. In this paper, a new mechanism is proposed, in which a servo motor is attached to each pan-and-tilt axis. The pan-and-tilt camera head is then controlled via a joystick by a cameraman to point at the desired angle [2].

There is a limitation for the cameraman to pan-and-tilt camera evenly and precisely to pursue on-going action. Motorized pan-and-tilt camera head will provide cameraman new experiences by introducing remote camera controls. This camera head no longer needs to be controlled directly on the holder of the tripod by hand. In contrast, motorized pan-and-tilt camera head can be remotely controlled using automation system using remote control or joystick [3].

There are bound to be unwanted effects when the tripod is handled manually [4]. It often leads to uneven and irregular camera movement. This is due to surrounding factors such as fatigue, insufficient space for handling tripods and overheating or cold temperatures that interfere with the focus of the cameraman. Besides that, unsuitable filming environment also contribute to difficulty in manually operating the panning and tilting of the camera. However, it can be argued that automating the pan-and-tilt movement may not provide the same visual aesthetics as an experienced cameraman. Nevertheless, when the inconvenient environment presents itself, for example when space is insufficient or harmful to the cameraman, this system offers a viable solution by allowing the cameraman to control the camera remotely [5]. The result from this