"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for award of Bachelor of Engineering Mechanical With Honours."

Signature : ..……

Supervisor's Name: MR. ZAIRULAZHA BIN ZAINAL

Date : ……..

GANTRY CRANE WITH ON –OFF MOTOR COMMAND : DESIGN AND IMPLEMENTATION

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"I hereby declare that this report is the result of my own work except for quotes as cited in the references."

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ABSTRACT

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The use of gantry crane systems for transporting payload is very common in building constructions. However, moving the payload using the crane is not an easy task especially when strict specifications on the swing angle and on the transfer time need to be satisfied.This project are only involved the development of the lab scale gantry crane by study the behaivour and the part related as well to the project.The hardware development will be interface with software development to get result. The actual gantry crane system will be interface with the Visual Basic Programming.

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LIST OF SYMBOLS

M	- Trolley mass
m	- Payload mass
l	- Length of the hoisting rope
F_x	- Input force
G	- Gravitational acceleration = $9.81 ms^{-2}$
G	- Centre point
S	- Point of suspension
x	- Trolley position
$\dot{x}$	- Velocity
$\ddot{x}$	- Acceleration
θ	- Sway angle
$\dot{\theta}$	- Angular velocity
$\ddot{\theta}$	- Angular acceleration

LIST OF ABBREVIATIONS

A/D	- Analog-to-digital
CPU	- Central Processing Unit
D/A	- Digital-to-Analog
DAQ	- Data Acquisition Board
DC	- Direct Current
EEPROM	- Electrically Erasable Programmable Read Only Memory
EIA	- Electronic Industries Alliance
FFT	- Fast Fourier Transform
I/O	- Input / Output
MCU	- Microchip Microcontroller
NI	- National Instruments
PIC	- Peripheral Interface Controller
RAM	- Random-Access Memory
RTW	- Real Time Workshop
RS	- Recommended Standard
ROM	- Read-only Memory
SNA	- Specified Negative Amplitude shaper
UMZV	- Unity Magnitude Zero Vibration Shaper

LIST OF APPENDIXS

CHAPTER I

PROJECT INTRODUCTION

This chapter will be discussed about the design and implementation of lab scale gantry system with on-off motor commands mechanism. The project introduction, project objective, problem statement, and scopes of work and methodology will also be presented.

1.1 Introduction

Gantry cranes are widely used for transporting heavy loads and hazardous materials in building constructions. The crane should move the load as fast as possible without having any excessive payload motion at the final position. However, most of the common gantry cranes result in a swing motion when payload is suddenly stopped after a fast motion. The swing motion can be reduced however; it is often time consuming processes which eventually affect the productivity (operational efficiency) in building constructions.

This project attempts to design the actual gantry crane system and interface it with visual basic programming. This project also covers about the hardware development of the lab – scale gantry crane which is consist the mechanical and electronic parts. The objective of the project is to build up the lab scale gantry crane and do the simulation using visual Basic programming. The task also covered about the conceptual design of the lab scale gantry crane system. The selection of the appropriate

component and study electronics and mechanical parts related as well as to do mechanical drawing for gantry crane also do in this project. The development of the system is about the arrangement of the lab scale gantry crane system also discuss in this project. So the whole project are to develop the lab scale gantry crane system that can be integrated with the software and make sure to be successful.

1.2 Objective

The objective of this project is to design a gantry crane system with on-off motor commands mechanism that can move as robustness, quickly, accurately and safely as possible without vibration from an initial position to target position and also do interfacing between hardware and software for the prototype.

1.3 Problem Statement

Gantry cranes are widely used for factories, transportation, nuclear installation and also construction. The crane has to move the load as fast as possible without causing any excessive movement at the final position or during it moves. However, moving the payload using the crane is not an easy task especially when strict specifications on the swing angle and on the transfer time need to be satisfied. Moreover, the gantry crane needs a skilful and experience operator to control manually for stopping the swing immediately at the right position. Beside this, the operator also needs time to wait the string stop from vibration after movement the load. Until today, the vibrations still clarify as serious problem in a mechanical system.

1.4 Scopes of Work

While doing the project, the scope of work plays a very important role. There is a guideline which student should attain to fulfill the requirement of project. The scopes of work are listed as below:

i. Study the basic concept and the dynamic behavior of gantry crane system, sensors, DC motors, and other electronic part.
ii. Fix the weight of the load and the length of the string for gantry crane.
iii. Design the gantry crane layout by using the CATIA.
iv. Study the response of the system in term of structural analysis using COSMOSWORK.
v. Construct the gantry crane that can be use for automatic control.
vi. To do interfacing between hardware and software for the prototype and get the parameter for the position of the trolley and sway angle of the mass by using Visual Basic Programming.

1.5 Methodology (Flow Chart)

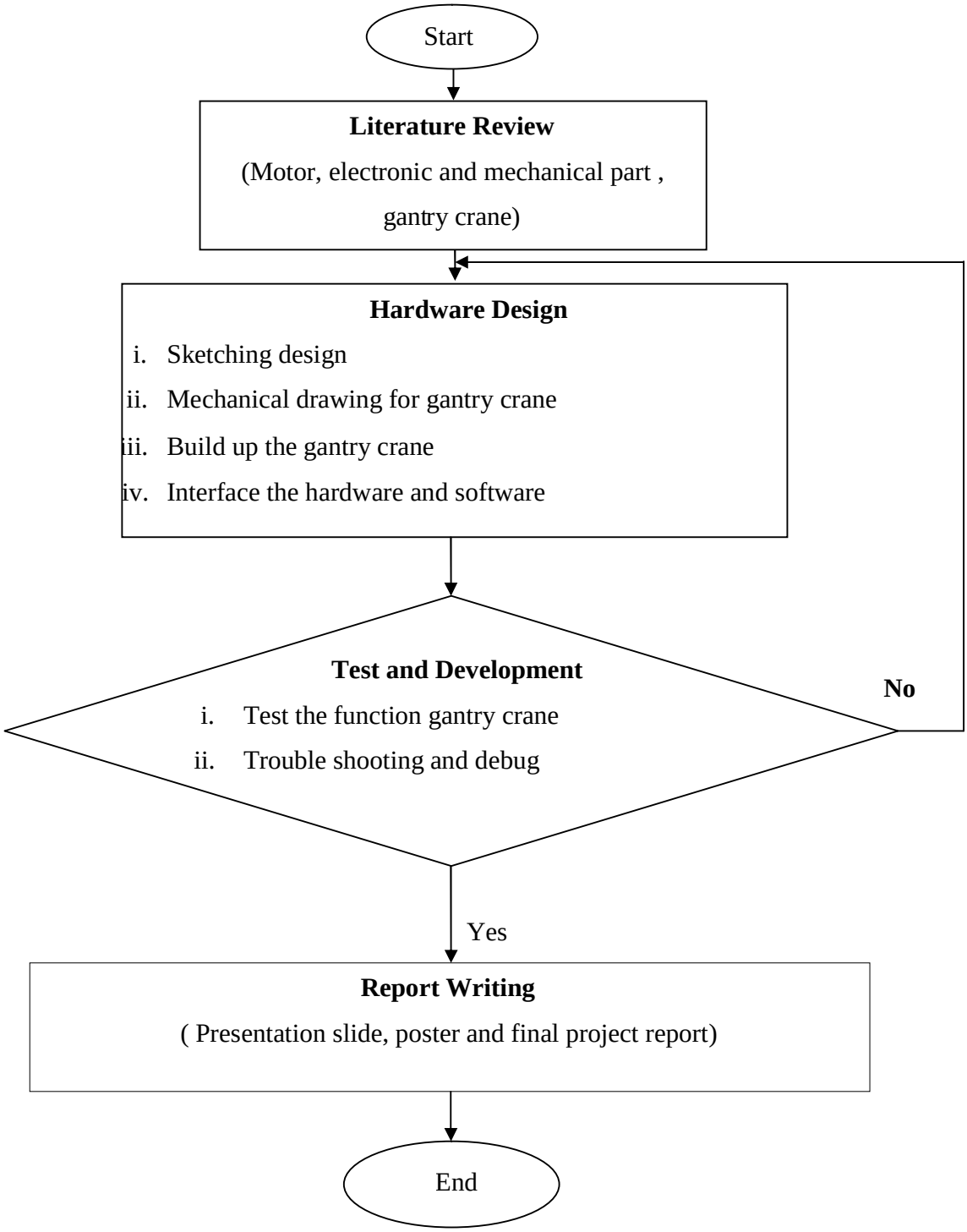

Figure 1.1 : Project flow chart

CHAPTER II

LITERATURE REVIEW

Literature review is done in this chapter to make a review of the dynamic behavior of gantry crane. This chapter also will clarify the way to choose the suitable motor and electronic part such as potentiometer, motor controller and implementation of the PC interfacing to actual gantry crane

2.1 Background of a Gantry Crane

Gantry cranes commonly used in numerous industrial applications, such as the loading and unloading of containers, nuclear waste handling facilities, factory automation and basically in any industry which requires heavy goods to be lifted and moved.

The study of the control of the crane is complex, as different industrial applications require different control systems. Some applications require a fact traversal time, and optimization motion of the cart is required. Others require very little or no swing of the goods as they are being moved. Some require that all three dynamics of the crane be optimally controlled likes load positioning swing cancellation and load height.

Gantry cranes are particularly suited to lift heavy objects in shipbuilding where the crane straddles the ship allowing massive objects like ship engines to be lifted and moved over the ship. Two famous gantry cranes built in 1974 and 1969 respectively are Samson and Goliath, which reside in the largest dry clock in the world in Belfast, Northern Ireland [1]. Each crane has a span of 140 meters and can lift loads of up to 840 tones to a height of 70 meters, making a combined lifting capacity of over 1,600 tones, one of the largest in the world [1].

However, gantry cranes are also available running rubber types so that tracks are not needed, and small gantry cranes can be used in workshops, for example for lifting automobile engines out of vehicles.