LIFT CONTROL WITH PLC
(HARDWARE)

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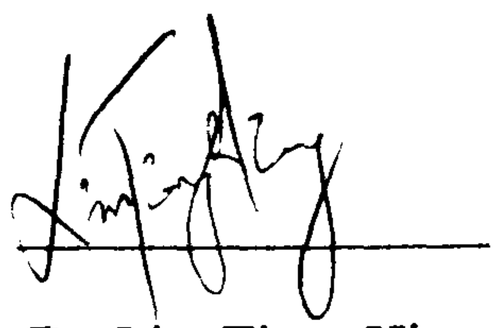
This project report entitled "Lift Control With PLC(Hardware) " was presented by TEOH KHENG CHONG as a partial fulfillment for the Bachelor of Engineering (Hons.) Electronic and Telecommunication degree program is hereby read and approved by:



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Date:

LIFT CONTROL WITH PLC

(HARDWARE)

TEOH KHENG CHONG

This report is submitted in partial fulfillment of the requirement for the degree of Bachelor of Engineering (Hons.) Electronic and Telecommunication from the

Faculty of Engineering

University of Malaysia Sarawak

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To my beloved family

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I would like to thank Tan Boon Kow, which borrow some equipment and tools to make this project a success. Lastly, I would like to forward my thanks to all those who contribute directly or indirectly to the project.

ABSTRACT

This project is a group project, which is developed by two persons. The project's specification is to design a lift structure in a 4-storey building model and use PLC as an operate system. Various research is done to design the lift structure which suitable for 4-storey building model. The building model is in a rectangular shape and it is built by transparent plastic. In side the building model, it has a pair of guide rail, which use to guide the movement of the lift car. The main components of the lift structure are dc motors, limit switches, roller guides, pulleys, gears and wire ropes. These components are selected by considering the cost, size and its functions. The monitoring panel is connected to the I/O units of PLC system. The monitoring panel uses to control the lift operation. It consists of inter control panel, outer control panel and output LED display.

ABSTRAK

Projek ini adalah berkumpulan di mana dibuat oleh dua orang. Projek ini dihendaki untuk merekabentuk dan membina struktur lif di dalam satu model bangunan bertingkap empat dan kemudian menggunakan "PLC" sebagai system operasi. Pelbagai kajian telah dilakukan merekabentuk struktur lif di mana mengikut kesesuaian model bangunan bertingkat empat itu. Model bangunan ini adalah berbentuk segiempat dan dibina daripada plastik lutsinar. Di dalam model bangunan ini, ia mengandungi sepasang penegak untuk memandu pergerakan lift. Komponen utama untuk struktur lif ini adalah dc motor, limit switch, roller guide, pulley, gear dan tali. Komponen dipilih dengan mengambilkira harga, saiz dan kegunaannya. Alat pengawal panel telah disambung ke input dan output units system "PLC". Alat pengawal panel digunakan untuk mengawal operasi lif. Ia mengandungi kawalan panel dalaman, panel kawalan luaran dan pameran output LED.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO LIFT

Lift is a hoisting and lowering mechanism equip with a car or platform that moves along guides in a shaft or hoistway in substantially vertical direction and that transports passengers or goods between two or more floors of a building. It has passenger lift, hospital lift and freight lift (Collin D. Simpsom, 1992).

Passenger lifts are designed primarily to carry persons. Hospital lifts are also passenger lifts but it employ with special cars, suitable sizes shape for transportation of patients in stretchers. Freight lifts carry freight, which may be accompanied only by an operator and persons necessary for loading and unloading it.

1.2 THE BASIC STRUCTURE OF LIFT

In a geared or gearless traction system, the lift car is supported in a hoistway by several steel hoist ropes, usually two sheaves and a counterweight. The weight of the

car and counterweight provides sufficient traction the sheaves and the hoist ropes. The car and counterweights ride along vertical guide rails to keep them from swaying.

The machinery that is used to drive the lift is located in a machine room. A multi-wire electrical cable connects from machine room to the car to feed electricity and received the signal from it.

A geared machine has a higher-speed motor and the drive sheave is connected to the motor shaft through gears in a gearbox, which reduce the rotational speed of the motor shaft to a lower drive-sheave speed.

1.3 PROJECT OVERVIEW

The main purpose for this project is to fulfill the requirement of final year thesis for program Electronic and Telecommunication. The title for this project is Lift Control with Programmable Logic Controller (PLC). It is a group project, which is developed by two persons. It consists of hardware design part and software design part. My report emphasis on the hardware design part and my partner, Miss Kueh Lee Hui will develops the ladder diagram of PLC and implements it for the lift operation.

This project's specification is to build a 4-storey building model. The building model is in a rectangular shape and it is built by transparent plastic. So, the operation of lift can be clearly view. The building is consists of only one lift structure. The lift car is build by transparent plastic. In side the building model, it has a pair of guide rail, which use to guide the movement of the lift car.

The main components of the lift structure are dc motors, limit switches, pulleys, gears and wire ropes. The function of dc motor is to lift up and lift down the car. It is also used to control the door's open and close operation. The function of roller limit switches is to detect the condition of the floor level. Meanwhile, the leaf limit switches are used to detect the door's operation. The gears transmit the motion from one rotating shaft to another and also control the speed of motion. The pulley is a machine used to lift the car. Finally, the ropes are used to travel the lift car.

In this project, Programmable Logic Controller (PLC) model OMRON C200HS-ETL11 is used to control the lift operation. It has input units, output units, CPU unit, programming console, test panels and seven segment displays.

1.4 OBJECTIVE

The main purpose of this project is to build a model of a lift operating system in a 4-storey building and implement the PLC program to control the lift operation in the building.

1.5 SCOPE OF WORKS

The scope of works is described as below:

a) Understanding the basic concept of the lift operation control.

b) Analyze the lift structure.

c) Selection of the main hardware components.

d) Design of 4-storey building model plan and lift structure.

e) Design of circuit layout for the lift structure.

f) Construction of building and lift model.

g) Implementation of the hardware components into the building model.

h) Combination of the software and hardware interface.

i) Troubleshooting and testing the lift operation.

j) Solving the errors encountered.

k) Execution of the lift operation.

l) Final report.

1.6 CHAPTERS CONTENTS

This report consists of six chapters regarding the progress of the project. The first chapter provides the overview of the project. The objective and scope of works are also mentioned in this chapter.

Chapter two explains the hardware components of the lift. It covers the general information of motors, switches, gears, car guide rails and counterweight.

Chapter three focuses on the hardware design part. The building model is designed according to the lift structure. The discussion is concentrated on the part of lift design. Then, the final selection of the lift components is also mentioned. Finally, the calculation of torque motor and velocity of gear are calculated.

Chapter four discusses the wire cabling from the I/O units to the other components in the lift structure and control panels. The testing and troubleshooting of the project are important part to ensure the completion of this project.

Chapter five mentions about the discussions. The discussions are according to the weekly planning chart and the problem encountered during the development of the project.

The final chapter summarizes the works had been done for two semesters. The recommendations also cover in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The basic hardware requirements for the lift are car, motors, roller guides, switches, gears, counterweight, pulley, guide rails and rope wires. The description for every component is provided as below.

2.2 MOTOR

Motor can be classified into two categories. They are dc motor uses for direct current and AC motor runs on alternating current.

2.2.1 DC MOTOR

Dc motors are commonly used to operate machinery in a variety of applications on the factory floor. The speed control of motor is set varying the voltage, which supply to them. Dc motors require large amounts of dc voltage for operation because dc voltage cannot be distributed over a long distance.

Figure 2.1 shows the operation of a simple dc motor. Dc motor rotates as a result of two reflections from magnetic fields. The armature acts through its coils. It has a field poles which not stationary and the armature has windings that are connected to commutator segments.

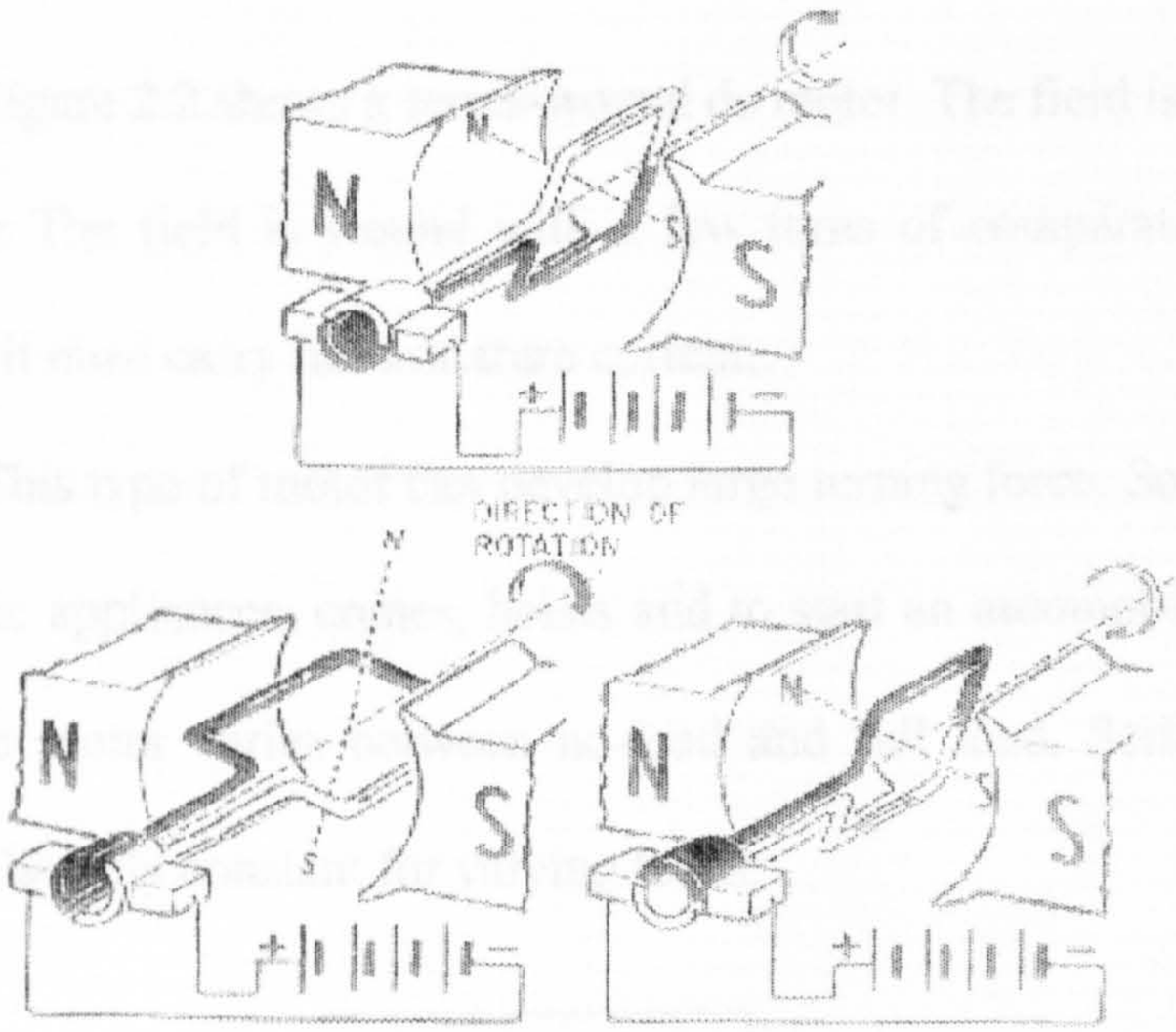

Figure 2.1 Dc motor armature rotation.

The brushes fitting on the commutator create a magnetic field according to polarity of the battery voltage. The direction of current flow through the armature is caused by the switching action of the commutator segment. The commutator continues to turn when the magnetic repel and attract to each other. The momentum of the rotating armature carries the armature past the position where the poles exactly lined up.

2.2.1.1 TYPES OF DC MOTOR

The three categories for dc motor are series, stunt and compound dc motor. Each type has a different characteristic.

Series Dc Motor

Figure 2.2 shows a series-wound dc motor. The field is connected series with the armature The field is wound with a few turns of comparatively large diameter wire because it must carry full armature current.

This type of motor can develop large turning force. So, it can be used to operate electronic appliances, cranes, hoists and to start an automobile engine. The speed of a series dc motor varies between no-load and full load. Series motor cannot be used where relatively constant for varying loads.

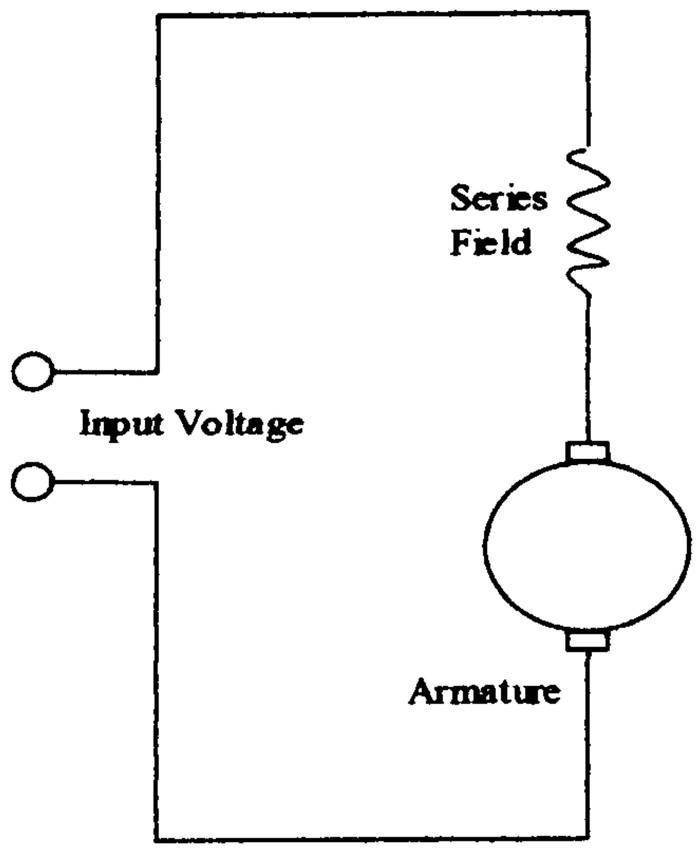

Figure 2.2 Series-wound dc motor diagram

Stunt Dc Motor

A dc stunt motor is connected the field in parallel with the armature windings (Figure 2.3). The speed of a stunt motor remains constant even under changing load condition. One reason is the flux field remains constants. So, a voltage across the fields makes it independent of variation in the armature circuit.

When the load on the motor increase, the motor turns to slow down. This allows down decreases the amount of counter EMF generates in the armature. The decrease in count EMF also decreases the opposition to the flow of battery current through armature. Armature current then increases and causes the motor to speed up. So, the original speed is maintained.

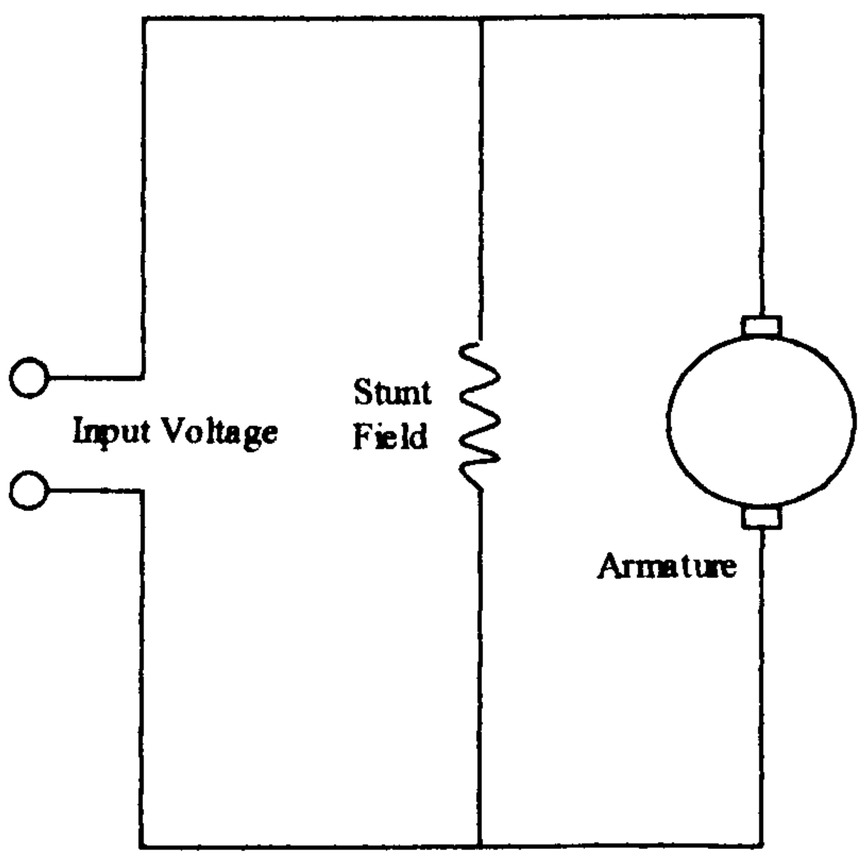

Figure 2.3 Stunt-wound DC motor diagram

Compound Dc Motor

A compound motor has two fielding windings, which is shown in Figure 2.4. One is a stunt field and it connects parallel with the armature. The other one is