AUTOMATIC ESCALATOR SYSTEM

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

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Date : 7th May 2007

"I hereby declared that this report is a result of my own research except that have been cited in the references"

Signature : .....

Name : Fadzlin Bt. Md. Fadzil

Date : 7th May 2007

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ABSTRAK

Projek ini dilaksanakan untuk merekabentuk dan membina *Sistem Eskalator Automatik* dengan menggunakan program PLC serta menggunakan perkakasan. Projek ini adalah mengenai eskalator yang hanya akan berfungsi apabila mempunyai objek di atasnya. Eskalator ini adalah rekabentuk eskalator yang biasa kecuali ia mempunyai pengesan. Pengesan ini akan mengesan sebarang objek dan eskalator tersebut akan bergerak selepas objek tersebut dikesan. Ia mempunyai satu pengesan, ia bertindak dengan memasang suis dan dan juga akan bertindak memadamkan suis motor yang menjalankan eskalator tersebut. Dengan menggunakan *timer* yang terdapat dalam program PLC, ia akan menetapkan jarak masa untuk memadamkan suis serta memasangkan suis eskalator tersebut. Tambahan pula, dengan menggunakan PLC program yang mempunyai *counter,* ia akan mengira bilangan pengguna yang menggunakan escalator tersebut. Dalam projek ini, saya membina automatik eskalator mini. Perkakasan yang akan digunakan adalah seperti, motor (power window), *belt,* pengesan, dan sebagainya. Saya merujuk kepada sistem *conveyor* selain daripada merujuk kepada sistem eskalator dalam merekabentuk model eskalator mini. Perbezaan di antara escalator dan *conveyor* adalah eskalator mempunyai anak tangga. Bekalan elektrik dapat dijimatkan dengan menggunakan eskalator automatik.

ABSTRACT

This project is to design and build an *Automatic Escalator System* by using PLC software and also using hardware. This project is about an escalator that will function when there's an object(s) on it. This escalator is a standard design of escalator except it has sensor. This sensor will detect an object and will start moving when it detected an object. There's a sensor that will switch on the escalator and also will turn off the escalator. Plus, by using timer that is in the PLC programming, it will set how long it takes to turn off and turn on the escalator. Moreover, it will count the objects that move pass by the sensor by using counter in PLC. In this project, I built an automatic miniature escalator. By using hardware, motor, belt, sensors, and etc are used. Besides referring to the escalator system, I also refer to the conveyor system to design a simple miniature model of this escalator. The difference between escalator and conveyor is escalator has steps. By using this automated escalator, electricity will be saved.

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CHAPTER I

INTRODUCTION

1.1 Introduction

In this chapter, I will introduce and explained briefly of my project that titled "Automatic Escalator System". The objectives and scopes are very important because it will guide the whole process and also gives the right way to discover of completing this project. A few literature reviews has been observed to verify clearly the problem statements of this project.

1.2 Project Title

In partial fulfillment of requirements for the Degree of Bachelor in Electrical Engineering (Control, Instrumentation and Automation), I had chosen to designed and constructed an automated escalator. This escalator is controlled by a sensor that will determine the motor when to switch on or off. It will be turned on when there's an object pass by the sensor and vice versa.

1.3 Project Objectives

There are a few objectives that I managed to clarify in completing my project. Firstly, I identified briefly and deeply what are escalator and the basic function of an escalator. Besides that, I also knew all the main parts of the escalator. To understand it, I studied all the substances that I searched.

Furthermore, I had understood PLC programming so that I can use it to connect to the hardware that controlled the sensor. I used this program to run the escalator because it has timer and counter. The timer will delay a few seconds before the escalator stop moving. Plus it has a counter that will count how many object that has passes by the sensor.

Next, I designed and built a miniature automatic escalator that has all the aspects that I planned for. This escalator will function by using sensor and also run with the help by PLC programming. Plus I would like to innovate the ideas and perform it into a real situation.

Finally, my last objectives are to accomplish the advantages of this automatic escalator. The advantages are such as saving the electricity bills different from standard escalator that will cost more on electricity bills. It is because of the usage that is nonstop moving. Besides, with it being automated, it won't be damaged easily because of the usages are used when it's needed only. Therefore it will cost less on the maintenance of the escalator.

1.4 Project Scopes

For this project, I will cover on learning and understanding all the basic function and every single parts of an escalator. After that, I will design and build the automatic escalator by using hardware and also software.

This automatic escalator system is using PLC programming to run and also two sensors to switch on or off the motor. I'd designed the program using PLC that has timer and sensor. After that I will connect the program to the hardware in completing the project.

1.5 Problem Statements

Since 1859 until now, escalator is being used widely around the world mostly in shopping malls. The standard escalator is very common. It can occur problems easily such as that it can be damaged and need to be repaired frequently. It is because that this escalator keeps on moving all day long. Besides that problem on maintenance, costs also are one of the problems in using standard escalator. By using it non-stop, the cost of electricity bills are high. For example, there's must be more than a dozen of escalator in one shopping mall. So, it must be plenty of usage on the power supply. Finally, the problem is about the safety of the users. When suddenly the escalator's broken while there're users on it, the user might fall down because of the inertia. So, with using automatic escalator, the safety of the users is more ensure.

1.6 Project Planning

Project Activities	2006						2007			
	J	A	S	O	N	D	J	F	M	A
Start on searching information and details about escalators	X									
Revising the information that had been searched & revise PLC		X								
Start making the program by using PLC & report			X							
Start design and make the miniature automatic escalator system			X	X						
Completing the hardware					X	X				
Testing hardware & software							X	X		
Completing the testing on hardware & software									X	
Final report & presentation									X	
Completing final report & any editing & correction										X

Table 1.1: Project Planning

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed about an existing project that is a high-speed walkway. The first attempt at an accelerated walkway in the 1980s was the TRAX (*Trottoir Roulant Accéléré)*, which was developed by Dassault and RATP and whose prototype was installed in the Paris Invalides metro station. Too complex, with its foldable articulated plates, it was a technical failure, which was never commercially exploited.

The latest attempt, the *Trottoir Roulant Rapide* ("fast-moving sidewalk") or TRR was launch in 2002 which shuttles commuters across the sprawling Montparnasse Metro station in Paris, has endured the test of time, if ungracefully.

Since its launch in 2002, the "Gateway," as its known, has acquired a reputation for tripping passengers and breaking down, a reputation some of its patrons believe is no longer warranted, as bugs in the system have been worked out.

Figure 2.1: Experts from all over the world have flocked to see the trottoir

The Figure 2.1 shows the TRR were opened for trial. The prototype carries passengers the length of Montparnasse station at 9km/h that is three times as fast as normal travelators, and about the average speed of a Paris bus. It is easy to spot old hands use the trottoir daily and stride boldly along its length. But new users also appear every day, and a small proportion promptly fall and hurt themselves.

However, unseasoned riders were getting tossed around on the walkway, some unlucky ones even breaking bones after harsh falls. The calamitous launch was less an engineering problem, though, than a failure by humans to behave as the engineers had expected. Since an 11-kph walkway is too difficult to step on and step off, Gateway riders are gradually accelerated via a 10-meter-long carpet of steel wheels resembling thick quarters. The first rollers are going about 2.2 kph, and subsequent rollers increase the speed until the 11-kph velocity is reached. As riders approach the end of the ramp, deceleration occurs in the same way.

But the system only works if passengers step on the slow-moving walkway and grab the handrails, letting the walkway take them for a ride. Instead, impatient Gateway riders would step over the transitions, planting their feet on a fast moving walkway, and causing them to lose their balance. By referring to Figure 2.2, it shows how the passenger supposed to use the TRR that is by keeping both feet flat on the ground.

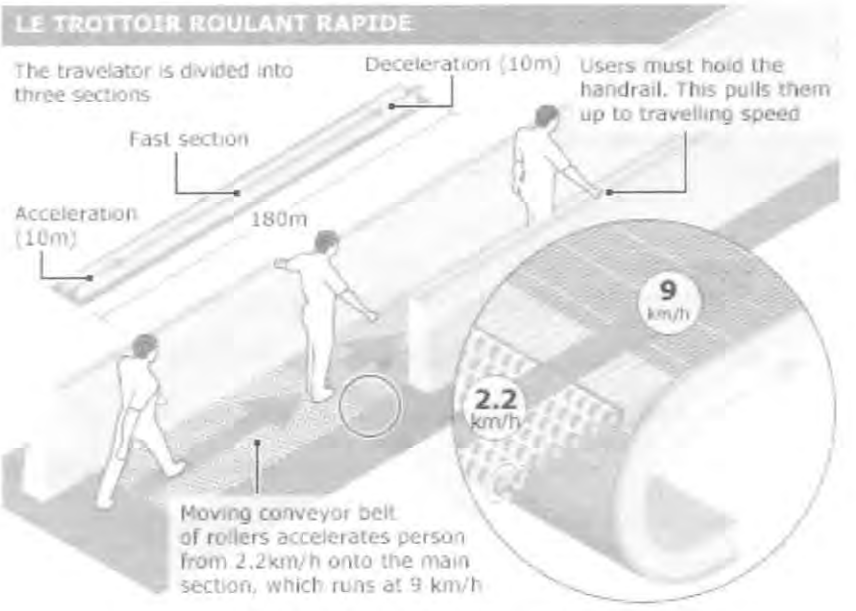

Figure 2.2: The Trottoir Roulant Rapide (TRR)

The RATP and CNIM shut the Gateway down within days of launch and relaunched three months later, with new video and audio warnings instructing passengers on proper behavior. As Lucien Le Gousse, the RATP maintenance engineer for the Gateway, says, the goal was to "make the users understand, in some fractions of a second, that they were not on the rolling walkways they had taken for 30 years." Around this time, says Le Gousse, RATP also slowed the walkway's top speed to 9 kph.

The result was a much safer system. In 2004, RATP demonstrated that the Gateway injury rate was comparable with existing walkways and escalators (about eight accidents per 10 million trips), earning the mechanism a permanent operating permit. And it's probably even safer today, since the fastest it runs now is about 6 kph, and then only during the morning and evening rush hours.

With a flood of new airport construction, especially in Asia, walkway manufacturers continue pushing for the next breakthrough. Düsseldorf-based ThyssenKrupp Elevator recently unveiled a 7-kph walkway system that employs overlapping panels, replacing both the belt and rollers used in the Gateway. The telescope out at the front end to ease passengers up to full speed, and then telescope back in for the step off.

ThyssenKrupp spokesperson Rembert Horstmann claims the firm has sold its first units, but also says they will remain "in development" with the buyers for at least six to eight months. Horstmann says they won't be demonstrating the walkways for the media until they're installed and running.

CHAPTER III

METHODOLOGY

3.1 Flow Chart

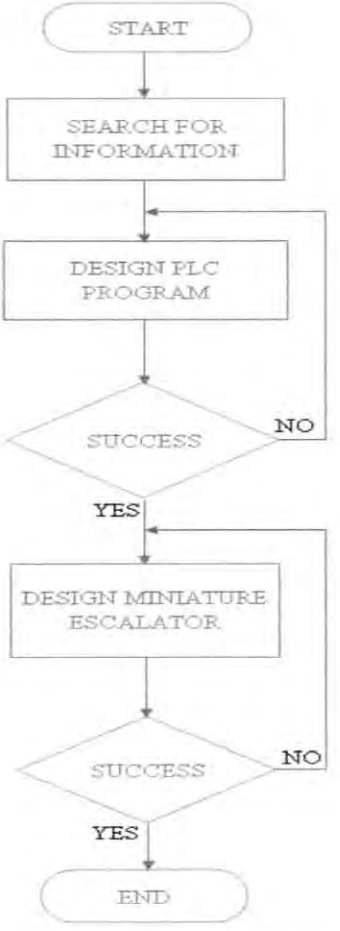

Figure 3.1: Flow Chart

3.2 Description

1. START

   Start this project by found a title to be my project.

2. SEARCH FOR INFORMATION

   Begin my project after chose a title by searching for information on escalator. I did some research and gather as much information as possible.

3. DESIGN PLC PROGRAM

   After completed on searching for information, I'd begun to design a program using programmable logic control (PLC). I designed it to have all the features needed to be function as I planned for.

4. DESIGN MINIATURE ESCALATOR

   After I finished designing the program, I test it to see if it's run smoothly or not. If it didn't run as I programmed it, I'll start back on design the program. If it's run smoothly, I continue with design a miniature escalator.

5. END

   After complete design the miniature escalator, I will build it. After that I will test it. To make sure that everything works properly. If it's not, I will redo it again until it works properly. After complete everything, my project will be done.

CHAPTER IV

PROJECT IMPLEMENTATION

4.1 INTRODUCTION

This chapter described about the implementation of this project. This chapter contains about the component / equipment background, the characteristics, types, and the explanation about the hardware and software.

These parts are very important, in fact of understanding the basic function of each type of the equipments that had been used for the development of this project.

4.2 ESCALATOR

An escalator is a conveyor transport device to transport people, consisting of a staircase whose steps move up or down on tracks which keep the surfaces of the individual steps horizontal. Most escalators also have moving handrails which approximately keep pace with the movement of the steps. The direction of movement (up or down) can be permanently the same, or be controlled by personnel according to the time of day, or automatically be controlled by whoever arrives first, someone at the bottom or at the top (of course the system is programmed such that the direction is not

reversed while somebody is on the escalator). In the last two cases there has to be an alternative nearby.

4.2.1 Background

An escalator is a power-driven, continuous moving stairway designed to transport passengers up and down short vertical distances. Escalators are used around the world to move pedestrian traffic in places where elevators would be impractical. Principal areas of usage include shopping centers, airports, transit systems, trade centers, hotels, and public buildings. The benefits of escalators are many. They have the capacity to move large numbers of people, and they can be placed in the same physical space as stairs would be. They have no waiting interval, except during very heavy traffic; they can be used to guide people towards main exits or special exhibits; and they may be weather-proofed for outdoor use. It is estimated that there are over 30,000 escalators in the United States, and that there are 90 billion riders traveling on escalators each year. Escalators and their cousins, moving walkways, are powered by constant speed alternating current motors and move at approximately 1-2 ft (0.3-0.6 m) per second. The maximum angle of inclination of an escalator to the horizontal is 30 degrees with a standard rise up to about 60 ft (18m).

The invention of the escalator is generally credited to Charles D. Seeberger who, as an employee of the Otis Elevator Company, produced the first step-type escalator manufactured for use by the general public. His creation was installed at the Paris Exhibition of 1900, where it won first prize. Seeberger also coined the term escalator by joining *scala,* which is Latin for steps, with a diminutive form of "elevator." In 1910 Seeberger sold the original patent rights for his invention to the Otis Elevator Company. Although numerous improvements have been made, Seeberger's basic design remains in use today. It consists of top and bottom landing platforms connected by a metal truss. The truss contains two tracks, which pull a collapsible staircase through an endless loop. The truss also supports two handrails, which are coordinated to move at the same speed as the step treads.