



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ELEVATOR DOOR MECHANISM CONTROL SYSTEM
IMPROVEMENT USING ARDUINO UNO**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

by

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.....

(Project Supervisor)

ABSTRAK

Sistem kawalan pintu lif digunakan untuk mengawal peranti kemasukan dan keluaran untuk operasi membuka dan menutup pintu lif. Projek ini juga untuk menambahbaik kawalan pintu lif secara automatik dengan sistem sampingan mekanisme kawalan menggunakan Arduino sebagai medium untuk menyambung dan mengawal motor pada pintu lif. Pintu lif percubaan atau latihan digunakan untuk projek ini dan fungsi untuk pintu lif percubaan atau latihan untuk dikaji dan melihat bagaimana sistem kawalan untuk pintu lif beroperasi. Projek ini, bagi sistem pintu lif mekanisme kawalan sampingan menggunakan Arduino Uno sebagai perkakasan dan perisian untuk penyambungan komponen elektronik melalui pin yang boleh mengawal sistem misalnya untuk menghidupkan lampu atau motor di dalam dan luar termasuklah seperti cahaya dan pemasa. Arduino Uno adalah yang terbaik di antara pelbagai jenis Arduino yang lain untuk projek ini kerana mudah diprogramkan untuk pelbagai aplikasi, memerlukan kos yang rendah dan mudah didapati. Kelajuan yang berbeza untuk membuka pintu lif digunakan sebagai parameter pengukuran untuk menentukan masa yang diambil untuk membuka dan menutup pintu lif. Masa yang sesuai untuk Kit Pintu Lif untuk dibuka dan ditutup adalah antara 15 hingga 20 saat dengan kelajuan antara 0.06 m/s sehingga 0.08 m/s. Panel kawalan baru boleh memantau status keadaan input dan output dengan Diod Pemancang Cahaya dari sistem kawalan baru untuk lif pintu dengan mekanisme pembukaan sampingan dan mengawal pintu lif sebuah system.

ABSTRACT

Elevator door control system used for control the input and output device to open and close operation of the elevator door. This project to improvement elevator door with side opening mechanism control system using Arduino as a medium to connect and control the elevator door's motor. The elevator door opening mechanism trainer kit used in this study to evaluate the opening mechanism trainer plus the system for door elevator operation. An Arduino Uno will be used as a hardware and software to connect electronic components that can control the operation system such for instance, turn lights signal, motor on and off and sense such as light and timer. Arduino Uno is the best Arduino board for this project because is easy, simple and available for any application. The different speed of elevator door during open and close used as a parameter of measurement to determine the time for opening and closing the elevator door. The movement of elevator door to open and closed the door depending on the time that set in the Arduino coding which shows long period time was setting while taking the slow or decreased speed to elevator door open or closed. The suitable timer for the Elevator Door Kit to open and closed is between 15 until 20 seconds with speed between 0.06 m/s until 0.08 m/s. The new control panel can monitor input and output condition status by Light Emitting Diode (LED) from the new control system for the door elevator with side opening mechanism and control the elevator door an automatic system.

DEDICATION

To my beloved family,

My supervisor,

My co-supervisor,

and to all my friends,

Thanks for all support and ideas

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First of all, I would like to express my grateful to ALLAH S.W.T. as for the blessing given that I can complete my final year project. In preparing this paper, I have been involved with many people in helping me to complete this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternative Current
APPS	-	Applications
BT	-	Bluetooth
°C	-	Celsius
DC	-	Direct Current
DC	-	Door Closed
DO	-	Door Open
FTK	-	Faculty of Engineering Technology
HMI	-	Human Mutual Interface
I	-	Input
IC	-	Integrated Circuit
IDE	-	Integrated Development Environment
IR	-	Infra Red
LAN	-	Local Area Network
LED	-	Light Emitted Diode
m/s	-	Meter Per Seconds
Nw	-	Nominal width
O	-	Output
OPC	-	OLE for Process Control
PCB	-	Printed Circuit Board
PLC	-	Programmable Logic Controller
PIR	-	Passive Infra-Red
RPM	-	Revolutions Per Minutes
SPST	-	Single Pole Single Throw
SPDT	-	Single Pole Double Throw
DPST	-	Double Pole Single Throw
DPDT	-	Double Pole Double Throw
TPLC	-	Test Program Logic Computer

USB	-	Universal Serial Bus
UTeM	-	Universiti Teknikal Malaysia Melaka
V	-	Volts
VVVF	-	Variable Voltage Variable Frequency
W	-	Watts
WiFi	-	Wireless Fidelity
WinCC	-	Window Combination Controller

CHAPTER 1

INTRODUCTION

1.1 Introduction

The control system of elevator door is designed to make an improvement in developing a new controller which can monitor input and output device status. This project is using Arduino as the main device which it can control the whole door control system of this project. This chapter will briefly discuss project background, problem statement, objectives, and scopes of this final year project.

1.2 Project Background

In the modern world and economic activity, the elevator has been one of the most important things for daily use as a technology equipment that was created. It is also considered as one of the most important transportation equipment, especially at high rise building for any function. In this study, Arduino is used as one of the most important topics to develop the elevator door controller. All the design of the controller door elevator is controlled by the Arduino application.

The main aims of this study are to improve the elevator door with side opening mechanism control system using Arduino as a medium to connect and control elevator door to the motor. The elevator door opening mechanism trainer kit use for this project and function as a door elevator opening mechanism trainer is for study and see how control system for door elevator is operating. Elevator control system is the system responsible for coordinating all aspects of elevator service such door opening speed and delay time. The door elevator opening mechanism trainer has two type which door elevator side opening mechanism and door elevator center opening mechanism. The

primary function of the door elevator controller is essential to receive and process a variety of signals from several different components of a door elevator system.

This project for door elevator side mechanism control system using Arduino Uno as a hardware and software to connect electronics through its pins that can control the system such for instance, turn lights or motor on and off or sense such as light and timer. In this study, the different speed of elevator door during open and close used as a parameter of measurement to determine the time for opening and closing door. Developing this control system can be fully virtualized trainer kit including to help the users to more understand and can directly see how this control system operating the door lift. Many types of Arduino boards are available, each with its own design to suit various applications. Arduino Uno used for this control system because Arduino Uno is one board can be considered the backbone of Arduino hardware and this is the one that almost all people start with and that is suitable for most applications.

1.3 Problem Statement

Faculty of Engineering Technology (FTK) have a door elevator opening mechanism trainer kit at Building Maintenance Laboratory. The current problem with the door elevator opening mechanism trainer kit is where the elevator opening mechanism trainer needs to control the door elevator manually. Besides that, the users or student only can used door elevator opening mechanism trainer manually without study how the control system for elevator door operation in the automatic system. Elevator door mechanism trainer is a kit to study working principal of elevator door mechanism and conduct a fault diagnostic process of elevator door mechanism. (Refer Appendix 1 & 2). In addition, current practice, the elevator door manually maneuvered by hand. So the main purposed of the objectives cannot be achieved by maneuvering the door manually only.



Figure 1.1: Door Elevator Opening Mechanism Trainer

1.4 Objective

The objectives of this project are:

1. To develop a control system which can automatically maneuver the elevator door.
2. To integrate a control panel which can effectively monitoring elevator door condition status.

1.5 Scope

The projects will be focusing on:

1. Developing a new control system with side opening mechanism on elevator door for a better controller.
2. Integrating on the new control panel with new monitoring by Light Emitting Diode (LED) elevator door condition status using Arduino Uno.

CHAPTER 2

LITERATURE REVIEW

2.1 The Elevator System

According to Sharma (2011), to produce a control system, an attempt has been made by the author in order to unify the programmable logic controller with an elevator. Besides that, the elevator control system is very important for the use of Programmable Logic Controller (PLC). The difference will be made in this study, where the project that will be designed by using the type of Arduino module that acts to replace PLC. There are many advantages in the Arduino compared to other control systems. Where the cost of using the Arduino is inexpensive and operating speed is good. In addition, the Arduino is also able to correct the error and using less space than the space of PLC (Yelpokonde, 2016).

According to Yang et al. (2008), the design and practice of an elevator control system based on PLC, it uses and developed lift type two nine-story to control the system of the residential building. PLC is adopted as a controller for the control system and to run two elevators in parallel mode and to dispatching rule based on the minimum waiting rule, the parallel connection will be used. The operation of the elevator is one aspect that the key in this system controller. To improve the reliability and performance of the elevator the system is highly desirable to use because it has a simple peripheral circuit (Dabhade, 2016). The difference between this journals with the project to be designed is the number of elevator use and the use of a module controller. The number of prototype elevator that will be designed is kind of single elevator and also the PLC will not use in this project and it will be replaced with Arduino module.

According to Irmak & Colak (2011), Development of a Real-Time Monitoring and Control System for PLC Based Elevator using the design of prototype elevator

based on real-time monitoring and how to control it. To develop Visual basic more visual, it needs the main control interface to guide it and by using Simatic version 4.0 it will improve the software system of the PLC. The PLC applied the dc motors, sensors, gas smoke detectors and temperature sensors and it is installed in a laboratory-sized elevator prototype. To transfer data in the PLC and control interface, the OPC server but this technique would not be used because using Bluetooth system to transfer data from android to PLC and constructed to control and monitor elevator system (Dabhade, 2016). However, this project is not designed to monitor the movement of the elevator but to show how the elevator door can be controlled by using the Arduino.

According to Htay et al. (2014), Implementation of PLC Based Elevator Control System. Besides that, Programmable Logic Controller (PLC) based control systems and wants to implement their projects on parking floors. Programmable Logic Controller and elevator model are used as a very important matter. The elevator will be determined by using Hall Effect Sensor. The movement up and down of the elevator car will be controlled by using a DC motor and uses a push button to call the elevator car (Yuvaraju & Rani, 2015). The display unit that is used to know the position of the elevator. To control the lift system, the authors use the auto station software to program the ladder logic. There are some inequalities devices that applied to this project. This project will not use the Hall Effect Sensor, but it will use the limit switch and encoder to determining the position of the elevator door which to detect open and closed elevator door. There is the little difference which the writer dealing with PLCs type IVC1 1410MA TPLC but in this study, it will be used is Arduino. Besides, not the Auto station software will be used in this project but Arduino software.

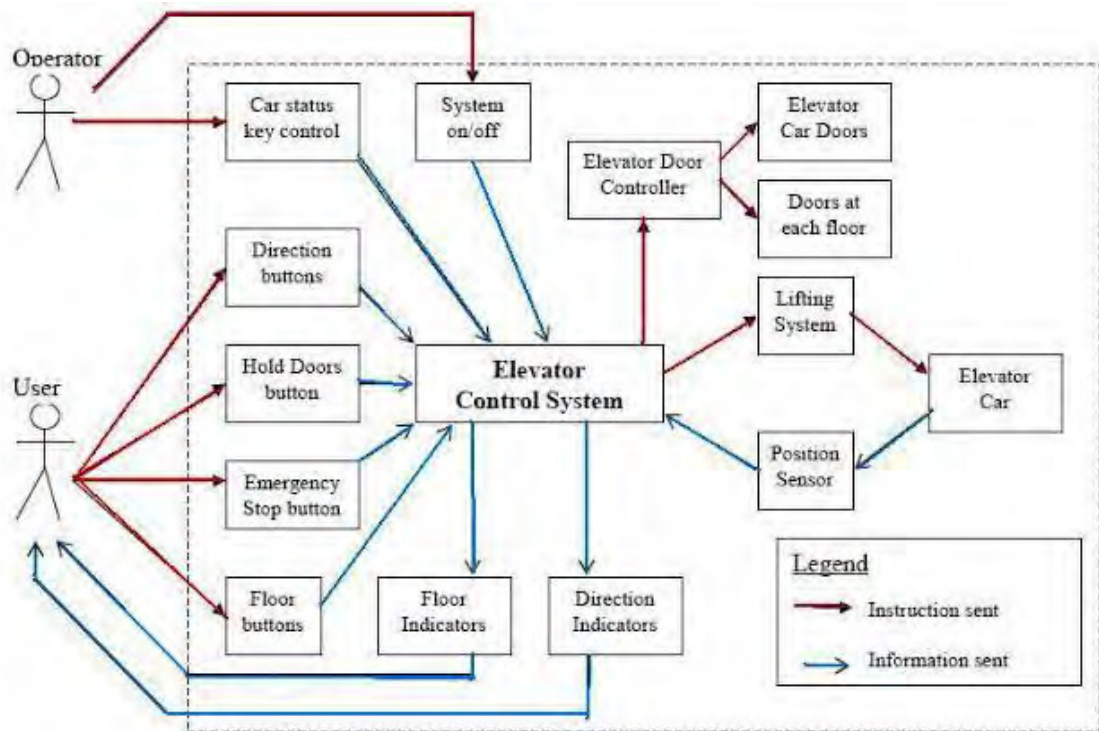


Figure 2.1: Simple Elevator Control System Inputs and Outputs

(Source: www.electrical-knowhow.com/2012/04/elevator-control-system.html)

2.2 Elevator Door Control System

The controller is a device which manages the visual monitoring of input and output device, interactive command control and traffic analysis system to ensure the elevators are functioning efficiently (Dabhade, 2016). Elevator door control system is an important thing that has to control the opening or closing door of Elevator. This control system also can provide feedback to the user through the lights on some of the buttons for processes information sent to it by load sensors in order to ensure that the door is open, close or emergency condition through the output device and direction displays at the monitor in each operation.

According to Klefer (2014) which the control electrical box for elevator door is using farmator VVVF-4+ a common type of control electrical box for elevator door mechanism kit and also in the real elevator door. Every component of this electrical box have their function that connecting with the elevator door mechanism but for this

control panel which cannot monitor the input and output device different with the new control panel will develop.



Figure 2.2: Electrical Box Controller (Klefer 2014)

The tractive elevator safety process control is the thing that will be discussed in Development of Elevator Intelligent Safety Control System Based on PLC (Jun & Min, 2013). This is because of a safe elevator conditions while in use. The use of PLC is a way to control an elevator that is required. The stream outline of PLC of programs control door is presented and work field area controls the elevator by utilizing PLC. The process of elevator monitoring requires the latest technology such as software configuration to complement the monitoring system. To through the real testing, it requires a stable and reliable condition in order to develop the elevator safety control system based on PLC (Irmak et al. 2011)

The elevator incorporates four parts that are the elevator door, floor monitoring screen, the call catch and inside pick board (Barney, 2012). Safety control is the establishment of PLC control tractive elevator. The outline of both mechanical components and control software ought to fit in with the standards of the safety system. This study acquaints a few measures with enhancing the safety of the elevator system, which helps the stable operation of monitoring system field area PLC and guarantees the correspondence between master and slave machine. According to Irmak et al. (2011), the testing result indicates that the framework security capacities of a traction elevator could meet the requests, and the elevator is in great operation. With the ever-

increasing amount requisition of new technology, in this study, the Arduino will acknowledge the elevator safety system will be most excellent than PLC.

2.3 Arduino

Arduino is constructed of both hardware and software. The Arduino hardware needs the software to program and the combination of that enable to create projects. It allows connecting electronics hardware through its pins so that it might control things for example, such as for instance, transform lights, alternately engine on and off and also alternately sense about things concerning illustration light. The Arduino board is a printed circuit board (PCB) that is specifically designed to use microcontroller chip as well as other input and outputs. The other electronic component that is needed in the microcontroller to function or extend its capabilities.

According to Anuradha et al. (2016), develop an application for the optimized locking and unlocking a system using Arduino used for smart home automation system which helps in reducing a work by using some technology. The signal sent to door from mobile devices by using a wireless system. The user can lock or unlock a door from inside or outside a house with Wi-Fi which makes a person to reduce its energy or save time. One of an excellent way to program and control electronics is microcontrollers which are small computer contained within a single, integrated circuit or computer chip (Barathi, 2016). The Wiring board and the Basic Stamp are also some devices with microcontroller boards.

Integrated Development Environment (IDE) is a type of Arduino software. This is a tool that is common in software development and allows to write, testing, and upload programs. The programming language used to program Arduino is a language called C.