A Survey Paper on Intelligent Twin Elevator Controller

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Abstract- *This paper research on the design of intelligent elevator control system and fabrication of the elevator model by using micro-controller. An elevator is a kind of transport device use to move people between building floors. Twin elevator system consist of two elevator cars in the two elevator shaft. Twin elevator is the novel system an attracts attention for improvement of transportation in high rise building. The system is based on its structural design, cost saving and efficiency in elevator system. The elevator control system is one of the important aspects in electronics control module in automotive application. Twin elevator system uses the micro-controller AVR AT-mega 328, 12V helical gear DC motor, optical IR sensor, DPDT relay driving card.*

Keywords- Twin elevator, AVR Atmega328, helical gear DC motor, optical IR sensor, DPDT relay card, opening and closing door system.

I. INTRODUCTION

An Elevators are simple devices, and the basic lifting systems have not changed much in over 50 years. An elevator is a type of transport device which is used to move people between building floors. Whenever a passenger presses the call button for an elevator, a controller receives the request and logs it for future reference. In modern life, elevators have become an integral part of any public or commercial complex. There are two sets of doors, which allow the passengers safely to enter and exit the lift. One of the door remains close until an elevator car's presence is detected and the elevator's controller controls the other door. Once both doors are open, passengers should leave quickly to allow new passengers. Elevator doors also contain presence-sensing devices to keep doors from presence of passengers.

The twin Elevators are designed for a specific building, taking into account such factors as the height of the building, the number of people traveling to each floor, and the expected periods of high usage.

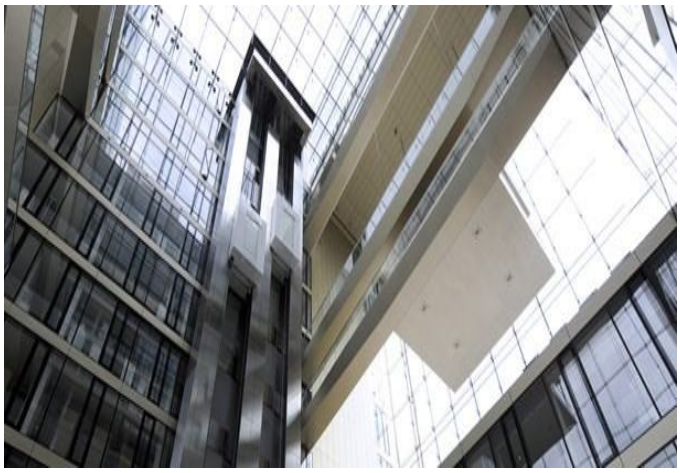

Fig:1.1 Twin Elevator

The twin elevator System does face some problem in the operation at which car should take the request when both are at the same positions. This allows passengers on different floors to be able to use the elevator simultaneously, significantly increasing the passenger capacity of an elevator shaft and time saving of an elevator. So, some assumptions are implemented in the elevator operation. And that assumptions are :

- **Elevator Priority:** The priority is assigned to the elevator's.
- **Default State:** The default position provides quick response to the request coming at any of the floor.
- **Closing the Elevator Door:** According to the defined time duration, door of the elevator close after some time duration.

Such a scheme can prove efficient in buildings where the volume of traffic would normally have a single elevator stopping at every floor.

1.1 Micro-controller AVR AT-mega 328 :-

- It is a low-power CMOS 8-bit micro-controller based on the AVR enhanced RISC architecture.
- It achieves through puts approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

- Low Power Consumption at 1 MHz, 1.8V, 25°C.
- In-System Programming by On-chip Boot Program.

PARAMETERS	VALUE
RAM	2 K bytes
Flash	32 K bytes
Max I/O Pins	26
Ext Interrupts	24
CPU	8-bit AVR
Max. Operating Frequency	20 MHz

1.2 DC Motor Drive Circuit:-

Helical geared DC motors are the favorably solution for drives with angular geared motors. The efficiency is significantly better than that of pure geared motors due to the implementation as helical geared DC motors. Helical geared DC motors represent the most cost-effective solution for angular geared motors in the lower torque range. Helical geared DC motors are available in the power range up to 11 KW.

- 12 volt helical gear dc motor.
- Helical gear dc motor is used for opening and closing door of elevator system.
- Helical gear units are coaxial units where the gear unit output shaft is in-line with the motor shaft. A solid shaft is always used as output shaft.

1.3 Optical IR sensor:-

Infrared (IR) is invisible radiant energy. Infrared radiation extends from the 700 nanometer to 1 mm.

- An IR Emitter is a light emitting diode (LED).
- Different types of IR LED's are specified based on their packaging and special features, such as output optical power, wavelength, and response time.
- IR Receivers are also called sensors since they detect the wavelength and spectral radiation of the light from the IR emitter.
- It is used in different applications such as:

1) Night vision
2) Thermography
3) Hyperspectral imaging
4) Tracking
5) Other imaging

1.4 RELAY DRIVING CARD:-

A relay is an electrically operated switch. Most of the relays use an electromagnet to operate a switch mechanically, but solid-state relay operate on other principles. Relays are used when it is necessary to control a circuit by a low-power signal or where one signal controls several circuits.

- 5Volt DPDT. DPDT stands for double pole double throw relay.
- Each set has three changeover contacts, namely, normally open (NO), normally closed (NC) and common (COM).

II. LITERATURE SURVEY

The first reference elevator was invented by Archimedes in 312. From some literacy source, elevator were developed as cable on a hemp rope and powered by hand or by through animals. This type of elevator was installed in the Sinai Mona story of Egypt. In the 17th century, the very small type elevators were placed in the building of England and France.

Table 2.1 History of Invention

Sr. no.	Year of invention	Author/ Invertor	Invention
1	1793	Lvan Kuliben	Creation of an elevator with the screw lifting mechanism for the winter place of Saint Petersburg.
2	1816	-	An elevator was established in the main building of Sub-moscow village called Arkhamgelskove
3	1852	Elisha Otis	Introduced the safety elevator, which prevented the fall of the cab, if the cable broke.
4	23,March 1857	-	First Otis passenger elevator was installed in
5	1874	J.W. Meaker	Patented a method which permitted elevator doors to open and close safely

Table 2.2 Summery of Review Papers

Sr.no.	Title of Paper	Author's Name	Publication Year
1	"Effectiveness and Control Strategies of Multi-car Elevators for High- rise Buildings. "	Sudo, T. Suzuki, H., Markon, S. and Kita	2002
2	"Linear Motor Coils as Brake Actuators for Multi-car Elevators"	Markon, S., Komatsu, Y., Yamanaka, A., Onat, A. and Kazan, E.	2007
3	"Design and Implementation of a Linear Motor for Multicar Elevators."	Onat, A., Kazan, E., Takahashi, N., Komatsu, Y. and Markon,	2010
4	“Design and implementation of embedded based elevator control system.”	Rajesh Kumar Patjoshi	2010
5	"Strategy Selection by Reinforcement Learning for Multi- car Elevator Systems."	Ikuta, M., Takahashi, K. and Inaba, M.	2013

III. METHODOLOGY

Most of the people experience long waiting time for the elevator in buildings without noticing the arrival time of the lift. The passenger also don’t know the approximate arrival time for the lift after press the lift button. In return, the impatient passenger might leave the waiting area of lift and this may lead to longer time of waiting for other passengers. Even some of the current lift remain stay at last call position and did not proceed to priority floor during peak time. We will compare different elevator control strategies with respect to the average waiting time and total travelling time in an office building with two elevators. So we are designing such system which will reduce the waiting time and it will provide efficient service passengers.

IV. SOFTWARE REQUIREMENT

- Multisim
- Proteus
- Embeded C

V. HARDWARE REQUIREMENT

- Micro-controller AVR Atmega328.
- DC Motor Drive Circuit.
- Optical IR sensor.
- Relay Driving Card.

VI. DATAFLOW

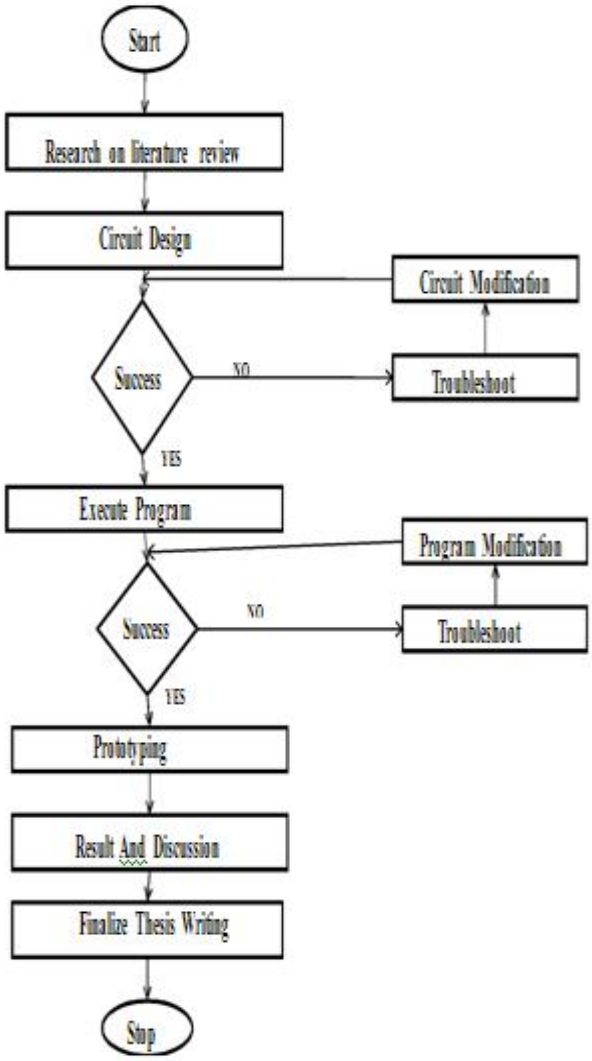

Fig.2 Data Flow Model

VII. ADVANTAGES

1. Arrival time of elevator reduces.
2. Power consumption reduces.
3. Energy Savings.
4. Safety and Reliability.
5. Increased Floor Space and Design Possibilities.

VIII. APPLICATION

1. Hospitals.
2. Offices.
3. Education.
4. Buildings.
5. Hotels.

IX. CONCLUSION

In this paper we have compare the different elevator control strategies with respect to the average waiting time and total traveling time in an office building with two elevators. We have also compared the aspects of twin elevator with respect to normal elevator system. Still the more research is needed to optimize the potential, waiting time, response time and efficiency of an intelligent twin elevator controller.

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