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Design and Implementation of Rope free, Motor less Elevator System

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Abstract— *with the increasing Urbanization, Engineers are being challenged to make cities more efficient. By the end of this century, most of the world population will reside in cities. These challenges can be solved by building taller and economical buildings. However, current elevator technology makes it difficult for the efficient construction and use of skyscrapers. The implementation of rope-free multidirectional elevator systems could be beneficial to solve these challenges by reducing elevator wait times, optimizing costs, and increasing energy efficiency. These systems are powered by electromagnetic induction that causes magnetic levitation, moves the elevator cars horizontally as well as vertically. This method removes limitations caused by ropes, restrict building heights, increases efficiency and reduces the speed of the elevator car. It also allows multiple elevator cars to fit into one shaft and move throughout the building in a loop. Users will experience shorter wait times and owners can better maximize their available floor space. These systems can also reduce building's electric bills by up to 60%. In this paper, we intend to analyze how Rope less Elevator as compared to traditional elevator systems proves to be efficient and how it could be implemented in to make the production of skyscrapers cheaper and more convenient.*

Keywords— Electromagnet, Elevator, Linear Motor, Magnetic Levitation, Permanent Magnet

I. INTRODUCTION

Land in cities is very expensive, which drives the expansion of rentable spaces into taller buildings and underground areas. However, in these taller and more number of buildings, more elevators are required to keep acceptable waiting times for dispatching. Taller buildings pose new challenges in constructing high-speed elevator systems. I.e. vertical oscillations, horizontal swaying, car noise, cable length limitation, and reduced efficiency. Therefore, conventional elevators with counterweight are not suitable for skyscrapers, however, rope-free elevators with the electromagnetic guiding system can be provided as a solution for this problem.

In the traditional elevators, mechanical guiding systems such as slide-ways or rollers are used. However, compared with electromagnetic non-conducted solutions, the conventional lead frame has many disadvantages such as reduced efficiency, increased deterioration, and requires lubrication that is to be done frequently and regular maintenance, more car swaying and audible noise. It is important to make the air gap of the linear motor constant, which in turn affects the magnitude of the propulsion force.

In this sense, conventional elevators with mechanical guiding systems can be used as a solution to overcome the limitations. A betterment in the operation of such high elevator systems can be achieved by replacing wear and lubricant free electromagnetic guides by slide or roller guides. This paper deals with different schemes for the electromagnetic guiding of vertical transportation systems. It will also respond to the technique of rope less elevators as an example for active magnetic guide ways.

II. OBJECTIVES

1. To develop and implement an elevator which can deal with smart technology
2. To make a rope-free, motor less, counter weightless elevator system.
3. To overcome the architecture limitations faced while designing a building structure.
4. To eliminate present complex system which enhance many limitations.

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TABLE 1
RESEARCH PAPERS

Sr. No.	Paper Name	Advantages	Disadvantages
01.	The Use of Ropefree Multidirectional Elevators in Skyscrapers	Precise information of ropeless elevator is provided.	Calculations of ropeless elevator is not provided.
02.	Research of Ropeless Elevator Driven By PLSM	Benefits of constructing the elevator using PLSM is described.	Requires Manual entry for every action. .
03.	A New Technique of Ropefree, Motorless Elevator Using Electromagnetic Principle	Benefits of constructing the elevator using electromagnetic principle is decribed.	Difficult in implementation.

III. MATERIAL AND METHOD

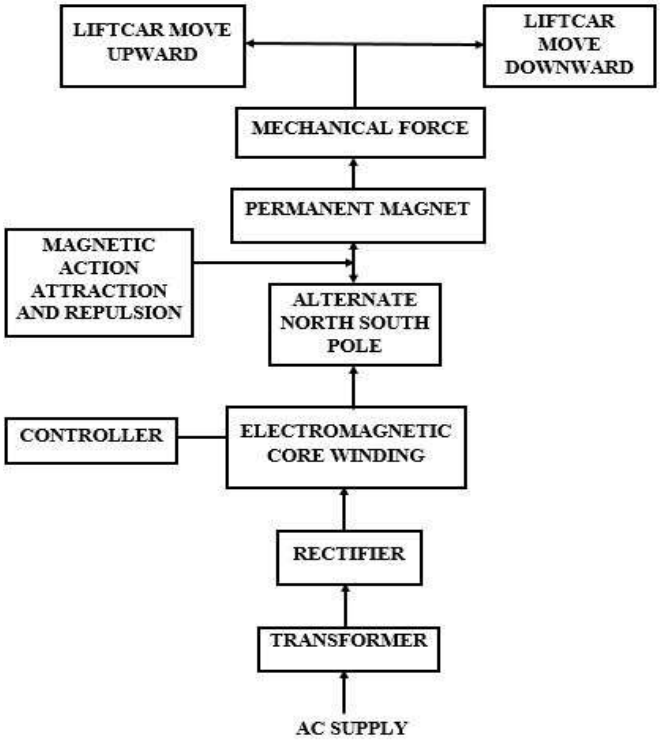

Fig. 1 shows Block Diagram Application code originally developed in high- level languages, such as C. Enhanced CCP Module: In PWM mode, this particular module provides either 1, 2 or 4 modulated outputs for controlling half-bridge and full-bridge drivers. Apart from this it includes automatically shutting down, for disabling PWM outputs on interrupt or other select conditions and restarting automatically to reactivate outputs once the condition has cleared. Enhanced Addressable USART: This serial communication module is capable of standard RS-232 operation and supports for the LIN/J2602 bus protocol. Some other enhancements include automatic baud rate detection and a 16-bit Baud Rate Generator for improved and better resolution. The EUSART allows stable operation for applications that communicate with the outside world without using an external crystal (or its accompanying power requirement) when the microcontroller is using an internal oscillator block. 10-Bit A/D Converter: The

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A/D module comprehends programmable acquisition time that allows for a channel to be selected and a conversion to be initiate without waiting for a sampling period.

IV. METHODOLOGY

Ropeless elevators operate due to magnetism and linear motor technology. In this elevator system the upward movement without a pulling force can be made possible by applying the linear motor technology of the magnetic levitation train, Trans rapid, to the elevator industry. The Trans rapid is a high-speed train that uses magnetic levitation to levitate or float above the track, which eliminates all friction, and it implements linear motors to motivate the Magnetic levitation as a result of electromagnetism and linear motor technology. Applying the mechanisms of the Trans rapid to the elevators means turning it on its side. This involves the combination of levitation and propulsion devices. An advantage of this elevator is the fact that it is not limited to a vertical track. The interlocking exchange system in the tracks of the elevator shaft does not interupt the magnetism in action. Electromagnetism, linear induction, and interlocking are the three main components of elevator which allows it to operate without ropes and move in multiple directions with multiple cars per shaft.[6]

V. ELECTROMAGNETISM

Electromagnetism is a branch of Physics, deals with the electromagnetic force that occurs between electrically charged particles. Being one of the four fundamental forces, electromagnetic force exhibits electromagnetic fields such as electric fields, magnetic fields, and light. It is an important reason why electrons are bound to the nucleus and responsible for the complete structure of the nucleus. Magnets have properties that can provide different types of material the ability to produce a force, and that force can be controlled to do work. This can be used to move the rope less elevators in forward direction. This involves activating Ferro magnets [6]. Electromagnetism is a process where a magnetic field is created by introducing the current in the conductor. Magnetic lines of force are generated when conductor is electrically charged. For instance, if current is moving in a wire, it produces the magnetic field along the wire and the direction of magnetic lines, and force can be determined using Right Hand Rule.

VI. LINEAR MOTORS

Linear motors are used to provide movement of the car through the shafts of ropeless elevator. We are going to use linear induction motor in multi-directional elevator systems. This concept can be compared to the technology used in maglev trains, like the Trans rapid. As the Trans rapid moves only horizontally, it needs different mechanisms to provide levitation and propulsion. The primary function of the motor on the elevator is to make it follow the track so it can rise vertically. This combines the propulsion and levitation mechanism [5].

VII. LITERATURE REVIEW

[I] Rachael Dancer et.al:-

In this paper the challenges and difficulties faced in conventional elevators are summarized in detail. The overview of multidirectional ropeless elevators are explained and the ways to overcome the difficulties encountered in conventional elevators are mentioned. The author has addressed the various advantages of using ropeless elevators over conventional elevators. With the continuing effects of urban migration, engineers, architectures, and builders are being challenged to make cities denser and more efficient. These challenges can be overcome by building taller and more economical buildings. The implementation of rope free elevators systems can solve these challenges by reducing elevator wait times, optimizing costs and increasing energy efficiency.

[II] Jiwei Dong et.al:-

In this paper, the implementation of ropeless elevator with the use of Permanent Magnet Linear Synchronous Motor (PMLSM) is described in detail. Here the author has given details of the proposed switch control technology which lowers the input current. The various simulation results are also explained and described in detail. Also the various merits of ropeless elevator driven by PMLSM are presented in a detailed manner.

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[III] Chaitali Mahale et.al:-

In this paper, implementation of rope free elevator using electromagnetic principle is described in detail. Firstly the various types of conventional elevators and the various challenges the face are explained. After that the author has described the construction and working of ropeless electromagnetic type elevator. Here we studied the application of permanent magnet and electromagnet in ropeless elevator.

[IV] Tomasz Huscio et.al:-

In this research the author has explained the design and implementation of the original rope free elevator. Here, the author has discussed both vertical and horizontal movement of rope free elevator. The various illustrations of the main elements of the rope free elevator have been shown. From this paper we understood the various advantages and applications of rope free elevators over conventional elevators

[V] Sead Kreso et.al:-

In this paper we studied the design and implementation of a modern elevator control system. The conventional elevator control system has several disadvantages (complicated circuits, a large number of wires, sensitivity to noise, low level security, etc). An alternative to conventional elevator control systems is a distributed elevator control system. This paper describes a network-based elevator control system via controller area network (CAN). The author has presented the results obtained from the experiment on a real model, i.e. the CAN based elevator control system.

VIII. CONCLUSION

This system can prove to be beneficial in the future because of its various advantages over the conventional elevator systems. By using this concept we can implement a rope free electromagnetic elevator without using high power motor, ropes and counterweight. Also this concept can overcome the limitations of the present conventional elevator systems which require more space and consume more power. Thus the aim of our project is to provide rope less elevator system which can move both vertically and horizontally without the use of pulleys and counterweight systems.

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