Elevator For Senior Citizen in Existing Building

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Abstract -**This research focuses on developing a compact, low-cost elevator system designed for two-story buildings. It addresses the limitations of traditional elevator systems, which often involve high expenses, significant space requirements, and installation challenges, particularly in existing small-scale structures. The proposed system emphasizes inclusive accessibility, particularly for elderly individuals and mobility-challenged users, while maintaining structural and economic feasibility of the system.**

Using a screw-driven mechanism and corrosion-resistant materials, such as stainless steel, the design ensures a lightweight structure with dependable outdoor performance. The elevator prototype incorporates energy-efficient features, a compact cabin construction, and integrated safety mechanisms. Field testing confirmed the device's reliable performance, smooth operation, and user comfort. This project offers a viable and scalable alternative to conventional elevators, promoting enhanced mobility and safety in low-rise public and residential environments.

Keywords - **Compact Elevator Design, Screw-Driven Lift System, Two-Story Building Elevator, Outdoor Elevator, Energy-Efficient Elevator, Accessible Vertical Transport, Cost-Effective Elevator,**

I. INTRODUCTION

Vertical mobility solutions have become essential in urban and rural infrastructure owing to the increasing demand for accessibility and convenience. While high-rise buildings commonly feature elevators, smaller structures, such as two-story homes or clinics, often lack vertical transport options because of high costs, structural constraints, or limited space. This gap in accessibility can have serious implications, especially among elderly individuals or those with physical disabilities.

This project presents a solution that addresses these challenges by designing a compact elevator system that is easy to install, cost-effective, and suitable for outdoor environments. The design eliminates the need for deep shafts or machine rooms, instead utilizing a simplified structure mounted externally to the buildings. It emphasizes minimal energy use, safe operation, and compliance with accessibility standards, ensuring ease of use and reliability across various environments and users.

II. LITERATURE SURVEY

Abdulmalik, I.O. (2020), ***"Scholars Journal of Engineering and Technology,"*** This paper presents a compact, one-person electric elevator using a simple belt-driven pulley system. The abstract emphasizes low cost, ease of assembly, and safety as the core features. The design is powered by a fractional horsepower motor and aims to improve accessibility in homes and low-rise buildings with minimal structural modifications.

Kaczmarczyk, S. (2020), ***"10th Symposium on Lift & Escalator Technologies",*** The study outlines methods for analyzing the mechanical integrity of elevator systems under peak loads. The abstract highlights the use of dynamic simulation and load testing protocols for screw-driven and traction systems, which can help engineers predict failure points and improve design safety margins.

Awale, S.R. (2022), ***"International Journal of Advanced Research in Science and Technology (IJARST)",*** This investigation examines causes of elevator accidents and emphasizes preventive design strategies. The abstract discusses the statistical data on elevator faults and advocates for enhanced sensor integration and user safety education. The findings are directly applicable to the safety of compact elevators.

Feng, S. (2021), ***"Journal of Physics: Conference Series",*** The paper assesses how decorative panels and cabin design affect traction performance. According to the abstract, changes in the cabin mass can significantly impact motor efficiency and wear. This is critical when selecting materials for lightweight outdoor elevators.

Al-Kodmany, K. (2023), ***"Encyclopedia",*** The abstract reviews how emerging technologies such as AI, IoT, and touchless controls are revolutionizing elevators in smart cities. These insights inspire future enhancements to this project's design, particularly in integrating predictive maintenance and wireless monitoring features.

Kherde, S. M., & Jadhav, A (2022), ***"International Research Journal of Engineering and Technology (IRJET)",*** The authors simulated traction elevator systems and evaluated energy consumption, validating that simpler systems like screw-driven elevators can outperform traditional models in low-rise scenarios.

Hung, D.T., & Chien, Y.S. (2021), ***"Automation in Construction,"*** The researchers showed that intelligent algorithms reduce elevator waiting times in busy facilities. This supports the use of smart control logic in basic elevator systems to enhance efficiency.

Mishra, R. C., & Bhandare, M.G. (2021), ***"International Journal of Mechanical and Production Engineering Research and Development (IJMPERD),"*** assessed noise and vibration in various elevator types, concluding that screw-based and traction elevators offer smoother and quieter rides, which are crucial for comfort in elderly focused applications.

III. TECHNOLOGICAL OVERVIEW AND APPLICATION DOMAIN

The elevator employs a screw-based vertical lift mechanism, which is a proven system valued for its mechanical simplicity, inherent safety through self-locking, and suitability for low-rise applications. Unlike hydraulic systems, which require complex maintenance and fluids, or traction systems that require counterweights and extensive internal infrastructure, the screw mechanism offers straightforward installation and operation. The motor, housed within a protective enclosure, drives a hardened leadscrew that raises or lowers the cabin using a nut assembly.

Designed specifically for two-story structures with two floors, the system is ideally suited for settings such as residential buildings, health clinics, small offices, and elderly care facilities. Its modular, space-saving design allows for outdoor attachment without altering the core layout of the building. The selected materials —stainless steel frame, mild steel supports, and weather-resistant panels–ensure durability in outdoor environments, even under challenging weather conditions.

The elevator includes user-friendly controls, accessible cabin dimensions, and built-in safety features, such as emergency brakes and power failure support systems. In the context of India's diverse building landscape, the design allows adaptation for both urban retrofits and rural construction, where conventional systems are not feasible.

The applicability of this elevator system extends to public infrastructure upgrades, especially where retrofitting is essential but interior space is limited. The system can also support emergency healthcare operations, mobile units, or infrastructure in remote areas, contributing to inclusive mobility and community-level development.

By combining affordability, accessibility, and technical simplicity, the proposed elevator system redefines the possibilities of small-scale vertical transportation and serves as a sustainable model for low-rise mobility enhancement.

The elevator system also offers low power consumption and requires minimal maintenance, making it energy-efficient and cost-effective for long-term use. Its quiet operation and smooth, vibration-free movement provide a comfortable user experience, which is particularly valuable in sensitive environments, such as clinics, homes for the elderly, and residential areas

IV. TYPE OF ELEVATOR

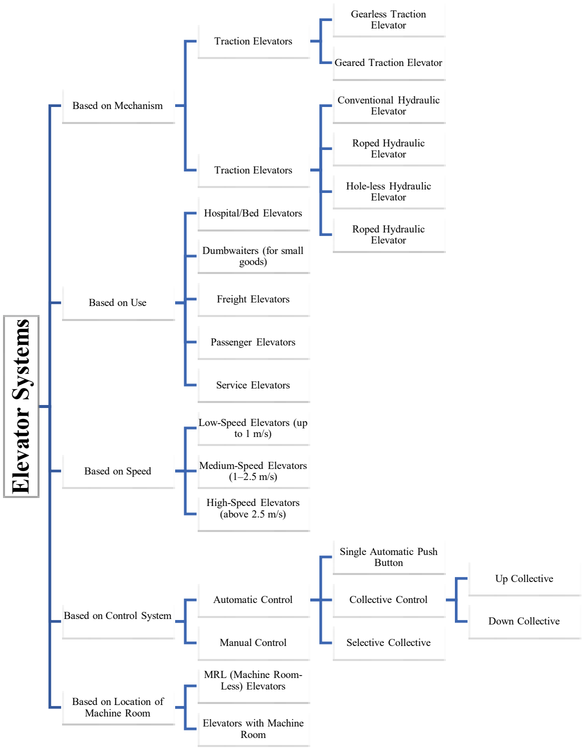

Fig 1: Types of elevator system

V. DESIGN AND METHODOLOGY

The elevator is designed to carry two persons or up to 160 kg, with a total travel height of approximately 4 m. The core structure uses 40 mm mild steel hollow cubes and stainless-steel components for corrosion resistance. The cabin was assembled using reinforced aluminum and anti-slip flooring. The motor used had a power capacity of 1.2 kW, which was selected for its energy efficiency.

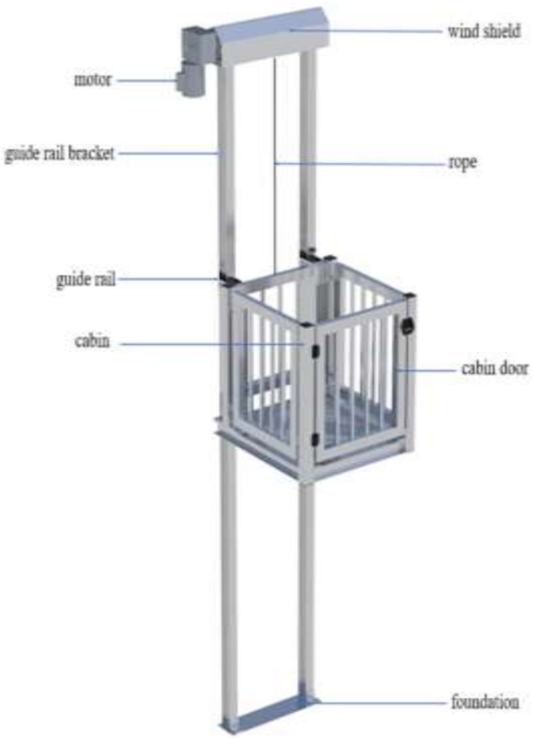

Fig 2: Parts of Elevator

A screw-driven mechanism ensured smooth vertical motion. Testing with loads from 25 to 200 kg yielded consistent results, with a travel time of 47.55 s over a distance of 3.96 m. No mechanical failures or instabilities were observed. The control systems are housed in weatherproof enclosures and include safety sensors, emergency buttons, and manual overrides.

VI. RESULTS AND TESTING

The experimental setup included all the key components: guide rail brackets, motor, cable system, cabin, doors, and structural foundation. The system demonstrated operational reliability at full load. The safety mechanisms were successfully validated through simulated emergencies. The energy consumption remained low, confirming the suitability of the system for energy-conscious installations.

Instruction for Use Before operation, ensure that the system is powered and free from obstruction. Do not exceed 160 kg. Avoid use during extreme weather conditions. Enter the cabin only when the door is fully opened. Designated control buttons should be used, and forceful interactions with doors or mechanisms during motion should be avoided. In emergencies, activate the emergency stop or the backup system. After use, close the doors properly and inspect for any issues.

VII. CALCULATIONS

Required Torque CalculationTo lift a load (W) of 160 kg using a screw with a 10 mm pitch: Force (F) = mass × gravity = 160 × 9.81 = 1569.6 N Assuming efficiency $\eta = 0.35$ and screw lead $l = 10$ mm, Torque (T) = $(F \times l) / (2\pi \times \eta) = (1569.6 \times 0.01) / (2 \times 3.1416 \times 0.35) \approx 7.15$ Nm

Power Required for Lifting Lift speed (v) = 0.083 m/s Power (P) = $F \times v = 1569.6 \times 0.083 = 130.28$ W With efficiency, actual motor power needed = $130.28 / 0.35 \approx 372$ W This confirms that a 1.2 kW motor is more than sufficient.

Energy Consumption Per Trip time ≈ 47.55 sec Energy = Power × Time = 1.2 kW × (47.55/3600) hr ≈ 0.01585 kWh per trip If 10 trips/day → Annual use = $0.01585 \times 10 \times 365 \approx 57.9$ kWh/year

VIII. CONCLUSION

The proposed elevator system achieves the goal of delivering a low-cost, compact, and accessible vertical transportation solution for two-story buildings. Its robust materials, simplified mechanics, and user-friendly features make it especially valuable for elderly users and small-scale infrastructures. The success of the prototype demonstrates its potential for widespread implementation in the future.

IX. FUTURE SCOPE

Further developments may include load capacity expansion to 500 kg, aesthetic customization, enhanced automation, smart features such as IoT-based monitoring, and renewable energy integration. These additions will extend the usability of elevators across more environments and improve sustainability.

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BIOGRAPHY

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