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An Analysis of Regenerative Solar Powered Elevator

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Abstract: ***The development of regenerative solar-powered elevators has the potential to significantly reduce the energy consumption and environmental impact of vertical transportation systems. These elevators are designed to capture and reuse energy that would otherwise be lost during operation, making them highly energy-efficient and cost-effective.***
This paper discusses the objectives that should be considered when designing regenerative solar-powered elevators. These objectives include energy efficiency, renewable energy, reliability and safety, cost-effectiveness, accessibility, and innovation. By focusing on these objectives, regenerative solar-powered elevators can provide a safe, reliable, and sustainable solution for vertical transportation.
The paper also discusses the various components of a regenerative solar-powered elevator system, including the solar panels, battery storage system, regenerative braking system, and control system. These components work together to capture, store, and reuse energy during elevator operation, reducing the overall energy consumption of the system.
Overall, the development of regenerative solar-powered elevators represents a significant step forward in sustainable transportation technology. By incorporating innovative design features and utilizing renewable energy sources, these elevators can provide a more environmentally friendly and cost-effective alternative to traditional vertical transportation systems.

I. INTRODUCTION

In last years, energy savings has become a particularly significant issue; in fact, energy efficiency policy in many countries has been established in order to mitigate the environmental effects of the conventional energy sources. Moreover, the reduction of electrical energy consumption is considered a key aspect to make the national energy systems robust enough to ensure the energy services needed for local and global economies. Among the several international and national action plans undertaken for energy saving, a considerable prominence has been given to the sustainability certifications of buildings and green building ratings. In the context of a sustainable development, the lift consumptions plays a key role as it strongly affects the energy use associated to the buildings.

New elevator configurations are proposed nowadays from specialized industry in this sector, mainly based on the use of regenerative PMSM electrical drives, coupled to energy storage systems for regeneration and power peak shaving; such solutions show good service and energy saving capability, but the investment cost for systems modernization can be significant.

Here we are talking about regenerative drive system, A regenerative drive is a type of electrical drive system that is able to recover some of the energy that would otherwise be lost during operation, and convert it back into usable electrical power. This is achieved through the use of a special type of power converter that is able to convert the kinetic energy of the system back into electrical energy, which can then be used to power other devices or be fed back into the electrical grid.

II. LITERATURE REVIEW

A. Hirzel, S., and Dutschke, E. (2010).

From one-off sales of lifts, escalators and air conditioning and ventilation systems to complete packages for commercial and residential building complexes, Mitsubishi electric is ready to provide a solution that best matches building requirement and user needs.

Mitsubishi electric lifts are contributing to the development and expansion of high-tech cityscapes around the world, and providing architects and developers with new options for innovative building designs. Unique state-of-the-art technologies are continuously being introduced lift operation and system efficiency.

From providing conventional and customized straight line escalators the production of the world's only spiral escalators, Mitsubishi eclectic is an industry leader in vertical transport. Systems incorporate innovative engineering and energy efficient technologies that ensure operation efficiency, including the at most reliability, durability and safety.

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B. Masaki Nomura, HiroyuIkejima, and Shigetekamorita

The electromagnetic with non asbestos lining shall be spring applied an electrically released type having noiseless operation. The brake capable of stopping and holding the elevator car in its downward travel to rest with 125% of its rated load from the maximum governor stripping speed. In this condition the retardation of the car shall not exceed that result in from the operation of the safety gear or stopping on the buffer. Spring used to apply the beak shoes shall be in compression an adequately supported. Break lining shall be of renewable incombustible materials and shall be secured to the brake shoes such that normal wear shall not weaken their fixings. Band breaks shall not be used.

III. PROBLRM STATEMENT

The majority of elevators in buildings today rely on traditional energy sources such as electricity from the grid or diesel generators, which contribute to greenhouse gas emissions and can be costly to operate. As the world becomes more focused on sustainability, there is a need for more environmentally-friendly solutions for vertical transportation. The challenge is to design and implement an elevator system that is powered primarily by renewable energy, such as solar power, and incorporates regenerative technology to minimize energy consumption and reduce costs. This system should be reliable, efficient, and cost-effective, while also meeting safety and accessibility standards. The goal of this project is to develop a regenerative solar-powered elevator system that can operate independently of the grid, reducing the building's energy consumption and carbon footprint. This system should also provide a comfortable and seamless user experience for building occupants.

IV. CHALLENGES

One of the main challenges for a regenerative solar-powered elevator is designing a system that can generate enough energy from solar power to operate the elevator consistently, even on days with limited sunlight. Another challenge is ensuring that the system can store excess energy generated during peak sunlight hours, so that it can be used during periods of low sunlight.

Another challenge is developing a regenerative braking system that can efficiently capture and store the energy generated by the elevator during descent, and then use it to power the elevator during ascent. This requires advanced engineering and control systems to ensure that the energy is captured and stored safely, and that the elevator remains stable and secure during operation.

Additionally, it is important to consider the cost-effectiveness and reliability of the system, as well as its compatibility with existing buildings and infrastructure. The system must be designed to meet safety and accessibility standards, and be capable of integrating with building management systems and other technology.

Overall, the challenge is to design a regenerative solar-powered elevator system that can efficiently generate and store energy, while meeting the performance and safety requirements of a traditional elevator system.

V. IMPORTANT FACTOR TO BE CONSIDERED

1) *Solar Power Generation:* The solar panels used to generate electricity for the elevator system must be capable of producing enough energy to power the elevator, even on cloudy or low-light days. Factors such as panel orientation, tilt, and shading must be considered when designing the solar array.
2) *Energy Storage:* A reliable and efficient energy storage system is necessary to ensure that excess energy generated by the solar panels is stored and available for use when needed. Batteries or other energy storage systems must be designed to provide enough power to operate the elevator during periods of low sunlight or high demand.
3) *Regenerative Braking:* The regenerative braking system must be capable of efficiently capturing and storing energy generated during descent, and then using it to power the elevator during ascent. This requires advanced control systems and energy management strategies to ensure that the system operates safely and reliably.
4) *Efficiency and Performance:* The elevator system must be designed to operate efficiently, using as little energy as possible while still providing safe and comfortable transportation. The system must also be capable of meeting performance standards for speed, capacity, and reliability.
5) *Safety and Accessibility:* The elevator system must meet all safety and accessibility standards, including emergency evacuation procedures, fire safety, and compliance with building codes and regulations. The system must also be accessible to people with disabilities and meet relevant accessibility standards.
6) *Cost-effectiveness:* The regenerative solar-powered elevator system must be cost-effective, both in terms of initial installation costs and ongoing maintenance and operation costs. The system must provide a reasonable return on investment while still delivering reliable and efficient transportation.

7) *Integration with Building Systems:* The elevator system must be capable of integrating with other building systems, such as building automation and control systems, to ensure efficient operation and energy management. It must also be compatible with existing building infrastructure and design requirements.

VI. IMPLEMENTATION OF REGENERATIVE DRIVE SYSTEM

A regenerative solar-powered elevator is an elevator that is powered by solar energy and has a regenerative braking system that recovers energy when the elevator is descending. Here are the steps to implement such an elevator:

Determine the power requirements: The power requirements for an elevator depend on the weight it needs to carry and the speed at which it needs to travel. You need to calculate the maximum power requirement and design the solar panel system accordingly.

Choose the right solar panels: Solar panels come in different sizes and capacities. You need to choose the right solar panels that can generate enough power to meet the elevator's needs.

Select the battery system: The battery system is required to store the energy generated by the solar panels. You need to choose the right battery system that can store enough energy to power the elevator during non-sunlight hours.

Design the regenerative braking system: The regenerative braking system recovers the energy when the elevator is descending. You need to design a system that can capture this energy and send it back to the battery system for storage.

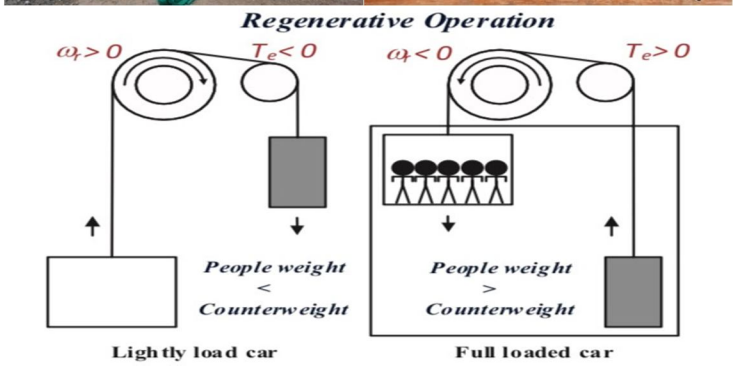
Install the solar panels and battery system: Once you have designed the system, you need to install the solar panels and battery system on the elevator shaft or on the roof of the building.

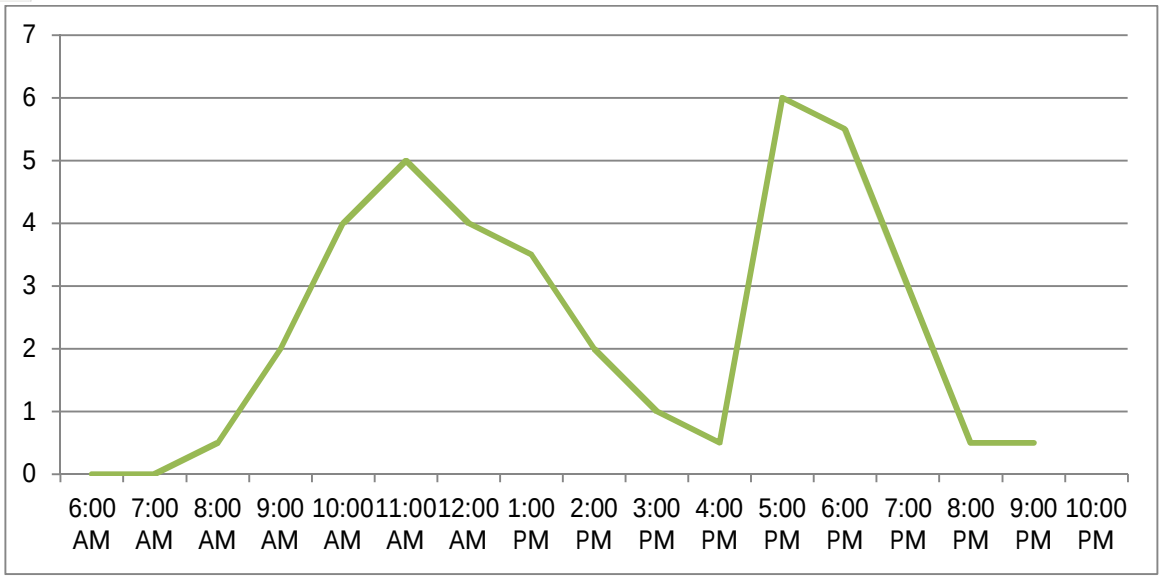
Install the regenerative braking system: The regenerative braking system needs to be installed in the elevator to recover the energy during descent.

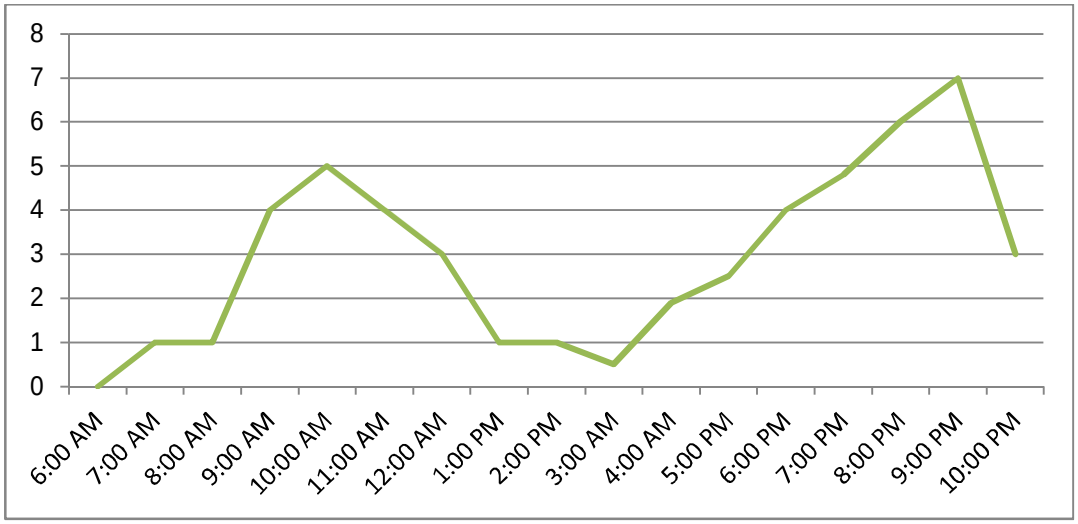
VII. RESULT ANALYSIS

DIFFERENT WEIGHT	Voltage (V) OUT PUT
900 GM	7.25
1500 GM	12.76
1800 GM	17.51
2200 GM	19.44

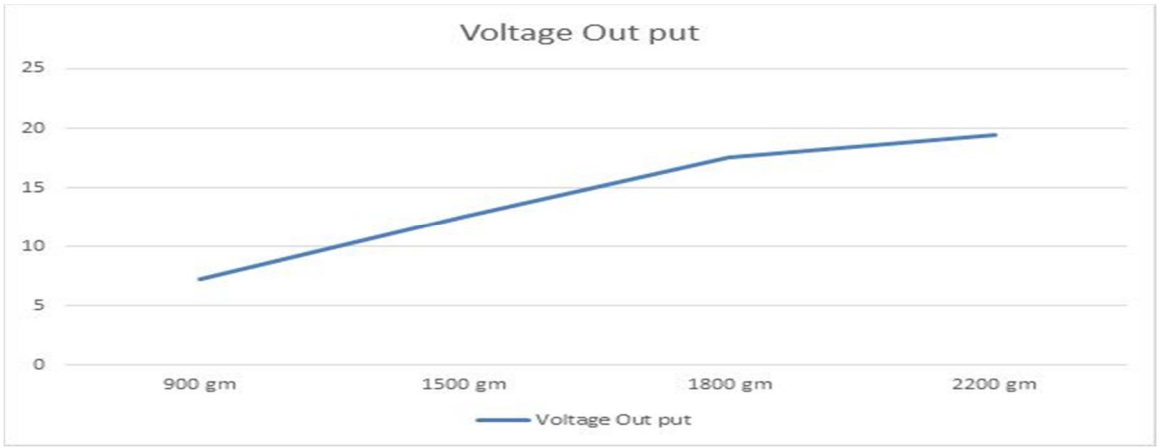








X = time per hour
Y = elevator usage



X = different weight
Y = voltage out put

VIII. CONCLUSION

Regenerative solar-powered elevators are an innovative and sustainable solution for vertical transportation systems. These elevators capture and reuse energy that would otherwise be lost during operation, making them highly energy-efficient and cost-effective.

To design a successful regenerative solar-powered elevator, it is important to focus on objectives such as energy efficiency, renewable energy, reliability and safety, cost-effectiveness, accessibility, and innovation. By considering these objectives, elevators can be designed to provide a safe, reliable, and sustainable solution for vertical transportation.

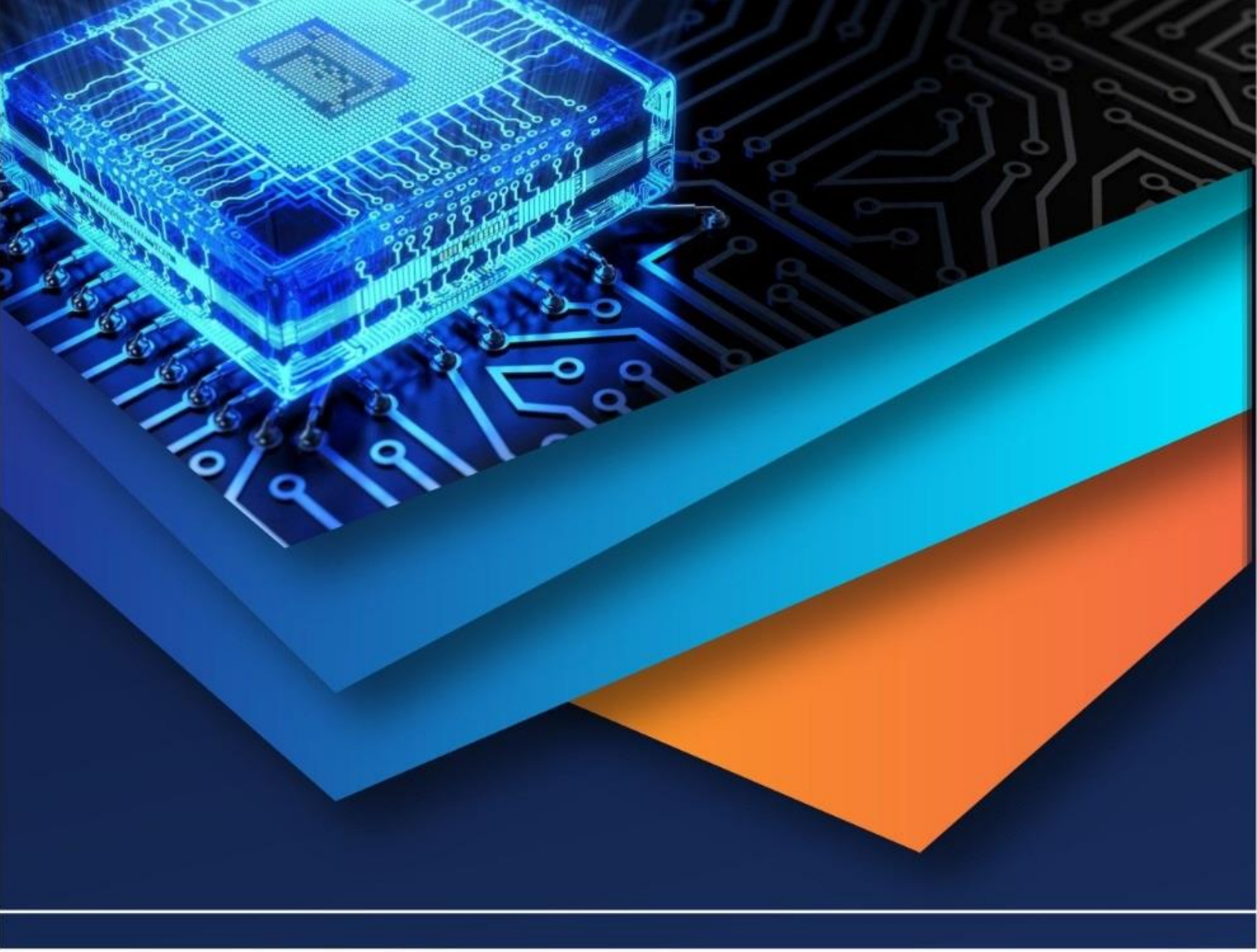
The key components of a regenerative solar-powered elevator system include solar panels, battery storage systems, regenerative braking systems, and control systems. These components work together to capture, store, and reuse energy during elevator operation, reducing the overall energy consumption of the system.

The development of regenerative solar-powered elevators represents an important step forward in sustainable transportation technology. By utilizing renewable energy sources and incorporating innovative design features, these elevators can provide a more environmentally friendly and cost-effective alternative to traditional vertical transportation systems.

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