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Turnstile based Kinetic Energy Generation System-Review

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Abstract: ***This project presents a comprehensive analysis of the turnstile gate mechanism, focusing on its design, functionality, applications, and engineering considerations. Turnstile gates play a crucial role in crowd control and security, and they have the potential to harness mechanical energy for electricity generation. This report helps valuable insights for engineering projects that involve turnstile gate systems. Turnstile gates are a common sight in various public spaces, including transportation hubs, stadiums, and secure facilities. They are designed to allow the controlled passage of individuals while preventing unauthorized entry. In recent years, engineers and designers have explored the possibility of using turnstile gates to generate electricity through the mechanical energy generated by users passing through.***

Keywords: Turnstile, Energy Harvesting, piezoelectric materials, electromagnetic induction, Pedestrian Walkways, Power Generation

I. INTRODUCTION

The Increase in the demand of electric power and pollution due to production of electric power have sidetracked the world to focus on the green energy generation which would satisfy the need without polluting the environment. Though there are various form of green energy. This article targets on unused manual work into use full energy in this context Turnstile structure is taken to serve the above purpose. Turnstile structure is usually used to control the entry of people one after the other and also to restrict the entry of animal. Normally these Turnstile are deployed in the places which are frequented by people such as railway stations, parks, tourist place, commercial mall, officers etc. Hence each time when a person enters via Turnstile it will rotate and this manual work is converted to electrical energy without any pollution. A prototype is designed and deployed in our workplace; electric power generated. This system seems to be fruitful solution for generating green energy in the cost-effective manner. During the last decades, the interest in generating clean energy by unconventional methods has grown due to the high electricity demand, especially in urban areas. In this context, several strategies for the conversion of mechanical energy to electrical energy have been identified. Electricity generation from waves and generated electric power, from a wheel, to be used in the public transport system. Besides, other authors proposed the generation of electrical energy using Dynamometer. Designed and built a power generator through a system of mechanical Sprocket, chain drive, and dynamometer.

II. SYNTHESIS OF TURNSTILE

The operation of turnstile gates typically involves the rotation of arms or barriers in a one-way direction. Users must present a valid credential or make a physical rotation to gain access. The mechanical components and locking mechanisms are designed for reliability and long-term use. Generating power from turnstiles involves harnessing the mechanical energy created when people pass through them. This energy can be converted into electrical power through various methods. One common approach is using kinetic energy harvesters. Here's how power generation from turnstiles works..

III.NEEDS OF TURNSTILE

1) Harnesses Human Energy: Converts pedestrian motion into electricity, utilizing otherwise wasted activity.
2) Promotes Sustainability: Reduces reliance on fossil fuels and lowers carbon emissions in urban areas.
3) Cost-Effective: Leverages existing foot traffic with minimal ongoing costs, supporting lights or small electronics.
4) Educational Impact: Demonstrates renewable energy in action and encourages public engagement.
5) Scalable and Adaptable: Suitable for metro stations, malls, airports, and schools with flexible designs.
6) Dual Functionality: Combines energy generation with access control and crowd management.
7) Encourages Urban Innovation: Highlights creative, eco-friendly solutions in everyday infrastructure

IV. APPLICATION OF TURNSTILE

1) Metro and train stations for commuter-powered electricity,
2) Public spaces with high pedestrian traffic,
3) Mechanical gear-driven energy harvesters,
4) Piezoelectric-integrated systems, and
5) Educational or demonstration setups focusing on sustainable energy.

V. LITERATURE SURVEY

Paz-Penagos H Electric power generation from a turnstile this research aimed to design, simulate in SolidWorks, build, and test two energy conversion mechanisms using mechanical gears and through 0 neodymium magnets. The used source of mechanical energy was the rotational movement of the turnstile arm, generated by pedestrians who enter and leave the campus at Escuela Colombian de Ingeniería Julio Garavito. To achieve it, the following tasks were performed: the literature review, parameterization of pedestrians' entrance and exit, characterization of the turnstile, simulation, construction, and the assessment of the mechanisms. The obtained energy conversion results varied from 7v to 11v (1W) for the mechanism using neodymium magnets, and from 12v to 17v (12W) for the mechanical gears. The developed system aims to promote environmental commitment and exploit the lost energy resulting from people's daily activities.

Saucedo et al. evaluated electricity generation from waves and generated electric power of 20V, from a magnetic wheel, to be used in the public transport system. Besides, other authors proposed the generation of electrical energy using piezoelectric devices. Furthermore, Márquez and Tlatelpa designed and built a power generator through a system of mechanical gears, chain drive, and alternator output to be used in the mass transport system in Mexico. Thus, 747.5 W were generated from a single turnstile of the station "Indian Green", for one hour. Moreover, Ahmad et al designed and fabricated a power generator induced by the movement of a door to charge a smartphone; as a result, it generated a voltage of 11.54V, which was enough to meet the target.

Blanchette and Al-Haddad implemented a permanent magnet generator of a double rotor with a magnetic gear to collect wind power directly without mechanical conversions; as a result, a prototype of a compact generator of 2,5kVA was proposed, which could be coupled directly to the source. Finally, Sepulveda designed and manufactured a power generator based on rotary piezoelectric, through a polygon-shaped gear. The power generator was built using the pair of the axle of the pedals of a gym's static bike. A previous device was developed to feed the control circuit of the bike. Therefore, a power of 16mW was generated, for an average input of 300 revolutions per minute.

Generating Electricity Using Piezoelectric Material Jedol Dayou, Man-Sang, C. , Dalimin, M. N. & Wang, S. This paper discusses the use of piezoelectric material to generate electricity. This includes the basic theoretical modelling of the electrical power generation mechanisms and optimization of the piezo-host system. It is shown that with proper configuration, a single piezo-film can generate enough electrical density that can be stored in a rechargeable battery for later usage. In this paper, a theoretical model on the generation mechanisms of electricity by piezoelectric material attached to a flexible structure has been developed and tested experimentally. The Euler-Bernoulli method was proven to be the most appropriate model in reference to the experimental data and its practicality. The piezo-host configuration was then optimized with huge increment in the voltage output. With the configuration optimized, the voltage and current density from the piezoelectric were made high enough to be stored in a 1.2V-2500 mAh nickel metal hydride battery for later applications.

A mechanical design of power generator using door openings for household use Electricity is one of the most important human resources in the life of today's human being. It keeps the lights on, air conditioners and fans running throughout the hot weather and connecting people through smart phones. These household appliances will be causing higher dependency on electricity among consumers. The electricity requirements are hiking at alarming rate where the fossil fuels and other conventional resources that are being used for generation of electrical energy may no longer be sufficient to keep pace with increasing demand of the electrical energy of the world. This power generation depends on fossil fuel which also causes pollution and changes to the global climate. Thus, the main objective of this study is to propose a mechanical design of power generator which the input is from the movement of door openings. The power generator is designed and fabricated through various manufacturing processes and it consists of bevel gears, shafts and wheels. The power generator is then attached to a moving door and connected to a voltmeter. Result shows that the power generator is able to generate approximately of 12V and this is sufficient to charge a smart phone. To conclude, the designed power generator is not only environmentally friendly but also has potential to be used by households because of its simple input requirement and small in size.

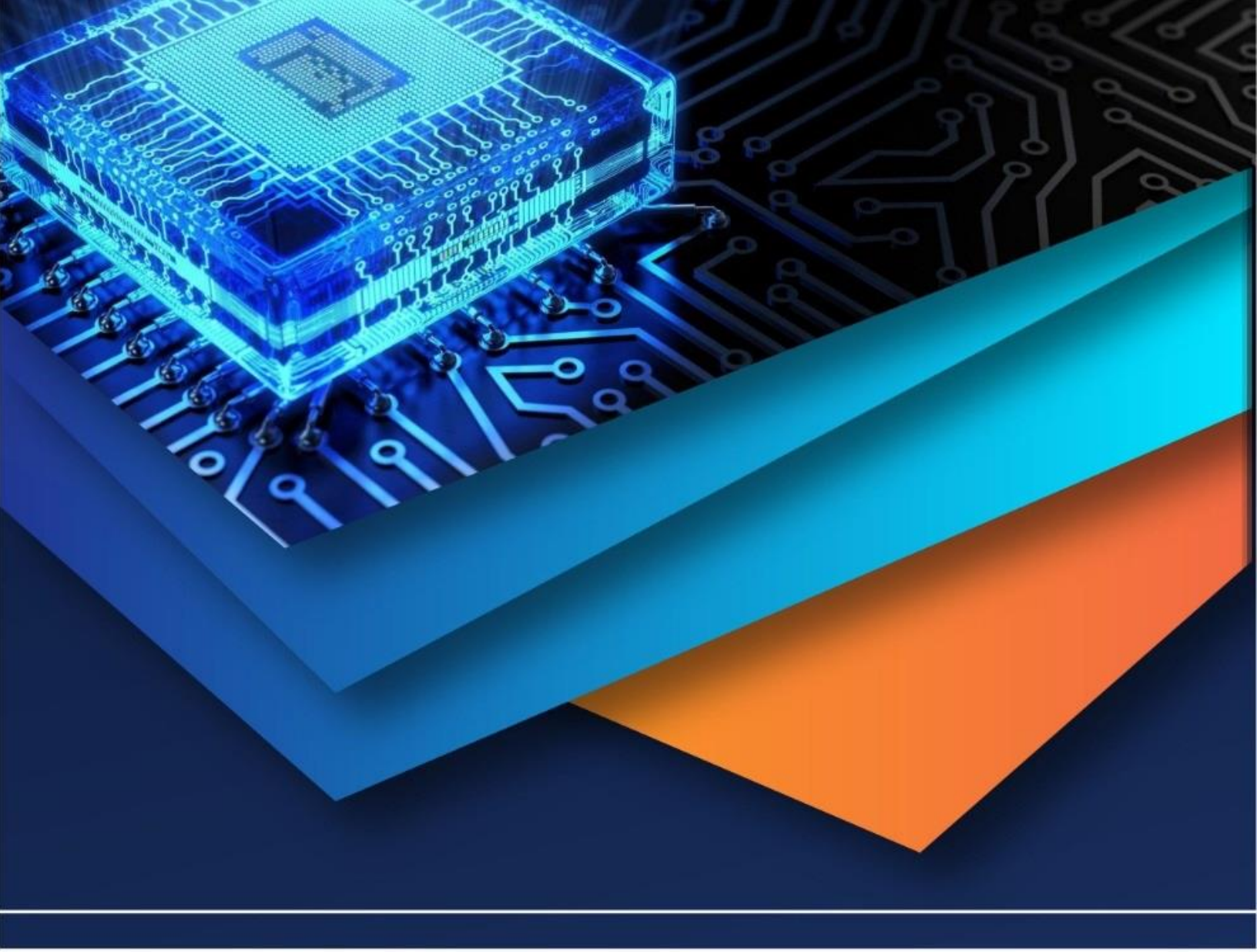
Hrishikesh Hinge, and P. E. Chaudhari Power Generation System and Automatic Opening of Door As the world is advance in various fields like research and development; conservation of energy is very important aspect. Due to shortage of electricity in the rural areas as well as developing cities saving of energy is an important factor so we have to save the energy whenever as possible. To conserve energy, we have taken the step and introduce a new concept. In this concept conversion of mechanical energy from opening a door into electrical energy for backup power supply is studied. The green energy solution makes use of an everyday occurrence to protect against intermitted power loss. The energy you expend by pushing a revolving door you can convert into electrical energy that is usable. For example, at Hospitals, Banks, Post offices, Hotels or the use of door is frequent etc. Our aim is to convert small amounts of human energy into electricity by use of generator. The Revolution Door and Electrical component are of two prototype devices with mechanical/electrical systems that harnesses human motion and redistribute it as electricity. This source of power can be used at the offices, colleges or Hotels and most likely by the Hospitals door operating system. Also, by accumulating this low intensity electricity in Batteries, it can be supplied to the big villages or in towns where there is scarcity of electric supply. Electric to Mechanical Energy Conversion of Linear Ultra-Fast Electro Mechanical Actuators Based on Stroke Requirements Ara Bissal, Jesper Magnusson, and Goran Engdahl the operational efficiency of ultra-fast actuators used as drives in high voltage direct current breakers are at best 5 %. To boost their efficiency, the design of the energizing circuit is crucial. A multi-physics finite element method (FEM) model coupled with a SPICE circuit model that is able to predict the performance of the actuator with an accuracy of at least 95 % has been developed and verified experimentally. Several variants of prototypes and models have been simulated, built, and tested. It was shown that one of the main problems leading to low efficiencies is the stroke of the drive. However, there is a possibility to increase the efficiency of the electric to mechanical energy conversion process of the studied Thomson (TC) and double-sided coils (DSC) to a maximum of 54 % and 88 % respectively if their stroke is minimized. This can be done at the expense of increasing the complexity and the cost of the contact system by designing a switch with several series connected contacts that is encapsulated in a medium with a high dielectric strength. Another proposed solution is to design a current pulse with a rise time that is considerably shorter than the mechanical response time of the system. Parametric variations of capacitances and charging voltages show that the TC and the DSC can achieve efficiencies up to 15 % and 23 % respectively. Regardless of the chosen method, the DSC has a superior efficiency compared to a TC.

VI. CONCLUSIONS

Turnstile-generated electricity illustrates a practical pathway to sustainable, decentralized energy by transforming daily human activity into usable power. Research and prototypes demonstrate that, while individual units generate modest power, aggregate deployment in high-traffic environments could contribute significantly to reducing energy demand and carbon emissions. Continued optimization of mechanical-electrical systems, coupled with smart energy management, positions this technology as a promising avenue for green energy development, with applications extending from transportation hubs to commercial and public spaces globally.

REFERENCES

[1] Ortega, M., & Vazquez, A. (2018). Experimental evaluation of human-powered microgenerators for foot-traffic installations. Energy Conversion and Management, 165, 415–423. https://doi.org/10.1016/j.enconman.2018.03.086
[2] Khalid, R., Ahmed, S., & Al-Hadidi, A. (2020). Pedestrian kinetic energy harvesting: Mechanical design and field study. IEEE Transactions on Industrial Electronics, 67(5), 4081–4090. https://doi.org/10.1109/TIE.2019.2924871
[3] Zhou, X., Li, Y., & Chen, W. (2019). Design and performance optimization of kinetic-energy-harvesting turnstiles. Journal of Renewable and Sustainable Energy, 11(4), 043101. https://doi.org/10.1063/1.5112345.
[4] Park, J., Kim, H., & Lee, S. (2017). Optimization of a human motion-powered generator using electromagnetic induction. Applied Energy, 204, 1258–1267. https://doi.org/10.1016/j.apenergy.2017.06.038
[5] Singh, P., & Rajan, K. (2021). Sustainable kinetic energy harvesting from pedestrian movement for microgrid applications. Energy Reports, 7, 731–742. https://doi.org/10.1016/j.egyr.2021.03.021.
[6] Rypina, I. I., Brown M. G., and Kocak, H.: Transport in an idealized three-gyre system with application to the Adriatic Sea, J. Phys. Oceanogr. 39, 675–690, 2009.
[7] Lowry, B.; Robbins, T.; Weng, C.-H.; O'Brien, R. V.; Cane, D. E.; Khosla, C. In vitro reconstitution and analysis of the 6- deoxyerythronolide B synthase. J. Am. Chem. Soc. 2013, 135, 16809−16812.
[8] Hernandez-Carrasco, I., Hernandez-Garcia, E., Lopez, C., and Turiel, A.: Reliability of a Lagrangian analysis from FSLEs, LAPCOD meeting 2009, Presentation B203, 2009.
[9] Walsh, C. T. Polyketide and nonribosomal peptide antibiotics: modularity and versatility. Science 2004, 303, 1805−1810.
[10] Aurell et al.(1997) Aurell, E., Boffetta, G., Crisanti, A., Paladin, G., and Vulpiani, A.: Predictability in the large: an extension of the concept of Lyapunov exponent, J. Phys. A, 30, 1-26, doi:10.1088/0305- 4470/30/1/003, 1997.
[11] [Beron-Vera et al.(2008)] Beron-Vera F., Olascoaga M J, Goni G J.: Oceanic mesoscale eddies as revealed by Lagrangian coherent structures, Geophys. Research Letters 35, L12603, 2008.



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