Power Generator Using Manual Door and Window Movementum

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Abstract—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 environmental friendly but also has potential to be used by households because of its simple input requirement and small in size.

Keywords—Power generator; mechanical input; door openings

I. INTRODUCTION

Electrical technology has been changing rapidly from the invention of a simple light bulb to the development of sophisticated electronic devices such as smartphones, computers and smart watches. These inventions will be causing higher dependency on the electricity among users. Thus, the production of electricity will increase and the power generation which mostly depends on fossil fuels produces huge amount of emissions. The important thing in this case is the awareness of the environmental consequences of the existing energy system as the fossil fuels could change global climate figure in the modern environmental. With the awareness of the environmental situation, this study aimed to design and fabricate a power generator which can be used by the household to generate electricity without being harmful to the environment.

Nowadays, the researchers are urged to focus on the renewable energy field in response to the increasing energydemands and environmental pollution that need for alternative energy sources. Wind energy has become a major source of the renewable energy in many countries due to many advantages [3]. Wind power generators work the opposite of a fan. The wind turns the blades that eventually spin a shaft which connect to a generator and generates electricity. The interesting part of wind energy is that it can generate electricity by small operation and maintenance costs. Although the generation of electricity is quite environmental friendly and the wind is free, the disadvantage of using this system is the nature of the wind is unpredictable and become a critical factor on investment decision.

A the energy demand in the world is keep increasing, there are many small electricity power productions have been invented to overcome this problem. These power generators are invented basically for household use and for appliances that use only small amount of electricity to function. There are several types of small electric power generator such as micro hydro system which uses household water supply as the source to generate power [10]. There is also an approach to generate electricity which the source is from the temperature changes. This idea is using thermoelectric power generation system. This technology was better known in the middle of 20^{th} century and the use of semiconductors with her band gap was found to perform better than two metals. The recent work done on improving the performance of the thermoelectric generation system is using the solar thermal energy and thermal concentration. Kraemer has demonstrated in his investigation that traditionally photovoltaic systems widely used flat panel whereas solar thermal systems generally use the optical concentrators to achieve high temperatures source for power generation.

Apart from that, there are also power generators that are using unconscious human's movement as its power input. Walking is a common activity performed in a person's everyday life. The energy is induced when the person's body weight is transferred to the ground when a person is walking. Therefore, the energy of the person from the foot step can be converted to the electricity by placing a device in a continuous human traffic such as in railway station platform, shopping complex or in a city footpath. This power generator uses piezoelectric effect to generate electricity.In this technology era, most of the gadgets or products that have been invented are run by the electricity. For an example, mobile phone is one of the necessary things that most people have. Mobile phone needs to be charged every day to ensure that it is always ready to be used. Although this

invention gives comfortable to human life but it also consumes higher amount of electricity because of its frequent charging. The increase of electric consumption also affects the environment as fossil fuel used to generate electricity produces carbon dioxide that is one of the major factors of global warming. The Environmental Protection Agency issued a rule where the power plants need to control emission of carbon dioxide. In response to this problem, a power generator that is environmental friendly and low energy input was designed and fabricated.

This study aims to design and fabricate a power generator that is the electricity was induced by a moving door.This study is also one of effective solutions to reduce environmental problem that has been faced by conventional power generator.

II. LITERATURE SURVEY

A substantial body of research has been conducted with the aim of improving battery management and energy exchange control by integrating power electrons technologies, according to the literature review. The studies have examined the short comings of conventional battery management system (BMS) in detail and have brought attention to the necessity of dynamic monitoring and control features to maximize battery performance and prolong lifespan. Studies have explored as data analytics communication. Power Electronics for Energy Conversion: Investigate literature on power electronics systems for energy conversion. This includes converters, inverters, and control strategies suitable for harvesting and conditioning the electricity generated from manual door and window movement. Efficiency Enhancement Techniques: Examine studies focusing on improving the efficiency of power conversion systems. This could involve maximum power point tracking (MPPT) algorithms, impedance matching techniques, and power management strategies tailored to intermittent energy sources.

III. PROPOSED METHOD

The concept of power generation using manual door and window movement presents an innovative and sustainable solution for generating electricity. This concept harnesses the unused motion of doors and windows to produce electrical energy, providing a cost-effective and eco-friendly alternative to conventional power sources. This methodology will outline the process of developing and implementing this concept, including the necessary components and steps involved in its operation

Once the design and selection of components are finalized, the next step is to construct and assemble the system. This involves mounting the components on a sturdy base and wiring them together according to the schematic diagram. Careful attention must be paid to ensure all connections are secure, and the system is properly grounded to prevent electrical hazards.

Block Diagram

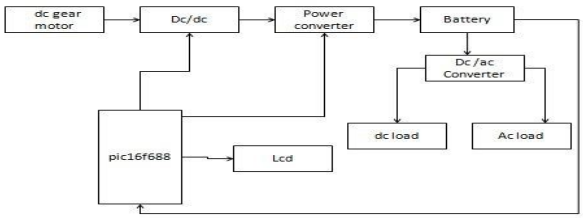

Figure no. 1 Proposed Method

IV. HARDWARE IMPLEMENTATION

The power generator was able to generate electricity when the wheel was rotated which caused by the moving door. One of the wheels was locked along with the shaft which meant that the wheel would push the shaft to rotate together and the turning force of the wheel would then has been transmitted the dynamo using the bevel gears. The electricity could only generate when the power generator was being pushed in one way because the dynamo will change its polarity when the direction of rotation was changed. To make sure there was no change in polarity, the diode was connected to the positive terminal. There were two stages of experiments for the voltage generated. First, the power examine how much voltage can be generated by the power generator. From the experiment, the voltage that had been generated was 11.54 V. This was a huge value for a small generator. As the objective of this project is to charge a smart phone, the power generator needed to step down the voltage generated until it reached 5V which it was the possible voltage to charge a smartphone. Next stage of this experiment was to make sure that the output was 5V by connecting the power generator to switching regulatorLM2596 5V module. The wheel was rotated for two full revolutions and the power generator generated 4.43V. The LED at the module lighted up brightly when the wheel was rotated. A mechanism of openings and closing door which gave motion was selected as an input to drive the power generator. The power generator was

installed at the back of the door as The door always had been pushed and pulled therefore the translation motion acting on the opened and closed door fulfilled the requirement as an unconscious and allow mechanical input

Figure no. 2 Power Generator Using Manual Door And Window Momentum

V. RESULT AND DISCUSSION

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There were two stages of experiments for the voltage generated. First, the power generator directly connected to the multi meter. This was to examine how much voltage can be generated by the power generator. From the experiment, the voltage that had been generated was 11.54 V. This was a huge value for a small generator. As the objective of this project is to charge a smart phone, the power generator needed to step- down the voltage generated until it reached 5V which it was the possible voltage to charge a smartphone. Next stage of this experiment was to make sure that the output was 5V by connecting the power generator to switching regulator LM2596 5V module. The wheel was rotated for two full revolutions and the power generator generated 4.43V. The LED at the module lighted up brightly when the wheel was rotated.

A mechanism of openings and closing door which gave motion was selected as an input to drive the power generator. The power generator was installed at the back of the door as shown in Fig. 5. The door always had been pushed and pulled therefore the translation motion acting on the opened and closed door fulfilled the requirement as an unconscious and a low mechanical input.
The torque applied by human being to open door was 15Nm which normally went waste was converted into suitable power source by moving the power generator forwards and backwards. Principle of this mechanism was similar to turbine used in hydroelectric dam or wind turbine to generate electricity. A door in a busy place usually keeps moving for hours every day. Much of the energy used to turn the door was wasted. A generator at the door could convert the mechanical energy from the moving door into electrical energy. Thus utilizing the kinetic energy in operation of door with the help of geared mechanism was the basic principle of this study.

VI. CONCLUSION

A power generator which included the input and output mechanism had been designed and fabricated. The components that involved in this study were dynamo, bevel gears, shafts and bearings. The power generator was tested and it was able to generate electricity with the voltage of 11.54V which was more than enough to charge a smart phone. Thus, the objective of this study had been achieved. The power generator was not only an environmental friendly but also had a potential to be used by the household since it came in small size and required only a low mechanical input to operate.

One recommendation had been made for the future work in order to improve the capability of the power generator. The number of rotations of the shafts and the gears shall be increased so that higher power output can be generated. One of the ways is that to increase the gear ratio between pinion and driven gear which lead to higher angular velocity.

REFERENCES

[1] S. Jacobs son, and A. Johnson, “The dilusion of renewable energy technology: an analytical framework and key issues for research.” Energy Policy 28, pp. 625-640, 2000.

[2] S. Raju, and G. Pillai, "Design and real time implementation of type-2 fuzzy vector control for DFIG based wind generators." Renewable Energy, 2015.
[3] D. Xie, Z. Xu, L. Yang, J. Østergaard, Y. Xue, and K. P. Wong, "A comprehensive LVRT control strategy for DFIG wind turbines with enhanced reactive power support," IEEE Transactions on Power Systems, Vol. 28, No.3, 2013.
[4] A. Kumar, and K. Nair, "Wind power potential at Benau, Savusavu, Vanua Levu, Fiji", International Journal of Energy, Information and Communications, Vol. 4, Issue 1, 2013.
[5] Y. Chu, "Review and comparison of different solar energy technologies," 2011.
[6] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.
[7] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
[8] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
[9] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
[10] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.
[11] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
[12] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749
[13] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
[14] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
[15] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019
[16] S. H. Fukurozaki, R. Zilles, and I.L. Sauer, "Energy payback time and CO2 emissions of 1.2 kWp photovoltaic roof-top system in Brazil," International Journal of Smart Grid and Clean Energy, 2013.
[17] M. Maaßen, M. Rübsamen, and A. Perez, "Photovoltaic solar energy in Spain," International Financeand Economics, 2011.
[18] H. Liu, S. Ma, W. Li, H. Gu, Y. Lin, X. Sun, "A review on the development of tidal current energy in China," Renewable and Sustainable Energy, pp. 1141-1146, 2011.