Generation of Electrical Energy Using Road Transport Pressure at Speed Breaker

MD. Iqbal Hossain[1,a)], Rupa Akter[2,b)], Mahedi Hasan[3,c)], Ahamed Raihan[4,d)],
M F Shahriar Khan[1,e)], Fahad Bin Ali[1,f)], Rocky Chakma[5,g)], M. J. Alam[6,h)]
and S. S. Mahtab[6,i)]

[1] *Department of Electrical and Computer Engineering, South China University of Technology, China.*
[2] *Department of EEE, Mymensingh Engineering College, Mymensingh Bangladesh..*
[3] *Marine Engineering ,AMC (Australian Maritime College), University of Tasmania, Tasmania.*
[4] *Department Jahangirnagar University, Dhaka, Bangladesh.*
[5] *Department of EEE, University of Science and Technology Chittagong, Chittagong, Bangladesh.*
[6] *Department of EEE, Feni University , Feni-3900, Bangladesh.*

a) ih_sabuz@yahoo.com
b) rupa.mec.eee.bd@gmail.com
c) mahedih@utas.edu.au
d) araihan13@gmail.com
e) shahariar55@gmail.com
f) fahadbinali97@gmail.com
g) rocky.cht@gmail.com
h) alameee1993@gmail.com
i) Corresponding author: mahtabshahzad@gmail.com

Abstract.. This electric generator is a simple operated electro mechanical system which is controlled by gear and electricity is produced by the generator. This electric generator has been designed by using Sprocket and Chain, Gear, Flywheel, Bearing, spring, Generator, and Battery. Our target was to design and Construct a system that will produce Electricity using road transport pressure. When pressure is created on the pressure lever, the wheels of designated system rotate thoroughly and this rotation of wheels produce electricity in dc generator. The generated electricity may be used to meet the local demand. This may solve partially the national power generation problem.

INTRODUCTION

Production of Electricity is done by giving pressure on the pressure Lever. By Imposing weight on the pressure lever. The gear will force to the rotate. The rotation of gear will force the generator to produce electricity. There is no fuel so it is environment friendly.

There is a huge amount of difference in our country power demand & generation. Beside this most of the power in our country is meet by the conventional system using Fossil oil, Coal & Gas. All those are non-renewable. All of those may finish after a time. Along with this problem those problems, fossil fuel base generator pollutes our environment. Consequently, engineers must make serious and unrelenting efforts to explore the possibilities of harnessing energy from a variety of unconventional sources of energy. This project is one step in that direction.

Power has developed the significant necessity for human life at present. Energy is an important contribution to every division of the economy of any nation. The accessibility of customary Standard fossil-fuel will be the fundamental resources for the development of power, however There's a fear they are going to get depleted in the end by the following barely any decades. Subsequently, we need to research different kinds of non-conventional energy resources. The everyday expanding of population and diminishing power generation of conventional sources, gives a requirement for reflection on unconventional energy assets [1] [2] [3]. One more serious issue, which is turning into the major problems are population increasing. In addition, automobiles and Power stations are the significant pollution to create places. So, unconventional source power is expected to lessen this issue of difficultly. We suggested an unconventional power creating framework dependent on Speed shutter system which create power deprived of utilizing any marketable fossil fuels, which isn't creating contaminating items at all [3] [4]. Our aim in this paper is to reserve the kinetic energy that converts into squandered electricity while cars travel..

METHODOLOGY

In this project there are two basic principles are considered. They are-
I.   Simple transformation of the energy from mechanical to electric.
II.   To produce electricity using car weight (Potential energy) as import.
III.   Possible using three different mechanisms.
Possible using three different mechanisms are classified by three types are in below-
i.   Roller Appliance.
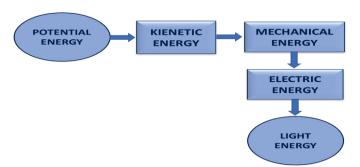ii.   Shaft appliance.
iii.   Rack-pinion appliance.

FIGURE 1. Power Conversion Diagram

In the figure 1 the block diagram has shown which are included by potential energy, kinetic energy, mechanical energy, electrical energy and light energy. Power conversion are working on few basic features. They are-
i.   Input is vehicle weight as potential energy.
ii.   Speed breaker arrangement converts it to kinetic energy.
iii.   Rack pinion, chain sprocket & flywheel convert it to rotational mechanical energy.
iv.   Generator converts it to electric energy.
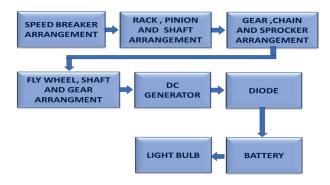v.   Light bulb makes it light energy.

FIGURE 2. Block diagram of the system

From the block diagram we observe that Speed breaker arrangement for car creating pressure on it. Rack pinion for making the linear motion to rotational motion. Shaft for transmitting the power to another parts. Gear chain & sprocket for increasing the rotation & one-way motion. Flywheel to keep the rotation continuous. DC generator for transformation of mechanical to electrical energy.
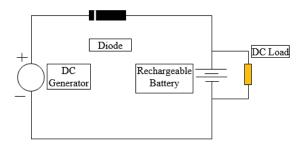

FIGURE 3. System Circuit Diagram

The circuit diagram is expressing the working principle how it works. Here DC generator for transformation of mechanical to electrical energy. Then diode to protect discharge of battery by generator while no input and battery to store electrical energy. Literally light bulb as DC load to convert the electrical energy to light energy.

HARDWARE DESIGN

Here, In this project, when passes over the roof, pressure will created & Rack will down. A linear motion will be created in Rack. Rack will move round the pinion attached with it. Linear motion will convert to the Rotating motion. Pinion will move the shaft which is fixed with it, shaft will move the large pinion.

The large pinion will pull the sprocket which is attached with secondary shaft along with fly wheel and the pinion of the gear. So, the shaft moves round with all the parts fixed with it. The dynamo is coupled with the gear so the dynamo moves round with the gear motion. Dynamo has permanent magnet & conductor coils. So, electricity induced in the dynamo. Dynamo supply the electricity to battery & Light.

bulb by connecting wire. So, the battery will charge & bulb start to lighting.
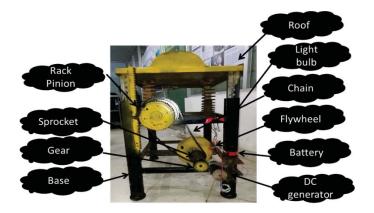
FIGURE 4. Electricity Generator using road transport pressure

A. Metal Base and Roof

It is a mild steel made structure with 4 legs. Rack legs will go through thinner side of the legs. Full design will stand over the base. It is a mild steel made roof of the system with four legs. The top is made as like speed breaker. Pressure will be created over it.

FIGURE 5. Metal Base and Roof

B. Rack Pinion

A rack and pinion is a category of linear actuator comprising a couple of gears that convert linear movement into rotational movement or rotational movement to linear movement. Here we used it to transform the linear motion to rotational motion.

FIGURE 6. Rack Pinion and Gear

C. Gear (Two Gear Train)

With the intention of transferring torque, a gear is a revolving machine part that has cut teeth, or cogs, that mesh with one more toothed portion. Two or more tandem gears are called a transmission and can provide a mechanical

advantage via a gear ratio, and can therefore be considered a simple machine. Geared devices can alter a power source 's speed, torque, and direction. The greatest mutual condition is for a gear to mesh with one more gear; though, a gear may also mesh a non-rotating dented portion, called a rack, resulting in transformation instead of revolution.

For a transmission the gears are similar to the pulley wheels. A benefit of gears is that a gear's teeth avoid slippage. A mechanical advantage is created when two gears with an unequal number of teeth are combined, with both the rotational speeds and the torques of the two gears varying in a simple relation. In transmissions that provide multiple gear ratios, such as bicycles and automobiles, the word gear refers to a gear ratio rather than a specific physical gear, as in first gear. The term is used to describe similar systems even if the gear ratio is constant rather than discrete, even if there are no gears in the system, as in a continuously variable transmission.
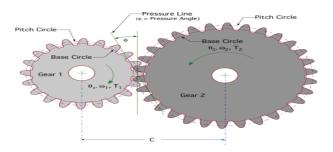

FIGURE 7. Two Gear Train

D. Chain Drives (Roller Mechanism)

Chain drive is a form of transmission of mechanical power from one residence to another. It is frequently used to transmit power to a vehicle's wheels. Most often the power is conveyed by a roller chain known as transmission chain drive. Passing over a sprocket gear with the gear's teeth mashing with the holes in the chain link, the gear is turned and this forces the chain into the device, bringing mechanical force.

The main purpose of a fly wheel is acting as energy "Accumulator' simply this decreases the 'fluctuation' of speediness. When the supply of energy does not vary and continuous in the same manner, it does not demand for energy. It will absorb energy when demand is less than the supply of energy and will give out energy when the demand is more than the energy being supplied. In our design we are not getting the continuous energy from the rack and we applied shock loads to the pinion besides this energy is not constant throughout the cycle. So as to eliminate or overcome this shock loads, we are using the flywheel to supply constant energy to the dynamo.

For a desired velocity ratio, gears are selected using the relationship

$$\frac{w_2}{w_1} = -\frac{D_1}{D_2} = -\frac{N_1}{N_2} \quad\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

However, N1 and N2 must be integers therefore ω2/ω1 can only be adjusted in discrete increments. If N1 and N2 can be found such that equation (1) is satisfied, then a workable gear design is achievable. If this relationship is not satisfied, then a multiple or compound gear train may be required. If a gear relationship exists that satisfies the constraints, then the pitch diameter can be chosen using N1 and N2, followed by the remaining gear parameters. Stress analysis must also be performed using expected loads in service to validate gear teeth sizing. Results can be used to select gears from vendor catalogs or gear drawings can be created for manufacture. Using non-standard gears, it is possible to have non-integer values of gear teeth per inch.

POWER CALCULATION AND RESULT ANALYSIS

From This project gives an overview about the power calculation with results. Also, we assumed the pressure vs voltage output data and its graph chart. In addition, we have got an idea about the analysis of the continuous pressure creating by vehicle by considering to total time need to charge the battery and the Average pressure is produce per 20 sec.

TABLE 1. Rating of Generator and Battery

Generator Rating			Battery Rating		
Content	Rating	Unit	Content	Rating	Unit
Generator Maximum Voltage	24	V	Voltage	4	V
Maximum Current	3.1	A	Current	2	A
Rated Rotation	1500	RPM	Power	8	W

Generator and battery rating are shown in Table I. and after getting the output we have got the data are shown in Table II.

TABLE 2. Final Result

Result		
Content	Output	Unit
Input Pressure	75	Kg (Appx)
Maximum Rotation	428.6	RPM
Voltage Output	6.2	V
Current	2	mA
Power	0.012	W

From the Table III. We can figure out the more pressure creates the more output voltage.

TABLE 3. Pressure vs Voltage Output Data

Pressure	Voltage
30 KG	2.6 V
45 KG	3.9 V
55 KG	4.7 V
61 KG	5 V

According to the pressure vs voltage output data here in below the graph chart are shown how the output voltage are increasing by creating and applying the pressure.
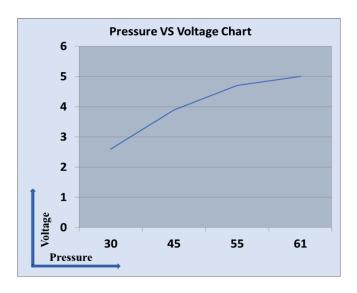
FIGURE 8. Pressure VS Voltage Output Graph Chart

A. Analysis-1

If consider the continuous pressure creating by vehicle, total time need to charge the battery =
0.012 W power Produce in 1second
1 W power produce in 1/0.012 =83.33seconds
8 W power produce in 1/0.012 * 8=666.66 seconds
Total time need = 666.66 second s= 11.11 minutes = 0.19 hour
Total Power produce per day = 8/0.19*24 W= 1010.526 W.

B. Analysis-2

If we consider the Average pressure is produce per 20 sec
Vehicle passes time 1 sec
Flywheel keeps the momentum for 4 sec- then,
Total power off time is 20-(1+4) =16 sec
The power production ratio is 5/16=0.313.
So, total power producing per day= 1010.526*0.313= 315W
For the process to improve the efficiency we have to consider below options-
- If we consider one more gear with ratio of 4:1 to get 1500 RPM, then we will get near about 24 V as the generated voltage is directly proportional with the RPM of the rotor.
- 40 KG fly wheel to keep the momentum of rotor about 20 second after release from the pressure.

CONCLUSION

It is an unconventional kind of energy producing. The remaining energy source, like the coal, oil etc., may well not be sufficient to meet ever-growing demands for energy. These conventional energy sources are also diminishing and may be overwhelmed by the end of the 21st century or the start with the following century. Accordingly, engineers must make serious and unrelenting efforts to explore the possibilities of harnessing energy from a variety of non-conventional sources of energy. This task is a one footstep to track of that system. The final aim was scheming the speed shutter system by keeping the manufacturing, creator and purchaser models in check. The cause of using the feature more in almost all other features is because other features wouldn't affect the whole system as much.

REFERENCES

1. Sharma, P.C., "Non-conventional power plants", Public Printing Service, New Delhi, 2003.
2. Mukherjee, D. Chakrabarti, S., "Non-conventional power plants", 2005.
3. K. M. Ullah, K. M. Ahsan-uz-Zaman, S. Hosen, R. H. Khan and S. Parvin, "Electrical power generation through speed breaker," 2016 9th International Conference on Electrical and Computer Engineering (ICECE), Dhaka, 2016, pp. 30-33..
4. Watts,G., "Effects of speed distribution on the Hormonoise model predictions", Inter-noise Conference, Prague, 2004.
5. S. S. Mahtab, M. J. Alam, A. M. Khan, Z. Uddm, A. A. Mamun and M. M. Uddin, "Optimization of InSb QWFET layer structure for high-speed and low power nano electronics applications," 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), Dhaka, 2017, pp. 707-711, doi: 10.1109/ICAEE.2017.8255447. [Publisher: IEEE]
6. S. S. Mahtab, A. Monsur, S. S. Ahmed, R. Chakma and M. J. Alam, "Design and Optimization of Perovskite Solar Cell with Thin ZnO Insulator Layer as Electron Transport," 2018 International Conference on Advancement in Electrical and Electronic Engineering (ICAEEE), Gazipur, Bangladesh, 2018, pp. 1-4, doi: 10.1109/ICAEEE.2018.8643012. [Publisher: IEEE]
7. S. S. Mahtab ,M. A. Hossain., "Efficient and Stable Perovskite Solar Cell with TiO2 Thin Insulator Layer as Electron Transport," 2019 International Conference on Robotics,Electrical and Signal Processing Techniques (ICREST), Dhaka, Bangladesh, 2019, pp. 54-58, doi: 10.1109/ICREST.2019.8644093. [Publisher: IEEE]
8. R. Chakma ,S. S. Mahtab., "Navigation and Tracking of AGV in ware house via Wireless Sensor Network," 2019 IEEE 3rd International Electrical and Energy Conference (CIEEC), Beijing, China, 2019, pp. 1686-1690, doi: 10.1109/CIEEC47146.2019.CIEEC-2019589. [Publisher: IEEE]
9. M. F. S. Khan, S. S. Mahtab., "PLC Based Energy-Efficient Home Automation System with Smart Task Scheduling," 2019 IEEE Sustainable Power and Energy Conference (iSPEC), Beijing, China, 2019, pp. 35-38, doi: 10.1109/iSPEC48194.2019.8975223 [Publisher: IEEE]
10. Ismail Siddiqi Emon, Sabiha Sunjida Ahmed, Sharmin Akter Milu, and S. S. Mahtab. 2019. Sentiment analysis of bengali online reviews written with english letter using machine learning approaches. In Proceedings of the 6th International Conference on Networking, Systems and Security (NSysS '19). Association for Computing Machinery, New York, NY, USA, 109–115. DOI:https://doi.org/10.1145/3362966.3362977
11. Milu S.A. et al. (2020) Sentiment Analysis of Bengali Reviews for Data and Knowledge Engineering: A Bengali Language Processing Approach. In: Bindhu V., Chen J., Tavares J. (eds) International Conference on Communication, Computing and Electronics Systems. Lecture Notes in Electrical Engineering, vol 637. Springer, Singapore. https://doi.org/10.1007/978-981-15-2612-1_8
12. Ahmed S.S., Milu S. A., Emon I. S., Mahtab S. S. (2020) Opinion Mining of Bengali Review Written with English Character Using Machine Learning Approaches. In: Bindhu V., Chen J., Tavares J. (eds) International Conference on Communication, Computing and Electronics Systems. Lecture Notes in Electrical Engineering, vol 637. Springer, Singapore. https://doi.org/10.1007/978-981-15-2612-1_5
13. Jahan Buurat, Mahtab S. S. , Milu S. A., Emon I. S., (2020) An Automated Bengali Text Summarization Technique Using Lexicon Based Approach. In: International Conference on Innovations in Computer Science and Engineering (ICICSE-2020). Springer "Lecture Notes in Networks and Systems"
14. Jahan Buurat, Mahtab S. S. , Milu S. A., Emon I. S., (2020) A Pronoun Replacement Based Special Tagging System for Bengali Language Processing (BLP) In: International Conference on Innovations in Computer Science and Engineering (ICICSE-2020). Springer "Lecture Notes in Networks and Systems"
15. Fazlul Hoque, Rocky Chakma, S. S. Mahtab, Rupa Akter , Sabiha Sunjida Ahmed "Design and Developing Real Time Interactive IIUC Bus Tracking System":, Journal of Innovation in Computer Science and Engineering" (JICSE) with ISSN 2278-0947 in Volume 9(2), Volume 10(1)