FOOTSTEP ENERGY GENERATION AT RAILWAY STATIONS & BUS STOPS

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ABSTRACT

Electricity is the most general forms of energy used across the world. This project focuses on designing a setup that leads to the generation of electrical energy which is going to waste when humans are walking. Footsteps are an untapped natural resources. This generated energy is, however, cost effective and nonhazardous for human. Electrical energy can be produced by converting mechanical energy using footsteps. Generating the electric power through the fabrication of footstep arrangement with combination of piezo electric elements. Whenever pressure is exerted on the piezo element, it generates some amount of electrical energy. This energy is stored in the battery and can be later use to light up domestic lights or small applications like mobile charging. This project will reduce the global warming and need of electricity in a much cleaner cost-effective way.

Keyword: - *Piezo crystals, Energy generation, Footstep, Battery Charging*

1. Introduction

In the 21st century, electricity has become a lifeline for human population. Its demand is increasing day by day. Modern technology needs a huge amount of electrical power for its various operations. Electricity production is the single largest source of pollution in the whole world. At one hand, rising concern about the gap between demand and supply of electricity for masses has highlighted the exploration of alternate sources of energy and its sustainable use. On the other hand, human population all over the world and hence energy demand is increasing day by day linearly. Accordingly, it is an objective of the present invention to provide a method of electrical power generation from this ever increasing human population that does not negatively impact the environment. This technology is based on a principle called the piezoelectric effect, in which certain materials have the ability to build up an electrical charge from having pressure and strain applied to them. Piezoelectricity refers to the ability of some materials to generate an electric potential in response to applied pressure. Harvesting of energy which means energy is already available, but is going to waste if not utilized. Embedded piezoelectric material can provide the magic of converting pressure exerted by the moving people into electric current.

Out of the many things, there are major reasons for development of this project is electricity Crises in the world. Electricity is critical to fuel the economic growth of India. The country is on the fast trajectory of development but to keep the momentum of growth high, availability of uninterrupted power supply is a must. India needs electricity to fuel the growth of every industry, be it large-scale or small scale, manufacturing, healthcare or education. To satisfy the need of electricity, we always need to search for energy generation systems with better performance and less environmental damage, free from pollution. So in this project we are developing prototype for electricity generation system using piezo electric elements

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2. Literature Survey

2.1 Dr. Meena Chavan1, Sachin Chauhan

The electrical power consumption is increasing exponentially. Therefore, the need of a fool-proof and economically viable power generation and distribution system demands a certain interest. This paper proposes utilization of human locomotion energy which, although extractable goes mainly to waste. This paper[1] proposes a model that uses human walking, jumping and running as a source of energy and store it for essential use. Such a model is apt in a demography that of a country like India which has such a huge pedestrian population. This paper illustrates a method for harvesting this human locomotion energy with the use of piezoelectric sensor and demonstrates an application with the stored energy i.e. to charge a mobile phone securely using RFID. The ground reaction force (GRF) exerted from the foot, when converted to voltage by piezoelectric sensors is capable enough to power up a device. Successive exertion leads to aperiodic voltage build up which with proper circuitry can be used to charge a storage battery. The power produced by this technique can also be employed in basic application such as street lighting, notice boards, gyms and other areas of public domain. It also promotes green energy and environment friendly approach towards energy generation. In this paper we have provided the basic concept and design details of this model and a basic implementation of the same.

2.2 Iqbal Mahmud

This paper[2] focuses on designing a setup that leads to the generation of electrical energy which is going to waste when humans are walking. Footsteps are an untapped natural resources. This generated energy is, however, costeffective and nonhazardous for human. Electrical energy can be produced by converting mechanical energy using footsteps. Generating the electric power through the fabrication of footstep arrangement by a prototype comprises of a pipe, nozzle, unidirectional valve, water reservoir, turbine, and DC motor. Whenever pressure is exerted on the reservoir, water flows through the nozzle into the turbine and generates electrical energy. This energy is stored in the battery. This project will reduce the global warming and load shedding in a much cleaner cost-effective way. Since this project is related directly to the human movement, the weight of the setup is a crucial factor. The system repeatedly operates in a short duration of time and is not possible for the turbine to maintain a constant speed. As a result, voltage variation occurred which is controlled by a voltage regulator. The total system of the power generation using footsteps depend mainly on the angle of attack of the flowing medium. High voltage dynamo should be used to produce more electricity. Though many systems are available for power generation from footsteps, the proposed system is very economical and affordable. As Bangladesh is a developing country with a large population, we face difficulty day by day due to power shortage. Many people in our country cannot enjoy the facility used for generating electricity. Though power produced in this process is minimal, as a whole country, this will be a considerable source of electrical energy.
This project also reduces global warming

2.3 Debojyoti Sen

This project[3] describes the use of piezoelectric materials in order to harvest energy from people walking vibration for generating and accumulating the energy. This concept is also applicable to some large vibration sources which can find from nature. This project also represents a footstep of piezoelectric energy harvesting model which is cost effective and easy to implement. The project is successfully tested which is the best economical, affordable energy solution to common people. This can be used for many applications in city areas where want more power. Bangladesh is a developing country where energy management is a big challenge for huge population. By using this project we can drive D.C loads according to the force we applied on the piezo electric sensor. Although the theory developed in this report justifies the use of switching techniques in efficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented. The final prototype design does fulfill the objective of generating electricity from piezoelectric disk. Due to the low cost design of the piezoelectric system it is a practical product which could increase the operating period of most common products. The data collected is capable of extending the operational lifespan per charge of portable electronic devices. Although the theory developed in this report justifies the use of switching techniques in efficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented. Measurements of source current into the primary and load current transferred from the secondary reveal that very little current gain truly occurs between the input and output ports of the switch in the forward converter hybrid. Further, similar results were encountered when one examines the energy transferred through the series switch and inductor in the buck converter. In addition, based on the results gathered in this investigation, the final prototype design does fulfill the objective of generating electricity from piezoelectric disk. Due to the low cost design of the piezoelectric system it is a practical product which could increase the operating period of most common products. The data collected is capable of extending the operational lifespan per charge of portable electronic devices.

2.4 Nayan HR

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2.5 Zehao Wu; Qingsong Xu

This paper[5] presents the design, fabrication and testing of a new piezoelectric energy harvester with a single piezo-stack for harvesting energy from excitations with back and forth motion. A rhombus-type force amplifier is combined with a selectivity lever to utilize both pull and push input. Analytical model is established to predict the force amplification ratio of the proposed energy harvester under different directions of input force. In order to maximize the output performance of the energy harvester, the mechanism parameters are optimally designed. A prototype energy harvester is fabricated for experimental testing. Results indicate that the developed harvester has the merits of high safety factor and compact size, which can be adopted to harvest the mechanical energy for excitations with both pull and push input.

2.6 Liu Zhenming; Jiang Pei

The challenge for the high speed direct injection (HSDI) diesel engines today is to reduce harmful emissions of diesel engines, such as particulate matter (PM) and Nitrogen oxides (NOx), and enhance the fuel efficiency and power. To meet this challenge, more accurate control of injection parameters such as the injection timing, injection rate, and injection quantity is required[6]. Compared with solenoid actuated injectors, the piezo actuated injectors can reduce the transition time for the start and end of the fuel injection event, resulting in more accurate and faster injections, and are gradually replacing the solenoid injectors. In this study, an electromechanical model of a piezo injector is developed with MATLAB/Simulink. The piezo injector model consists of three subsystems: the piezoelectric stack actuator subsystem, the mechanical subsystem and the hydraulic subsystem. A lumped parameter electromechanical model is used for describing the nonlinear behavior of the piezoelectric stack actuator. Different operating conditions of the injection system are modeled and tested. The model has been used to provide insight into the operating conditions of the piezo injector and highlight the application to injection system design.

3. Block Diagram

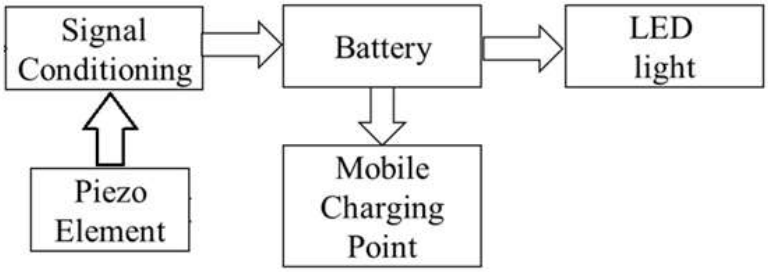

Fig -1: Block Diagram of System

Piezo elements are arrange on plane surface to make footstep arrangement. Output voltage generated by piezo element is given to signal conditioning block where it will be amplified and make suitable level for battery charging. This voltage is given to the battery. From battery, loads like LED light or mobile charger can be run..

4. Connection Diagram

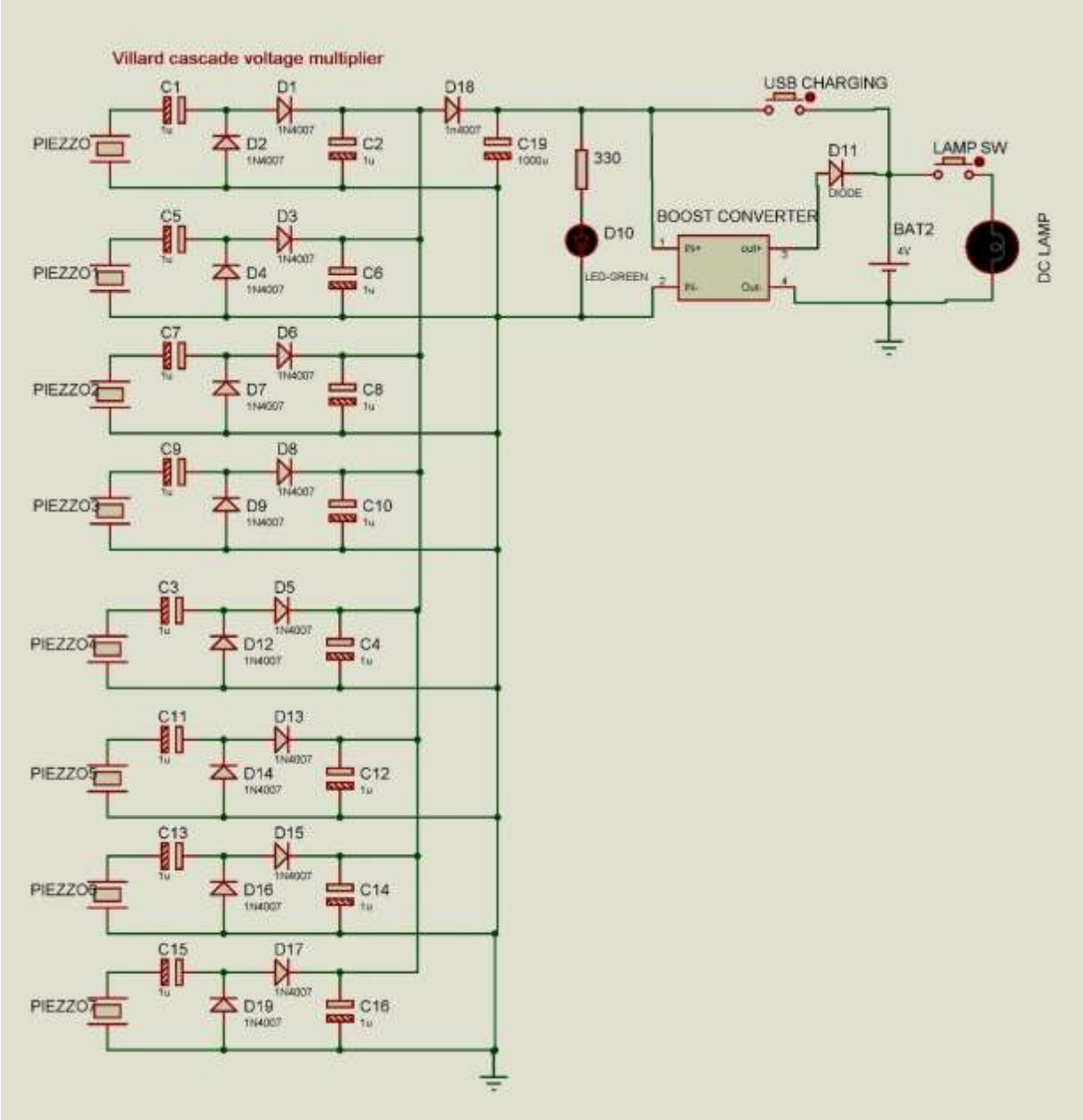

Fig -2: Connection Diagram of System

Voltage Multiplier- Villard Cascade:

A voltage multiplier is an electrical circuit that converts AC electrical power from a lower voltage to a higher DC voltage, typically using a network of capacitors and diodes. It can be used to generate a small amount of volts for electronic appliances, to high voltage for any application purposes such as high-energy physics experiments and lightning safety testing. Half-wave series multiplier, is the most common type of voltage multiplie. Its well known as Villard cascade.

5. Results

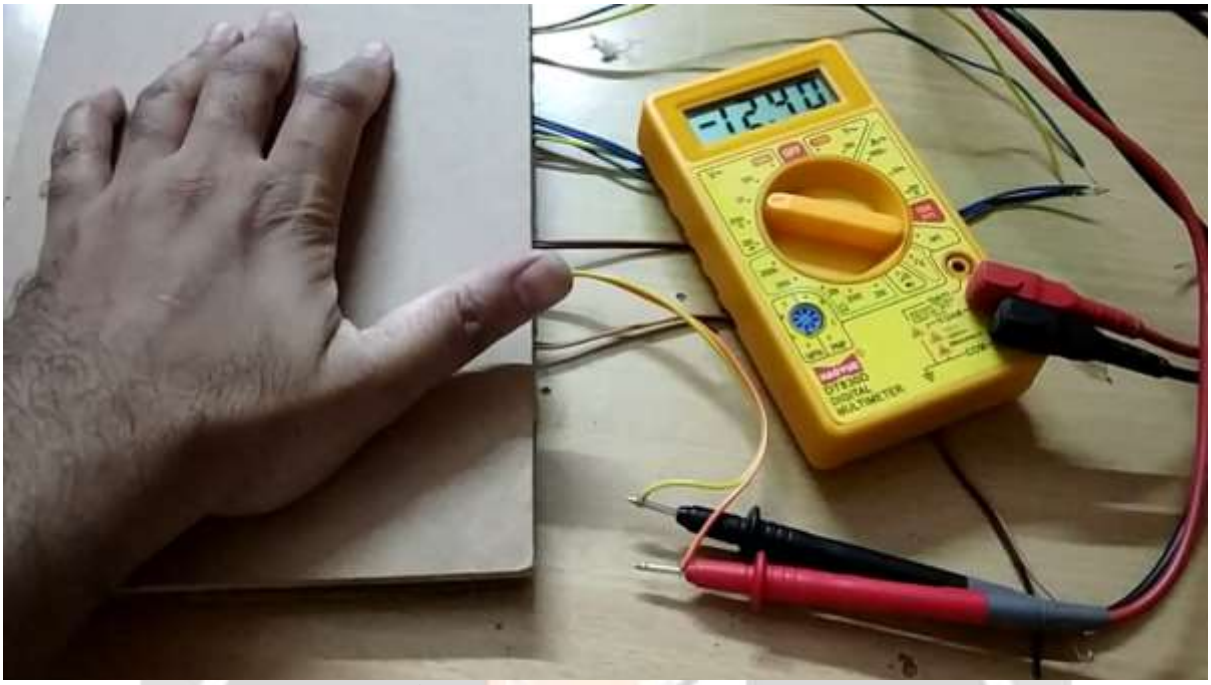

Fig -3: Footstep unit power generation

In 1 square ft. I used 6 piezo sensor. Generated power from piezo sensors changes with number of steps, get
Minimum voltage=1 V per step
Maximum voltage=10.5 V per step
So by taking an average of 50 Kg weight pressure from single person. Considering the steps of a 50 Kg weighted single person, the average calculation is:
So to increase 1 V charge in battery, It will takes 500 steps.
So, to increase 4 V in battery total steps needed =(4 × 800)
=3200 steps
As we will implement our project in a populated area where foot step as source will available, I took an average of 2 steps in 1 second. So for 3200 steps time needed is,
=2000/(60 × 2)
=26.6 minutes. (Approximately)

6. CONCLUSIONS

Satisfying energy requirement of world is crucial task. In this project, we are trying to implement a prototype which will be helpful for energy generation in future. Here different energy generation system are studied and designed one on the basis of knowledge obtained from referred systems. The project is tested successfully & found to be the economical, affordable energy solution to common people. Power generated from this project can be used for many applications in city areas where want more power. By using this project. we can drive D.C loads according to the force I applied on the piezo electric sensor. Although the theory developed in this report justifies the use of switching techniques in efficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented.

As result, final prototype successfully generates energy from piezoelectric disk. Since its cost is low, it is affordable & commercialize as secondary backup and generation source. By pressing the structure the piezoelectric sensors will get the vibration and the sensors give electricity as output. After passing through a circuit the charge will store in the battery. Project is successfully implemented and able to detect the gas leaks and sends alert via SMS and call. Similarly sound and visual alerts are generated using buzer and LED respectively. We believe that this project will be helpful to detect gas leak and can save the many life by providing alert on time so that people can go to safer places and rescue operation can be start immediately. Likewise it can help to contaminate gas leaks within time before the small gas leak become major accident.

7. REFERENCES

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