A

Project Report on

"ELECTRICITY GENERATION BY PIEZO SENSOR"

Submitted

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DECLARATION

We, Sanjay Meghvanshi, Shohed Khan, Shubham Soni and Soumay Gupta hereby declare that the work presented in this project entitled "ELECTRICITY GENERATION BY PIEZO SENSOR"

In partial fulfilment of the requirements for the award of Degree of Bachelor of Technology, submitted in the Department of Mechanical Engineering of JECRC, Jaipur. This submission is an authentic record of our own work under the supervision of Mr. Satyaprakash Saini.

We also declare that the work embodied in the present thesis is our original work and has not been copied from any journal/thesis/book and has not been submitted by us for any other Degree/Diploma.

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CERTIFICATE

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This is to certify that Project Report entitled "ELECTRICITY GENERATION BY PIEZO SENSOR" which is submitted by Sanjay Meghvanshi, Shohed Khan, Shubham Soni and Soumay Gupta in partial fulfillment of the requirement for the award of degree B. Tech. in mechanical engineering of Rajasthan Technical University, Kota, is a record of the candidate own work carried out by him under my/our supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

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ABSTRACT

Electrical energy is important and had been demand increasingly. A lot of energy resources have been wasted and exhausted. An alternative way to generate electricity by using a population of human had been discovered. When walking, the vibration that generates between the surface and the footstep is wasted. By utilizing this wasted energy, the electrical energy can be generated and fulfil the demand. The transducer that uses to detect the vibration is a piezoelectric transducer. This transducer converts the mechanical energy into electrical energy. When the pressure from the footstep is applied to the piezoelectric transducer, it will convert the pressure or the force into the electrical energy. The piezoelectric transducer is connected in series-parallel connection. Then, it is placed on the tile that been made from wood as a model for footstep tile to give pressure to the piezoelectric transducers. This tile can be placed in the crowded area, walking pavement or exercise instruments. The electric energy that generates from this piezoelectric tile can be power up low power appliances.

In this paper, we have presented the design of power generation using footstep based on available piezoelectric sensors. Human race requires energy at very rapid rate for their living and wellbeing from the time of their arrival on this planet, because of this reason power resources have been worn out and enervated. Proposal for the employment and application of extravagant energy in foots of human is very much to the purpose for extremely populated nations like China and India. Where the streets, rail and bus station are over peopled and packed like sardines moving around the clock. So, using such concept the power can be availed and deployed by converting mechanical energy to electrical energy.

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LIST OF ABBREVIATION

BHP	Brake horse power
PCB	Printed Circuit Board
LED	Light-emitting diode
MPH	Miles per hour
RPM	Revolution per minute

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

As the availability of conventional energy declines, there is need to find alternate energy sources. All most all the state electricity departments in our country, they are unable to supply the power according to the demand. The power produced by these companies is not even sufficient for domestic utilities; in such critical situation it is very difficult to divert the energy for other public needs. There by an alternative source must be discovered, many people proposes for solar energy, but it is going to be a costliest affair, moreover availability of solar energy is poor particularly in rainy & winter seasons, as a result it is not dependable. Hence an alternative cheapest method must be determined for few applications; consequently this project work has been taken up, which is aimed to generate electricity from footsteps mechanism. Out of the many alternative energy resources, this technology described in this project report is the ultimate source of all known forms of energy. It is clear, safe, and free, does not pollute the environment and thus will be an extremely viable alternative in the days to come. As there is a tremendous increase in the crowd, the load applied on the footsteps by the people, it generates nonstop energy, which can be stored and utilized to energize the street lights. Here the concept is to convert the mechanical energy in to electric energy. Man has needed and used energy at an increasing rate for his sustenance and well-being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted. With the passage of time, man started to cultivate land for agriculture. He added a new dimension to the use of energy by domesticating and training animals to work for him.

With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy. This whole human energy being wasted if can be made possible for utilization it will be great invention and power producing platform will be very useful energy sources in crowded countries.

TYPES OF ENERGY RESOURCES:

- Conventional energy sources.
- Alternative energy sources.

CONVENTIONAL ENERGY SOURCES: Primary energy sources can be defined as sources which provide a net supply of energy coal, oil, uranium etc. The energy required to obtain these fuel is much less than what they can produce by combustion or nuclear reaction. The supply primary fuel is limited .It becomes very essential to use these fuel sparingly.

Example: Coal, natural gas, oil and nuclear energy.

ALTERNATIVE ENERGY SOURCES: It is any energy source that is an alternative to fossil fuel. These alternatives are intended to address concerns about such fossil fuels. The nature of what constitutes an alternative energy source has changed considerably over time, as have controversies regarding energy use. Today, because of the variety of energy choices and

differing goals of their advocates, defining some energy types as "alternative" is highly controversial. In a general sense, alternative energy as it is currently conceived is that which is produced or recovered without the undesirable consequences inherent in fossil fuel use, particularly high carbon dioxide emissions, an important factor in global warming. Question that every time comes before every country i.e., the need of non-conventional energy sources or systems. Why we need these systems and the answers are the growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil & gas. Rising prices of oil and gases and their potential shortages have raised uncertainties about the security of energy supply in future, which has serious repercussions on the growth of the national economy. The main factor is increasing use of fossil fuels also causes serious environmental problems. Hence there is primary need to use renewable energy sources like solar, wind, tidal, bio-mass and energy from waste material. Man has needed and used energy at an increasing rate for his sustenance and wellbeing ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted.

With the passage of time, man started to cultivate land for agriculture. He added a new dimension to the use of energy by domesticating and training animals to work for him. With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy. For an alternate method to generate electricity there are number of methods by which electricity can be produced, out if such methods footstep energy generation can be an effective method to generate electricity. Walking is the most common activity in human life. When a person walks, he loses energy to the road surface in the form of impact, vibration, sound etc., due to the transfer of his weight on to the road surface, through foot falls on the ground during every step. This energy can be tapped and converted in the usable form such as in electrical form. This device, if embedded in the footpath, can convert foot impact energy into electrical form. Human-powered transport has been in existence since time immemorial in the form of walking, running and swimming. However modern technology has led to machines to enhance the use of human-power in more efficient manner. In this context, pedal power is an excellent source of energy and has been in use since the nineteenth century making use of the most powerful muscles in the body. Ninety-five percent of the exertion put into pedal power is converted into energy. Pedal power can be applied to a wide range of jobs and is a simple, cheap, and convenient source of energy. However, human kinetic energy can be useful in a number of ways but it can also be used to generate electricity based on different approaches and many organizations are already implementing human powered technologies to generate electricity to power small electronic appliances. Now let us come to its some working principle, this device if embedded in footsteps of railway platforms, city malls, city footpaths etc. can convert the weight impact of people into electrical energy. When a pedestrian will step on the top plate of this device, the plate will go down and this downward motion results in rotation of the shaft of the alternator which produces electrical energy. After removal of force the top plate returns to its original position due to springs.

Considering the daily emerging demand for power and the global climatic changes there is a heavy requirement of cleaner sources of power before it is too late. Also, India has set targets of achieving 175 GW of power by 2022 only through renewable forms of energy. Keeping in mind the above ambitious targets that countries are putting forth regarding the cleaner sources of fuel, there is an urgent requirement of alternate sources of power that not only satisfies the requirement but also meets the financial, adoption, and implementation into the real-time scenarios as well. Below, the shares of energy generation in India are shown fig.1.

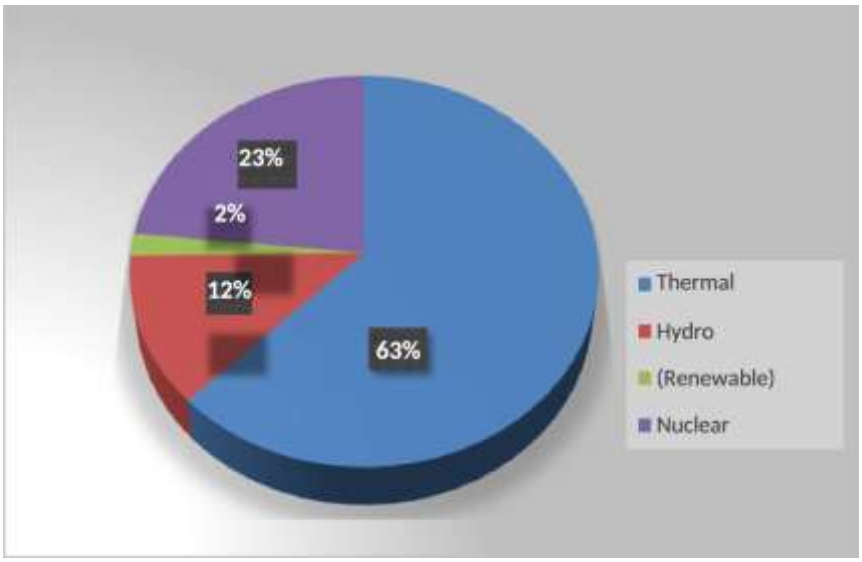

Figure 1: Power capacity in India till Jan'2020.

The creation of new source of perennial environmentally acceptable, low cost electrical energy as a replacement for energy from rapidly depleting resources of fossil fuels is the fundamental need for the survival of mankind. We have only about 25 years of oil reserves and 75 – 100 years of coal reserves. Resort to measure beginning of coal in thermal electric stations to serve the population would result in global elementary change in leading to worldwide drought and decertification. The buzzards of nuclear electric-stations are only too will. Now electric power beamed directly by micro-wave for orbiting satellite. Solar power stations (S.P.S) provide a cost-effective solution even though work on solar photo voltaic and solar thermo electric energy sources has been extensively pursued by many countries. Earth based solar stations suffer certain basic limitations.

Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China where the roads, railway stations, bus stands, temples, etc. are all over crowded and millions of people move around the clock. This whole human/bio-energy being wasted if can be made possible for utilization it will be great invention and crowd energy farms will be very useful energy sources in crowded countries. Walking across a "Crowd Farm," floor, then, will be a fun for idle people who can improve their health by exercising in such farms with earning. The electrical energy generated at such farms will be useful for nearby applications.

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1.2 THE PIEZOELECTRIC EFFECT

The piezoelectric effect was discovered in 1880, by two French physicists' brothers Pierre and Paul. A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, and force by converting them to an electrical signal fig.2. When pressure is applied to piezoelectric crystals electricity is developed over the crystal lattice.

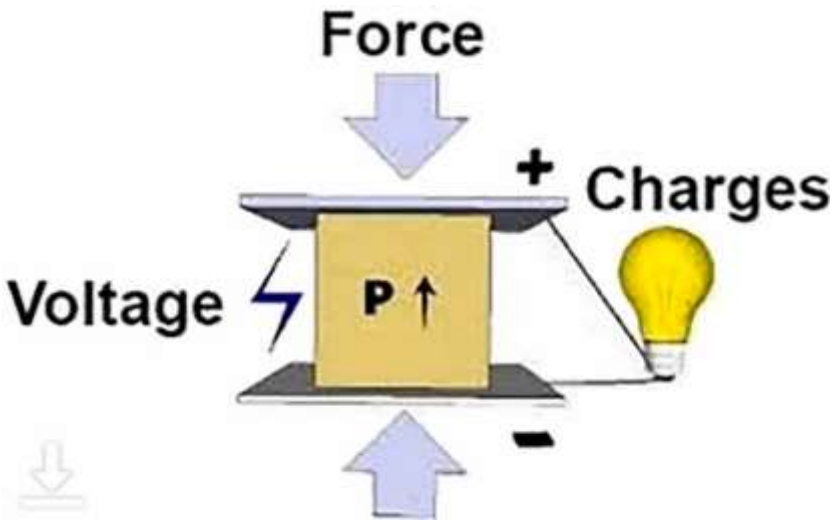

Figure 2: Piezo power with force direction.

Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. The word Piezoelectric is derived from the Greek piezo in, which means to squeeze or press, and piezo, which is Greek for "push".

One of the unique characteristics of the piezoelectric effect is that it is reversible, meaning that materials exhibiting the direct piezoelectric effect (the generation of electricity when stress is applied) also exhibit the converse piezoelectric effect (the generation of stress when an electric field is applied). When piezoelectric material is placed under mechanical stress, a shifting of the positive and negative charge centers in the material takes place, which then results in an external electrical field. When reversed, an outer electrical field either stretches or compresses

the piezoelectric material. The piezoelectric effect is very useful within many applications that involve the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, such as scanning probe microscopes (STM, AFM, etc). The piezoelectric effect also has its use in more mundane applications as well, such as acting as the ignition source for cigarette lighters.

Other people have developed piezo-electric (mechanical-to-electrical) surfaces in the past, but the Crowd Farm has the potential to redefine urban space by adding a sense of fluidity and encouraging people to activate spaces with their movement. The Crowd Farm floor is composed of standard parts that are easily replicated but it is expensive to produce at this stage. This technology would facilitate the future creation of new urban landscapes athletic fields with a spectator area, music halls, theatres, nightclubs and a large gathering space for rallies, demonstrations and celebrations, railway stations, bus stands, subways, airports etc. Like Capable Of Harnessing Human Locomotion For Electricity Generation.

Since the piezoelectric effect was discovered more than a century ago, it has spread into various applications and is now widely used. Areas include frequency control, in for example clocks, loudspeakers to generate sound, and microbalances, such as QCM and QCM-D, to monitor mass changes. But it doesn't stop there. Now piezoelectricity is a candidate contributor to future sustainable energy supply. Light, wind and thermal have long been obvious sources, and thanks to the piezoelectric effect, vibration has now been added to the list. One way to use vibrational sources for power generation is, for example, to harvest human kinetic energy via street or pavement tiles. i.e. to convert the energy of footsteps to electricity. Energy generated this way could be used to run for example street lights or other low-voltage equipment in cities.

Piezoelectricity appearance under pressure in ceramic or crystal materials:

Materials (like everything in the world) are composed of molecules which are arranged in a certain way. When the material is in a free state (without any pressure), those molecules will be arranged in a certain way which corresponds to an equilibrium of the matter in which the charges of the molecules cancels itself if we look at the whole.

When a pressure is applied however, those molecules change position and align into a dipolar state in which the global charge distribution isn't null anymore and 2 sides of the materials become polarized, it is because of the special arrangement of the piezoelectric material crystals in a hexagonal configuration. If you look at the atoms that compose a Quartz Material (commonly used in watches as resonators) crystal for example, you will notice that they are arranged like this.

What happens when the piezoelectric crystal is compressed:

When you compress the crystal, the 2 positive charges on the top move horizontally and not vertically, which causes the center of positive charge to change position upward.

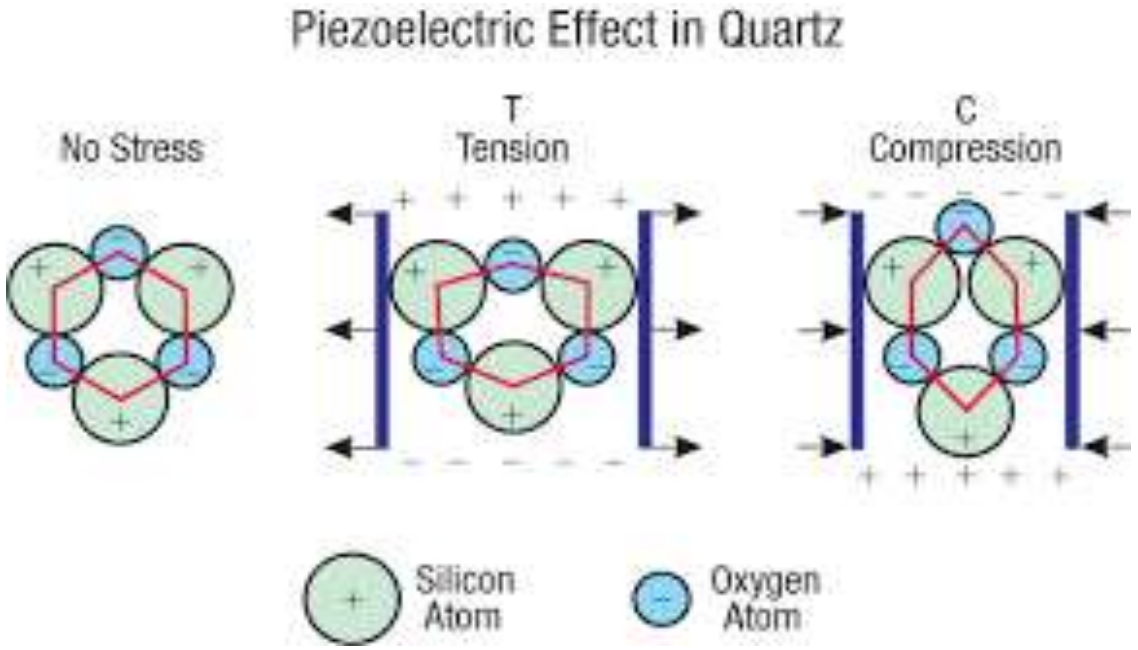

Figure 3: Piezoelectric effect in Materials

In an uncompressed crystal, the positive charges and negative charges just cancel each other and the resultant charge distribution is null.When you compress the crystal in a certain orientation, you are slightly shifting the average position of the positive charges in one direction and the average of the negative charges in the other direction.This creates an accumulation of positive charges on one face and an accumulation of negative charges on the other face.If you then wire up those faces, the positively charges face will start to pull electrons negatively charged towards it through the wire and the negatively charged face will repel electrons.

1.3 CHARACTERISTICS OF PIEZO ELECTRICITY

These days most of the research in the energy field is to develop sources of energy for the future. It is time to find renewable sources of energy for the future. Piezoelectric materials are being more and more studied as they turn out to be very unusual materials with very specific and interesting properties. Energy can never be created nor destroyed; it can only be transferred from one form to another. In fact, their materials could produce electrical energy from mechanical energy and may convert mechanical behaviour like vibrations into electricity. While recent experiments have shown that these materials could be used as power generators fig.4.

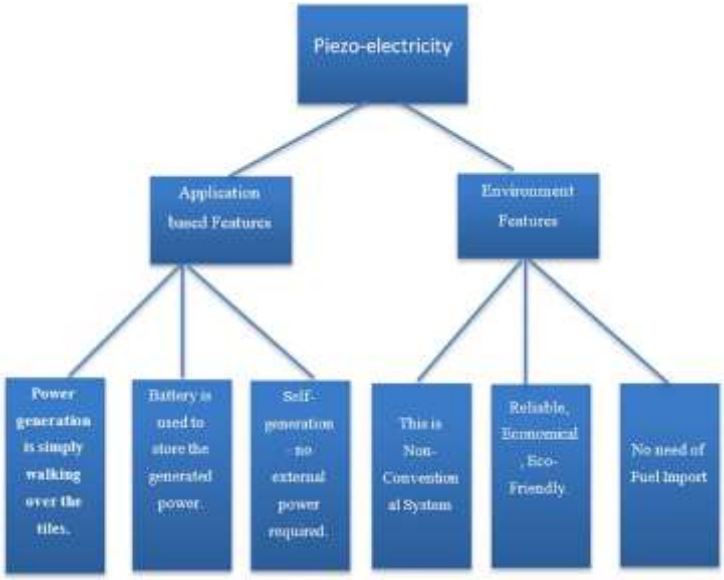

Figure 4: Piezoelectricity properties layout.

Applications Best Suited for the Piezoelectric Effect

Due to the intrinsic characteristics of piezoelectric materials, there are numerous applications that benefit from their use:

High Voltage and Power Sources

An example of applications in this area is the electric cigarette lighter, where pressing a button causes a spring-loaded hammer to hit a piezoelectric crystal, thereby producing a sufficiently high voltage that electric current flows across a small spark gap, heating and igniting the gas. Most types of gas burners and ranges have a built-in piezo based injection systems.

Sensors

The principle of operation of a piezoelectric sensor is that a physical dimension, transformed into a force, acts on two opposing faces of the sensing element. The detection of pressure variations in the form of sound is the most common sensor application, which is seen in piezoelectric microphones and piezoelectric pickups for electrically amplified guitars. Piezoelectric sensors in particular are used with high frequency sound in ultrasonic transducers for medical imaging and industrial nondestructive testing.

Piezoelectric Motors

Because very high voltages correspond to only tiny changes in the width of the crystal, this crystal width can be manipulated with better-than-micrometer precision, making piezo crystals an important tool for positioning objects with extreme accuracy, making them perfect for use in motors, such as the various motor series offered by Nanomotion.

Regarding piezoelectric motors, the piezoelectric element receives an electrical pulse, and then applies directional force to an opposing ceramic plate, causing it to move in the desired direction. Motion is generated when the piezoelectric element moves against a static platform (such as ceramic strips).

The characteristics of piezoelectric materials provided the perfect technology upon which Nanomotion developed our various lines of unique piezoelectric motors. Using patented piezoelectric technology, Nanomotion has designed various series of motors ranging in size from a single element (providing 0.4Kg of force) to an eight-element motor (providing 3.2Kg of force). Nanomotion motors are capable of driving both linear and rotary stages, and have a wide dynamic range of speed, from several microns per second to 250mm/sec and can easily mount to traditional low friction stages or other devices. The operating characteristics of Nanomotion's motors provide inherent braking and the ability to eliminate servo dither when in a static position.

1.4 OBJECTIVE

The recent study has revealed that an alternate source of energy is desperately required to meet the emerging future energy demands. Hence to meet the requirements a financially stable and viable source of power is required that will be environment friendly and possess a very easy methodology of producing energy. Hence the piezoelectric model justifies the study for an alternate source of power generation. Through the literature study, various parameters for considering the piezoelectric tile to be used as an alternate source of energy were identified like power availability, usage pattern in an area, cost of a unit of power, and overall electricity bill of a consumer. Few parameters identified were awareness about piezoelectricity, the willingness of producing standalone power. The above parameters have been studied in detail for meeting the core objectives of the research.

1.5 SCOPE OF WORK

The piezoelectric crystals have been started better use with positive result. In India, maximum public movement is observed in rail way stations, temples, and shopping malls; hence this place can be used for piezoelectric crystals for generation of electric power. Apart from all the above places an attempt is made to develop energy from our daily life by initiating piezoelectric crystals in shoe thus in each step piezoelectric crystal can be compressed which can turn enough power to charge a cell phone, mp3 player etc. through this we can generate electric power and used that for small electronic gadgets.

CHAPTER 2: LITERATURE REVIEW & PROBLEM DEFINITION

2.1 LITERATURE REVIEW

1. Feasibility Study for Using Piezoelectric Energy Harvesting Floor in Buildings' Interior Spaces- Adnan Mohamed Elhalwagy, Mahmoud Yousef M. Ghoneem, Mohamed Elhadidi

Low pedestrian Spaces like apartment case can use harvesting floor tiles in a different way to generate and save energy. Firstly, using high generated power tiles as that one used in the study as a power source generator, that can be used to operate LED lighting systems, since LEDs use far less energy than more conventional (fluorescent and incandescent) bulbs. But other types that harvesting very low power; Nano or micro watts, can be used as a trigger for a self-powered sensor that tracking the users and control all equipment depending on their movement.

2. Footstep power generation system- Pankaj Mouri, Sachin Dhaked

This paper discusses about the importance of the energy wasted and converted it to renewable energy.It mainly deals with the produced by the force applied through the piezo transducer. Demands of electricity are increasing day by day and its use has become so advanced and applicable in the present lifeline of a human being. This method produces electricity the help of piezoelectric elements that make use of the energy of human footsteps. The capacitor used in the circuit stores the charge for future applications. In order to increase the effluence of the whole system a super capacitor is used in place of the conventional ones then more charge can be stored than the conventional.

3. Electrical Power Generation Using Footsteps, Iqbal Mahmud

The waste energy of human during walking is used in this system. Footstep is an uninterrupted and renewable source of energy. 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, the best economical, affordable energy solution to common people.

4. Power generation using piezoelectric material, Ratnesh Srivastava1, Navneet Tiwari, Abhishek Kumar, Debojyoti Sen.

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 inefficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented.

5. Power generating using human foot step with piezoelectric sensor and treadmill, Gopinath.R, M.Lavanya, M.Arivalagan.

This technique produces electricity with the assistance of electricity components that create use of the energy of human footsteps. The converter employed in the circuit stores the charge for future applications. So as to extend. The potency of the total system if super capacitors and converter square measure employed in place of the standard ones then a lot of charge will be hold on than the standard ones. The super capacitors store and discharge energy while not intense abundant energy. Thus, the need of constant increase of power will be met by putting in these systems in heavily packed places. This may doubtless not solely overcome the energy crises however conjointly build up a healthy encompassing.

6. Design and fabrication of mechanical footstep power generator, Shivendra Nandan, Rishikesh Trivedi

Footstep power generation system produces electricity by utilizing energy which is wasted through walking. Mechanism like rack and pinion and piezo-electric material are integrated to produce desired output. Cost of electricity generation solely depends upon the initial cost, maintenance cost and life of system. Maximum advantage of this system can be taken if installed in highly dense area. Since in this project of power generation there is not any fuel input requirement for the generation of electrical power. Thus, it can also be concluded that this mode of power generation system is eco-friendly, i.e., no pollution is caused during the generation of power using this type of model. Hence due to such advantages, this system can be embedded at any of the public places like railway platforms, busy foot-paths, malls etc. Implementing this system, we can easily reduce our dependency on the conventional sources of energy, thus can be considered beneficial from that point of view.

7. Footstep Power Generation using Piezoelectric Sensor and Distribution using RFID, Dr. Meena Chavan, Sachin Chauhan, Maanvendra Singh, Archie Tripathi

Thus, we have shown a design of a system capable of harnessing human locomotion energy; and have implemented it around a basic application of charging a mobile device. This project promotes an uninterrupted way of using smart phones and other devices. The described system

can be built independently and delivers off the grid power for public/private usage. Lastly, this project is an attractive approach for obtaining clean sustainable energy and is highly consumer friendly.

8. Study on footstep power generation using piezoelectric tile, Anis Maisarah Mohd Asry, Farahiyah Mustafa, Sy Yi Sim, Maizul Ishak, Aznizam Mohamad

A piezoelectric tile is capable of generating more voltage when longer the time taken. The longer the time taken means more footstep/force are applied on the tile. The linear relation is found between the voltage generated and the time taken. This piezoelectric are specifically suitable for the implementation in the crowded area such as pavement street, train ticket counter, stairs and dance floor. The piezoelectric tile is also suited for the exercise tile such as for skipping or on the treadmill. The power that is generated from this piezoelectric tile can be used to power up the light street, light along the stairs and also low power appliances.

9. Design of footstep power generator using piezoelectric sensors, Akshat Kamboj, Altamash Haque, Ayush Kumar, V. K. Sharma, Arun Kumar

In this paper we have calculated the various methodologies for foot step generation using piezoelectric sensors. The Experimental setup is discussed with all sub equipment. The results have been discussed in terms of output voltages. The plot between current and voltage shows the extent of power generated. The various merits are power generation is simply walking on the step and no need of fuel, power may also be generated by running or exercising on the step and battery may be used to store the conventional power. In future works one may attempt to overcome following limiting factors as it is only applicable for the particular place and limited power is generated using the conventional ICs present in market. In future we may implement the same methodology in treadmills, staircases and places with frequent human moment with their commercial usage model.

10. An IOT used piezoelectric sensor used power generation through footsteps, M. Santhiya, M. Keerthika, M. Shobana, R. Jegatha, N.S. Julie Joan.

In this study the IOT based piezoelectric sensor used power generation through footsteps produced the following conclusions. Power generation by piezoelectric sensors is possible and stored in the battery. IOT integrated power generation also possible to maintain the power generation. Message received from the system provided details of the maximum/ current position of the power production and power storage. These Message help to change the alternate or additional storage device to the system. These IOT based Message system increase the life of the storage devices and usage of the power production.

11. Experimental study on footstep power generation system using piezoelectric sensor R. Jai Ganesh, D.B. Shanmugam, S. Munusamy, T. Karthikeyan

The proposed system suggests that individual potential energy could be transformed by piezoelectric materials into electrical power. This device is ideally suited in which there is a large density of traffic and people and particularly small business firms such as club rooms, supermarkets, and religious centres, shopping centres, transport hubs, beaches, etc. may produce their own energy during the operation of the company. The device can also be used to power small electrical devices and expensive devices such as smart phones, telephone radio,

TV, fans and even street lamps on the highways via a device where vehicles operate on the placed piezoelectric materials on the roadway. This power generation system is renewable and has no negative environmental effect, which is why it has contributed to the direction of sustainable alternative energies. And also, this proposed system was successfully implemented with the features of sensors and microcontrollers-based voltage monitoring system of piezo electric sensor energy generation. In addition, the output generated value can be easily monitored through the mobile application in anywhere with the help of IoT technology.

12. Review On Foot Step Power Generation By Piezoelectric Transducer, K.VINEESH, Amarnath.K.T, M.Lavanya, R.A.Priya

The main aim of this paper is to generate power in a nonconventional, nonpolluting form of energy can be harvested and maintain economically. The electric power is produced from the mechanical strain to electrical energy by piezoelectric material (PZT). The PZT (Lead Zirconate titanate) has used to generate electric power, because it is easily polarized and low field strength, high coupling factor. The (PZT) is superior in all characteristics than other transducers. In future the piezoelectric is main source to generate electric energy. With future development in the field of electronics better manufactured piezoelectric crystals and better selection of place of installation to get more electricity can be generated. Though this is just an idea of us. The work model implementation and conceptualization would require some effort and time on our part.

13. FOOT STEP POWER GENERATION, Sarat Kumar Sahoo.

Since in this project of power generation there is not any fuel input requirement for the generation of electrical power. Thus, it can also be concluded that this mode of power generation system is eco-friendly, i.e., no pollution is caused during the generation of power using this type of model. Hence due to such advantages, this system can be embedded at any of the public places like railway platforms, busy footpaths, malls etc. Implementing this system, we can easily reduce our dependency on the conventional sources of energy, thus can be considered beneficial from that point of view.

14. Utilization of Pedestrian Movement on The Sidewalk as A Source of Electric Power for Lighting Using Piezoelectric Sensors, Agus Dwi Triono, Arthur Daniel Limantara.

Results Calculation of the average number of footsteps most effective to fill the power-bank to the full, if the capacity of the bank power in use of 8800 mAh 5volt output in need of 192423 times the footing in 1 hour, or an average of 3207 per minute and Led Strip Light power consumption with a length of 30 cm per minute in 1 medium in need of power of 0.00528 Watt / minute With the sidewalk design in such a way, for every 1 step produces a voltage of 6.8 V and power 0.000319 Watt when given 441 N style, the voltage will continue to grow as the force is given more weight on the piezoelectric. For further research is necessary to the development of tools to be more efficient so that greater electrical energy output and can be used in bulk and apply the real outdoors.

15. Piezoelectric Sensors and Sensor Materials, JAMES F. TRESSLER, SEDAT ALKOY & ROBERT E. NEWNHAM.

Beginning with the discovery of ferroelectricity in BaTiO3 and with the development of applications such as, electroacoustic transformers, signal processing devices, actuators and sensors piezoelectric materials have became an important part of engineering applications, as

well as daily life. This is evidenced by a review of piezoelectric sensors and sensors materials and an examination of the properties of the most common piezoelectric ceramic material: PZT, as well as other piezoelectric ceramics and single crystals. Several sensor congurations can be prepared from bulk ceramics as can piezoelectric ceramicÐpolymer composite sensors described by the connectivity of their constituent phases. A wide range of hydrophone ®gure of merit (dh?gh) can be engineered through these sensor con®gurations. Recent examples of piezoelectric ceramicÐmetal composite sensors, and the future trends in the area of piezoelectric sensors show that piezoelectric sensors have established a solid presence in our daily life from ultrasound applications in medicine, to underwater ultrasound in military and civilian applications, to smart sensor systems in automobiles, to non-destructive testing in industry. They will continue to increase their impact even further with emerging technologies, improved material properties, and with an increased understanding of piezoelectric and ferroelectric phenomena.

16. Study on footstep power generation using piezoelectric tile, Anis Maisarah Mohd Asry, Farahiyah Mustafa, Sy Yi Sim, Maizul Ishak, Aznizam Mohamad.

A piezoelectric tile is capable of generating more voltage when longer the time taken. The longer the time taken means more footstep/force are applied on the tile. The linear relation is found between the voltage generated and the time taken. This piezoelectric are specifically suitable for the implementation in the crowded area such as pavement street, train ticket counter, stairs and dance floor. The piezoelectric tile is also suited for the exercise tile such as for skipping or on the treadmill. The power that is generated from this piezoelectric tile can be used to power up the light street, light along the stairs and also low power appliances.

17. Electrical Power Generation Using Piezoelectric Crystal, Anil Kumar.

As the results shows that by using double actuators in parallel we can reduce the charging time of the battery and increase the power generated by the piezoelectric device. In second research where a piezoelectric generator was put to the test and generated some 2,000 watt-hours of electricity. The setup consists of a ten-meter strip of asphalt, with generators lying underneath, and batteries in the road' proximity. So that it is clear by using parallel combination we can overcome the problems like of impedance matching and low power generation. The results clearly show that piezoelectric materials are the future of electric power generation.

18. Non-Conventional energy sources using piezoelectric crystal for wearable electronics ,A.Bhaumik, A.Das, A. K. Mishra, A.Shaw, A. Shaw, A.Yadav.

Conventional sources of energy and batteries need periodic recharging and replacement. Thus it cannot be used to power certain devices and instruments which need to be selfpowered. In such cases, piezoelectric energy harvesters promise to solve such power problems. Wireless devices and those devices which perform real time biomedical monitoring should ideally be self-powered rather than use batteries. Nature is full of vibrational energy such as muscles movement in human, ultrasonic and hydraulic energy. Piezoelectric crystal makes use of these wasted energy sources to power self-powered devices. Total voltage generated by the arrays has been increased in this work.

19. Power Generating Slabs: Lost energy conversion of human locomotive force into electrical energy, Rajesh Kumar Datta, Sazid Rahman.

In the world of modern technology, newer sources of energy and new methods of power generation are two important area of interest for researchers and engineers. Recently a new method is established to generate power from the lost energy of a human during his/her locomotive period. A piezoelectric sensor based costly product is available in some developed

countries which can generate power from human locomotive force, but it is not suitable for countries like Bangladesh where power demand is very high but economy is not highly developed. In this paper we will explain the design and construction method of a "PowerGenerating Slab" which can be used to generate power by establishing anywhere of the walking zone of human (roads, stairs, pavements, dais etc). This is done in a low cost process with locally available equipments (micro-generator, iron plate, rack pinion gear, free-wheeling system, spring etc*)*. These slabs can easily sustain human weight when people walk along them. With a small deformation of spring, the weight (mechanical energy) of a human body is converted into electrical energy by rotating a micro-generator with the help of a 'rotating shaft' coupled with it. From each foot step almost 10V-12V is generated. This energy is stored in a rechergeable battery which can be used as a power source to drive loads. Assembly of some power generating slabs can give better result. This is a method which is reusable and it will run for a longer period.

20. Power Generation for Auto Street Light Using PZT Mrinmoy Dey, Tawhida Akand and Sadeka Sultana.

Energy consumption is an indicator of development of the universe. Modern world needs a huge amount of electrical power to meet up the current demand whereas the resources of conventional energy sources are diminishing steadily in response of vast consumption of energy. So, alternate sources of energy are required not only to fill up the large gap between demand and supply of electricity but also they should be clean, environment friendly and sustainable. This research work is based on the piezoelectric effect in which certain materials have the ability to build up an electrical charge from having pressure and strain applied to them. This research paper focused on the applications of auto street light for transportation facilities using that energy. When the roads or the tires of vehicle are engineered with piezoelectric technology, the energy produced by the pressure of moving vehicles is captured by piezo sensors and converted it into electrical charge by Lead Zirconium Titanate as a Piezoelectric Transducer (PZT), then stored the energy and used as an energy generation source. This energy source can be used for auto street lighting as a source of roadside power generation unit. In this research work, generated voltage and current depend on the system configuration of PZT, stress on the PZT, displacement of PZT from its original state and the way of connection of PZT plates.

21. Power Generation Through Footsteps Using Piezoelectric Sensors Along With GPS Tracking, Rajendra Prasad P.

In the present scenario there is a significant growth in the generation of electric power from different sources. In the proposed project the electric power is generated by human locomotion. Whenever a person walks on piezoelectric sensors placed on footpath the corresponding kinetic energy is converted into electric power and these applied pressure and corresponding voltage values is displayed on the LCD display. During day time the streetlights will be turned off and in the night times it is turned on. During night times if there is human presence the intensity of light is high and in the absence of human the intensity goes low automatically and these results are displayed on the LCD. The overall circuit of the project is observed in the following Fig4. The obtained results are Fig5 displaying the applied pressure and voltage. This technique of power generation is easy and can be used in areas where the power is in short fall. The power generated in response to the applied pressure is given to the streetlights controlled by a switch and can be used for the basic needs like charging of lights, mobile phones without causing any adverse effect to the environment and depletion of natural resources. The future scope of this proposed model is to implement in smart floor mats, smart tiles.

22. POWER GENERATION USING PIEZOELECTRIC MATERIAL, Ratnesh Srivastava.

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 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.

23. The Use of Piezoelectric Ceramics for Electric Power Generation Within Orthopedic Implants, Stephen R. Platt, Shane Farritor, Kevin Garvin, and Hani Haider.

This paper presents results that suggest PZT ceramics can be used to generate sufficient electrical energy within TKR implants to operate low power microprocessors and sensors for diagnostic and monitoring applications. A major limitation to widespread, clinical use of embedded implant sensors is the lack of a long-term self-contained power supply. By encapsulating PZT materials within orthopedic implants, a small amount of the mechanical energy generated during normal physical activities can be converted into useful electrical energy. The results indicate that three PZT ceramic elements with a total volume of 1.2 cm3 embedded within a TKR implant can generate 4.8 mW of raw electrical power under expected axial loading conditions. A simple, prototype power conditioning circuit was used to transform the raw PZT output into regulated electrical power which wasus ed to continuously operate a low-power microprocessor. Laboratory measurements show that the efficiency of transforming mechanical input power into raw electrical power isapproximately 19%, in excellent agreement with the electromechanical model and simulation tools developed during thisw ork. The overall efficiency of converting input mechanical power into useful electrical energy is approximately 4% with the prototype conditioning circuit. Time degradation of the electrical output of the PZT elementsus ed in thisw ork after 6.5 million cyclesunder expected TKR loading conditionsindicate deterioration of less than 17% over the expected 20-year lifetime of an implant. Future work will include the development of more efficient power conditioning circuitry that addresses the capacitive nature and other poor source characteristics of PZT generators.An initial suite of sensors and a more detailed implant design are also required. The application ofthis technology to hip replacement implants will also be investigated.

24. Piezoelectricity: a literature review for power generation support Denis O. Urroz-Montoya1, Jeffrey R. Alverto-Suazo.

It is necessary that innovation be encouraged, and the licensing and financing processes become more transparent. N. Edomah, affirms in his work: Economics of Energy Supply, the complexity of the processes of creation of energy projects in terms of investment and the complexity of the state apparatus [24]. In recent years, renewable energy has increased considerably around the world; specifically, the percentage of energy from renewable sources in the final gross consumption of energy has almost doubled in recent years, in the case of the European Union, they have gone from approximately 8.5% in 2004 to 17.0% in 2016 [34]. This positive evolution has contributed to the binding state objectives aimed at increasing the percentage of energy from renewable sources, which were established in European Union agreements. The study presents some limitations as opportunities for future research, in subjects such as the viability and economic profitability of more advanced projects, due to the little diffusion of piezoelectricity in the industry. In addition, as of now there is still very little data available to perform a comparison that determines its competitiveness with traditional methods of energy generation, urging for more empirical and experimental research. Piezoelectric materials, as protagonists of harvesting energy support not only represent a solution to explore, but also an opportunity to encourage innovation, it is a new field of study that deserves to be analyzed. Therefore, our paper has presented a review from many perspectives of the piezoelectric energy and its future, determining its relevance in an increasingly changing world and thirsty for new options, which are viable and whose impact be as small as possible. Finally, this represents a first literature review about piezoelectricity as a support to power generation, showing the practical implications of the implementation of piezoelectric systems.

2.2 PROBLEM DEFINITION

Some developing countries, in almost all cities and villagers, faces several hours of daily load shedding due to uneven demand for electricity with the electric power generation rate. Many developed countries use gasoline electric generator and IPS (Instant power supply) at their homes during the power-cut. Industry and IT hubs also use standby generator due to power crisis. This system ultimately intensifies the crisis of power.

CHAPTER 3: MATERIALS & METHODOLOGY

3.1 MATERIALS: Piezoelectric material has a crystalline structure It is ability to convert mechanical strain to electrical energy. Piezoelectric material is the main component of the project. It is belonging to the group of ferroelectric material. It is important to choose the proper piezoelectric material. The most available piezoelectric material is PVDF and PZT. For getting better output voltage for various pressure, it is important to select the best piezoelectric material. As we apply various pressure applied to the piezoelectric material the different voltage readings corresponding to the force is displayed. The PZT (lead Zirconate titavate) has more advantage than PVDF.

There are many materials, both natural and man-made, that exhibit a range of piezoelectric effects. Some naturally piezoelectric occurring materials include Berlinite (structurally identical to quartz), cane sugar, quartz, Rochelle salt, topaz, tourmaline, and bone (dry bone exhibits some piezoelectric properties due to the apatite crystals, and the piezoelectric effect is generally thought to act as a biological force sensor). An example of man-made piezoelectric materials includes barium titanate and lead zirconate titanate.

In recent years, due to the growing environmental concern regarding toxicity in lead-containing devices and the RoHS directive followed within the European Union, there has been a push to develop lead free piezoelectric materials. To date, this initiative to develop new lead-free piezoelectric materials has resulted in a variety of new piezoelectric materials which are more environmentally safe.

3.2 DETAILED EXPLAINATION OF COMPONENTS

3.2.1. PIEZOELECTRIC SENSOR:

A piezoelectric sensor requires no external voltage or current source, they are able to generate an output signal from the strain applied. This makes them a popular choice for many applications. The use of them is growing significantly throughout different industries and they are sometimes incorporated into other sensors. “Piezo” is Greek for “press” or “squeeze” so a piezoelectric sensor effectively measures compression using the piezoelectric effect. A piezoelectric sensor converts physical parameters - for example, acceleration, strain or pressure into an electrical charge which can then be measured. They are highly sensitive and very small in size making them well suited to everyday objects. Piezo sensors are part of our product range here at Var ohm; we can offer piezo cables, film elements, piezo film sheets and piezo switches.

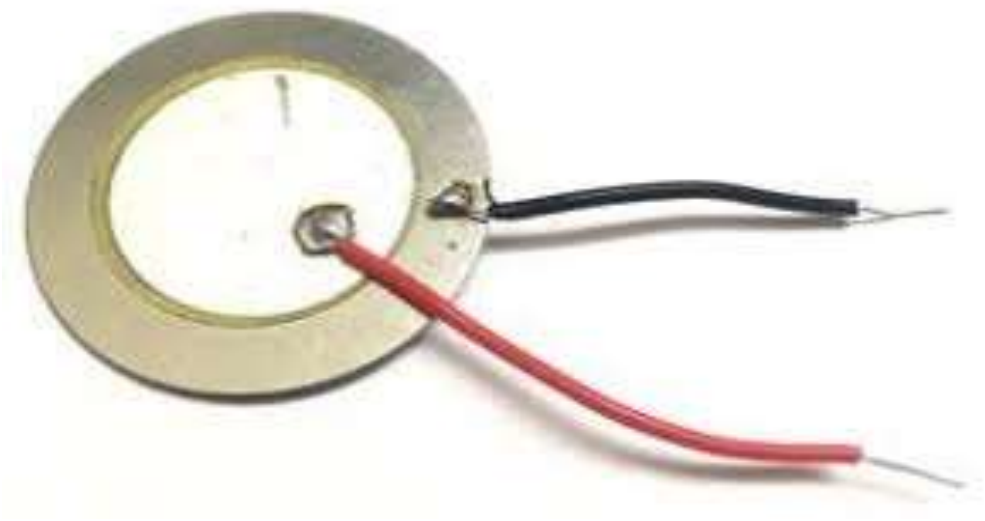

Figure 5: Piezoelectric Sensor

3.2.2. MULTIMETER

A multimeter is an electronic tool used to measure voltage, amps and resistance across circuits. By attaching two leads to different parts of an electrical system, professionals can use multimeters to detect levels of voltage and resistance, or changes in electrical currents. This tool may also be known as a volt-ohm meter or volt-ohm-milliammeter (VOM). New digital multimeters have advanced to the point that they can measure extremely tiny differences or fluctuations. Experts point out that although some multimeters test higher ranges of voltage, it will be less possible to detect smaller changes in these higher ranges. Multimeters have a lot of practical applications in IT. Hardware troubleshooting is an area where professionals may use a multimeter to figure out whether individual hardware devices are getting enough current, or whether anything has changed in an existing IT setup. Although many thinks of the multimeter as something that is in a residential or commercial electrician's toolbox, this tool can also be something that IT professionals use in diagnosing energy supply issues behind advanced data systems.

3.3.3. PCB

PCB or Printed Circuit Board is the traditional name for the bare board of which you supply us with the layout data and which you use to mount your components on once we have delivered it to you. A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate. When the board has only copper tracks and features, and no circuit elements such as capacitors, resistors or active devices have been manufactured into the actual substrate of the board, it is more correctly referred to as printed wiring board (PWB) or etched wiring board. Use of the term PWB or printed wiring board although more accurate and distinct from what would be known as a true printed circuit board, has generally fallen by the wayside for many people as the distinction between circuit and wiring has become blurred. Today printed wiring (circuit) boards are used in virtually all

but the simplest commercially produced electronic devices, and allow fully automated assembly processes that were not possible or practical in earlier era tag type circuit assembly processes.

Figure 6: PCB

3.3.4. LED'S

A Light Emitting Diode (LED) is a special type of PN junction diode. The light emitting diode is specially doped and made of a special type of semiconductor. This diode can emit light when it is in the forward biased state. Aluminum indium gallium phosphide (AlInGaP) and indium gallium nitride (InGaN) are two of the most commonly used semiconductors for LED technologies. Older LED technologies used gallium arsenide phosphide (GaAsP), gallium phosphide (GaP), and aluminum gallium arsenide (AlGaAs). LEDs generate visible radiation by electroluminescence phenomenon when a low-voltage direct current is applied to a suitably doped crystal containing a p-n junction, as shown in the diagram below. The doping is typically carried out with elements from column III and V of the periodic table. When a forward biased current, IF, energizes the p-n junction, it emits light at a wavelength defined by the active region energy gap. When the forward biased current IF is applied through the p-n junction of the diode, minority carrier electrons are injected into the p-region and corresponding minority carrier electrons are injected into the n-region. Photon emission occurs due to electron-hole recombination in the p-region. Electron energy transitions across the energy gap, called radiative recombinations, produce photons (i.e., light), while shunt energy transitions, called non-radiative recombinations, produce phonons (i.e., heat). The luminous efficacies of typical AlInGaP LEDs and InGaN LEDs for different peak wavelengths are shown in the table below. The efficacy depends on the light energy generated at the junction and losses due to re-absorption when light tries to escape through the crystal. The high index of refraction of most semiconductors causes the light to reflect back from the surface into the crystal and highly attenuated before finally exiting. The efficacy expressed in terms of this ultimate measurable visible energy is called the external efficacy. The phenomenon of electroluminescence was observed in the year 1923 in naturally occurring junctions, but it was impractical at that time

due to its low luminous efficacy in converting electric energy to light. But today efficacy has increased considerably and LEDs are used not only in signals, indicators, signs, and displays but also in indoor lighting applications and road lighting applications.

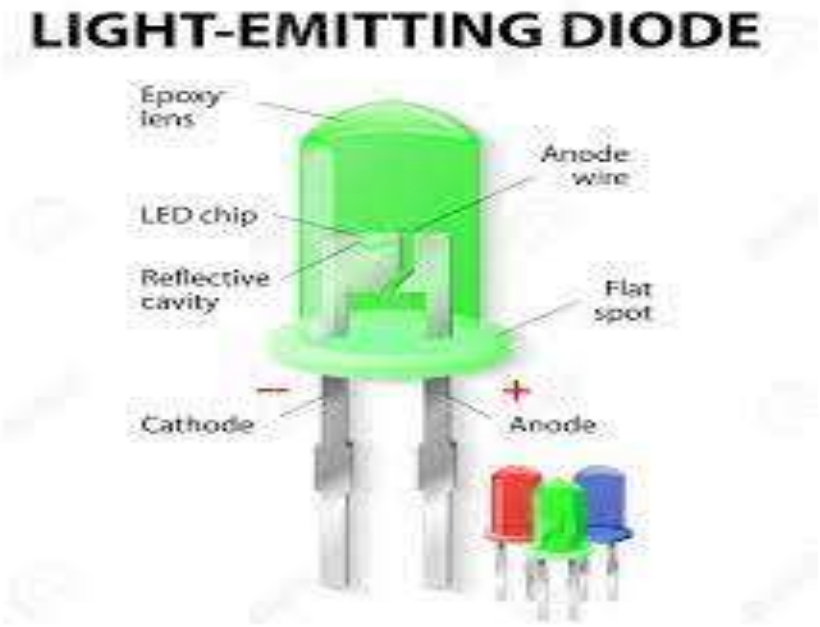

Figure 7: LED

3.3.5. RECHARGEABLE BATTERY

A rechargeable battery, storage battery, or secondary cell, (or archaically accumulator) is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction. Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead–acid, zinc–air, nickel–cadmium (NiCd), nickel–metal hydride (NiMH), lithium-ion (Li-ion), lithium iron phosphate (LiFePO4), and lithium-ion polymer (Li-ion polymer). Rechargeable batteries typically initially cost more than disposable batteries, but have a much lower total cost of ownership and environmental impact, as they can be recharged inexpensively many times before they need replacing. Some rechargeable battery types are available in the same sizes and voltages as disposable types, and can be used interchangeably with them.

Figure 8: Rechargeable Battery

3.3.6. CAPACITOR

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e., insulator). The conductors can be thin films of metal, aluminum foil or disks, etc. The 'nonconducting' dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, paper, mica, etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, a capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates. When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if an accelerating or alternating voltage is applied across the leads of the capacitor, a displacement current can flow. An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential difference (V) between them. The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10−12 F) to about 1 mF (10−3 F). The capacitance is greater when there is a narrower separation between conductors and when the conductors have a larger surface area. In practice, the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired inductance and resistance. Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems they stabilize voltage and power flow.

Figure 9: Capacitor

3.3 Methodology

Newton second law of motion

Newton's 2nd law is defined as

"The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object."

Mathematically,

$F = ma$

Where

F = force exerted

m = weight of body

$a = 9.8\ m/s^2$

Law of Energy Conservation

The law of conservation of energy states that energy can neither be created nor destroyed - only converted from one form of energy to another. This means that a system always has the same amount of energy, unless it's added from the outside.

Power estimation is found by some calculation i.e, first we have to find the magnitude of force that is exerted by human foot on the ground because without it we cannot find the power output. From a research there is a supposition that while walking human exert force which is 1-1.5 times of his body weight. Now assuming that the average weight of a student is 80 kg the force can be calculated as

$F = 80 * 9.8$

F = 784 N

So approximately we take it 800N. To convert it into work done or energy we will use

J = N-m

We will find the displacement and then the answer will be in J/step. So now need to convert it into KWh as we know

1 kWh = 2.778 * 10-6 J

Finally, we can find the units produced from one person and we can easily find the total output of the day.

Assume,

- Force exerted is 1.3 times weight
- Acceleration of gravity value 9.8 m/sec2
- Weight of one person is 80 kg (including everything)
- Tile's displacement 0.01m
- Each tile has 50% efficiency

F = 1.3 * 784

F = 1019.2 N

Now find energy per step by multiplying this energy by the displacement of tile i.e.

Energy = 1019.2 * 0.01

Energy = **10.192 J**

The efficiency of each tile is 50% so energy will be

Energy = 5.096 J

As we have approximated that the distance at which if we have installed our system is 1 m2 then

Total energy = **5.096 J**

Now convert this energy to total units produced by a single person i.e.

Units produced = 5.096 * 2.778 * 10-6 J

Units produced = 0.141567 * 10-4 KWh

This is the units produced by a single person i.e.

Units produced per step = 0.141567 * 10-4

Let we assume that 10000 steps produce on a single day

Units produced in a day = 0.141567 * 10-4 * 10,000

Units produced in a day = **0.141567 kWh**

So this is the calculation of our project per day. This states that if we install in a gallery of our campus and if total numbers of persons visit it more than one in a day then the numbers of units produced will be **0.141567 kWh** in a day.

4.3 Maximum Theoretical Voltage Generation

When a force is applied on piezo material, a charge is generated across it. Thus, it can be assumed to be an ideal capacitor. Thus, all equations governing capacitors can be applied to it. In this project, on one tile, we connect 5 piezo in such series connections are connected in parallel. Thus when 5 piezoelectric discs are connected in series, its equivalent capacitance becomes:

Total sensors = 20

voltage given by 1 piezo = 13v

We are going to use series and parallel connection so

Veq = V1 + V2 + V3 + V4 + V5

= 13 +13 + 13 + 13 + 13

= 65v

Plate Size = 1 m2

If a man weight of 80 kg is applying pressure on plate then applying pressure is

P = 80 * 9.81 / 1

= **784.8 pa**

Voltage generated by piezo = P * g * t

where : P = Applied pressure

g = Voltage sensitivity consent

t = thickness of piezo sensor

t = 1 mm

And if we are using n number of sensor's then

V = n * P * g * t

If we assume that 120v Voltage we needed then

120 = 20 * 588.6 * g * 1 * 10-3

g = 10.2 mv/N

We need output power, Pout = 10 w

P = V * I, 10 = 120 * I, **I = 0.0833**

CHAPTER 4: EXPERIMENTAL DETAIL

4.1 Experimental setup

The power generation set up concept with piezoelectric sensor setup is clearly shown in fig. 1 as a flow chart. It consists of piezoelectric sensors, unidirectional diode, dc to ac booster, super capacitor, storage device (12 v battery), dc to ac inverter, relay and supply to ac load. The above mentioned parts were clearly connected as per the produce the power by the applied load on the piezoelectric transducer. The applied load creates electricity on the piezoelectric sensor which is transferred to the unidirectional diode. Then the diode supplied the electricity to the dc to ac booster to increase the direct current level and passed to the capacitor. The capacitor used to intermediate of the storage device. Then the stored power can be inverted by the inverter as ac from dc then the relays used to operate the ac loads . The above mentioned piezoelectric setup is up to super capacitor were placed in every step in as per the to create the series connection of the piezoelectric setups . There are twelve steps considered for this investigation. This series connection is connected with the storage device of 12 v capacity battery. There is a connection also available to use the produced power from this arrangement. The piezoelectric setup further connected with analog to digital converter to convert the piezoelectric sensors sensed power converted from the analog to the digital output. These values were used to send their output to the next level to the iot.

- The basic worling principle of our project is based on piezoelectric sensor.
- To implement to adjust the wooden plates above and below the sensors and movable springs.
- Non coventional energy using footstep is coneverted mechaical energy into the electrical energy.
- Footstep board it consists of 16 piezoelectric sensor which are connected in parallel.
- When the pressure is applied on the sensors, the sensor is converted mechanical energy into electrical energy.
- This electrical energy will be storing in the 12 volt recharagble battery connected to the inverter.
- We are using conventional battery charging unit also giving suppply for the circuitry.
- This inverter is used to convert the 12volt d.c to the 230 volt a.c. This 220 volt ac use to activate loads.
- By using this ac voltage we can operate ac loads.

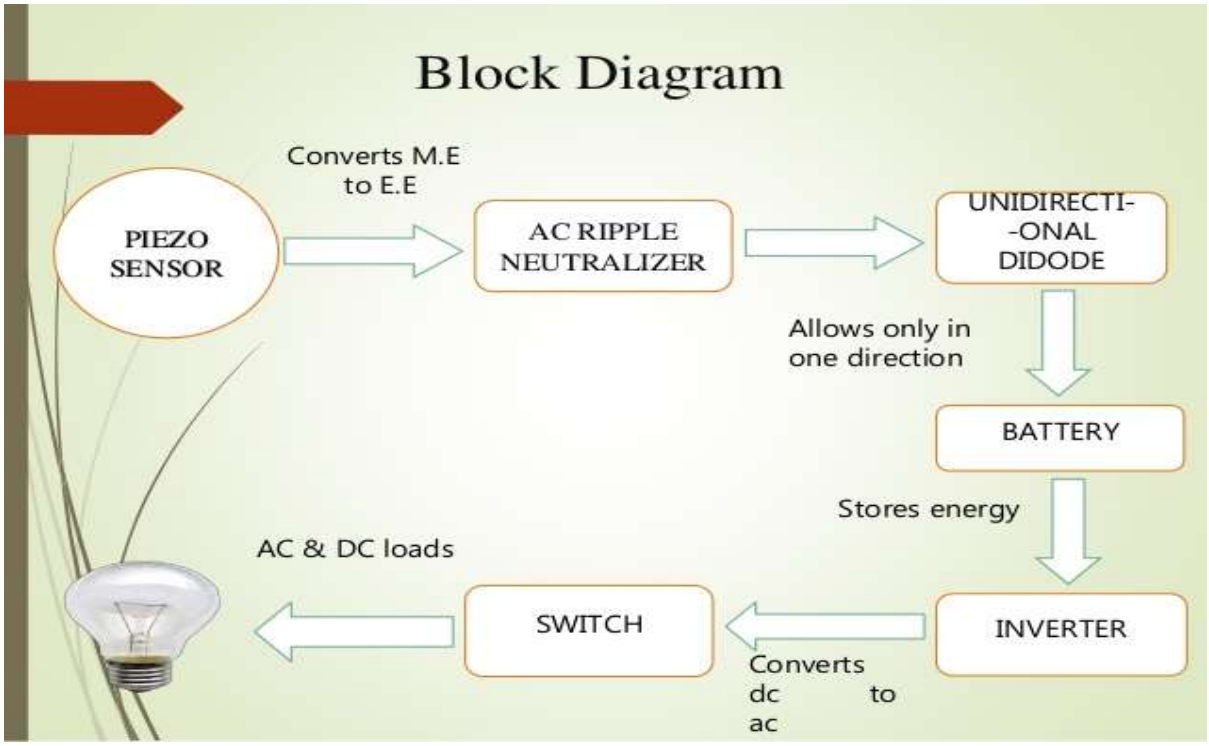

Fig. 10 Block Diagram

CHAPTER 5: RESULT & DISCUSSION

The project work "**ELECTRICITY GENERATION BY PIEZO SENSORS**" is designed and developed successfully, for the demonstration purpose a proto type module is constructed with lower ratings of devices, & results are found to be satisfactory. As it is a demo module it cannot be used for real applications, but the concept is near to the real working system, to make it more realistic, higher rating power generator with suitable gear mechanism is essential to produce more energy.

This concept falls under the subject of non-conventional energy resources, out of the many alternative energy resources one dependable source is solar energy, but it is quite costliest affair. Therefore alternative cheapest source is to generate electricity from foot step. This technology proven here is the ultimate inexpensive source of all known forms of energy. When it is implemented practically, depending up on the size & traffic flow, each foot step may produce tens of kilowatts power every day, this power can be utilized for many applications. If we are used this project at very busy stairs palace then we produce efficient useful electrical for large purposes. One important advantage of producing energy through this technology is that it does not pollute the environment.. Hence these foot step can be altered with this technology, there by all the street lights belongs to a particular city can be energized.

CHAPTER 6: CONCLUSIONS & FUTURE SCOPE

CONCLUSION:

The project "ELECTRICITY GENERATION BY PIEZO SENSOR" is successfully tested and implemented which is the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence as India is a developing country where energy management is a big challenge for huge population. By using this project, we can drive both A.C. as well as D.C. loads according to the force we applied on the piezo electric sensor.

A piezo tile capable of generating 40V has devised. Comparison between various piezo electric material shows that PZT is superior in characteristics. Also by comparison it was found that series – parallel combination connection is more suitable. The weight applied on the tile and corresponding voltage generated is studied and they are found to have linear relation. It is especially suited for implementation is crowded areas. This can be used in street lighting without use of long power lines. It can also be used as charging ports, lighting of pavement side buildings.

As a fact only 11% of renewable energy contributes to our primary energy. If this project is deployed then not only, we can overcome the energy crises problem but this also contributes to create healthy global environmental change.

- Smart system.
- Durable.
- Have a life of approx. 5 years.

FUTURE SCOPE

- Electricity generation for streetlights through speed breaker
- Security check in platform converted into in this mechanism at various places working of x – ray machines conventionally.
- A particular model could be sell to common people for using it at home as well the company making these models can help in employment of various officials.

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