Technical Review on Power Generation through Foot Step

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Abstract: The energy problems today combine these issues: much of the world's population has too little energy to meet basic human needs; the monetary costs of energy are rising; the environmental impacts of energy supply are growing and already dominant contributors to global environmental problems. Confront with global energy problems will require greatly increased investment in improving the efficiency of energy end use and in reducing the environmental impacts of contemporary energy technologies. It will require financing a transition over the next several decades to a set of more sustainable and renewable energy sources. Truth be told, we can see that everyone considers the human is the main reason for many problems especially which related to energy and environment. In the following paragraph, I'll point out the importance of Life Energy as a solution of energy problems. In streets, malls, buildings, clubs, gym, also at homes. Only by considering the human isn't a reason of wasting energy but is a resource of generating power, from his movement, heat, playing, breathes, from his life as a clean, sustainable and renewable energy resource. The denial that the energy generated from human body in power plants seems to me to constitute a fundamental misunderstanding about the real human role in the life and society. Human generating power, Start using the thermal and kinetic energy of people in a lot of buildings. To recapitulate, what we have here is an exposition of how we can deal with crowded farms in Egypt as a human power plant to generate life energy. The intriguing ideas expressed here open the door to questions about how we can use the population in solving our problems, can we consider life energy a new renewable source of energy, what is the efficiency of energy generated from human.

Index Terms **– Foot Step, Power Generation, Piezoelectric, Non-Conventional source of energy**

I. INTRODUCTION:

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. Subsequently he discovered fire and his energy needs increased as he started to make use of wood and other bio mass to supply the energy needs for cooking as well as for keeping himself warm. 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. [1]The formation of electrical energy from the force exerted by footstep on the floor is illustrated in this research work. It will be surprising to know that the normal footstep movement on the floor can generate how much energy. As thousands of step per day is taken by each person. Electrical energy is generated by the footstep taken by the peoples as a result of walking. It is a fact that large amount of energy is lost by each person during routine walk which is the main source for this system. The approach of this Electro-Kinetic energy floor is to convert kinetic energy into electrical energy by walking on floor. The energy that is produced from a person walking on floor is noise and pollution free. That type of energy is advantageous and even not need any type of fuel or power source to run. By implementation of this renewable energy in today's world while the demand of energy is increasing day by day is the current solution of this modern world. In this research work a system is designed which generate power through non-conventional energy source technique such a walking on the gardens, grounds, and floors etc. This system is established in heavy populated areas. Basic way of the, Foot Step Power Generation‟ is based on the piezoelectric sensor to apply this system wooden plates up and down will be placed and adjusted on the piezoelectric sensor and moving spring. The force is applied when the person is walking on that mat and the magnet is fixed on the upper portion of the wooden sheet as a result of force, and moves into the cavity. However, the cavity is fixed on the bottom wooden sheet of the mat. A compatible system has been design to complete the procedure through which the load will run, Home appliances will work on alternating current output voltage. And the task is with the help of direct current to charge battery and then using inverter to convert direct current into alternating current for normal usage. At last, designing for the power generation of such types are very useful as compare to the demand of energy all over the world. As the requirement of energy is growing rapidly, so the possible solution to deal with these type of problems is just to utilize non-conventional energy sources. Mankind is utilizing non-conventional sources like solar, wind and so forth yet at the same time they can't satisfy power needs, as a result of that we need to produce power through other possible renewable energy sources. The target of this work is to deliver power through steps as a wellspring of non-conventional that we can got while walking or remaining on to the specific location of action like pathways, steps, plate structures and these frameworks can be introduced especially in more populated regions. In this undertaking the power vitality is delivered by human stride and power vitality is changed over into mechanical vitality by the rack and pinion instrument can be converted into electrical energy. Power is created by DC generator. We should consider existing techniques for stride power age that are rack and pinion game plan and

piezoelectric precious stones and expected to change the current framework. [2] Power is described as set of physical miracle associated with the stream of charge. There are two sorts of capacity to be explicit Static force that can be held consistent and dynamic power which can spill out of one potential to another. With the redesigning populace and establishment of the prospective associations and creation lines there have been a wonderful enthusiasm for the need of intensity in order to run the machines and sorts of apparatus. Power can spill out of one segment to another either as glimmer or current in metal. These generators themselves require broad proportion of data vitality to convey power which hence depends on upon the" NON RENEWABLE" resources of imperativeness to make power with a particular ultimate objective to run them. [3]

II. LITERATURE REVIEW:

For generation of power is finished by utilizing piezo plate. When a power is connected on the piezo plate the state of the piezo plate changes which prompts the generation of voltage. Piezo electric impact is depicted as a straight electromechanical collaboration between the mechanical and the electrical state in crystalline materials with no reversal symmetry. This voltage is then given to unidirectional diode. A unidirectional diode is a gadget utilized for permitting the voltage to travel just in one bearing. It is most usually found in electronic circuits where it serves as associations between two or more components. It is found in the modern control level for such atomic force plants, and electric force era. The boost DC-DC converter is the propensity of an inductor to oppose changes in current by making and devastating an attractive field, the yield voltage is constantly higher than the input voltage. The idea is that when the switch is closed, current moves through the inductor in clockwise generating so as to bear and the inductor stores some vitality a magnetic field. Polarity of the left half of the inductor is positive. Electrochemical pseudo-capacitors use metal oxide or leading polymer anodes with a high measure of electrochemical pseudo capacitance. Hybrid capacitors, for example, the lithium-particle capacitor, use cathodes with contrasting qualities: one displaying for the most part electrostatic capacitance and the other generally electrochemical capacitance. This boosted voltage is then gone through the SUPER CAPACITOR the capacitor here is utilized as a part of request to low the losing because of transportation of charge the voltage then coming after the capacitor is given to the battery to charge. This technique for generation of power is very easy. It can be utilized as a part of rural zones additionally where accessibility of power is less or exceptionally low. It can be utilized to drive both AC and in addition DC load. In developing nation like India we can utilize this strategy for power generation with a specific end goal to uncover the heaps from Renewable and non-Renewable wellspring of energy. [3]

In order to make the energy harvesting paver easy to assemble and scale up to deploy as part of a pathway, the proposed paver is made of energy paver modules the cover (top panel) of the box will move up and- down when it is stepped on. Four rack-and-pinions, one at each corner, are then used to transmit the up-and-down motion to the rotation motion of the shafts. Thus, the panel can always drive the generator no matter whether the step force is applied. Bevel gears synchronize the motion of all the three shafts. When the top panel reaches its displacement limit of 6mm (stopped by the wall of the box) or the top panel cannot keep up with the rotation of the generator anymore, the one-way-clutch disengages. Meanwhile, the generator continues to rotate due to inertia and to produce electrical energy. The flywheel attached at the high-speed shaft of the electric generator extends the duration of rotation. When the step is released, the generator is disengaged by the one-way clutch. The springs in the four corners reset the top panel to its original position.

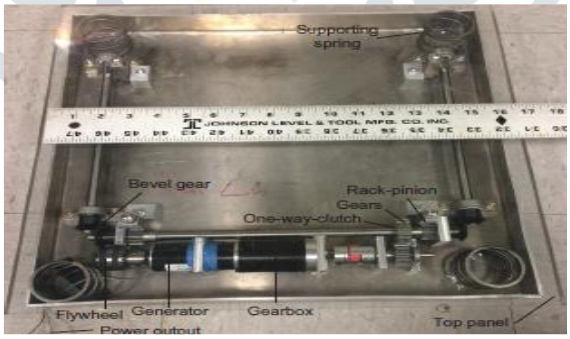

figure 1 Prototype assembly [4]

In this paper, they presented the design, modeling, analysis, simulations and experimental tests of a novel high-efficiency energy harvesting paver. Based on the novel design, high power output and high energy harvesting efficiency are obtained. A complete dynamic model is developed. Based on the modeling and simulation, optimal parameters are obtained. [4] [5]

The projections on the tile surface come in contact with the piezoelectric material (yellow) and hence apply force on it. The applied force produces stresses inside piezoelectric material which will produce current. Foot step power can be used for agricultural, home applications, street-lighting. Foot step power generation can be used in emergency power failure situations. Metros, Rural applications, etc. This can be used for many applications in rural areas where power availability is less or totally absent as India is a developing country where energy management is a big challenge for huge population. [6] Paper is based on electric power generation without polluting the environment the waste energy of human walking is utilized in the system. it is useful at crowded places to install this system to produce electricity. This system plays an important role for producing electricity at places where there

are no sources of electricity like village areas. This energy source is renewable and continuous. [2] The data collection and analysis show that the interest, defined by the number of published scientific articles in piezoelectric energy harvesting, has grown exponentially in the last decade. That discrepancy between idea generation and innovation on the one side and commercialization on other side. [7]

The fly haggle wheel is likewise coupled to the littler sprocket shaft-The flywheel is utilized to expand the rpm of the littler sprocket shaft-The rigging wheel is coupled to the generator shaft with the assistance of another apparatus wheel-The generator is utilized here, is perpetual magnet D.C Stepper Motor-The created voltage is 12Volt D.C. This voltage is further intensified utilizing IC MC34063 DC-DC convertor and is put away to the Lead-corrosive 12 Volt battery. This technique produces the electric power without dirtying our surrounding. The waste energy supplied by human is used in this frame-work. This energy source is ceaseless & renewable. In addition, we are certain that this technique for power era will be utilized for rustic jolt & to satisfy our energy needs. [8]

The setup pressed due to the spring action and pulls the lever assembly which rotates one of the freewheel bearing fitted to the shaft. The shaft then rotates the large pulley which is connected to the smaller pulley through a V-belt. This smaller pulley coupled with the dynamo (or Sanyo coil), a device that converts the energy of rotary motion into electric current and power is obtained. 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 in crowded areas. This can be used in street lighting without use of long power lines. [9] Project is based on electric power generation without polluting the environment the waste energy of human walking is utilized in the system. It is useful at crowded places to install this system to produce electricity. This system plays an important role for producing electricity at places where there are no sources of electricity like village areas. This energy source is renewable and continuous.

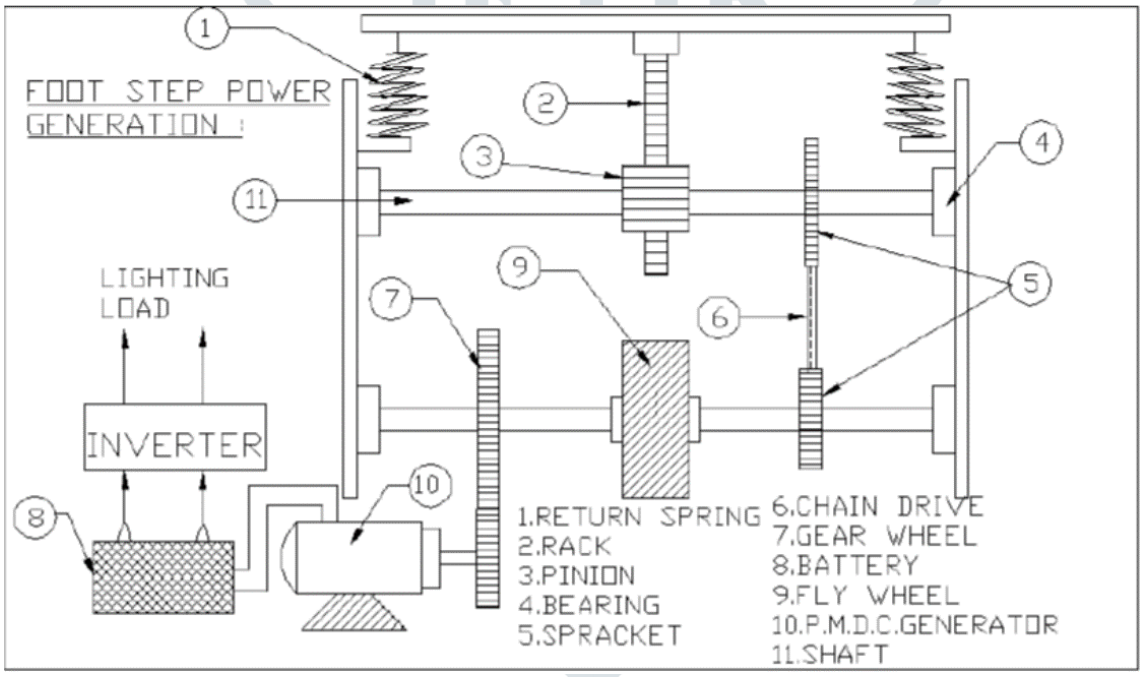

figure 2 Design of footstep power generator [1]

To fulfill the requirements of increasing demand of energy people are using solar and wind. Another way is to generate the electricity is footstep power generation by adding rack and pinion and piezoelectric crystals mechanism in existing system. Simple setup and component that is installed under the walking or standing platform. We utilize the waste energy of footstep and stored in battery. Single step is required to generate electricity. Components are used in this is rack and pinion, Sprocket, springs, Inverter, Voltage regulator, Dynamo, Battery and Piezo crystals. Dynamo is an electrical generator which generates direct current. Piezoelectric crystals are another way of generating electricity by using human footsteps. The piezoelectric placed under insulating material like hard rubber and pressure created by foot step and water fall pressure will produce electrical energy which can be stored and used for domestic purpose. Electricity is generated when rack move in upward direction. The main objective is to save conventional energy sources, to store the electricity for further use, to produce electricity at cheapest cost and to combine two methods for more output from one system. I t is very useful at crowded places to install this system to produce electricity. This energy source is renewable and continuous. [2]

Technique for the generation of power using piezoelectric sensors kept on footpaths. The footstep power generation technique through piezoelectric sensors produces electrical force by changing mechanical energy into electrical energy. This system is addition of mechanical part and electrical part. There are two types of power static power and dynamic power. A substitute strategy for generation of power is finished by utilizing piezo plate. In this framework when a power is connected on the piezo plate the state

of the piezo plate changes which generates voltage. Electrostatic twofold layer and Hybrid capacitors are used. Battery that is being charged by using this method can be later be used to run both DC as well as AC loads. Generated power at 50kg weight is 0.600 W. This technique for generation of power is extremely prudent and is anything but easy to produce. It can be utilized as a part of rural zones additionally where accessibility of power is less or exceptionally low. It can be utilized to drive both AC and in addition DC load. In developing nation like India we can utilize this strategy for power generation with a specific end goal to uncover the heaps from Renewable and non-Renewable wellspring of energy. [3]

Energy harvesting is important in low power intelligent networks. A decision making model is proposed including a requirement for better understanding of niches, niche definitions and configuration of energy harvesting design considerations. Piezo electric energy is one of the most typical method. With support of this gained knowledge, the authors present a technology foresight of this field. Technology foresight is to identify and evaluate the emerging technologies, which will probably result in great economic and social bene-fits in the future. The purpose of this foresight is to present the future interest in this field. Give the minimal breakthrough of piezoelectric energy. Piezoelectricity is a fundamental effect of physics, which generates electric voltage, if a material is mechanically stressed. For more understanding of the interest into energy harvesting through piezoelectricity. A remarkable discrepancy between idea generation and innovation on the one side, and commercialization on the other side. Decision making model is useful for future design of piezoelectric energy. As a key learning, it is demonstrated that lack of commercialization is not restrain research interest, which might suggest a general problem in management and prioritization of energy research. [7]

Harvesting energy from pedestrians can be used to power sensors in smart infrastructure, monitor structural health, and provide environmental sensing data. By the movements of rack power is generated A flywheel is attached to the electric generator to take full advantage of the theoretically available potential energy during human walking. The average harvested energy is 1.8 J per step. The energy output is far below the available potential energy during human walking. A DC generator is used to convert kinetic energy into electricity. The simulation result is obtained by inputting the vertical ground reaction force (VGRF). In order to compare the experimental results with the numerical simulation, evaluation sensors were employed to test the prototype. The force sensor was attached to the bottom of the test subject's shoe. The average energy output from six individual tests are plotted with error bar. The experimental results match well with numerical simulations. The experimental results show that the energy harvesting paver can produce an average power output of 3.6W over 0.5 s of the step time, with a peak power of 12W in walking conditions. The output electrical energy is 1.8 J per step. 75% of all the theoretically available potential energy is transmitted into the energy harvesting paver and 50% of them in converted into electricity. [4] [5]

Piezoelectric material is seen as a potential candidate for energy generation since it has an outstanding property of converting kinetic energy into electricity. In this study, a prototype termed as Vibration Energy Harvester (VEnH) is developed to assess its performance in generating electricity from a vibration source. The prototype consists of a cantilever beam with a piezo ceramic attached at half-length of the cantilever beam, a DC motor for emulation of the vibration produced by human footsteps and a microcontroller, When a continuous force is applied to the VEnH, the cantilever beam experienced form actions and thus induces electricity Piezoelectric ceramics can be used for energy conversion , i.e. from kinetic energy into electricity (transducers) or inversely from electricity into kinetic energy (actuators). Piezoelectric materials can be electrically polarized or undergo a change in polarization when subjected to a stress. The efficiency of energy generation depends not only to the amplitude of input displacement but also excitation frequencies. It is achieved only when someone is in running mode and this frequency is the system threshold. [10]

The critical analysis of this research is to design a piezoelectric tile for harvesting energy from footsteps and to optimize the system for harvesting maximum energy. Because piezoelectric modules easily break when directly subjected to energy generated by human movements, we designed a tile that employs indirect energy transmission using springs and a tip mass. We aimed at matching the mechanical resonance frequency of the tile with that of the piezoelectric modules. The piezoelectric tile used in our experiment. Shows that it is modeled on a real tile, and its area is shows that the piezoelectric tile consists of an upper plate that has to be directly stepped on, a middle plate where the piezoelectric modules are set up, a bottom plate, and four supporting springs. The middle plate is piezo installed layer which is attached upper plate. We dropped a steel ball from a height of for equal input energy. We adopted the tip mass with the most similar resonance frequency to the vibration frequency of the tile and conclusion on the piezoelectric tile when it is impacted by steel balls under free fall. They performed mechanical optimization by matching the vibration frequency of the tile to the resonance frequency of the piezoelectric module the resonance frequency which was very close to the vibration frequency. Under that condition we also performed circuit optimization through impedance matching. One piezoelectric module was matched, yielding an output power. Four piezoelectric modules were matched, yielding output power and peak. This RMS value was 203% higher than Moro's shoe-mounted harvester. This indirect type harvester has many advantages to applying real environment. [11]

The method is used by the authors is based on the piezoelectric sensor. To implement this, we adjust the wooden plates above and below the sensors and moveable springs. Achieving non-conventional energy using foot step is simply converting mechanical energy into electrical energy. The Foot step board consists of 16 piezo electric sensors which are connected in parallel. When the pressure is applied on the sensors, the sensors will convert mechanical energy into electrical energy. This electrical energy will be stored in the 12v rechargeable battery which is connected to inverter. The battery charging system used here is conventional battery charging unit which is also used for giving supply to the circuitry This inverter is used to convert the 12 Volt D.C to the 230

Volt A.C. This 230 Volt A.C voltage is used to activate the loads and by using this AC voltage we can operate AC loads. The piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can from of the weight of the people walking over it. The output of the piezoelectric material is not a steady. So a bridge circuit is used to convert this variable voltage into a linear one. Again an AC ripple filter is used to filter out any further fluctuations in the output. The output DC voltage is then stored in a rechargeable battery. As the power output from a single piezo-film was extremely low, combination of few Piezo films was investigated. Two possible connections were tested - parallel and series connections. The parallel connection did not show significant increase in the voltage output. With series connection, additional piezo-film results in increased of voltage output but not in linear proportion. So here a combination of both parallel and series connection is employed for producing 40V voltage output with high current density. From battery provisions are provided to connect dc load. An inverter is connected to battery to provide provision to connect AC load. The voltage produced across the tile can be seen in a LCD. It focuses on one such advanced method of energy harvesting using piezoelectric material. Piezoelectric materials can be used as mechanisms to transfer mechanical energy, usually ambient vibration, into electrical energy that can be stored and used to power other devices. The method is used by the authors is based on the piezoelectric sensor. To implement this we adjust the wooden plates above and below the sensors and moveable springs. Achieving non-conventional energy using foot step is simply converting mechanical energy into electrical energy. The Foot step board consists of 16 piezo electric sensors which are connected in parallel. When the pressure is applied on the sensors, the sensors will convert mechanical energy into electrical energy. The project is successfully tested and implemented which is the best economical, affordable energy solution to common people. A piezo tile capable of generating 40V has been devised. 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 in crowded areas. This can be used in street lighting without use of long power lines lighting of pavement side buildings. As a fact only 11% of renewable energy contributes to our primary energy. This also contributes to create a healthy global environmental change. [12] [13]

In this paper a novel paver that efficiently harvests energy from human walking. Within the paver. Harvesting energy from pedestrians can be used to power sensors in smart infrastructure, monitor structural health, and provide environmental sensing data. Parameters of the energy harvesting paver are analysed to optimize the harvested energy from human walking. methodology is used by authors is harvesting paver of the rack and pinion mechanism how rotates and after that Design concept and prototype the energy harvesting paver and Modelling and simulation Potential Energy Human walking results in a Vertical Ground Reaction Force (VGRF) on the ground. Measured typical walking, speed walking, and running VGRF profiles. Then Overall Model Based on the above modelling of the generator and the working principle, the energy harvesting paver can be modelled as a mass-spring damper system. Then all Simulation and parameter optimization and experiment and evaluation. They all are presented the design, modelling, analysis, simulations and experimental tests of a novel high-efficiency energy harvesting paver. Based on the novel. The theoretically available potential energy is transmitted into the energy harvesting paver and 50% of them in converted into electricity. This is significantly higher than the values published in literature this paper shows applicable Amount of energy can be obtained while not affect human walking. The presented dynamic model, analytical and optimization method can also be used in the design of similar vibration energy harvesting devices. [4]

The main objective is generating electrical energy by means of a non- conventional method just by walking on the footsteps. The mechanism consists of rack & pinion, chain drives, alternator and battery. They had discussed its various alternate applications with extension also. This result is mention in the abstract. This setup is made up of mild steel. The upper plate is fixed with the help of springs and rack & pinion. Below this plate a shaft is mounted which is connected to a dc alternator and this alternator is to the lightning LEDs. Foot step arrangement-rack & pinion and chain Drive-Dc generator-LEDs. 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. [14]

In the experiment the force energy is produced by human footsteps and the force energy is converted into mechanical energy by rack and pinion mechanism, electricity is produced by dc generator. And this power source has many applications as in agriculture, home application and street lighting and as energy source for sensors in remote locations. The basic working principle of our project is based on the spring force that is used to convert mechanical into the electrical energy. The utilization of waste energy of foot power with human motion is very important for highly populated countries. Components are used in this is rack and pinion, Sprocket, springs, Inverter, Voltage regulator, Dynamo, Battery and Piezo crystals. Dynamo is an electrical generator which generates direct current. Piezoelectric crystals are another way of generating electricity by using human footsteps. It is especially suited for implementation in crowded areas. We can overcome the energy crises problem but this also contributes to create a healthy global environmental change. [15]

III. CONCLUSION:

In all, since the power generation using foot step get its energy requirements from the Non-Conventional source of energy. There is no need of power from the mains and there is less pollution in this source of energy. It is very useful to the places all roads and as well as all kind of foot step which is used to generate the non-conventional energy like electricity. It is able to extend this

idea by using same arrangement and construct in the footsteps/speed breaker so that increase the power production rate by fixing school and colleges, highways etc. 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 AC as well as DC loads according to the force we apply on the piezo electric sensor. A piezo tile capable of generating 52V has been devised. 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 in 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 idea is deployed then not we can overcome the energy crises problem by some extent. Moreover, this also contributes to create a healthy global environmental change.

IV. REFERENCES

[1] V. K. GARG, "POWER GENERATION BY FOOT STEP," Jalandhar.

[2] P. K. e. al., "Design of Foot Step Power Generation System An Investigation on Generation of Electricity Using Foot Step," *IJSRSET,* pp. 655-660, 2018.

[3] M. .. e. al., "Footstep Power production using Piezoelectric Sensors," *Research Journal of Pharmacy and Technology,* pp. 831-834, 2016.

[4] M. L. e. al., "Design, simulation and experiment of a novel high efficiency energy haresting paver," *Applied Energy,* pp. 966-975, 2018.

[5] ShengxiZhou, "Broadband tristable energy harvester: Modeling and experiment verification," *Applied Energy,* vol. 133, pp. 33-39, 2014.

[6] S. J. H. e. al., "Designing and manufacturing a piezoelectric tile for harvesting energy from footstep," *Current Applied Physics,* pp. 669-674, 2015.

[7] F. L. e. al., "Energy harvesting through piezoelectricity - technology foresight," *Energy Procedia,* pp. 3062-3068, 2017.

[8] G. e. al., "REVIEW ON POWER GENERATING USING HUMAN FOOT STEP WITHPIZEO ELECTRIC SENSOR AND TREADMILL," *International Journal of Pure and Applied Mathematics,* vol. 119, pp. 3219-3228, 2018.

[9] R. R. T. e. al., "Foot Step Power Generation," *International Research Journal of Engineering and Technology,* vol. 16, pp. 5094-5100, 2019.

[10] D. N. e. al., "Footsteps: Trail-blazing the Web," *Computer Networks and ISDN Systems,* pp. 879-885, 1995.

[11] S. J. H. e. al., "Designing and manufacturing a piezoelectric tile for harvesting energy from footstep," *Current Applied Physics,* vol. 15, pp. 669-674, 2015.

[12] S. Kumawat, "Foot Step Power Generation," *International Journal of Science and Research,* vol. 7, no. 12, pp. 879-882, 2016.

[13] A. Kumar, "Electrical Power Generation Using Piezoelectric Crystal," *International Journal of Scientific & Engineering Research,* vol. 2, no. 5, 2011.

[14] S. k. e. al., "Footstep Power Generation".

[15] R. R. T. e. al., "Foot Step Power Generation," *International Research Journal of Engineering and Technology,* vol. 6, no. 5, pp. 5094-5100, 2019.