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HARNESSING KINETIC POWER AND SOUND POWER USING PZT IN A CONDENSED ZONE

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Abstract- A **proliferation in population has got its effect on the power demands, thereby creating a compulsion for more power generation. Erupting conventional power sources like the thermal and nuclear power stations are life threatening with harmful smoke and radiation. In order to counteract all the difficulties there is urgency for healthy way of power harnessing. Power harnessing refers to the practice of acquiring energy from the environment which would be otherwise wasted and converting it into usable electric energy. The objective of this project is to overcome power needs by transduction of stress generated by human footfall upon the surface where PZT (Lead Zirconate Titanate) piezo transducers are placed. This system can be installed at railway stations, airports, ship yards, roads etc where people move around the clock. When people walk on the steps or that of platform, power is generated from weight of the person by piezoelectric effect. In addition to this noise being a longitudinal vibration can also be converted into electricity using PZT's and associated circuits mounted just beneath the speakerS.**

Keywords- **Electricity generating floor, piezoelectric design, Micro-controller, Energy saving system.**

I. INTRODUCTION

Today, the demand of electricity is rapidly growing in this world and set to be doubled by 2030. So it is necessary to increase the supply of electric power and for that it is very essential to find other alternative methods to produce electric energy. Walking is the most common activity done by human being. While walking the energy is wasted in the form of vibration to the surface; this wasted energy can be converted into electricity using the principle of piezoelectric effect. Likewise, noise being a longitudinal vibration can also be converted into electricity. The proposed project gives idea about how the wasted energy is utilized and converted to electricity by piezoelectric effect.

II. PIEZO ELECTRICITY GENERATING FLOOR

Piezo electric floors are designed to capture the wasted energy and resources are stored or redistribute them when they are needed. Energy is generated when a person steps on tiles that feature piezo electric attributes.

A. Principle of piezoelectricity

Principle of piezo electric transducer is that a force, when applied on the crystal, produces electric charges on the crystal surface. The rate of charge produced will be proportional to the rate of change of force applied as input. The charge thus produced is called as piezo electricity.

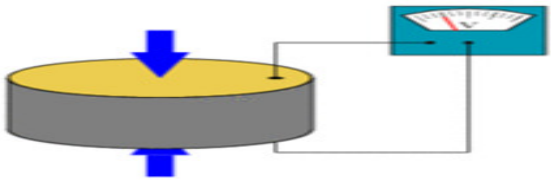

Fig.1 Schematic representation of piezoelectric effect

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B. Design of piezo floor

For energy generation through piezoelectricity piezoelectric crystals made of PZT are arranged in a grid on the floor. The active element is basically a piece of polarized material with electrodes attached to its two opposite faces. In this design process eight number of pzts are placed under the floor made of mild steel plate. Lead zirconate titanate (PZT) crystals will generate measurable piezoelectricity when their static structure is deformed by about 0.1% of the original dimension. The mechanical stress due to human weight is considered as the input power and the electricity generated through it is the output.

Fig 2. PZT Transducer

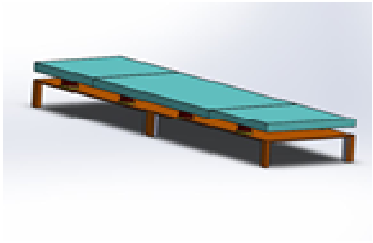

Fig 3. Piezoelectric floor design

The generated voltage from a piezoelectric material can be calculated from the following equation

1. **E = P * G * T**

Where,

E= Output voltage
G= voltage sensitivity
T= thickness of the material
P= Force applied (m*a) * unit area

2. **G = Charge sensitivity/€o€r**

Table 1. Comparative Estimate

Mass of person(Kg)	Expected output voltage(V)
50	4-5
60	5-7
70	7-9

C. Series parallel connection

To give better voltage and current eight PZTs are connected in series. A voltmeter is connected in parallel to this series combination. As varying forces are applied on this connection and corresponding voltages are noted. Voltage and current generated across the series connection is measured. The voltage and current generated across the parallel connection is measured. From series connection obtained current is poor and from parallel connection obtained voltage is poor. To overcome this problem PZTs in series-parallel connection is used. Here a combination of both parallel and series connection producing voltage output with high current density.

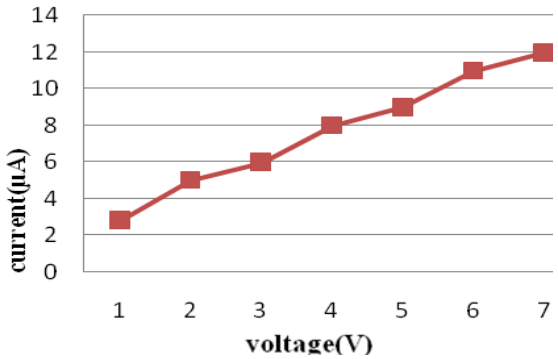

Fig.4 V-I characteristics of PZT in series parallel connection

III. SOUND ENERGY HARVESTING

Sound is basically a waveform of energy that is produced by some form of a mechanical vibration. These vibrations created by noise can be converted into electrical energy. The proposed technique generates electrical energy through readily available sound energy. This paves the good way for solving energy crisis.

A. Principle

As per the law of thermodynamics, oscillations of mechanical waves can be converted into electrical energy. PZT transducers are used to convert mechanical vibrations to electrical energy through the principle of electromagnetic induction.

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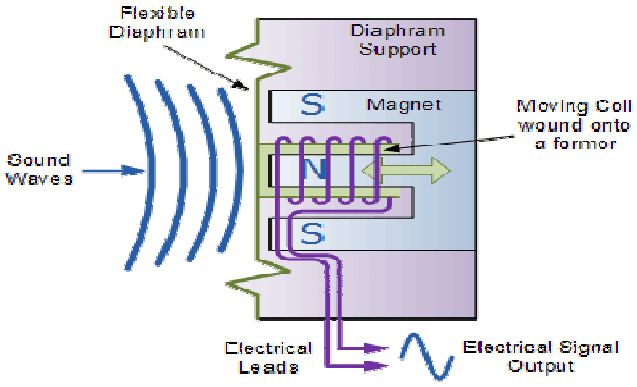

Fig.5 Principle of sound conversion

A. Design of Sound circuit

In the sound conversion circuit, the sound input is given to the condensed microphone. The condensed microphone gives the sound input to the piezoelectric crystal. Due to piezoelectric effect the piezoelectric crystal converts the sound energy into electrical energy. Then the electrical energy is given to one end of the operational amplifier. For the other end a feedback circuit gives the reference voltage to the negative terminal. The condensed microphone output is regulated by the tripot. When the sound signal is given and then only the operational amplifier will give the positive output voltage to the transistor. The transistor acts as a switch used for turning on and off the LED

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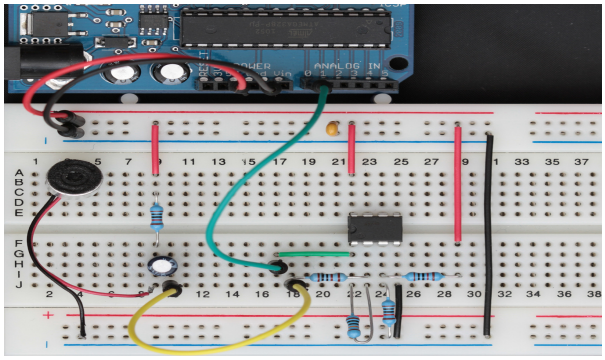

Fig.5 Sound conversion circuit

IV. INTELLIGENT ENERGY SAVING SYSTEM

For the intelligent lighting and gate control, PIC microcontroller (16F877), RF transmitter and receiver module, IR sensor module, LDR (Light Dependant Resistor) and dc motor are required. With the c programming embedded in microcontroller, intensity of platform light in a railway station is varied depending upon the concentration of pedestrians on platform and opening and closing of railway gate is done with radio frequency signal received form arriving or departing trains.

A. PIC16F877A Microcontroller

A micro-controller is a computer control system on a single chip. It has many electronic circuits built in it, which can decode written instructions and convert them to electrical signals. The micro-controller will then step through these instructions and execute them one by one. As an example of this, a micro-controller can use to control the lighting of a street by using the exact procedures.

B. Radio frequency module

RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/RX) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF and its antenna is connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D are some commonly used encoder/decoder pair ICs.

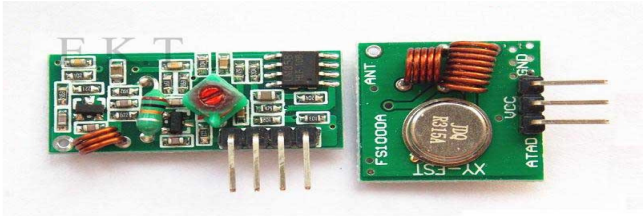

Fig .5 RF

C. IR Module

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either

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emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

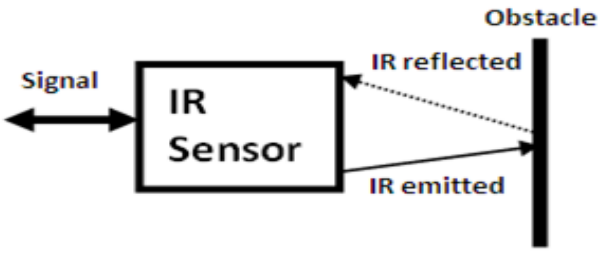

Fig.6 IR Sensor

D. LDR Module

LDR or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 10, 00,000 ohms but when they are illuminated with light, resistance drops drastically.

E. DC Motor

A direct current (DC) motor is a fairly simple electric motor that uses electricity and magnetic field to produce torque, which causes it to turn. It is most simple, so it only requires two magnets of opposite polarity and an electric coil, which acts as an electromagnet. The repellent and attractive electromagnetic forces of the magnets provide the torque that causes the motor to turn on.

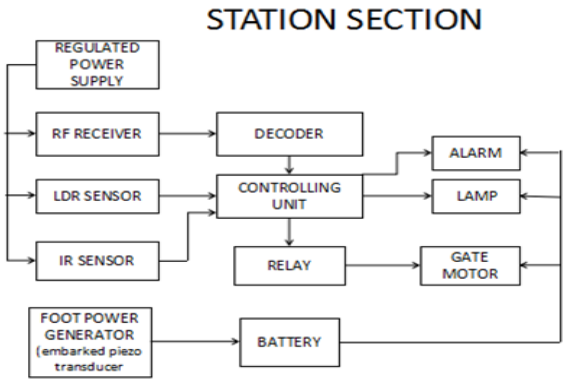

Fig.6 Block Diagram

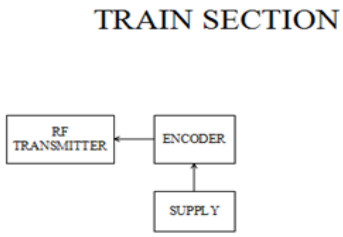

Fig.7 Block Diagram

V.SIMULATION

Simulation for the proposed project is done is proteus software.

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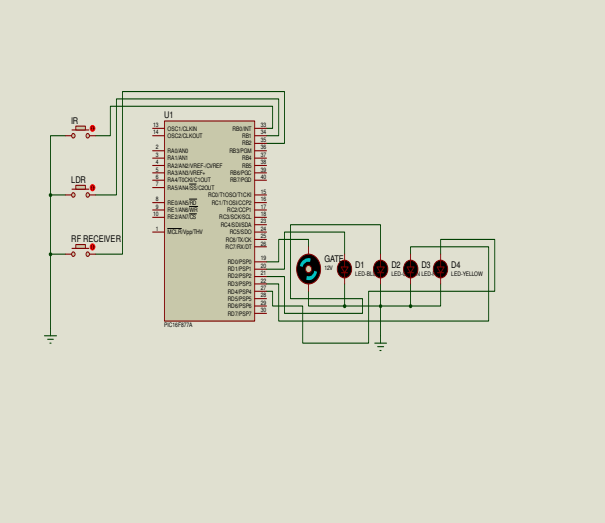

VI.CONCLUSION

The proposed work has been successfully 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 absent. By using this project, we can drive both A.C. as well as D.C loads according to the force we applied on the piezoelectric sensor. 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 in future.

REFERENCES

[1] Prabaharan R, Jayramaprakash A, Vijay Anand. "Power Harvesting by Using Human Foot Step"- International Journal of Innovative Research in Science Engineering and Technology, vol.2, issue 7, July2013

[2] Ramesh Raja R, Sherin Mathew." Power Generation from Staircase (steps)"- International Journal of Innovative Research in Science Engineering and Technology, vol.3, Issue 1, February 2014

[3] Power Generation Using Foot Step Method

[4] Itika Tandon, Alok Kumar." A Unique Step towards Generation of Electricity via New Methodology"- International Journal of Advanced Research in Computer and Communication Engineering, vol.3, Issue 10, October 2014

[5] Kiran Boby, Aleena Paul K, Anumol. C.V, Josnie Ann Thomas, Nimisha K.K." Footstep Power Generation Using Piezoelectric Transducer"- International Journal of Engineering and Innovative Technology, vol.3, Issue 10, April 2014

[6] Jose Ananth Vino, AP." Power Generation Using Footstep"- International Journal of Engineering Trends and Technology, vol.1, Issue 2, May 2011

[7] Alla Chandra Sekhar, B Maruti Kishore, T Jogi Raju." Electromagnetic Foot Step Power Generation"- International Journal of Scientific and Research Publication, vol.4, Issue 6, June 2014

[8] Umeda, M., Nakamura, K., and Ueha, S. Energy Storage Characteristics of a Piezogenerator Using Impact Vibration. Japan Journal of Applied

