Foot Step Power Generation

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Abstract – *The footstep Power generation and its use is one of the issues. Now-a- days numbers of power sources are present, non-renewable & renewable, but still we can't overcome our power needs. Among these human population is one of the resources. In this project we are doing generation of power by walking or running. Power can be generated by walking on the stairs. The generated power will be stored and then we can use it for domestic purpose. This system can be installed at homes, schools, colleges, where the people move around the clock. When people walk on the steps or that of platform, power is generated by using weight of person. The control mechanism carries piezoelectric sensor, this mechanical energy applied on the crystal into electrical energy. When there is some vibrations, stress or straining force exert by foot on flat platform. This output is provided to our monitoring circuitry which is micro controller based circuit that allow user to monitor the voltage and charges a battery, and this power source has many application. The project model is cost effective and easy to implement.*

***Key Words*: *Arduino uno, RFID sensor, piezoelectric sensors, LCD, Relay, I2C Protocol*

1. INTRODUCTION

Energy is nothing but the ability to do the work. In day to day life, Electricity is most commonly used energy resource. Now-a-days energy demand is increasing and which is life-line for people. Due to this number of energy resources are generated and wasted. Electricity can be generated from resources like water, wind etc. to generate the electricity from these resources development of big plants are needed having high maintenance cost. Some other energy resources are also costly and cause pollution. They are not affordable to common people. Electricity has become important resources for human being hence, it is needed that wasted energy must have to utilize, walking is the most common activity done by human being while walking energy is wasted in the form of vibration to the surface. And this wasted energy can be converted into electricity. Using the principle called piezoelectric effect. Piezoelectric effect is the effect in which mechanical vibrations. Pressure or strain applied to piezoelectric material is converted into electrical form. This project gives idea about how energy is used on stepping on stairs. The use of stairs in every building is increasing day by day even small building has some floors when we are stepping amount of this wasted energy is utilized and converted to electricity by Piezoelectric effect. Piezoelectric effect is the effect of specific materials to generate an electric charge in response to applied mechanical stress. From this system we are generating energy by human footsteps using the piezoelectric effect. Piezoelectric effect is the effect which coverts mechanical stress, stain, pressure into electrical energy. This idea not only overcome the energy crises problem but also helps to maintain the eco- friendly environment for generating energy. When we stored power in battery then we want to use this power so that we are here using RFID security system.

1.1 literature survey

In 3 March 2013 Tom Jose v [1] had developed a system for electricity generation from footstep .it is Microcontroller based model for generating electricity it can be used anywhere using Piezo electric sensors. This power is generating in ac form so we need rectifier circuit to store the power.

In 4 Oct 2007 U.K Singh and R.H. Middleton[2] has developed a system "piezoelectric power scavenging of mechanical vibration energy" here they are using same principle. When mechanical force is applied on Piezo sensors it generates power in ac form so we need to store this power in dc form and also we need booster circuit.

In 2011 Mechatronics (ICOM) 4th International conference by fakhzan, M.N., Muthalif, A.G.A. [3] their using same principle. Example (1) A beam with piezo ceramic patches have been used as a method to harvest energy. (2) A unimorph piezoelectric cantilever beam generates electric current or voltage from the piezoelectric strain effect

In 20 sept 2014 Generation of electric power through Foot steps[5] k.Ramakrishna, Guruswamy Revana and venu Madhav Gopaka International journal of multidisciplinary and current Research. Their using same principle. Example (1) Diaphragm movement in certain material will cause generation of electric charge.(2) pressure polarizes some crystals, such as quartz.

In 5 may 2011 Electrical power generation using piezoelectric crystal anil kumar, International journal of scientific & Engineering Research .here using same principle .from here I get it idea how to generate power and also understand how to boost this power so that this energy can be used in big plateform.

1.2 Proposed system

Electricity has become lifeline for human population. Demand of electricity is increasing day by day. Some technology needs high amount of electrical power to perform various operations. As we know electricity is generated by some sources like water, wind etc. To generate the electricity from these resources, development of big plants or big mills is needed having high maintenance cost. As the use of energy is increases, no of energy resources are generated and wasted. If the wastage of energy is rapidly increases then one day will come at that time we will face totally absence of energy.

This technology is based on principle of piezoelectric effect which has ability to build up electrical charge from pressure and strain applied to them. Piezoelectric ceramics belongs to the group of ferroelectric materials. These materials are the crystals and they do not need electric field being applied. Piezoelectric ceramics like PbTio3, PbZro3, PVDF and PZT. Most commonly available piezoelectric materials are PZT and PVDF.

[A] study of connection

To give better voltage and current three PZT are connected in series .A force sensor and voltmeter is connected 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 rectifier in series-parallel connection is used. This dc power is stores in storing battery and this storing Battery is connected to the Relay Switch. This switch provide a path from storing battery to our application. Our application is to charge a phone. Here we are also using Arduino Uno ,LCD and RFID sensors. Arduino is open source electronic prototyping platform based on flexible, easy to use hardware and software .RFID it is a wireless communication technology working on radio frequency radio waves .it is used to identify the object or track the objects.

[B]   working

Piezoelectric material converts pressure into electrical energy. The pressure can be either from weight of moving vehicles or from the weight of people walking on it. The produced output is in the variable form .so bridge rectifier circuit is used to convert variable voltage into linear voltage. An AC filter is used to filter out this output voltage and it is stored in rechargeable battery. We are using arduino uno . Arduino is open source electronic prototyping platform based on flexible, easy to use hardware and software. When system is on it display a message on LCD then it is RFID based security system allows only authorized people to use this system. Here we are using RFID TAGS .this are comprises a microchip containing identifying information and an antenna that transmits this data wirelessly to the reader. RFID READER is active device that is used to read information stored in tags or transmit information to the arduino . it`s consists of an antenna either internal or external which continuously emits radio waves

.so that RFID tag can respond to it by sending back their information .this information is generally known as electronic product code(EPC). After that this system give time slot to user the charge phone. The time slot is it display on the LCD at the same time arduino turn on Relay switch and it makes path between storage battery our application after finishing time slot .arduino turn off the Relay switch there is disconnection between battery and application. From this system we are generating energy by human footsteps using the piezoelectric effect. Piezoelectric effect is the effect which coverts mechanical stress, stain, pressure into electrical energy. This idea not only overcome the energy crises problem but also helps to maintain the eco- friendly environment for generating energy.
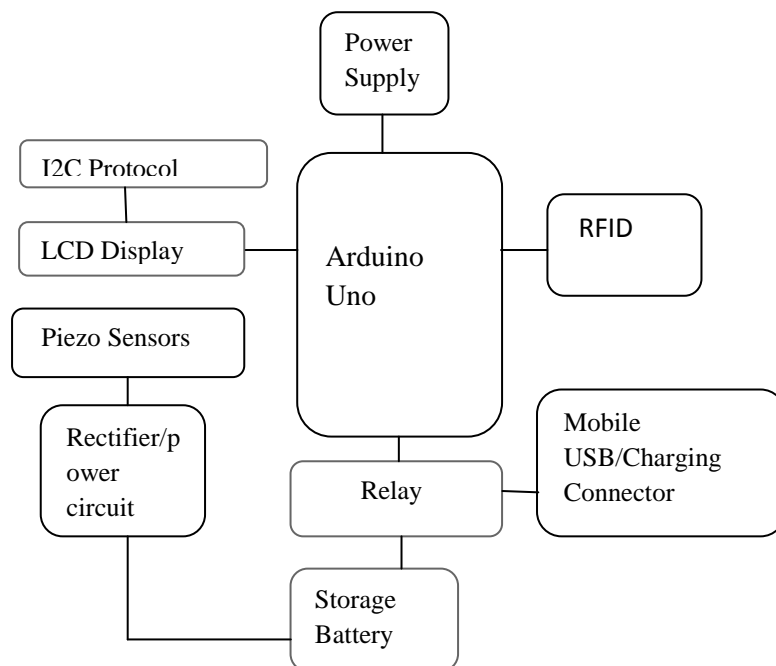
2. Desiegn and implementation

Fig 2.1: Block Diagram

2.1 Electronics parts

Arduino uno:

The main component of the proposed system is arduino uno microcontroller which work on ATMega328P. It need a 5v power supply which can be build by different component like step transform, rectifier, filter and regulator. Arduino controls the major three sections of our proposed system. There is RFID information reading, arduino turn on the relay switch and display a message on LCD about time slot.

Lcd display

The 16x2 LCD is used to display various status system. When system turn on, controller unit is display. First is so message on the LCD "Register Mode" after registering .it display message to user tag your RFID TAG after tagging it display time slot for this time slot duration our application comes to use after completing time slot. It display message again tag your RFID TAG.
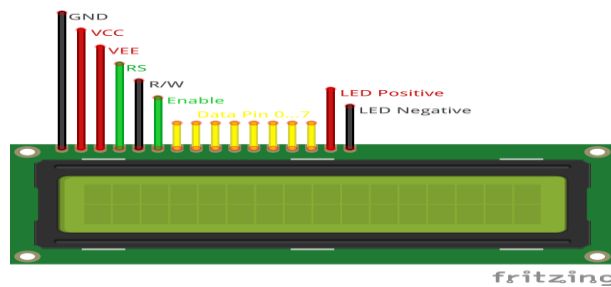
Fig 2.2: LCD

Piezo electric sensor

Piezoelectric sensor is a device that uses the piezoelectric effect to measure change in acceleration, pressure, strain, temperature or force by converting this energy into an electrical charge. A transducer can be anything that convert one form of energy to another. The piezoelectric material is one kind of transducers. When we squeeze this piezoelectric material or apply any force or pressure, the transducer convert this energy into voltage. This voltage is a function of the force or pressure applied to it.
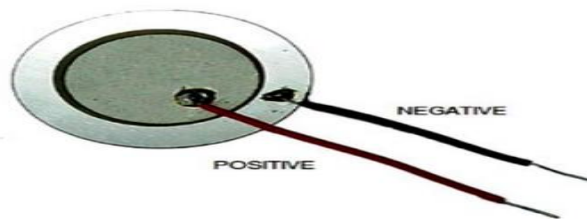

Fig 2.3 –Piezo electric sensor

I2c protocol:

I2C is serial communication protocol, so data is transferred bit by bit along a single wire (the SDA line).Like SPI, I2C is synchronous, so the output of bits is synchronized to the sampling of bits by a clock signal shared between the master and the slave. The clock signal is always controlled by the master.

Fig 2.4 –I2C Protocol

Relay Switch:

So relay is switch which controls circuits electromechanically, the main operation of this device is to make or break contact with the help of a signal without any human involvement in order to switch it on or off. It is mainly used to control a high Powered circuit using a low power. It allow a between storage battery to our application.

Fig 2.5- Relay switch

RFID Reader and RFID Tag

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time. An RFID tag consists of an integrated circuit and an antenna. The tag is also composed of a protective material that holds the pieces together and shields them from various environmental conditions. The protective material depends on the application. For example, employee ID badges containing RFID tags are typically made from durable plastic, and the tag is embedded between the layers of plastic. RFID tags come in a variety of shapes and sizes and are either passive or active. Passive tags are the most widely used, as they are smaller and less expensive to implement. Passive tags must be "powered up" by the RFID reader before they can transmit data. Unlike passive tags, active RFID tags have an onboard power supply (e.g., a battery), thereby enabling them to transmit data at all times. For a more detailed discussion, refer to this article: Passive RFID Tags vs. Active RFID Tags. Smart labels differ from RFID tags in that they incorporate both RFID and barcode technologies. They're made of an adhesive label embedded with an RFID tag inlay, and they may also feature a barcode and/or other printed information. Smart labels can be encoded and printed on-demand using desktop label printers, whereas programming RFID tags are more time consuming and requires more advanced equipment.

Fig2.6: RFID Reader and RFID Tag

Software Tool:

The software platform used for arduino is arduino IDE version 1.8.5.
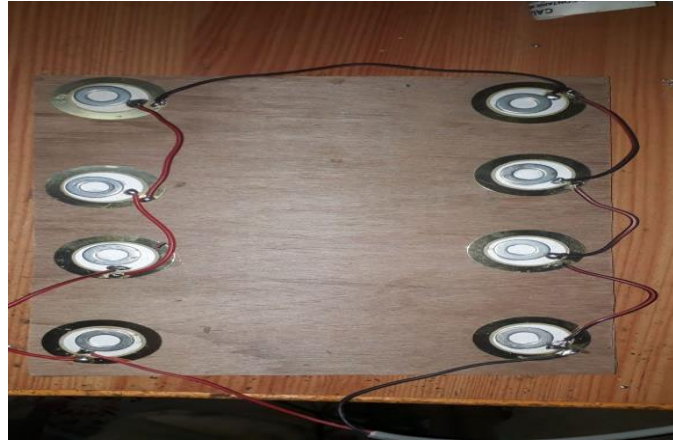
3. Hardware and Implement:

Fig 3.1: Piezoelectric sensors connection

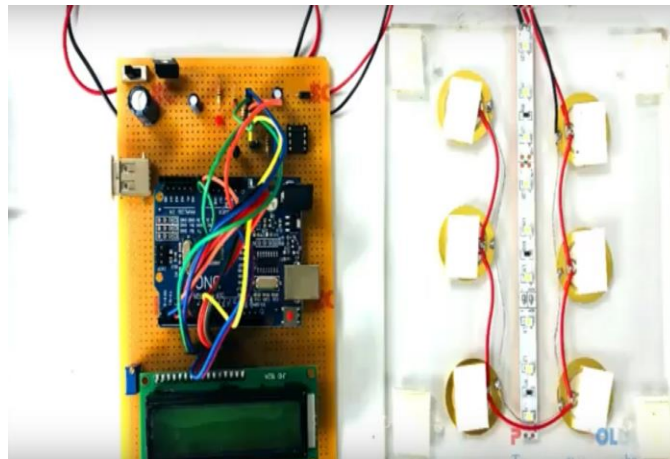Fig 3.2: Prototype of proposed system during initial condition

Fig 8: final Prototype of proposed system

3. CONCLUSION

The project " ADVANCE FOOT STEP POWER GENERATION USING PIEZO SENSORS WITH RFID" 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 a huge population. By using this project we can drive both AC and DC loads according to the force we applied on the Piezoelectric sensor.

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BIOGRAPHIES

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