

POWER GENERATION BY FOOTAGE

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ABSTRACT

By the increase in energy demand, man began to use the renewable sources as a replacement of conventional energy sources. But the renewable energy sources processing are expensive one. So alternating method to generate power is the possible solution. In this paper, Mechanical energy is converted as Electrical energy by utilising the waste energy in a useful way. By using Rack and Pinion arrangement the fro motion of the steps are converted into rotational motion of the dynamo. In first foot step rack and pinion arrangement is used directly to rotate the dynamo. But in second step chain drive mechanism is used to obtain better efficiency. Through Dynamo the rotational energy is converted into electrical energy.

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.

COMPONENTS USED

The footstep arrangement is used to generate the electric power. Now a day's power demand is increased, so the footstep arrangement is used to generate the electrical power in order to compensate the electric power demand. In this arrangement the mechanical energy is converted into electrical energy. This section is constructed by of rubber or other material which is placed within the surface areas. This section is mainly placed in the crowded areas. This footstep arrangement is attached with spring section. Footstep section consists of,

- Springs
- Foot – step
- Gearwheel arrangement
- Rack and Pinion section
- DC Generator
- Millimeter.
- Shaft.

The rack & pinion, spring arrangement is fixed at the inclined step. The spring issued to return the inclined step in same position by releasing the load. The pinion shaft is connected to the supporter by end bearing. The gearwheel arrangement is connected to the shaft which in turn is connected to the DC generator. The DC generator is connected to the battery and the LEDs.



Fig (a): Base And Upper Plate



Figure(b): Gears



Fig (c) : Generator



Fig (d): Shaft



Fig (e) : Rack



Fig(f) : Hard Chrome Steel Solid Pipe and Iron Hollow Pipes



Fig(g): Linear Motion Bearings



Fig(h): Circular Bearings



Fig (i): Circular Caps



Fig(j): Multimeter

FOOT STEP ARRANGEMENT

This is made up of mild steel and iron pipes. The complete set up is fixed in this model Foot Steps. The solid steel pipes are implanted on to the hollow pipes using a linear motion bearing and springs for compression and tension. And upper plates and base plates are ben constructed on which this are mounted and the power generating gear mechanism and generator is placed on the base plates with the help of shafts, side plates and angle rods.

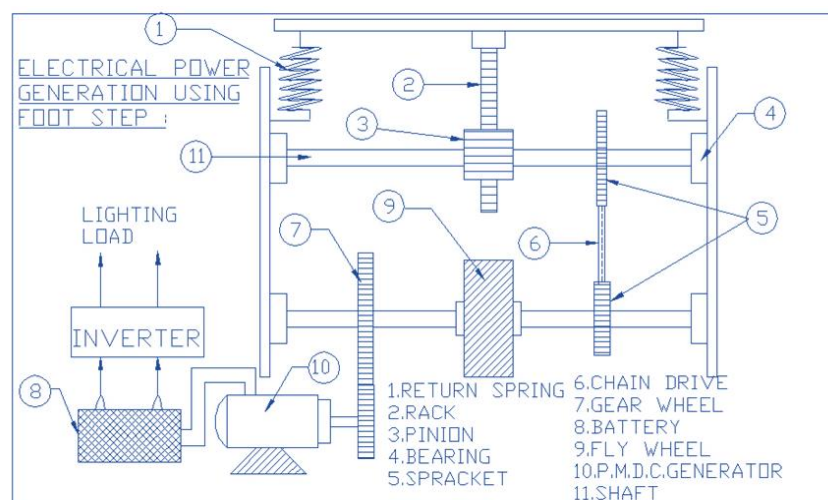


Fig (k): Layout of the Power Generate By Foot Step

PROCEDURE

The footstep arrangement is used to generate the electric power. Now a day's power demand is increased, so the footstep arrangement is used to generate the electrical power in order to compensate the electric power demand. In this arrangement the mechanical energy is converted into electrical energy.

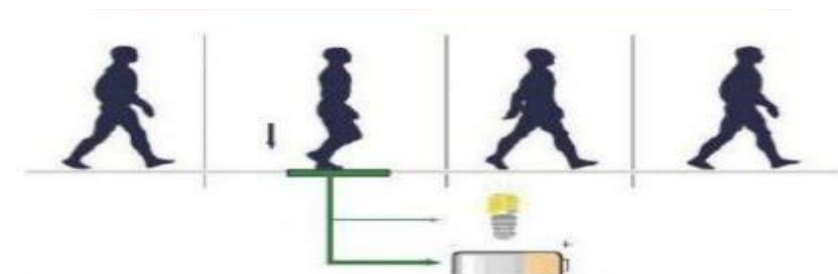


Fig (l): Schematic Representation of Foot Step

PRINCIPLE OF WORKING

The downward movement of the plate results in rotation of the shaft of an electrical generator fitted in the device, to produce electrical energy. The top plate reverts back to its original position due to negating springs provided in the device. The upper plate is mounted on two springs; the weight impact is converted into electrical power with proper control unit. The spring and rack & pinion arrangement is fixed below the foot step which is mounted on base. Spring system is used for return mechanism of upper plate after release of load.

The shaft along with pinion is supported by end bearings. One end is connected with small belt pulley system and on the other end a flywheel is mounted. The dc generator is rotated with the help of this belt & pulley arrangement. The terminal of DC generator is connected to lightning LEDs. The complete diagram of the footstep power generation is given below. Only one step is inclined in certain small angle which is used to generate the power. The pushing power is converted into electrical energy by proper driving arrangement.



Fig (m): Outer Structure

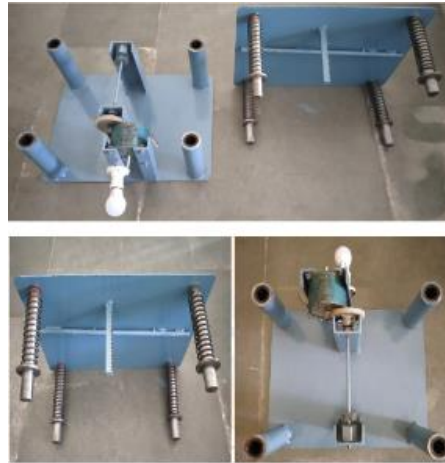


Fig (n): Inner Mechanism

WORKING

The complete fabricated model picture of Foot Step is shown below. The upper plate is mounted on two springs; the weight impact is converted into electrical power with proper control unit. The spring and rack & pinion arrangement is fixed below the foot step which is mounted on base. Spring system is used for return mechanism of upper plate after release of load. The shaft along with pinion is supported by end bearings. A gear is provided there also. A gear is coupled to the shaft.

The gear wheel which is provided in shaft is coupled to the Dynamo. The dynamo capacity used here is 12V. From the dynamo the wires are taken. These wires are connected to LEDs, to show the output power. The generator is used here is 12Volt permanent magnet DC generator. The terminal of DC generator is connected to lightning LEDs. In the first step the footsteps is directly connected to the Rack & pinion arrangement. To the pinion shaft dynamo is provided and LEDs are coupled to it. Thus Mechanical energy is converted in to Electrical energy.

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.

DESIEGN AND IMPLEMENTATION

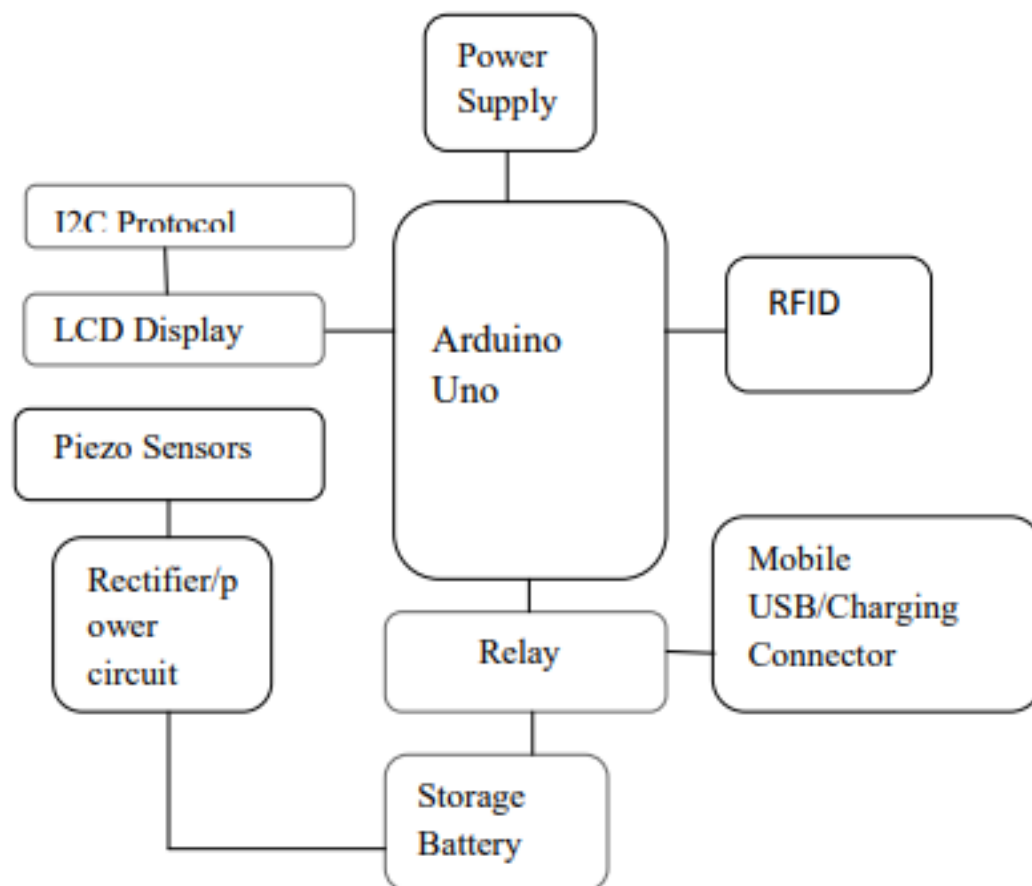


Fig:4.3 block diagram

HARDWARE AND IMPLEMENT



Fig (o): piezoelectric sensors connection **Fig(p) :** Prototype of proposed system during initial condition

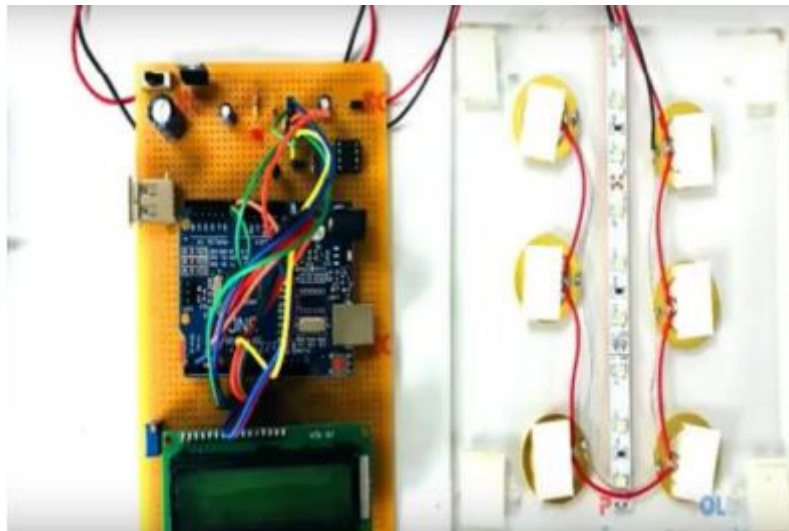


Fig (q): final Prototype of proposed system

DESIGN AND CALCULATION

TOP PLATE ASSEMBLY

Top Plate assembly is assembly of components like angle frame made of mild steel material and MDF sheet which is used as platform.

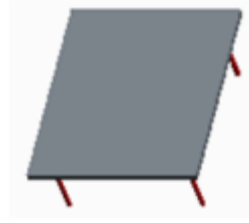


Fig (r) : Top Plate assembly

CALCULATION

Assuming the setup step is installed in 5 different places along platform of the crowded area like footpath, tracking path, railway platform which has 20 steps. Considering a human weight acting on the unit = 80 kg.

Load acting on the unit = $80 \times 9.81 = 784.8 = 790 \text{ N}$

Self-weight of the unit assembly under no load condition = 22 N

Total load acting on the unit when a person step on the unit = 800 N

Work done = Force x Distance

Force = Weight of the man and unit load

Total Distance obtained from 20 steps located at 5 different places = 0.57 m

Therefore, Work done = (800×0.57) Work done = 45.6 J

Output power = Work done/Sec

= $45.6/60$

= 0.76 Watts (For 1 pushing force)

So the power developed for 1 person passing this power step in a minute = 0.76 Watts.

Power developed for 60 minutes (1 hr) = $0.76 \times 60 = 45.6 \text{ Watts}$

Power developed for 24 hours (1 day) = $45.6 \times 24 = 1.09 \text{ Kw}$

This power is developed in one step only. As we said, if the step is installed in 5 places out of 20 steps, in a building, then the

Total generated power = $(1.09 \times 5) = 5.47 \text{ kW}$

If this setup works round the clock, sufficient power can be generated which can be stored for application which can lighten surrounding area.

RESULT

Result for output voltage Generation during performance of the unit. A small foot step power generation unit has been implemented in real time and tested with various load conditions. The system has produced voltage at various weights as shown in the graph. During the experimentation it is observed that weight cannot be kept constant for number of footsteps. From the graph it is observed that the system produced voltage for average minimum weight of 266 N. The foot step power generation unit produces a positive voltage for the load range above 394 N. Observation from the graph found that up to 380N output generated in the voltmeter is below 6 Volts. As unit is having battery of 6 Volt, to charge the battery minimum voltage required is more than 6 Volt.

When the load varies from 394 N to 540N for 25 steps per minute voltage output generated by the unit was up to 18 Volts, which seem positive outcome for generation of power. During performance single footstep does not produce output. This unit is designed for a person of 780N. However from the experimentation it is observed that unit will perform for below 600N weight also. The result obtained for single unit only. The output can be increase further by putting number of unit along the places and connected together.

CONCLUTION

Project work exhibits the idea of electric power generation without polluting our environment. The waste energy supplied by human walking is utilized in the system. This method is a promising technology to provide efficient solution to power crisis to affordable extent. This technology would facilitate the future creation of new urban athletic fields, music halls, railway stations, bus stand, airports capable of harnessing human locomotion for electricity generation.

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