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# Advanced Footstep Power Generation system using RFID for Charging and to Run an Automated Toll Gate System

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**ABSTRACT:** Day by day, the population of the country is increasing and the requirement of the power is also increasing. At the same time the wastage of energy is also increasing in many ways. So, reforming this energy back to usable form is the major solution. So, in this footstep power generation project, we are generating power with the help of human's footsteps either by walking or running. It uses the piezoelectric sensors. To generate a voltage from footstep the piezo sensors are mounted below the platform. Also, it consists of a USB mobile phone charging point where a user may connect cables to charge the mobile phone from the battery charge. The current is distributed using (radio-frequency Identification) RFID cards so that only an authorized person can use the generator for charging. Thus we charge a battery using power from footsteps, display it on LCD using a microcontroller circuit and allow for mobile charging through the setup. In the present day scenario, power is a major need for human life. There is a need to develop non-conventional sources for power generation due to the reason that our conventional sources of power are getting scarcer by the day. The main aim is to run the toll system using piezoelectric sensor. In turn we are saving the power needed for running the toll gate. Now a day there is a huge rush in the toll plazas in order to pay the toll tax. In this paper automation in toll tax payment using RFID is designed. Automation of toll plaza is made using the combination of microcontroller, RFID and Piezoelectric sensor. In addition, this paper also has solar panels, which would satisfy our power needs, when there is no vehicular movement.

**KEYWORDS:** Automation of Toll gate, RFID sensor, Power harvesting, Battery, ARDUINO UNO ATMEGA328 Micro controller, Piezo sensors, Charging circuit, LCD display, RFID reader and tags

## I. INTRODUCTION

Our project model cost is effective and easy to implement and also it is green and not harmful to the environment. This system can be installed at homes, schools, colleges, where the people move around the clock. It can be used for charging devices e.g. laptop, mobile, etc. To generate maximum output voltage the sensors are placed in such an arrangement. This is then forwarded to our monitoring circuitry.

The circuit is the microcontroller based monitoring circuit that allows users to monitor the charges and voltage a connected battery to it and this power source has many applications. It also displays the charge generated by our footstep and displays on an LCD. The main aim of the project is to generate power from renewable energy sources; system makes use of Piezo. The system monitors the parameters coming from the piezo sensor, energy from piezo sensor values displayed on the LCD. The energy from the piezo sensors is used to charge the mobile. Using RFID technology to charge the mobile phone battery with the help of USB point. It is useful only authorized persons. The main controlling device of the project is Arduino UNO which interfaced with input and output modules. A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix piezo- is Greek for 'press' or 'squeeze'.

"Design and develop a Automatic toll plaza which is based On microcontroller, RFID technology and load sensor (Piezoelectric sensor) to save the time at toll plaza and having cash free operation". As the name suggests "Automatic Toll Plaza" the key theme of this paper is the automation. So in very simple language the Automation means to replace the human being from the process with the machines [1]. Means what presently the



human is doing on the process now onwards the machines are going to do. Before moving further we will just take the overlook of history of the toll plazas. So before the 90's decade the toll plazas were fully manual controlled. Means there are two people for opening & closing of the gate & another two are for reception of money & data keeping etc. But in 1995 when the Express ways had been developed the semi automatic toll plazas were launched in which data is stored in computers & gate operation is automatic, only two personals are required for single booth. But here we are going to see the human less toll plaza [2]. It has been observed that a lot of electrical energy is wasted at toll gates just to operate gates, computer systems and for lighting. Nearly 500 units of electrical energy is required to operate one toll gate in one day. If all the toll gates are considered, a huge amount of electrical energy is needed. Electrical energy can be generated at the toll gates by using PIEZOELECTRIC SENSORS and SOLAR ENERGY to overcome this problem. In recent years, piezoelectric sensors have been widely used in various applications of mechanical sensors. piezoelectric sensors have several beneficial properties, such as: flexible, lightweight, very wide frequency range and no need of power supply as it is self generating. The multilayer technology allows the component to convert (harvest) mechanical energy and produce electrical energy with low voltage that can be used for direct supply of electronic devices. This paper also operates solar panels by constantly facing towards sun at 90 degrees to produce maximum voltage. It can move the solar panel from east to west also from south to north & also to correct for the durational movement of the Sun in the sky. The set of light sensors give the input and it operates stepper motor with gear mechanism. This is based most demanded natural resources where recurring cost of energy is nil. This is an ideal solution urban agriculture area where electricity is not available or may be far from the available spot.

## **II. LITERATURE REVIEW AND OBJECTIVE**

### **2.1 Literature Review**

1. Piezoelectricity, Discovered By Curie Brothers in 1880, Originated From the Greek Word "Piezenin", Meaning, To Press. The Original Meaning Of The Word "Piezoelectric" Implies "Pressure Electricity" – The Generation Of Electric Field From Applied Pressure. This Definition Ignores The Fact That The Process Is Reversible, Thus Allowing The Generation Of Mechanical Motion By Applying A Field. Piezoelectricity Is Observed If A Stress Is Applied To A Solid, For Example, By Bending Twisting Or Squeezing It. The Phenomenon Of Generation Of A Voltage Under Mechanical Stress Is Referred To As The Direct Piezoelectric Effect, And The Mechanical Strain Produced In The Crystal Under Electric Stress Is Called The Converse Piezoelectric Effect.
2. Aganit Thakur, presented method to produce pollution free electricity by the technique i.e. piezoelectric effect. This is kind of green solution for power generation. Piezoelectric effect is the ability of a material to generate electric charge by applying mechanical stress. This report assess to commercial status of piezoelectric based techniques in roadway and railways. In this project we try to provide a sufficient energy as it can reduce the damage of pollution caused by power plants.

### **2.2 Objectives**

In this foot step, power generation project is to convert foot step, walking and running energy into electrical energy. It is used to generate electricity from by walking on foot step. The need of electrical energy is increasing day by day. But power generation conventional resources are not enough for a total demand of electrical energy. Therefore many researchers are working on nonconventional ways of electrical power generation. Footstep power generation system is also a non-conventional electrical energy production system. It converts mechanical energy of footsteps into electrical energy by using transducers. This power generation system can become very popular among countries like Pakistan, china, India. It can be implemented on roads, bus stations, and many public places.

- The objective is to convert foot step, walking and running energy into electrical energy by using transducer and use it in an electronic device that requires low power.
- Utilize the power for helping up the road lights, additionally for activity reason, sign boards of streets and in other public places.



**III.MATERIALS AND METHODS**

A sensor which works on the principle of piezoelectricity is known as a piezoelectric sensor. Where piezoelectricity is a phenomenon where electricity is generated if mechanical stress is applied to a material. Not all materials have piezoelectric characteristics. To design a circuit board, simply drag and drop components onto your document and connect them together using the intelligent wiring tool. Then select the menu option 'Convert to PCB' and leave PCB Wizard 3 to do the rest for you. LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits

- Requirement Analysis
- Power supply
- LEDs
- Mobile
- RFID sensor & cards
- Voltage regulator
- Capacitor etc.

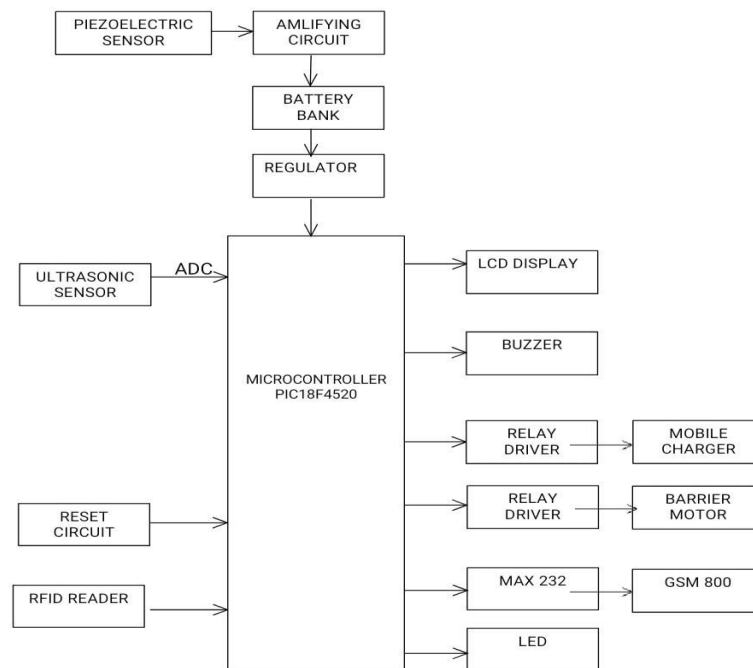


Fig1. Block diagram of system

**IV. RESULTS AND DISCUSSION**

In 1 square ft. we used an 8 piezo sensor. As piezo sensors power generating varies with different steps, we get Minimum voltage = 1V per step Maximum voltage = 10.5V per step We took an average of 50Kg weight pressure from a single person. Considering the steps of a 50Kg weighted single person, the average calculation is: It takes 800 steps to increase the 1V charge in the battery. So, to increase 12V in battery total steps needed = (8\*800) = 6400 steps As we will implement our project in a populated area where footsteps as source will be available, we took an



average of 2 steps in 1 second. For 6400 steps time needed =  $6400 / (60 \times 2) = 53$  minutes. (Approximately) Once the System has been implemented completely then next task is to observe how system is supposed to operate to carry out different operations involved in System. When vehicle will cross the sensor which are fixed at some meter distance from processing unit, Tag will read by RFID Reader. Sensor may be fixed vertically at both sides or at the centre of road depend upon where the TAG is mounted on vehicle. TAG contains unique identification number. Then data read by the RFID reader will be taken by Microcontroller (8051) which will process the data for authentication of authorized user. If valid user then data will send to processing unit which then check the respective account of that user from database to ensure whether user have sufficient amount for toll payment or not. If amount is not sufficient to pay toll then user must have to recharge its account by paying manually. If sufficient amount then user is allowed to pass by iron bar which will rise up with the help of mechanical assembly after receiving the permission signal from processing unit.

#### V. ACKNOWLEDGEMENTS

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