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Advanced Footstep Power Generation using RFID for Charging

Mrs. Wrushali Deshmukh[1], Ayush Thakur[2], Bhumika Mhatre[3], Vaibhavi Shelake[4], Shlok khanvilkar[5]
Lecturer, Department of Electronics and Telecommunication[1]
Students, Department of Electronics and Telecommunication[2,3,4,5]
Bharati Vidyapeeth Institute of Technology, Navi Mumbai, India

Abstract: *Day by day, the population of the country is increasing and the requirement of the power is also increasing in many ways. So, reforming this energy back to usable form is the major solution for future needs. In this Footstep power generation project, power is generated by human's footsteps, so as to charge the battery by storing the power generated with the help of piezo sensors. The power stored in the battery, used to charge the mobile phones using RFID card. This system is powered by Atmega 328 microcontroller, it consists of Arduino IDE, RFID Sensor, USB Cable and LCD. When power is on in the system, the system enters into the registration mode. Three users can register. Once all the users entered in the system, then the system asks to swipe the card and connect the charger. Initially all the user is given 5 minutes of charging time as default. When card is swiped and the user is authorized, the system turns on for charging the Mobile phone within a given time period.*

Keywords: Arduino IDE

I. INTRODUCTION

The demands of electricity are increasing day by day and its use has become so advanced and applicable in the present lifeline of a human being. The arising value of new technology each day demands more power of electricity as the population of human beings is increasing day by day and hence the energy demand is increasing rapidly.

TABLE 1
Main compnents of the system

Components	Description
Mechanical Frame	Designed to concentrate on energy that is generated by people's footsteps. Mechanical frame depends on the principle by which electricity is generated. Here, electricity generates through human footsteps by pressing piezoelectric sensors.
Electricity Generated Module	Electricity generating module may be thermo-couple, Piezo-electric module, electromagnetic generator or thermal electricity generator. This generators convert different forms of energy into electrical energy. Here, piezoelectric sensors were used to convert the mechanical energy into electrical energy.
Battery Storage	Power that is generated from footsteps is generating in real-time and this power is no eventual in magnitude. Therefore, it is necessary to store power generation for future usage. For this purpose, battery backup system is used.
Control Circuits	This circuits is used to control and regulate power generation and backup it to a battery. Some indicators are displayed for the status of working system.

Advanced Footstep Power Generation using RFID for Charging is a new advanced system, in which new technology i.e. RFID technology is used. Due to this technology system provides charging to the Mobile Phone within a provided time period. Hence, the system innovated here does not consume more time. In this system, piezo sensors were used to store the waste energy by our footsteps, due to which power shortages were reduced and hence, the system develops much cleaner cost-effective way of power generation method using RFID, which helps to bring down global warming. Microcontroller based footstep power generation is used to generate voltage using footstep force. The proposed system works as a medium to generate power using force. This project is very useful in public places like bus

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stands, theatres, railway stations, shopping malls, etc. So, these systems are placed in public places where people walk and they have to travel on this system to get through the entrance or exits.

II. LITERATURE REVIEW

The fundamental principles of electricity generation were discovered in the 1820's and early 1830's by British scientist "Michael Faraday". His method, still used today, for electricity to be generated by the movement of loop of wire, or Faraday disc, between the poles of the magnet. Joydev Ghosh, Supratim Sen, Amit Saha and Samir Basak from IEEE paper has initiated the design methodology of "Electrical power generation using foot step for urban area energy applications". This system is proposed to innovate idea of storing waste energy by using footsteps to reduce pollution in polluted countries.[1] Piezoelectricity was discovered in 1880 by "Pierre and Paul-Jacques Curie", who found that when they compressed certain types of crystals including quartz, tourmaline, and Rochelle salt, along certain axes, a voltage was produced on the surface of the crystal. This effect is known as piezoelectric effect. By using piezoelectric sensors, which uses piezoelectric effect for working purpose, another system is proposed known as "Footstep Power Generation using Piezoelectric Sensors". In this system, energy is generated by using piezoelectric sensors. By pressing these sensors, using human footsteps, energy is stored in the battery for further process. Due to this project size and cost is reduced and system become less complicated.[2] In our proposed system "Advanced Footstep Power Generation using RFID for Charging", RFID technology is used. RFID was, officially invented in 1983 by Charles Walton when he filed the first patent with the word 'RFID'. By using this RFID technology in our project, the power is distributed among users according to their user identification number with the help of electromagnetic waves.

Evolution of RFID Technology

Radio-frequency Identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects.

Table 2
Inventions done from 1945 to 1983

Year	Inventor	Invented
1945	Leon Theremin	Listening device for the Soviet Union
1945	Allies and Germany	The Identification Friend and Foe Transponder
1948	Harry Stockman	"Communication by Means of Reflected Power" (Seminar paper)
1973	Mario Cardullo	Passive radio transponder with memory
1973	Steven Depp, Alfred Koelle, Robert Frayman	Demonstration of reflected power usind RFID tags, both passive and semi-passive
1983	Charless Walton	First patent to be associated with the abbreviations RFID

Advances in semiconductor technologies led to significant improvements of the technology. Within the same time frame, commercial success of the marked applications generated a dramatic reduction of cost and an ever-increasing interest from businesses. There are many indications that the proliferation of applications using RFID technology is only at its beginning. According to a Gartner Study (2005), the RFID markets revenue grew over 33% between 2004 and 2005 and will be worth USD 3 million by 2010. Research firm IDTechEx predicts a global market for RFID including systems and services of USD 26.23 billion in 2016 and a total number of tags delivered of 585 billion, 450 times the amount of 2006. Benefits of RFID technology for business and individuals are very promising (OECD, 2006a). One important driver for market growth today is that of improving traceability of goods in the supply chain in order to increase supply chain in order to increase supply chain efficiency, reduce theft and fraud, and realise significant cost savings. In addition, many other types of RFID applications have been reported, and the use of RFID technology is common in areas including passports, hospitals, transportation, ticketing, libraries, museums, counterfeiting, baggage tracking in airports and livestock tagging.[3]As stated by the European Article 29 Working Policy (2005), "the specific functions that RFID tags can deliver in different sections is also increasing and its possibilities are just beginning to emerge"

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III. PROPOSED SYSTEM

Innovate efficient method of "Advanced Footstep Power Generation using RFID for Charging", which stores energy when piezoelectric sensors senses weight with the help of human footsteps. This stored energy is stored in the battery, from which the stored energy is distributed among different users using RFID cards. This cards have human identification number i.e. 12 digit number, which is used to get information regarding each user. RFID technology uses electromagnetic waves for this purpose. The system works according to the provided software code, in which certain minutes is provided for each user at a time. Hence, this system reduces pollution and saves time, due to which our future generation get more help to get pollution free environment and time-consuming requirements

Block diagram of Advanced Footstep Power Generation using RFID for Charging

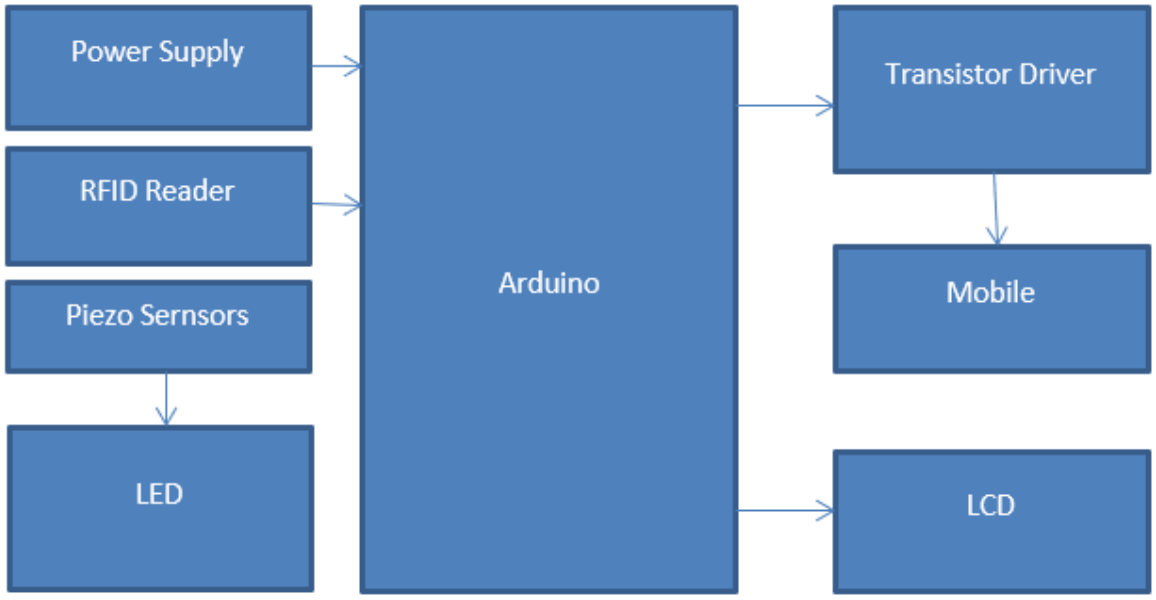

Fig. 2 Block diagram of proposed system

IV. SYSTEM DESIGN

Methodology

The system designed here, is relatively efficient and also affordable. The advantage of our model is that the system provides charging to the user within a limited time as allocated to the system software. Our methodology for the project:

- Creating an idea for design and construction of a Advanced Footstep Power Generation using RFID for Charging. Designing a block diagram and circuit diagram to know which components to be connected/implemented in hardware.
- Implementing all the components according to circuit diagram and programming the Arduino by using Arduino IDE to control the whole system.
- Assembling all the blocks in a board and to run the system and for checking purposes.
- At the end to get the work done such as mobile phone charging, this is main task/output of the proposed system.

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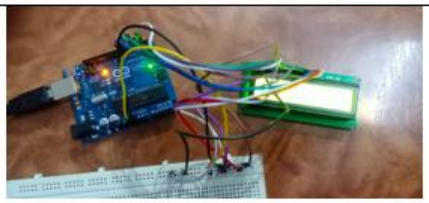
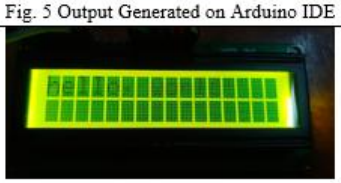
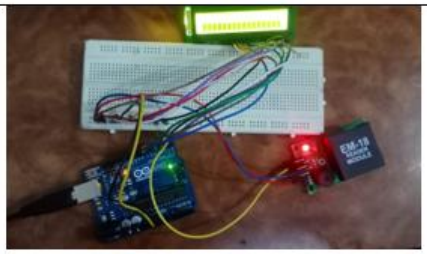
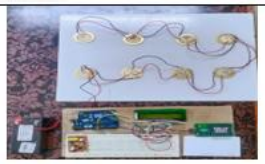
TABLE 7
Implementation and Output

Steps	Hardware Implementation	Output	Comments
1	 Fig. 4 Interfacing EM-18 with Arduino Uno	 Fig. 5 Output Generated on Arduino IDE	Detection of user using RFID Technology is done.
2	 Fig. 6 Interfacing LCD with Arduino Uno	 Fig. 7 Displayed Message on Screen	Message displayed on LCD.
3	 Fig. 8 Interfacing LCD and EM-18 Reader with Arduino Uno	 Fig. 9 Displayed output i.e. user identification number	User Identification done and message is displayed.
4	 Fig. 10 Voltage generation using Piezosensors	 Fig. 11 Displayed voltage on Multimeter	Voltage generated through piezoelectric sensors
5	 Fig. 12 Designed system	Charged Mobile	Mobile Phone is charged by identifying user at a time.

Software Requirements

The proposed system works through Arduino IDE software. The Arduino IDE is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. This

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software is used to provide instruction to the proposed system i.e., to detect user and provide efficient charging to the user within a limited time period as allocated in the commands.

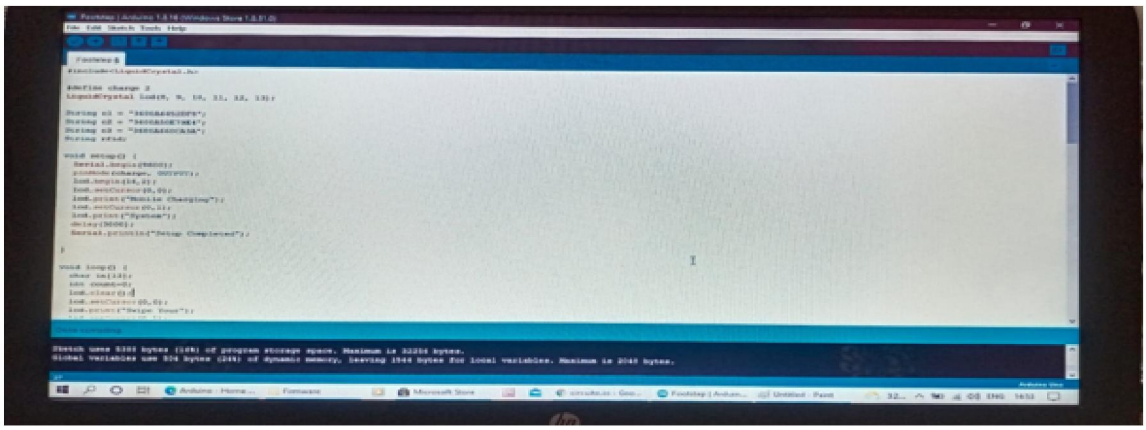

Fig. 10 Simulation of Software Code

When system is power on, the system enters into registration mode. Three users registered in the system. Once all the user is entered in the system then the system asks to swipe the card and connect the charger. Initially all the user is given 5 minutes of charging time as default. When the card is swiped, the user is authorized, the system turns on for charging purpose and will charge the Mobile Phone with given time in coding

Number of series in parallel= 1 series

Total number of batteries: 1

Current of the storage system=3A

Capacity of the storage system (energy stored)=3Ah=0.036kWh

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