# Project Flash

# Harvesting Energy & Proximity Detector

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***Abstract*— Project Flash aims at harvesting renewable energy in human surroundings with the help of piezoelectric materials which convert mechanical energy from ambient vibrations from our bodily motions into electrical energy that can be stored and used to power other devices. A system which detects proximity to nearby objects and relays the information via a mp3 module to a speaker which will help blind people navigate better in their surroundings has also been implemented into the shoes.***

## I. Introduction

In recent times low powered devices are gaining popularity because of their portability and hence the demand increases for low power & portable energy sources. Apart from the conventional and non-conventional methods of generating power, researchers are finding other ways of utilizing the energy that is wasted in the environment in form of vibrations, pressure, heat, sound, etc. The waste energy available in the environment can be exploited to generate an appreciable amount of useful power with the help of transducers. Thus harvesting energy from these shoes comes out as a clean and sustainable way to power these devices. In this report, we will discuss about the available energy from a person shoes during brisk walking and the corresponding effects on the piezo polymer mounted in his shoes .The visually impaired population has to struggle for even small tasks .To improve their condition we have developed a proximity sensor that will help them in navigating proficiently in their vicinity .

TABLE I

Components Used

| Component | Quantity |
|---|---|
| Piezoelectric Transducer Elements | 14 |
| Glue Sticks | 2 |
| Glue Gun | 1 |
| Shoes | 1 pair |
| Arduino Mega 2560 | 1 |
| Breadboard/PCB board | 1 |
| 3A DC power supply rectifier diodes | 4 |
| 5 MM Diffused Red LED light | 1 |
| 5V Voltage Regulator | 1 |
| Electrolytic Capacitor | 1 |
| FN-M16P SD Card MP3 module for Arduino | 1 |
| UltraSonic Range Finder Sensor Module | 5 |
| 9V Rechargeable battery | 1 |
| Arduino Cable | 1 |
| Thermocol Sheet and Cardboard Sheet | 1 |

## II. Description Of Components

### A. Arduino Mega

Arduino Mega board uses a variety of controllers and micro-processors. They are equipped with a number of analog and digital input output (I/O) pins. Arduino software is an open source software and the microcontrollers are programmed in basic C/C++ language. Here it interprets the signals coming from the ultrasonic sensors and we can hear the programmed commands on the speaker.

Fig.1 Arduino Mega
(https://www.robotshop.com/en/arduino-mega-2560-microcontroller-rev3.html)

### B. Piezoelectric Transducers

These are used to generate voltage by means of pressure applied on the feet while walking. Piezoelectric sensors are versatile tools for the measurement of various processes.

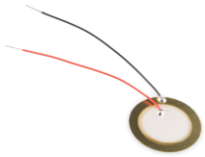

Fig.2 Piezoelectric Transducer
(https://www.rpelectronics.com/tv4-piezo-transducer-30vac-0-5-20hz-75db.html)

### C. Rectifier Diodes & Capacitor

Piezoelectric transducers generate AC voltage. A Bridge Rectifier circuit is setup to convert AC to DC and the voltage generated by the transducers is measured across the capacitor.

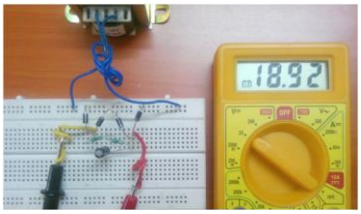


Fig.3 Applied BR circuit on breadboard.

### D. Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific

frequency and waiting for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Here, it is used as an **obstacle detector**. In our project it detects the presence of obstacles and communicates with DF player with help of Arduino interface which in turn instructs speakers to play the required commands.


Fig.4 Ultrasonic Sensor
(http://mindsieducation.com/parallax-ping-ultrasound-sensor.html)

### *E. DF Player*

Here, it interprets which command to play according to the signal received by the combination of Arduino and ultrasonic sensors and gives this as input to the speakers. It has a slot for a SD card in which we have stored mp3 files of commands .There are 5 commands we have implemented-

1. Turn Left
2. Turn Right
3. Turn Around
4. Step Over
5. Turn Left or Right

Fig.5 DF Player
(http://mindsieducation.com/parallax-ping-ultrasound-sensor.html)

## III. FEATURES

Each shoe has 7 piezoelectric transducers imbedded onto the sole. Since the voltage generated is AC. We need a bridge rectifier to convert it into DC which can then be stored in a battery for later use.

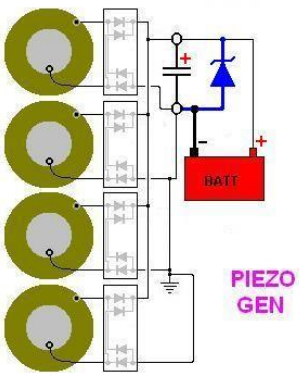


Fig 6. Circuit Diagram
(https://www.researchgate.net/post/Can_I_charge_a_NI-MH_battery_using_a_standard_piezoelectric_circuit_with_a_bridge_rectifier_and_smoothing_capacitor)

Two ultrasonic sensors have been glued onto the sides of each of the shoes, which are used to detect the proximity of the feet to nearby surroundings .The data collected by them is used to then further relay commands via a speaker so that a blind person may be able navigate in his vicinity with better precision and paint a better picture of his surroundings.

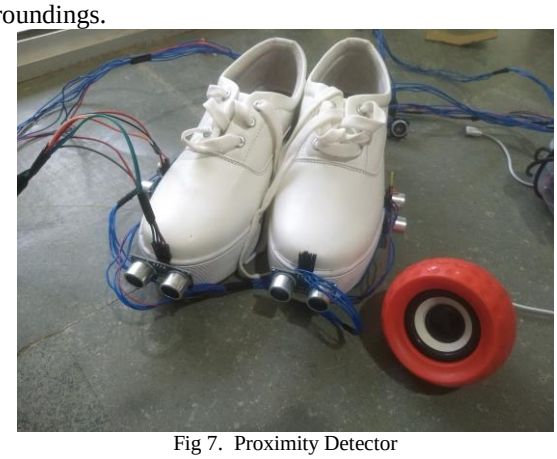

Fig 7. Proximity Detector

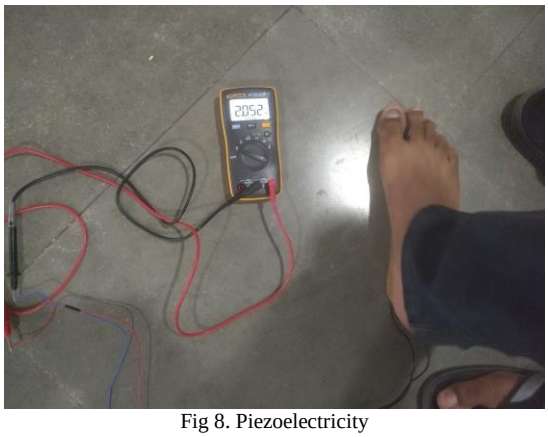

Fig 8. Piezoelectricity

## IV. PIN CONFIGURATION

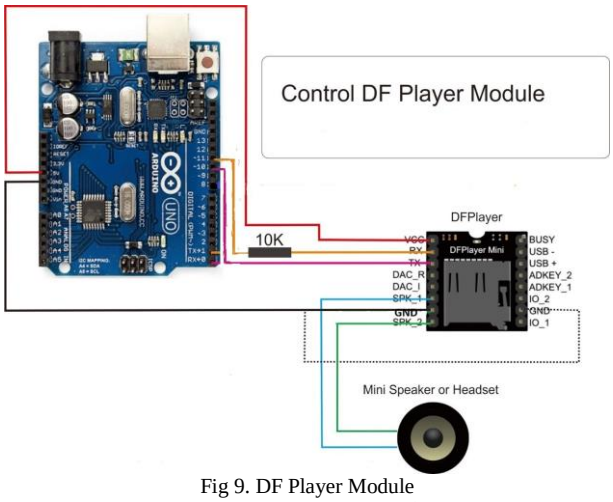


Fig 9. DF Player Module
(https://blog.robberg.net/build-mp3-player-dfplayer-arduino/)

1) First pin of DF player is $V_{cc}$. Here 5V will be applied to power DF module.
2) Second pin is RX which communicates with Arduino Mega 2560 via software serial port 11 which receives serial input.

3) Third pin is of TX which communicates with Arduino Mega 2560 via software serial port 10 by sending the required serial output.
4) The 6th and 8th pins are negative and positive terminals of speaker
5) The 7th and 10th pin is Ground pin of DF module.

## V. PSEUDO CODE

- Set Rx and Tx for Arduino using software serial
- Initialize all pins of the 5 sonars used.
- Until all sensors send a wave repeat

```
{
    digitalWrite(trigPin, LOW); //To send a wave from ultrasonic sensor
    Wait for a few microseconds
    digitalWrite(trigPin, HIGH);
    Wait for a few microseconds
    digitalWrite(trigPin, LOW);
    Duration = pulseIn(echoPin, HIGH);
    Distance = Duration*0.034/2;
}
```

- According to the distances calculated , play the required audio file

## MOTIVATIONS

With an exponential increase in power consumption in modern times it is now the utmost imperative to think of alternate energy sources which can help to ease the pressure. The energy harvested from piezoelectricity can help immensely in the long run .With the proximity detector built into the shoes the blind can now get a better understanding of the world around them and in doing so empower them to be independent and confident.

## IMPROVEMENTS

Our prototype in its rudimentary stage can be further enhanced to improve its efficiency, visual appeal and accuracy.

- A bluetooth headset which will directly transmit commands to the user, removing the need for cumbersome wires.
- Micro ultrasonic sensors which can be integrated into the shoe's fabric without being fastened onto the periphery of the shoe from which it could tear off.
- Integration of piezoelectric transducers with better efficiency of energy conversion.

## CONCLUSIONS

By this project we have endeavoured to harness the mechanical energy lost when we walk into reusable electrical energy which can be helpful in powering your small electronic devices. During the course of this project we faced many challenging including but not limited to accurately and comfortably fitting all transducers onto the shoe sole, ensuring that the soldering of wires does not come out while using the shoes, proper calibration of the ultrasonic sensors to provide an apt description of the surroundings etc. We learnt how to overcome them by perseverance, trial and error and drawing inspiration from products made in earlier projects and by products already available in the market. We also learnt about Arduino, Mp3 modules, ultrasonic sensors and bridge rectifiers, hence making this a learning experience from an electronics point of view. We hope that this project paves the way for further research and experimentation into alternative forms of energy which will be sorely needed in the future.

## ACKNOWLEDGMENTS

The authors would like to thank Dr. Hitesh Shrimali, for mentoring the project through his experience .We would also like to thank Dr Ankush Bagh and Dr Kunal Ghosh for their unwavering zeal to answer all our queries . Finally we would like to express our profound gratitude to our mentor Suryavanshi Virendra Singh who gave us critical insights and advice throughout our project and provided the necessary help whenever needed. We are also grateful to Mr. Tarun who permitted us in issuing the components from electronic lab.

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