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COMMUTING AID FOR VISUALLY IMPAIRED PEOPLE

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Abstract - *In the last few years the use of power electronic devices has been increasing rapidly. The devices are being used in large numbers to comfort our daily lives with the energy consumption of these portable electronic devices, the concept of harvesting alternative renewable energy in human surroundings arise a now interest among us. Here we focus on such advanced materials in order to harvest energy from people walking vibration for generating and accumulating the energy. Piezoelectric materials can be used as mechanisms to transfer mechanical energy, usually ambient vibration, into electric energy that can be sorted and used to power other devices. A piezoelectric substance is one that produces an electric charge when a mechanical stress is applied.*

Key Words: Energy harvesting, Piezoelectric material, Arduino UNO, ultrasonic sensor.

1. INTRODUCTION

In recent years there has been an increasing interest in research and development of advanced smartphone technology. But as technology evolves so do the problems associated with it. One among those is the fast draining out of the battery. Almost every smartphone user wishes he had more battery life. Now, imagine charging your batteries wherever you go. This is possible by piezoelectric power generation and wireless transfer mobile charging techniques. Mechanical energy is one of the most ubiquitous energies that can be reused in our surroundings. The sources of mechanical energy can be vibrating structures, a moving object, and vibration induced by flowing air or water. Harvesting mechanical energy from human motion is an attractive approach for obtaining clean and sustainable electric energy. Piezoelectricity is the energy produced when pressure is applied on an embedded piezoelectric charge is produced on the expanded side and a positive charge is produced on the compressed side of the piezoelectric crystal. Once the pressure is relieved, electrical current flows across the material. Wireless power or wireless energy transmission is the transmission of electrical energy from a power source to a load without any physical connector such as wires or conductors. Energy is harvested from the human movements and is transmitted wirelessly through wireless power transfer technique and is used to charge the mobile battery.

2. LITERATURE SURVEY

The fundamental idea of research work in paper (1) is to present an approach to energy harvesting, which basically uses piezoelectric technology and is implemented in a shoe. It takes advantage of the energy that the user wastes when walks and thus is able to convert it into electric energy and can be used in an electronic device that requires low power. For measuring the power generated and construction, by the plantar pressures of the foot during the walking or running cycle. As seen in the results there is more power in the running test than in the walking test because higher speed and jumping while running produce higher pressure and more power. Also, it is observed that there is not much difference between the right foot and the left foot since almost the same power is generated. It can be concluded that the greater the weight of the person, the more the pressure generated in the piezoelectric sensors and then the power is great. (1)

This is a process of designing a hybrid energy harvesting system for small powered battery applications. The system is constructed with two separate systems that are the mechanical harvesting system and piezoelectric harvesting system. They are coupled together with an efficient power management circuit with the intention to generate electricity through walking while acting as a battery charger. The system has shown positive results when used to charge up a small battery powered electronic gadget such as a mobile phone. The proposed prototype has clearly demonstrated its ability to charge up a mobile phone. This project integrates both the mechanical harvesting system and piezoelectric harvesting system in order to convert kinetic energy from human movement into electrical energy while at the same time the electrical energy generated is processed by their respective efficient power management circuits. Although both the harvesting systems are playing an important role in generating a power source, yet the efficient power management circuits are essential in processing and regulating in order to produce a more constant supply. Besides that, the practicability of this prototype is experimented. When a person is using this prototype to charge the battery in the mobile phone throughout the day, the battery level does not decrease and at the same time increases from an initial 50% to 69% state of charge. Hence, this prototype has demonstrated the feasibility of energy harvesting from human movement and the potential of this prototype as an endless power source for charging and powering up low powered electronic gadgets. Even though the amount of resources saved such as energy and money are rather trivial in the short term, yet the impact would be notable in the long run. (2)

Energy harvesting technology provides a promising choice to replace the batteries used in modern wearable devices. New kind of piezoelectric energy harvesting devices aiming for high power output at low frequency with broad bandwidth. By accessing the performance of the device at different frequencies, we have demonstrated two energy harvesting devices with power output at 10 microwatts level. A complete energy harvesting system is also designed to adjust the output voltage for practical applications. Energy from human motion has been successfully harvested to power an LCD device and an LED lamp. Those demonstrations reveal potential applications of the energy harvester in other wearable devices. Demonstrate two kinds of piezoelectric energy harvester that can be used as alternative power sources for wearable devices. With the piezoelectric beam fabricated, the output voltage is adequate for power collecting circuit. The prototypes of the energy harvester are examined in real scenario and the results show good performance. The joint rotation driven energy harvester is available with a wide frequency range. The hand-terminal driven energy harvester is sensitive to small vibration. The devices designed are compatible with current commercial energy harvesting IC solution, thus a complete energy harvesting system was demonstrated. The design of the energy harvester exploits the motion of the human body and was proved effective by the experiment. The results reveal potential applications of the energy harvester in wearable devices. (3)

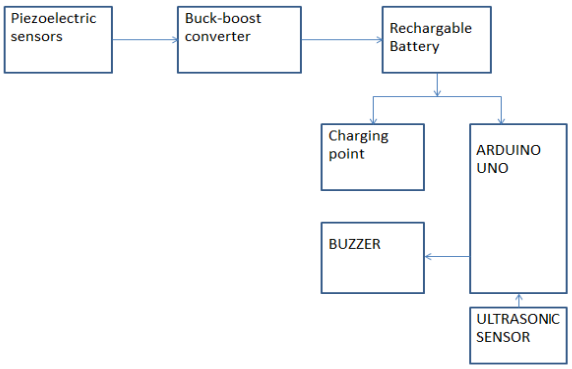
Over the last several years, indoor mobile robot systems not only for industrial use but also for home or office use have been developed. When the robot works in a narrow workspace, it often collides with obstacles. One of the causes of the collisions was an arrangement of circumambient obstacles. The robot often works in an unknown workspace where there are no maps prepared previously. A simple obstacle arrangement detection algorithm for the workspace map creation is proposed. The algorithm uses ultrasonic stereo sonar and a single image sensor. The stereo sonar can measure by the distance detection accuracy that is approximately 13 mm of errors out of 1300 mm and the angular detection accuracy that is approximately a few degrees of errors. The image processing algorithm can measure angles of corners and/or edges of obstacles using a laser line generator as an extra light source. An obstacle arrangement detection algorithm that uses combining ultrasonic stereo sonar and a single image sensor is proposed. It is confirmed the distance measurement accuracy and the position detection accuracy of ultrasonic stereo sonar. In the experimental results, the error rate of distance is approximately 2% and the error of angle detection is in a few degrees. It is also confirmed the spatial feature detection algorithm using an image sensor. It can detect accurate direction of obstacles. (4)

Ultrasonic sensors are adopted to implement a real-time obstacle avoidance system for wheeled robots, so that the robot can continually detect surroundings, avoid obstacles, and move toward the target area. Secondly, six ultrasound sensors installed on the wheeled robot were utilized to detect large obstacles and to obtain distance information between the robot and the obstacle. The PD controller was used in the wall-following method to achieve the optimized path design. Experimental results verified that ultrasonic sensors of the obstacle avoidance system on the wheeled robot, with ATMega162 embedded microcontroller as the core of the system, can indeed help avoid obstacles and reach the established target area. The main contribution of this study is the establishment of a working platform for an obstacle avoidance system for small robots. The entire development, including hardware assembly, unit testing, system integration, and writing of the embedded microcontroller driving program in assembly language, were carried out systematically. Distance information, obtained by ultrasound sensors, which is suitable for point-to-point detection, is used in the wall following method to ensure that the wheeled mobile robot avoids large obstacles. The system uses a third-generation ATMega162 chips as microcontrollers of the robot to obtain the information of six ultrasonic sensors. (5)

3. METHODOLOGY

In this project, when the pressure is applied on piezoelectric sensor the power is generated, this power is stored in the battery. We can use the power saved in the battery to charge the mobile phones. On the other hand the battery acts as the supply source to the Arduino to which the ultra-sonic sensors are connected. The ultra-sonic sensors help in detecting the obstacles and alert the blind person about the obstacles along the path he walks.

3.1 Proposed Block Diagram



In this project, when the pressure is applied on a piezoelectric sensor the power is generated, this power is stored in the battery. We can use the power saved in the battery to charge the mobile phones. On the other hand the battery acts as the supply source to the Arduino to which the ultrasonic sensors are connected. The ultrasonic sensors help in detecting the obstacles and alert the blind person about the obstacles along the path he walks.

Methodology includes three steps:

1. Energy harvesting using piezoelectric sensors

2. Storing the generated power in a rechargeable battery
3. Using the stored power in battery to power the arduino UNO (which is inturn used to by the ultrasonic sensors to determine obstacles)

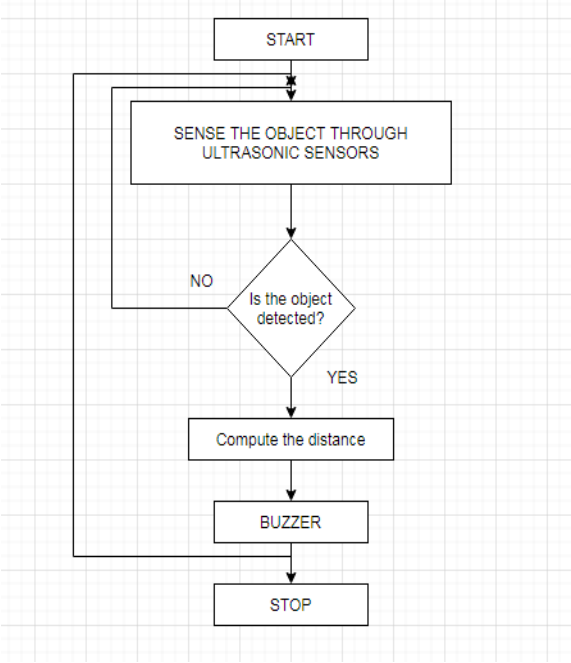
Hardware components used:

a. Piezoelectric sensors
b. Lipo batteries
c. Buck-boost converter
d. Charging Cable/ USB Cable
e. Arduino UNO Microcontroller
f. Ultrasonic sensor

Software components used:

a. Arduino Software IDE

3.2 FLOWCHART



Our project is going to work on the principle of Ultrasonic waves. As shown in the flow chart above. The Ultrasonic sensor will detect if there is any object in front or not and accordingly they will do their function and will trigger the buzzer. Similarly the function of other Ultrasonic sensor will be coded in such a way that if the distance between the ground and the sensor increases to a value more than x (Value of x mentioned in coding) then it will trigger the buzzer .

4. RESULT

Power generated by the piezoelectric sensors are stored in a rechargeable battery .Power generated is used as a supply power to the Arduino The ultrasonic sensor connected to the Arduino is used to detect obstacles.When the ultrasonic sensor detects obstacles , the buzzer sends a beep signal which can be heard by the blind person to avoid obstacles.

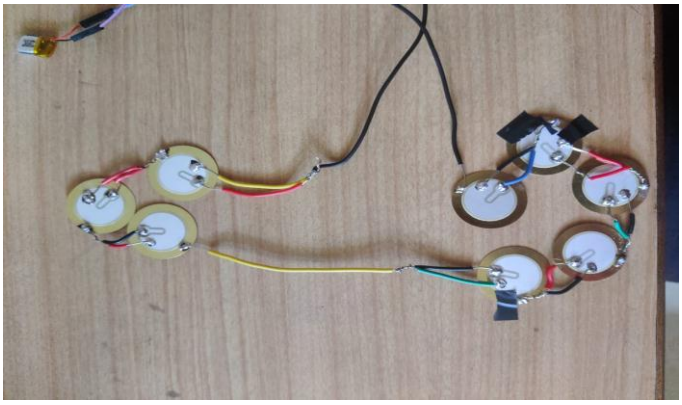


Fig 4.1 : collection of piezo-electric sensors in series in the shape of right foot

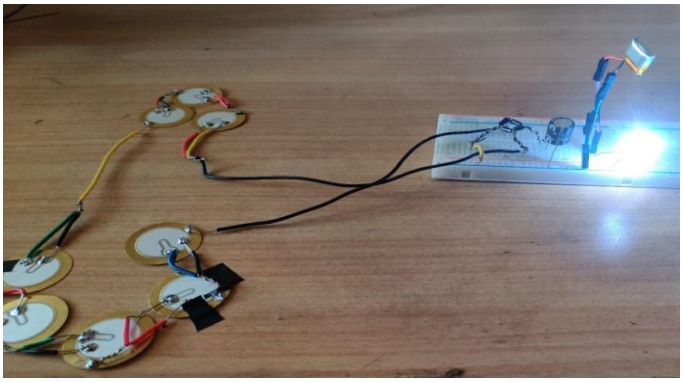


Fig 4.2 : the piezoelectric sensors connected to the AC to DC rectifier circuit which is in turn connected to capacitor and rechargeable battery connected in parallel to store the energy produced by the sensors

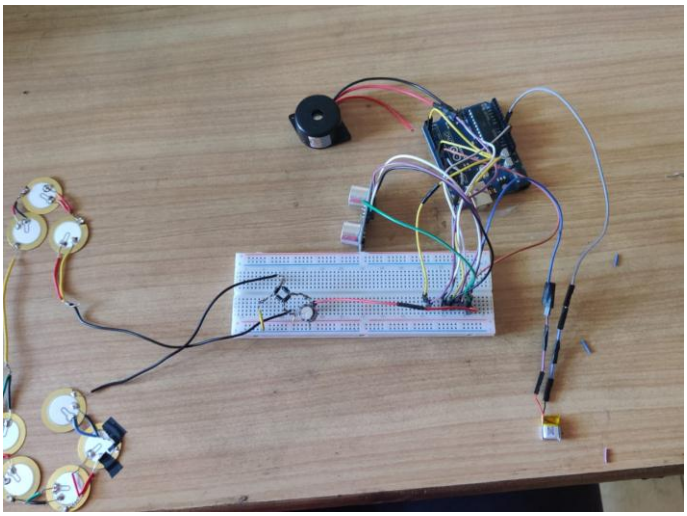


Fig 4.3 : the charge stored in the battery is used to power up the arduino UNO , which is inturn connected to the ultrasonic sensor to detect obstacles and a buzzer to produce a buzz sound when the obstacle is detected.

5. CONCLUSION

Energy is one of the most important issues around the world. Renewable energy sources can be a great media to solve this energy crisis problem. Renewable sources of energy are not rendered free and its price keeps increasing. Energy generated by movement (when people walk, run, jog, jump) is left unused. Charging of batteries has not been flexible. The main aim of this project is to develop a much easier and efficient way for power generation. Here , we have illustrated the design of a system which can harness the power generated by human movements and transfer the power to a device. This system can also be built shoe independent and as a compact version that can strap on to any shoe. This system can easily generate enough charge to power up an arduino UNO. Once powered it is connected to the ultrasonic sensors which produce a buzz sound when any obstacle is detected on the way of a blind person so that he can avoid obstacles in his way.

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