INTELLIGENT ELECTRONIC EYE FOR VISUALLY IMPAIRED PEOPLE

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Abstract- **Eyes are organs of our visual system. In this paper, we are presenting a unique intelligent electronic eye that provides road guidance to blind people while they are walking. Surrounding visual data is collected by image and obstacle sensors mounted on a helmet which the user has to put in. The data is sent to a processor which works in a line similar to our brain function. The processor analyses the data and provides necessary voice information to the user which helps them in movement. The electric power for this unit is availed through solar photo voltaic module, piezoelectric source and also from electricity generated from body temperature. The device will help in great extent to the visually impaired people who are unfortunate see this beautiful world.**
Keywords- Sensors; Processor; Electronic eye; Helmet;

I. INTRODUCTION

The visually impaired people face lot of problem in their movement. Some face this problem from the time they are born while others due to accidents or of different causes they encountered in this life. The Fig.1 shows the percentage of different blind people. Our prototype aims to provide simulated vision to these people. Electronic eye carries a concept of complex human eye. A helmet is specially designed to mount all necessary hardware in it. A stepper motor controlled small rotating camera mounted on the helmet gives the 360 degree visual information to a microcontroller. The controller processes the image and generates a continuous audio instruction to the person about the closed views. The generated useful audio command is conveyed to the person through a head phone. Power required for the entire unit is generated through different renewable sources. These are small solar module on the helmet, piezoelectric generator fixed with shoes and electric generation unit from body heat. In addition to the camera four obstacle detectors have also been mounted on the helmet to provide additional object distance detection. These are flexible solar module mounted on the helmet, piezo module fixed in the shoe and body heat to electricity generating module mounted on the body. A lithium ion battery has also been used to store generated power required for idle situation. Different papers are found where researcher has worked in the area of distance measurement [1] to [10], obstacle detection system to help the blind people. But visual information converted to audio guiding information is unique here.

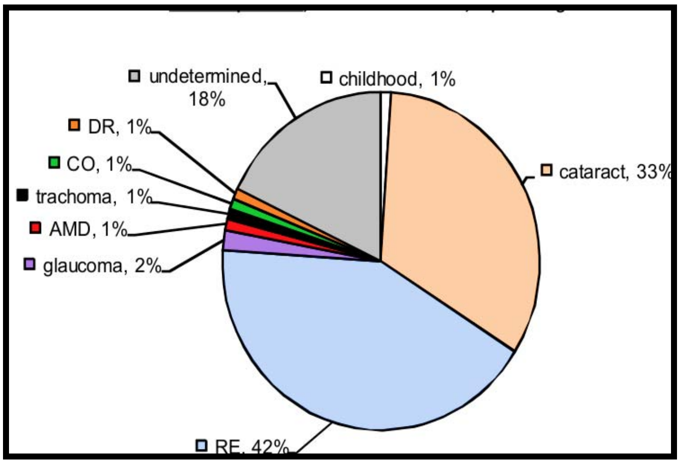

Fig. 1. Pie Chart showing percentage of blind people

II. METHODOLOGY

Working procedure of this device is same as the working procedure of a human eye and brain. Here the function of the organs is achieved by some efficient microelectronic devices. All the hardware is mounted on a specially designed helmet as shown in Fig.2 Different parts of the helmet are indicated in this figure. A group objects distance sensors are installed at the front, back, right and left side of the helmet. These are used to detect obstruction with distance of any type (moving and static obstruction). A charged coupled camera installed on to the helmet is rotated using a stepper motor to provide 360-degreesurrounding view. The sensors and camera communicate a microprocessor, where the microprocessor produces a voice signal instructing to the person about the distance and the type of obstruction through head phone. Power source for the entire hardware is accumulated from three different sources. One of them is a flexible solar photovoltaic module mounted on the helmet. While the person is on road in a sunny weather the solar module generate electric power which is converted to a suitable level for the electronic circuit. Excess power generation is used to charge a rechargeable lithium ion battery used when no other power generating source is available. Second source of power is generated through piezoelectric generator mounted in the shoe hills. When the person is in motion the pressure exerted on the piezo module generates power for the system. Third type of power generation is done from the body heat of the person converted to electric energy. Finally, the battery can be charged from commercial 230V AC power source.

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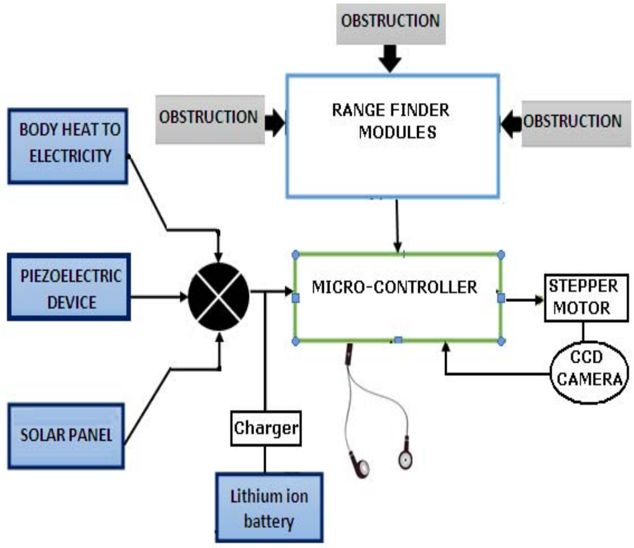

Fig. 2. Block diagram of the hardware

III. DIFFERENT SENSORS AND COMPONENTS USED

A. AVR micro controller

Atmega32 microcontroller has been used to realize the project**.**
feet). The long range makes them a good alternative to sonar sensor.

B. Range Finder Module

This extra-long-range sharp distance sensor as shown in the Fig.3, bounces IR off objects to determine how far away they are. It returns an analogy voltage that can be used to determine how close the nearest object is. These sensors are good for detection between 100cm-500cm (1-5 meters / 3-15

Fig. 3. Object sensor

C. Charge Coupled Device

Fundamentally, a charge coupled device (CCD) is an integrated circuit etched onto a silicon surface forming light sensitive elements called pixels. Photons incident on this surface generate charge that can be read by electronics and turned into a digital copy of the light patterns falling on the device. Fig.4 shows the type of camera used for object visualization.

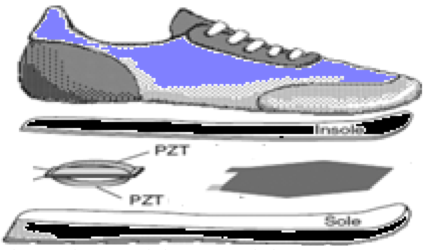

Fig. 7. Piezo module mounted shoe

Fig. 4. Ultra mini CCD camera module

V. POWER SOURCE

A. Solar PV module

Flexible solar PV module wrapped on the helmet generates electricity while walking on road during daytime. A typical flexible solar module is shown in Fig.5.

Fig. 5. Flexible solar PV module

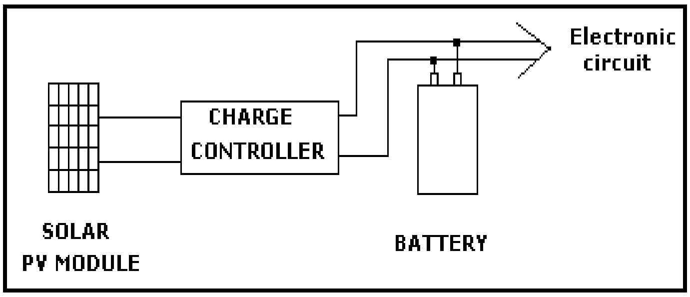

Fig. 6. *Battery charger from solar pv module*

B. Piezoelectric generation

Piezoelectric effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.
Piezoelectric module mounted in the shoe hills generate electricity due to pressure exerted at the time of walking. A piezoelectric generator formed by PZT chips when shaken at resonance, produce 100 microwatts. For a 1 Hz per leg gait, the power generated per shoe is 250 mw.

C. Body Heat

According to the researchers, because of the small temperature difference between skin (approximately 32°C) and the temperature of our surroundings, it is difficult to make use of body heat. Previous thermoelectric generators, such as those based on semiconductors, produce too little energy, are costly, or are too brittle for use in wearable systems. Thermo-cycles with electrolyte solutions are difficult to integrate into extensive wearable electronics. The team found a solution to this problem by using thermo-cells with gel-based electrolytes. The scientists combined two types of cells containing two different radix pairs. Each cell consists of two metal plates that act as electrodes, with an electrolyte gel in between. The first cell type contains the Fe^{2+}/Fe^{3+} pair. The second type of cell contains the complex ions $[Fe(CN)_6]^{3-}/[Fe(CN)_6]^{4-}$. In cell type 1, the cold end gives a negative potential, while in type 2, the cold end gives a positive potential.

Using a Carnot engine to model the recoverable energy yields 3.7-6.4 W of power. The maximum power available without trying to reclaim heat expended by the latent heat of vaporization drops to 2.8-4.8 W. The neck offers a good location for a tight seal, access to major centres of blood flow, and easy removal by the user. The neck is approximately 1/15 of the surface area of the "core" region (those parts that the body tries to keep warm at all times). As a rough estimate, assuming even heat dissipation over the body, a maximum of 0.20-0.32 W could be recovered conveniently by such a neck braces. The head may also be a convenient heat source for some applications where protective hoods are already in place - the head is also a very convenient spot for coupling sensory input to the user. The surface area of the head is approximately three times that of the neck and could provide 0.60-0.96 W of power given optimal conversion.

V. PICTORIAL VIEW

In Fig. 8., a pictorial view of the helmet and other arrangements are shown.

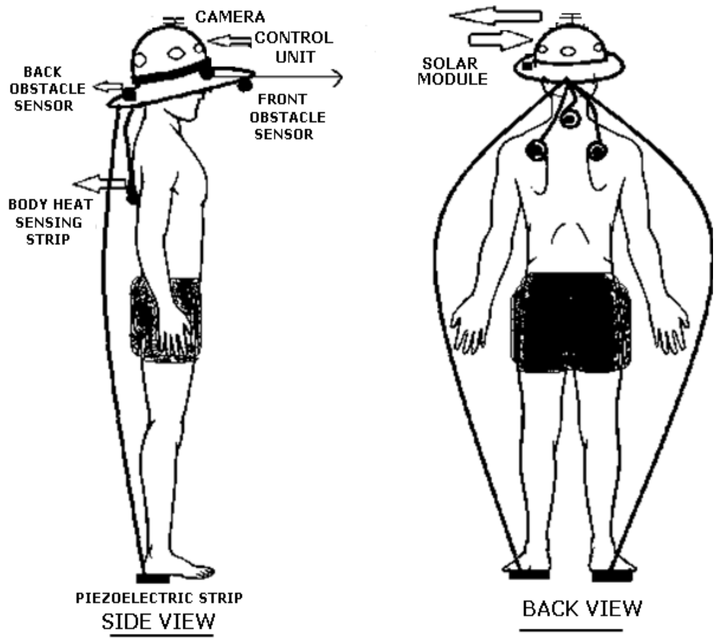

Fig. 8. Pictorial view

Detailed mounting arrangement of the components are shown in Fig. 9.

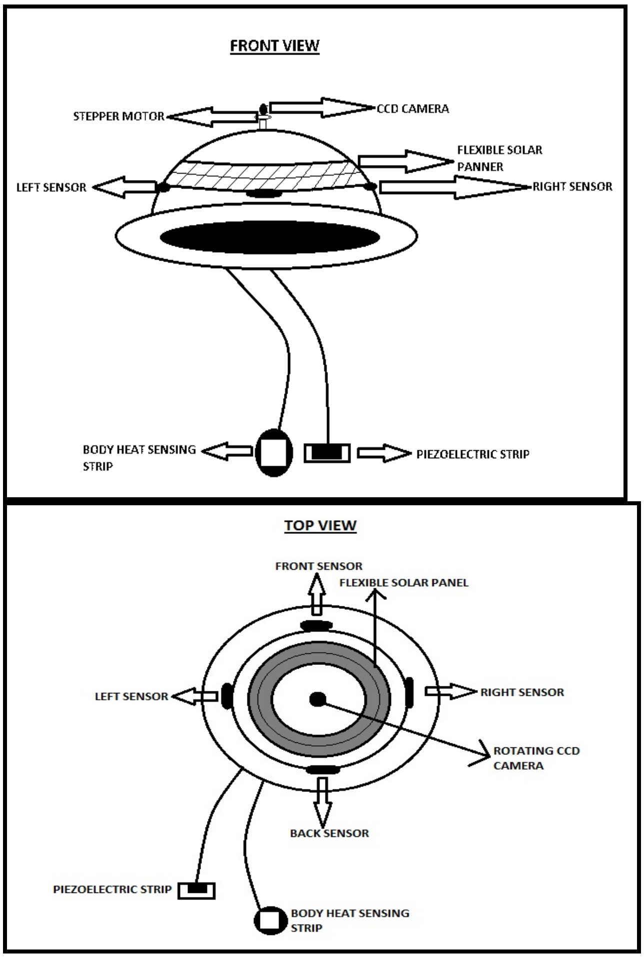

Fig. 9. Various component mounting details

This prototype can be used in future as an aid for people in wheelchairs so that they can easily move without anyone's interference. This can also be helpful for people with poor vision.

VI. ACKNOWLEDGMENT

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VII. CONCLUSION

This prototype designed for the betterment of mankind. Not only the visually impaired will be able to navigate on their own but will also get the feel of having an eye. This will also be useful for people with poor vision. Around the world researchers are trying to find a solution for blindness. The unique factor of this prototype is the way it is powered. We have tried to use renewable sources for the entire functioning of the unit. The entire model is placed in a helmet which is a light in weight.

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