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RESEARCH ARTICLE

Developing a Vibrating Foot Wear for Physically Impaired People with Health Monitoring using Microcontroller

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ABSTRACT

Presently, impaired people face lots of challenges in the society. They need aids/applications to achieve their capability to live a safe and secured life. Surveys reveal that the impaired people take much effort to finish even their simple action when compared with normal people. This has planted us the idea to develop a vibrating shoe for the visually impaired people that serve as a guidance tool. One of the biggest problems that the visual impaired ones face is while travelling, because when they walk outdoors they are not well aware of information about their location and orientation with respect to traffic and obstacles. The wearable shoe helps them for mobility and other outdoor activities. It has sensors to guide and vibration unit to alert them of the obstacles that lay ahead on the way. Besides, it consumes less power and is of small size and low weight and has an acceptable accurate performance. An android application is developed by which health status of the person can be monitored, and the database consists of emergency number that connects the user kit. The integrated system of microcontroller and bluetooth helps to send the health information to the family members through android application.

Keywords: Shoe module, Arduino Uno microcontroller, Vibrating motor, Android, Bluetooth.

1. INTRODUCTION

Embedded system plays a major role in electronics. Its hardware depends upon microprocessor and microcontroller. Embedded system which consists of memory and input and output interfaces also acts as the user interface. It is difficult for the physically challenged people to get around due to lack of information about their location with respect to obstacle and collusion on the path. Several existing systems use speakers for obstacle detection based on voice command, but that is noisy and does not suitable for physically impaired people. Smart white cane can be used only for obstacle detection and not for emergency purpose. Infrared (IR) sensor is also not efficient, because it can only detect the obstacle in short distance on the user way. In this project, a vibrating shoe is designed to support physically impaired people. This system is a prototype model and provides a smart aid for them. This system is intended to measure obstacle detection and send message related to user. The system includes microcontroller, ultrasonic sensor, vibrating motor, bluetooth and health monitoring sensors like temperature and pulse sensors [1]. Ultrasonic sensor plays a major role in detecting the obstacle in front of the user path. After identifying the obstacle, the vibration motor alerts the user by vibrating signal. If the obstacle is present near the user path, it provides continuous mode vibration and if the obstacle is away from the user, the vibration becomes breaking mode with respect to the distance of the obstacles. For navigation

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purpose, google map is used to reach the destination point. The concerned persons can be monitored using wireless sensors such as temperature and pulse sensors to avoid any complex situation. Figure 1 shows the estimation graph of blind population.

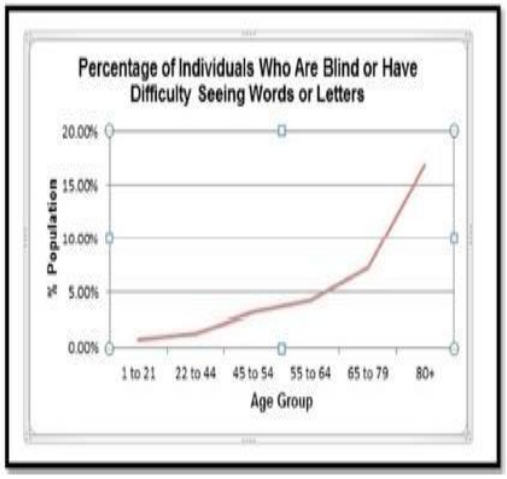

Figure 1.Graph estimating the blind population over life span

The temperature sensor is used to measure the temperature changes and the pulse sensor measures the change in blood volume through any organ of a body. If it detects data in the abnormal condition, the information is sent to neighbors/friends through android application using bluetooth module.

2. LITERATURE SURVEY

An electronic long cane based on ergonomic technology design and embedded electronic system serves as a mobility tool for blinds. The system uses haptic sensors for the detection of obstacles above waistline. When the obstacles are detected, the cane vibrates or creates sound. As this detects obstacles only above the waistline, an alternate system has to be proposed [2-4].

Blind shoes include vibration sensors to detect obstacles like pits, transports, stones and walls, which also shows road marks. They also consist of microcomputer to control all mechanisms and to store data. Further automatic rechargeable battery is also included that can be charged when the user walks using kinetic generator connected with the shoes [5-9]. Smart canes for blinds provide an early warning about the obstacles based on IR sensors. It alerts them via vibration signals. But it is limited to detecting obstacles of short distance and does not provide any information during emergency situation [10-15]. A smart cane similar to guide cane with almost same configurations are also available. Smart cane uses ultrasonic sensors and servomotors to detect the obstacles. It comprises a microcontroller inside the cane which works based on the received instructions like right, left, straight etc. However it not easy to handle and foldable and requires large area. Additionally it is also very expensive [16].

[17] has proposed audio-haptic map for efficient movement of visually challenged people. It is based on multimodal application that makes them to walk and orient themself in real space. It aims at managing real space but it includes only small number of participants or sample size. [18] has studied the prototype, which offer guidance and recognition system to assist blinds by which they can avoid obstacles in indoor environments. It relies on synthesis module and speech recognition, and yields better performance. Haptic technology is suggested to provide improved performance with verbal instructions. [19] has discussed a context-aware smartphone to detect obstacles for visually challenged people by processing images, computing flow and tracking points with better accuracy and precision. Limitations arise since it detects certain objects like reflective floors, surfaces as obstacles. Noisy effects are eliminated by avoiding these features.

3. PROPOSED METHOD

The system consists of microcontroller, ultrasonic sensor, bluetooth module, RF transmitter, RF receiver, vibration motor and temperature and pulse sensors.

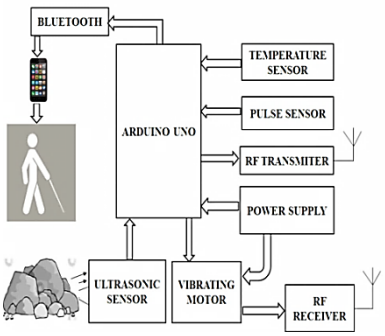

Figure 2.Block diagram of vibrating shoes

The ultrasonic sensor integrated with the outer surface of the shoes plays the role of obstacle detection. Figure 2 shows the block

diagram of vibrating shoes. It senses the obstacle on the user path. When any obstacle comes in front of shoe, the ultrasonic sensor detects the obstacle and the electromagnetic waves from the obstacle reflect back to the ultrasonic sensor, and then it transmits the signal to microcontroller.

The distance calculation between the sensor and the object is as follows:

Distance = High Pulse Time Width (HPTW) * 0.034/2

where,

D - Distance in cm

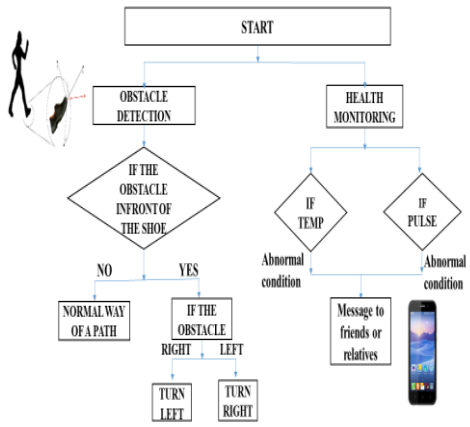

Figure 3.Flow chart of the proposed system

Flow chart of the proposed system is shown in figure 3. The RF transmitter gets the data from microcontroller and sends to the RF receiver through RF communication. The vibrating motor acquires signal from RF receiver, and it works on two modes (continuous and breaking). If the obstacle is present near the user path, it vibrates continuously and if the obstacle is away from the user, the vibration becomes breaking mode with respect to the distance of the obstacle. Temperature and pulse sensors present in shoe act as a wearable medicare tools for physically impaired people. The person's temperature and pulse rate of user are monitored automatically using medicare tool whenever the person is walking. If the person is abnormal, then his/her status can be sent to friends/neighbours via mobile application by bluetooth module. Mobile application includes the emergency number which interfaces with user kit to send messages.

The major components used in the vibrating footwear are: Arduino microcontroller (operating voltage 5 V), ultrasonic sensor (power supply 5V DC), vibrating controller, temperature sensor (LM35), pulse sensor, bluetooth (operating voltage is 3.3V). In vibrating controller, description-coin type motor is used which vibrates when the input logic is high. Arduino Uno and Embedded C are the software tools used in this project.

4. HARDWARE IMPLEMENTATION

We have tried our best to keep the hardware implementation as compact as we can. The heart of the system is the microcontroller which has been mounted in the shoe unit is shown in figure 4.

Figure 4.Shoe unit

The ultrasonic sensor detects the obstacle in front of the user path. The entire circuitry is kept in a compact box. The wirings are also placed such that they do not disturb the user. The vibrating footwear also includes health monitoring. Its advantages and applications are as follows:

1. Low manufacturing time
2. Low cost
3. Suitable for indoor and outdoor surroundings
4. Dynamic and automatic system
5. Compact
6. Lower power consumption
7. Can be used as a guidance system for humans with no or relatively low eye sight capability

5. CONCLUSION

The proposed method becomes a reliable support for physically impaired people

in every situation. This paper describes the purpose of smart shoe for obstacle detection and navigation. Certain existing problems like conveying of less information, poor efficiency of IR sensor and dependency on stick are overcome and it is successfully implemented with efficiency of object detection and with clear information to guide visually challenged ones, such that they do not depend on other humans anymore. Using this system, the blind people receive information about every obstacle and reach the desired destination. The temperature and heartbeat of the user is monitored automatically using the sensors that act as a medicare tools. With the help of the information through SMS, abnormal health condition can be identified. Hence monitoring can be done automatically. This project provides a complete solution for monitoring problem.

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