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Obstacle Detection and Emergency Alert (ODEA) Walking Stick for the Visually Impaired

[1]Jayalekshmi V P, [2] Hemanth Mithun Praveen, [3]G.Sakthivel
[1] School of Electronics and Communications Engineering, VIT Chennai
[2], [3] School of Mechanical and Building Sciences, VIT Chennai
[1]jayalekshmi434@gmail.com, [2]hemanth.mithun.praveen@gmail.com, [3]sakthivel.g@vit.ac.in

***Abstract:* — This paper proposes the development of a walking aid for the visually impaired which can sense the surroundings sideways, front, top and bottom and can provide a guidance for navigation by giving audio messages. The device is capable alerting the caretaker of the user in case of emergency by sending an SMS .The system is designed to be power efficient and low cost to be made affordable to common man. The audio messages delivered can be in any language and user-fed which is independent of the system and it overcomes the problem of language constraint in existing systems. Vibration alerts which are provided in case of closer proximity along with the audio messages help the visually challenged to navigate comfortably and safely.**

***Index Terms*— Audio messages for navigation-guidance, Emergency alert using GSM, Obstacle detection and avoidance, Vibration alert.**

I. INTRODUCTION

Visually challenged people finds that, it is very difficult to do their day to day tasks and thus have to depend on others for their work. In case of an emergency, it becomes difficult for them to contact their kin or any other person. Considering all these problems, many people have developed their walking stick in order to help them. But in most of the cases this technology is unaffordable to the disabled. Also, there is a need to incorporate all the features in a single stick that can solve the above problems. The use of this stick can make the life of the disabled easier and safer.

The ODEA system mainly performs two functions, first one is the detection of obstacles and the other is alerting the care taker in case of emergency by sending an SMS. The obstacle detection process is carried out with the help of three ultrasonic sensors. Positioning of the sensors are designed in such a way that the stick can detect obstacles sideways, front, up and down. Depending on the proximity of obstacle, it decides the operation to be performed.

When the obstacle is at a distance more than 1.5m, a recorded audio message is played which alerts the user about the obstacle detected. This message also indicates the direction of the obstacle detected so that the user can deviate and take a safer path to avoid collision. These messages are played using a speaker. In case the person fails to listen to the message, and the obstacle proximity is less than 1.5m, the vibrator is activated to physically alert him so that he can stop at that instant and avoid the collision.

In case of an emergency, a person can send message to the mobile number saved as an emergency contact by pressing an emergency button. This message will include date, time and location of the stick carried by the person.

II. OBSTACLE DETECTION AND AVOIDANCE

2.1. Obstacle detection

The obstacle detection is carried out with the help of three ultrasonic sensors which has a range of about 4 meters. The sensors are positioned in such a way that the stick can detect obstacles in front, sideways, eyelevel and knee level. Two of the sensors which have angular range of 15 degrees are aligned at 45 degrees with the centre. This enables effective obstacle detection sideways. The third sensor is mounted on a servo motor that can move 60 degrees up and down to detect obstacles in the eyelevel and knee level of the user. The servo can be switched off when the stick is used indoor which saves the power consumed by the servo. The sensors are interfaced to a microcontroller which takes decision based on the proximity of the obstacles detected.

2.2. Obstacle avoidance with the help of guidance audio messages.

The microcontroller samples proximity data from all three sensors and runs certain algorithms to decide which audio message has to be given to direct the

user in an obstacle free path. One of the constraints in the existing systems is the language in which the audio messages are delivered. In most of the cases the language is English, at the same time this walking stick is mainly used by elderly people who may not follow the language. This system solves the above problem by integrating an MP3 module in which the user can store messages in a micro SD card in his own language. The audio is played using a speaker or earphones. If the user fails to respond to the messages and the proximity is very near (less than 1.5m), a vibrator is activated in order to physically alert the user. This overcomes the possibility of colliding with obstacle even if the speaker or earphone is faulty.

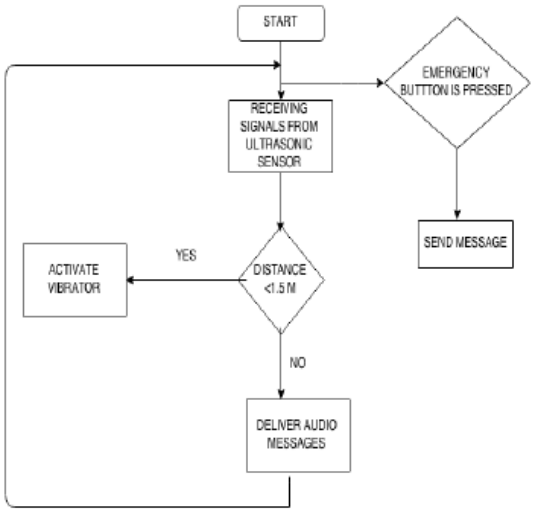

Fig.1. Flowchart of the working

III. EMERGENCY ALERT

Day to day life is a challenge for the visually disabled people and usually they end up in a panic in case of emergency. An emergency alert system is incorporated in the walking stick to help the blind in such situations.
The stick is provided with an emergency button which near to the handle of the stick which when pressed sends a message to the care taker whose number is saved in the controller's memory over the GSM. With lesser complex design, it is easy to handle the stick which makes the user more comfortable and secure.

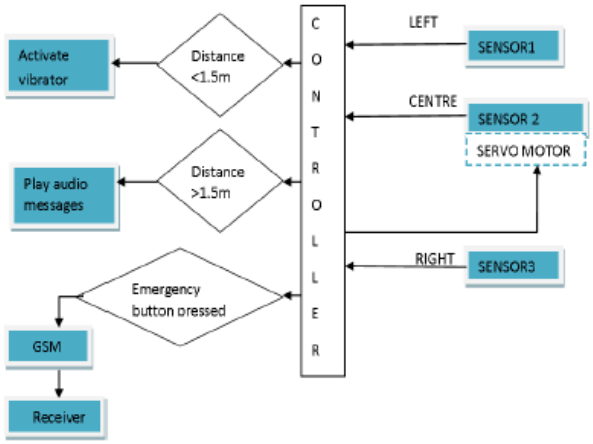

Fig.2. Design of ODEA

IV. TESTING AND RESULTS

The device was tested with the help of a blind person who was asked to use ODEA walking stick and also a normal white cane one after the other. The time taken to cover the same distance in a corridor was noted. The person took 2 minutes 13 sec to cover a distance using the white cane where as he took only 1 minute 38 seconds to cover the same distance using the assistance of white cane.

The ODEA walking stick effectively helps the visually impaired to navigate without the help of a care taker safely and comfortably.

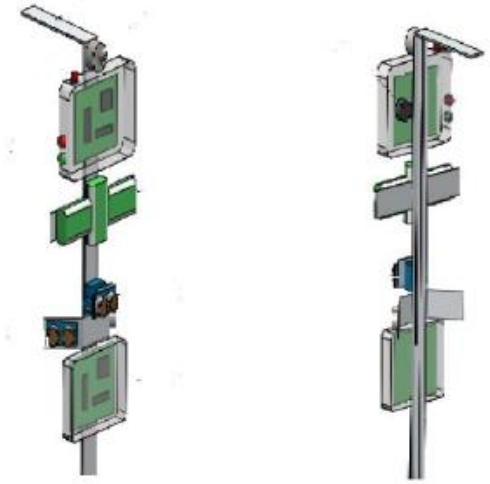

Fig.3. 3- Dimensional model of ODEA walking stick

IV. CONCLUSION

The current prototype can be upgraded in terms of quality of material used and features. Steel is used for the physical design of the prototype which can be replaced by carbon fiber which is lighter. A GPS module can be incorporated in order to provide navigational guidance. Sensors of higher resolution can be used for better performance.

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