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Designing a Smart Glasses for Blind People

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Abstract: Blindness is the inability to see anything, even light. The term blindness is used for complete or nearly complete vision loss. Visual impairment may cause people difficulties with normal daily activities such as driving, reading, socializing and walking. The glasses don't replace lost vision but assist with spatial awareness. Anyone using the glasses looks through them to make the most of their existing sight with additional images appearing in their line of sight to give extra information about who or what is in front of them. This study presents a system that it can prove to be very low cost solution to Blind People (BP) worldwide. In addition, it provides some parts of the hardware in order to get ride of some difficulties in terms of application.

Key words: Electronic Travelling Aids (ETA), smart glasses, usltrasonic sensor, arduino, provides, socializing

INTRODUCTION

Smart glasses that can help people with limited vision to navigate and avoid walking into obstacles have been developed by researchers at Oxford University. The smart glasses which consist of a video camera mounted on the frame of the glasses and a computer processing unit that is small enough to fit in a pocket are designed to boost people's awareness of what is around them. Images of nearby people and obstacles such as Krebs, tables and chairs whachare processed by specially-designed software and projected onto transparent electronic displays where the glasse's lenses would be normally working (Palleja *et al*., 2010).

A pair of "smart glasses" might help Blind People (BP) navigate an unfamiliar environment by recognizing objects or translating signs into speech, scientists say. The majority of registered blind people have some residual ability to perceive light and motion. But assistive technologies for the visually impaired have been limited.

Blindness is frequently used to describe severe visual impairments with or without residual vision. The extent of vision loss is described using an international scale (Mahmud *et al*., 2013).

According to the World Health Organization (WHO) in 2006 there were approximately 314 million people around the world whose vision is impaired. Of this number, there are 45 million blind people and the most frequent causes are cataracts (47%), glaucoma (12%), age-related macular degeneration (9%), corneal opacity (5%), diabetic retinopathy (5%), childhood blindness (4%), trachoma (4%), onchocerciasis (1%) and others (13%). All traditional methods to help blind and partially sighted people to move around on foot are the white cane (or white stick) and the guide dog that is very expensive due the training process and maintenance. Currently, there are many centers around the world researching and developing devices known as Electronic Travelling Aids (ETA) in order to improve the everyday life of blind people (Palleja *et al*., 2010). Total blindness means that cannot see anything, so in this research presents a smart glasses may be solving blindness problem depend on intelligent techniques.

Literature review: Palleja *et al*. (2010) have created a bioinspired electronic white cane for blind people using the whiskers priunciple for short-range navigation and exploration. They developed the idea from the hairs of animale's face which tells the animal that it has touched something using the nerves of the skin.

Mahmud *et al*. (2013), main purposed of this study is based on abating the disabilities of blindness by constructing a microcontroller based automated hardware that corroborated a blind to detect obstacles in front of him/her instantly. The hardware consisted of a microcontroller incorporated with ping sonar sensor, proximity sensor, wet detector, a micro pager motor and additional equipment.

Wenqin *et al*. (2011), this study presented a new computer vision based blindness navigation system, using robust and stable computer vision technologies to strengthen the weakness of existing electronic intellectual aid device. The system offered state information of the road scene and assistsed the blind to find out the

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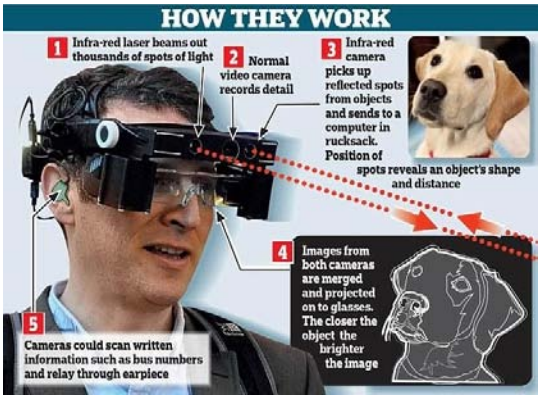

Fig. 1: Smart glasses

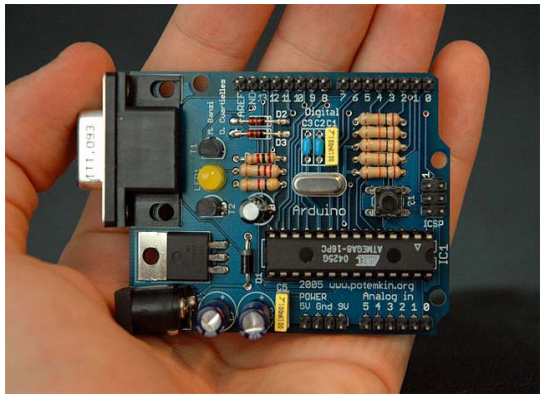

Fig. 2: Arduino technology

obstacles and the walkable planar regions, through which the blind can walk independently. The real scene experiments showed that the method provided a robust cognitive result of road scene.

Smart glasses: This is the beginning of a golden age for computer vision, study researcher Stephen Hicks said in a statement "The Royal Society's Brian Mercer Innovation Award will allow us to incorporate this research into this work to help sight-impaired people deal with everyday situations much more easily". Here's, how the smart glasses work. Two small cameras mounted on the corners of the glasses capture two different pictures, just as human's eyes do. The spectacles display information from the cameras on transparent LED displays on the lenses, so, the wearer can see an enhanced image as well as use their remaining sight. Comparing the distance between the cameras reveals how far the object is from the wearer. A set of headphones takes text and translates it into speech to provide directions or read signs aloud as shown in Fig. 1 (Kher *et al*., 2015).

Part of glasses: There are many parts of devices which can depend on the hardware of the glasses.

Ultrasonic sensor: Sensor is a device which can use with the BASIC stamp to measure how faraway an object iswith a range of 3-3.3 m. Ultrasonic sensors are commonly used for a wide variety of noncontact presence, proximity or distance measuring applications. Sensor and verify that it gives echo time measurements that correspond to an object's distance (Batarseh *et al*., 1997).

Resistance: Resistance is a measure of the tendency of a material to resist the flow of an electrical current. It is dependent on the nature of the material, its thickness and length and on temperature. Resistance is low in substances such as metals that are good conductors and high in materials such as plastic and rubber that are insulators (Batarseh *et al*., 1997).

Arduino: Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button or a Twitter message and turn it into an output.

Activating a motor, turning on an LED, publishing something online. It is sending a set of instructions to the microcontroller on the board. It use the Arduino programming language (based on wiring) and the Arduino Software (IDE), based on processing (Wenqin *et al*., 2011) as shown in Fig. 2.

GP sensor (a710): Sharp infrared detectors and rangers boast a small package, very low power consumption and a variety of output options. In order to maximize each sensor's potential, it is important to understand how these types IR sensors work, their effective ranges and how does interface between them (Hu *et al*., 2009; Innet and Ritnoom, 2009). Others equipment jumb wire, light, micro SD card, charger, earphone, mini breadboard, glass cover.

MATERIALS AND METHODS

The proposed system: This study describes of all stages to connect the parts of hardware system. Algorithms used to implement the smart glasses will be explained. Next, the implementation and code details will be mentioned, the system's steps will be illustrated as shown in Fig. 3.

Algorithm of machines work: The idea of this device is to aid during walking in the roads if an obstacle is found for a distance of four meters, a sound will be issued as alarm,

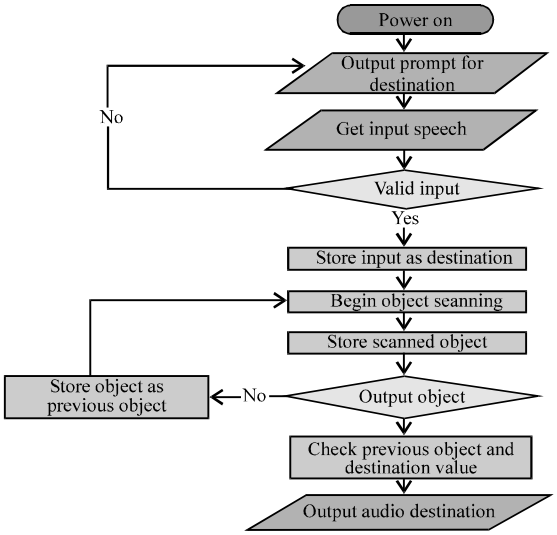

Fig. 3: Steps of proposed system

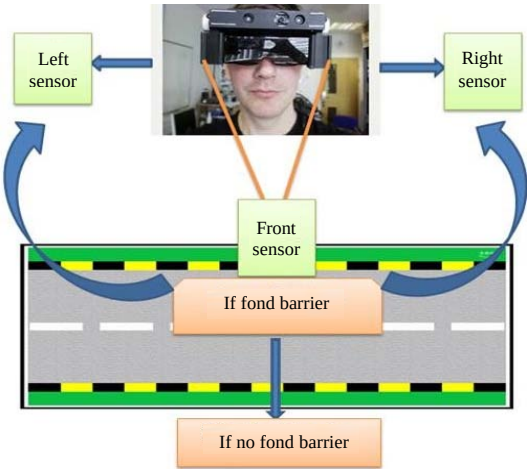

Fig. 4: Blind's system

then it will test the right and left directions by the corresponding sensors in order to makes sure if there are no obstacles on the right or left side, then the BP can follow the empty direction as shown in Fig. 4 (Sanfeliu *et al*., 2010; Hong *et al*., 2008).

Distance measuring: It's used to measure the high and low of the object that founded. If the distance more is than 4 m then send a voice message to keep walking. The goal of this research is to move BP from its initial point and reaches the desired point as shown in Fig. 5.

The distance Between Points BP (b_p) and desired point (d_p) is the length of the line between two object (BP and its destination) connecting them (b_p d_p) as:

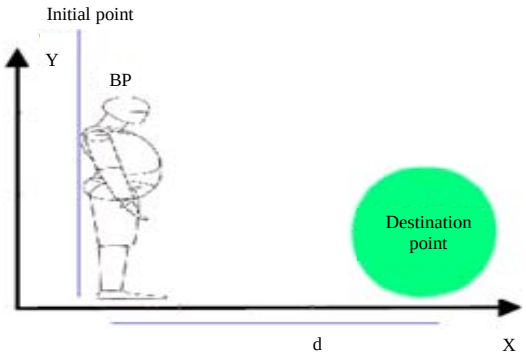

Fig. 5: Direction of blind people for its destination

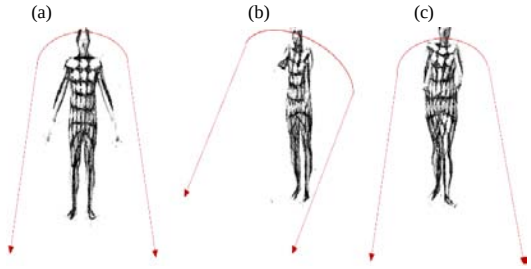

Fig. 6: a-c) Moving BP to a destination point

$$D(b_p, d_p) = \sqrt{\sum_{i=1}^{n} (b_p - d_p)^2}$$

where it measures the distance in 4 m to find the objects. Distance between (dis≥4 and dis<3 m) send a voice message to alert the user that there is an object is founded. Distance <2 m, send a voice message to stop, and change the direction of walking to right or left.

Program mechanism: All Arduino programs have two functions, setup and loop. The instructions of the setup function are executed once when the program begins and are used to initialize. Use it to set directions of pins or to initialize variables. The instructions placed in loop are executed repeatedly and form the main tasks of the program.

The control scheme for smart glasses directions extracted different behaviors of BP that need to be funded by our system, i.e., moving BP to a destination point which was checked by generating the required directions as shown in Fig. 6.

Ultrasonic sensor used to measure the height of the man, the holes and road obstacle, the right side and the left side, it contains of four pins first, one to send ultrasonic waves, one to receives ultrasonic. Finally, pin used as for a positive and for as negative pole. Ultrasonic sensor used the ultrasonic signals to detect the distance (Hu *et al*., 2009).

RESULTS AND DISCUSSION

The designed smart glasses are implemented and tested with different types of obstacles. The BP moves from initial point and follows a voice message to recognize some obstacles to get the destination point as shown in Fig. 7. The results to Table 1, that display the obtained resultsto provide directions and reflected a success for the proposed device as it can recognize six out of eight Barriers and obstacles, wall, tree, Hole, etc., by using smart glasses as shown in Fig. 8.

Table 1: Obtained results

Barriers and obstacles	Discover	Un discover
Wall	√	-
Tree	√	-
Hole	√	-
electricity pole	√	-
Stone	-	X
Glass wall	-	X
Car	√	-
Cubic cardboard	√	-

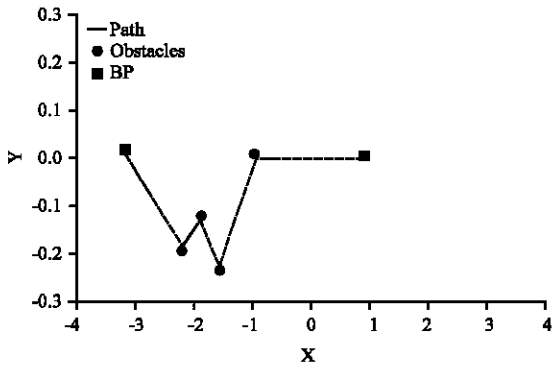

Fig. 7: Moving BP with obsticales

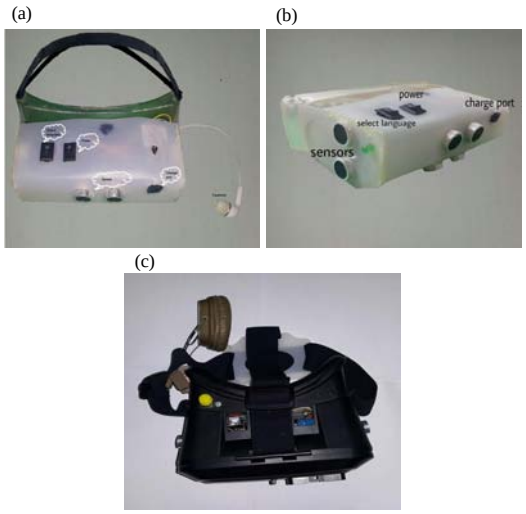

Fig. 8: Smart glasses

CONCLUSION

This research presented a system that proved to be very low cost solution to BP worldwide. There are some conclusion in this research as following. The proposed system enables design smart glasses, using a newconcept of smart electronic in order to help blind people to find their way during walking. The advantage of the system lies in the fact that it can prove to bevery low cost solution to blind people. Provides solution by making navigation more safe and secure. Solve the problems faced by the BP in their daily life. The system also takes measures to ensure their safety. Using programing language Micro C' code was very efficient for voice system. In this system, there were some difficulties in terms of application and provide some parts of the hardware.

SUGGESTION

For future research, we sugust to reduce the size of the device to become more comfortable to wear by blind people.

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