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Conception of Third Eye for Blind based Internet of Things IoT

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ABSTRACT: Visual impairment and blindness are two tasks of significant mobility difficulties in the people they affect. In an attempt to lighten the burden of these difficulties, various assistance devices have been imagined, designed, tested, and sometimes adopted. To make it easier for visually impaired people to get around, researchers have developed smart glasses. They integrate sensors, a geo-location system, and a camera responsible for collecting information on the nearby environment. The glasses are connected to a tablet which allows the person to be guided in their movements, to avoid static or moving obstacles or to recognize places, objects or even inscriptions. In this paper, we are thinking of adding technology that helps identify things and inform the blind user. Many studies and many recent projects tend the development of recent techniques by using the internet of things (IoT) to facilitate the communication of blind people with their environment and essentially the detection of things in front.The aim of our project for the visually impaired is an innovation that helps blind people navigate with speed and confidence by detecting nearby obstacles using ultrasonic waves and warning them with an audible or vibration signal. They only have to wear this portable device like a band or a cloth.

KEYWORDS: Internet of Things, Blind, portable device, visually impaired, ultrasonic waves.

I. INTRODUCTION

During the research work, one of the challenges of the 21st century is to help visually impaired and blind people to move around in their environment in order to facilitate their daily lives. Although many low vision conditions can be treated with medical advances, patients who cannot be helped by medicine can benefit from a revolutionary artificial intelligence system and assistive technology. The question at the heart of the work presented in the literature is the improvement of the mobility of visually impaired people. Mobility and reading are two of the biggest challenges for visually impaired people **[1]**. How to walk when you can't see? How to cross a road? How to buy what we need to live? How to find an object? Mobility is perhaps the area of human activity in which the difficulties associated with low vision are the most intuitive. Perhaps because the context in which able-bodied people meet – and notice – the most visually impaired people is the street, during their travels. Perhaps also because everyone has already had the experience at least once of moving around in absolute darkness, at night, or by closing their eyes. It is very difficult: after only a few steps, you no longer know where you are in a space that you have just "left" visually.

The World Health Organization (WHO) defines six levels of visual impairment affecting distance vision and one level affecting near vision **[2].** Visual impairment affecting distance vision interests us more, given its much greater impact on mobility. According to World Health Organization estimates, that 39 million people are blind worldwide. They suffer from many difficulties in their daily life. Today we are going to offer you a simple, inexpensive and easy application idea to be an effective solution to help the visually impaired based on internet of things **[3].**Our motivation is to create a wearable device for the visually impaired using ultrasound to detect obstacles followed by user notification via vibration or buzzer. The residual of this study is orderly as follows: we briefly present in section II some previous works; in section III presents the proposed technique for the visually impaired. Then we will detail the materials used for the test and the validation of our proposed wearable device. Then section IV presents the implementation of submitted wearable device. Finally, we would end up with a conclusion and submit some perspectives.

II. PREVIOUS WORKS

Visual impairment and blindness are sources of significant mobility difficulties in the people they affect. In an attempt to lighten the burden of these difficulties, various assistance devices have been imagined, designed, tested, and sometimes adopted. The design of such mobility assistance devices comes up against

The extent of the problem, located at the intersection of three already individually complex areas: visual impairment, mobility, and perception.The analysis of several types of assistance devices - classic canes, electronic, urban devices, and devices not directly dedicated to mobility. The researchers helped to highlight several angles of approach, according to the technical characteristics, the functionalities, the form, and dependence on an infrastructure. Taken together, they have made it possible to draw a general portrait of the existing systems. Alongside these fairly classic approaches, we propose a model for analyzing devices according to the way they fit into the perception and mobility process of people. This model has the advantage of being able to be applied, a priori, to all devices and of being both relevant in their evaluation and classification.

The "natural" knowledge of the mobility problems described above tends to come up against, in an intuitive representation of the situation, another aspect of the disability, leading to an incomplete if not distorted representation. Indeed, specific abilities can be acquired by some visually impaired people; these abilities, impressive for sighted people, partly compensate for the loss of vision. The most impressive is undoubtedly echolocation: some visually impaired people are able to "feel" the distance of objects **[4]**. If you think about it, this technique is not so much impressive because of its performance in absolute terms – vision is a much more effective tool – than because of the (false) impression of inaccessibility perceived by the sighted people.The first part of Diderot's letter on the blind (17th century) is devoted to the description of the prodigious capacities of a man born blind **[5]**.

In the Discourse on Method **[6**], Descartes mentions the use of a stick to perceive objects by blind people. Marion Chottin analyzed this text to bring it closer to recent developments in assistive devices **[7]**. The use made of the stick raises the question of its nature, and by extension that of the nature of modern systems. Descartes does not consider the stick as a replacement for vision, because it does not allow seeing, but neither does he consider perception with the stick to be of the same nature as common tactile perception **[7].** The stick is therefore a new form of perception, a "sixth sense". The stick is not considered by Descartes as a real organ but it is nevertheless very close, being "almost" one. It is not one because it is not a constituent part of the body, which for Descartes has a divine character. Thus, the mobility of the blind is very dependent on their memory: working memory, episodic memory **[8]**. It is also dependent on language because guidance by an attendant largely depends on verbal indications.

It is also dependent on language: firstly, because guidance by an accompanying person depends largely on verbal indications. Then, because it is probable that spatial memory is partly structured by language: Hermer-Vazquez showed that spatial orientation is linked, in certain circumstances, to the functions of language: thus, subjects tested were able to memorize certain information by memorizing a verbal encoding of the information **[9].** In addition, because of its structure similar to that of computerized systems, cognitive psychology interfaces well with issues related to electronic assistive devices. In the 1960s, Gibson proposed an approach that placed perception in a broader framework, postulating that it should be understood by analyzing how it achieves its "purpose" **[10]**; the word goal being understood here not in the sense of a will but in that which the theory of evolution and natural selection give it. Another approach **[11][12]** based on the possibilities of interactions is useful to us because it sheds light on the differences that may exist between normal human vision, perception in the absence of vision and, even more , perception with the help of an assistive device.The use of the stick as an assistive tool for visually impaired people seems very old. Descartes attests to its use in the Discourse on Method **[6]** (Fig.1).

And he speaks of it as a settled thing. Indeed, for a visually impaired person, using a stick as a tactile extension seems natural and it is difficult to see what could prevent someone from grabbing a piece of wood and using it in this way. The stick, the first assistive device, differs in this from most other subsequent assistive devices: its use does not depend on prior broad reflection. What is meant here by "expanded reflection", is a form of reflection that examines not the subject individually, but rather surrounded by a social and material environment. The direct practicality of using the stick seems relatively obvious, whatever the context, dispensing with the need for such reflection.

Fig.1. Reproduction of a plate from Descartes' Dioptrics in Diderot's Letter on the Blind; the plate dates from 1724 **[5]**

The use of dogs to help the visually impaired also seems ancient. Fishman mentions graphic representations found in Pompeii (1st century or earlier), in China in the 13th century, and a description in Western Europe, also in the 13th century **[13]**. In terms of reflection, compared to the use of a stick which can be direct, the training of a dog in order to assist a disabled person requires anticipation, because of the duration of the training and the analysis of cases that may be encountered.Since the 1960s, many electronic aids have been developed. Early work focused on improvements to the reference aid, i.e. the white cane. We call this category of aids "simple" electronic canes.

Electronic canes are designed as extensions of the traditional white cane (and stick), in their role of obstacle detection and identification that can be retained or not. Although not all of these aids take on the characteristic elongated shape or attach to standard canes, we call them canes because of their similar function. They take the form of a sensor to be held in the hand. Moreover, in this case, the name is not completely undeserved either because their use is very similar to that of a "virtual" cane. In this class, we group together two families of electronic aids identified by Brabyn **[14**] and Andò **[15].** On the one hand, there are the obstacle sensors indicating the presence of obstacles or, conversely, of free space, in a binary way or with an approximate distance. On the other hand, there are the environmental sensors, which indicate with much more precision the distance of the targeted surfaces, and make it possible to provide assistance to perception. Simple electronic rods are very numerous and seem, at first glance, similar. There are in fact important differences between them and this on all the points that characterize them. At least two aspects of the sensors have a strong influence on the function of the devices: the type or principle of the sensor and the opening of the detection cone. Three technologies dominate: ultrasonic sensors, infrared sensors and laser sensors.

Chang et al. proposed to use passive Radio Frequency Identification RFID tags to enrich the navigation of visually impaired people. Their device, called iCane, makes it possible to offer geographically contextual information to the user via a voice interface **[16][17].** The RFID tags each have an identifier and are placed on the ground at the location of points of interest. The person carries an on-board computer on which is installed a database which stores all the information on the tags: from an identifier, the system is thus able to provide the person with the data which is linked to the place (Fig.2). This indirect storage solution was chosen because of the difficulty of reading tags when they contain more information. Indeed, the reading must be robust despite the movement of the person holding the rod and despite the limited range of the tags.The major problem with the few existing systems is that the white cane can easily crack or break. The stick can get stuck in cracks in the pavement of various objects. So pet dog technology is very expensive (~$42,000).

Generally, all proposed technologies including smart devices have common and major drawbacks such that it cannot be transported easily and requires a lot of training to use. For this reason, we are going to offer a simple, inexpensive and easy application idea to be an effective solution to help the visually impaired.

Fig.2. the iCane cane from Chang et al [16]

III. THE PROPOSED TECHNOLOGY FOR BLIND

In this paper, we expose the suggested technology which is to make a wearable device for the visually impaired by using ultrasound to detect obstacles by receiving notification or signal for the blind user via vibration or buzzer.Our project for the visually impaired is an innovation that helps blind people navigate with speed and confidence by detecting nearby obstacles using ultrasonic waves and alerting them with an audible or vibrating signal. They just have to wear this device as a band or cloth (Fig.3).

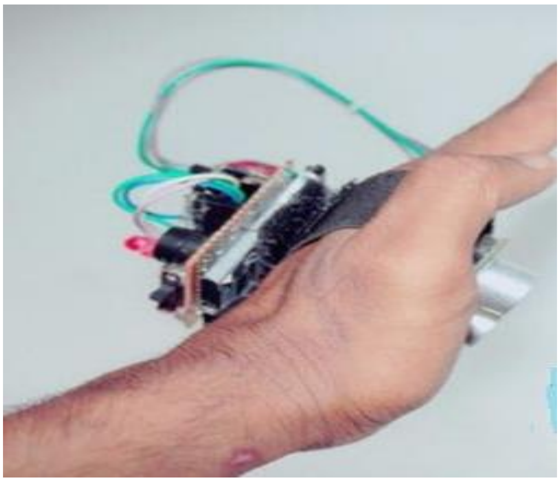

Fig.3. Proposed portable wearable device

to feed the movement of vibration, and which are called "vibrators".By wearing this device, they can completely avoid the use of the white cane and other devices. This device will help visually impaired to navigate without holding a stick, which is a bit boring for them. They can just wear it like a band or a cloth and it can work very precisely and they only need very little training to use it. By description of our proposed project, we have designed a wearable device based on an Arduinonano board, this device is equipped with five ultrasonic sensors, consisting of five units connected to different parts of the body.By using the five ultrasonic sensors, visually impaired people can detect objects in a five-dimensional view around them and can easily travel anywhere. When the ultrasonic sensor detects an obstacle, the device notifies the user with vibrations and beeps and the intensity of the vibrations and the beep rate increases with decreasing distance: it is a fully automated device (Fig.4).

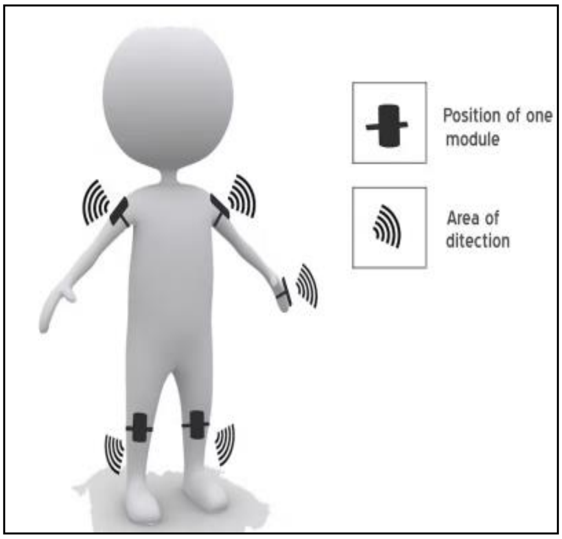

Fig.4. Used ultrasonic sensors

IV. THE PROTOTYPING

To realize this project idea we used mainly the following materials (Fig.5).:Arduino Nano: an even smaller version of the Arduino powered by USB and using an ATmega168 or ATmega328 from CMS type.

1- Arduino Nano: an even smaller version of the Arduino powered by USB and using an ATmega168 or ATmega328 from CMS type.
2- Motor of Vibration: It is these motors which have the role
3- Buzzer: is a component consisting essentially of a lamella reacting to the piezoelectric effect
4- ultrasound sensor: are devices that use these frequencies for presence detection and/or to calculate the distance to a distant object.
5- Red LEDs
6-Switch
7- Male and female header pins
8- Cable
9- Battery

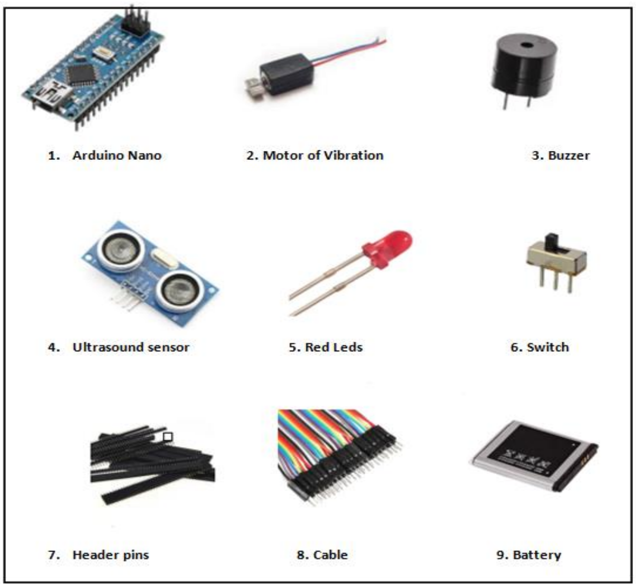

Fig.5. The materials needed for the proposed application

To make the diagram of the circuit (Fig.6) for the proposed application, follow the instructions below:

- Put the GND of LED, buzzer and VIBRATION MOTOR to GND of Arduino.
- Put the LED vcc and 2nd switch pin to Arduino pin 5.
- Put the vcc from Buzzer to the first switch pin.
- Put the vibration motor vcc towards 3rd switch oin.

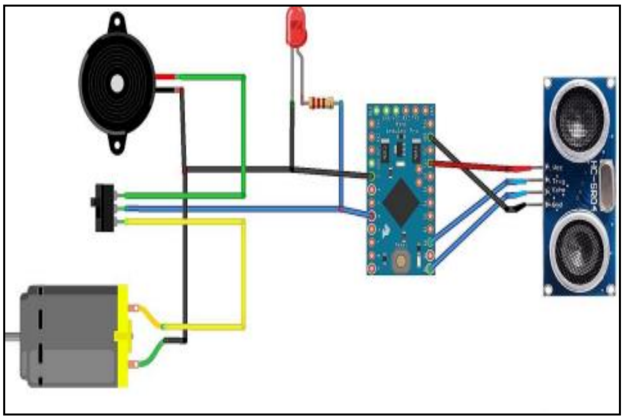

Fig.6. Circuit diagram

- The ultrasonic sensor pin VCC - Arduino pin VCC.
- The pin GND ultrasonic sensor - Arduino pin GND.
- The ultrasonic sensor pin Trig - Arduino pin 12.
- The ultrasonic sensor pin Echo - Arduino PIN 12.

The switch used here is used to select the mode. (Buzzer or vibration mode.)

Regarding the task of connecting the materials used, the following welding steps can be followed: solder the female heads for the Arduino to the card. Then solder the buzzer. Connect the vibration motor using the glue gun and solder wires. Thus, connect the Led and the switch. Next, connect the header pins for the ultrasonic sensors and for the battery input.

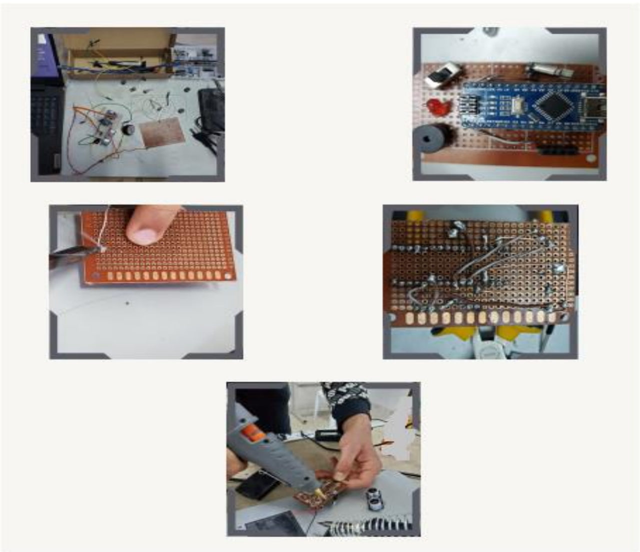

Fig.7. Module creation

We get the soldering as shown in the circuit diagram (Fig.6). And finally connect the Arduino and ultrasonic sensor to the board.We conceptualized and implemented a feature allowing visually impaired people to interact with smart objects by producing a portable, easy to use and less expensive device.

We have tested our product well; it is working in good state with the favorable conditions.

To synthesize the proposed idea has been well realized and tested, when we wear the bracelet, we can detect the objects in front of us with the sound signal which increases more and more according to our distance from the object.

V. CONCLUSION

In this paper, we are interested in the creation of an electronic help mobility of visually impaired people. This general issue is broad, and we first had to define the framework in which we carried out our work: choice of a mobility model, explanation of the type of visual impairment targeted, and overview of the different approaches to the study perception. This framework allowed us to analyze a fairly wide variety of existing devices, from several angles: in relation to their functions, their technologies, their interfaces with the person, but also their perceptual positioning.The work of the proposed project focuses on a new subject The Internet of Things (IoT) and to realize an intelligent system of detection of things to through which we can help visually impaired people through this device and we hope to develop it through new technologies as we mentioned earlier.Our visually impaired project is an innovation that helps blind people navigates with speed and confidence by detecting nearby obstacles using ultrasonic waves and warning them with a sound or vibration signal. They just have to wear this device as a band or cloth.We conceptualized and implemented a feature allowing visually impaired people to interact with smart objects by producing a portable, easy to use and less expensive device.In the future, we want to develop our project and do it based on artificial intelligence to identify things via machine learning.As we can add technology that helps identify things and inform the user, thus analyze, identify, detect, categorize and qualify images in a machine learning way.

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