# PSEUDO EYE FOR VISUALLY IMPAIRED USING ARTIFICIAL INTELLIGENCE – PROTOTYPE

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**Abstract-The project presents a smart electronic aid for blind people. The system is intended to provide overall measures-Artificial vision, object detection and instant location tracking with emergency alert. Blind people frequently have no knowledge of outdoor obstacles and need guidance in order to avoid colliding risks. The aim of this research is to develop a system for helping blind people in outdoor navigation. The proposed system will be able to reduce the obstacle collision risks by enabling users to walk outside smoothly with voice awareness .The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of objects using Artificial intelligence (AI). Ultrasonic sensor is used to calculate distance of the objects around the blind person to guide the user voice and vibration, which the blind person can hear and feel. The camera is used to detect the object in front of the blind people and alert them using APR voice module. This project employs an image Artificial intelligence (AI) of pre-trained objects on the Image AI dataset using machine learning. A camera, aligned with the systems pre-determined orientation, serves as input to a computer system, which has the object recognition to carry out real-time object detection. Output from the network can then be parsed to present to the visually impaired person in form of audio. Proposed solution is not limited to any specific environment and provides the voice aids about surrounding obstacles for users.**

**Keywords: Artificial intelligence (AI), Machine learning, visually impaired people, object detection, object recognition, Location tracking.**

## I. INTRODUCTION

The human eye is like a camera that collects, focuses, and transmits light through a lens to create an image of its surroundings. In a camera, the image is created on film or an image sensor. In the eye, the image is created in the retina, a thin layer of light-sensitive tissue at the back of the eye. Like a camera, the human eye controls the amount of light that enters the eye. The iris (the colored circular part of the eye) controls the amount of light passing through the pupil. It closes up the pupil in bright light and opens it wider in dim light. The cornea is the transparent, protective surface of the eye. It helps focus light, as does the lens, which sits just behind the iris. When light enters the eye, the retina changes the light into nerve signals. The retina then sends these signals along the optic nerve (a cable of more than 1,000,000 nerve fibres) to the brain. Without a retina or optic nerve, the eye cannot communicate with the brain, making vision impossible.

Visual impairment is also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems not fixable by usual means, such as glasses and lenses. Visual impairment is often coined as a best corrected visual acuity of worse than either 20/40 or 20/60. The term blindness is usually used for complete or nearby complete vision loss. The World Health Organization (WHO) estimates that around 80% of visual impairment is either preventable or curable with appropriate treatments. It also includes glaucoma, diabetic retinopathy, childhood blindness, trachoma, cataract, the infections river blindness. Many people with visual impairment benefits from vision rehabilitation through assistive devices [1]. In order to provide the visually impaired people hearable environment, this project focus on the field of assist device for blind people.

Pseudo eye is the automated navigation system for the blind people in the complex environment, whether indoor or outdoor, through a user friendly interface .With the advancement in AI technology usage of image recognition, voice recognition and path navigation system will enhance the blind people mobility. By combining the IOT and AI where IOT deals with the providing data with various sensors and the artificial intelligence make informative decisions about what has been seen. Here the device can detect multiple objects and returns feedback with voice output and vibration. The whole system is controlled by Arduino microcontroller. This prototype uses various sensors like ultrasonic sensor, camera module, GSM, GPS, emergency alert which helps the system module to gather the required data. Hence this project AI based system offer a simple electronic guidance vision system that helps the blind to be highly self independently assisting there mobility.

## II. ARCHITECTURE AND WORKING THEORY

A system architecture is the conceptual model of the project which defines the structure behavior and functionality. It also expresses how the sensor will communication with each other for the desired output. The architecture of the system consists of components of the system and the systems developed, that will work together to utilize the overall system. The system is designed to give full, total navigation and path planning to the individual about is environment. It guides the individual along obstacle free path and also gives information about appropriate or obstacle free/ clear path, including distance between obstacles, with the use of sensors based system. It also as a Tele-assistance/Tele-guidance system which is a remote human guide, in which the visually impaired uses a camera and GPS to aid real time assistance. The proposed system consists of the hardware and the software module as shown in the figure 1. They are multiple object detection using artificial intelligence and the hardware interface in order to identify the distance and location of the user [2].

The whole system is controlled by Arduino microcontroller. This prototype uses various sensors like ultrasonic sensor, camera module, GSM, GPS, emergency alert which helps the system module to gather the required data. In addition to this voice/playback module is used were once the object detected will convert into voice. The microcontroller is used to communicate with all sensor. It then processes the collected data and convert the information which delivered to the end user, while the ultrasonic sensor get the data about the distance of the object at regular intervals.

The emergency button is provided to the user in case of emergency if user click the button then the alert message immediately go to the caretaker and the doctor and location of the user will be track. Camera module plays an important role to take pictures which is then processed using image processing to detect or visualize the object. the pin configuration of the system has been shown in figure 2. These multi object detection is made using AI was it involves two major tasks: image classification, object detection. All the information are processed and converted into voice using voice /playback module which delivers this model of AI based on the navigation tool for blind which benefits the visually impaired people to help in their day to day life. These pseudo eye provide the visually impaired people to visualize the information to end user in his/her ear using headphones.

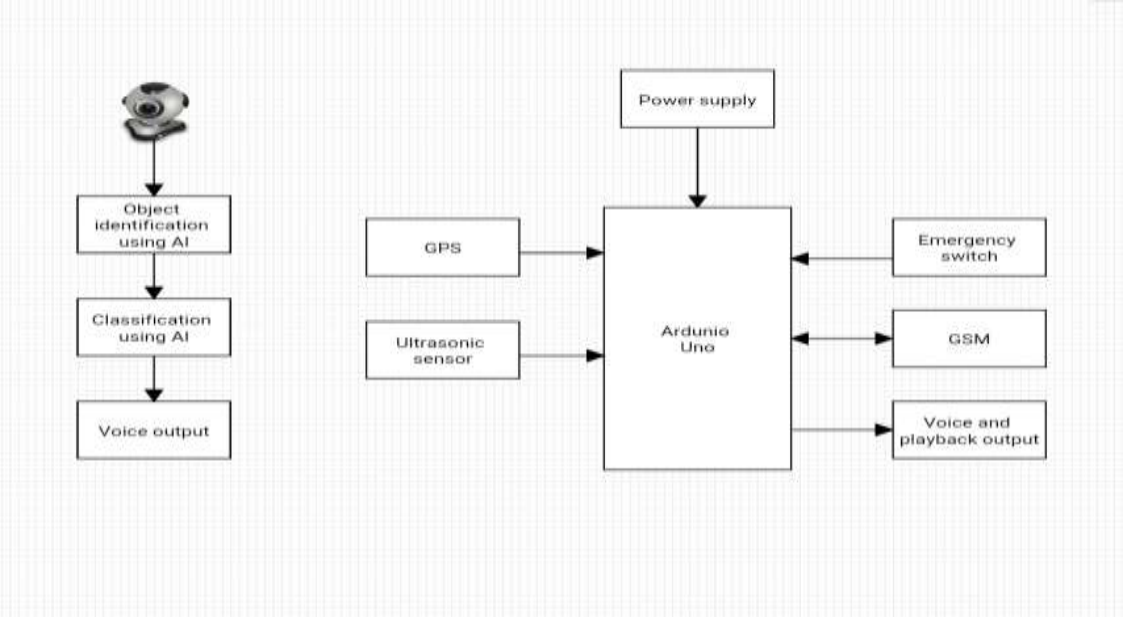


Figure1. Block Diagram

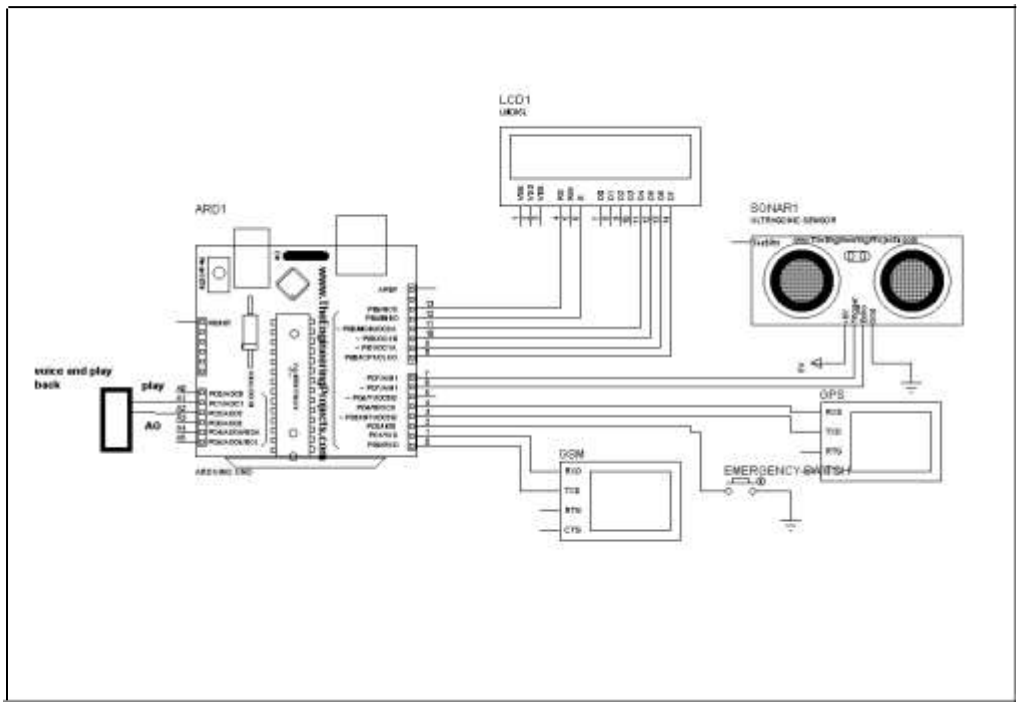


Figure 2. Pin Configuration

## III. HARDWARE AND SOFTWARE MODULE

**Power Supply**: The supply of power for our system is given by 12v and 5v. The MCU is given supply of 12V of current. A 5V is generated by using a voltage regulator. 5V is fed to the emergency button module. They are both needed and are fed with the power supply.

**Emergency Button**: They are interconnected to the microcontroller. The switch when inactive state means it's in neutral state. In case of emergency once if the button is pressed of our system perform as it goes to active state which sends to MCU which turn on the selection of modes.

**Ultrasonic Sensor**: The sensor module is designed by using Ultrasonic sensor. This sensor module transmits a sound wave into the surrounding continuously. When it detects an obstacle, sound waves are sent back to the sensor. Meanwhile the sensor collects reflected wave and give appropriate signal by the sensor.

This signal is interpreted by the microcontroller in its right form, which are the output to user. Thus, there are sections covered by the use of the sensor mode. The sensor system can be placed anywhere on the user to detect and provide obstacle free path [3].

**Arduino UNO:** The microcontroller unit which is the ATMEGA328P microcontroller. This is basically the main component of the system. Each instruction given applied towards the proposed system are decided by MCU. The MCU acquires signals given by the sensor and translates into the right form and are used by the output mode to guide or is environment.

**Navigation Mode**: The three main components used to send GPS location via SMS and call using GSM and Arduino. Here we are sending the live coordinates received by the GPS receiver module to mobile phone via SMS and call using GSM module.

- **GPS (Global Positioning System)**:GPS is a system used as the navigation tool. The working principle here is when the emergency alert switch is clicked by the user. Automatically GPS will be activated immediately the signal receive by the receiver to figure out where the user is exactly located. A GPS receiver module is a device that receives information from GPS satellites and obtain the geographical position of the device.
- **GSM (Global System Of Mobile Communication):** A GSM module is a device used to establish communication over a mobile network. GSM or GPRS Module requires a SIM card to operate or to register a connection with the network operator or service provider. The GPS receiver obtains the data as a whole NMEA format text. Only the latitude and longitude coordinates are taken from it, using the Arduino Tiny GPS library. Then the GSM module sends SMS to the number specified in the code followed by the call to the specified number.

**Display Module:**

- **LCD Display**: LCD (Liquid Crystal Display) screen is an electronic display module were it has been interfaced with the Arduino. The purpose of the display is once the obstacles is detected by the sensor it will automatically show the display output as OBSTACLE DETECTED [4].
- **Voice Module**: The voice module is further followed by the display. When the display shows the output the voice module will produce voice that the obstacles has been detected.

**Camera:** It plays an important role to take pictures which is then processed using image processing to detect or visualize the object.

**Multi Object Detection**: It involves two major tasks.

**Image Classification:** In FastAI model is an ImageDatabunch object. The Data bunch object consists of a variety of datasets including training, validation, and testing (optional) datasets. These datasets need to be normalized (using the normalized function) to make the entire data of the same size. In case of images, normalization means making the mean and standard deviation(std) same for all the images, that is, the pixel values of the three channels(red, green, blue) gets normalized it focuses on grouping of an image into predefined category. To achieve this, we need to have multiple images with the class that is of interest to us and train a computer to essentially convert pixel number to symbols. This is just saying the computer sees a photo of a person and says there is a person in it [5].

**Object Detection**: Using python as the programming language in Google Colaboratory. Google Drive is the default location for many operations in Colaboratory and can always choose it as a destination. When working with Drive, a list of files similar to those shown above. To open a particular file, you click it's link in the dialog box. The file opens in the current tab of your browser. If we want to use the downloadable source for any local source, we select the Upload tab of the dialog box. In the center is a single button, Choose File. Clicking this button opens the File Open dialog box for your browser. we locate the file you want to upload, just as you normally would for opening

any file. Further once the code get compiled as soon as the object gets detected it will produce the voice of the object that became an obstacles. If the obstacle gets detected as person the code gets complied and provide the output the word person as voice so that visually impaired can hear what obstacle is present in front of them [4]. Once the predefined set matches the input data set then the image captured by camera is converted into voice output.

## IV. RESULT AND DISCUSSION

The PSEUDO-EYE for visually impaired is developed and integrated as per the design documented in this section. The system is implemented using sonar sensors, voice module and camera as the hardware base, is used to program the hardware and multi object detection using artificial intelligence is used to setup and run the object detection model. The system has separated components, sonar sensor, voice module, display and camera which work simultaneously. once the system starts processing all the component will perform their task to provide output. For object detection, artificial intelligence provides framework to control the camera and perform object detection.

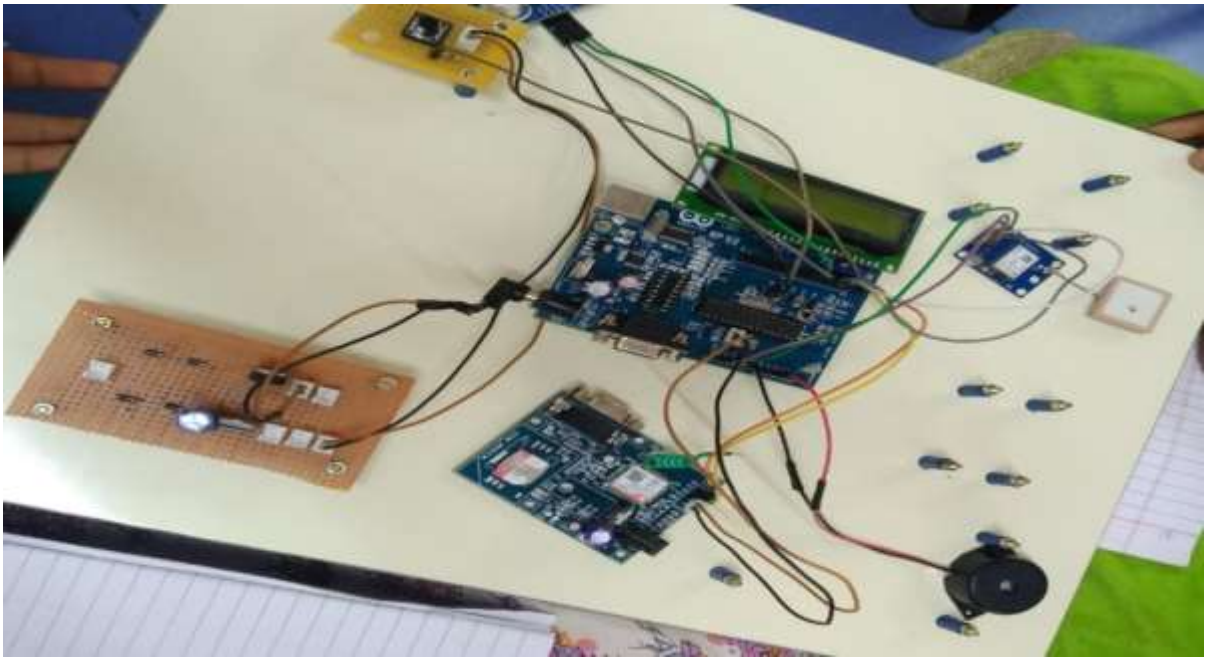

Figure 3. Pseudo Eye Hardware Kit

The presented system is designed and configured for practical use. The system is able to handle states that may face the blind people. The system will respond to each state according to a specific program which is coded and installed in the Arduino microcontroller.

**Detection of the object**:

It involves ultrasonic sensor, LCD display and headphones. When the obstacle is detected by the sensor then immediately the voice will be played on the headphones as “the obstacles is detected” followed by the LCD display which will display as obstacle is detected.

**Emergency alert:**

If the patient know that he/she will be unconscious or some other relatable problems they can press the emergency button. When the emergency button is pressed, automatically the process forward to GPS and GSM where first the call will be sent to the care takers followed by the message to the care taker as “emergency alert” and the LOCATION OF THE PERSON link through google map will be given. Once the link is clicked, the caretaker can exactly figure out the place where the patient is located.

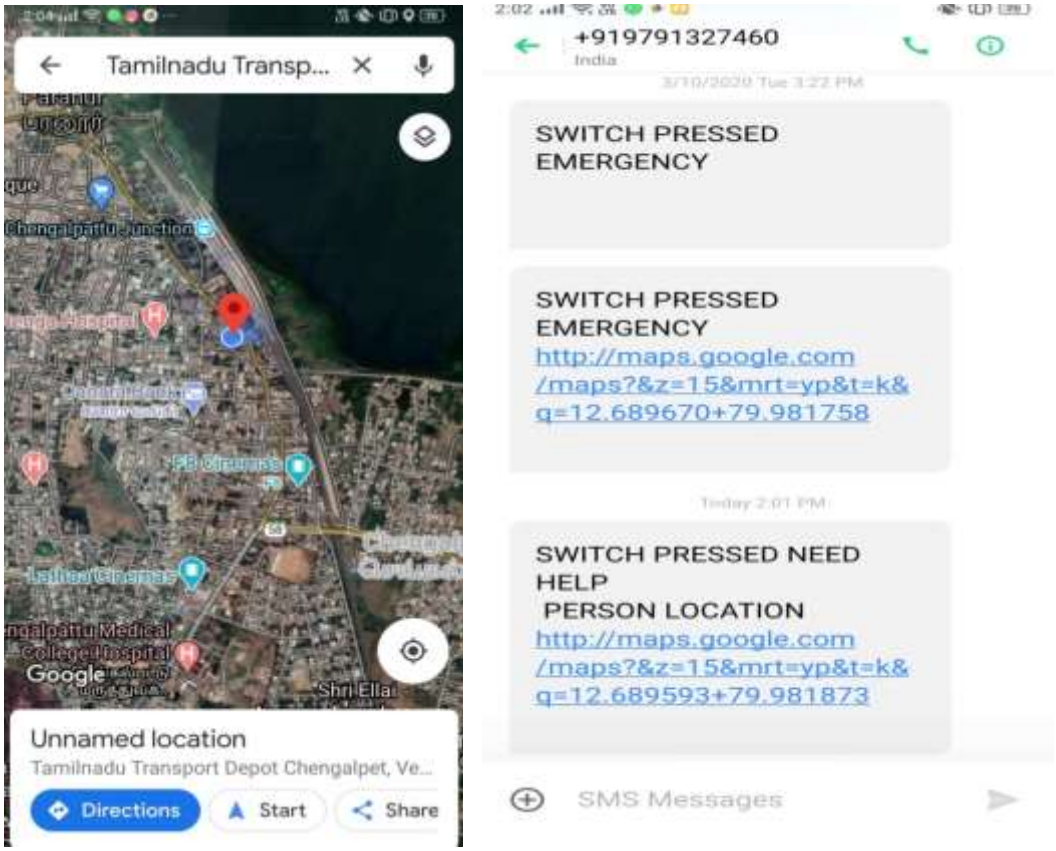


Figure 4. GPS location tracking and GSM message to care taker.

**Detect what the object is: (using AI)**

The camera will capture the object using AI. Basically whenever machine process raw visual input- such as jpeg or camera feed it is using the computer vision to understand what it is seeing. It is easiest to think the computer vision is the part of the human brain that information. Object detection is used by a number of pre-collected object datasets such as google open images that are readily available along with the pre trained model for the identifying only fix site of items.

To train the dataset we used google collab by the following steps of progress as preparing the dataset, installing imageAI and dependencies, initiate the detection, evaluate the models, detect the object in the image.

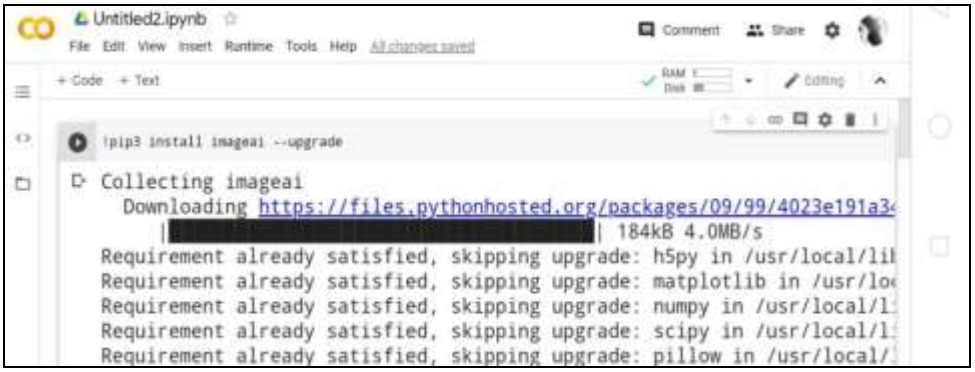


Figure 5. Code complied in Google colaboratory.

## V. CONCLUSION AND FUTURE WORK

In today's world, disability of any kind for any person can be hard and it is the same case with blindness. Blind people are generally left underprivileged. It is very difficult to give a vision to a blind person. In this system, a new AI based system called PSEUDO-EYES for visually impaired to control the navigation of a blind person has been proposed and developed.

This AI based system offers a simple electronic guidance embedded vision system which is configurable and efficient. The system helps blind and visually impaired people to be highly self-dependent by assisting their mobility regardless of where they are; outdoor or indoor.

Results show that all the sensors work properly and give accurate readings, though the range of the prototype sensors is not high. The system performed three main tasks of image recognition, collision detection and obstacle detection allowing the user to navigate his route independently. It is able to scan areas left, right, back and in front of the blind person regardless of its height or depth. A simple, cheap, configurable, easy to handle the prototype system is proposed to provide constructive assistant and support for blind and visually impaired persons.

The results indicate that the system is efficient and unique in its capability in specifying the source and distance of the objects that may encounter the blind. Therefore, the ultrasonic sensor has been fully utilized in order to advance the mobility of the blind and visual impaired people in safe and independent way. Also it is used in order to track the location of the patients and allow the person to know the exact location of patients through GSM and GPS. This system also resolves limitations that are related to the most of the movement problems that may influence the blind people in their environment. The results show that the solution is useful and usable to guide the user in environments.

## REFERENCES

[1] Hu, Menghan, Yuzhen Chen, Guangtao Zhai, Zhongpai Gao, and Lei Fan. "AN OVERVIEW OF ASSISTIVE DEVICES FOR BLIND AND VISUALLY IMPAIRED PEOPLE." *International Journal of Robotics and Automation* 34, no. 5, 2019.

[2] Tian, Long, Yingli Tian, and Chucai Yi. "Detecting good quality frames in videos captured by a wearable camera for blind navigation." In *2013 IEEE International Conference on Bioinformatics and Biomedicine*, pp. 334-337. IEEE, 2013.

[3] Moreno, M., Somayeh Shahrabadi, João José, JM Hans du Buf, and João MF Rodrigues. "Realtime local navigation for the blind: detection of lateral doors and sound interface." *Procedia Computer Science* 14: 74-82, 2012.

[4] Rizzo, John-Ross, Yubo Pan, Todd Hudson, Edward K. Wong, and Yi Fang. "Sensor fusion for ecologically valid obstacle identification: Building a comprehensive assistive technology platform for the visually impaired." In *2017 7th International Conference on Modeling, Simulation, and Applied Optimization (ICMSAO)*, pp. 1-5. IEEE, 2017.

[5] Aladren, Aitor, Gonzalo López-Nicolás, Luis Puig, and Josechu J. Guerrero. "Navigation assistance for the visually impaired using RGB-D sensor with range expansion." *IEEE Systems Journal* 10, no. 3: 922-932, 2014.

[6] Dakopoulos, Dimitrios, and Nikolaos G. Bourbakis. "Wearable obstacle avoidance electronic travel aids for blind: a survey." *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)* 40, no. 1: 25-35, 2009.