**ABSTRACT**

Visual impairment is one of the issues that several millions of people suffer from. They go through a lot of difficulties even to complete the basic chores. Even in their own home or office the struggle to navigate from one place to another without being dependent on anybody. As per the data from WHO (world health organisation) there are around 250+ million people with visual disablement out of which nearly 35+ million are totally blind which constitute a huge part of the population. The "Blind Assist System Using ML and Image Processing" is a cutting-edge technological solution aimed at empowering visually impaired individuals to navigate their surroundings with greater autonomy and safety. This innovative system relies on the integration of Machine Learning (ML) and Image Processing techniques to enhance the sensory capabilities of individuals who are blind or visually impaired. By capturing and analysing real-time visual data from the environment, the system employs ML algorithms to identify and categorize objects and obstacles in the user's path. It then translates this information into actionable guidance, providing auditory or tactile feedback to the user through wearable devices like smart glasses. This abstracts the visual world into comprehensible data, thus enabling visually impaired individuals to make informed decisions and move confidently in their surroundings while avoiding potential hazards. The "Blind Assist System Using ML and Image Processing" represents a significant leap in assistive technology, promising greater independence and safety for those with visually impairments.

**INTRODUCTION**

Visually impaired people or in other words especially unable people are the ones who face a lot of difficulties even to accomplish their daily routine chores. Most of them even though they don’t want, have to rely on other people for some kind of help. There are thousands of technologies being developed or have been developed for the assistance of these people. Computer vision being one of these technologies is providing the most promising solute. Blind people find hard time navigating around the street. Due to their inability to see world, they are often in danger of getting hit by obstacle and vehicle.

Eyesight is one of the essential human senses, and it plays a significant role in human perception about the surrounding environment. For visually impaired people to be able to provide, experience their vision, imagination mobility is necessary. The International Classification of Diseases 11 (2018) classifies vision impairment into two groups, distance and near presenting vision impairment.[6] Globally, the leading causes of vision impairment are uncorrected refractive errors, cataract, age-related macular degeneration, glaucoma, diabetic retinopathy, corneal opacity, trachoma, and eye injuries. It limits visually impaired ability to navigate, perform everyday tasks, and affect their quality of life and ability to interact with the surrounding world upon unaided. With the advancement in technologies, diverse solutions have been introduced such, as the Eye- ring project, the text recognition system, the hand gesture, and face recognition system, etc. However, these solutions have disadvantages such as heavyweight, expensive, less robustness, low acceptance, etc. [2] hence, advanced techniques must evolve to help them. So, we propose a system built on the breakthrough of image processing and machine learning. The proposed system captures real-time images, then images are pre-processed, their background and foreground are separated and then the DNN module with a pre-trained YOLO model is applied resulting in feature extraction. The extracted features are matched with known object features to identify the objects. Once the object is successfully recognized, the object name is stated as voice output with the help of text-to-speech conversion. The key contributions of the paper include:

* Robust and efficient object detection and recognition for visually impaired people to independently access familiar and unfamiliar environments and avoid dangers.
* Offline text-to-speech conversion and speech output.

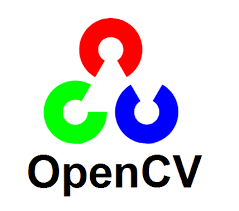
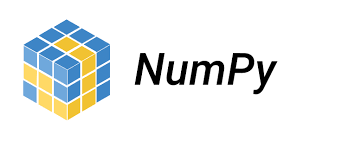
**MACHINE LEARNING**

Machine learning (ML) is a [field of study](https://en.wikipedia.org/wiki/Field_of_study) in [artificial intelligence](https://en.wikipedia.org/wiki/Artificial_intelligence) concerned with the development and study of [statistical algorithms](https://en.wikipedia.org/wiki/Computational_statistics) that can effectively [generalize](https://en.wikipedia.org/wiki/Generalize) and thus perform tasks without explicit instructions. Recently, generative [artificial neural networks](https://en.wikipedia.org/wiki/Artificial_neural_network) have been able to surpass many previous approaches in performance. Machine learning approaches have been applied to [large language models](https://en.wikipedia.org/wiki/Large_language_model), [computer vision](https://en.wikipedia.org/wiki/Computer_vision), [speech recognition](https://en.wikipedia.org/wiki/Speech_recognition), [email filtering](https://en.wikipedia.org/wiki/Email_filtering), [agriculture](https://en.wikipedia.org/wiki/Agriculture) and medicine, where it is too costly to develop algorithms to perform the needed tasks.

The mathematical foundations of ML are provided by [mathematical optimization](https://en.wikipedia.org/wiki/Mathematical_optimization) (mathematical programming) methods. [Data mining](https://en.wikipedia.org/wiki/Data_mining) is a related (parallel) field of study, focusing on [exploratory data analysis](https://en.wikipedia.org/wiki/Exploratory_data_analysis) through [unsupervised learning](https://en.wikipedia.org/wiki/Unsupervised_learning).

ML is known in its application across business problems under the name [predictive analytics](https://en.wikipedia.org/wiki/Predictive_analytics). Although not all machine learning is statistically based, [computational statistics](https://en.wikipedia.org/wiki/Computational_statistics) is an important source of the field's methods.

**OpenCV and NumPy:**

**** ****

OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays

**LITERATURE SURVEY**

1. **Assisting Blind People Using Object Detection with Vocal Feedback**

**Publisher: IEEE**

[**Heba Najm**](https://ieeexplore.ieee.org/author/37089465284)**;** [**Khirallah Elferjani**](https://ieeexplore.ieee.org/author/37089463560)**;** [**Alhaam Alariyibi**](https://ieeexplore.ieee.org/author/37089462947)

**Abstract:**

For visually impaired people, it is highly difficult to make independent movement and safely move in both indoors and outdoors environment. Furthermore, these physically and visually challenges prevent them from in day-to- day live activities. Similarly, they have problem perceiving objects of surrounding environment that may pose a risk to them. The proposed approach suggests detection of objects in real-time video by using a web camera, for the object identification, process. You Look Only Once (YOLO) model is utilized which is CNN-based real-time object detection technique. Additionally, The OpenCV libraries of Python is used to implement the software program as well as deep learning process is performed. Image recognition results are transferred to the visually impaired users in audible form by means of Google text-to-speech library and determine object location relative to its position in the screen. The obtaining result was evaluated by using the mean Average Precision (mAP), and it was found that the proposed approach achieves excellent results when it compared to previous approaches.

Published in: [2022 IEEE 2nd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA)](https://ieeexplore.ieee.org/xpl/conhome/9837334/proceeding)

[**https://ieeexplore.ieee.org/document/9837737**](https://ieeexplore.ieee.org/document/9837737)

1. **Robot Eye: Automatic Object Detection And Recognition Using Deep Attention Network to Assist Blind People**

**Publisher: IEEE**

[**Ervin Yohannes**](https://ieeexplore.ieee.org/author/37088598578)**;** [**Paul Lin**](https://ieeexplore.ieee.org/author/37088601195)**;** [**Chih-Yang Lin**](https://ieeexplore.ieee.org/author/37597041000)**;** [**Timothy K. Shih**](https://ieeexplore.ieee.org/author/37269251200)

**Abstract:**

Detection and Recognition is a well-known topic in computer vision that still faces many unresolved issues. One of the main contributions of this research is a method to guide blind people around an outdoor environment with the assistance of a ZED stereo camera, a camera that can calculate depth information. In this paper, we propose a deep attention network to automatically detect and recognize objects. The objects are not only limited to general people or cars, but include convenience stores and traffic lights as well, in order to help blind people cross a road and make purchases in a store. Since public datasets are limited, we also create a novel dataset with images captured by the ZED stereo camera and collected from Google Street View. When testing with images of different resolutions, our method achieves an accuracy rate of about 81%, which is better than naive YOLO v3.

Published in: [2020 International Conference on Pervasive Artificial Intelligence (ICPAI)](https://ieeexplore.ieee.org/xpl/conhome/9302522/proceeding)

[**https://ieeexplore.ieee.org/document/9302726**](https://ieeexplore.ieee.org/document/9302726)

1. **Visual Assistance for Blind Using Image Processing**

**Publisher: IEEE**

[**B Deepthi Jain**](https://ieeexplore.ieee.org/author/37086507915)**;** [**Shwetha M Thakur**](https://ieeexplore.ieee.org/author/37086508363)**;** [**K V Suresh**](https://ieeexplore.ieee.org/author/37684712700)

**Abstract:**

Visually impaired people face lot of difficulties in their daily life. Many a times they rely on others for help. Several technologies for assistance of visually impaired people have been developed. Among the various technologies being utilized to assist the blind, Computer Vision based solutions are emerging as one of the most promising options due to their affordability and accessibility. This paper proposes a system for visually impaired people. The proposed system aims to create a wearable visual aid for visually impaired people in which speech commands are accepted from the user. Its functionality addresses identification of objects and sign boards. This will help the visually impaired person to manage day-to-day activities and to navigate through his/her surroundings. Raspberry Pi is used to implement artificial vision using python language on the Open CV platform.

**Published in:** [2018 International Conference on Communication and Signal Processing (ICCSP)](https://ieeexplore.ieee.org/xpl/conhome/8501332/proceeding)

<https://ieeexplore.ieee.org/document/8524251>

1. **Design and Implementation of Obstacle Detection and Warning System for Visually Impaired People**

**Publisher: IEEE**

[**Yusuf Sahabi Lolo**](https://ieeexplore.ieee.org/author/37089434685)**;** [**Kelechi Lawrence Ohammah**](https://ieeexplore.ieee.org/author/37089435243)**;** [**Amina Nna Alfa**](https://ieeexplore.ieee.org/author/37089433240)**;** [**Sadiq Abubakar Mohammed**](https://ieeexplore.ieee.org/author/37089434374)**;**

**Abstract:**

Environmental information assists human beings to learn about the source that surround them, most visually impaired people make extensive use of the auditory environment not just to determine the presence of an obstacle, but also to successfully makeover around it. This paper discusses various methods for improving blind people’s navigation by utilizing readily available technologies. The system includes the ability to detect obstacles for collision avoidance, as well as the ability to detect objects in up, down, and front directions using ultrasonic sensor. The other sensor detects water on the ground and is located near the bottom tip of the walking cane. The system’s whole operation is controlled by a microcontroller-based circuit. In the case of a crisis or loss, the technology also allows the blind person to send an SMS message with his or her GPS position to the caretaker or family. These sensors are critical in detecting objects in all directions, allowing blind persons to be self- sufficient.

Published in: [2022 IEEE Nigeria 4th International Conference on Disruptive Technologies for Sustainable Development (NIGERCON)](https://ieeexplore.ieee.org/xpl/conhome/9802998/proceeding)

<https://ieeexplore.ieee.org/document/9803138>

1. **Visual Assistance for Blind Using Image Processing**

**Publisher: IEEE**

[**B Deepthi Jain**](https://ieeexplore.ieee.org/author/37086507915)**;** [**Shwetha M Thakur**](https://ieeexplore.ieee.org/author/37086508363)**;** [**K V Suresh**](https://ieeexplore.ieee.org/author/37684712700)

**Abstract:**

Visually impaired people face lot of difficulties in their daily life. Many a times they rely on others for help. Several technologies for assistance of visually impaired people have been developed. Among the various technologies being utilized to assist the blind, Computer Vision based solutions are emerging as one of the most promising options due to their affordability and accessibility. This paper proposes a system for visually impaired people. The proposed system aims to create a wearable visual aid for visually impaired people in which speech commands are accepted from the user. Its functionality addresses identification of objects and sign boards. This will help the visually impaired person to manage day-to-day activities and to navigate through his/her surroundings. Raspberry Pi is used to implement artificial vision using python language on the Open CV platform.

Published in:[2018 International Conference on Communication and Signal Processing (ICCSP)](https://ieeexplore.ieee.org/xpl/conhome/8501332/proceeding)

<https://ieeexplore.ieee.org/document/8524251>

1. **Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification**

**Publisher: IEEE**

[**Usman Masud**](https://ieeexplore.ieee.org/author/37590652200)**;** [**Tareq Saeed**](https://ieeexplore.ieee.org/author/37089285658)**;** [**Hunida M. Malaikah**](https://ieeexplore.ieee.org/author/37089285169)**;** [**Fezan Ul Islam**](https://ieeexplore.ieee.org/author/37089284707)**;** [**Ghulam Abbas**](https://ieeexplore.ieee.org/author/37089283002)

**Abstract:**

Recent progress in innovation is making the life prosper, simpler and easier for common individual. The World Health Organization (WHO) statistics indicate that a large amount of people experience visual losses, because of which they encounter many difficulties in everyday jobs. Hence, our goal is to structure a modest, secure, wearable, and versatile framework for visually impaired to help them in their daily routines. For this, the plan is to make an effective system which will assist visually impaired people through obstacle detection and scenes classification. The proposed methodology utilizes Raspberry-Pi 4B, Camera, Ultrasonic Sensor and Arduino, mounted on the stick of the individual. We take pictures of the scene and afterwards pre-process these pictures with the help of Viola Jones and TensorFlow Object Detection algorithm. The said techniques are used to detect objects. We also used an ultrasonic sensor mounted on a servomotor to measure the distance between the blind person and obstacles. The presented research utilizes simple calculations for its execution, and detects the obstructions with a notably high efficiency. When contrasted with different frameworks, this framework is a minimal effort, convenient, and simple to wear.

**Published in:** [IEEE Access](https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6287639) (Volume: 10)

<https://ieeexplore.ieee.org/document/9691323>

1. **Design and Implementation of Obstacle Detection and Warning System for Visually Impaired People**

**Publisher: IEEE**

[Yusuf Sahabi Lolo](https://ieeexplore.ieee.org/author/37089434685); [Kelechi Lawrence Ohammah](https://ieeexplore.ieee.org/author/37089435243); [Amina Nna Alfa](https://ieeexplore.ieee.org/author/37089433240); [Sadiq Abubakar Mohammed](https://ieeexplore.ieee.org/author/37089434374);

**Abstract:**

Environmental information assists human beings to learn about the source that surround them, most visually impaired people make extensive use of the auditory environment not just to determine the presence of an obstacle, but also to successfully makeover around it. This paper discusses various methods for improving blind people’s navigation by utilizing readily available technologies. The system includes the ability to detect obstacles for collision avoidance, as well as the ability to detect objects in up, down, and front directions using ultrasonic sensor. The other sensor detects water on the ground and is located near the bottom tip of the walking cane. The system’s whole operation is controlled by a microcontroller-based circuit. In the case of a crisis or loss, the technology also allows the blind person to send an SMS message with his or her GPS position to the caretaker or family. These sensors are critical in detecting objects in all directions, allowing blind persons to be self- sufficient.

**Published in:** [2022 IEEE Nigeria 4th International Conference on Disruptive Technologies for Sustainable Development (NIGERCON)](https://ieeexplore.ieee.org/xpl/conhome/9802998/proceeding)

<https://ieeexplore.ieee.org/document/9803138>

**CHALLENGES AND MOTIVATION**

This innovative blind assist system aims to empower individuals with visual impairments by seamlessly integrating cutting-edge computer vision and image processing technologies. By harnessing the capabilities of a pre-trained object detection model on the COCO dataset, the system not only identifies and narrates surrounding objects but also offers a unique book reading feature. This feature, supported by optical character recognition and text-to-speech technologies, allows users to explore and engage with written content independently. The project's motivation lies in fostering inclusivity, independence, and accessibility, providing a valuable tool for individuals with visual challenges to navigate and access information in their daily lives.

**PROBLEM STATEMENT**

There are lots of strategies or ways that have been adopted by visually impaired people to address this hassle of theirs. A traditional approach that has been used for years by the visually impaired humans is using dogs that could help so as to navigate through their paths. One more traditional method use stick to find obstacle, these sticks are used to find the obstacle in front. User gets to know the obstacle in front of him when the stick touches the obstacle. But it cannot detect without object contact with the obstacle which sometimes is dangerous since we have to detect object bit farther away. Also, blind people cannot read normal books since they cannot see, they can only understand special books which are designed to blind but the problem is not every book is designed for blind people.

**EXISTING SYSTEM**

There are lots of strategies or ways that have been adopted by visually impaired people to address this hassle of theirs. A traditional approach that has been used for years by the visually impaired humans is using dogs that could help so as to navigate through their paths or using walking canes to keep themselves away from any obstacles. Both of them are inexpensive or reachable but aren't error prone. Being error prone is what is wanted for blind people as even the slightest of blunders can motive a large damage. Another manner to cope with this problem is to provide blind people with clever rehabilitative shoes alongside the spectacles. Each such shoe is surmounted with ultrasonic transducers to detect objects at unique level of heights and spectacles have a pair of ultrasonic transducers mounted centrally stored above the bridge and with a buzzer at one of the ends. A major drawback of this sensor primarily based approach is that it is just beneficial to detect items in place of recognizing them and hence image processing gives a promising answer to address such situations. One more traditional method use stick to find obstacle, these sticks are used to find the obstacle Infront. User gets to know the obstacle Infront of him when the stick touches the obstacle.

**SCOPE OF THE PROJECT**

To build device which will be able to capture image of a book and identify the text and convert and play in audio format.

The device should be able to detect the object using camera and play the object name in speaker.

Our solution to the problem is to create a device which can recognize obstacle using camera and also say whether the traffic light is red or green, using voice alert. The system uses small compact arm computer raspberry pi, and the system is battery powered. The design of module is small and compact also easy to carry.

This system will continuously record video of the surrounding and will convert it into frames. After analysing these frames, the system will alert the person about some obstacle or the surrounding. The main advantages are the portable, affordable and accessible system using image processing technologies is able to help visually impaired people. This system will help the visually impaired people to navigate their way through any obstacle and will give them a sense of visualization of world around them.

**PROPOSED METHODOLOGY**

Project consists of two functionalities:

1. **Object detection and audio output:** for detecting the object we have camera attached from which live video acquisition will be taken then that video will be converted into frames of images which is then used to detect the object, for which we have pre-trained dataset called COCO dataset in which 80 object have been trained and by using that dataset we will compare the object obtained from the camera and then make the detection of the object, after detection the label of the object will be obtained and then we have ESPEAK library to make the audio conversion of the labeled object.
2. **Text recognition and audio conversion:** Live video acquisition using camera is the first step. Video will be converted into frames of images which will be used to detect text in the image. The image is then preprocessed to achieve required resolution using open cv library. Preprocesses image will be sent to Convolution Neural Network based text detector tesseract library which detects text and then we have ESPEAK library to make the audio conversion and Announces using speak.

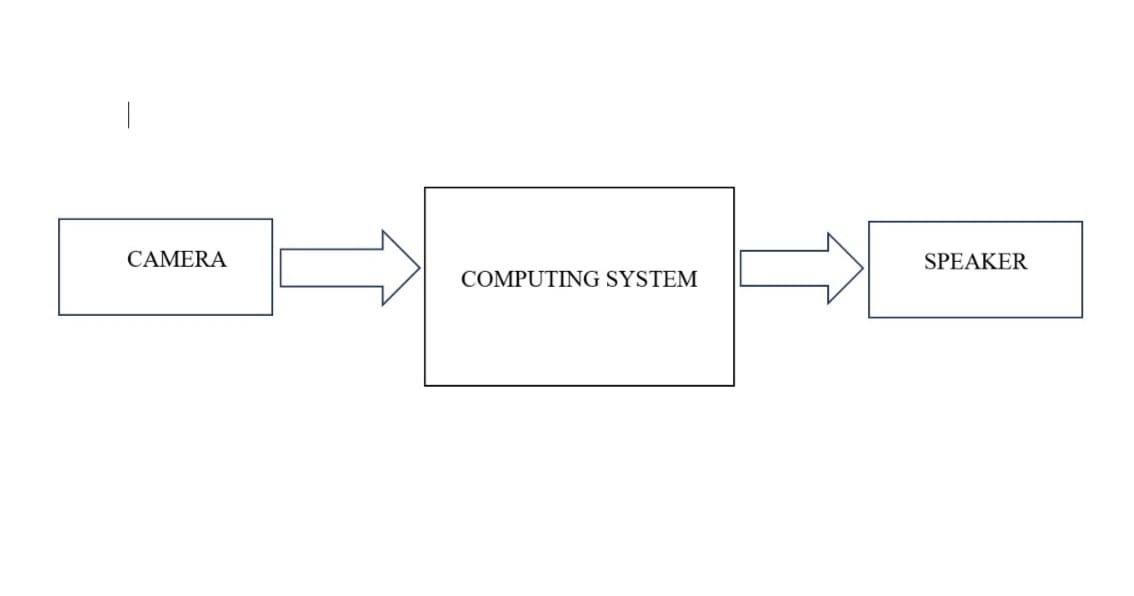


Fig. 1: Block diagram of blind assist system

The brain of our system is laptop, all the processes are executed by laptop using machine learning. In the fig (1) the system consists of a laptop camera which is used to take live video capture. The video is then processed by laptop. The output can be observed by laptop speaker.

**APPLICATION AND SRS:**

1. Assisting the Visually Impaired: Enhances independence for individuals with visual impairments.
2. Object Identification: Real-time detection and narration of surrounding objects.
3. Book Reading Accessibility: Enables autonomous access to written content.
4. Inclusive Navigation: Facilitates inclusive navigation in diverse environments.
5. Educational Support: Provides educational support through autonomous book reading.
6. Hands-Free Interaction: Allows hands-free interaction using voice commands.
7. Privacy-Preserving: Ensures privacy while processing visual information.
8. Customization: Adaptable features to suit individual user preferences.
9. User-Friendly Interface: Simple and accessible interface for seamless interaction.
10. Technological Innovation: Demonstrates the potential of technology for social impact.

**System Requirements**

**Hardware Requirements**

System : Intel i5 or above RAM : 8 GBInput devices : Mouse , Keyboard and Laptop cameraHard disk : 1TB

**Software Requirements**

Operating system : 32 bit or 64 bit Microsoft WindowsProgramming language : Python Tool : Open CV

**CONCLUSION**

In conclusion, this blind assist system, incorporating object detection with the COCO dataset and a novel book reading feature, represents a significant stride towards fostering inclusivity and independence for individuals with visual impairments. By seamlessly integrating advanced computer vision and image processing technologies, the project empowers users to navigate their surroundings confidently through real-time object identification. Moreover, the innovative inclusion of a book reading capability, supported by optical character recognition and text-to-speech functionalities, opens new avenues for autonomous access to written content. This project not only addresses practical challenges faced by the visually impaired but also underscores the transformative potential of technology in enhancing accessibility, enriching educational experiences, and ultimately improving the overall quality of life for this community.

**REFERENCES**

1. Rajani Suryakant Kolhe, Kajal Gajanan Dhole, Pratibha Sampat Thakre, Priyanka Sohan Prasad,” Smart Stick for The Blind and Visually Impaired People”, International Journal of Scientific Research in Science, Engineering and Technology, pp.207-210,2021.
2. Yeong-Hwa Chang, Nilima Sahoo and Hung-Wei Lin,” An Intelligent Walking Stick for the Visually Challenged People”, Proceedings of IEEE International Conference on Applied System Innovation 2018, IEEE ICASI 2018- Meen, Prior & Lam (Eds).
3. K. B. Swain, R. K. Patnaik, S. Pal, R. Rajeswari, A. Mishra and C. Dash, "Arduino based automated STICK GUIDE for a visually impaired person", IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), pp. 407- 410, 2017.
4. Nadia Nowshin, Sakib Shadman, Saha Joy, Sarker Aninda, Islam Md Minhajul, “An Intelligent Walking Stick for the Visually Impaired People", International Journal of Online and Biomedical Engineering (iJOE), vol. 13, No. 11, 2017.
5. Radhika R, Payal G Pai, Rakshitha S, Rampur Srinath, "Implementation of Smart Stick for Obstacle Detection and Navigation", International Journal of Latest Research in Engineering and Technology (IJLRET), vol. 02, pp. 45-50, 2016.Manikanta K, T. Siva Sankara Phani and A. Pravin, "Implementation and Design of Smart Blind Stick for Obstacle Detection and Navigation System”,2018.