e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

LIVE OBJECT DETECTION SYSTEM FOR VISUALLY IMPAIRED PEOPLES

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ABSTRACT

According to the World Health Organization, 250 million people have some form of vision impairment, and about 40 million people are blind. They frequently run into a lot of issues, especially when navigating. To meet their everyday requirements, they typically rely on help from others. Therefore, implementing a technology solution to aid them is a rather challenging task. For the benefit of persons who are blind, numerous technologies have been developed. As an illustration, we would like to develop a machine learning system that is integrated and enables blind people to distinguish and classify items in real-time while also providing voice feedback and distance. Which also generates warnings, whether they are very near or far from the thing?

Keywords: Analysis, investigation, research

I. INTRODUCTION

Navigating through life involves various activities such as work, education, shopping, and more, and eyesight play a crucial role in facilitating these tasks by making it easier to move from one place to another. Hence, it can be generally acknowledged that vision is essential for effective navigation. In well-known surroundings, like our homeroom or even our business, it is comparatively simple to envisage moving around without eyesight. However, navigating strange environments might be challenging. [1] Blindness is a prevalent disability, with an increasing number of people affected in recent decades. Partially blind people have various vision problems, while completely blind people have no vision at all. The mission of the system is to assist visually impaired people, promoting their independence and self-reliance. The system includes glasses that enable reading, studying, and learning from printed text or images, particularly useful in the field of education. visually impaired individuals due to their disability.[2] For humans to engage with their surroundings, vision, and touch are crucial sensory organs. One of the most important challenges to regaining the ability to carry out daily tasks for blind amputees is how to swiftly and intuitively relay environmental information to them. [3] For a person with blindness, the lack of visual input can lead to difficulties in realizing and understanding the things around them. They may rely on sharp observation and hearing to form mental images, but may still struggle to remember or identify objects. This can result in the need for assistance from others. Finding directions can also be a challenge, leading to inconvenience and potential reliance on guides.

[4-5] Blind and visually impaired individuals face challenges in daily activities, including lower work-force participation rates and higher risks of falls. Computer vision technology has potential to assist, but there is currently no effective approach for conveying environmental information. Improving information transfer rate (ITR) is important for facilitating spatial cognition. Public transport management systems (PTMS) are helpful for most passengers, but useless forvisually impaired individuals due to their disability.[6] As of the end of 2016, there were approximately 7.338 billion people in the world, with 285 million being visually impaired according to WHO statistics. Of the visually impaired individuals, 246 million had amblyopia and 39 million were blind, representing 4.25% of the world's total population. [7-10]An estimated 285 million visually impaired people worldwide need assistance with navigation, so there is ongoing research into Blind Assistance Systems, including Electronic Travel Aids (ETAs), Position Locator Devices (PLDs), bionic eyes, and artificial vision systems. Some of these devices, such as ultrasonic sensors, have limitations in detecting obstacles, while others rely on GPS technology, which is not always efficient. Recent research has focused on the stereo disparity concept, which estimates depth using stereo cameras and offers a feasible, cost-effective, and independent navigation system for the blind.

II. LITERATURE SURVEY

In [1], The authors have proposed an intelligent voice assistance system. The Raspberry Pi 3 Model B+ was chosen as the primary component for the prototype due to its affordable cost, compact dimensions, and seamless integration capability. The design features a camera, obstacle avoidance sensors, and advanced image processing algorithms that enable object detection and classification. The combination of the camera and ultrasonic sensors assists in calculating the distance between the user and any obstacles. Furthermore, the system incorporates an image-to-text converter that generates audio feedback. The drawback of this system is that it has a lot of hardware requirements and does not use real-time data video for feedback but rather uses images.

In [2], The system under consideration employs the SSD algorithm and TensorFlow, which function at two levels to enable the recognition and localization of objects while also measuring the distance between the user and the object. This study proposes a novel framework that harnesses the power of AI to create a more user-friendly system specifically designed for individuals with visual impairments. The drawback of this system is that it uses an SSD object detection algorithm which is slow compared to YOLO and R-CNN so this affects the accuracy and response time of the model.

In [3], authors have given one potential solution for aiding visually impaired individuals through the use of a machine learning algorithm. To access this algorithm, data input is gathered using an Image Classification technique. This involves capturing images of objects in the surroundings of the visually impaired person through a camera, which can accurately detect objects within a certain distance. The images are then converted into audio signals, providing a convenient means of assistance for those with visual impairments. The drawback of this system is that it uses ML algorithms which are not as efficient as Deep Learning algorithms as the data set used is not large and they are using image classification which takes time and is not very efficient.

In [4], The authors have created a device called Stereo Pilot. It is a target location system that can be worn as a wearable device, aimed at improving the spatial cognition of people with visual impairments (BVI). It involves a head-mounted RGB-D camera that captures 3D spatial information of the surrounding environment, which is then used to create navigation cues. These cues are transmitted through a special type of 3D sound using spatial audio rendering (SAR) technology, allowing for the sound orientation to be discerned based on human sound localization instincts. The drawback of this system is that it is a wearable device and is not cost-effective. Everyone including visually impaired people might not be able to afford it and also it is very complex to understand its working.

In [5], The system being proposed utilizes Bluetooth Low Energy (BLE) technology for both location and communication purposes, along with a mobile application for user interaction with their smartphone. BLE beacons are strategically placed on buses and at bus stops, and the mobile application can track their movements in real time, providing users with necessary information via spoken instructions. This information includes the transportation line, destination, name of the next stop, and current location. With this information, users can select the correct bus in advance and ensure they disembark at the intended destination stop. The drawback of this system is that it is solely based on transportation and not all day-to-day help for visually impaired people. It could help in traveling to their desired destination but not guide them at every step and detect objects in front of them.

III. METHODOLOGY

- The system is set up so that an android application, presuming you're using one, would record real-time frames and transfer them to a networked server running on a laptop, where all the computations happen.
- A pre-trained SSD identification model trained on COCO DATASETS will be utilized by the laptop-based server. The output class will then be tested and identified using an accuracy metric.
- The class of the object will be transformed into default voice notes after testing with the aid of voice modules, and assistance will then be delivered to the blind victims.
- We have utilized an alarm system that calculates estimates in addition to item detection. It will also produce voice-based outputs in addition to distance units depending on whether the Blind Person is in close proximity to the frame or is far away in a safer location.

IV. MODELING AND ANALYSIS

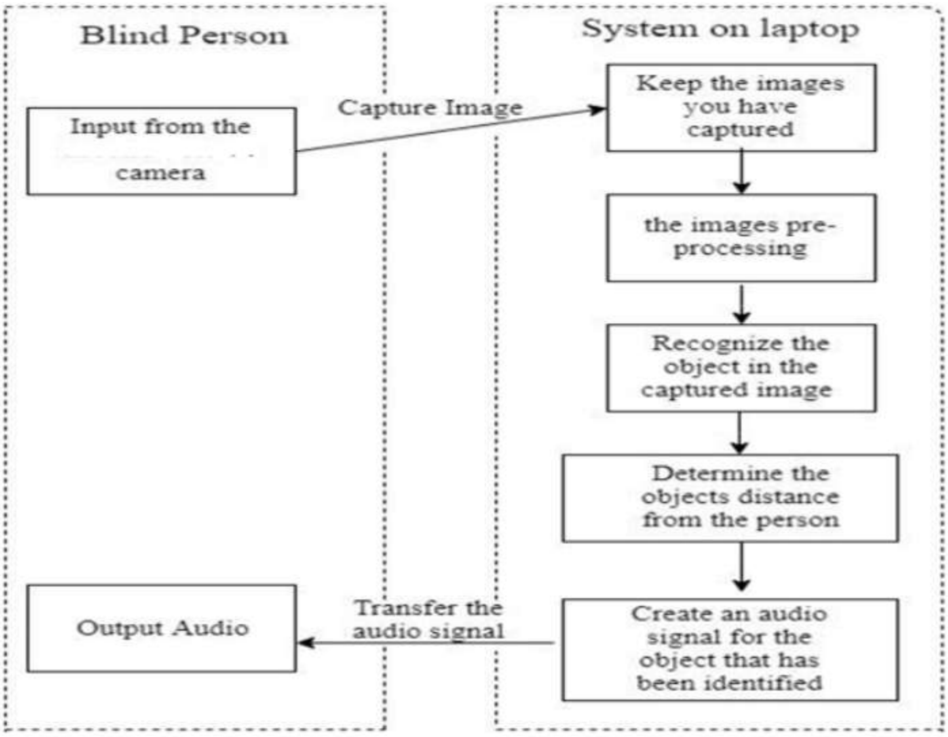


Figure: System Architecture.

V. RESULTS AND DISCUSSION

A. System Setup

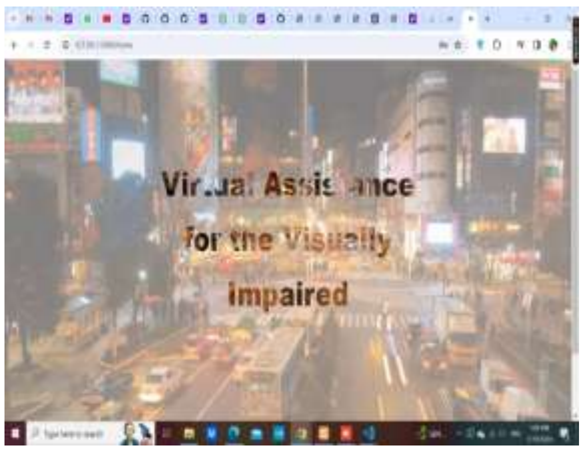
The proposed system was implemented using the following setup:

Software Specifications:

- Operating System: Windows
- Development Tools: Pycharm and Visual Studio
- Languages and Frameworks: Python, HTML, Bootstrap, CSS
- Database: SQLite for storing configuration and user data

Hardware Specifications:

- Processor: Intel i5 (tested on i3 and i7 as well)
- Speed: 3.1 GHz
- RAM: 4 GB
- Hard Disk: 20 GB available storage



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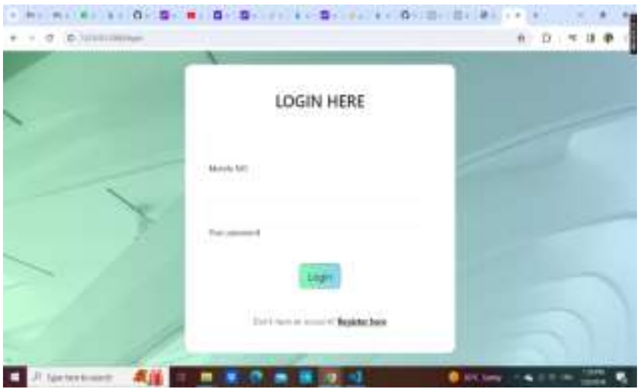

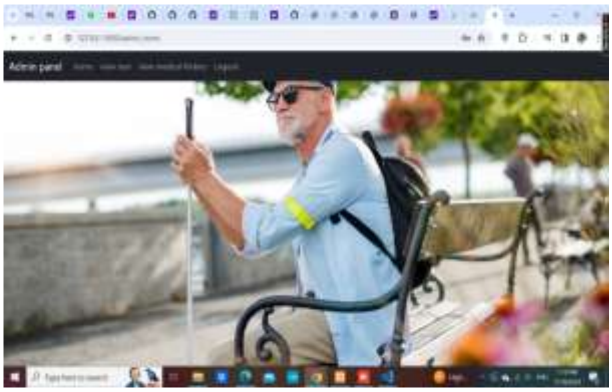

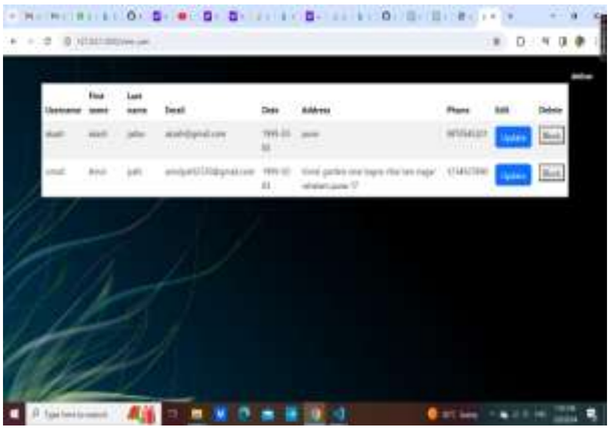


VI. CONCLUSION

The primary goal of the suggested system is to help those who are blind by giving them a sense of their surroundings. This sense of their surroundings helps them avoid obstacles and move from one place to another. The objective of offering a straightforward, practical, and helpful solution is accomplished. The suggested method has good speed and accuracy for detecting items in the immediate area. It efficiently identifies things in both indoor and outdoor settings. The system can successfully identify the many things that are present in the immediate surroundings and convey that information to the user through headphones or speakers. The suggested system is evaluated for object detection in three different environments: indoors, outdoors, and objects more than 10 metres from the camera. The system has the ability to recognise items in the immediate area and output audio to the user.

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