"Voice operated assistant system for blind people Using Machine Learning"

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Abstract—Addressing the challenges faced by the visually impaired, there is a pressing need for innovative solutions. With 250 million people experiencing vision impairment and 40 million facing blindness, daily navigation remains a significant hurdle. Existing technologies, while beneficial, often require assistance from others.

To empower individuals who are blind, the development of an integrated machine learning system is proposed. This system aims to distinguish and classify objects in real-time, offering voice feedback and distance estimation. The inclusion of a warning mechanism, triggered based on object proximity, ensures enhanced safety by alerting users to the closeness or distance of identified items. The intersection of computer vision, machine learning, and audio processing holds the key to creating a transformative technology for the visually impaired, fostering independence and accessibility in their everyday lives.

Keywords—BlindAssistance,MachineLearning, Dataset,Blind People, Assistive Technology, Real-Time Object Recognition, Voice Feedback, Distance Estimation, Computer Vision, Artificial Intelligence, User Interface Design, Assistance for Visually Impaired

INTRODUCTION

In response to the formidable challenges faced by the visually impaired community, the development of a "Voice-Operated Assistant System for Blind People Using Machine Learning" emerges as a groundbreaking solution. With an estimated 250 million individuals grappling with various forms of vision impairment and 40 million experiencing total blindness, the need for innovative assistive technologies has never been more pressing.

This proposed system harnesses the power of machine learning to provide real-time object recognition, voice feedback, and distance estimation, thereby empowering blind individuals in their daily navigation. By merging advanced computer vision techniques with artificial intelligence, this technology not only enhances accessibility but also fosters independent living, marking a significant stride towards a more inclusive and empowering future for the visually impaired.

Developing a machine learning system to aid visually impaired individuals is a noble and impactful initiative.

Creating a system that can distinguish and classify items in real-time, provide voice feedback, and estimate distances requires a combination of computer vision, machine learning, and audio processing techniques. Here's a general outline of how you might approach this task:

Data Collection

Gather a diverse dataset of images representing various objects and scenes. Ensure the dataset includes images taken from different angles, distances, and lighting conditions.

Data Preprocessing

Clean and preprocess the images to ensure consistency in the dataset.Annotate the images with labels indicating the objects and their distances from the camera.

Model Architecture

Choose or design a suitable deep learning architecture for object detection and classification. Convolutional Neural Networks (CNNs) are commonly used for computer vision tasks.
Consider architectures that allow real-time processing, as speed is crucial for providing immediate feedback.

Training

Train the model on the annotated dataset using appropriate loss functions and optimization techniques.Implement techniques for handling class imbalance, as certain objects may be less common than others.

Integration with Voice Feedback and Distance Estimation

Integrate the trained model with a system that can convert the output into voice feedback. Text-to-speech (TTS) technology can be employed for this purpose.Use computer vision techniques to estimate the distance to detected objects. This can involve depth estimation or other distance-related algorithms.

Real-Time Processing

Optimize the model and system for real-time processing. Consider hardware acceleration options (e.g., GPU) to improve performance.

Warning System:

Implement a system that generates warnings based on the proximity of detected objects. This can be achieved by setting distance thresholds and triggering warnings accordingly.

User Interface:

Develop a user-friendly interface for blind users, possibly using a combination of voice commands and tactile feedback.

Testing and Iteration:

Test the system with visually impaired individuals to gather feedback.Iterate on the design based on user feedback to improve usability and performance.

Accessibility and Inclusivity:

Ensure that the system is accessible to individuals with varying levels of vision impairment and consider localization for different languages.

Regulatory and Ethical Considerations:

Collaborating with organizations and individuals experienced in assistive technology and accessibility can provide valuable insights and guidance throughout the development process.

Motivation

Image processing of ML is getting advanced day by day. Why not use these capabilities for assisting people with disabilities. Artificial Intelligence and Machine learningtechnologies are contributing in everyfield nowadays soit inspired us to make something that will help partially and fully visually impaired people in their everyday activities.

Aim

The aim of the "Voice-Operated Assistant System for Blind People Using Machine Learning" is to revolutionize the daily lives of visually impaired individuals by leveraging cutting-edge technology. This project strives to develop a sophisticated and user-friendly system that employs machine learning algorithms for real-time object recognition, voice-based feedback, and accurate distance estimation.

Objectives

- To Study machine learning algorithms for the Blind assistance system.
- To implement the Yolov3 algorithms.
- To check the workings of the algorithms with the acquired dataset.
- To test and compare the accuracy of base models with Yolov3 inspired algorithms.

Problem statement

To build and implement Blind Assistance system using YOLOv3(You only look once version 3) Algorithm.

Problem Definition

As we know Visually impaired people suffer from regular and constant challenges in Navigation especially when they are on their own. They are mostly dependent on someone for even accessing their basic day-to-day needs. So, it's quite a challenging task and the technological solution for them is of utmost importance and much needed so our aim is to make it easier for them by developing an application thatwill help them in navigation by audio assistance.

RESEARCH METHODOLOGY

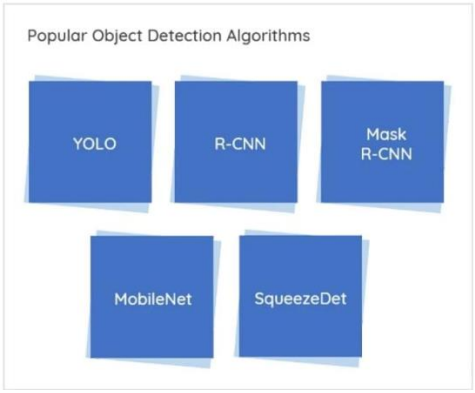

Figure1.1: Methodology Flow Chart

Assumptions and Dependencies

- User must know English Language.
- The device has a 64-bit architecture.
- The User and the device on which the app is running must be indoors.
- A particular institution when required may approach our team and we can provide help for setting an indoor map. Hence, the must provide a blue print or plans of the building.

System Feature 1(Functional Requirement)
1. Blind assistance system

External Interface Requirements

User Interfaces
Home page
open camera page detects object page result page

Hardware Interfaces
The entire software requires a completely equipped computer system including monitor, keyboard, and other input output devices.

Software Interfaces
The system can use Microsoft as the operating system platform. System also makes use of certain GUI tools. To run this application, we need python and above as Windows platform. To store data, we need MySQL database.

Communication Interfaces
Communication using python APIs

Nonfunctional Requirements
Performance Requirements
The performance of the system lies in the way it is handled. Every user must be given proper guidance regarding how to use

the system. The other factor which affects the performance is the absence of any of the suggested requirements.

Safety Requirements
To ensure the safety of the system, perform regular monitoring of the system so asto trace the proper working of the system. An authenticated user is only able to access system.

Security Requirements
Any unauthorized user should be prevented from accessing the system. Password authentication can be introduced.

Software Quality Attributes
Accuracy: -
The level of accuracy in the proposed system will be higher. All operation would be done correctly and it ensures that whatever information is coming from the

Center is accurate. Result is organic results. Reliability
The reliability of the proposed system will be high due to the above stated reasons. The reason for the increased reliability of the system is that now there would be proper storage of information and Recommending location model.

System Requirements

Database Requirements
MySQL Database

Software Requirements (Platform Choice)

- Operating System - Windows
- Application Server - Apache Tomcat
- Front End - HTML, CSS,Bootstrap
- Language - Python.

Hardware Requirements

- Processor - I3/I5/I7
- Speed - 3.1 GHz
- RAM - 2 GB (min)
- Hard Disk - 20 GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

System Design and Architecture

1. The system operates by recording real-time frames through a designated application, with subsequent transfer to a networked server hosted on a laptop. All computational processes take place on this server.
2. The server employs a pre-trained SSD identification model, specifically trained on COCO DATASETS. The model's output classes undergo testing, and accuracy metrics are applied for precise identification.
3. Post-testing, the identified object classes are converted into default voice notes with the assistance of voice modules. These voice notes are then delivered to provide immediate assistance to individuals with visual impairments.
4. Introducing an innovative alarm system, the technology not only calculates distance estimates but also combines item detection capabilities. Depending on the proximity of a Blind Person to the frame, the system generates voice-based outputs and distance units, enhancing safety by offering warnings for both close and distant scenarios.

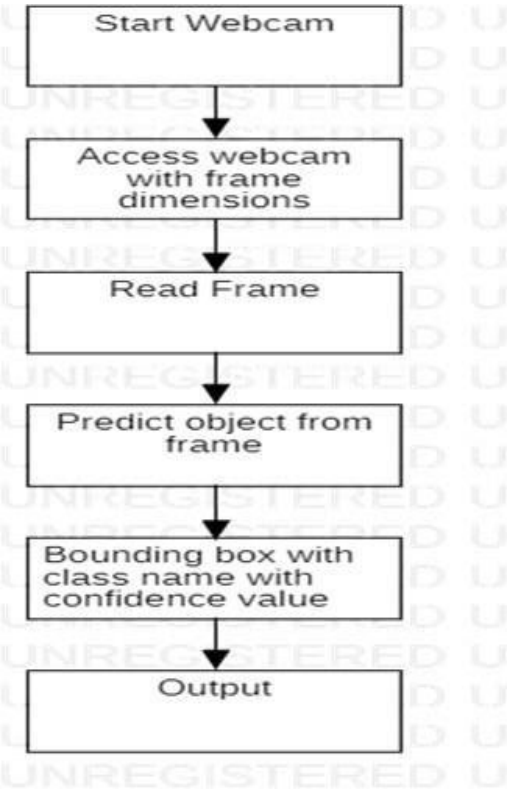

Figure1.2: System Architecture

Data Flow Diagram
Level-Zero

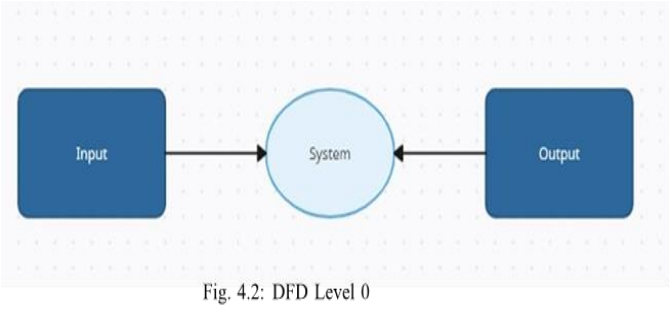

Fig. 4.2: DFD Level 0

A Data Flow Diagram (DFD), also known as a bubble chart, is a graphical representation simplifying a system's input, processing, and output. It illustrates how input data undergoes processing to generate output.
The DFD is a crucial modeling tool for system components, including the system process, data utilized, external entities interacting, and information flows within the system.
In above Figure, a level 0 DFD depicts information flow and transformations in the system, illustrating how data moves through the system and undergoes modifications from input to output.

Use Case Diagram

A use case diagram is a graphical representation capturing a user's interactions with a system and outlining use case specifications. It illustrates different user types and their interactions with the system, serving as a tool to gather design requirements, both internal and external. This diagram is

instrumental in understanding system functionality, identifying actors, and showcasing interactions among them. Key purposes include requirement gathering, providing an external view of the system, recognizing internal and external influences, and depicting actor interactions.

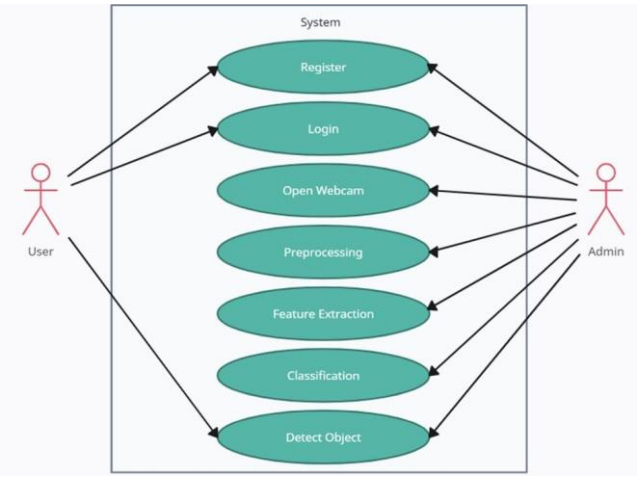

Figure1.3: Use Case Diagram

The class diagram serves as a static representation, offering insights into various facets of an application. Beyond visualization and documentation, it plays a crucial role in generating executable code for software applications. Detailing class attributes, operations, and system constraints, it is a fundamental tool for modeling object-oriented systems. As the only UML diagram directly mappable to object-oriented languages, class diagrams encompass classes, interfaces, associations, collaborations, and constraints. Recognized as a structural diagram, their primary objective is to model the static perspective of an application.

Class Diagram

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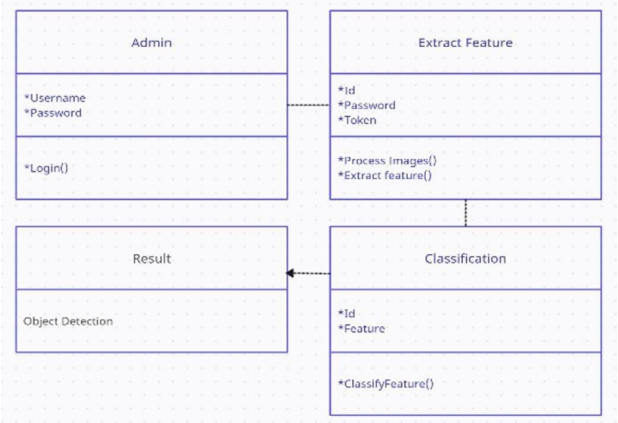


Figure1.4: Class Diagram

Component Diagram

A Component Diagram illustrates the structural connections among various components within a software system, particularly beneficial for intricate systems with numerous components. In this representation, components interact through interfaces, which are connected using connectors.

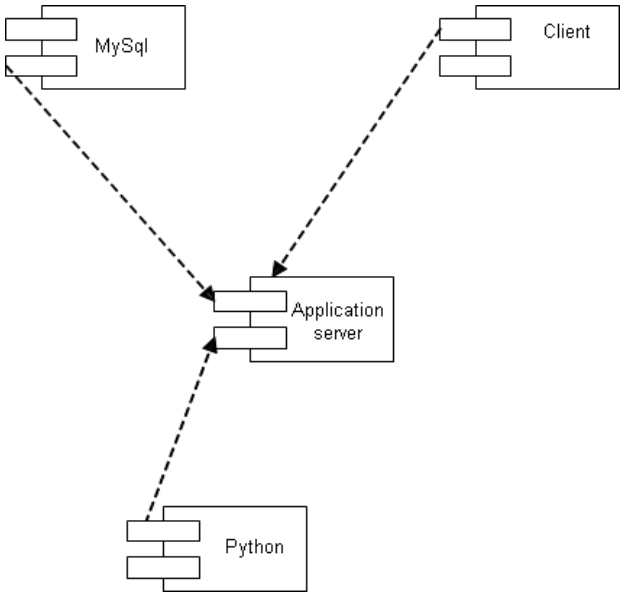


Figure1.5: Component Diagram

Deployment Diagram

Deployment diagrams serve as visualizations for depicting the physical topology of a system's deployment, showcasing the arrangement of software components. These diagrams provide a static view of how the software components are deployed. Comprising nodes and their relationships, deployment diagrams effectively illustrate the static deployment perspective of a system.

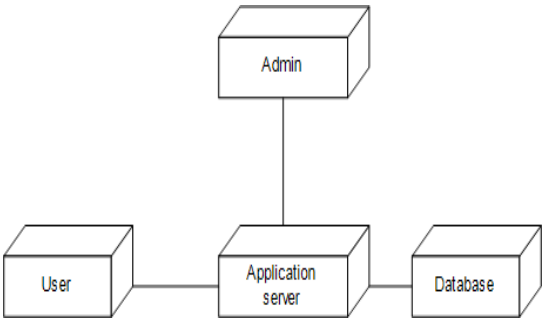


Figure1.6: Deployment Diagram

Module ID

Testing of project problem statement using generated test data (using mathematical models, GUI, Function testing principles, if any) selection and appropriate use of testing tools, testing of UML diagram's reliability.

Module-ID: 01

Modules to be tested: -Registration

- Enter the case insensitive Username click on Submit button. Expected: It should display error.

- Enter the case sensitive Username click on Submit button. Expected: It should accept.
- Enter the case insensitive Password click on Submit button. Expected: It should display error.
- Enter the case sensitive Password click on Submit button. Expected: It should accept.
- Enter the case insensitive Mobile Number click on Submit button. Expected: It should display error.
- Enter the case sensitive Mobile Number click on Submit button. Expected: It should accept.
- Enter the wrong address and click on Submit button. Expected: It should display error.
- Enter the correct address and click on Submit button. Expected: It should accept.

Test Case_ID	Description	Test case I/P	Actual Result	Expected result	Test case criteria (P/F)
101	Enter the case insensitive Username click on Submit button.	Username	Error comes	Error Should come	P
102	Enter the case sensitive Username click on Submit button.	Username	Accept	Accept Username	P
201	Enter the case insensitive Password click on Submit button.	Password	Error comes	Error Should come	P
202	Enter the case sensitive Password click on Submit button	Password	Accept	Accept	P
301	Enter the case insensitive Mobile Number click on Submit button	Mobile Number	Error comes	Error Should come	P
302	Enter the case sensitive Mobile Number click on Submit button.	Mobile Number	Accept	Accept	P

Module-ID:2
Modules to be tested: Login

- Enter the correct username and wrong password click on Submit button. Expected: It should display error.

Test Case_ID	Description	Test case I/P	Actual Result	Expected result	Test case criteria (P/F)
001	Enter the correct username and wrong password click on Login button.	Username Password	Error comes	Error Should come	P
002	Enter the wrong username and correct password click on Login button,	Username Password	Error comes	Error Should come	P
003	Enter the correct username and password and click on Login button.	Username Password	Accept	Accept	P

- Enter the wrong username and correct password and click on Submit button. Expected: It should display error.
- Enter the correct username and password and click on Login button.

Expected: It should display welcome page.

- After login with valid credentials click on back button.
- Expected: The page should be expired.
- After login with valid credentials copy the URL and paste in another browser. Expected: It should not display the user's welcome page.
- Check the password with Lower case and upper case. Expected: Password should be case sensitive.

Result and Discussion

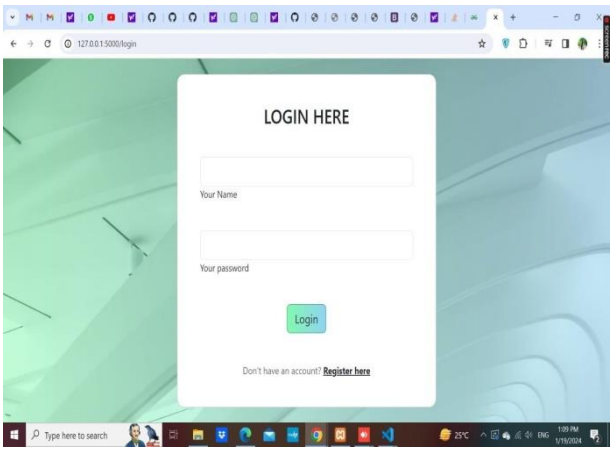
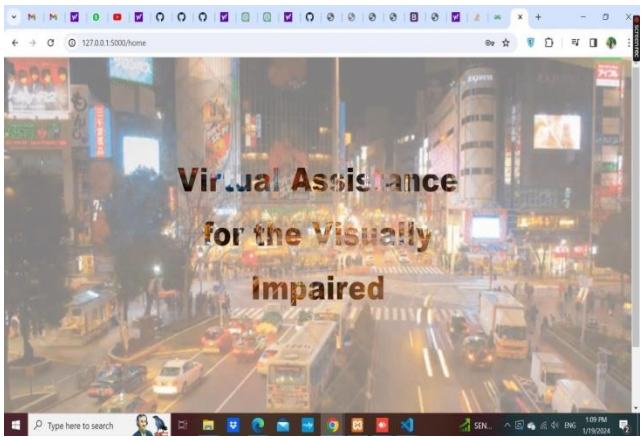
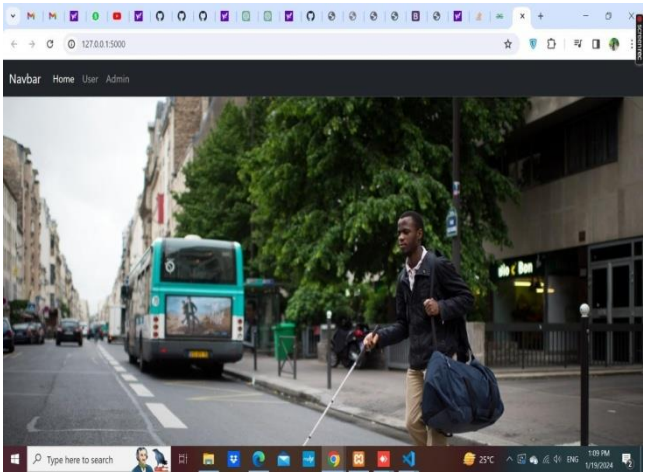
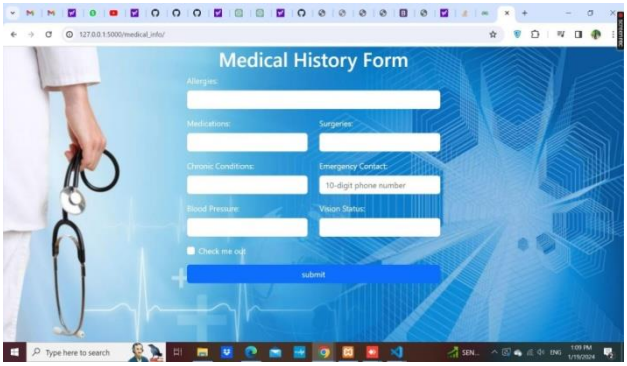
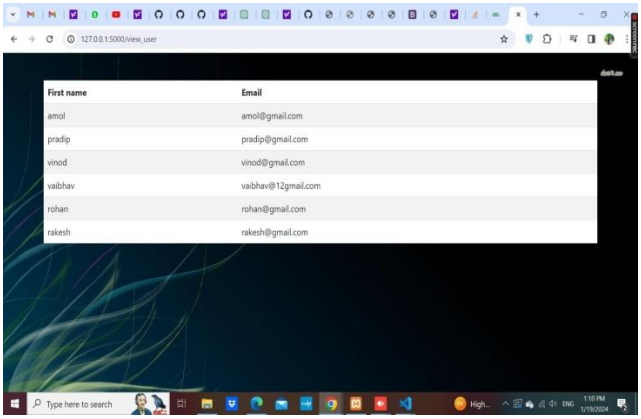


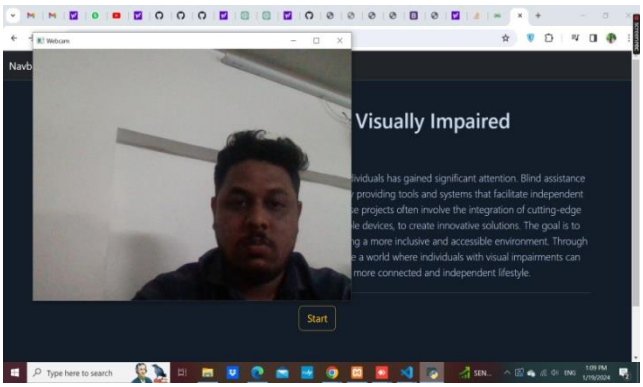
Figure1.7: Login page Using GUI

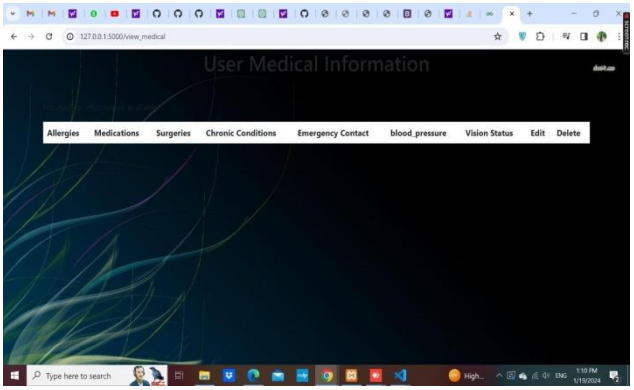


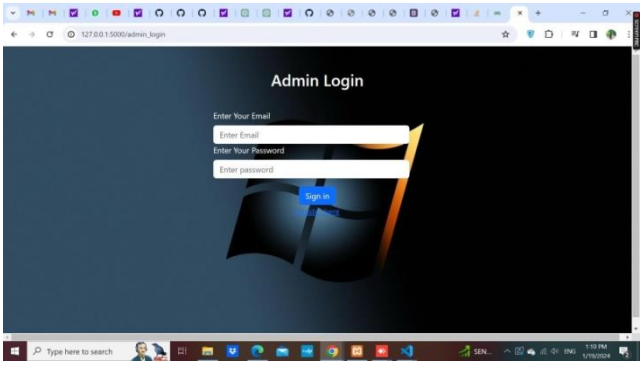


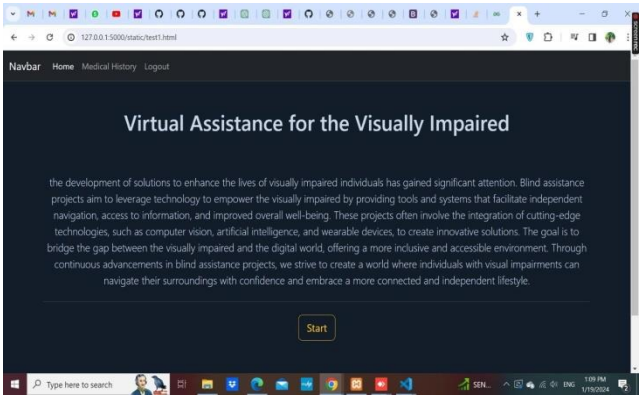


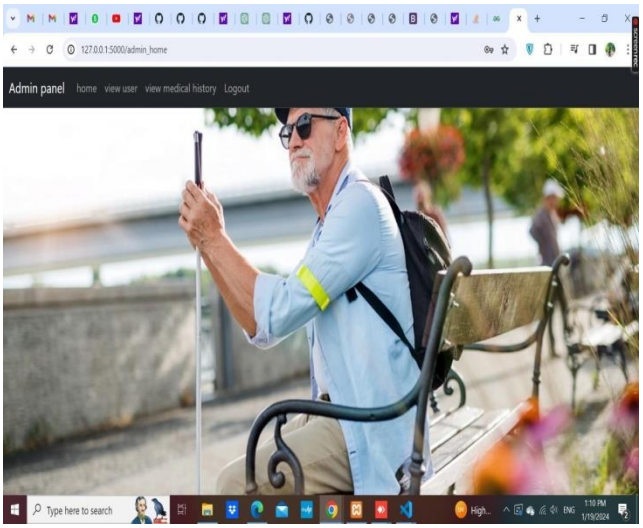












CONCLUSION

- Primary Goal: The system's main aim is to assist individuals with visual impairments by providing them with a comprehensive understanding of their surroundings.
- Obstacle Avoidance: The system contributes to obstacle avoidance, facilitating seamless navigation for users, allowing them to move from one location to another safely.
- Straightforward Solution: The proposed system prioritizes simplicity, practicality, and usefulness to deliver a straightforward solution to the challenges faced by the visually impaired.
- Speed and Accuracy: Demonstrating commendable speed and accuracy, the system excels in detecting items in the immediate vicinity, ensuring efficient real-time processing.

- Versatility: The system exhibits versatility by effectively identifying objects in diverse environments, including both indoor and outdoor settings.
- Audio Output: Through the use of headphones or speakers, the system successfully conveys information about the surrounding objects to the user, enhancing their situational awareness.
- Evaluation Environments: The system's object detection capabilities are rigorously evaluated in three distinct environments: indoor spaces, outdoor areas, and objects situated more than 10 meters away from the camera.
- Recognition Capability: The system demonstrates the ability to recognize a wide array of items within the immediate surroundings, contributing to a comprehensive and informative user experience**.**

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REFERENCES

1. R. R. Varghese, P. M. Jacob, M. Shaji, A. R, E. S. John and S. B. Philip, ”An Intelligent Voice Assistance System for Visually Impaired using Deep Learn- ing,” 2022 International Conference on Decision Aid Sciences and Applications (DASA), Chiangrai, Thailand, 2022, pp. 449-453.
2. S. C. Jakka, Y. V. Sai, J. A and V. A. M. A, ”Blind Assistance System using TensorFlow,” 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2022, pp. 1505-1511, doi: 10.1109/ICESC54411.2022.9885356.
3. S. Durgadevi, K. Thirupurasundari, C. Komathi and S. M. Balaji, ”Smart Machine Learning System for Blind Assistance,” 2020 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS), Chennai, India, 2020, pp. 1-4, doi: 10.1109/ICPECTS49113.2020.9337031.
4. [4]X. Hu, A. Song, Z. Wei and H. Zeng, ”StereoPilot: A Wearable Target Location System for Blind and Visually Impaired Using Spatial Audio Rendering,” in IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 30,pp. 1621-1630, 2022, doi: 10.1109/TNSRE.2022.3182661.
5. [5]S.Mart´ınez-Cruz, L. A. Morales-Hern´andez, G. I. P´erez-Soto, J. P. Benitez- Rangel and K. A. Camarillo-G´omez, ”An Outdoor Navigation Assistance System for Visually Impaired People in Public Transportation,” in IEEE Access, vol. 9, pp. 130767- 130777, 2021, doi: 10.1109/ACCESS.2021.3111544.
6. Ziad O. Abu-Faraj, Paul Ibrahim, Elie Jabbour and Anthony Ghaoui, “Design and Development of a Prototype Rehabilitative Shoes and Spectacles for the Blind”, IEEE Int. Conf. BioMedical Engineering and Informatics, 2012,
pp. 795- 799.
7. Giva Andriana Mutiara, Gita Indah Hapsari and RamantaRijalul, “Smart Guide Extension for Blind Cane”, IEEE Int. Conf. Information and Communi- cation Technologies, 2016.
8. G. Balakrishnan, G. Sainarayanan, R. Nagarajan, and Sazali Yaacob, “A Stereo Image Processing System for Visually Impaired”, Int. Journal of Computer, Electrical, Automation, Control and Information Engineering, vol.2, No.8, 2008, pp. 2794-2803.
9. Rui Jiang, Qian Lin Li, “Let Blind People See: Real-Time Visual Recogni- tion with Results Converted to 3D Audio”, Proc. International Conference on Computer Vision, 2015.
10. M. Hiromoto, H. Sugano, and R. Miyamoto,“Partially Parallel Architecturefor AdaBoost-Based Detection With Haar-Like Features”, IEEE Trans. Circuits and Systems for Video Technology, vol. 19, Jan 2009, pp. 41-52.
11. L. -B. Chen, J. -P. Su, M. -C. Chen, W. -J. Chang, C. -H.Yang and C. -Y. Sie, ”An Implementation of an Intelligent Assistance System for Visually Impaired/Blind People,” 2019 IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, USA, 2019,pp. 1-2, doi:10.1109/ICCE.2019.8661943.
12. N. Ghatwary, A. Abouzeina, A. Kantoush, B. Eltawil, M. Ramadan andM. Yasser,”Intelligent Assistance System for Visually Impaired/Blind People (ISVB),” 2022 5th International Conference on Communications, Signal Pro-cessing, and their Applications (ICCSPA), Cairo, Egypt, 2022, pp. 1-7, Doi: 10.1109/ICCSPA55860.2022.10019201.
13. Neelam Labhade-Kumar,"To Study Different Types of Supervised Learning Algorithm” May 2023, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), Volume 3, Issue 8, May 2023,PP-25-32, ISSN-2581-9429
14. Neelam Labhade-Kumar,“To Study the Different Types of Face Reorganization Algorithm” May 2023, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), Volume 3, Issue11 , May 2023,PP-108-114
15. Neelam Labhade-Kumar, to study different types of machine learning algorithm for gesture recognition, International Research Journal of Modernization in Engineering Technology and Science, Volume 5, Issue 5, May 2023,PP- 7751-7754,
16. [Neelam Labhade-Kumar,“Facial Recognition with Convolutional Neural Network for Driver” International GIS SCIENCE JOURNAL, May 2022 VOLUME 9, ISSUE 5, 1869-9391, UGC care, impact factor 6.1,