The Blue Badge

An Engineering Project in Community Service

Phase – II Report

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Bonafide Certificate

Certified that this project report titled **"The Blue Badge"** is the Bonafide work of "20BAI10249 (MVN Rajesh Reddy), 20BAI10340 (Mohd Mohsin Khan), 20BCE10064 (Shivansh Yadav), 20BCE10150 (Saransh Yadav), 20BCE10155 (Ayush Kumar), 20BCE10338 (Abhisurendra Prajapati), 20MEI10033 (Sourabh Sahu), 20MIM10122 (Shalu Singh)**"** who carried out the project work under my supervision.

This project report (Phase I) is submitted for the Project Viva-Voce examination held in May 2023.

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INTRODUCTION

The term "blue badge" is commonly used to describe individuals with disabilities who are granted certain privileges to facilitate their daily lives. Inspired by this concept, we have chosen this name for our group.

Globally, there are over 2.2 billion people with near or distant vision impairment. In India alone, there are 9.3 million visually impaired individuals, including 270,000 blind children. Shockingly, more than 75% of these cases could be prevented or treated.

Navigation devices for the blind are not sufficiently accessible, as they primarily rely on infrastructure that may not be available in all areas. This can make it difficult for visually impaired individuals to navigate through rooms or along different routes. They also face numerous challenges in their daily lives, including difficulties communicating and accessing information. This can impact their personal, professional, and social lives in significant ways.

Typically, people who are blind rely on constant assistance, such as a guide dog, to navigate their surroundings. Unfortunately, such assistance can be costly and may not be feasible for everyone. This is where our project comes in.

Through our efforts, we aim to improve the lives of visually impaired individuals by providing them with greater independence and freedom. Our technology will enable them to go anywhere they wish without assistance, giving them greater control over their lives. They will be able to move around the streets on their own and manage themselves more effectively.

Ultimately, our project aims to make a positive impact on the lives of visually impaired individuals and provide them with greater opportunities for personal growth and development. We are committed to advancing our technology and working towards a more accessible and inclusive world for all.

MOTIVATION

Navigation is an essential part of our daily lives. It allows us to go about our day-to-day activities with ease, and it gives us the freedom to move around and explore our surroundings. Unfortunately, for individuals who are blind or visually impaired, navigation can be a significant challenge. It can be difficult for them to move around confidently and independently, leading to decreased mobility and reduced participation in daily activities.

However, by creating an app to help blind individuals navigate, we can empower and support this community in their daily lives. This project can make a meaningful and positive impact on the lives of blind individuals, and we should be motivated to undertake it to give back and make a difference.

The app will enable blind individuals to navigate unfamiliar environments with greater ease and confidence. It will use advanced technologies such as machine learning, computer vision, and speech recognition to identify objects, detect obstacles, and provide audio-based directions. It will also include features such as location tracking, voice-activated commands, and real-time feedback to provide users with a comprehensive and intuitive navigation experience.

The development of this app will require a multidisciplinary team, including software developers, data scientists, UX/UI designers, and individuals who are blind or visually impaired themselves. Collaboration with individuals from this community will be crucial in ensuring that the app is designed to meet their specific needs and preferences.

In addition to improving mobility and independence, this app can also have a significant impact on the mental health and well-being of blind individuals. By empowering them to navigate their surroundings confidently and independently, they can feel more in control of their lives and experience a greater sense of freedom and agency.

Ultimately, this project is about making a difference in the lives of blind individuals. By creating an app to help them navigate, we can support this community and contribute to a more inclusive and accessible society. It is a worthy endeavor that has the potential to make a lasting impact, and we should be inspired and motivated to take it on.

OBJECTIVE

The objective of the project is to create an app that assists blind individuals in navigating unfamiliar environments. The app will be developed to be user-friendly and intuitive, providing real-time audio instructions and information to guide users along their desired route. To achieve this objective, advanced technologies such as location tracking and voice recognition will be utilized to accurately track the user's location and provide relevant information about their surroundings.

Potential objective for a project to create an app to help blind individuals navigate is to:

- Develop a user-friendly and intuitive app that provides real-time audio instructions and information to assist blind individuals in navigating unfamiliar environments.
- Utilize advanced technologies such as location tracking, and voice recognition to accurately guide users along their desired route and provide relevant information about their surroundings.
- Collaborate with members of the blind community to ensure that the app meets their needs and preferences, and to gather feedback for ongoing improvements.
- Test and iterate on the app to ensure its effectiveness and reliability in many environments and situations.

The app's user interface will be designed with the specific needs and preferences of blind individuals in mind. It will include features such as voice-activated commands, high-contrast graphics, and customizable font sizes to improve the accessibility of the app.

Collaboration with members of the blind community will be a key aspect of the project. By involving individuals who are blind or visually impaired in the development process, the team can ensure that the app meets their specific needs and preferences. Feedback from these individuals will be gathered regularly throughout the development process to make ongoing improvements to the app.

To ensure the app's effectiveness and reliability, rigorous testing and iteration will be conducted in various environments and situations. This includes testing the app in both urban and rural environments, indoor and outdoor settings, and different weather conditions.

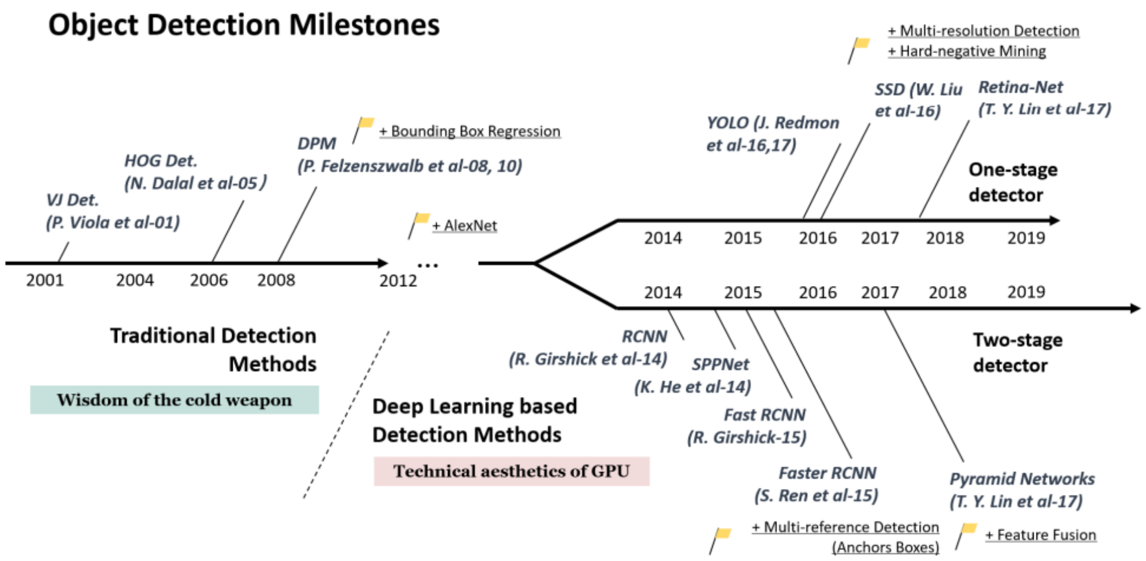
Overall, the objective of the project is to create an app that can improve the independence and mobility of blind individuals. By utilizing advanced technologies and collaborating with the blind community, the team can develop an app that meets the specific needs and preferences of blind individuals, empowering them to navigate their environment with confidence and independence.

EXISTING WORK AND LITERATURE REVIEW

Object Detection

The crucial computer vision problem of object detection involves finding instances of visual objects of a specific type in digital photographs (such as people, animals, or cars). Object detection aims to create computational models and methods that supply one of the most fundamental bits of data required by computer vision applications.

Modern object detection systems have been merged with a wide range of approaches after years of development, including "multiscale detection," "hard negative mining," "bounding box regression," etc.



Conventional Detection Techniques

A two-stage detection paradigm is used by most conventional remote sensing target identification techniques:

1. Candidate Extraction
2. Target Verification

Gray value filtering-based approaches, visual saliency-based methods, wavelet transform-based methods, anomaly detection-based methods, etc. are some frequently utilized techniques in the candidate extraction stage. The fact that all the strategies mentioned above lack supervision and typically fail in complicated contexts is one thing in common with them.

HOG, LBP, SIFT, and other frequently used characteristics are used during the target verification stage. In addition, there are some additional techniques that use the sliding window detection paradigm. Some domain knowledge is employed to recognize objects with specific structure and shape, including oil pots and inshore ships. One example of a circle/arc detection issue is the ability to recognize oil pots. The foredeck and stern of the ship can be detected as part of inshore ship detection. One frequently employed concept is "detection by parts" to enhance the obscured target detection. The "mixing model" is used to detect targets with varied orientations by training various detectors for targets with different orientations.

Deep Learning-Based Detection Methods

Following the huge success of RCNN in 2014, deep CNN has rapidly been used for target recognition in remote sensing. In the remote sensing community, broad object identification frameworks like Faster RCNN and SSD are gaining popularity. The efficacy of deep CNN features for remote sensing images has been studied because there is such a big difference between a remote sensing image and a regular image. Despite its enormous popularity, deep CNN for spectral data was found to be inferior to conventional approaches. Some researchers have enhanced the ROI Pooling layer for better rotation invariance to recognize targets with varying orientations. Some researchers developed the detection from a Bayesian perspective, where the model is adaptively updated based on the distribution of test images, to increase domain adaptation. Additionally, feature fusion and attention techniques have both been applied to enhance the identification of small targets.

FUTURE OF OBJECT DETECTION

1. Lightweight object detection

To hasten the algorithm for object detection so that it can operate without stuttering on mobile devices. Mobile augmented reality, smart cameras, face recognition, and other applications are some of the more significant ones. Despite significant progress in recent years, a machine's performance is still significantly slower than a human's, particularly when detecting some small objects.

2. AutoML meets detection

The sophistication of recent deep learning-based detectors is increasing, and they strongly rely on prior experiences. By utilizing neural architecture search, it is possible to minimize human involvement in the detection model's design (such as how to build the engine and how to create anchor boxes). The future of object detection may lie in autoML.

3. Detection meets domain adaptation

Assuming independent and identically distributed (i.i.d.) data, the training phase of any target detector can be conceptualized as a likelihood estimation process. It is still difficult to recognize objects using non-i.i.d. data, especially for some real-world applications. In terms of domain adaptation, GAN has demonstrated encouraging results, and it could eventually be very beneficial for object detection.

4. Weakly supervised detection

A deep learning-based detector is often trained using many carefully annotated images. The annotating procedure is costly, time-consuming, and ineffective. For lowering labor costs and increasing detection flexibility, it is crucial to develop weakly supervised detection methods where the detectors are only trained using image-level annotations, or partially with bounding box annotations.

5. Small item detection

It has long been difficult to find small objects in vast settings. This research approach may have applications such as using remote sensing photos to count the population of wild animals and determining the condition of some significant military targets. The incorporation of visual attention mechanisms and the creation of high resolution, lightweight networks may be some more directions.

6. Detection in videos

Real-time object detection and tracking in HD videos is essential for video surveillance and autonomous vehicles. Traditional object detectors typically focus on image-wise detection while ignoring the relationships between video frame correlations. An important study area is enhancing detection by investigating the spatial and temporal connection.

Distance Detection

In machine learning, distance metrics are crucial.

Many well-liked and successful machine learning algorithms, such as k-nearest Neighbours for supervised learning and k-means clustering for unsupervised learning, are built on their foundation. Depending on the nature of the data, several distance measures must be selected and applied. As a result, it's crucial to understand how to apply, compute, and arrive at scores using a variety of common distance measurements.

A distance measure is an objective score that encapsulates how different two items are from one another in a certain issue domain. The two objects are often rows of data that describe an event or a subject (such a person, automobile, or house) (such as a purchase, a claim, or a diagnosis).

The following is a brief list of some of the more well-known machine learning algorithms that rely on distance measures at their core -

1. K-Nearest Neighbors
2. Learning Vector Quantization (LVQ)
3. Self-Organizing Map (SOM)
4. K-Means Clustering

Different scales may apply to numerical numbers. It is frequently a good practice to normalize or standardize numerical values before computing the distance measure because this might have a significant impact on the calculation.

It's possible to think about numerical error in regression problems as a distance. One such one-dimensional distance measure is the difference between the expected value and the predicted value, which may be added up or averaged over all samples in a test set to provide the overall distance between the expected and predicted outcomes in the dataset. A common distance measurement may mimic the computation of the error, such as the mean squared error or mean absolute error.

As can be seen, distance measurements are crucial to machine learning. The following list includes four distance metrics that are maybe the most often employed in machine learning -

1. Hamming Distance

Hamming distance is a mathematical formula that determines the separation between two binary vectors, commonly known as binary strings or bitstrings. When one-hot encoding categorical columns of data, bitstrings are almost certainly going to be present.

2. Euclidean Distance

The Euclidean distance measures the separation between two vectors with real values. When determining the distance between two rows of data with numerical values, such as floating point or integer values, you are most likely to utilize the Euclidean distance.

3. Manhattan Distance

The distance between two real-valued vectors is determined using the Manhattan distance, also known as the Taxicab distance or the City Block distance. Perhaps vectors that describe items on a regular grid, such as a chessboard or city blocks, are more beneficial. The measure's nickname, "taxicab," alludes to the idea behind what it calculates: the quickest route a taxicab would travel between city blocks (coordinates on grid). For two vectors in an integer feature space, Manhattan distance may be more appropriate to use than Euclidean distance.

4. Minkowski Distance

The Minkowski distance measures the separation between two vectors with real values. It is a generalization of the Euclidean and Manhattan distance measurements that includes the "order" or "p" parameter, which enables the calculation of other distance measures.

Text-to-speech recognition

A novel technology with rapidly evolving capabilities and prospective uses is text-to-speech conversion. Even the most intelligent contemporary systems have a variety of flaws that are frequently referred to as "lack of naturalness" as a catch-all. We have outlined numerous places in this article where rules and table values might be gradually enhanced in the future to provide more believable and understandable speech output from text-to-speech systems. As a result, a variety of users should find these systems more tolerable.

The ability of a computer to identify phonemes and remarks in verbal lexicon and transform them into engine-coherent composition is known as speech recurrence. The following frameworks' underlying speech recognition scheme can be confidential:

Speakers: Every sort of speaker uses a different style of speaking. The designs are created for either a specific speaker or an independent speaker.

Articulate Sound: The way a speaker speaks demonstrates a component of voice acknowledgment. Some ideals can distinguish between a single claim and two separate assertions separated by a halt.

Terminology: The amount of terminology used demonstrates a crucial role in determining the complexity, effectiveness, and accuracy of the structure.

We have also noted several additional fundamental issues that hinder development in some aspects of text-to-speech conversion (as well as negatively affect development in other speech science and technology domains). The first involves spectral data from female voices being fitted into the present formant synthesizer models. The fit is not very good for breathy vowels, and it seems that some of the spectrum variations brought on by tracheal coupling have perceptual significance.

When thinking about the development of "natural" rule systems that manipulate articulatory structures, we find a second set of fundamental issues. Although still in its infancy, it appears that research into the fundamental mechanisms behind speech perception and production is essential for advancement. Supporting these initiatives will ultimately provide us with new perspectives and technical skills. On the other hand, text-to-speech conversion is a great area of attention for honing the research topics in the fundamental sciences.

Utilizing MATLAB, the TTS format is successfully converted. The suggested algorithm is an effective solution for text to speech conversion utilizing visually impaired individuals. The image is taken using the Raspberry Pi camera and then converted to text format. OCR is an image to text conversion tool. For TTS conversion, TTS is utilized.

These algorithms convert text to audio format, and the output is audibly audible for blind or low vision individuals. High precision text to speech conversion will aid blind individuals in the future.

A beneficial technology that will soon be prevalent is speech-to-text conversion. It's simple to construct applications with this tool using Python, one of the most widely used programming languages worldwide.

As we advance in this area, we're establishing the foundation for a time when spoken commands as well as fingertips can be used to access digital information.

Python Deployment with Android Studio

Python is a popular programming language used for various purposes such as web development, data analysis, artificial intelligence, and more. With the increasing popularity of mobile devices, many developers are interested in integrating Python code into their Android applications. Android Studio is an integrated development environment (IDE) that is widely used for developing Android applications. In this article, we will discuss Python deployment in Android Studio.

The process of deploying Python code in Android Studio involves using the Chaquopy plugin. Chaquopy is a Python SDK that enables developers to write Python code in Android Studio and deploy it as a native Android application. The Chaquopy plugin provides an interface between the Python interpreter and the Android platform, allowing developers to easily integrate Python code into their Android applications.

To deploy Python code in Android Studio using Chaquopy, follow these steps:

1. Install the Chaquopy plugin: First, you need to install the Chaquopy plugin in Android Studio. To do this, open Android Studio and navigate to File > Settings > Plugins. In the search box, enter "Chaquopy" and click on the "Install" button. After installation, you need to restart Android Studio.
2. Create a new project: After installing the Chaquopy plugin, create a new Android project in Android Studio. In the "Create New Project" dialog box, select "Empty Activity" and click on "Next". Enter a name for your project and select the target Android version. Click on "Finish" to create the project.
3. Add the Chaquopy dependency: To add the Chaquopy dependency to your project, open the build.gradle file and add the following code to the dependencies section:

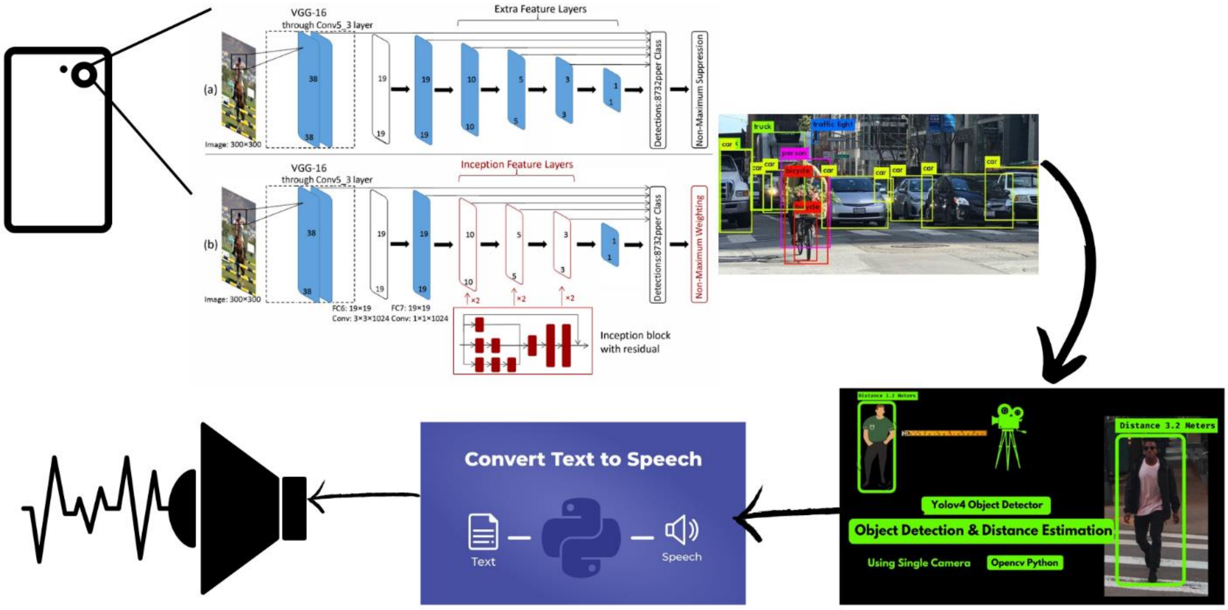
```
arduinoCopy code

dependencies { implementation 'com.chaquo.python:chaquopy:6.2.3'
}
```

4. Write Python code: After adding the Chaquopy dependency, you can start writing Python code in Android Studio. To create a new Python file, right-click on the project folder and select New > Python file. You can now write your Python code in this file.
5. Build and run the project: After writing your Python code, you need to build and run the project to deploy the Python code as an Android application. To build the project, click on the "Build" menu and select "Make Project". Once the project is built, click on the "Run" button to run the application on an Android emulator or a physical device.

In conclusion, deploying Python code in Android Studio is a straightforward process using the Chaquopy plugin. By following the steps outlined above, you can easily integrate Python code into your Android applications and leverage the power of Python in mobile development.

TOPIC OF THE WORK

a) System Design / Architecture



The architecture of a system to assist visually impaired individuals is designed to address the challenges faced by this community in their daily lives. The system is divided into three main parts: the image detection part, the distance approximation part, and the conversion of text output to speech.

The first part, image detection, is a crucial step in the process. The system utilizes a machine learning model to detect objects in the environment. The ML model is trained to recognize a variety of objects, such as cars, poles, lights, trucks, buses, and many more. When the model detects an object, it is identified and labeled accordingly. This information is then passed on to the next step.

The second part of the system involves the detection of the approximate distance between the object and the camera, which in this case is the camera on a mobile device. This step is essential in determining the appropriate action to be taken, such as alerting the user to an obstacle in their path or providing them with information about their surroundings. The output for this step is in the form of text, which is then passed on to the final step.

The third and final part of the system is the conversion of the text output to speech. This step is crucial to ensure that visually impaired individuals receive the necessary information in a format that is accessible to them. The text output is converted into speech using advanced speech synthesis techniques. The output is then played through the device’s speakers, allowing the user to hear the information in real-time.

The entire system is deployed through a user-friendly Android app. The app is designed to be intuitive and accessible for visually impaired individuals, making it easy for them to navigate through unfamiliar environments. The app also allows users to customize their experience based on their individual preferences and needs.

The potential impact of this system on the lives of visually impaired individuals is significant. The system can empower individuals to navigate through their environment independently, providing them with a greater sense of freedom and mobility. By using advanced technologies such as machine learning and speech synthesis, the system can provide visually impaired individuals with information in a way that is both accurate and accessible.

In conclusion, the architecture of a system to assist visually impaired individuals is designed to address the challenges faced by this community. The system utilizes advanced technologies to detect objects, approximate distances, and convert text output to speech. The system is deployed through a user-friendly Android app, empowering visually impaired individuals to navigate through their environment independently.

b) Working Principle

The operating principle of the app to aid visually impaired individuals in navigation has three main components.

Part 1) Image detection: -

The first component is image detection, which involves using the YOLOv7 object detection model to identify and detect objects in an image. The model is able to identify various objects such as cars, poles, lights, trucks, buses, and more, and is designed to draw bounding boxes around these objects to better identify them.

Part 2) The distance approximation part: -

The second component is the distance approximation part, where geometry is utilized to estimate the distance between the camera (in this case, a mobile camera) and the detected object. By knowing the perceived focal length of the camera, distances to objects of known width can be estimated using a simple equation. For instance, if the width of a vehicle is known to be 2m, the object detector can output a bounding box around the vehicle, which provides the perceived width "p" to be used in the distance equation to estimate the distance "d" to the vehicle.

Here, we use geometry to our advantage. Generally, when using one camera, distance to objects of know width can be estimated using the perceived focal length of the camera.

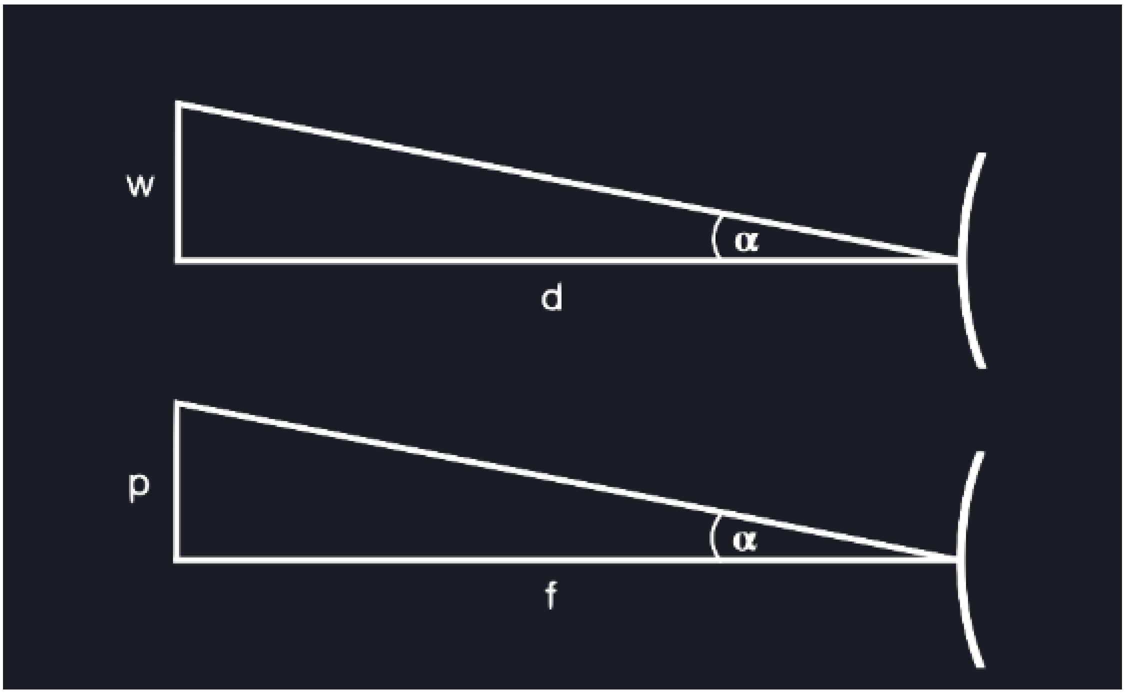


Fig: -1) Relation between width(w) and distance(d) in the physical space, Physical dimensions on the top, and dimensions in the pixel space on the bottom.

By expressing both using the angle α we get:

$$\tan(\alpha) = \frac{w}{d} = \frac{p}{f} \tag{1.1}$$

where w and d are in metres, and perceived distance p as well as perceived focal length f in pixels. Since α is in both equations we can do

$$\frac{w}{d} = \frac{p}{f} <=> f = \frac{pd}{w} <=> d = \frac{wf}{p} \tag{1.2}$$

Conclusion: - So. Let's say we want to estimate the distance from the camera to a nearby vehicle. If we know the perceived focal length **f** in pixels of you camera we can use **equation 1.2** to approximate distances in the wild.

Example: - We assume the vehicles are 2m wide, which is the **w.** Then we use object detector to output a bonding box around it. This gives use the perceived width **p** in **equation 1.2,** with which we get the distance **d.**

Part -3) Converting the text output to speech

The third component involves converting the text output to speech. After the object and its distance have been predicted by the app, the results are stored in a list, and the text is converted to speech using a package like "pyttsx3". This allows the user to receive real-time audio instructions and information about their surroundings.

There are several APIs available to convert text to speech in Python like **'pyttsx3'** package. The general idea behind text to speech is simple first our model will predict the object and its distance then the predicted result will be stored in list and at last using **'pysttsx3'** package we will convert the text to speech.

Part -4) Deploying Python with Android Studio

Finally, the Python code is implemented in Android Studio and deployed on an Android platform. The app is designed to be user-friendly and easy to use for visually impaired individuals. The inclusion of vibrations in the app can provide additional feedback to users, making it even more accessible for individuals with visual impairments. By combining the power of image detection, distance approximation, and text-to-speech conversion, this app can help visually impaired individuals navigate unfamiliar environments more confidently and independently.

c) Expected Results -

The result of the project is to develop a safety system app for visually impaired people using deep learning and machine learning algorithms, which detects obstacles like potholes, humps, vehicles, and objects on the road and reduces the speed of the vehicle gradually. Some of the benefits of this system are:

• Saves time by detecting obstacles beforehand and avoiding accidents or crashes.
• Assists people who take care of visually impaired individuals by providing an extra layer of safety on the road.
• Prototype of the system is developed which measures and monitors road conditions from a distance of about 3 meters from the obstacle.
• Notifies the driver of any sudden movement of obstacles that may pose a threat, leading to a decrease in the speed of the vehicle and avoidance of accidents or crashes.
• Develops a system for the detection and recognition of various poses of the objects and tracks them efficiently, ensuring that the system is reliable and accurate.
• Helps those who can't afford eye operations, power glasses, or lenses by providing a low-cost project approach that ensures safety on the road.

The project uses deep learning and machine learning algorithms to detect obstacles and reduce the speed of the vehicle gradually. It is a software-based approach, making it a cost-effective solution for visually impaired individuals or those who cannot afford high-tech gadgets or expensive eye treatments.

The system uses a prototype that can measure and monitor road conditions from a distance of about 3 meters from the obstacle, and notify the driver of any sudden movement of obstacles that may pose a threat. This system helps in avoiding accidents or crashes, which is beneficial for visually impaired individuals who often face challenges while crossing roads or navigating through unfamiliar areas.

Moreover, this project aims to develop a system that detects and recognizes various poses of objects and tracks them efficiently. It ensures that the system is reliable and accurate, providing an extra layer of safety for visually impaired individuals.

The project is an innovative solution that aims to provide safety on the road for visually impaired individuals and those who cannot afford high-tech gadgets or expensive eye treatments. It uses advanced technologies like deep learning and machine learning algorithms to detect obstacles, reduce the speed of the vehicle gradually, and ensure a safe journey for all.

Individual Report and Analysis:

1. **MVN Rajesh Reddy (20BAI10249)**

   a) *Data Gathering:* The first step entails gathering a sizable and varied dataset containing pictures of numerous things in various settings. The YOLO model will be trained and tested using this dataset. The names of the items in the photographs will be labelled.
   b) *Data Preprocessing:* The acquired photographs will go through preprocessing to improve their quality and make sure the YOLO algorithm can use them. Resizing, normalisation, and format conversion are all parts of the preparation process for images.
   c) *Training the YOLO model:* The preprocessed dataset will be used to train the YOLO model. A convolutional neural network used in the YOLO method can recognise objects in real-time with just one forward pass. The model will be honed to instantly identify different items and produce a bounding box around them.
   d) The YOLO model will be combined with a camera to capture real-time photos, which will then be processed using the model. This integration will also include audio output. An audio description of the discovered objects will be produced using the model's output and played to the user. The system will be made to be lightweight and portable so users can transport it.
   e) *Testing and optimisation:* After the system is created, it will be tested on people who are blind in order to gauge its success and spot any flaws. The system will be improved based on the comments to enhance its usability and performance.
   f) *Tools and Technologies:*
   The following tools and technologies will be used to develop the system:
   Python programming language
   YOLO object detection algorithm

OpenCV (Open Source Computer Vision Library)

CONCLUSION

The creation of an object detection system for blind users that is implemented on Android and uses the YOLO machine learning algorithm has the potential to greatly raise the standard of living for blind users. The goal of this project is to create a tool that will enable visually impaired people to travel more safely and freely.

The project's major goal was to create a system that can recognise different items in real-time and produce audio descriptions of them, allowing vision impaired people to move around more safely and independently. By creating an Android application that incorporated the YOLO algorithm, a camera, and an audio output system, the project was successful in attaining this goal.

By utilising the YOLO method, the study also attempted to overcome some of the shortcomings of current object identification systems for those with visual impairments. A system that is intended to help people who are visually impaired navigate their environment safely and independently must be able to recognise things in real-time. The YOLO algorithm is notable for its accuracy and efficiency. Additionally, the project connected the system with an Android mobile, enhancing its use and accessibility.

Data gathering, data preparation, model training, system integration, and optimisation were some of the stages that made up the project's development process. In order to train and evaluate the YOLO model, a broad dataset of photos of different objects in various situations had to be gathered. To improve its quality and make it compatible with the YOLO method, the acquired data underwent preprocessing. The YOLO model was developed to instantly identify different items and create a bounding box around them. Users may shoot real-time photos, process them using the model, and produce an audio output to describe the found objects thanks to the system's integration with an Android device. To assess the system's efficacy and usefulness, it was put to the test with people who are blind based upon their need.

The created system's portability and cost are two of its main benefits. The technology was made to be small and portable so that blind or visually impaired people may use it wherever they went. Additionally, the device is reasonably priced, making a wider spectrum of visually impaired people able to use it.

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