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Currency Detector for Visually Impaired using Deep Learning

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Abstract : The project " Currency Detector for Visually Impaired using deep learning " focuses on creating an assistive technology to help visually challenged individuals recognize currency denominations. Despite some tactile features on banknotes, distinguishing it remains difficult. The system employs a convolution neural network (CNN) trained on images of various cash notes under different conditions to achieve high accuracy.

The device consists of a high-resolution camera it captures images, processes it using AI, and provides audio feedback to inform the user of the denomination. It ensures ease of use, privacy, and financial independence for visually impaired individuals. The system has received positive user feedback, proving beneficial in multicultural environments to different currencies are used. By leveraging deep learning and image processing, this portable solution enhances accessibility and reduces reliance on others for financial transactions, making everyday activities easier for the visually impaired.

I. INTRODUCTION

The project is for who are blind or visually challenged, recognizing currency provides a serious barrier the affects it independence and self-assurance in daily interactions. For people with significant vision problems, the capacity to recognize and distinguish between different denominations of money is largely inaccessible, although being essential for financial liberty. The goal of this work is to create a cash detecting system it is affordable, effective, and easily accessed for the benefit of visually impaired people.

It introduces an innovative assistive technology it combines cutting-edge machine learning algorithms and image processing techniques; quick and accurate cash recognition is made possible and effective for image recognition tasks using a large dataset of bank notes as training material. To ensure excellent accuracy in real-world scenarios, the training contains photos taken at various angles and with a range of lighting conditions. The user receives discrete and instantaneous feedback via an auditory interface that conveys the system's output.

For visually impaired individuals, recognizing currency is a significant challenge, impacting their financial independence and daily transactions. While

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Indian banknotes feature unique tactile marks, distinguishing between denominations remains difficult. The project presents a Generative AI Based Currency Detector designed to assist visually impaired users by accurately identifying banknotes and providing real-time audio feedback

II METHODOLOGY

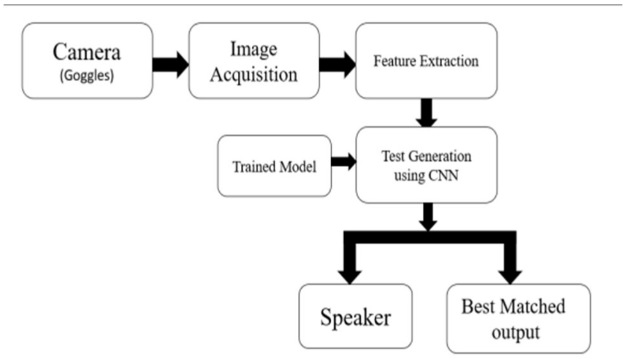

Fig 1: Block diagram

The methodology section outlines the systematic approach employed in designing, implementing, and evaluating the Currency Detector for Visually Impaired system. The section describes the processes involved in dataset collection, model selection, preprocessing techniques, training strategies, and evaluation metrics. The core objective is to develop a robust and efficient currency detection system that leverages various techniques to enhance the accuracy of currency recognition.

The provided block diagram Fig 1 represents a vision-based system utilizing Convolutional Neural Networks (CNNs) for image processing and classification. The system starts with a Camera (glasses), which captures images from the surroundings. These images are then processed in the Image Acquisition stage, where they are digitized and prepared for analysis. The processed images are passed to the Feature Extraction/Image Classification using CNN module, where CNN algorithms analyze patterns and classify the images. Following this, the Test generation by using CNN step further refines the extracted data, transforming it into a structured format. The integrated system is likely designed for assistive applications, such as aiding visually impaired individuals by converting visual information into auditory outputs.

III IMPLEMENTATION

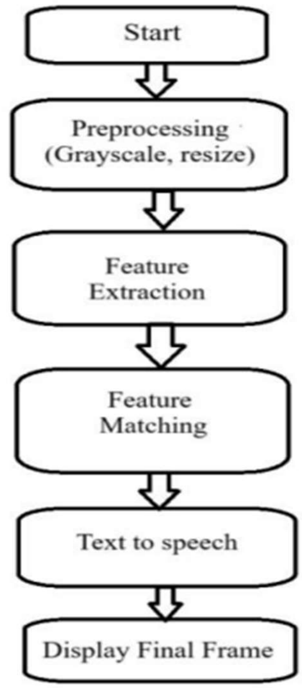

Fig 2: Flow chart

The implementation of a currency detector for visually impaired individuals addresses a crucial need by enabling them to independently and accurately identify paper currency. Traditional methods, such as tactile marks or differences in size, are often insufficient, especially for individuals with total vision loss. The proposed solution integrates computer vision and audio output technologies to create a reliable and accessible system. The captured image undergoes preprocessing steps such as grayscale conversion, noise reduction, and resizing to prepare it for recognition. Currency identification can be achieved using either traditional computer vision techniques, such as feature matching, or more advanced machine learning models like Convolutional Neural Networks (CNNs).

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The deep learning approach is generally preferred due to its higher accuracy and robustness under varied lighting and orientation conditions. Once the denomination is identified, it is conveyed to the user through a text-to-speech engine, providing audio feedback via a speaker. The user interface is designed for simplicity and accessibility, potentially including voice commands, tactile buttons, and vibration feedback. The system is suitable for implementation as a mobile app or as a portable embedded device and can be adapted to recognize multiple currencies. For optimal performance, the model should be trained on a diverse dataset of currency images and tested under real-world conditions.

Manual detection methods involve human inspection, which is time-consuming and prone to errors, reducing overall accuracy. Traditional counterfeit detection relies on UV or magnetic detection techniques, which can be ineffective against sophisticated fakes. CCTV-based monitoring systems lack real-time classification capabilities, leading to delays in counterfeit identification. Most existing systems do not integrate advanced deep learning models, limiting their ability to detect complex counterfeit patterns. Feedback mechanisms in traditional systems are often limited to visual alerts, lacking auditory or multi-sensory feedback options. Manual inspection lacks consistency, as human judgment may vary, leading to inconsistent results and overlooked counterfeit notes. Traditional methods rely on visual inspection, which becomes ineffective in identifying complex counterfeit patterns. This increases the likelihood of errors and compromises the overall accuracy of the detection process. Conventional counterfeit detection methods are vulnerable to sophisticated counterfeiting techniques, rendering them ineffective in modern scenarios. Advanced counterfeiters use high-quality replication methods that bypass UV and magnetic detection systems. As a result, traditional approaches fail to adapt to evolving threats in currency security.

The given flow diagram represents a currency detection, particularly designed for use with wearable goggles, which integrates both software and hardware components for real-time assistance. The software block diagram begins with a camera mounted on the goggles, which continuously captures video input. This video stream is divided into individual frames, allowing each image to be processed separately. Through image segmentation, specific regions of interest are isolated, and filtering techniques are applied to reduce noise and enhance image clarity. These pre-processed images are then analyzed using advanced object detection algorithms. Simultaneously, a parallel path processes images using techniques like SVM-SIFT, where SIFT extracts scale-invariant features, and SVM classifies these features. The outputs from both paths are fed into a Convolutional Neural Network (CNN) algorithm to improve accuracy and generate final detection results. These results are sent to the hardware block via serial communication. A Python-based text-to-speech engine (pyttsx3) converts the detected object names into audible speech, which is relayed through a speaker.

IV RESULTS

The implementation of this object detection and alert system using camera-equipped goggles, integrated with deep learning algorithms and embedded hardware, proves to be an efficient and effective solution for real-time object recognition and user notification. By employing advanced techniques such as image segmentation, filtering, CNN classification, the system ensures identification of objects from live video feed. The use of Python's text-to-speech (pyttsx3) enhances user interaction by providing voice-based alerts. The coordination of software and hardware components results in a responsive system capable of assisting users especially those with visual impairments by informing them of currency. The result demonstrates that the system is functional, reliable, and suitable for real-time applications.

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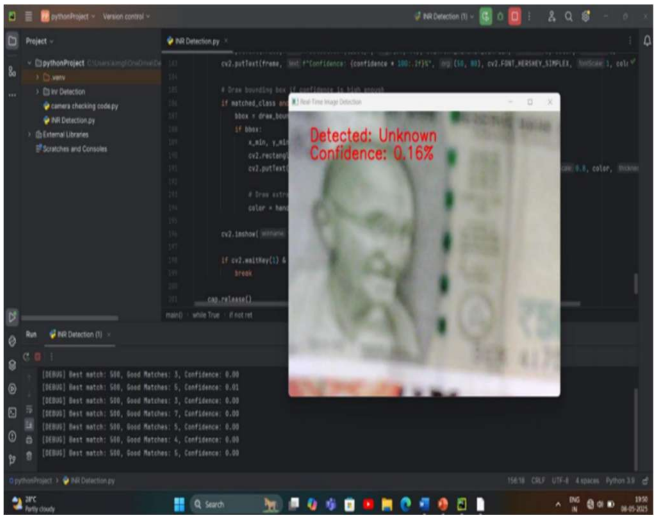

Fig.3 Implementation of the Program

The displayed image captures the output of a real-time currency detection system built using Python and OpenCV. In the interface, the system is actively analyzing a currency note visible through a webcam feed.

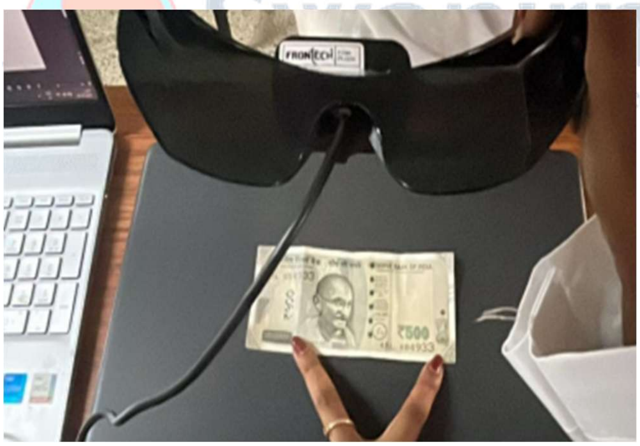

Fig.4 500 rupee note

```
[DEBUG] Best match: 500, Good Matches: 39, Confidence: 0.02
[DEBUG] Best match: 500, Good Matches: 59, Confidence: 0.03
```

Fig.5 Result for 500 currency

The above image shows the result for showing a 500 rupee currency note with its good matches for 39 to 59.

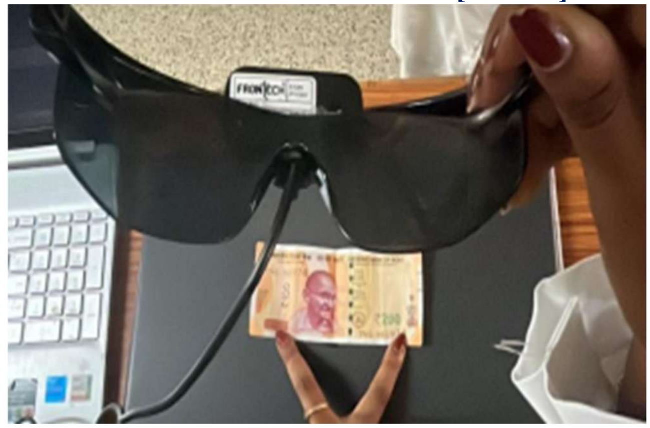

Fig.6 200 currency note

```
[DEBUG] Best match: 200, Good Matches: 17, Confidence: 0.02
[DEBUG] Best match: 200, Good Matches: 9, Confidence: 0.01
```

Fig.7 Result for 200 Currency note

The above image shows result for showing a 200 rupee currency note with its good matches of 90 to 17.

Fig.8 100rupee Currency note

```
[DEBUG] Best match: 100, Good Matches: 143, Confidence: 0.05
[DEBUG] Best match: 100, Good Matches: 28, Confidence: 0.01
```

Fig.9 Result for 100rupee Currency note

The above shows results for an hundred rupee currency note with its good matches from 28 to 143

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Fig.10 50 rupee Currency note

```
[DEBUG] Best match: 50, Good Matches: 9, Confidence: 0.05
[DEBUG] Best match: 50, Good Matches: 6, Confidence: 0.03
```

Fig. 11 Result for 50 rupee Currency note

The above shows results for a fifty rupee currency note with its good matches from 6 to 9

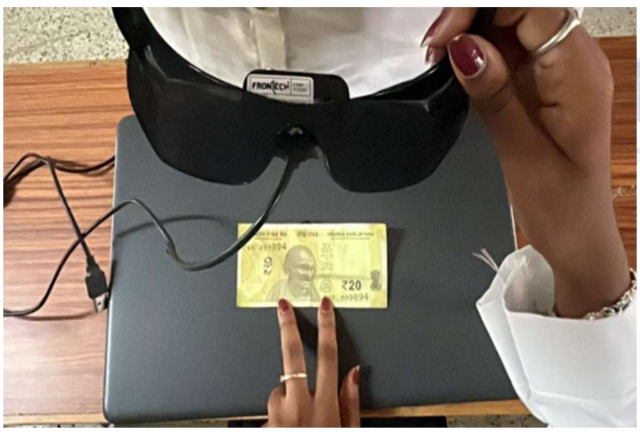

Fig. 12 20 rupee Currency note

```
[DEBUG] Best match: 20, Good Matches: 50, Confidence: 0.01
[DEBUG] Best match: 20, Good Matches: 49, Confidence: 0.01
```

Fig. 13 20 rupee Currency note

The above shows results for a twenty rupee currency note with its good matches from 46 to 50.

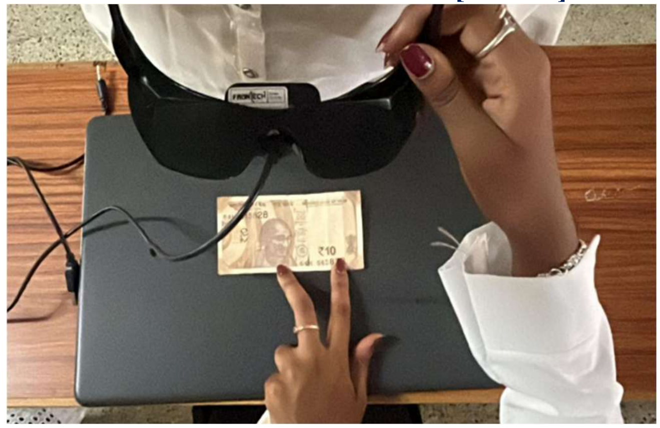

Fig. 14 10 rupee Currency note

```
[DEBUG] Best match: 10, Good Matches: 14, Confidence: 0.07
[DEBUG] Best match: 10, Good Matches: 15, Confidence: 0.08
```

Fig. 15 Result for10 rupee Currency note

The above shows results for a ten rupee currency note with its good matches from 14 to 15

V CONCLUSION

The development and implementation of a currency detection system designed to assist visually impaired individuals represent a significant step toward inclusive technology and practical social innovation. By integrating classical computer vision techniques such as Scale-Invariant Feature Transform (SIFT) and Brute-Force Matching (BFMatcher), the system effectively analyzes and identifies Indian currency denominations through a live video stream. A camera mounted on wearable glasses captures the currency, and the processed results including denomination and confidence level are displayed on the screen and announced via voice feedback. This approach addresses a critical gap in accessibility by enabling visually impaired individuals to gain independence in handling physical currency, which remains a predominant medium of exchange in India despite the rise of digital payment systems.

The Indian currency detection system not only demonstrates the practical application of computer vision and real-time image processing but also reflects a thoughtful effort to use technology for social good. It highlights how simple hardware

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combined with intelligent software design can create tools that meaningfully improve lives. With further refinements, including AI-based learning models and mobile or embedded implementations, this system could be expanded into a robust and widely adoptable solution for the visually impaired community in India and beyond.

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