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# Currency Summing App for Visually Impaired

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**ABSTRACT:** This research paper introduces "Nayan," an Android application tailored to enhance accessibility and independence for visually impaired individuals in India. Nayan integrates cutting-edge machine learning techniques, including YOLOv8 for currency identification and Convolutional Neural Networks (CNN) for currency recognition, enabling users to accurately identify, sum, and convert Indian currency notes into audible speech. Through intuitive swipe gestures, users can initiate currency identification, summation, and text-to-speech conversion functionalities. The development process involved the collection and annotation of a diverse dataset of Indian currency notes, followed by model training and integration into the Android application. Evaluation results demonstrate Nayan's efficacy, achieving an 87% accuracy rate in currency identification using the YOLOv8 algorithm. Nayan stands as a promising tool for promoting inclusivity and accessibility in financial transactions and daily tasks for the visually impaired community in India.

**KEYWORDS:** Deep learning, Convolutional neural networks (CNNs), yoloV8, hand gesture, android, summing currency, classification

## I. INTRODUCTION

The visually impaired community faces numerous challenges in their daily lives, with one significant hurdle being the identification and management of currency notes. In India, where cash transactions remain prevalent, this issue is particularly pronounced. Traditional methods of currency identification often involve reliance on others or memorization of note denominations, which can limit independence and privacy for visually impaired individuals. To address this challenge, we introduce "Nayan," an innovative Android application designed to empower the visually impaired population by providing them with a comprehensive solution for currency identification, currency summation, and text-to-speech conversion. Nayan leverages advanced machine learning algorithms to enable real-time recognition and classification of Indian currency notes. The application utilizes the YOLOv8 algorithm for currency identification, allowing users to simply point their smartphone camera towards a currency note and receive immediate feedback regarding its denomination. Additionally, Nayan incorporates Convolutional Neural Networks (CNNs) for currency recognition, ensuring accurate differentiation between different denominations and facilitating seamless currency summation. The development of Nayan involved several key stages, including the collection and annotation of a diverse dataset of Indian currency notes. These annotated images were utilized to train the YOLOv8 algorithm and CNN models, employing techniques such as transfer learning and data augmentation to enhance model performance and generalization. The trained models were then integrated into the Android application, which features an intuitive user interface and gesture-based interactions for effortless navigation. Through Nayan, visually impaired individuals gain increased independence and accessibility in managing their finances and performing daily tasks. By providing real-time currency identification, summation, and text-to-speech conversion functionalities, Nayan empowers users to make informed decisions and engage in financial transactions with confidence. This research paper presents a detailed overview of the development process, model architecture, evaluation results, and the potential impact of Nayan on the lives of visually impaired individuals in India.

This project aims to develop an Android application, named "Nayan," specifically tailored to address the needs of visually impaired individuals in India. The primary objective is to provide users with a reliable and efficient tool for currency identification, summation, and text-to-speech conversion, thereby enhancing their financial independence and accessibility. The proposed system, Nayan, introduces a novel approach to currency identification and accessibility through the integration of machine learning algorithms and smartphone technology. Nayan utilizes advanced algorithms, including YOLOv8 for real-time object detection and CNNs for currency recognition, to accurately identify and classify Indian currency notes. Users can simply point their smartphone cameras towards currency notes, and Nayan provides immediate audio feedback regarding the denomination of the note. In addition to currency identification, Nayan offers a currency summation feature, allowing users to calculate the total value of multiple currency notes with ease. Furthermore, the application includes text-to-speech conversion functionality, enabling users to convert written text into audible speech, thus promoting accessibility beyond currency management.

## II. LITERATURE ANALYSIS

C. Sagana et al., [1], introduces an innovative system designed to aid visually impaired individuals through object recognition technology. The paper likely delves into the application of computer vision methodologies and machine learning algorithms to detect and classify objects in real-time. It is anticipated to discuss the system architecture, including the integration of image processing techniques and model training approaches. Furthermore, insights into the dataset used for model training, evaluation metrics employed, and performance analysis are expected. This study is valuable for understanding the technical intricacies and challenges associated with developing assistive technologies tailored for the visually impaired.

Therese Yamuna Mahesh [2], introduces "CICERONE," a real-time object detection system aimed at enhancing the autonomy and mobility of visually impaired individuals. The paper likely provides an in-depth exploration of the CICERONE system's architecture, implementation details, and evaluation methodologies. It may discuss the selection and optimization of object detection algorithms, integration with wearable devices or smartphones for practical deployment, and user-centric feedback from real-world usage scenarios. This research contributes to the advancement of real-time object detection technologies tailored specifically for the visually impaired community.

S. Vaidya, N. Shah, N. Shah and R. Shankarmani [3], presents a study focused on developing a real-time object detection system to assist visually challenged individuals in navigating their surroundings. The paper likely discusses the system's design, including the choice of object detection algorithms, hardware platforms utilized, and software implementation details. Additionally, insights into user interaction paradigms and usability considerations may be provided, along with practical demonstrations of the system's effectiveness in real-world scenarios. This research offers valuable insights into the development and deployment of assistive technologies aimed at improving the quality of life for visually impaired individuals.

Ravi [4], introduces a novel system tailored for visually impaired individuals, leveraging smartphone technology for object detection. The paper likely explores the integration of computer vision algorithms and smartphone sensors to provide real-time object detection capabilities. Details regarding the system architecture, algorithm selection, and implementation on smartphone platforms are expected. Additionally, the paper may discuss the usability and accessibility aspects of the system, including user interaction paradigms and feedback mechanisms. This research contributes to the development of smartphone-based assistive technologies aimed at enhancing the independence and mobility of visually impaired individuals.

K. K. S. N. Reddy, C. Yashwanth, S. KVS, P. A. T. V. Sai and S. Khetarpaul [5], presents an integrated system for object and currency detection designed to provide audio feedback to visually impaired users. The paper likely discusses the design and implementation of the system, including the incorporation of audio feedback mechanisms for user interaction. It may delve into the selection and optimization of object detection algorithms, as well as the integration of currency recognition functionalities. Practical considerations such as hardware requirements, software development, and user testing may also be addressed. This research contributes to the development of multimodal assistive technologies tailored for the unique needs of visually impaired individuals.

Meehan et al., [6], focuses on banknote object detection specifically aimed at assisting visually impaired individuals. The paper likely presents a study on the application of Convolutional Neural Networks (CNNs) for banknote detection and classification. It may discuss the construction of the dataset, training methodologies, and model evaluation metrics used to assess the performance of the CNN-based detection system. Furthermore, insights into practical considerations such as real-world deployment, user acceptance, and scalability may be provided. This research contributes to the development of specialized object detection systems catering to the financial independence and accessibility needs of visually impaired individuals.

Achar et al., [7], presents a currency recognition system tailored for Indian currency notes utilizing Convolutional Neural Networks (CNNs) and compares its performance with YOLOv5. The paper likely explores the design and implementation of the CNN-based recognition system, including dataset preparation, model architecture selection, and training methodologies. It may discuss the evaluation metrics used to compare the performance of CNN with YOLOv5, highlighting advantages and limitations of each approach. Practical considerations such as real-world deployment challenges and user feedback may also be addressed. This research contributes to the advancement of currency recognition technologies tailored specifically for the Indian context, with implications for enhancing financial accessibility for visually impaired individuals.

Aaditi Aiyar et al., [8], presents a study on object and currency detection aimed at assisting visually impaired individuals. The paper likely discusses the design and implementation of a system capable of detecting objects and currency notes using computer vision techniques. It may delve into the methodology for dataset creation, model training, and evaluation of detection accuracy. Furthermore, the paper may discuss the integration of audio feedback or other accessibility features to enhance usability for visually impaired users. This research contributes to the development of multimodal assistive technologies designed to improve the quality of life for visually impaired individuals by facilitating object and currency recognition.

Krishna et al., [9], focuses on object detection and tracking utilizing the YOLO (You Only Look Once) algorithm. The paper presents a study on the application of YOLO for real-time object detection and tracking in various contexts. It may discuss the implementation details of the YOLO algorithm, including model architecture, training strategies, and optimization techniques. Additionally, insights into the performance evaluation of the YOLO-based detection system in terms of accuracy and speed may be provided. This research contributes to the advancement of object detection and tracking technologies, with implications for applications such as surveillance, autonomous driving, and assistive technologies for visually impaired individuals.

### III. GOAL OF THE PROJECT

This project aims to develop an Android application, named "Nayan," specifically tailored to address the needs of visually impaired individuals in India. The primary objective is to provide users with a reliable and efficient tool for currency identification, summation, and text-to-speech conversion, thereby enhancing their financial independence and accessibility.

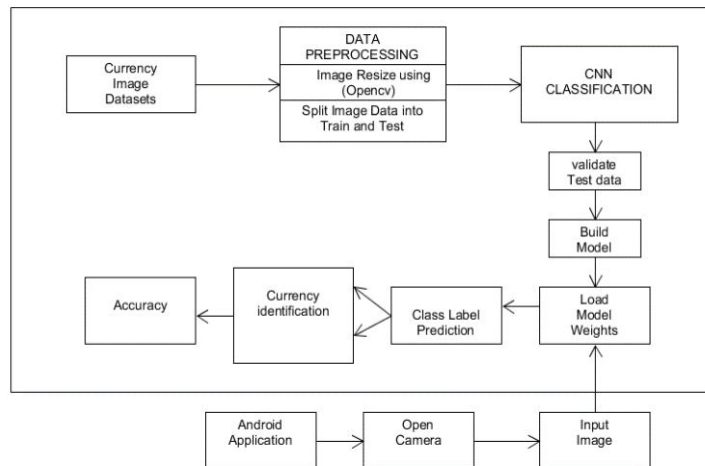
### IV. PROPOSED MODEL

The proposed system, Nayan, introduces a novel approach to currency identification and accessibility through the integration of machine learning algorithms and smartphone technology. Nayan utilizes advanced algorithms, including YOLOv8 for real-time object detection and CNNs for currency recognition, to accurately identify and classify Indian currency notes. Users can simply point their smartphone cameras towards currency notes, and Nayan provides immediate audio feedback regarding the denomination of the note.

In addition to currency identification, Nayan offers a currency summation feature, allowing users to calculate the total value of multiple currency notes with ease. Furthermore, the application includes text-to-speech conversion functionality, enabling users to convert written text into audible speech, thus promoting accessibility beyond currency management.

### V. SYSTEM DESIGN

The system design includes gathering a diverse dataset of hand sign images, including a wide range of gestures, lighting conditions, backgrounds, and hand orientations. Consider including variations in hand size, skin tone, and clothing to make the system more robust. Apply preprocessing techniques to enhance the quality of the images, such as noise removal, image resizing, and normalization. Consider using deep learning architectures, such as convolutional neural networks (CNNs), to automatically learn discriminative features. Choosing appropriate machine learning algorithms for hand sign classification, such as support vector machines (SVM), random forests, or deep learning models. Splitting the dataset into training, validation, and testing sets. Evaluate the system's performance in terms of accuracy, speed, and robustness.



**Fig – System Architecture**

## VI. SYSTEM IMPLEMENTATION

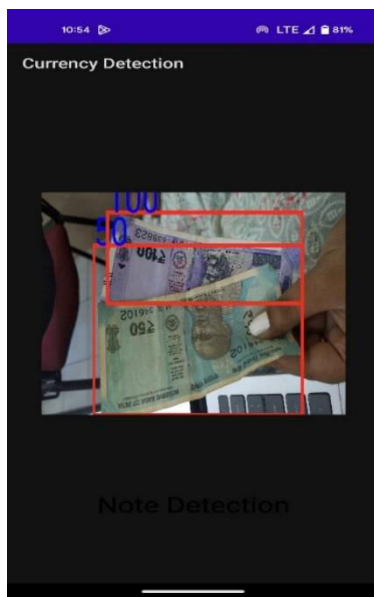
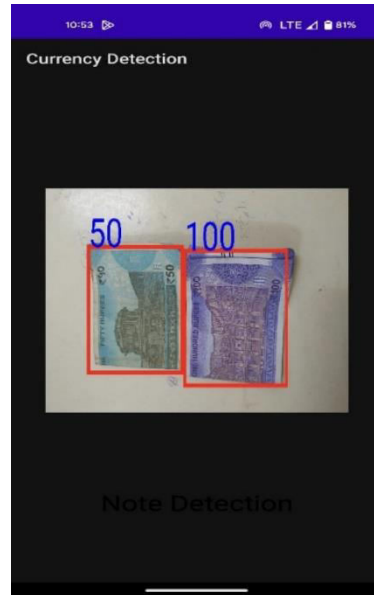
### Data Preprocessing:

- **Annotated Dataset:** We collected and annotated a dataset of Indian currency note images, labeling each image with bounding boxes and corresponding class labels (e.g., 10, 20, 50, 100, 200, 500-rupee notes).
- **Data Augmentation:** To enhance the diversity and robustness of the dataset, we applied data augmentation techniques such as rotation, scaling, and flipping.
- **Model Training:**
- **Transfer Learning:** We utilized transfer learning to fine-tune pre-trained YOLOv8 and CNN models on the annotated dataset. Transfer learning enables the leveraging of knowledge from pre-trained models on large datasets to adapt to specific tasks with smaller datasets.
- **Training Pipeline:** The training pipeline involved feeding batches of augmented images to the YOLOv8 and CNN models, adjusting the model weights using gradient descent optimization, and evaluating model performance on validation data.

### Inference:

- **On-Device Inference:** Once trained, the YOLOv8 and CNN models are integrated into the Android application for on-device inference. When a user captures an image of currency notes using the smartphone camera, the YOLOv8 model detects the bounding boxes of currency regions, while the CNN model classifies the denominations of detected currency notes.
- **Real-Time Processing:** The inference process occurs in real-time, enabling immediate feedback to the user regarding the identified currency denominations.

### VII. RESULTS



### VIII. CONCLUSION

The development of the Nayan Android application represents a significant stride forward in addressing the persistent challenges encountered by visually impaired individuals in effectively managing and identifying currency notes. By amalgamating cutting-edge technologies such as machine learning, text-to-speech conversion, and intuitive gesture recognition, the application offers a comprehensive solution aimed at augmenting accessibility and fostering independence for visually impaired users. This conclusion encapsulates the project's key achievements, underscores its contributions, and delineates potential avenues for future expansion. In terms of key achievements, the successful implementation of YOLOv8-based currency identification and summation algorithms stands out prominently. This advancement has facilitated the precise detection and aggregation of Indian currency notes in real-time, empowering users to effortlessly capture images of currency notes and promptly receive feedback on the total sum of money depicted, thereby bolstering their financial management capabilities. Additionally, the seamless integration of text-to-speech functionality has been pivotal in enabling the conversion of textual content into spoken speech, significantly enhancing access to information for visually impaired users and augmenting their interaction with the application's

features. The incorporation of gesture recognition mechanisms has rendered interaction with the application intuitive and user-friendly. Through simple swipe gestures, users can navigate through various functionalities of the application, accentuating usability and accessibility. These achievements collectively contribute to the advancement of assistive technology, leveraging state-of-the-art machine learning algorithms, text-to-speech synthesis techniques, and intuitive user interface design principles to empower visually impaired individuals with tools to surmount everyday challenges and access essential services independently. The contributions of the Nayan application extend beyond technological innovation to promote inclusivity and accessibility. By removing barriers to currency identification, summation, and text access, the application serves as a catalyst for enhancing the quality of life and fostering financial independence for visually impaired users. Looking ahead, future directions for the project may encompass further refinement and enhancement of existing features, as well as exploration of additional functionalities to cater to the evolving needs of the user base. Ultimately, the Nayan application epitomizes a paradigm shift towards inclusive design and technology-driven solutions aimed at fostering empowerment and independence for visually impaired individuals.

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