



“VISUAL ASSISTANCE FOR BLIND PEOPLES USING DEEP LEARNING TECHNOLOGY”

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Abstract:

This research paper introduces "Vision" 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 Vision's efficacy, achieving an 87% accuracy rate in currency identification using the YOLOv8 algorithm. Vision stands as a promising tool for promoting inclusivity and accessibility in financial transactions and daily tasks for the visually impaired community in India.

CHAPTER 1

INTRODUCTION

1.1 DOMAIN INTRODUCTION

Deep learning, a branch of machine learning, has revolutionized the field with its ability to train neural networks with numerous layers, hence the term "deep." At its core, deep learning relies on artificial neural networks, which mimic the structure and function of the human brain. These networks consist of interconnected layers of neurons, with each layer processing and transforming input data to generate output.

The training process involves iterative adjustments to the network's parameters, guided by a feedback mechanism known as backpropagation, to minimize the discrepancy between predicted and actual outcomes. One of the key strengths of deep learning lies in its capacity for representation learning, allowing it to automatically extract hierarchical features from raw data, enabling superior performance in complex tasks.

Deep learning finds applications across diverse domains, including image recognition, natural language processing, computer vision, and generative modeling. Despite its successes, challenges such as data scarcity, interpretability, and robustness persist, driving ongoing research efforts to enhance deep learning techniques and address emerging limitations.

As deep learning continues to evolve, it holds the promise of unlocking new frontiers in artificial intelligence and driving transformative advancements across various fields.

Deep learning is the branch of machine learning which is based on artificial neural network architecture. An artificial neural network or ANN uses layers of interconnected nodes called neurons that work together to process and learn from the input data.

In a fully connected Deep neural network, there is an input layer and one or more hidden layers connected one after the other. Each neuron receives input from the previous layer neurons or the input layer. The output of one neuron becomes the input to other neurons in the next layer of the network, and this process continues until the final layer produces the output of the network. The layers of the neural network transform the input data through a series of nonlinear transformations, allowing the network to learn complex representations of the input data.

1.2 OVERVIEW

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 "Vision," 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.

Vision 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, Vision incorporates Convolutional Neural Networks (CNNs) for currency recognition, ensuring accurate differentiation between different denominations and facilitating seamless currency summation.

The development of vision 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 Vision, 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, vision 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 Vision on the lives of visually impaired individuals in India.

1.3 OBJECTIVES

- Develop an Android application capable of accurately identifying Indian currency notes using YOLOv8 and CNN algorithms.
- Implement intuitive swipe gestures for seamless navigation and interaction.
- Integrate text-to-speech conversion functionality to facilitate the reading of printed text.
- Ensure the robustness and reliability of the application across various lighting conditions and environments.
- Provide a user-friendly interface with clear audio cues and instructions for ease of use.

1.4 EXISTING SYSTEM

Currently, visually impaired individuals often rely on conventional methods for currency identification, such as seeking assistance from others or employing memorization techniques. These methods are time-consuming, prone to errors, and may result in the loss of privacy and dignity for the user. There is a clear need for a modern and technologically advanced solution to address these challenges effectively.

1.4.1 DISADVANTAGES

- **Manual counting for currency summation**

Counting currency notes manually is time consuming, error-prone, and challenging for individuals with visual impairments. This method lacks efficiency and accuracy, leading to potential errors in financial transactions.

- **Dependency on external assistance**

Visually impaired individuals often rely on sighted assistance or specialized devices to identify and differentiate between currency notes. This dependency compromises their privacy, independence, and dignity, as they must rely on others for routine financial transactions.

- **Accessibility barriers**

Despite efforts to create an accessible interface, the nayan application may still present usability challenges for some visually impaired individuals, particularly those with additional disabilities or limitations in using touch-based interfaces.

1.5 PROPOSED SYSTEM

The proposed system, Vision, introduces a novel approach to currency identification and accessibility through the integration of machine learning algorithms and smartphone technology. Vision 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 Vision provides immediate audio feedback regarding the denomination of the note.

In addition to currency identification, Vision offers a currency summation feature, allowing users to calculate the

total value of multiple currency notes with ease.

1.5.1 ADVANTAGES OF PROPOSED SYSTEM

- **Enhanced Independence:** Vision empowers visually impaired individuals to manage their finances independently, reducing their reliance on external assistance.
- **Improved Accessibility:** The application promotes accessibility by providing real-time currency identification and text-to-speech conversion features, thereby facilitating engagement with printed materials.
- **Privacy Preservation:** By enabling users to identify currency notes discreetly, Vision safeguards their privacy and dignity in financial transactions.
- **Efficiency and Accuracy:** The integration of advanced machine learning algorithms ensures accurate and efficient currency identification, enhancing the user experience.
- **Inclusivity:** Vision promotes inclusivity by bridging the accessibility gap and providing visually impaired individuals with equal opportunities to participate in financial transactions and everyday tasks.
- **Real-Time Currency Identification:** Leveraging a Convolutional Neural Network (CNN) algorithm, the application offers real-time currency identification capabilities. Users can simply capture images of currency notes using their smartphone's camera, enabling quick and accurate determination of denominations without external aid.

CHAPTER-2

LITERATURE SURVEY

1.1 INTRODUCTION

Object Recognition System for Visually Impaired People by C. Sagana et al. (2021)[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. deep learning-based networks have gone deeper to gain performance improvements. With more depth, a larger number of parameters is required, thus causing an exponential increase in the complexity of the networks. The bulkier models are unsuitable for resource-constrained devices such as mobile phones and edge-based devices.

1.2 SURVEY PAPERS

1] **TITLE: Real-Time Object Detection for Visually Challenged People AUTHOR: S. Vaidya et al.**

YEAR: 2019

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.

2] TITLE: CICERONE- A Real-Time Object Detection for Visually Impaired People AUTHOR: Therese Yamuna Mahesh.

YEAR: 2019

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.

3] TITLE: Object Detection System for Visually Impaired Persons Using Smartphone AUTHOR: Ravi.

YEAR: 2020

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.

4] TITLE: Object and Currency Detection with Audio Feedback for Visually Impaired AUTHOR: K. K. S. N. Reddy.

YEAR: 2021

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.

5] TITLE: Banknote Object Detection for the Visually Impaired using a CNN AUTHOR: M. Thomas and K. Meehan.

YEAR: 2022

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.

6] TITLE: Indian Currency Recognition System Using CNN And Comparison With YOLOv5

AUTHOR: S. D. Achar. YEAR: 2023

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.

CHAPTER-3

SOFTWARE REQUIREMENTS

3.1 INTRODUCTION

3.1.1 Introduction to Software Requirements Specification (SRS):

The Software Requirements Specification (SRS) serves as a foundational document in software development, outlining the detailed description of the software system to be developed. It serves as a communication bridge between stakeholders, including clients, developers, testers, and project managers, ensuring a common understanding of the software's functionalities, features, and constraints. The SRS document acts as a blueprint for the entire software development lifecycle, guiding the design, implementation, testing, and maintenance phases.

3.1.2 Purpose of Software Requirements Specification (SRS):

The primary purpose of the Software Requirements Specification (SRS) is to clearly and precisely define the functional and non-functional requirements of the software system. By documenting user needs, system behaviour, and constraints, the SRS helps stakeholders understand the scope of the project and serves as a basis for agreement between the client and the development team. Additionally, the SRS acts as a reference point for all subsequent phases of software development, guiding design decisions, development efforts, and testing procedures. It also facilitates communication and collaboration among project stakeholders, ensuring that everyone involved has a shared understanding of the project's objectives and deliverables.

3.1.3 Scope of Software Requirements Specification (SRS):

The scope of the Software Requirements Specification (SRS) defines the boundaries and extent of the software system being developed. It outlines what functionalities and features will be included in the software, as well as what is explicitly excluded. The scope statement clarifies the project's objectives and constraints, helping stakeholders manage expectations and allocate resources effectively. Additionally, the SRS scope defines the intended users of the software.

3.2 REQUIREMENT SPECIFICATION

3.2.1 Non-functional Requirements Specification:

Non-functional requirements specify the quality attributes and constraints that define how the system should behave, rather than what it should do. These requirements address aspects such as performance, reliability, usability, security, and compliance. Here are detailed non-functional requirements for our software system:

Performance:

Response Time: The system shall respond to user inputs (e.g., gestures, commands) within 2 seconds under normal operating conditions.

Processing Speed: Currency identification and summation processes shall be completed within 5 seconds for up to 10 currency notes.

Reliability:

- **Availability:** The system shall have an uptime of at least 99%, ensuring reliable operation under normal usage conditions.
- **Error Handling:** The system shall handle errors gracefully, providing informative error messages and recovering from failures without data loss.

Usability:

- **User Interface:** The user interface shall be intuitive and easy to navigate, featuring large buttons, clear text labels, and high contrast for visibility.
- **Accessibility:** The system shall comply with accessibility standards (e.g., WCAG) to ensure usability for individuals with disabilities, including screen reader compatibility and keyboard navigation support.

Security:

- **Data Privacy:** The system shall adhere to data privacy regulations (e.g., GDPR) and protect user data from unauthorized access or disclosure.
- **Authentication:** If user authentication is required, it shall support secure authentication methods (e.g., biometric authentication) to prevent unauthorized access.

Scalability:

- **Device Compatibility:** The system shall be compatible with a wide range of Android smartphones and tablets, supporting various screen sizes and hardware configurations.
- **Performance Scaling:** The system architecture shall be scalable to accommodate increases in user load and processing demands without degradation in performance.

Maintainability:

- **Modularity:** The system shall be designed with a modular architecture, allowing for easy maintenance, updates, and enhancements to individual components.
- **Documentation:** Comprehensive documentation shall be provided for developers, administrators, and end-users, including installation guides, user manuals, and API documentation.

Compliance:

- **Regulatory Compliance:** The system shall comply with relevant regulatory requirements and industry standards, including but not limited to currency recognition regulations and accessibility guidelines.
- **Localization:** The system shall support localization for different languages and regions, enabling users from diverse backgrounds to use the application effectively.

3.2.2 Functional Requirements Specification:

Functional requirements specify the behavior of the software system, detailing the specific functions, features, and capabilities it must possess to satisfy user needs and achieve its intended purpose. These requirements describe what the system should do in terms of

input, processing, and output, without specifying how these functions will be implemented. Here are detailed functional requirements for our software system:

Currency Identification:

The system shall accurately identify Indian currency notes of denominations ₹10, ₹20, ₹50, ₹100, ₹200, ₹500, and ₹2000. It shall utilize machine learning algorithms, such as YOLOv8 and CNNs, to detect and classify currency notes based on image inputs. The identification process shall be initiated upon user request through a dedicated interface or gesture command.

Currency Summation:

- The system shall provide functionality to sum the total value of multiple currency notes.
- It shall accurately calculate the total sum of currency notes detected within the camera's field of view.
- The summation feature shall be activated upon user request through a dedicated interface or gesture command.

Text-to-Speech Conversion:

- The system shall support text-to-speech conversion for assisting visually impaired users in understanding printed text.

- It shall accurately convert text content displayed on the smartphone screen or captured through the camera into audible speech.
- The text-to-speech conversion feature shall be accessible through a dedicated interface or gesture command.

Gesture-Based Interactions:

- The system shall support intuitive gesture-based interactions for user navigation and control.
- It shall interpret swipe gestures (e.g., swipe right, swipe left, swipe up) to trigger specific functionalities such as currency summation, text-to-speech conversion, and currency identification.
- Gesture commands shall be configurable and customizable to accommodate user preferences.

Real-Time Feedback:

- The system shall provide real-time feedback to users during currency identification, summation, and text-to-speech conversion processes.
- It shall convey results audibly through synthesized speech and visually through text or graphical overlays on the smartphone screen.
- Feedback messages shall be clear, concise, and informative, enhancing the user experience and usability of the system.

3.3 SYSTEM REQUIREMENTS

3.3.1 HARDWARE REQUIREMENTS

RAM	2 GB
Hard Disk	100 GB
Process	32/64 PENTIUM

Table: 3.3.1 Software Requirements

3.3.2 SOFTWARE REQUIREMENTS

IDE	Flask
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Language	Python
Tool	Jupyter Notebook
Software	Anaconda
Front-end	HTML, CSS
Libraries	Tensorflow, keras, numpy,pandas

Table: 3.3.2 Hardware Requirements

3.4 Feasibility Study:

A feasibility study assesses the viability of a proposed project or system from various perspectives, including technical, economic, operational, and scheduling considerations. Here's an overview of the feasibility study for our software system:

1. Technical Feasibility:

- **Assessment:** Evaluate the technical capabilities required to develop the software system, including expertise in machine learning algorithms, computer vision techniques, mobile app development, and integration with smartphone functionalities.
- **Resources:** Determine the availability of skilled personnel, software tools, development frameworks, and hardware infrastructure necessary for implementing the system.

2. Economic Feasibility:

- **Cost-Benefit Analysis:** Estimate the costs associated with developing, deploying, and maintaining the software system, including personnel expenses, software licenses, hardware procurement, and ongoing support.
- **Revenue Generation:** Explore potential revenue streams, such as app sales, subscription models, or partnerships, to offset development costs and generate profit.

3. Operational Feasibility:

- **User Needs Analysis:** Assess the needs and preferences of the target user base, including visually impaired individuals, to ensure that the software system addresses their requirements effectively.
- **User Acceptance Testing:** Conduct usability testing and gather feedback from potential users to evaluate the system's usability, accessibility, and overall satisfaction.

4. Scheduling Feasibility:

- **Project Planning:** Develop a detailed project plan outlining the tasks, milestones, dependencies, and timelines for

each phase of the software development lifecycle, from requirements gathering to deployment.

- Resource Allocation: Allocate human and technical resources efficiently to ensure that project deadlines are met and deliverables are produced according to the agreed-upon schedule.

CHAPTER-4

SYSTEM DESIGN

4.1 INTRODUCTION

System design is the process of defining the architecture, components, modules, and interactions of a software system to meet specified requirements and objectives. It involves translating functional and non-functional requirements into a well-structured design that can be implemented effectively. In the context of your project, system design encompasses the design of the software application for assisting visually impaired individuals in currency identification, summation, and text-to-speech conversion on Android devices. This involves outlining the system's high-level architecture, components, communication protocols, database structure, security measures, and user interface design to ensure the effective implementation of the desired functionalities.

Scope of System Design:

The scope of system design for your project encompasses the following key aspects:

Functional Scope:

- Designing modules for currency identification, summation, and text-to-speech conversion functionalities.
- Identifying the necessary algorithms, data structures, and processing techniques to implement each functionality effectively.

Technical Scope:

- Selecting appropriate machine learning algorithms (e.g., YOLOv8, CNNs) for currency identification.
- Determining the communication protocols (e.g., HTTP, WebSocket) for interaction between the client application and backend services.

Security Scope:

- Implementing measures to ensure the security and privacy of user data, including data encryption, authentication, and authorization mechanisms.
- Securing communication channels between the client application and backend services to prevent unauthorized access or data breaches.

Performance Scope:

- Optimizing algorithms and data processing techniques to achieve fast response times and efficient resource

utilization.

- Designing for scalability and load balancing to handle fluctuations in user traffic and processing demands effectively.

Requirement Analysis:

- Conduct interviews and surveys with visually impaired individuals to understand their needs and challenges regarding currency identification and accessibility.
- Identify key features and functionalities required in the Vision application based on user feedback and domain knowledge.

Data Collection and Annotation:

- Gather a diverse dataset of Indian currency notes, including various denominations (₹10, ₹20, ₹50, ₹100, ₹200, ₹500, and ₹2000).
- Annotate the images in Pascal VOC XML format, specifying bounding boxes around each currency note and corresponding labels.

Model Selection and Training:

- Choose appropriate machine learning algorithms for currency identification and recognition, such as YOLOv8 for object detection and CNNs for image classification.
- Preprocess the dataset, including data augmentation techniques such as rotation, scaling, and flipping to enhance model generalization.

Android Application Development:

- Develop the Vision Android application using Java or Kotlin programming language and Android Studio IDE.
- Integrate the trained YOLOv8 and CNN models into the application for currency identification and recognition.

Testing and Evaluation:

- Conduct extensive testing of the Vision application across various Android devices and environments to ensure compatibility and reliability.
- Evaluate the performance of the application in terms of accuracy, speed, and usability through user testing sessions with visually impaired individuals.

4.2 SYSTEM ARCHITECTUR

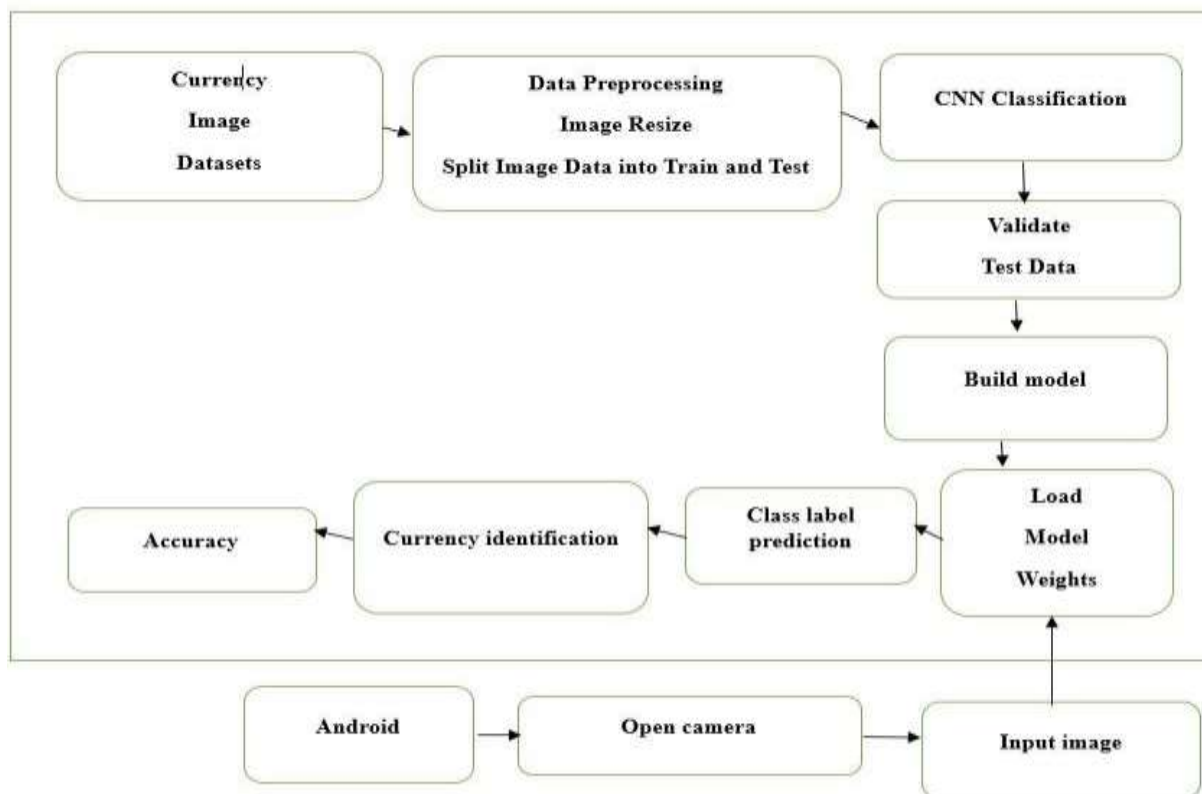


Fig 4.2 System Architecture

System Architecture refers to the overall design and structure of a system, including its components, interactions, and relationships. It encompasses both the high-level structure of the system and the low-level details of its individual components and their interactions. System Architecture defines how the system is organized, how its components are connected, and how they collaborate to achieve the system’s objectives.

4.3 DATAFLOW DIAGRAM:

DFD 0

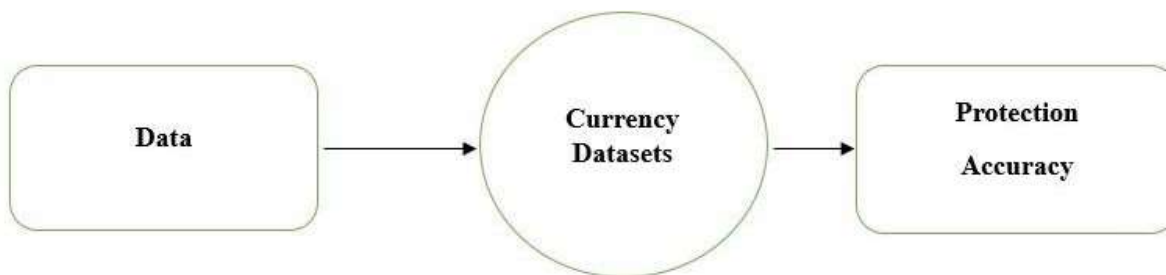


Fig 4.3 Dataflow 0

DFD 1

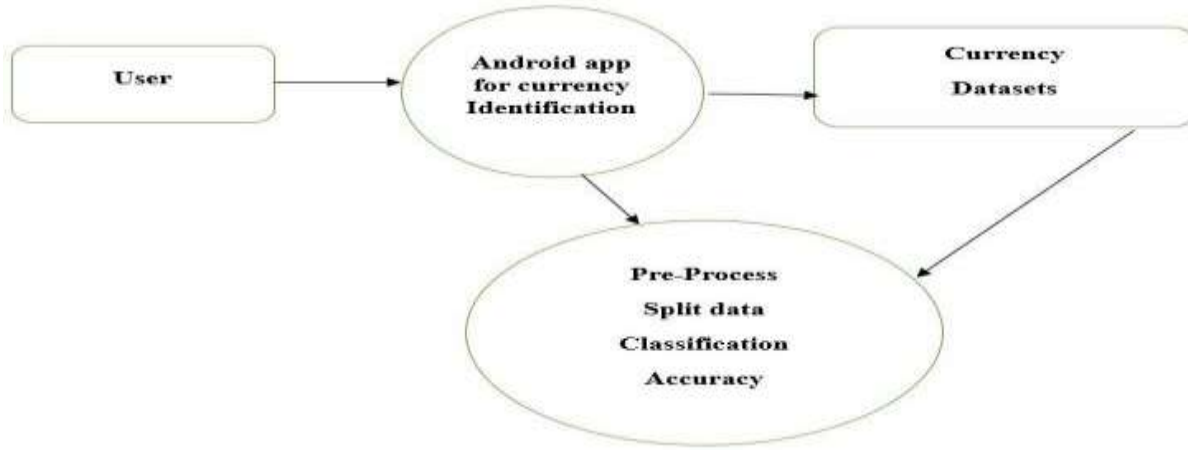


Fig 4.3.1 level 1

DFD-(Data Flow Diagram) it's a visual representation of the flow of data within a system, showing how data moves from one process to another. DFDs are commonly used in software engineering to model the processes involved in a system and the interactions between them.



4.4 USE CASE DIAGRAM

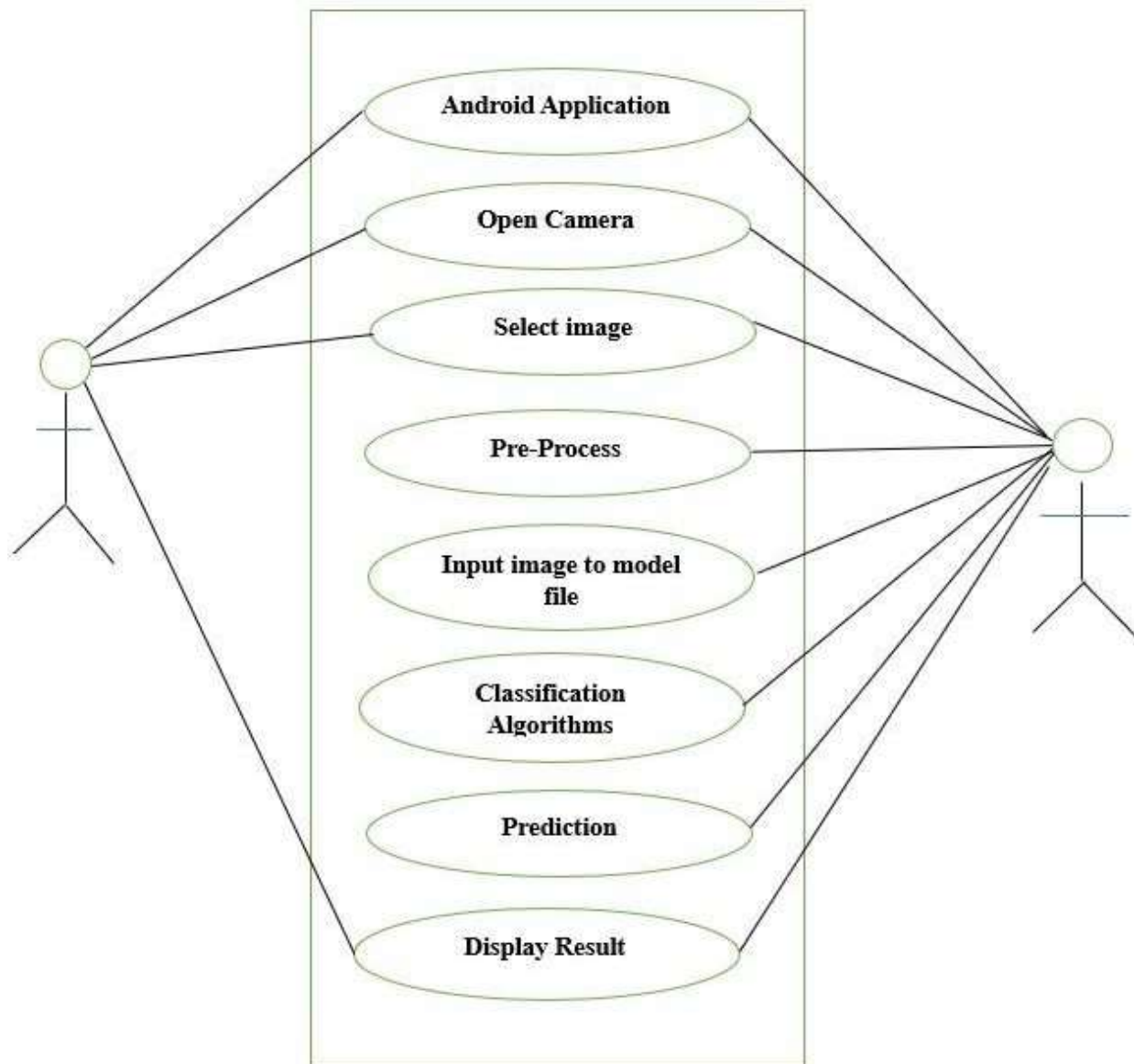


Fig 4.4 Use case diagram

A Use Case Diagram is a type of behavioral diagram in the unified modeling language(UML) that represents the interactions between a system and its users or external entities. It illustrates the different use cases, or functionalities, of a system, and how users interact with those functionalities. Use cases (representing the specific actions or goals that users can perform within the system).

4.5 SEQUENCE DIAGRAM

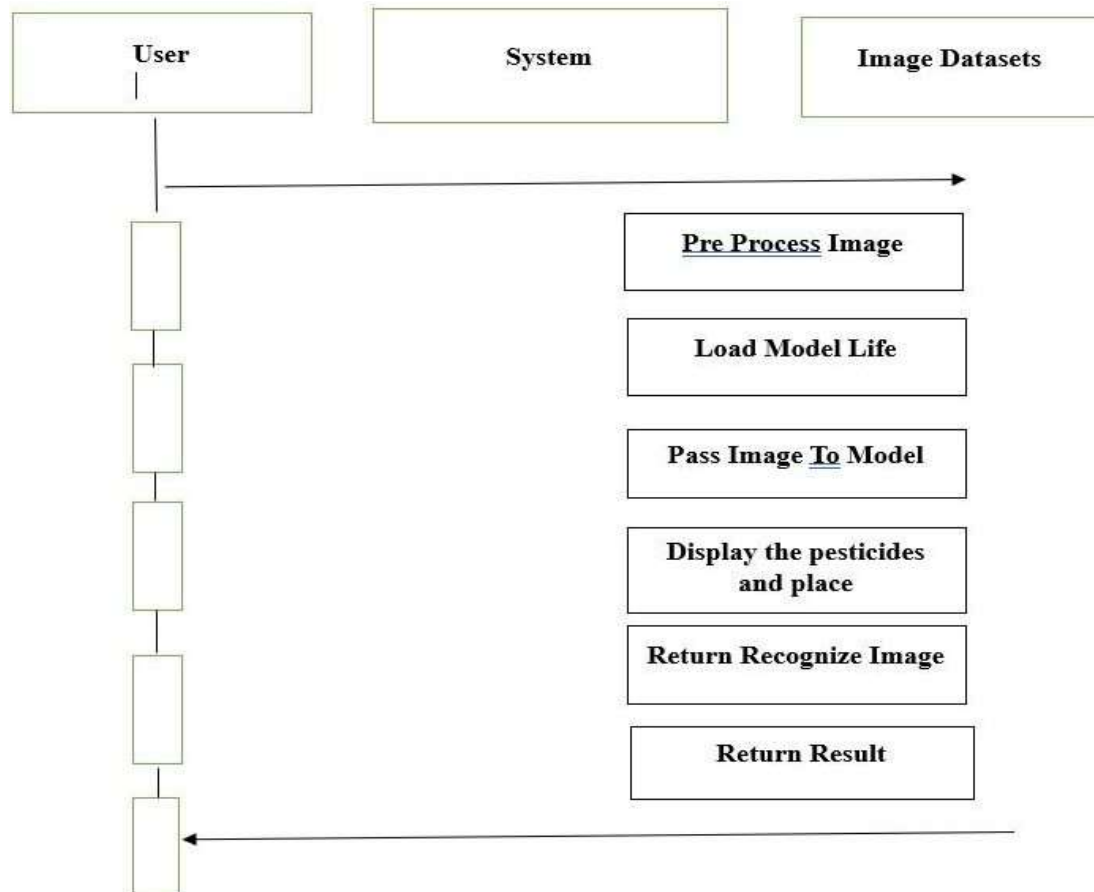


Fig 4.5 Sequence Diagram

A Sequence Diagram is another type of diagram used in software engineering. It illustrates the interactions between objects or components in a system over time. It shows the Sequence of messages exchanged between objects, along with their lifelines, which represent the lifespan of each object during the interactions. Sequence Diagrams are especially useful for visualizing the dynamic behavior of a system, such as the flow of control the order of method invocations.

4.6 ACTIVITY DIAGRAM

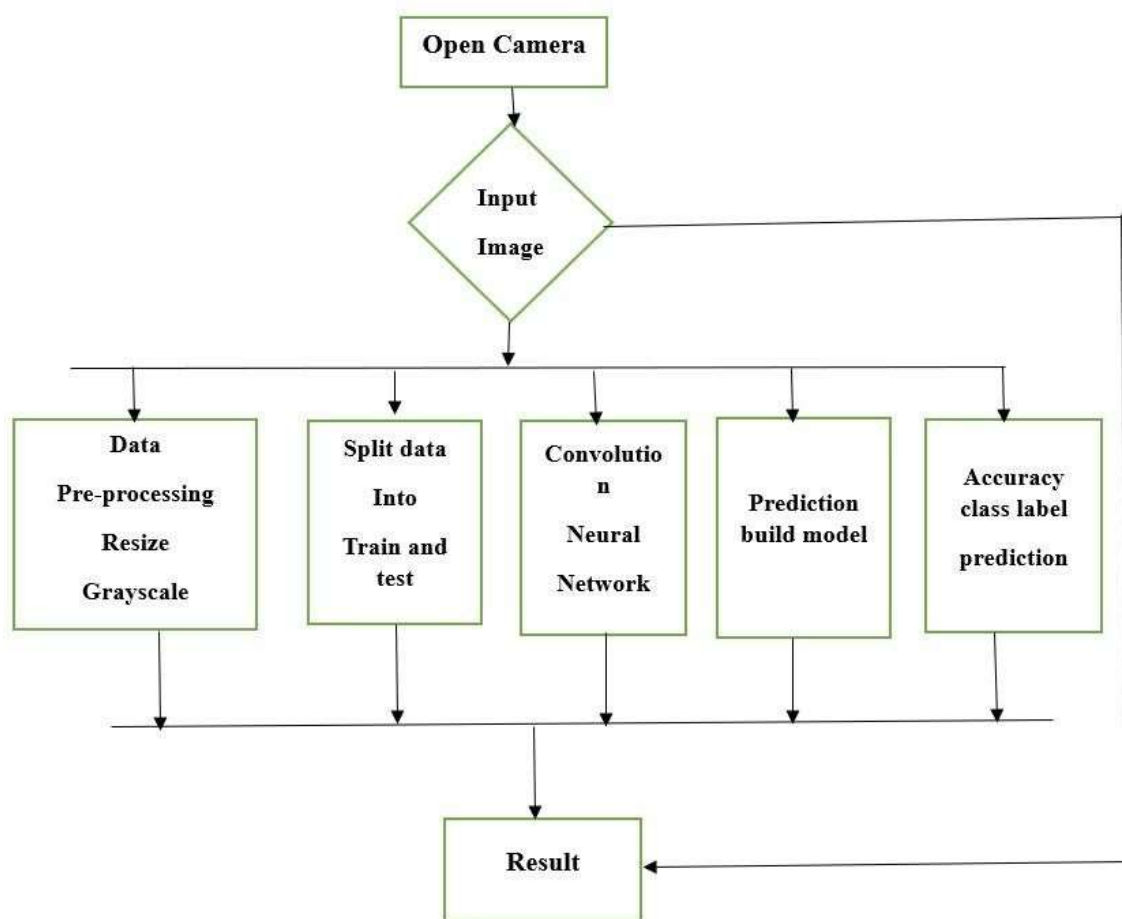


Fig 4.6 Activity Diagram

An Activity Diagram is a type of behavioral diagram in the unified module language (UML) that depicts the flow of control or the sequence of activities in a system. It shows the workflow of a process, including activities, decisions, and the flow of data or objects between them. Activity diagrams are often used to model the steps involved in a business process, software workflow, or system behavior, providing a visual representation that helps in understanding and analyzing the process logic.

CHAPTER-5

IMPLEMENTATION

5.1 DETAILS OF IMPLEMENTATION PROCESS

The implementation phase marks a crucial step in the realization of the software application aimed at assisting visually impaired individuals in currency identification, summation, and text-to-speech conversion on Android devices. In this phase, the focus shifts from conceptualization and design to the actual development and coding of the software components outlined in the system design. This chapter provides an in-depth overview of the implementation process, highlighting the key methodologies, technologies, and strategies employed to translate the system design and requirements into a functioning application.

Integrated Development Environment (IDE):

- **Android Studio:** We utilized Android Studio as the primary IDE for developing the Android application. Android Studio provides a robust development environment with features such as code editing, debugging, and performance profiling tailored specifically for Android development.

Programming Languages:

- **Java:** Java served as the primary programming language for Android application development. It offers platform independence, object-oriented programming paradigms, and extensive libraries and APIs for building robust and scalable applications.

Currency identification module:

The Currency Identification Module is a critical component of the software application designed to recognize Indian currency notes from images captured by the smartphone camera. This section provides an in-depth explanation of the algorithms and techniques used for currency identification, followed by details of the implementation process, including data preprocessing, model training, and inference.

Convolutional Neural Networks (CNNs):

- CNNs are a class of deep learning models widely used for image recognition tasks. They consist of multiple layers of convolutional and pooling operations followed by fully connected layers for classification.

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, 2000 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.

Currency Summation Module:

The Currency Summation Module is responsible for aggregating the values of detected currency notes to provide the total sum of money present in the captured image. This section provides an in-depth explanation of the logic and algorithms used for currency summation, along with a description of how the system aggregates the values of detected currency notes.

Description of Summation Process:

Detection and Labelling:

- The Currency Identification Module detects currency notes in the captured image and assigns denomination labels to each detected note.
- Each currency note is represented by a bounding box, and its denomination label indicates its value (e.g., 10 rupees, 20 rupees, etc.).

Text-to-Speech Conversion Module:

The Text-to-Speech (TTS) Conversion Module is a vital component of the software application designed to provide auditory feedback to visually impaired users by converting text content into spoken speech. This section provides a detailed overview of the text-to-speech synthesis techniques employed, along with information on integrating text-to-speech functionality into the user interface and the process of converting text content into audible speech.

5.2 METHODOLOGY

Requirement Gathering: Conduct extensive research and user interviews to understand the specific needs and challenges faced by visually impaired individuals in currency identification, summation, and accessing printed materials. **System Design:** Design the architecture and user interface of the Nayan application, ensuring a user-friendly and intuitive experience for blind users. **CNN Algorithm Development:** Train and fine-tune a Convolutional Neural Network (CNN) model using a large dataset of Indian currency notes to accurately identify different denominations. **Application Development:** Implement the Nayan application for Android devices, integrating the CNN algorithm, currency summation, and text-to-speech conversion features.

5.3 CNN ARCHITECTURE

1. Convolutional Layers:

- The convolutional layers are the core building blocks of a CNN. They apply a set of learnable filters (also known as kernels) to the input image, sliding the filters across the image and computing the dot product between the filter and the overlapping regions of the input. This operation extracts features from the image, capturing spatial patterns such as edges, textures, and shapes.

2. Pooling Layers:

- Pooling layers are interspersed between convolutional layers to reduce the spatial dimensions of the feature maps while retaining the most important information. The pooling operation (commonly max pooling or average pooling) aggregates information from local regions of the feature maps, reducing computational complexity and helping to control overfitting.

3. Fully Connected (Dense) Layers:

- Following the convolutional and pooling layers, the feature maps are flattened into a one-dimensional vector and passed through one or more fully connected (dense) layers.
- Output Layer: The final dense layer, often with a single neuron and a sigmoid activation function, outputs the predicted probability that the input image belongs to a particular class (e.g., normal or cancerous).

4. Dropout and Batch Normalization:

- To prevent overfitting and improve generalization, techniques such as dropout and batch normalization may be applied. Dropout randomly drops a fraction of neurons during training, forcing the network to learn more robust features.

5. Output Layer and Loss Function:

- The output layer of the CNN typically consists of a single neuron with a sigmoid activation function for binary classification tasks (normal vs. cancerous). The output represents the predicted probability that the input image belongs to the positive class (cancerous). The binary cross-entropy loss function is commonly used to compute the discrepancy between the predicted probabilities and the ground truth labels during training.

5.4 ABOUT YOLO

You Only Look Once(YOLO):

You Only Look Once (YOLO) is a state-of-the-art object detection algorithm known for its speed and accuracy. YOLO approaches object detection as a single regression problem, directly predicting bounding boxes and class probabilities for multiple objects in a single pass through the neural network. Here's a detailed overview of YOLO:

Single Shot Detection:

- YOLO is a single-shot detection algorithm, meaning it predicts bounding boxes and class probabilities for all objects in an image simultaneously, in a single forward pass of the neural network.

5.5 CODING

```
import android.widget.ImageView; import android.speech.tts.TextToSpeech;
```

```
import android.speech.tts.UtteranceProgressListener;
```

```
import com.google.mediarpipe.tasks.components.containers.Category; import
```

```
com.google.mediarpipe.tasks.components.containers.Detection; import
```

```
com.google.mediarpipe.tasks.vision.core.RunningMode;
```

```
import com.google.mediarpipe.tasks.vision.objectdetector.ObjectDetectionResult; import java.io.FileDescriptor;
```

```
import java.io.IOException; import java.security.Permission; import java.util.List;
```

```
import java.util.Locale;
```

```
public class MainActivity extends AppCompatActivity implements
```

```

ObjectDetectorHelper.DetectorListener,TextToSpeech.OnInitListener {

private static final int RESULT_LOAD_IMAGE = 123; public static final int IMAGE_CAPTURE_CODE = 654;

private static final int PERMISSION_CODE = 321; ImageView innerImage;

private Uri image_uri;

private final float CONFIDENCE_THRESHOLD = 0.3f; private TextToSpeech textToSpeech; //..

ObjectDetectorHelper objectDetectorHelper; @Override

protected void onCreate(Bundle savedInstanceState) { super.onCreate(savedInstanceState);

setContentView(R.layout.activity_main); textToSpeech = new TextToSpeech(this, this);//.. innerImage =

findViewById(R.id.imageView2);

innerImage.setOnClickListener(new View.OnClickListener() { @Override

public void onClick(View v) {

Intent galleryIntent = new Intent(Intent.ACTION_PICK,

MediaStore.Images.Media.EXTERNAL_CONTENT_URI);

startActivityForResult(galleryIntent, RESULT_LOAD_IMAGE);

}

});

innerImage.setOnLongClickListener(new View.OnLongClickListener() { @Override

public boolean onLongClick(View v) {

if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.M){

if (checkSelfPermission(Manifest.permission.CAMERA) == PackageManager.PERMISSION_DENIED ||

checkSelfPermission(Manifest.permission.WRITE_EXTERNAL_STORAGE)

== PackageManager.PERMISSION_DENIED){

String[] permission = {Manifest.permission.CAMERA, Manifest.permission.WRITE_EXTERNAL_STORAGE};

requestPermissions(permission, PERMISSION_CODE);

}

else {

openCamera();

}

```

```
}  
  
else {  
  
openCamera();  
  
}  
  
return false;  
  
}  
  
});  
  
objectDetectorHelper = new  
ObjectDetectorHelper(0.5f, ObjectDetectorHelper.MAX_RESULTS_DEFAULT, ObjectDetectorHelper.DELEGATE_CPU, "des.tflite", RunningMode.IMAGE, getApplicationContext(), this);  
  
}  
  
//open camera to capture picture private void openCamera() {  
  
ContentValues values = new ContentValues(); values.put(MediaStore.Images.Media.TITLE, "New Picture");  
values.put(MediaStore.Images.Media.DESCRPTION, "From the Camera");  
image_uri = getContentResolver().insert(MediaStore.Images.Media.EXTERNAL_CONTENT_URI, values);  
Intent cameraIntent = new Intent(MediaStore.ACTION_IMAGE_CAPTURE);  
cameraIntent.putExtra(MediaStore.EXTRA_OUTPUT, image_uri); startActivityForResult(cameraIntent,  
IMAGE_CAPTURE_CODE);  
  
// String serverUrl = "http://192.168.29.50:8080"; // Replace with your laptop's IP address  
  
// Intent webViewIntent = new Intent(this, WebViewActivity.class);  
  
// webViewIntent.putExtra("url", serverUrl);  
  
// startActivity(webViewIntent);  
  
}  
  
@Override  
  
protected void onActivityResult(int requestCode, int resultCode, Intent data) {  
  
super.onActivityResult(requestCode, resultCode, data);  
  
if (requestCode == RESULT_LOAD_IMAGE && resultCode == RESULT_OK && data != null){  
  
image_uri = data.getData(); doInference();
```

```
}  
  
if (requestCode == IMAGE_CAPTURE_CODE && resultCode == RESULT_OK){ doInference();  
  
}  
  
}  
  
// //Passing image to the model, getting the results and drawing rectangles  
  
// public void doInference(){  
  
// Bitmap bitmap = uriToBitmap(image_uri);  
  
// innerImage.setImageBitmap(bitmap);  
  
// Bitmap mutableBmp = bitmap.copy(Bitmap.Config.ARGB_8888,true);  
  
// Canvas canvas = new Canvas(mutableBmp);  
  
// Paint paint = new Paint();  
  
// paint.setColor(Color.RED);  
  
// paint.setStyle(Paint.Style.STROKE);  
  
// paint.setStrokeWidth((mutableBmp.getWidth() / 95));  
  
// Paint paintText = new Paint();  
  
// paintText.setColor(Color.BLUE);  
  
// paintText.setTextSize(mutableBmp.getWidth()/10);  
  
// ObjectDetectorHelper.ResultBundle resultBundle = objectDetectorHelper.detectImage(bitmap);  
  
// if(resultBundle != null){  
  
// Log.d("tryRess", "results are not null");  
  
// List<ObjectDetectionResult> resultList = resultBundle.getResults();  
  
// StringBuilder speechText = new StringBuilder("I found ");  
  
// for (ObjectDetectionResult singleResult: resultList) {  
  
// List<Detection> detectionList =singleResult.detections();  
  
// for(Detection detection : detectionList){  
  
// float confidence = 0;  
  
// String objectName = "";  
  
// for(Category category : detection.categories()){
```

```

// if(category.score())>confidence){
// confidence = category.score();
// objectName = category.categoryName();
// }
// }

// canvas.drawRect(detection.boundingBox(),paint);
canvas.drawText(objectName,detection.boundingBox().left,detection.boundingBox().top,paintText);

// // Add object name to speech text

// speechText.append(objectName).append(" Rupees,");
// }

// // Remove the trailing comma and space
// if (speechText.length() > 8) {
// speechText.delete(speechText.length() - 2, speechText.length());
// }

// // Speak the result
// speakResult(speechText.toString());
// innerImage.setImageBitmap(mutableBmp);
// }else{
// Log.d("tryRess","results are null");
// }
// }

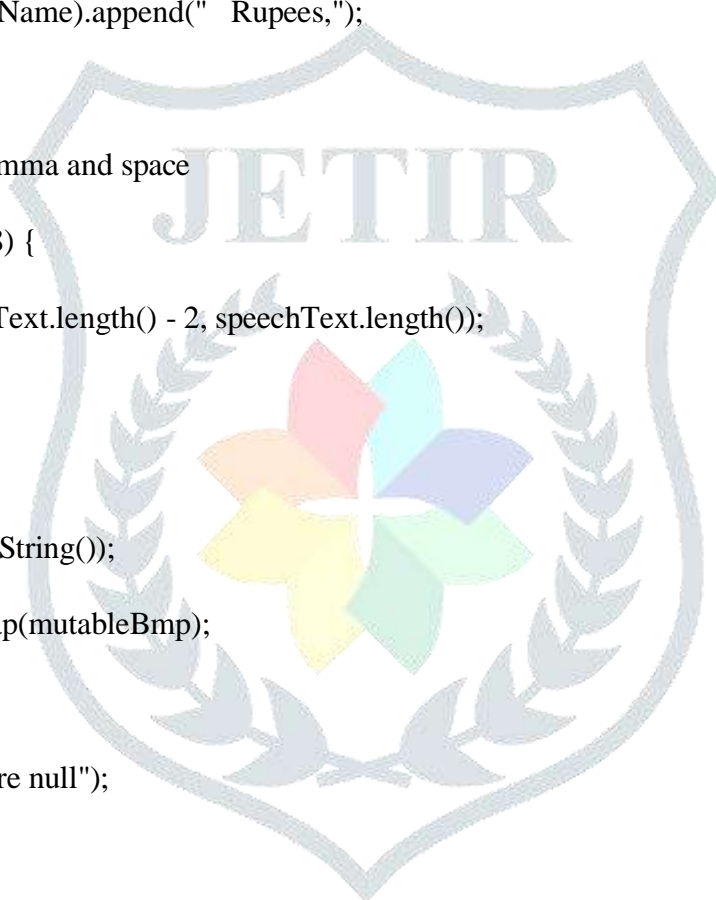
public void doInference() {
Bitmap bitmap = uriToBitmap(image_uri); innerImage.setImageBitmap(bitmap);

Bitmap mutableBmp = bitmap.copy(Bitmap.Config.ARGB_8888, true); Canvas canvas = new
Canvas(mutableBmp);

Paint paint = new Paint(); paint.setColor(Color.RED);

paint.setStyle(Paint.Style.STROKE); paint.setStrokeWidth((mutableBmp.getWidth() / 95)); Paint paintText = new
Paint(); paintText.setColor(Color.BLUE); paintText.setTextSize(mutableBmp.getWidth() / 10);

```



```

ObjectDetectorHelper.ResultBundle resultBundle = objectDetectorHelper.detectImage(bitmap);

if (resultBundle != null) { Log.d("tryRes", "results are not null");

List<ObjectDetectionResult> resultList = resultBundle.getResults(); StringBuilder speechText = new
StringBuilder("I found ");

// int totalAmount = 0;

for (ObjectDetectionResult singleResult : resultList) { List<Detection> detectionList = singleResult.detections();

for (Detection detection : detectionList) {

float confidence = 0; String objectName = "";

for (Category category : detection.categories()) { if (category.score() > confidence) {

confidence = category.score(); objectName = category.categoryName();

}

}

// Check if the detected object is a currency note

if (isCurrency(objectName)) {

int denomination = getDenomination(objectName); denomination1 = Integer.toString(denomination);

// Update total amount totalAmount += denomination;

canvas.drawRect(detection.boundingBox(), paint);

canvas.drawText(objectName, detection.boundingBox().left, detection.boundingBox().top, paintText);

// Add object name to speech text

// speechText.append(objectName).append(" ");

}

}

}

textView2.setText("Detected Amount: "+denomination1); textView3.setText("Total
Amount:"+String.valueOf(totalAmount));

// Append total amount to speech text

speechText.append("Detected Amount: "+denomination1).append(" rupees"); speechText.append("Total
Amount:"+String.valueOf(totalAmount)).append("

```

```
rupees");
```

```
// Speak the result speakResult(speechText.toString()); innerImage.setImageBitmap(mutableBmp);
```

```
} else {
```

```
Log.d("tryRess", "results are null");
```

```
}
```

```
}
```

```
// Helper function to check if the detected object is a currency note private boolean isCurrency(String objectName)
```

```
{
```

```
// Add your logic here to identify currency notes based on class names
```

```
// For example, you can check if objectName is one of the currency denominations return
```

```
objectName.equals("10") || objectName.equals("20") || objectName.equals("50") ||
```

```
objectName.equals("100") || objectName.equals("200") || objectName.equals("500") || objectName.equals("1000");
```

```
}
```

```
// Helper function to get the denomination value from the object name private int getDenomination(String
```

```
objectName) {
```

```
// Add your logic here to map object names to their corresponding denominations switch (objectName) {
```

```
case "10": return 10;
```

```
case "20": return 20;
```

```
case "50": return 50;
```

```
case "100": return 100;
```

```
case "200": return 200;
```

```
case "500": return 500;
```

```
case "1000": return 1000;
```

```
default: return 0; // Default value if not recognized
```

```
}
```

```
}
```

```
//TODO rotate image if image captured on samsong devices
```

```
//Most phone cameras are landscape, meaning if you take the photo in portrait, the resulting photos will be rotated
```

90 degrees.

```
@SuppressWarnings("Range")
```

```
public Bitmap rotateBitmap(Bitmap input){
```

```
String[] orientationColumn = {MediaStore.Images.Media.ORIENTATION}; Cursor cur =
```

```
getContentResolver().query(image_uri, orientationColumn, null, null,
                            null);
```

```
int orientation = -1;
```

```
if (cur != null && cur.moveToFirst()) {
```

```
orientation = cur.getInt(cur.getColumnIndex(orientationColumn[0]));
```

```
}
```

```
Log.d("tryOrientation",orientation+""); Matrix rotationMatrix = new Matrix();
```

```
rotationMatrix.setRotate(orientation);
```

```
Bitmap cropped = Bitmap.createBitmap(input,0,0, input.getWidth(), input.getHeight(), rotationMatrix, true);
```

```
return cropped;
```

```
}
```

```
//takes image uri as input and return that image in a bitmap format private Bitmap uriToBitmap(Uri
```

```
selectedFileUri) {
```

```
try {
```

```
ParcelFileDescriptor parcelFileDescriptor = getContentResolver().openFileDescriptor(selectedFileUri, "r");
```

```
FileDescriptor fileDescriptor = parcelFileDescriptor.getFileDescriptor();
```

```
Bitmap image = BitmapFactory.decodeFileDescriptor(fileDescriptor); parcelFileDescriptor.close();
```

```
return image;
```

```
} catch (IOException e) { e.printStackTrace();
```

```
}
```

```
return null
```

```
}
```

```
//If user gives permission then launch camera @Override
```

```
public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[]
```

```
grantResults) {
```

```
super.onRequestPermissionsResult(requestCode, permissions, grantResults);
```

```
if(requestCode == PERMISSION_CODE && grantResults.length>0 && grantResults[0] ==
```

```
PackageManager.PERMISSION_GRANTED){
```

```
openCamera();
```

```
}
```

```
}
```

```
@Override
```

```
public void onResults(ObjectDetectorHelper.ResultBundle var1) { if (var1 != null) {
```

```
List<ObjectDetectionResult> resultList = var1.getResults(); StringBuilder speechText = new StringBuilder("I
```

```
found "); for (ObjectDetectionResult singleResult : resultList) {
```

```
List<Detection> detectionList = singleResult.detections();
```

```
for (Detection detection : detectionList) { float confidence = 0;
```

```
String objectName = "";
```

```
for (Category category : detection.categories()) { if (category.score() > confidence) {
```

```
confidence = category.score();
```

```
objectName = category.categoryName();
```

```
}
```

```
}
```

```
// Add object name to speech text
```

```
speechText.append(objectName).append(",");
```

```
}
```

```
}
```

```
// Remove the trailing comma and space if (speechText.length() > 2) {
```

```
speechText.delete(speechText.length() - 2, speechText.length());
```

```
}
```

```
// Speak the result speakResult(speechText.toString());
```

```
}
```

```
}  
  
// Initialize TextToSpeech  
  
@Override  
  
public void onInit(int status) {  
    if (status == TextToSpeech.SUCCESS) {  
  
        int result = textToSpeech.setLanguage(Locale.US);  
  
        if (result == TextToSpeech.LANG_MISSING_DATA || result == TextToSpeech.LANG_NOT_SUPPORTED) {  
  
            Log.e("TextToSpeech", "Language is not supported.");  
  
        }  
  
        } else {  
  
            Log.e("TextToSpeech", "Initialization failed.");  
  
        }  
  
        }  
  
// Speak the result  
  
private void speakResult(String text) {  
  
    textToSpeech.speak(text, TextToSpeech.QUEUE_FLUSH, null, null);  
  
    }  
  
// Release TextToSpeech when the activity is destroyed @Override  
  
protected void onDestroy() { if (textToSpeech != null) {  
  
    textToSpeech.stop(); textToSpeech.shutdown();  
  
    }  
  
    }  
  
}
```

CHAPTER-6

SYSTEM TESTING

6.1 INTRODUCTION

Testing is the way toward running a framework with the expectation of discovering blunders. Testing upgrades the uprightness of the framework by distinguishing the deviations in plans and blunders in the framework. Testing targets distinguishing blunders – prom zones. This aides in the avoidance of mistakes in the framework. Testing additionally adds esteems to the item by affirming the client's necessity.

The primary intention is to distinguish blunders and mistake get-prom zones in a framework. Testing must be intensive and all around arranged. A somewhat tried framework is as terrible as an untested framework. Furthermore, the cost of an untested and under-tried framework is high. The execution is the last and significant stage. It includes client preparation, framework testing so as to guarantee the effective running of the proposed framework. The client tests the framework and changes are made by their requirements. The testing includes the testing of the created framework utilizing different sorts of information. While testing, blunders are noted and rightness is the mode.

6.2 OBJECTIVES OF TESTING

- Testing in a cycle of executing a program with the expectation of discovering mistakes.
- A effective experiment is one that reveals an up 'til now unfamiliar blunder.

Framework testing is a phase of usage, which is pointed toward guaranteeing that the framework works accurately and productively according to the client's need before the live activity initiates. As expressed previously, testing is indispensable to the achievement of a framework. Framework testing makes the coherent presumption that if all the framework is right, the objective will be effectively accomplished. A progression of tests are performed before the framework is prepared for the client acknowledgment test.

6.3 LEVELS OF TESTING

System testing is a stage of implementation. This helps the weather system works accurately and efficiently before live operation commences. Testing is vital to the success of the system. The candidate system is subject to a variety of tests: online response, volume, stress, recovery, security, and usability tests series of tests are performed for the proposed system are ready for user acceptance testing.

• Unit Testing

Unit testing chiefly centers around the littlest unit of programming plan. This is known as module testing. The modules are tried independently. The test is done during the programming stage itself. In this progression, every module is discovered to be working acceptably as respects the normal yield from the module.

• Integration Testing

Mix testing is an efficient methodology for developing the program structure, while simultaneously leading tests to reveal blunders related with the interface. The goal is to take unit tried modules and manufacture a program structure. All the modules are joined and tried in general.

- **Output Testing**

Subsequent to performing approval testing, the following stage is yield trying of the proposed framework, since no framework could be valuable on the off chance that it doesn't create the necessary yield in a particular configuration. The yield design on the screen is discovered to be right. The organization was planned in the framework configuration time as indicated by the client needs. For the printed copy likewise, the yield comes according to the predefined prerequisites by the client. Subsequently yield testing didn't bring about any amendment for the framework.

- **User Acceptance Testing**

Client acknowledgment of a framework is the vital factor for the achievement of any framework. The framework viable is tried for client acknowledgment by continually staying in contact with the imminent framework clients at the hour of creating and making changes at whatever point required.

6.4 TEST CASES

The users test the developed system when changes are made according to the needs. The testing phase involves the testing of the developed system using various kinds of data. An elaborate testing of data is prepared and system is tested using the test data. Test cases are used to check for outputs with different set of inputs.

Test Case ID	Description	Test Steps	Expected Results	Actual Results	Pass/Fail
TC_001	Live Video Object Detection	1. Open the web application.	The web application interface loads successfully.	The web application interface loaded successfully.	Pass
		2. Start the live video stream.	Live video stream starts without errors.	Live video stream started without errors.	Pass
		3. Observe the detected objects.	Plastic objects in the video stream are detected and highlighted with bounding boxes.	Plastic objects in the video stream were detected and highlighted.	Pass
TC_002	Path-based Object Detection	1. Upload an image containing underwater scene.	The image is uploaded successfully.	The image was uploaded successfully.	Pass
		2. Initiate object detection on the uploaded image.	Plastic objects in the image are detected, and bounding boxes are displayed around them.	Plastic objects in the image were detected, and bounding boxes were displayed.	Pass

		3. Verify the accuracy of object detection.	Detected objects match the ground truth annotations with high precision.	Detected objects matched the ground truth annotations with high precision.	Pass
TC_003	Mobile Application Integration	1. Open the mobile application.	The mobile application interface loads without errors.	The mobile application interface loaded without errors.	Pass

Test Case ID	Description	Test Steps	Expected Results	Actual Results	Pass/Fail
		2. Submerge the mobile device underwater.	Mobile device camera activates, and the underwater scene is displayed on the screen.	Mobile device camera activated, and the underwater scene was displayed.	Pass
		3. Capture an image using the mobile camera.	Image is captured successfully and displayed on the screen.	Image was captured successfully and displayed on the screen.	Pass
		4. Send the captured image for object detection.	Plastic objects in the image are detected, and bounding boxes are displayed around them.	Plastic objects in the image were detected, and bounding boxes were displayed.	Pass
TC_004	System Performance	1. Run the system with a live video stream for 10 minutes.	The system performs real-time object detection without significant lag or delays.	The system performed real-time object detection without significant lag or delays.	Pass
		2. Monitor system resource usage during operation.	CPU and GPU usage remain within acceptable limits.	CPU and GPU usage remained within acceptable limits.	Pass
TC_005	Error Handling	1. Disconnect the live video stream unexpectedly.	The web application displays an error message indicating the stream connection failure.	The web application displayed an error message indicating the stream connection failure.	Pass

Test Case ID	Description	Test Steps	Expected Results	Actual Results	Pass/Fail
		2. Upload a corrupted image file for object detection.	The web application handles the error gracefully and prompts the user to upload a valid image file.	The web application handled the error gracefully and prompted the user to upload a valid image file.	Pass
TC_006	Integration Testing	1. Initiate object detection from the mobile application.	The mobile application successfully sends the captured image to the web application for detection.	The mobile application successfully sent the captured image to the web application for detection.	Pass
		2. Verify the detection results on both the web and mobile applications.	The detected objects displayed on both interfaces match, indicating successful integration.	The detected objects displayed on both interfaces matched, indicating successful integration.	Pass
TC_007	Usability Testing	1. Invite a user unfamiliar with the system to perform object detection tasks using the web application.	The user successfully navigates the web application interface and performs object detection tasks without errors.	The user successfully navigated the web application interface and performed object detection tasks without errors.	Pass
		2. Repeat the same usability test with the mobile application.	The user finds it intuitive to capture images and perform object detection using the mobile application.	The user found it intuitive to capture images and perform object detection using the mobile application.	Pass
TC_008	Annotation Quality	1. Review a subset of annotated images.	Annotations accurately mark the location and extent of plastic	Annotations accurately marked the location	Pass

Test Case ID	Description	Test Steps	Expected Results	Actual Results	Pass/Fail
			objects in the images.	and extent of plastic objects in the images.	

		2. Assess consistency and accuracy of annotations.	Annotations show consistency across different annotators and match the ground truth.	Annotations showed consistency across different annotators and matched the ground truth.	Pass
TC_009	Model Training	1. Train the YOLOv8 model on the annotated dataset.	The model converges during training, and loss decreases steadily over epochs.	The model converged during training, and loss decreased steadily over epochs.	Pass
		2. Monitor training metrics such as loss and accuracy.	Loss decreases, while accuracy improves over training epochs.	Loss decreased, while accuracy improved over training epochs.	Pass
TC_010	Model Evaluation	1. Evaluate the trained model on a validation dataset.	Model achieves high precision, recall, and F1-score on the validation set.	Model achieved high precision, recall, and F1-score on the validation set.	Pass



Table: 6.4.1 Test case

CHAPTER-7

SNAPSHOTS

7.1 SNAPSHOTS OF JUPYTER NOTEBOOK[BACK-END]

```

model.summary()
Model: "sequential"
Layer (type)                Output Shape                Param #
-----
rescaling_1 (Rescaling)     (None, 300, 300, 3)        0
conv2d (Conv2D)             (None, 300, 300, 16)       448
max_pooling2d (MaxPooling2D) (None, 150, 150, 16)       0
conv2d_1 (Conv2D)           (None, 150, 150, 32)       4640
max_pooling2d_1 (MaxPooling2D) (None, 75, 75, 32)         0
conv2d_2 (Conv2D)           (None, 75, 75, 64)         18496
max_pooling2d_2 (MaxPooling2D) (None, 37, 37, 64)         0
flatten (Flatten)           (None, 87616)              0
dense (Dense)               (None, 128)                11214976
dense_1 (Dense)             (None, 7)                  903
-----
Total params: 11,239,463
Trainable params: 11,239,463
Non-trainable params: 0
    
```

Fig 7.7.1 Model Summary



Fig 7.7.2 Input Image

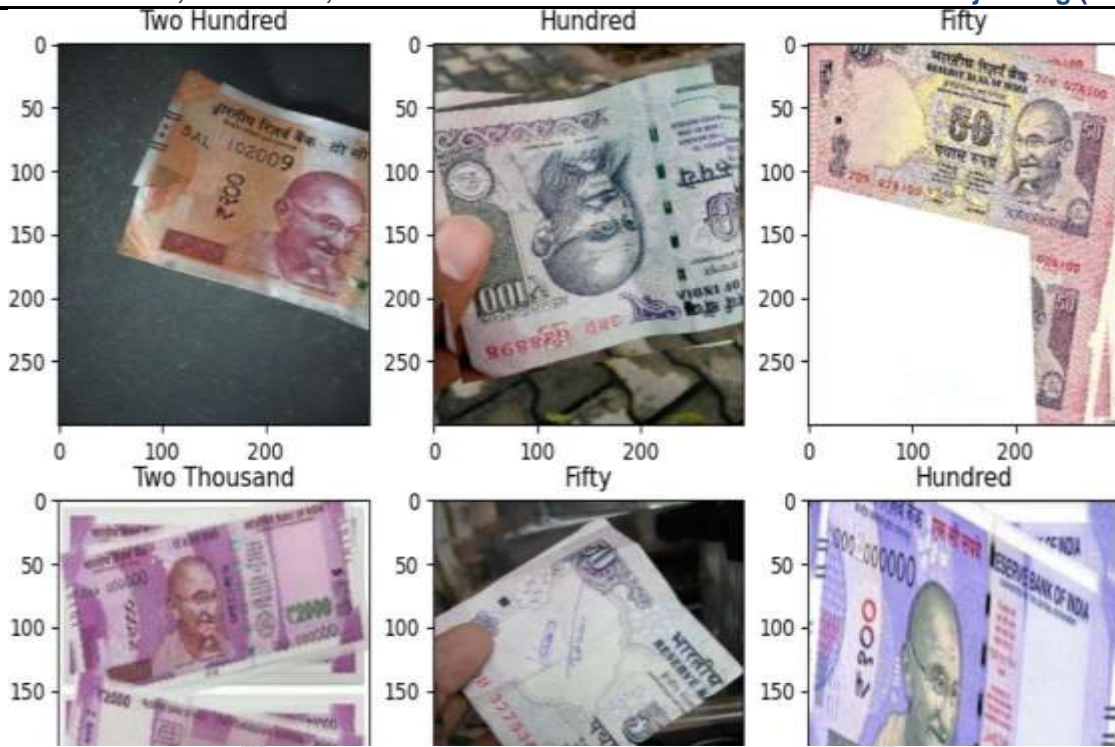


Fig 7.7.3 Currency Analysis

```
*]: epochs=7  
history = model.fit(  
    train_ds,  
    validation_data=val_ds,  
    epochs=epochs  
)
```

Epoch 1/7

15/94 [===>.....] - ETA: 1:50 - loss: 2.1812 - accuracy: 0.1867

Fig 7.7.4 Epochs

7.2 SNAPSHOT OF ANDROID STUDIO[FRONT-END]

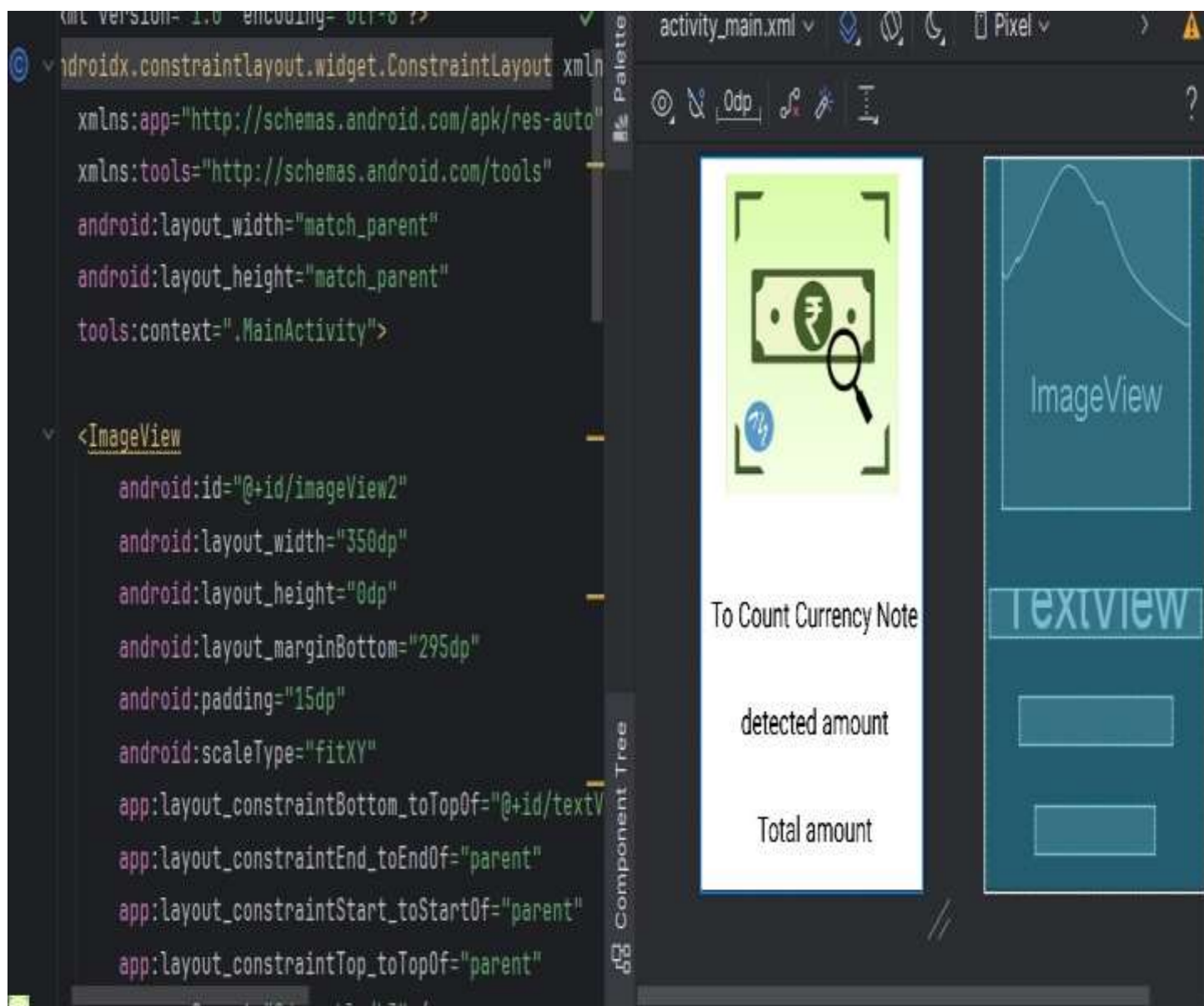


Fig 7.7.5 Android Studio prompt



Fig 7.7.6 Home Page



Note Detection

Swipe Up gesture detected

Fig 7.7.7 Note Detection



To Count Currency Note

detected amount

Total amount

Fig 7.7.8 Currency Summation

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 "Vision," 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. Vision leverages advanced machine learning algorithms to enable real-time recognition and classification of Indian currency notes. The application utilizes the YOLOv8 algorithm for

Fig 7.7.9 Text-to-Speech

CONCLUSION

The development of the Vision Android application marks a significant milestone in addressing the challenges faced by visually impaired individuals in identifying and managing currency notes. Through the integration of advanced technologies such as machine learning, text-to-speech conversion, and intuitive gesture recognition, the application provides a comprehensive solution to enhance accessibility and independence for visually impaired users.

Key Achievements:

Currency Identification and Summation:

- The implementation of YOLOv8-based currency identification and summation algorithms has enabled accurate detection and aggregation of Indian currency notes in real-time.
- Users can effortlessly capture images of currency notes and receive immediate feedback on the total sum of money present in the image, enhancing their financial management capabilities.

Text-to-Speech Conversion:

- The integration of text-to-speech functionality enables the conversion of textual content into spoken speech, facilitating access to information for visually impaired users.
- Users can receive auditory feedback on textual information, enhancing their ability to interact with the application's features and content.

Gesture Recognition and Intuitive Interaction:

- The implementation of gesture recognition allows for intuitive interaction with the application through swipe gestures.

FUTURE ENHANCEMENT

Enhanced Currency Recognition:

- Further improvements can be made to enhance the accuracy and robustness of currency recognition algorithms, particularly in challenging lighting conditions or with non- standard currency notes.
- Integration of additional machine learning techniques and data augmentation strategies may help improve performance in real-world scenarios.

Expanded Feature Set:

- Future iterations of the application could incorporate additional features such as currency conversion, bill payment assistance, and object recognition for everyday objects beyond currency notes.
- Collaboration with financial institutions and accessibility organizations can help identify and prioritize features that meet the evolving needs of visually impaired users.

User Feedback and Iterative Design:

- Continuous user feedback and usability testing are essential for refining the user experience and addressing any usability issues or accessibility challenges.
- Iterative design and development cycles should be employed to incorporate user feedback, iterate on features, and continuously improve the application's functionality and accessibility.

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