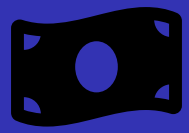

Indian Currency Recognition for Visually Impaired People

First-Level Project Presentation

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Introduction

Introduction

This project is designed to assist visually impaired individuals in recognizing and managing Indian currency notes independently. It provides a **voice-guided system with audio feedback**, enabling users to identify currency and track amounts without needing visual cues.

Problem Statement

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A user-friendly, accessible solution for independent recognition and handling of Indian currency through non-visual means.

Project Objective

Project Objective

- Provide a reliable currency recognition service
- Enable real-time auditory feedback
- Maintain a digital virtual purse
- Offer an accessible, keyboard- and voice-driven interface
- Enhance financial independence and security

Goal: To develop an accessible system that empowers users to recognize and manage currency independently and securely.

Literature Survey (Part 1)

Paper Title	Methodology	Advantages	Disadvantages
A Robust System for Indian Paper Currency Recognition using Deep Learning	Fine-tuned VGG-16 CNN with transfer learning and image augmentation.	High accuracy, real-world robustness.	Computationally heavy; unsuitable for low-end devices.
Deep Learning Based Currency Recognition and Verification	Custom CNN trained on raw pixel inputs for denomination classification.	Good accuracy, fast inference with pre-trained layers.	Model size too large for real-time embedded applications.
SURF-Based Indian Currency Recognition	SURF feature extraction and keypoint matching with currency DB.	Low resource usage; fast detection.	Performance drops under varied lighting or distortion.

Literature Survey (Part 2)

Paper Title	Methodology	Advantages	Disadvantages
Fake Banknote Detection Using Machine Learning	Used statistical features from wavelet images; Random Forest gave best accuracy for fake note detection	High accuracy; portable and affordable hardware.	Requires special sensors; not ideal for large-scale classification.
A Survey on Paper Currency Recognition Systems	Comprehensive review of classification, detection, and feature extraction methods across studies.	Broad coverage of technologies; comparative insights.	No original model or implementation details provided.

Existing System Limitations

Current System Issues

- Relies on faded tactile marks
- Depends on subtle differences in size and texture
- Limits user independence and privacy

Proposed System

Proposed System

- Deep learning model based on ResNet architecture
- Currency recognition via webcam or image upload
- Voice command integration using Web Speech API
- Keyboard-driven interface requiring no mouse
- Continuous audio feedback for seamless interaction
- Virtual purse to track total currency amount

Tech Stack:

TensorFlow, ResNet, HTML, CSS, JavaScript, Web Speech API, Flask

Methodology

Data Collection & Preprocessing

- **Dataset:** Collected from Kaggle; images under varied lighting, angles, backgrounds.
- **Image Standardization:** Resized to 224×224 pixels, normalized, RGB preserved.
- **Label Encoding:** Folder-based class extraction and one-hot encoding.
- **Data Augmentation:** Rotation, flipping, brightness variation, and shifting (training set only).

Methodology

Model Architecture

- **Base Model:** Pre-trained ResNet50 (ImageNet).
- **Custom Layers:** Dense output layers tailored for Indian currency.
- **Loss Function:** Categorical Cross-Entropy:

$$L = -\sum_{i=1}^{C} y_i \log(\hat{y}_i)$$

- **Optimizer:** Adam optimizer used for adaptive learning.

Methodology

Two-Phase Training Strategy

- **Phase 1 – Feature Extraction:** Freeze base layers, train top layers (7 epochs, LR $= 10^{-4}$).
- **Phase 2 – Fine-Tuning:** Unfreeze last 30 layers of ResNet50, fine-tune (8 epochs, LR $= 10^{-5}$).

  Dropout Layers: Dropout applied (rates 0.5, 0.3, 0.2) to prevent overfitting.

Methodology

Callbacks & Regularization

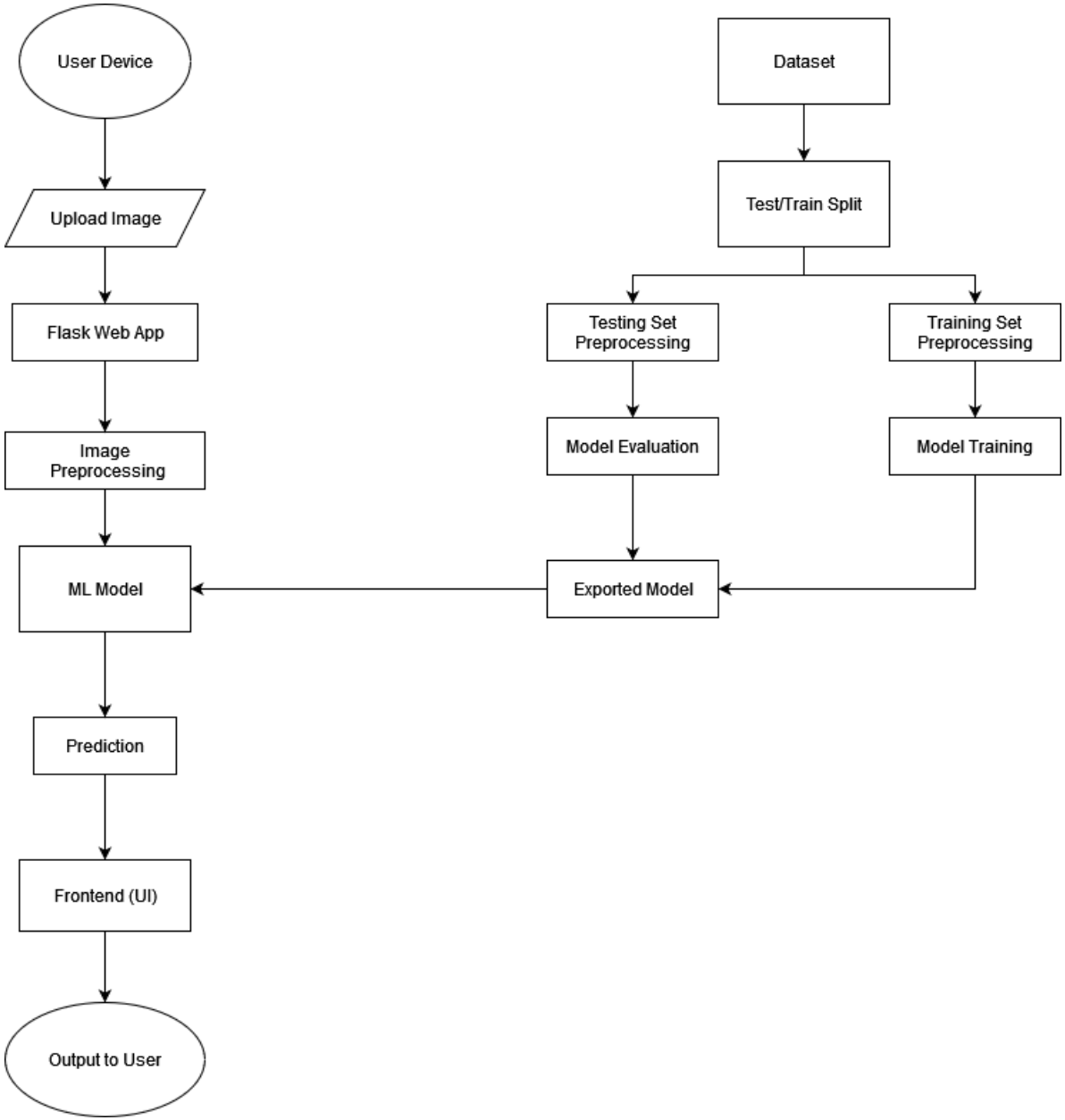
- **Early Stopping:** Stops training if validation loss doesn't improve for 5 epochs.
- **ReduceLROnPlateau:** Lowers learning rate on plateaued validation loss.
- **Model Checkpoint:** Saves model with highest validation accuracy.

Methodology

Evaluation Metrics

- **Test Accuracy:** Overall correct predictions.
- **Top-3 Accuracy:** True label in top 3 predictions.
- **Classification Report:** Shows per-class precision, recall, and F1-score.
- **Confusion Matrix:** Displays confusion between similar denominations.

System Design / Architecture



Unit Testing

Unit testing verifies individual components to ensure they function correctly. In the Indian Currency Recognition system, unit tests covered image processing, currency classification, and voice command handling.

Test Case	Description	Expected Result	P/F
1	Data Preprocessing	Missing values are handled correctly	Pass
2	Feature Scaling	Features are scaled to correct range	Pass
3	Model Training	Model trains successfully	Pass
4	Prediction	Model correctly identifies currency denomination	Pass

Unit Testing (Contd.)

Test Case	Description	Expected Result	P/F
5	Audio Feedback	Correct denomination audio is played	Pass
6	Wallet Logic	Currency is added to virtual wallet	Pass
7	UI Display	UI elements render properly	Pass

Integration Testing

Integration testing makes sure all parts of the system work well together. For the Indian Currency Recognition system, this means testing how image input, currency detection, voice commands, and audio feedback work as a whole.

Test Case	Description	Expected Result	P/F
1	User Interface and Prediction	Input is correctly processed and currency is accurately identified	Pass
2	Model Prediction Interpretation	System uses softmax output to identify currency; requests retake if confidence is low	Pass
3	Recognized Currency Added to Wallet	Detected denomination is added to the user's virtual wallet	Pass

Integration Testing (Contd.)

Test Case	Description	Expected Result	P/F
4	Audio Feedback	Correct denomination is clearly and promptly announced	Pass
5	Error Handling	If model fails or input is invalid, the user hears an appropriate message	Pass

System Testing

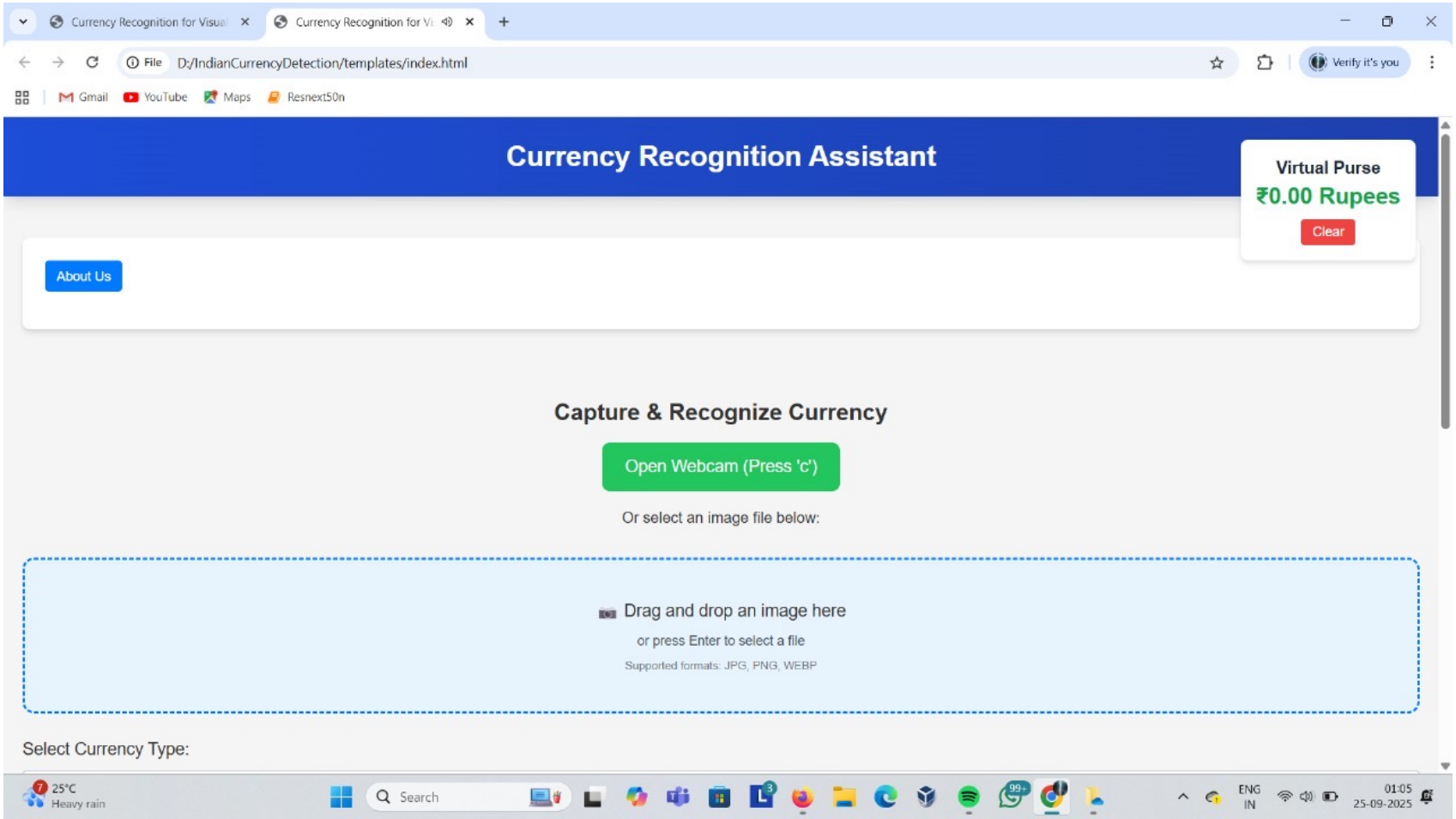
System testing validates the complete functionality of the Indian Currency Recognition system under real-world scenarios.

Test Case	Description	Expected Result	P/F
1	Overall System Functionality	System functions correctly from input to prediction	Pass
2	User Interaction Testing	Users can input data and receive accurate predictions	Pass
3	Content Management Testing	Advertiser content is displayed and retrievable correctly	Pass

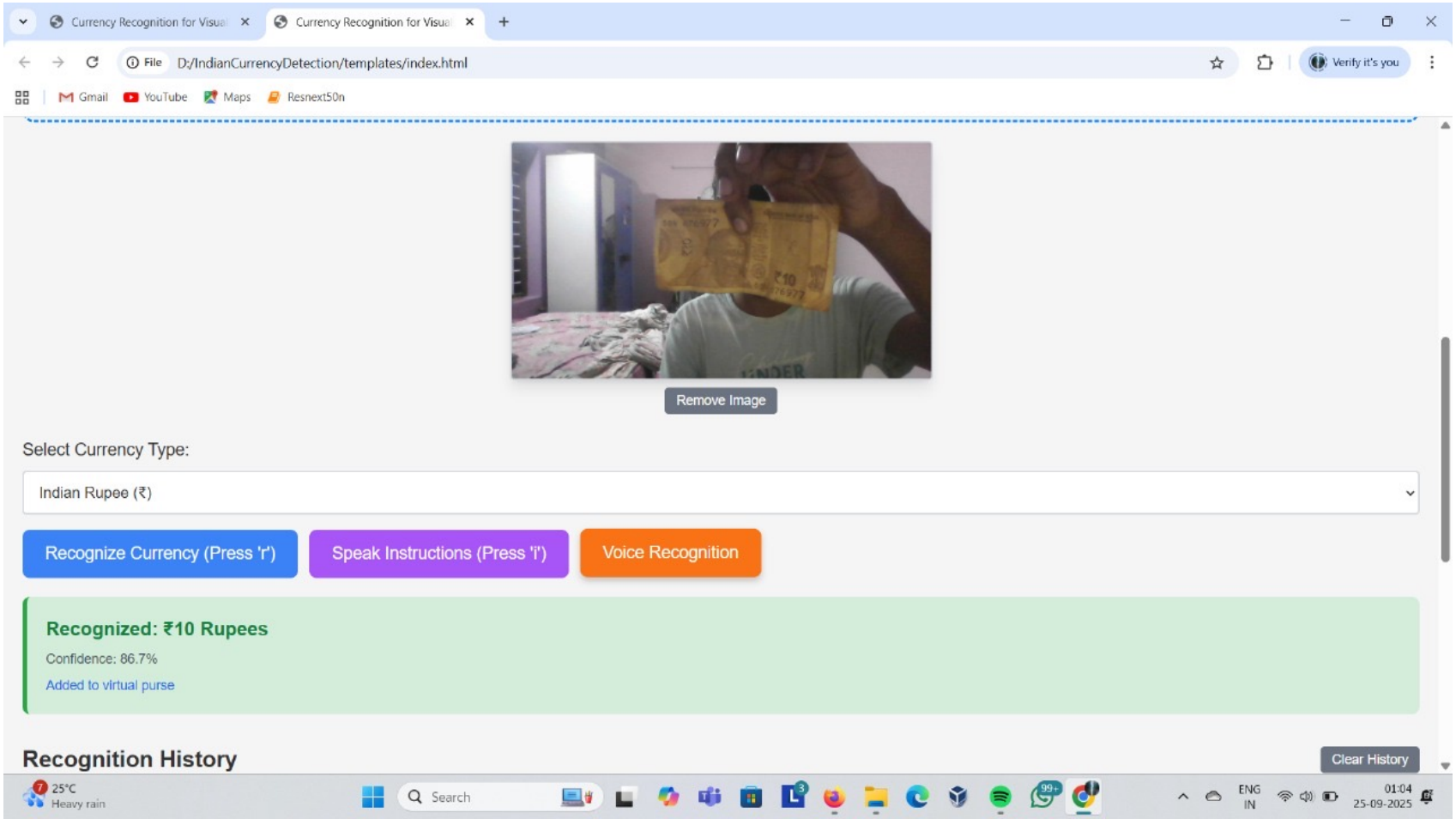
System Testing (Contd.)

Test Case	Description	Expected Result	P/F
4	Performance Testing	System handles multiple requests without crashes or delays	Pass
5	Compatibility Testing	Application works across devices (smartphones, tablets) and OS	Pass
6	Security Testing	User data is securely processed; content management is protected	Pass

Implementation - UI Screenshot 1



Implementation - UI Screenshot 2



System Configuration

System Configuration

Hardware Configuration

- **Operating System:** Windows
- **Processor:** AMD Ryzen 5 5600H
- **Memory:** 8GB RAM

Software Configuration

- **Language:** Python
- **Machine Learning Library:** TensorFlow
- **Model Architecture:** ResNet (CNN)
- **Front End:** HTML, CSS3, JavaScript, Web Speech API
- **Back End:** Python Flask

Results and Discussion

Results and Discussion

Advantages

- **Enhanced Independence and Confidence**
- **Optimized for the Visually Impaired**
- **Convenience and Cost-Effectiveness**
- **Accessibility**
- **Scalability**

Limitations

- **Technical Barriers**
- **Accuracy of User Input**
- **Limited Dataset**
- **Lighting Conditions**

Conclusion

Conclusion

This project empowers visually impaired individuals to independently identify and manage currency, promoting financial autonomy and confidence. By prioritizing accessibility and inclusion, it supports a more equitable and dignified digital experience for all.

Future Scope

Future Scope

- **Advanced Recognition**
- **Personalized Virtual Purse**
- **Counterfeit Detection**
- **Multilingual & Multi-currency Support**
- **Dedicated Mobile App**
- **Lighting Adjustment**

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GitHub Repository

GitHub Link

github.com/Kevin-Monachan/CurrencyDetection

Thank You!