IPMV Report

Project Name (Group Number)	**Creating Simulink based simulation for at least four Currency Notes Detection**

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Vivekanand Education Society's Institute of Technology

Students Names (Class /Roll Number)	Rishika Chaubal (D14B/10)
Students Names (Class /Roll Number)	Renu Dharamkar (D14B/17)
Students Names (Class /Roll Number)	Hritika Mulay (D14B/35)
Students Names (Class /Roll Number)	Aman Yadav (D14B/66)
Faculty Name	Mr. Mrugendra Vasmatkar
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Problem Statement	Manual currency note detection is inefficient and prone to errors, leading to financial losses and security concerns. Automating this process through a robust and versatile Simulink-based simulation for at least four currency notes is crucial for enhancing accuracy, efficiency, and security in various real-world applications. Simulink simulations are highly scalable, allowing for future expansion to detect additional note denominations or currencies..

Objectives	Developing a robust and versatile Simulink-based simulation system capable of automating currency note detection for at least four denominations. The primary aim is to enhance accuracy, efficiency, and security in real-world applications by replacing inefficient manual detection methods prone to errors, financial losses, and security concerns. The simulation will leverage the scalability of Simulink to accommodate future expansion for detecting additional note denominations or currencies, ensuring adaptability to evolving requirements and technological advancements in currency processing systems.
Specific	The project aims to create a reliable and effective recognition system for identifying characters on banknotes, including alphanumeric letters, symbols, and pertinent data. It seeks to develop a solution capable of accommodating a wide range of typefaces, sizes, orientations, and lighting conditions typical in real-world settings. The evaluation will assess the progress made in developing this system, focusing on its reliability and effectiveness in improving currency processing efficiency..Our Team include four members Rishika Chuabal, Renu Dharamkar, Hritika Mulay and Aman Yadav
Measurable	Our objective is to implement a system capable of achieving an accuracy rate of at least 95% in identifying alphanumeric characters, symbols, and pertinent data printed on diverse currency note denominations across different currencies.
Achievable	The end result of this project is to Develop a comprehensive recognition system capable of accurately identifying alphanumeric letters, symbols, and relevant data printed on diverse currency note denominations across multiple currencies. This system will be designed to effectively handle a wide range

	of typefaces, sizes, orientations, and lighting conditions commonly encountered in real-world situations
Relevant	Goal is to Creating a complete character recognition system for banknotes is in line with the main objective of increasing the effectiveness of cash processing. A crucial gap in currency processing systems is filled by the system's accurate recognition of alphanumeric characters, symbols, and other data across multiple currencies and note denominations. The project's goal is to developing a dependable and efficient recognition system that can function in a variety of real-world scenarios is pertinent to the objective, which will ultimately help to increase the efficacy and efficiency of money processing activities. .
S.M.A.R.T. Goal	The Project aims to develop and implement a character recognition system for banknotes in identifying alphanumeric characters, symbols, and relevant data across diverse currencies and denominations for improving currency processing efficiency

Introduction:

In the realm of currency management, manual detection of currency notes has proven to be inefficient, error-prone, and fraught with financial losses and security concerns. To address these challenges, this study proposes the development of a robust and versatile Simulink-based simulation for automating the currency note detection process, focusing initially on at least four currency denominations. The use of Simulink simulations offers scalability, providing a foundation for future expansion to detect additional note denominations or currencies. The proposed system aims to significantly enhance accuracy, efficiency, and security in various real-world applications, such as banking, retail, and automated teller machines (ATMs). By leveraging Simulink's capabilities, the simulation model will be designed to emulate the intricate features and security elements present in currency notes, enabling the system to accurately identify and authenticate different denominations.

Flow chart of the Project :

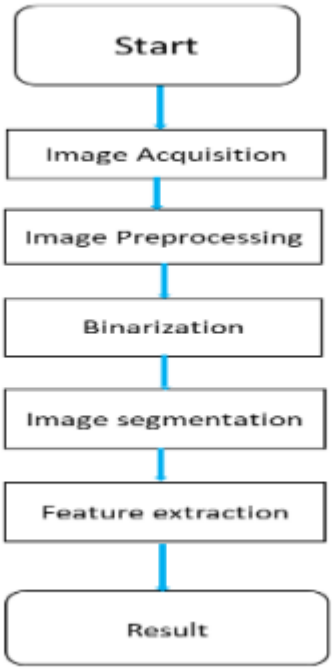

Fig 1. Flow chart of the project

1. **Start**: This is the starting point of the flowchart, indicating the initiation of the currency note recognition process.
2. **Image Acquisition:** In this step, an image of the currency note is acquired. This image could be obtained from a camera or loaded from a file.
3. **Image Preprocessing:** The image undergoes preprocessing techniques to improve its quality and suitability for further analysis, including resizing, removing noise, and adjusting brightness and contrast.
4. **Binarization:** Binarization converts preprocessed images into binary format, representing each pixel as black or white, simplifying subsequent processing by reducing the image to a binary format
5. **Image Segmentation:**The image is segmented into distinct regions based on the detected edges, enabling isolation and analysis of specific currency note components.
6. **Feature Extraction:** The process involves extracting essential features like shape, texture, and intensity from the segmented regions of the image to differentiate between different currency note characters or elements.
7. **Result:** After extracting features from the image, the recognized information is written to an output file or database for further analysis .

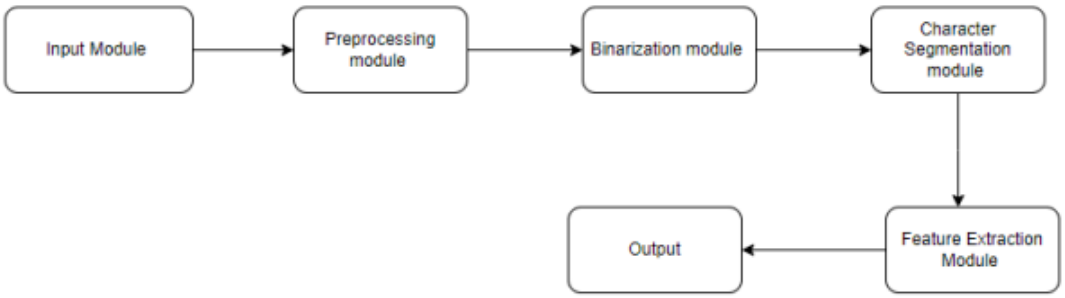

Fig 2. Block Diagram of the Project

1. **Input Module :** This module represents the input source, which could be a digital camera capturing images of currency notes or a file input if processing pre-captured images.

2. **Preprocessing Module:** Preprocesses the input images to enhance their quality and suitability for character recognition.Includes operations like resizing, noise reduction, and contrast enhancement

3. **Binarization Module:** Binarization converts preprocessed images into binary format, representing each pixel as black or white, simplifying subsequent processing by reducing the image to a binary format.

4. **Character Segmentation Module :** Divides the preprocessed image into individual characters such as Find contours in the binary image and Filter out small contours to remove noise. It Utilizes techniques such as contour detection and bounding box extraction.

5. **Feature Extraction Module :** Extracts relevant features from segmented characters. Includes shape descriptors, texture features, and intensity-based features.(area, perimeter,character,number plate aspect ratio).

6. **Output Module :** Display recognized denomination or characters. Optionally, provide confidence scores for the classification results. Store recognized information in a database or file for further analysis.

Algorithm of the project :

1. **Input Acquisition:** Capture or load the currency note image.
2. **Preprocessing:** Convert the image to grayscale. Apply Gaussian blur to reduce noise
3. **Binarization:** Apply adaptive thresholding to create a binary image
4. **Edge Detection:** Apply the Canny edge detection algorithm to detect edges
5. **Image Segmentation**: Find contours in the binary image. Filter out small contours to remove noise. Extract bounding boxes around remaining contours.
6. **Feature Extraction:** For each segmented region: Compute shape descriptors (area, perimeter,character,number plate aspect ratio). Extract texture features (local binary patterns). Compute intensity-based features (mean intensity, standard deviation).
7. **Output**: Display recognized denomination or characters. Optionally, provide confidence scores for the classification results. Store recognized information in a database or file for further analysis

Mentor Name&Signature with date: