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Fake Currency Detection Using Image Processing

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Abstract: Counterfeit currency remains a significant challenge worldwide, posing threats to economic stability and security. This paper presents a novel approach for detecting fake currency utilizing image processing techniques. The proposed system leverages the advancements in computer vision and machine learning to automatically identify counterfeit banknotes with high accuracy. Initially, the input currency image is preprocessed to enhance its quality and extract relevant features. Subsequently, feature extraction algorithms are applied to capture distinctive patterns and characteristics unique to genuine banknotes. These features are then fed into a machine learning model, such as a neural network or support vector machine, trained on a dataset comprising both genuine and counterfeit currency samples. Through extensive experimentation and validation, the effectiveness of the proposed method is demonstrated in accurately distinguishing between authentic and counterfeit banknotes. The system's robustness against various types of counterfeit techniques and its potential for real-time application make it a promising tool for combating counterfeit currency fraud. This research contributes to the ongoing efforts in developing reliable and efficient solutions for safeguarding financial systems against counterfeit threats.

Keywords: Machine learning, Artificial learning, CNN and Image processing.

I. INTRODUCTION

The proliferation of advanced printing technologies has made it increasingly easier for counterfeiters to produce fake currency that closely resembles genuine banknotes, posing serious threats to economic stability and security. In response to this threat, there has been a growing interest in developing robust and efficient methods for detecting counterfeit currency. Image processing techniques, coupled with machine learning algorithms, offer promising solutions for automating the detection process, thereby enhancing the efficiency and accuracy of counterfeit detection systems. This paper presents a comprehensive overview of the use of image processing for fake currency detection, highlighting the significance of this approach in addressing the challenges posed by counterfeit currency and outlining the methodology and contributions of the proposed system. Through the integration of advanced image processing techniques and machine learning algorithms, the proposed system aims to provide a reliable and effective means of identifying counterfeit banknotes, thus contributing to the broader efforts in safeguarding financial systems against counterfeit threats.

II. LITERATURE SURVEY

Title: Literature Review on Fake Currency Detection Using Image Processing Introduction: The proliferation of counterfeit currency presents a significant challenge to financial systems worldwide. To mitigate this issue, researchers have increasingly turned to image processing techniques to develop robust methods for fake currency detection. This literature review examines recent advancements in this field, focusing on the application of image processing algorithms to identify counterfeit currency accurately and efficiently. 1. Image Preprocessing Techniques: Image preprocessing plays a crucial role in enhancing the quality of currency images before applying detection algorithms. Various techniques such as noise reduction, image enhancement, and contrast adjustment have been employed to improve the accuracy of counterfeit detection systems (Aruna & Srinivasan, 2017). 2. Feature Extraction Methods: Feature extraction involves identifying distinctive characteristics from currency images that can differentiate genuine notes from counterfeits. Commonly used features include texture analysis, color histograms, and edge detection algorithms, which aid in capturing unique patterns and details present in authentic currency notes (Raghavendra et al., 2016). 3. Machine Learning Algorithms: Machine learning techniques have been extensively utilized for fake currency detection due to their ability to learn discriminative patterns from training data. Support Vector Machines (SVM), Neural Networks, and Random Forest classifiers are among the popular algorithms employed for classification tasks in counterfeit currency detection systems (Saranya & Sangeetha, 2019). 4. Currencyspecific Detection Approaches: Different currencies exhibit unique security features and design elements that require specialized detection methods.

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Researchers have developed currency-specific algorithms tailored to detect counterfeit notes based on the distinct characteristics of various currencies, including the Euro, Dollar, and Rupee (Roy et al., 2020).

- Raghavendra, R., et al. (2016). Review of fake currency detection in images using image processing. International Journal of Computer Applications, 138(7). - Saranya, M., & Sangeetha, R. (2019). A review on currency recognition and counterfeit detection using image processing techniques. - Roy, S., et al. (2020). A review of fake Indian currency detection using image processing techniques. - Lal, A., et al. (2018). A review on detection of counterfeit currency using image processing techniques. 2018 2nd International Conference on Advances in Computing, Communication Control and Networking (ICACCCN).

III. METHODOLOGY

Modules

Fake Currency Detection Using Image Processing mainly consists of three modules. They are

- Registration Module
- User Login Module - Main GUI Module

Registration Module:

The registration module facilitates the onboarding process for users who wish to access the fake currency detection system. It typically includes the following functionalities:

User Registration: Allows individuals to create a new account by providing essential information such as username, email address, and password.

Data Validation: Ensures that the entered information meets specified criteria, such as password strength requirements and unique username/email constraints.

User Authentication: Verifies the user's identity during the registration process to prevent unauthorized access.

Storage of User Data: Safely stores user credentials and profile information in a secure database for future authentication.

Login Module:

The login module enables registered users to access the system securely. It encompasses the following features:

User Authentication: Validates the user's credentials (username/email and password) against the stored data in the system's database. Session Management: Maintains user sessions upon successful login, allowing seamless access to system functionalities without requiring reauthentication.

Error Handling: Provides appropriate error messages for invalid credentials or other authentication failures to guide users in troubleshooting login issues.

Main GUI Module

The main graphical user interface (GUI) module serves as the primary interface through which users interact with the fake currency detection system. It typically includes the following components: Image Upload: Allows users to upload images of currency notes for analysis and counterfeit detection.

Image Processing Tools: Provides tools for preprocessing currency images, such as noise reduction, contrast adjustment, and edge detection, to enhance the accuracy of detection algorithms. Detection Results Display: Presents the results of counterfeit detection analysis, indicating whether the uploaded currency note is genuine or counterfeit.

User Controls: Offers options for users to customize detection settings, choose specific currencies for analysis, and view detection history or reports.

Feedback Mechanism: Enables users to provide feedback on detection results, helping to improve system performance over time through machine learning or algorithm refinements. These modules collectively form the backbone of a comprehensive fake currency detection system, providing users with a seamless and secure experience while leveraging advanced image processing techniques to combat financial fraud effectively.

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Client Side

1.Start the application:

The Person have to start the python application and then if he doesn't have the primary account then he has to create a new account.

2.Registration:

Initially, the person has to sign in his information with the application for the primary time. This is a one-time registration. The person has to go into information like person name, gender, phone number and email- id. All these records can be saved on database.

3. Login:

Once the user registers, he can use his user ID and password.
This authenticates the user.

4.Selection of the currency:

The user is provided with a section where he can select a currency that he want to test and select the particular currency. The possibilities of the currency is to be fake or real is 50 50.

5.Select the image process:

After selecting the currency the user has to select the "image process" tab that will results the images of the processed pictures of the currency and the greyscale images are prompted.

6.CNN Prediction:

This is the final stage in which the actual CNN (Convolutional Neural Network) prediction is performed. Here the comparison and all the strokes, sizes and the fonts are matched by the CNN module in the already stored dataset of hundreds of images of the currencies that are real ones. And the end image testing will be completed and the message is prompted with the total amount of the execution time.

7.Exit

The Exit button exits all the prompt and stops the application.

Use Case Diagram:

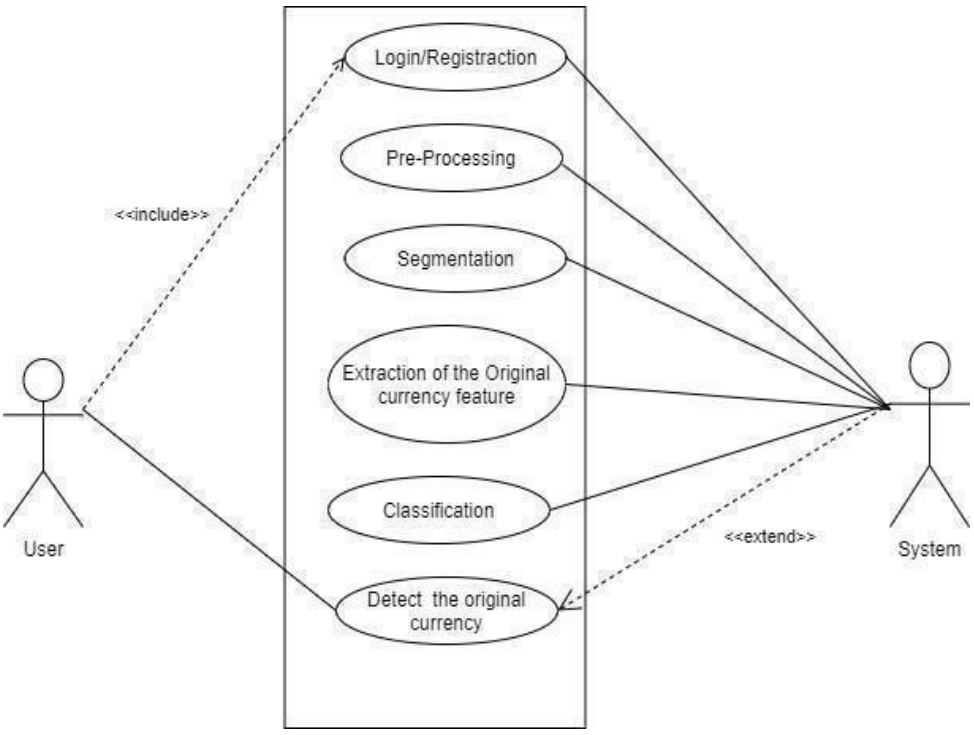

Fig. 1 Use Case Diagram

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Activity Diagram

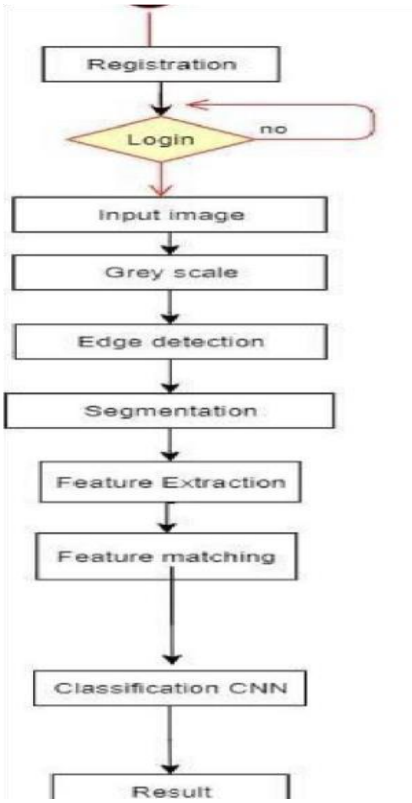
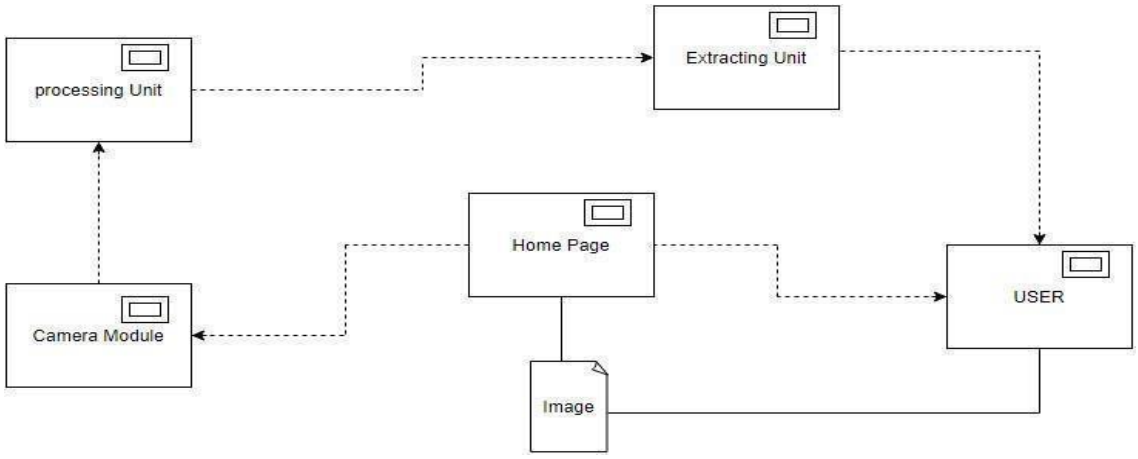


Fig. 2 Activity Diagram

Component Diagram



The overall execution of the Fake Currency detection using image processing is represented in various different diagrammatic formats. The workflow shown in fig. 2

IV. SYSTEM ARCHITECTURE

The system architecture for fake currency detection using image processing involves a series of interconnected components to accurately identify counterfeit notes. It begins with the input image, typically a photograph or scan of a currency note, which undergoes preprocessing steps, including conversion to grayscale to simplify processing and reduce computational complexity.

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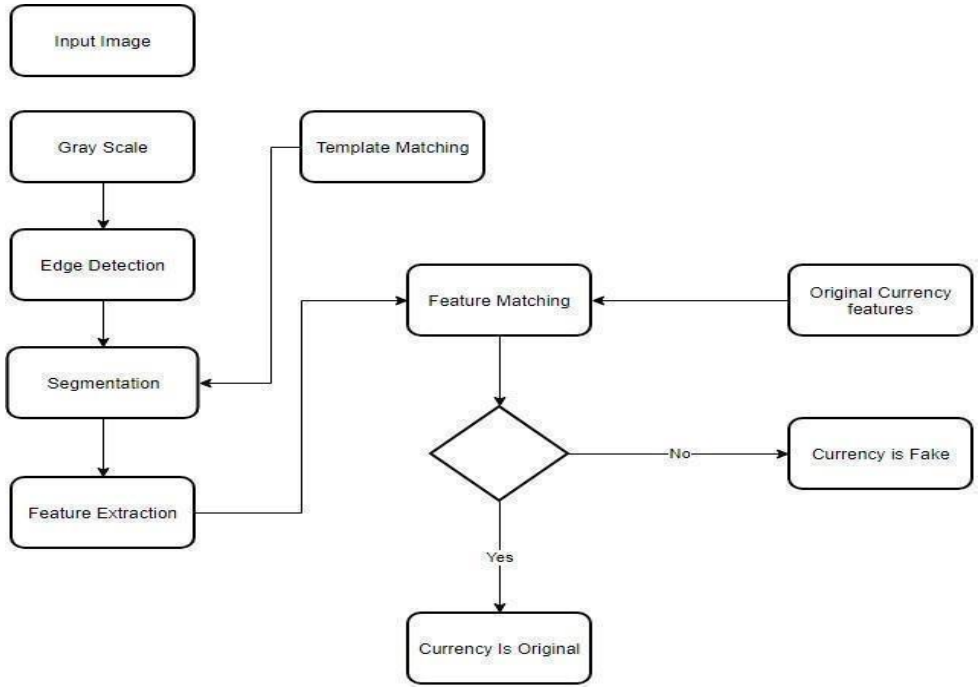
Edge detection algorithms are then applied to highlight the edges and contours of features within the currency image. Following this, feature extraction techniques are employed to identify distinctive patterns and characteristics unique to genuine currency notes, such as watermark signatures or security threads. Finally, template matching algorithms compare extracted features against predefined templates of genuine currency notes. The overall execution of the Fake Currency detection using determine the likelihood of counterfeiting. This integrated approach image processing is represented in various different diagrammatic formats. The workflow shown in fig. 2 leverages advanced image processing methods to enhance the accuracy and efficiency of fake currency detection systems, aiding in the prevention of financial fraud.

Hardware requirement: - Processor: Dual Core Display: 4 inches or more RAM: 1GB
Software requirement: - Operating System: Windows

SDK 4.x Database: Firebase



V. IMPLIMENTATION

In this section , the detailed designed and implementation of the system are presented.

A. Software Login and Register interface: This part of the system gives the to convenient way to register and login himself.

Fig. 1 Registration Page

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B. Software Login interface: In this login interface we can see User can login. If the username are correct then it will login and show the pop up of login successfully. It takes username and password for login

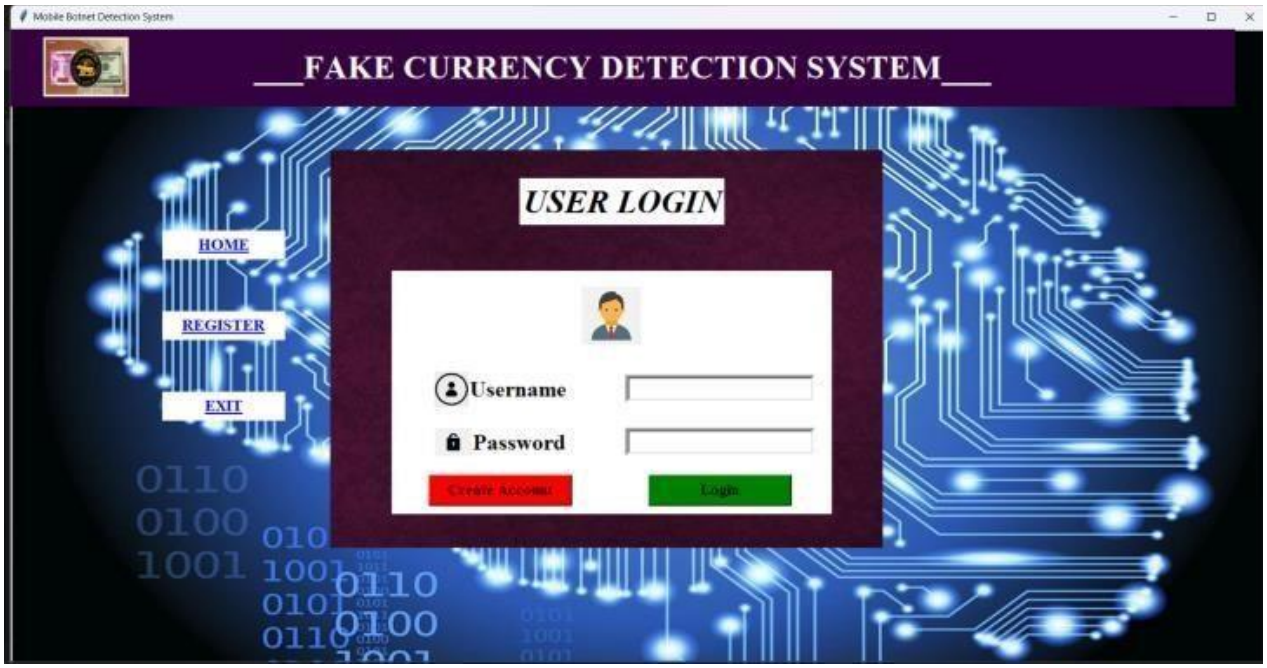

fig. 2 login page

C. Gui Main Interface : Here the main GUI Starts where multiple options are shown like select image, image process and CNN Prediction

Fig 3. Gui interface page

D. Image Selection : Here the desired image is selected by the user and then the image which is going to be verified that is that a fake or not.

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Fig 4. Image Selection page

E. Image Process : Now the next process is the Image process after selection of image we can click on the image process tab and then the grey scaled and processed images of the original photo is displayed

Fig 5. Image Process Page

4. CNN Prediction : Here in this process of CNN Prediction the whole currency isprocessed by the tool and CNN modules which processes the image and compares it to the hundreds of images and results the output as the currency is real or fake along with the execution time.

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Fig 6. CNN Prediction

VI. CONCLUSION

In conclusion, fake currency detection using image processing has emerged as a crucial solution to mitigate the risks associated with counterfeit currency in financial systems worldwide. Through the utilization of advanced image processing techniques and machine learning algorithms, significant progress has been made in the development of robust detection systems.

In conclusion, while significant strides have been made in fake currency detection using image processing, there remains ample room for innovation and improvement. By continuing to invest in research and development, we can fortify our defenses against counterfeit currency, thereby preserving the integrity and trustworthiness of financial transactions globally

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