iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** V **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.82762

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

Fake Currency Detection By Using Convolutional Neutral Networks

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Abstract: ***The Fake Currency Detection System using Convolutional Neural Networks (CNN) and Deep Learning is a desktop-based application designed to accurately identify counterfeit currency notes. The system allows users to upload or input an image of a currency note, which is then processed using a trained CNN model that learns important visual features such as patterns, textures, security marks, and edges from real and fake currency datasets. Based on this analysis, the system classifies the note as either genuine or fake. The application is developed using Python, Tkinter, TensorFlow/Keras, OpenCV, and Deep Learning libraries, providing a simple and interactive user interface for easy image selection and instant prediction results. This system improves detection accuracy, reduces manual verification errors, saves time, and offers a fast and reliable solution for real-time currency authentication.***

Keywords: Fake Currency Detection, Convolutional Neural Networks (CNN), Deep Learning, Image Processing, Tkinter, Python, OpenCV, Classification, Feature Extraction, Real-time Detection.

I. INTRODUCTION

In today's digital world, the use of automated systems is increasing to improve accuracy and reduce manual effort in various applications. One major challenge is the identification of counterfeit currency, which is difficult to detect using traditional manual methods. To address this problem, the Fake Currency Detection System using Convolutional Neural Networks (CNN) and Deep Learning is developed as a desktop-based application. The system allows users to upload an image of a currency note, which is then analysed using a trained CNN model. The model learns important visual features such as patterns, textures, security marks, and edges from real and fake currency datasets to accurately classify the note as genuine or fake. The application provides instant prediction results through a simple user interface. The project is implemented using Python, Tkinter, OpenCV, TensorFlow/Kera's, and Deep Learning libraries. The main aim of the system is to improve detection accuracy, reduce manual verification errors, save time, and provide a reliable and efficient solution for counterfeit currency identification.

II. LITERATURE SURVEY

This project is based on research focused on improving fake currency detection systems using Convolutional Neural Networks (CNN) and Deep Learning techniques[1].Researchers have shown that traditional manual methods and basic image processing techniques are not sufficient for accurately identifying counterfeit currency due to variations in printing quality and security features[2].Recent studies highlight that deep learning models, especially CNNs, are highly effective in automatically extracting important visual features such as textures, patterns, edges, and security markings from currency images for accurate classification[3]. Many existing works using image processing and machine learning algorithms have improved detection accuracy, but still face limitations in handling complex counterfeit patterns. Modern deep learning-based systems trained on large datasets of real and fake currency notes provide higher accuracy, faster prediction, and better generalization[5].These existing research works and technologies form the foundation for developing this Fake Currency Detection System using CNN and Deep Learning[6].

III. CHALLENGES

Implementing a Fake Currency Detection System using Convolutional Neural Networks (CNN) and Deep Learning involves several technical and practical challenges related to image processing, model training, and system accuracy.[1] One major challenge is collecting a large and high-quality dataset of real and fake currency images, as poor or unbalanced data can directly affect the performance of the CNN model[2].The system must also correctly learn and differentiate fine visual features such as patterns, security marks, textures, and edges, which can be difficult due to similarities between real and counterfeit notes[3].

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Another challenge is preventing overfitting in the deep learning model while ensuring good generalization to new and unseen currency images[4].

Additionally, maintaining high accuracy under different lighting conditions, image quality variations, and camera angles is a significant issue in real-world usage[5]. Integrating the trained CNN model into a desktop application using Tkinter while ensuring smooth performance is another technical challenge[6]. The system also requires high computational resources for training deep learning models, which may increase processing time and hardware requirements.Furthermore, improving prediction speed while maintaining accuracy is important for real-time detection scenarios[8]. Continuous model tuning, dataset updates, and system optimization are necessary to maintain reliability and performance over time[9].

IV. PROPOSED METHODOLOGY

The proposed methodology for this project uses a Deep Learning-based desktop applicationapproach to accurately detect fake currency using Convolutional Neural Networks (CNN)[1]. The process begins with data collection, where a dataset of real and fake currency note images is gathered under different conditions such as lighting, background variations, and angles[2].During data preprocessing, the images are resized, normalized, and enhanced to improve quality and make them suitable for model training, using image processing techniques such as OpenCV[3].

A CNN model is then designed and trained to automatically extract important visual features like edges, textures, security threads, patterns, and watermarks from the currency images[4]. The model learns to differentiate between genuine and counterfeit notes based on these features[5]. After training, the model is tested using unseen images to evaluate its accuracy and performance.

The trained model is then integrated into a Tkinter-based desktop application, where users can upload or select a currency image for prediction[7]. The system processes the input image and displays the result as real or fake currency. This methodology ensures fast, automated, and accurate detection, reducing manual verification effort and improving reliability in currency authentication[8].

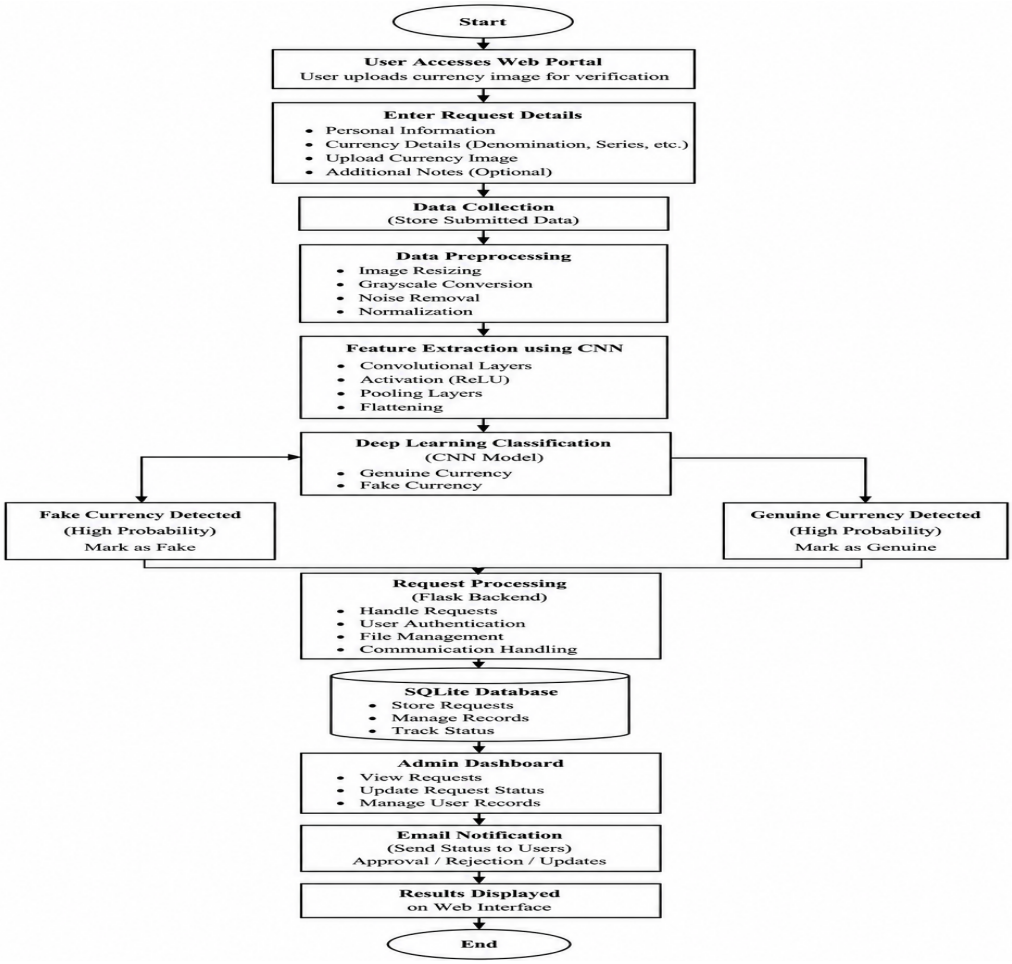


Figure 1: Flow chart of the proposed methodology

V. ALGORITHMS AND TECHNIQUES

The project utilizes a combination of Deep Learning, Image Processing, and web technologies to accurately identify fake currency notes and automate the verification process.

1) *Convolutional Neural Network (CNN):* Used as the main Deep Learning algorithm to automatically detect whether a currency note is real or fake by analysing important visual features such as texture, colour patterns, serial numbers, watermarks, and security threads[2].
2) *Deep Learning Techniques:* Applied to train the system using large datasets of genuine and counterfeit currency images. The model learns hidden patterns and improves detection accuracy over time[3].
3) *Image Processing Techniques:* Used to enhance and prepare currency note images before analysis. These techniques help the system identify important details clearly and improve prediction performance[14].
4) *Flask Web Framework:* Used as the backend framework to handle routing, image upload processing, user requests, and communication between the frontend and the CNN model[5].
5) *SQLite Database:* Used for secure storage and management of uploaded currency images, prediction results, user details, and system records[6].
6) *Data Preprocessing Techniques:*

- Image Resizing: Used to resize all currency images into a fixed dimension suitable for CNN model training and testing[7].
- Normalization: Applied to scale image pixel values for faster and more accurate model learning.
- Image Augmentation: Used to increase dataset variety by rotating, flipping, or adjusting images to improve model performance and reduce overfitting[10].

7) *Prediction and Classification System:* Used to classify the uploaded currency note as either real or fake based on the trained CNN model output[11].
8) *HTML, CSS, and Bootstrap:* Used to design a simple, responsive, and user-friendly interface for uploading currency note images and displaying prediction results.

VI. ARCHITECTURE

The architecture of the Fake Currency Detection System using CNN and Deep Learning is designed as a web-based intelligent application[1]. The frontend uses HTML, CSS, Bootstrap, and JavaScript to provide a simple and user-friendly interface for users to upload currency note images and view prediction results[2]. The backend is developed using the Flask framework, which handles image processing, file uploads, user requests, and communication with the CNN and Deep Learning models[3]. The system uses Convolutional Neural Networks (CNN) to analyse important features of currency notes such as texture, colour patterns, serial numbers, and security threads to identify whether the note is real or fake[4]. Image preprocessing techniques are applied before analysis to improve prediction accuracy and overall system performance[5].

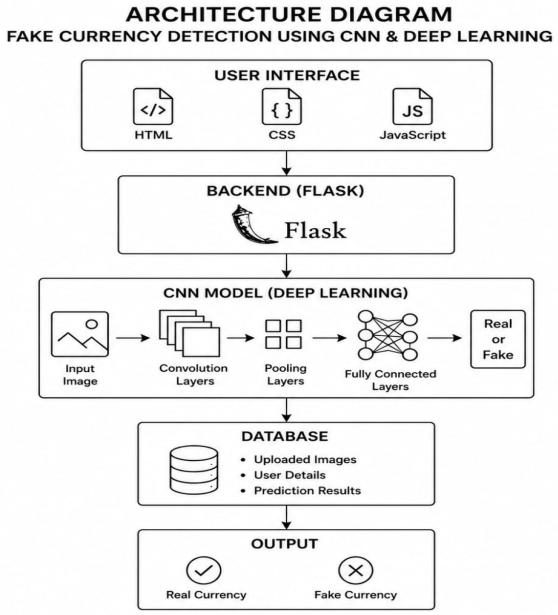


Figure 2: Architecture Diagram

SQLite database is used to securely store uploaded currency images, prediction results, user details, and system records for future analysis and reference[11] The system uses Convolutional Neural Networks (CNN) and Deep Learning techniques to analyse important features of currency notes such as texture, colour patterns, serial numbers, watermarks, and security threads to accurately identify whether the note is real or fake[3]. Image preprocessing techniques like resizing, normalization, and feature extraction are applied before analysis to improve prediction accuracy and overall system performance[5]. The system helps users quickly verify currency authenticity and provides reliable prediction results through a simple and user-friendly interface.

VII. OUTPUT



Fig 1. Home page

The Home Page of the Fake Currency Detection System using CNN and Deep Learning provides a simple, attractive, and user-friendly interface for users to verify currency notes[11]. Through this page, users can easily upload an image of a currency note for analysis[2]. The system uses image preprocessing and Convolutional Neural Network (CNN) techniques to analyse important security features such as texture, watermark, serial number, colour patterns, and security threads1[3].
The homepage acts as the main entry point of the application, allowing users to interact with the system quickly and efficiently[4]. It also displays prediction results indicating whether the uploaded note is real or fake[15]. The interface is designed using HTML, CSS, Bootstrap, and JavaScript to ensure smooth navigation and better user experience.



Fig2. Fake Currency

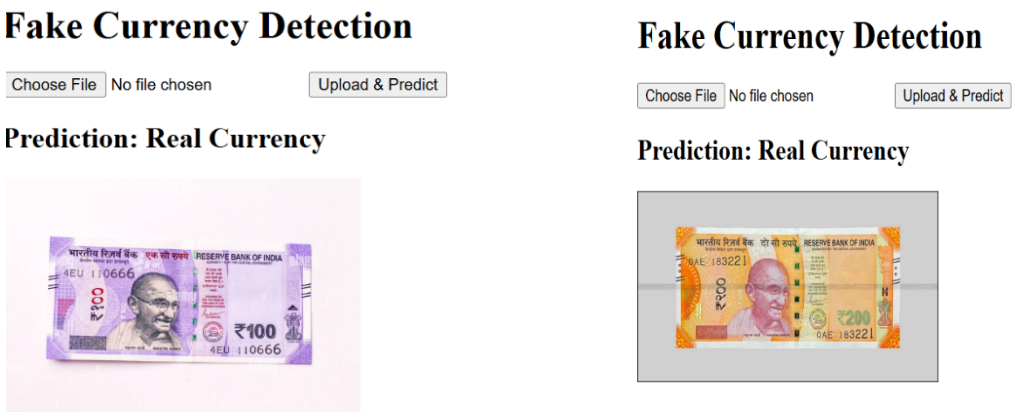


Fig3.Real Currency

The Fake Currency Detection System using CNN and Deep Learning successfully analyses uploaded currency note images and predicts whether the note is real or fake[1]. After the user uploads an image, the system preprocesses the image using resizing and normalization techniques before sending it to the trained CNN model[12]. The model extracts important features such as texture, colour patterns, serial numbers, watermarks, and security threads to perform classification[3].

The final output is displayed on the webpage as “Real Currency” or “Fake Currency” along with the uploaded image[4]. The system provides fast, accurate, and reliable prediction results through a simple and user-friendly interface[15]. The output demonstrates that the CNN-based Deep Learning model can effectively detect counterfeit currency notes and improve financial security by reducing manual verification efforts[6].

VIII. CONCLUSION

The Fake Currency Detection System using CNN and Deep Learning provides a simple, secure, and efficient solution for identifying counterfeit currency notes. The system reduces manual work by allowing users to upload currency note images online and helps in automatically detecting whether the note is real or fake through Deep Learning techniques. By using Convolutional Neural Networks (CNN), the system can analyse important security features such as texture, colour patterns, watermarks, serial numbers, and security threads automatically. Features like image preprocessing, real-time prediction, secure data storage, and user-friendly interface improve system accuracy and overall efficiency. Overall, the project saves time, improves financial security, reduces the circulation of fake currency, and provides a better user experience through fast and reliable currency verification.

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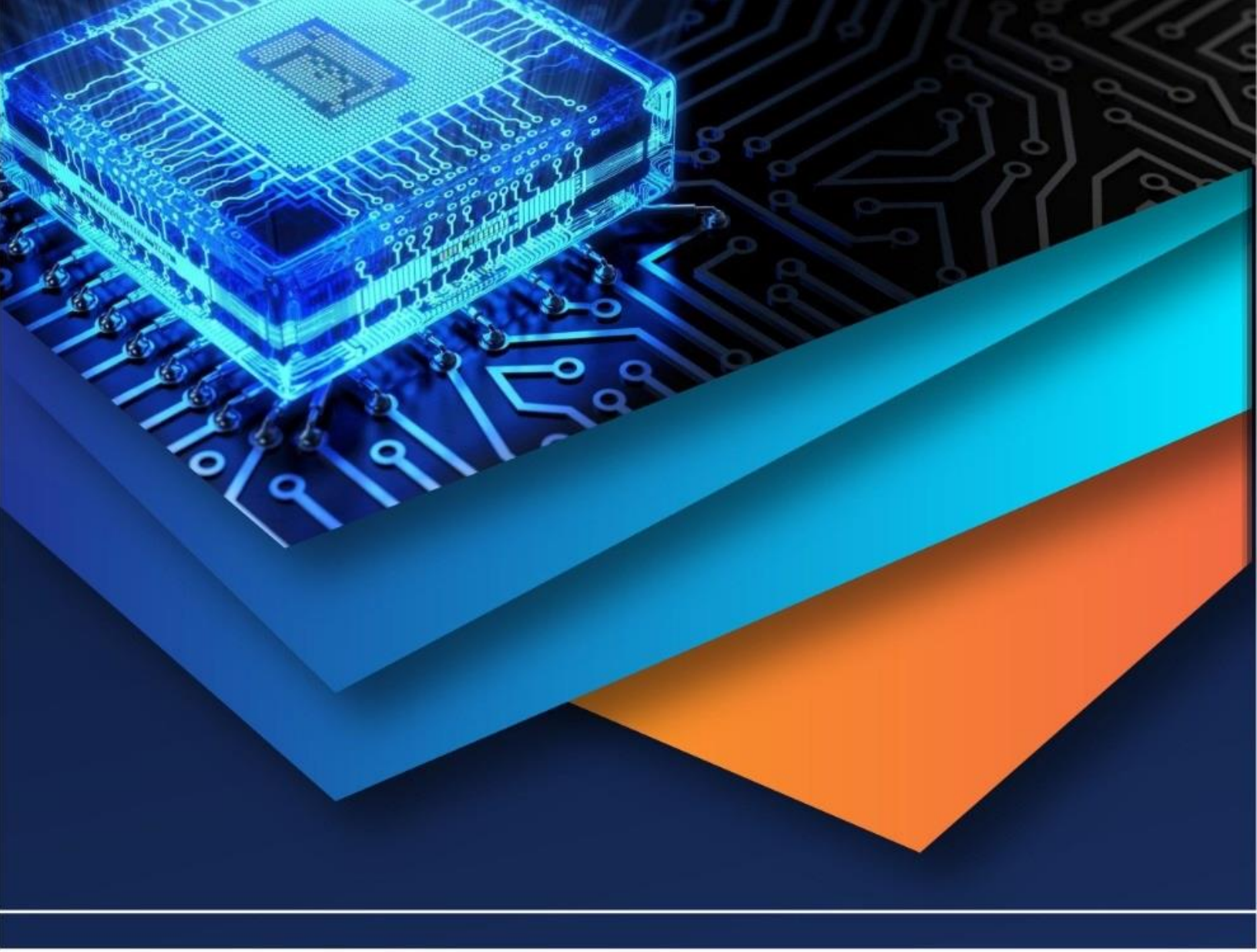
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