IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

Fake Currency Detection using Image Processing

Uday Ghuli, Shridhar Patil, Deepak Patil, Pruthviraj Deshmukh
Students, Department of Electronic & Tele-communication Engineering
Dr. S. V. Phakade
Assistant Professor, Department of Electronics & Tele-communication Engineering
Padmabhooshan Vasantraodada Patil Institute of Technology (PVPIT), Budhgaon, Sangli

Abstract: *The widespread circulation of counterfeit currency poses significant economic and security challenges worldwide. This project presents the design and development of a Fake Currency Detection System utilizing image processing techniques to authenticate currency notes. The system captures images of currency notes and applies a series of image processing operations such as grayscale conversion, edge detection, feature extraction, and pattern recognition to identify key security features including watermarks, micro-text, color patterns, and holograms. Advanced algorithms analyze these features and compare them against a database of genuine currency characteristics to detect anomalies indicative of counterfeit notes. The system aims to provide a cost-effective, fast, and reliable method for real-time currency authentication, reducing human error and enhancing financial security. This approach demonstrates the potential of image processing as an effective tool in combating the circulation of fake currency.*

Keywords: *fake currency*

I. INTRODUCTION

Currency is the most essential medium of exchange in any country's economic system. With increasing advancements in printing technology, the incidence of fake or counterfeit currency circulation has become a growing ihreat to economies around the world. The presence of such counterfeit notes not only disrupts the financial system but also diminishes public trust and results in economic instability. Traditional methods of currency verification, which involve human inspection and specialized hardware like ultraviolet light detectors, are often time-consuming, expensive, and prone to human error. As such, the need for a reliable, efficient, and cost-effective automated solution has become a priority.

The goal of this project is to develop a Fake Currency Detection System using Image Processing techniques implemented in Python within the Anaconda Navigator environment, using Jupyter Notebook for execution. The project leverages computer vision algorithms and image analysis to identify key security features embedded in authentic currency notes. These features may include watermarks, micro-print patterns, color-shifting inks, security threads, serial number positioning, and more. By processing and analyzing the scanned or captured image of a currency note, the system will be able to determine whether the note is genuine or fake.

With the help of Python's powerful image processing library OpenCV, and supporting tools like NumPy, Matplotlib, and optionally scikit-learn or TensorFlow for classification, the system is built to be simple, fast, and accurate. Unlike traditional verification systems that require physical inspection, this image-based system provides a digital solution that can be scaled for use in banking systems, ATMs, retail counters, and even mobile apps.

The significance of this project is not just technical, but also practical. In a country like India, where large volumes of currency transactions occur daily and a sizable unorganized sector still deals in cash, counterfeit detection is of critical importance. The Reserve Bank of India (RBI) and other financial institutions continuously emphasize the use of technology to curb this issue. Our project aims to align with this national objective by offering a technology-driven approach that is both innovative and relevant

DOI: 10.48175/IJARSCT-28135

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

II. METHODOLOGY

The methodology outlines the systematic approach followed to design and implement the Fake Currency Detection System using Python, Anaconda Navigator, Jupyter Notebook, and image processing techniques. It describes each step involved in the development lifecycle of the system, from input acquisition to final classification.

The architecture is divided into the following key components:

1. Image Acquisition Layer (Hardware
   - Input Device: Webcam or external camera
   - Function: Captures the live image of the currency note presented by the user.
   - Output: RGB image of the currency note passed to the next layer.
2. Preprocessing Layer
   - Tools Used: OpenCV in Python
   - Operations Performed:

1. Convert image to grayscale
2. Resize to uniform resolution
3. Apply Gaussian blur or median filtering to reduce noise
4. Normalize brightness and contrast

Purpose: To ensure the image is clean and consistent for analysis.

1. Feature Extraction Layer
   - Techniques Used: Image segmentation, template matching, edge detection
   - Extracted Features:

1. Watermark area
2. Serial number structure and placement
3. Security thread

2. Classification Layer Methodology:
   - Rule-Based Logic: Check for specific feature thresholds or patterns.
   - Optional ML Model: Train using SVM/CNN for pattern recognition.

1. Input: Extracted features
2. Output: Classification result (Genuine or Fake)

3. Output Layer
   - Function: Displays final result to the user
   - Output: Message such as:

1. “Genuine Currency Detected” 2. “Fake Currency Detected”

   - Optional Output: Visual feedback or error analysis of missing features. The flow diagram of the process to be followed in the proposed system is as follows:-

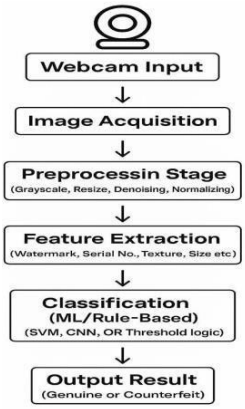

Figure 1. Flow diagram of process.

DOI: 10.48175/IJARSCT-28135

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

1) Image acquisition:
The image is kept under ultraviolet light and the image is captured through a simple digital camera

Figure 2. Acquired image.

2) Image preprocessing:
It involves the operations required prior to data analysis and information extraction. Here image resizing is done.
3) Gray scale conversion and edge detection:
The acquired image is obtained as RGB image which is now converted into gray scale image since it carries intensity information. This image is further processed and edges of gray scale images are detected.

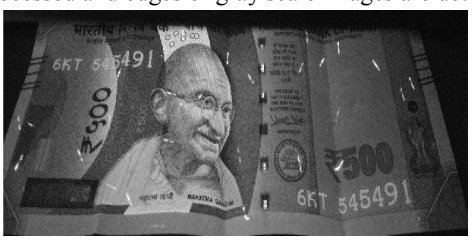

Figure 3.Gray scale image

4) Image segmentation:
It's the process of dividing image into multiple parts by cropping it.
5) Feature extraction:
Now the features are extracted using edge based segmentation.

Figure 4. Identification mark

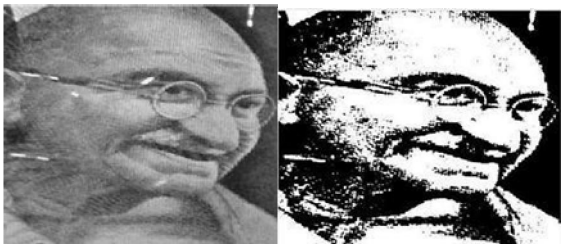

Figure 5. Edge based segmentation of Mahatma Gandhi portrait.

6) Image preprocessing:
It involves the operations required prior to data analysis and information extraction. Here image resizing .

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

7) Gray scale conversion and edge detection:
The acquired image is obtained as RGB image which is now converted into gray scale image since it carries intensity information. This image is further processed and edges of gray scale images are detected.
8) Image segmentation:
It's the process of dividing image into multiple parts by cropping it.
9) Feature extraction:
Now the features are extracted using edge based segmentation.

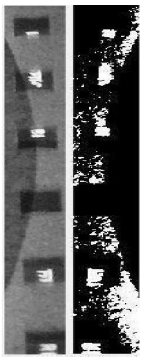

Figure 6.Edge based segmentation of security thread.

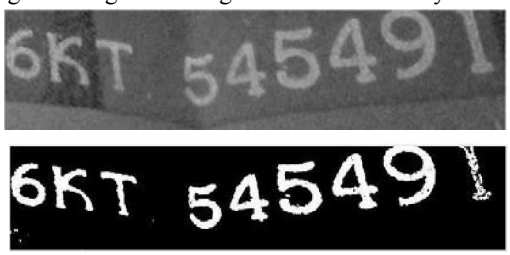

Figure 7. Edge based segmentation of serial number

10) Now the process of calculation of intensity of each extracted feature is done. If the calculated intensity is greater than the threshold of 70%, then it is classified as original note otherwise it is considered as fake one.
11) The final decision depends upon the intensities of all extracted features.
12) Now the process of calculation of intensity of each extracted feature is done. If the calculated intensity is greater than the threshold of 70%, then it is classified as original note otherwise it is considered as fake one.
13) The final decision depends upon the intensities of all extracted features.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

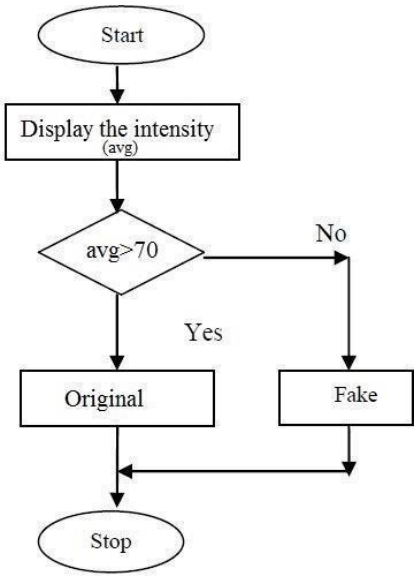

Figure 8. Flow chart for decision making

1. Experimental results

The results are shown in a GUI which shows extracted features like security thread and serial number.

Figure 9. Testing a 500 denomination note.

Figure 10. Testing a 2000 denomination note.

Intensities of all remaining features were also calculated for different notes of 500 and 2000.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

Table 1. Results for 500-1 note

Features	Intensity
Serial number	93%
Security thread	82%
Mahatma Gandhi portrait	83%
Identification mark	80%

Table 2. Results for 500-2 note

Features	Intensity
Serial number	76%
Security thread	73%
Mahatma Gandhi portrait	60%
Identification mark	68%

Table 3. Results for 2000 note

Features	Intensity
Serial number	75%
Security thread	82%
Mahatma Gandhi portrait	86%
Identification mark	73%

From the above results it was observed clearly that an original currency note's extracted features displays minimum intensity of 70%, it is seen that the 500-2 note displays intensity less than 75% for some features hence it is considered as fake note.

III . CONCLUSION

The problem of fake currency circulation poses a significant threat to the economy, affecting not only the financial stability of a country but also eroding public trust in cash-based transactions. Through this project, an efficient and practical approach has been developed to identify counterfeit currency notes using the power of image processing and Python programming. The use of Anaconda Navigator and Jupyter Notebook provided a flexible and robust development environment, while the integration of a webcam for real-time image acquisition made the system both cost-effective and user-friendly.

By focusing on visual features such as watermarks, serial numbers, textures, and note dimensions, the system is capable of distinguishing between genuine and fake notes with considerable accuracy. The preprocessing steps like grayscale conversion, resizing, and denoising ensure that the input images are optimized for analysis, while the feature extraction and classification stages form the core of the detection mechanism. The system architecture has been carefully designed to be modular and scalable, enabling easy upgrades and the possibility of incorporating machine learning models in the future for even higher precision.

The successful implementation of this project demonstrates how modern technologies like computer vision, image analysis, and programming can be applied to solve real-world problems. It also highlights the potential of open-source tools and platforms in building intelligent systems that can serve society in a meaningful way.

DOI: 10.48175/IJARSCT-28135

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, June 2025
Impact Factor: 7.67

REFERENCES

[1] Megha Thakur and Amrit Kaur, "Various Fake Currency Detection Techniques",
[2] B R Kavya and B Devendran , "INDIAN CURRENCY DETECTION AND DENOMINATION USING SIFT", International Journal of Sci- ence Engineering and Technology Research, vol. 4, no. 6, June 2015.
[3] W. K. El Said , " Fake Egyptian Currency Detection System using Texture and Shape Characteristics", International Journal of Computer Applications (0975 – 8887), vol. 143, no. 2, June 2016.
[4] Binod Prasad yadav,C.S patil,R.R Karhe,P.H patil – " HSV Technique by using MATLAB" Trupti Pathrabe G and Swapnili Karmore 2011 Int. J. CompTrends Tech 152-156.
[5] Tanaka M, Takeda F, Ohkouchi K and Michiyuk 1998 IEEE Tran on Neural Network 1748- 1753.
[6] Jahangir N, Ahsan Raja Chowdhury 2007 IEEE 10th Int. Conf. on Computer and InformationTechnology 1-5
[7] Rubeena Mirza, Vinti Nanda 2012 IFRSA Int.J. Computing 2375-2380 9. Junfang Guo, Yanyun Zhao and Anni Cai 2010 Proc IEEE Int. Conf Network Infrastructure and Digital Content 359-363.