Fake Indian Currency Recognition System with Contrast-Limited Adaptive Histogram Equalization Using Matlab

Kurela Ananda Kumar[1], Mr. Anji Babu[2]
[1]*PG Scholar, Dept of electronics and communication engineering, ARKG College of Engineering, Nallajerla, Tadepalligudem*
[2] *Assistant Professor, Dept of electronics and communication engineering, ARKG College of Engineering, Nallajerla, Tadepalligudem*

Abstract **- This research created a computer vision-based method for detecting Indian paper cash. In this approach, currency features are extracted and custom datasets are created for currency detection. The front and back side security features of the Rs. 200 denomination Indian currency note were extracted using a feature extraction method. The ORB (Oriented FAST and Rotated BRIEF) and Brute-Force matcher approaches are primarily used. so that the obverse and reverse denominations of banknotes may be detected more correctly Our significant contribution is that we tested this method on several denominations of Indian banknotes using ORB and BF matchers in OpenCV. The average accuracy of detection is up to 95.0 percent.**

Index Terms **- Fake Currency, KNN, ORB, DOG, SIFT.**

1.INTRODUCTION

In today's world, technology is advancing at a breakneck pace. With the advancement of technology, the government and banking sectors are increasingly confronted with the problem of counterfeit currency. This is a really significant problem in India today. Similarly, the government is developing day by day, yet counterfeiters circulate bogus banknotes in the Indian market [1] utilizing advanced printing technology. In its latest annual report, the Reserve Bank of India (RBI) stated that during 2017-2018, 17,929 pieces of Rs 2,000 notes were identified, compared to only 638 counterfeit notes of the same amount the year before. In the past, people could only detect counterfeit banknotes with a manual or a hardware machine, both of which were difficult to come by [3]. The technology of currency detection systems is mostly utilized for identifying and extracting bank note properties [2].

The main goal of this paper is to familiarize yourself with the new security feature offered by the Indian government so that you can tell the difference between a fake and a real note. Detecting fake notes requires some modules, such as image acquisition, image processing, image adjusting, gray-scale conversion, edge detection, segmentation, and feature extraction classification, Each of these tasks necessitates the use of the OpenCV library (open source computer vision library) [3]. Image acquisition is the process of acquiring a digital image from a camera in such a way that all elements are highlighted. In the study, we suggested a novel approach for identifying and classifying money duplication. In OpenCV, I used ORB (Oriented FAST and Rotated BRIEF) and the Brute-Force matcher. In OpenCV, I used ORB (Oriented FAST and Rotated BRIEF) and the Brute-Force matcher.

2. LITERATURE SURVEY

Several academics have made significant advancements to the field of money note detection throughout the past year. The researchers used security features, texture, and color to detect the threat. We evaluate previous work on currency detection techniques in this part.

Deshpande and Shrivastava [1] suggest an image-based recognition and authentication system that could be useful in detecting counterfeit money notes. Multi-spectral imaging is used to extract security aspects in this methodology. Mahatma Gandhi's face, watermark, RBI watermark, 2000 watermark, and electrotype watermark of 2000 denomination note are among the many features extracted in this procedure.

Y. Neeraja et al. [2] offer a k-nn approach for detecting fraudulent cash. The k-nn technology feature

extraction procedure is a strong and versatile classifier that is frequently used as a benchmark for more complicated classifiers such as support vector machines in this methodology (SVM).

Sawant and More [3] present a method for detecting false notes based on the minimal distance classifier algorithm. The Euclidean distance between the test sample and the train sample is computed in this work by extracting an ID mark and latent picture. The note boundary is described using the Fourier descriptor. Rupees 20, 50, 100, 500, and 1000 are used in the experiment. The success rate is 90.0 percent on average.

K. B. Zende et al. [4] demonstrate a MATLAB-based false note detection system that recognizes Indian currency security features automatically. There are numerous steps in this process, including feature extraction, picture segmentation, edge detection, bit plane slicing, and image comparison. Watermark detection, security thread detection, and other features are extracted in this document. This document contains a number of feature checking and register viewing extracts. They propose a graphical user interface for determining whether or not a currency is fake.

Li Liu et al. [5] present a method for detecting counterfeit coins using digital imagery. In this study, the image is represented in the dissimilarity space, a vector space created by comparing it to a set of prototypes. They employed the DOG and SIFT detectors to identify crucial spots.

A Recognition System for Pakistani Paper Currency is described by Ali and Manzoor [6]. Knn was utilized to scan an image and classify it in this process. They extract the area, height, breadth, and aspect ratio of the money. They proposed that the system detect currency using different features of the coin and that it be a low-cost machine.

Bhagat and Patil [7] presented the ORB, a fast binary descriptor based on BRIEF that is noise robust. In this work, the system is proposed on both sides of the currency characteristic. The samples that were recognized for lighting changes, rotation, and scale variations. The experimental setup consists of 210 Indian currency notes, 15 of each of the following denominations: Rs. 5, 10, 20, 50, 100, 500, and 1000. The success rate is 97.14 percent on average.

SIFT suggested systems by Yanyan Qin et al. [8]. (Scale-Invariant Feature Transform). The scale spaces were initially constructed to detect stable extreme points, and the found stable extreme points were subsequently regarded feature points with scale in variance. Second, the currency feature points are described using the ORB descriptor. Finally, the binary descriptors with scale and rotation in variance were constructed. SIFT is 65.28 times faster than the ORB. The experimental setup consists of 20 photos and achieves a 92.53 percent accuracy.

3. PROBLEM DEFINITION

Counterfeiters are primarily interested in paper currency. Counterfeit detection is primarily carried out using the chemical or physical features of paper money. Due to technical advancements, counterfeiters can now bypass chemical property and physical feature based counterfeit paper currency detection systems. Furthermore, the lack of availability, high cost, poor accuracy, and lack of user-friendliness of these fake detection technologies leads to a low level of adoption among end-users. As a result, substantial research is being focused on feature-based counterfeit detection systems. The proposed project entails

Implementation Study

The technique suggested here uses a digital camera to capture an image of an Indian rupee note. The method used in this case is as follows:

a. Using a simple digital camera or scanner, capture an image of an Indian money note.

b. The RGB image was acquired and transformed to a gray-scale image.

c. Detection of edges in a grayscale image as a whole.

d. The observe and reverse Indian currency aspects of the paper money will now be cropped and separated.

e. Indian currency note features are extracted after segmentation.

f. If the database features match the test images note, the test note is deemed to be genuine; otherwise, it is said to be phone

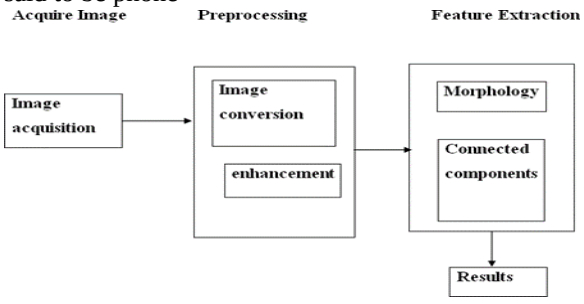

Fig 1:- Block Diagram

The block diagram above depicts methods for determining whether a piece of cash is false or genuine. The input currency image was captured using the Image Acquisition toolkit. For normalization and enhancement, the image was preprocessed. ROI (region of interest) was calculated for several currency regions based on denominations. Image and object analysis with the morphology algorithm were used to process the ROI regions. The findings were generated based on the values derived from the features. Pre-processing is the process of removing any noise or other disruptions from an image so that it may be used for feature extraction. The preprocessing stage entails To select and extract regions of interest, various methods are utilised. Morphology is a collection of image processing techniques that work with images based on their shapes. The threshold approach for image segmentation is a simple but effective method for segmenting images based on image-space area or image attributes. Contrast-Limited Adaptive Histogram Equalization (CLAHE) is an acronym for Contrast-Limited Adaptive Histogram Equalization augmentation of the image After the regions of interest have been chosen, segmentation is used to extract them. The findings were generated based on the values derived from the features.

4 PROPOSED APPROACH

The goal of the proposed system is to create a robust prototype that can recognize Indian rupee notes efficiently and reliably for visually impaired people (VIP). The following are the planned study's problem identifications: Noise is present when taking the image of a money note, and it must be mitigated. Calculating the size of the threshold to be utilized for color matching for various denominations in difficult physical conditions (skewed, variable illumination, etc). We will extract the following elements from this system in order to recognize fraudulent and authentic notes:- See through Register Security Thread Identification Mark, Serial Number Optically Variable Ink

The design flow of fake Indian currency detection system includes following stages:

1. Image acquisition
2. Pre-processing
3. Gray scale conversion
4. Binarization Image
5. Edge detection
6. Image segmentation
7. Feature extraction
8. Comparison
9. Result

The suggested system consists of two modules: one that extracts the Indian currency security characteristic and generates datasets, and the other that generates a test currency dataset image on which authentication is done.

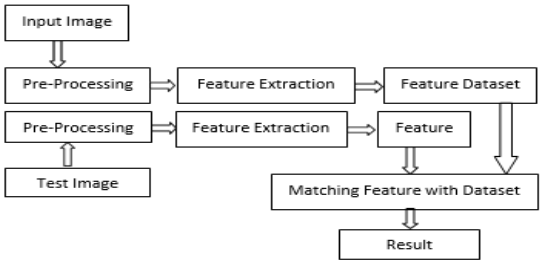

Fig 2:- Proposed Detection System

5 ALGORITHMS

A. A simple scanner or digital camera will be used to capture an image of paper cash.

B. The acquired image is RGB, and it will be transformed to grayscale later.

C. The grayscale image will be edge detected in its entirety.

D. The four features of the paper currency will be cropped and segmented after the edges have been detected.

E. The features of the paper money will be extracted after segmentation.

F. The test image's properties are compared to the system's original pre-stored image.

G. If the numbers match, the money is genuine; otherwise, it is counterfeit.

6 RESULTS AND EVOLUTION METRICS

Fig 3 :- Reference note

Fig 4:- verification note

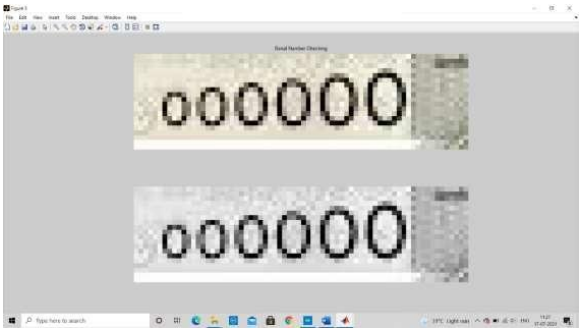

Fig 5 :- seiral number checking

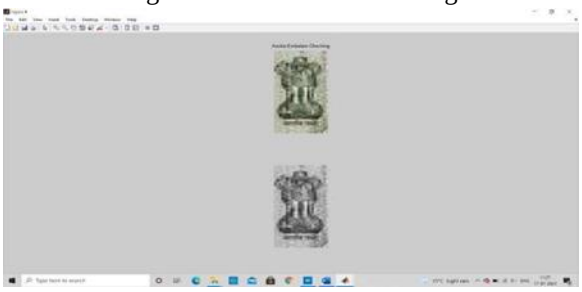

Fig 5 :- Ashoka alblum checking

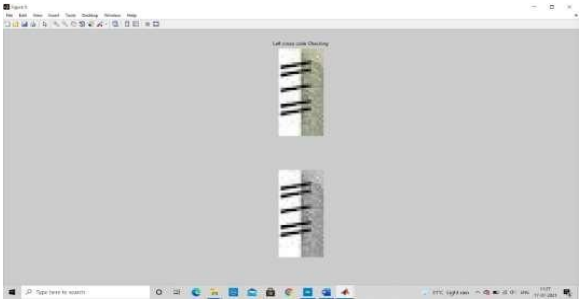

Fig 6 left cross code checking

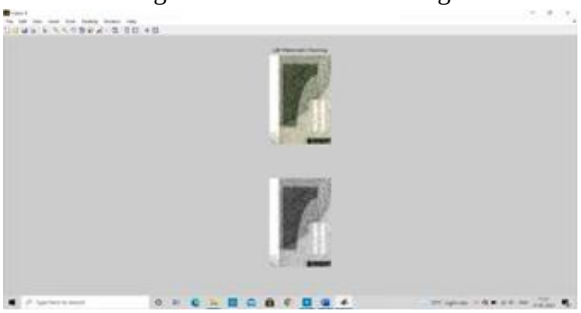

Fig 7 left watermark checking

Fig 8 :- Gandhiji photo checking

Fig 9 :- Gridline checking

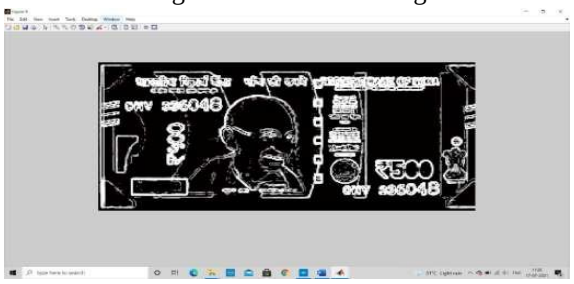

Fig 10 :- Test Section

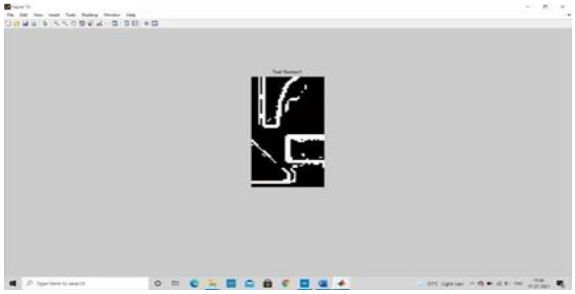

Fig 11 :- Test Section1

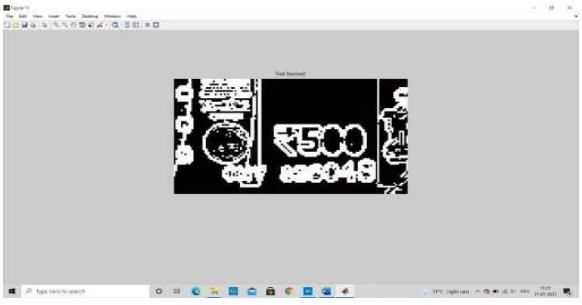

Fig 12:- Test section2

Fig 13: - Fake Note detected

7.CONCLUSION

We applied our original notion in two ways: one, using hyperspectral image analysis, and the other, through the extraction of different features of fake and real money notes and comparing them to each other to distinguish the fake from the real. In our suggested work, we combined these two systematic methodologies. Ultraviolet (UV) light, normal LED bulb, red LED light, green LED light, and blue LED light with wavelengths ranging from 360 nm to 800 nm are the distinct colour lights used for hyperspectral imaging.

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