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FAKE CURRENCY DETECTION

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Abstract: Currency fraud has grown to be a serious danger to both the national economy and the way of life for the populace. Although they exist, phoney cash detectors are limited in their use. exposing average people and small enterprises to banks and big headquarters. Therefore, the goal of this project is to examine the many security aspects of Indian cash and then develop a software-based system that uses sophisticated image processing and computer vision techniques to identify and invalidate counterfeit Indian currency. The whole design of this currency authentication system was done in a Jupyter Notebook using the Python programming language.

***IndexTerms* - Fake currency, counterfeit detection, image processing, feature extraction, Bruteforce matcher, ORB detector.**

I.INTRODUCTION

Currency duplication, or the illicit creation of counterfeit notes by copying real manufacturing processes, is a major issue that affects all nations. Because fake currency increases the money supply in an illegal and unnatural way, it can devalue real money and lead to inflation. Although there is a method, manually authenticating money notes is a laborious, complicated, and time-consuming operation. For this reason, automatic currency note testing is required in order to handle vast amounts of notes and provide reliable results quickly. In this project, we propose to use different image processing techniques and algorithms to develop a fake cash note detection system.

The 500 and 2000 rupee notes made in India are intended to be validated by the proposed system. The three primary algorithms in the system verify the legitimacy of a banknote's many aspects. The first approach includes advanced image processing techniques like ORB and SSIM and consists of multiple processes like picture acquisition, pre-processing, greyscale conversion, feature extraction, image segmentation, and output comparisons. While the third algorithm authenticates the currency notes' number panel, the second method verifies the bleed lines on the notes. Each currency note's processing output is finally shown. Accurate and fast currency note authentication is made simple with this solution. The current manual procedures can be substituted with this automated system, which is usable by Anyone can easily identify counterfeit money.

A. Frequently Employed Security Features to Spot False Memos
1) Bleed lines: On the left and right corners of the 500 and 2000 notes, there are angular bleed lines printed in raised print. There are five bleed lines in the 500Rs note and seven in the 2000Rs note.
2) Security Thread: A security thread that changes colour and says "Bharat" (in Hindi).2000 (500 for 500 note) and the RBI. When tilted, the tint shifts from green to blue.
3) Latent Image: When a note is held at a 45-degree angle, latent images of the numbers 2000 and 500 can be seen.
4) Watermark: An electrotype of the number 2000/500 and a watermark of Mahatma Gandhi.
5) Denominational Numeral: When you hold the note up to the light, you can see the see-through register with the denominational number 2000.
6) Mahatma Gandhi's portrait: With an RBI written on his eyeglasses that can be read with a magnifying glass, this portrait of Mahatma Gandhi
7) Number panel: The top left and bottom right sections are printed with numbers that get larger as they get smaller.
8) Denominational numeral: The 500/2000 in Devnagari script is located on the left side of Mahatma Gandhi.
9) Ashoka Pillar: Ashoka Pillar is located on the bottom right side.
10) Promise and guarantee clause: On the upper left and upper right corners of the currency notes, respectively, are the RBI's promise and guarantee clauses, written in both Hindi and English.
11) RBI seal: The RBI seal can be found directly behind the governor's signature. The guarantee clause, this seal, and other text are printed in intaglio. 12) Word-for-word denominational value: The top central portion of the currency note has the value inscribed in Devanagari script.

II.LITERATURE SURVEY.

- This study presents the design of an automated system for determining whether an Indian banknote is authentic or counterfeit. In the banking industry as well as other areas, the automated system is quite helpful. There is a rise of counterfeit 100, 500, and 1000 rupee notes in India. Technology advancements like scanning, colour printing, and duplicating have led to a rise in the counterfeit issue.
- This methodology applies the pre-processing to the image after completing the image acquisition. When pre-processing a crop, tweak and smooth afterwards. When the image has been converted to greyscale, segment the image, extract the features, decrease the image, and then compare the two.
- This work implements automatic detection of counterfeit Indian paper money notes using MATLAB, along with feature extraction using the HSV color space and additional image processing techniques. Image acquisition, grayscale conversion, edge detection, image segmentation, comparision, and output make up the suggested architecture. A note is set up in front of the camera in the project setup to determine whether it is real or phoney.
- This study presents the proposal and MATLAB implementation of a hybrid fake cash detection model. The model's purpose was to identify phoney notes from Bangladesh. Within the In order to achieve better results with the suggested model, three image processing algorithms—Optical Character Recognition (OCR), Hough Transformation, and Face Recognition (MSD)—were used. Next, each model that was employed and the outcomes of the suggested model were contrasted. The algorithm consisted of six main steps: gathering data, pre-processing it, identifying it, edge detection, feature extraction, and output results.
- This work employs two methods: the first is the analysis via hyperspectral imaging, and the second is the Taking distinct characteristics from real and fake cash notes and comparing them allows us to tell the fake note from the real one. Ultraviolet (UV), normal LED bulb, red, green, and blue LED lights with varying wavelengths ranging from 360 nm to 800 nm, respectively, are the various colour lights utilised for hyper spectrum imaging. MATLAB is used to implement each module. They have used image processing algorithms to create a fake note detection device. The experimental findings show that the outcomes are rather accurate.
- In this study, image processing techniques are used to illustrate how to recognise and verify paper cash. The suggested strategy consists of several component transactions such as voice output, texture features, image acquisition, and feature extraction and comparison. There are two components to this system. The first step involves using image processing to determine the money denomination. The visually impaired person is informed orally in the second half of the presentation about the denomination of the note they are now holding. The intended output of the recognised and validated money will be in text and voice.

III.EXISTING SYSTEM

1) In the current system, image processing is performed using a legacy version of the machine learning algorithm. Researchers presented various options. Some people employ physical features like breadth and length, while others solely use interior properties like texture and colour.
2) Their method does not address the peculiarities of note authentication. Such a system required an image input before carrying out numerous actions.
3) According to a recent government report, the number of counterfeit products has increased by 400%. transactions. Possessing counterfeit notes is illegal in India. Officials and media use the term "fake Indian currency note" to refer to counterfeit currency notes that circulate in India. Fake INR 2000 and INR 500 notes are nearly indistinguishable from genuine ones.

IV.PROPOSED METHODOLOGY

The identification of counterfeit cash is a significant global problem that affects the economies of almost all countries, including India. Using counterfeit money is one of the major concerns examined throughout the the modern world. This essay addresses the issue of determining which currency, if any, in the provided bank cash sample is counterfeit. There are several established techniques and procedures for identifying counterfeit banknotes. Generally speaking, despite the existence of numerous identifying factors, it is exceedingly challenging for a human to distinguish between a real and a forged note due to the similarity of many of its aspects. It's difficult to tell the difference between real banknotes and counterfeit ones.

To develop a system that accepts an image of a currency bill as input and outputs the result through the use of various image processing and computer vision techniques and algorithms in order to verify the authenticity of Indian currency notes.

1.objectives

- Using image processing and computer vision techniques, the project's primary goal is to identify counterfeit Indian rupee notes through an automated approach.
- High precision is expected from the system.
- It should not take long for the system to provide the final results.
- A user-friendly interface is essential for the system to ensure ease of use and comprehension.

Preparation Of Dataset

- The gathering of training and testing datasets is an essential stage in image processing projects since the quality and quantity of these datasets have a significant impact on the final model's performance and accuracy. In order to create a reliable and generalizable model that can correctly recognize or categorize many image types in real-world circumstances, it is helpful to gather a broad and varied dataset.
- The quantity and quality of the dataset are of equal importance. To guarantee that the model can extract useful features and patterns from the images, the dataset should include high-quality photos with constant lighting, resolution, and color balance. To prevent bias and overfitting, it's also critical to make sure the dataset is balanced, with an equal amount of photos for each class.
- It is impossible to overestimate the significance of dataset collecting for image processing projects since it provides the basis for developing reliable, accurate models that function well in real-world situations.

Feature detection and matching using ORB: Following the completion of the image's essential processing, ORB is used to carry out feature detection and matching. The photos of the various security features seen on ten different currency notes are already included in our dataset. Additionally, each security feature corresponds to a set of numerous images with different brightness and resolutions (6 templates for each characteristic). The ORB method is used to identify every security feature in the test image.

A search area will be set on the test money image where the template is most likely to be present to improve the accuracy and ease of looking for the security feature (template image). After that, the test image's template will be found using ORB, and the outcome will be appropriately marked with a marker. Every image with a security feature in the data set will go through this process, and each time a detected portion of the test image is found, it will be appropriately highlighted with the appropriate markers.

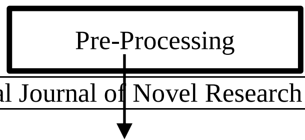
Feature extraction: At this point, each template's ORB location inside the indicated region of the input image is identified. Next, the highlighted area is cropped by slicing the image's 3D pixel matrix. After further smoothing the image with Gaussian blur and gray scaling, our feature is prepared for comparison with the corresponding feature in our trained model.

Feature comparison using SSIM: Using SSIM for feature comparison, the portion of the test currency image that corresponds to each template will be created based on the previous stage. Using SSIM, a score for the similarity between the two images will be determined by comparing the extracted feature with the original template.

$$SSIM(x, y) = (2\mu_x\mu_y + c1)(2\sigma_{xy} + c2) / (\mu_x^2 + \mu_y^2 + c1)(\sigma_x^2 + \sigma_y^2 + c2)$$

A scoring system called the Structural Similarity Index (SSIM) measures the deterioration of image quality brought on by processing steps like data compression or transmission losses. It searches for parallels between the two pictures. It is a component of the picture library and determines similarity using the previously stated formula. A value between -1 and 1 is returned. The resemblance increases with the SSIM's proximity to 1. Thus, The SSIM value between each image of a security feature and the matching extracted feature from the test image will therefore be determined for each security feature. Next, each security feature's mean SSIM is computed and saved.

Bleed lines are present on both the left and right sides of every currency note. Near each of the two, there are five lines for a 500 rupee note and seven lines for a 2000 rupee note. The number of bleed lines on the left and right sides of a currency note is counted and verified using this procedure. (Aspects 8 and 9)



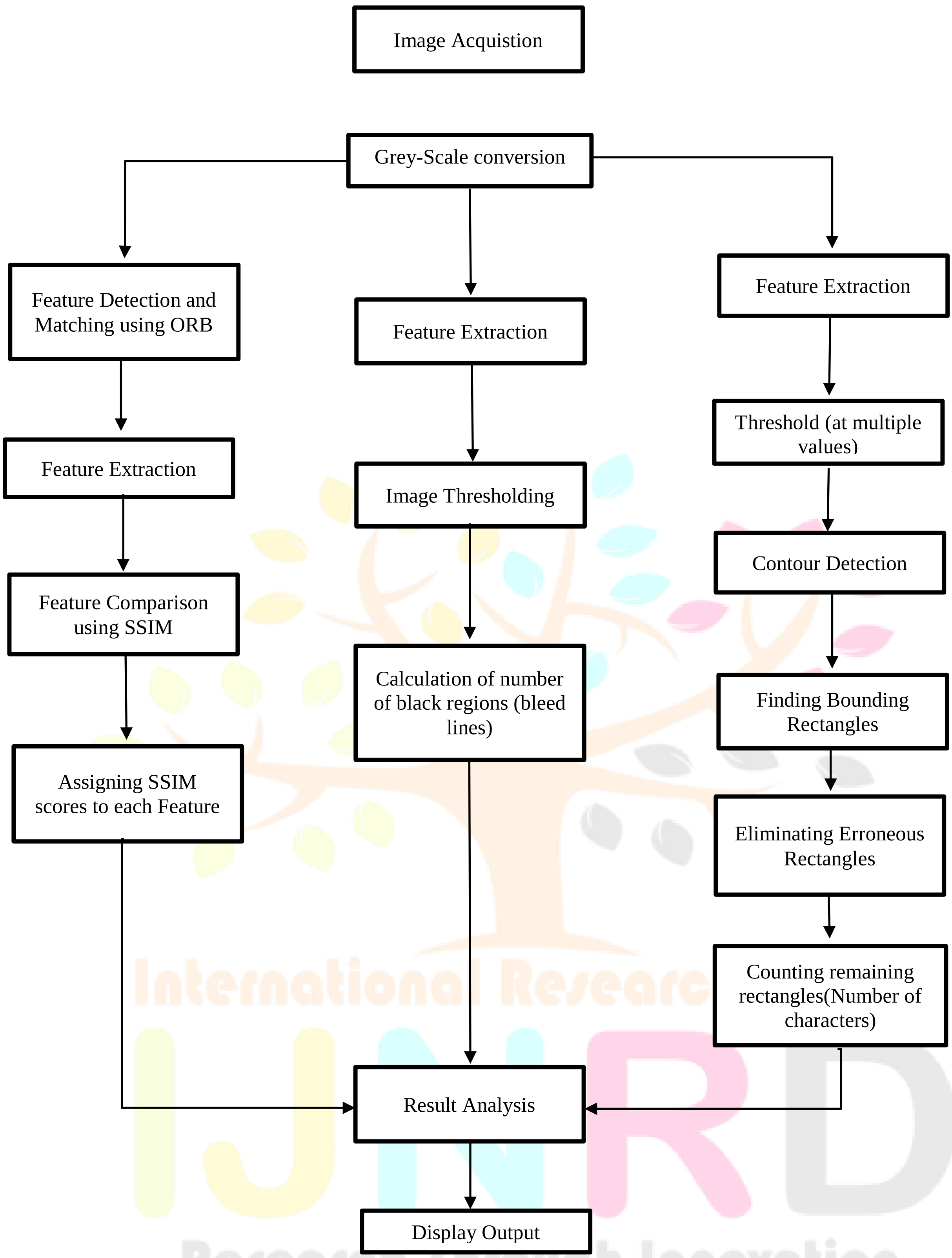


Fig.1: System Architecture

Feature extraction: The first step involves cropping the image to extract the area containing the bleed lines. Consequently, a portion close to the input currency's left and right sides takes note that the image was carefully extracted.

Image Thresholding: In the second phase, an appropriate threshold is applied to the image. This keeps the black bleed lines on a white background and facilitates easier processing in the future.

Determine the number of bleed lines: This is the third stage in the calculation process. We iterate over each column of the thresholded image in this step initially. Next, We go over every pixel in every column once. Next, we determine how many black areas there are in each column by incrementing a counter for each white pixel that occurs in that column and the black pixel that follows it immediately. Similarly, we count the number of black regions in each column; however, a column is considered erroneous and is eliminated if the number of black regions is excessively big (>= 10). Lastly, only the non-erroneous columns are taken into account when calculating the average count of black regions, and the result is shown as the number of bleed lines.

The serial number of each currency note is shown in a number panel located in the bottom right corner of the note. The quantity of characters that make up the number panel should equal nine, without taking into account the character spacing. After carrying out a series of processes, this algorithm counts the characters that are present in the number panel.

Image Thresholding (with various values): This algorithm's first stage involves thresholding once again with an appropriate value to keep just the black characters in the number panel on a white backdrop and appear noticeable. However, this technique uses multiple values for thresholding; that is, the image is thresholded at the starting value (90), followed by the completion of the remaining steps listed below and the calculation of the character count. Subsequently, the threshold value is raised by 5 each time, and the character count computation process is continued until either the final amount (150 in our case) is reached or sufficient evidence is found to indicate that 9 characters are present in the number panel.

Contour Detection: The thresholded image of the number panel is used for contour detection in the second stage.

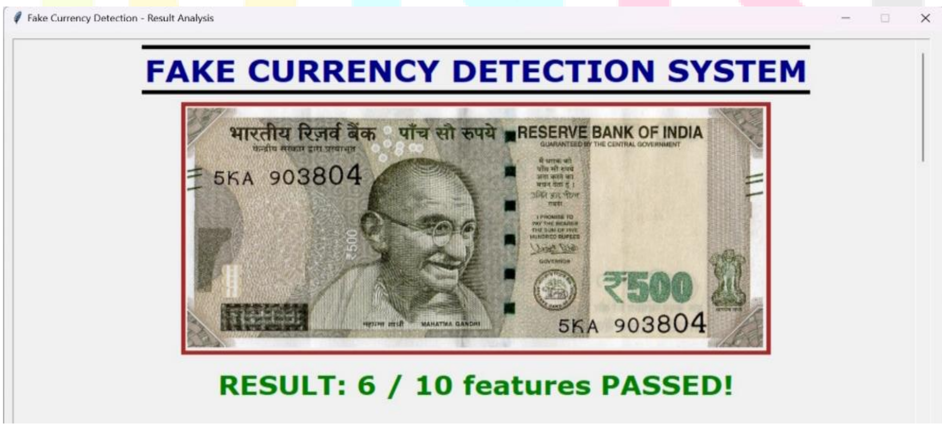
Locating Bounding Rectangles: The third stage involves locating the bounding rectangle associated with each contour. Each rectangle's details are contained in a list.

Removing incorrect rectangles: Because of the noise in the image, the list of rectangles generated in the previous step may have several incorrect and superfluous rectangles. It is necessary to remove these incorrect rectangles. Thus, all rectangles with an area that is too large or too small are removed in this stage. Subsequently, the rectangles enclosed by a larger rectangle are likewise removed. Lastly, the rectangles in the number panel that are positioned much too high are also removed.

Character count calculation: After the previous stage of elimination, the rectangles that bound each character in the number panel are the ones that were left. The computation determines how many rectangles are left, and this provides us with the amount of characters found in that specific thresholded image. Multiple threshold values can be reached by repeating the preceding procedure, increasing the threshold value by 5 each time, starting at 90 or 95.

The algorithm terminates when the threshold value hits the maximum value (150 in our example), or if it finds 9 characters in three consecutive iterations.

V. EXPERIMENTAL ANALYSIS



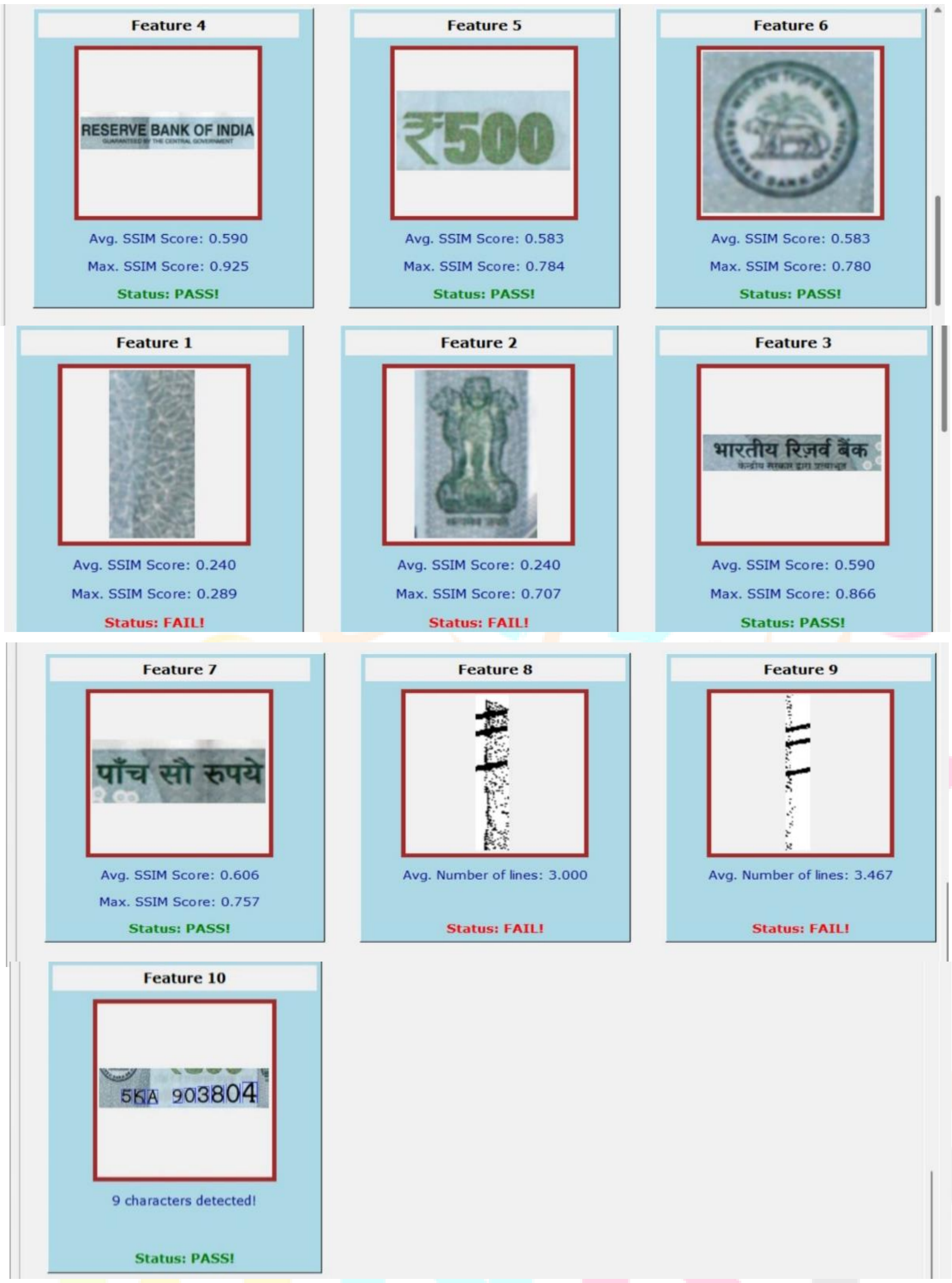


Fig 2: GUI showing final result(Fake note)

VI.CONCLUSION

This paper presents a fake currency detection model that uses the OpenCV image processing package in Python 3 to authenticate Indian currency notes with denominations of 500 and 2000. Ten characteristics are included in this model. of the input currency note are taken into account, and three distinct methods are then used for analysis. A graphical user interface (GUI) is used to capture the input image, allowing the user to browse the image on their system. The implemented model's findings are then computed, and a graphical user interface (GUI) built using the Tkinter GUI package shows a detailed examination of each feature. The model processes an input image in less time—roughly 5 seconds—when only the final results are displayed, eliminating extraneous features. The results are likewise fairly good, indicating that 83% of counterfeit currency can be detected with accuracy and 79% of genuine currency can be identified.

FUTURE ENHANCEMENTS

Technology is advancing at a tremendous rate these days. The proposed technique can be used to detect coins as well as identify counterfeit cash. Other countries' currencies can be added and compared. When a photo is loaded into the training folder from the outside, it does not provide perfect accuracy. This difficulty can be solved by optimising the system.

Future improvements to fake cash detection systems could include incorporating modern technologies such as deep learning algorithms like convolutional neural networks (CNNs), big data analytics, and blockchain technology to produce a more accurate, efficient, and transparent detection process. Furthermore, the combination of Internet of Things (IoT) devices, advanced sensor technologies, and user-friendly mobile applications with image recognition capabilities could enable individuals and organisations to swiftly detect counterfeit currency.

VII.RRFERENES

[1] S.R.Darade and G.Gidveer, "Automatic recognition of fake indian currency note," in 2016 international conference on Electrical Power and Energy Systems (ICEPES). IEEE, 2016, pp. 290–294.

[2] B.P.Yadav, C.Patil, R.Karhe, and P.Patil, "An automatic recognition of fake indian paper currency note using matlab," Int. J. Eng. Sci. Innov. Technol, vol. 3, pp. 560–566, 2014.

[3] A.Zarin and J.Uddin, "A hybrid fake banknote detection model using ocr, face recognition and hough features," in 2019 Cybersecurity and Cyberforensics Conference (CCC). IEEE, 2019, pp. 91–95.

[4] M.S.Veling, M.J.P.Sawal, M.S.A.Bandekar, M.T.C.Patil, and M.A.L.Sawant, "Fake indian currency recognition system by using matlab."

[5] F.A.B,P.Mangayarkarasi, Akhilendu, A. A. S, and M. K, "Fake indian currency note recognition,"vol.7,pp.4766–4770,2020.[Online].Available: https://www.irjet.net/archives/V7/i5/IRJET-V7I5915.pdf