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Fake Currency Note Detector Using MATLAB

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Abstract—**Fake currency notes are increasing day by day. For detecting the fake currency note is done by counting the number of interruptions in the thread line. For predicting the note is real or fake on the basis of number of interruptions. If the number of interruptions is zero, if it is real note otherwise it is fake. And also, we calculate the entropy of the currency notes for the efficient detection of fake currency note.**

The advancement of color printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. Few years back, the printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. As a result, the issue of fake notes instead of the genuine ones has been increased very largely. The proposed system gives an approach to verify the Indian currency notes. Verification of currency note is done by the concepts of image processing. This article describes extraction of various features of Indian currency notes. MATLAB software is used to extract the features of the note. The proposed system has got advantages like simplicity and high-performance speed. The result will predict whether the currency note is fake or not.

keywords— **Image processing, Currencies, Real and fake authentication, Classifier, Feature extraction.**

1.INTRODUCTION

Fake currency detection is a serious issue worldwide, affecting the economy of almost every country including India. Currency duplication also known as counterfeit currency is a vulnerable threat on economy. It is now a common phenomenon due to advanced printing and scanning technology. The possible solutions are to use either chemical properties of the currency or to use its physical appearance [17]. The approach presented in this paper is based upon physical appearance of the Indian currency. Image processing algorithms have been adopted to extract the features such as security thread, intaglio printing (RBI logo) and identification mark, which have been adopted as security features of Indian currency[18]. Hence, we propose a more user friendly and portable solution to this problem in form of a mobile app coupled with cloud storage. The Reserve bank is only one which has the sole authority to issue bank notes in India. Reserve bank, like other central banks the world over, changes the design of bank notes from time to time. Traditionally, anticounterfeiting measures involved including fine detail with raised intaglio printing on bills which allows non-experts to easily spot forgeries. On coins, milled or marked with parallel grooves edges are used to show that none of the valuable metal has been scraped off. reserve bank uses several techniques to detect fake currency. Manual testing of all notes in transactions is very time consuming and untidy process and also there is a chance of tearing while handing notes. Technology is growing in no time lately. Consequently, the banking sector is additionally obtaining modern-day by day. This brings a deep would like of automatic faux currency detection in the machine and automatic product merchant machine. several researchers are inspired to develop strong and economical automatic currency detection machine. An automatic machine which might notice banknotes are currently widely employed in dispensers of a contemporary product like candies, soft drinks bottle to bus or railway tickets. The technology of currency recognition essentially aims for distinctive and extracting visible and invisible options of currency notes.

Until now, several techniques are planned to spot the currency note. however, the most effective approach is to use the visible options of the note. for instance, color and size. however, this manner isn't useful if the note is dirty or torn. If a note is dirty, its color characteristic is modified wide. therefore, it's vital that however, we tend to extract the options of the image of the currency note and apply the correct algorithmic rule to enhance accuracy to acknowledge the note. we tend to apply here a straightforward algorithmic rule that works properly.

The image of the currency note is captured through a camera. The hidden options of the note are highlighted within the actinic radiation. Currently, process on the image is completed thereon non-inheritable image exploitation ideas like image

segmentation, edge data of image and characteristics feature extraction. MATLAB is that the excellent tool for procedure work, and analysis [19].

II. LITERATURE SURVEY

- Ms. Monali Patil, Prof. Jayant Adhikari, Prof. Rajesh Babu they proposed a system which uses image processing to distinguishes between features of a real note and a fake note. They used K-means algorithm for feature clustering and SVM algorithm to train their data model.[20]
- Nookala Venu et al., in their research paper they have suggested a methodology of detecting fake currency from the real by comparing their visual features such as distance between Gandhijis portrait and other notations. This methodology can be useful for a system purely based on software processing [21].
- Nookala Venu, et al. ,have proposed a system which uses the floral designs on the notes provided by RBI to distinguish between real and fake notes [22].
- Nookala Venu et al., in their paper they have suggested image processing along with supervised machine learning to learn the distinguishing feature of a real note from fake one which will increase the precision of this method [23].
- Nookala Venue et, at In their study they have proved that image processing along with logistic regression gives an accuracy of above 99% [24].
- Amol A. Shirsat, S.D. Bharkat [2013] have proposed a Paper Currency Recognition System. This system mainly consists of three parts. The image of interest is first processed and extracting the feature by applying toolbox MATLAB. The second part is currency recognition where classifier such as neural network is used.[6]
- Deborah. Soniya Prathap [2014] have proposed a paper Detection of Fake currency using Image Processing. Choose the image and apply preprocessing. In pre-processing the image to be crop, smooth and adjust. Convert the image into gray color.[7]

III. PROPOSED SYSTEM AND ALGORITHM

We propose a system in which the recognition of currency notes can be done automatically based on the combination of enhancement, segmentation and feature extraction method under image processing. First, we acquire the images under hardware setup which consists of camera mounted inside the box with the arrangement of UV light, Normal LED light along with multicolor LED's. The hardware setup is interfaced with the PC using USB port of web-camera. Once the power supply on, the images are captured using webcam software by placing the different currency notes inside the box setup. The acquired images are given as the input for the program created in the MATLAB software. Aspect Ratio is calculated initially. Based on the AR, it is classified that the given note is 100, 500 or 2000. Entropy and Mean act as the main feature extraction technique which is applied for all the images and the values are collected. After running the program, we will get the results such that the graph is plotted between the real note and the fake note under different modes and wavelengths. Therefore, we can able to obtain the threshold value which act as the center between real notes and fake notes. The utility of low-resolution images of currency notes acquired from camera is examined to ascertain the performance.

The different Features in the note are detected and extracted based on ROI extraction method by setting the width and height of the ROI portion. The extracted features are compared between real note and fake note. Entropy is applied and the entropy value is compared between the two. Through the difference in entropy values, we can classify that the given note is real note or fake note
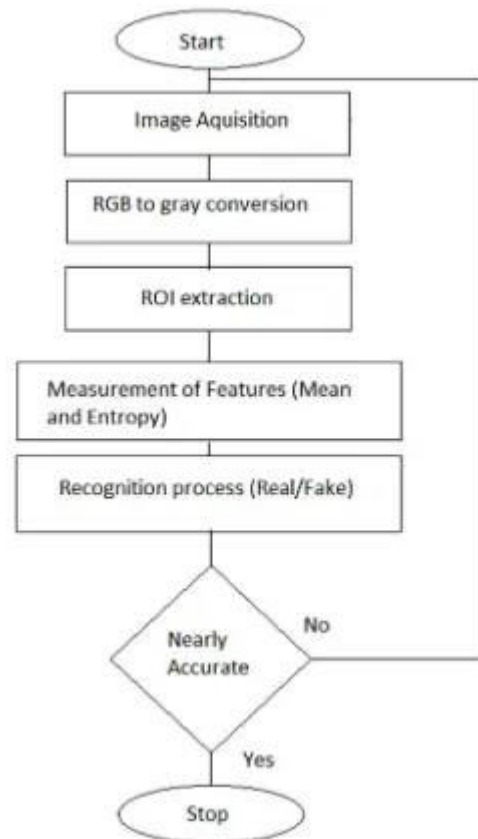

Fig.1 Flowchart of the proposed system

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IV. METHODOLOGY

The system proposed here work here on the image of currency note under ultraviolet light acquired by a digital camera. The algorithm which is applied here is as follows

Acquisition of image of currency note under ultraviolet light by simple digital camera or scanner.

1. Image acquired is RGB image and now is converted to grayscale image.
2. Edge detection of whole gray scale image.
3. Now characteristics features of the paper currency will be cropped and segmented.
4. After segmentation, characteristics of currency note are extracted.
5. Intensity of each feature is calculated.
6. If the condition is satisfied, then the currency note is said as original otherwise fake.

In this method, characteristics of currencies are employed which are used by common people for differentiating for different banknote denomination. The characteristics that can be used to check the authentication of currency note are:

1. Security Thread: It is a 3mm windowed security thread with inscriptions of India in Hindi, RBI and 2000/500 on banknotes with color shift. Color of the thread changes from green to blue when the note is tilted.
2. Serial Number: Serial number panel with banknote number growing from small to big on the top left side and bottom right side.
3. Latent image: A vertical band on front side of denomination at right hand size. It contains latent image showing numeral of denomination when banknote is held horizontally at eye level.
4. Water mark: The portrait of Mahatma Gandhi, and multidirectional lines and a mark showing the denominational numeral appear which can be viewed when held against light.
5. Identification Mark: A mark with intaglio print which can be felt by touch, helps blind person to identify the denomination. In 500 denomination the mark is of five lines while in 2000 line the mark is of seven lines.
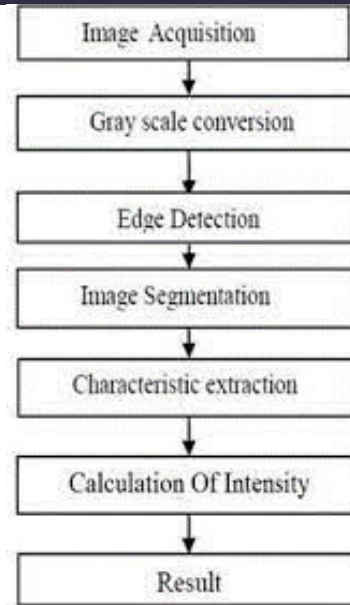

Fig.2 Flow Diagram of Process

Image Acquisition:

The image is kept under ultraviolet light and the image is captured through a simple digital camera

Fig 3: Image Acquisition

Image Preprocessing:

Image preprocessing are the steps taken to format images before they are used by model training and inference. This includes, but is not limited to, resizing, orienting, and color corrections. Thus, a transformation that could be an augmentation in some situations may best be a preprocessing step in others. It involves the operations required prior to data analysis and information extraction. Here image resizing is done.

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. The luminance of a pixel value of a grayscale image ranges from 0 to 255. The conversion of a color image into a grayscale image is converting the **RGB values (24 bit) into grayscale value (8 bit)**. Various image processing techniques and software applications converts color image to grayscale image. Edge detection is an image processing technique for finding the boundaries of objects within images. It works by

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detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. Edge detection helps to detect all the edges of the necessary ROI to perform various operations in the latter stages.

Fig 4: Gray scale image

Image Segmentation:

Image segmentation is a method in which a digital image is broken down into various subgroups called Image segments which helps in reducing the complexity of the image to make further processing or analysis of the image simpler. Segmentation in easy words is assigning labels to pixels.

Feature Extraction:

Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval. The features are extracted and then used for comparison in further step.

Characteristics Extraction:

It is a part of dimensionality reduction process, in which an initial set of raw data is divided and reduced to more manageable groups and image data will extracts some parts of characteristics.

It refers to process of transforming raw data into numerical features that can be processed while preserving information in original data set.

Fig 5: Identification Mark
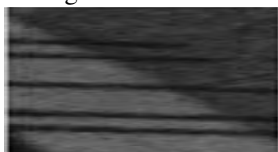
V. IMPLEMENTATION

The execution stage regarding the task is that the complete aim is essentially changed keen on running code. Intent regarding the stage is towards interpreting the aim keen on a finest likely result within an appropriate programmed language. In this section, it covers up the execution phase concerning the task, providing particulars regarding the programmed language as well as improvement background employed.

The execution phase involves the following tasks:
1. Cautious scheduling.
2. Examination regarding structure as well as constraints.
3. Aim concerning the techniques towards accomplishing the conversion.
4. Assessment concerning the conversion technique.
5. Accurate judgment about the choosing of the proposal.
A. Software Used

The necessary program regarding private PC that comprises configuration as specified as follows: -
1. Windows 7(64-bit) operating system.
2. MATLAB 7.14 Version R2012a
B. Image Processing Toolbox

Image processing device box permits carrying out image improvement, deblurring of image, characteristic identification, decreasing of noise, image segmentation, arithmetical alteration, as well as registration of image. Image processing device intended for the execution regarding methods proposed are specified below: -
1. Fundamental import as well as export
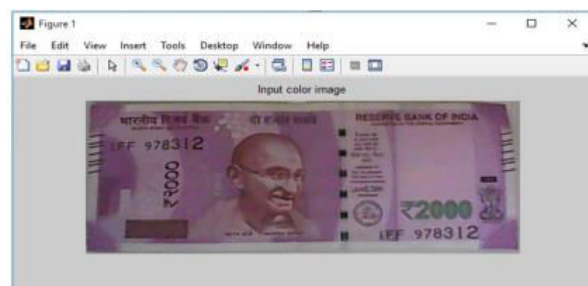2. Display

VI. RESULTS

Fig.6: Input of the real note

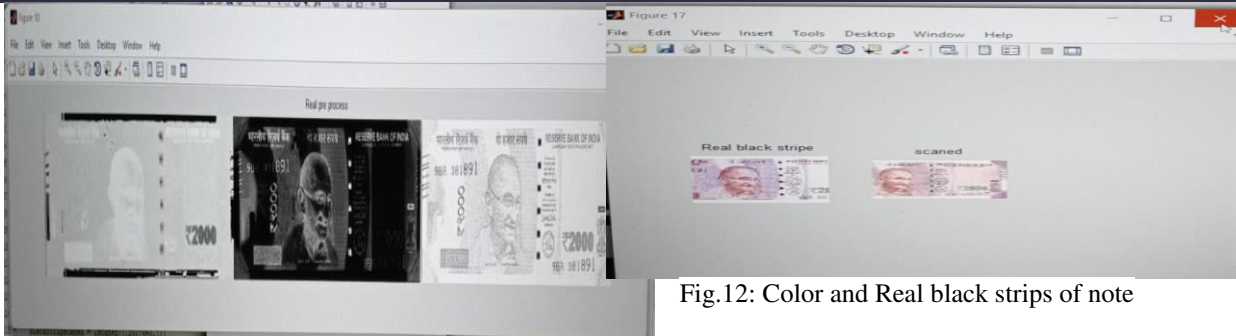Fig.7: Input image of a fake note

Fig 8: Gray Scale Conversion of Real Note

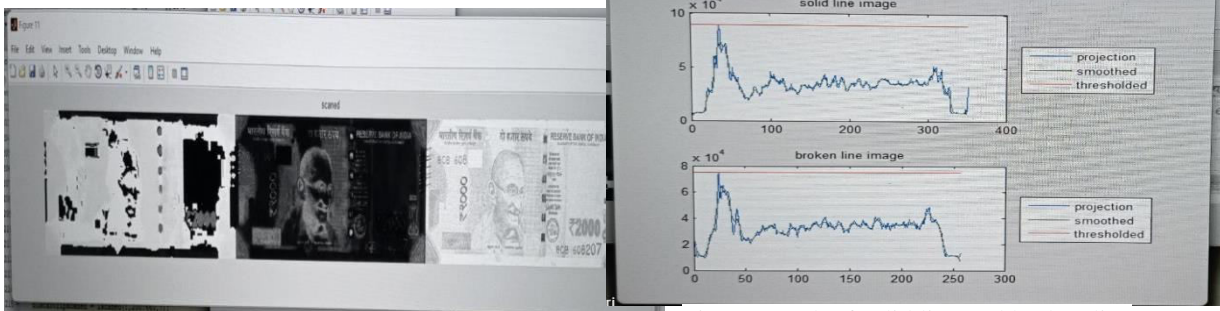Fig.12: Color and Real black strips of note

Fig 9: Gray Scale Conversion of Fake Note

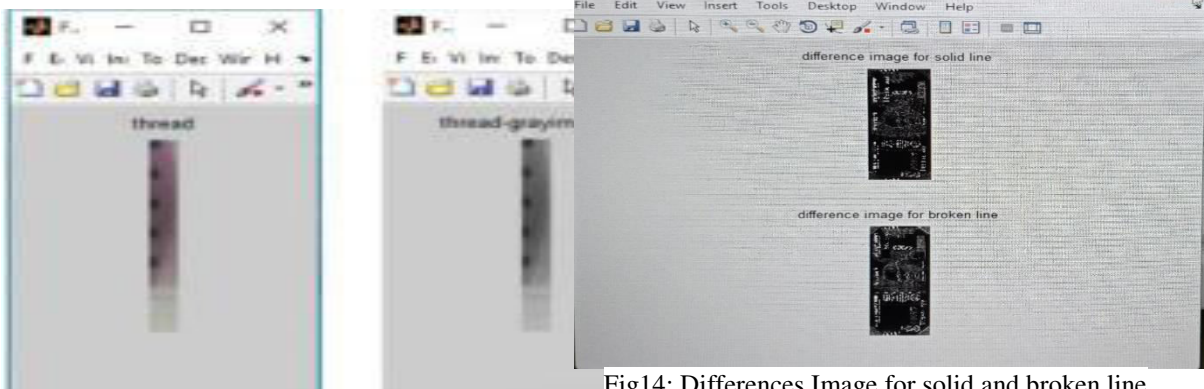Fig13: Graph of solid line and broken line

Fig.10: Thread feature of the note

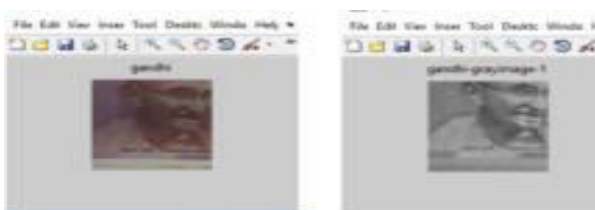Fig14: Differences Image for solid and broken line

Fig.11 Gandhi security feature of the note

VII. CONCLUSION

The fake currency detection using image processing was implemented by considering The Features of currency note like serial number, security thread, Identification mark, and Mahatma Gandhi portrait were extracted. The process starts from image acquisition to calculation of intensity of each extracted feature. The system is capable of extracting features even if the note has scribbles on it.

The algorithm processed here works suitably for the newly introduced 500 and 2000 denomination. Hardware implementation of the proposed system can also be done using suitable processor so that to increase the speed of detection. An automatic railway ticket booking system can also be proposed which includes

currency detection as one of its parts. By utilizing computerized image processing, examination of Currency picture is increasingly exact just as this strategy is proficient as far as expense and tedious contrasted with existing procedures. The proposed framework is worked adequately for separating highlight of Indian currency image. Separated features of cash picture will use for currency recognition system just as for its check. Application based framework will be intended to get appropriate outcome whether cash picture is fake or its real.

VIII. FUTURE SCOPE

The main motive behind this project was to make a system for common man which is fast and easy to use. This is a MATLAB based system for automatic recognition for fake and genuine Indian currency. This is a low-cost system, using effective and efficient image processing techniques, provide accurate and reliable results at good throughput as shown by experimental results which are totally done at server's end. The developed MATLAB Code works for detection of all Indian currencies and for fake detection it works with Rs 2000 and Rs 500. Our proposed system could replace the Hardware system in some initial stages of currency verification process. Our system will helpful for regular peoples who are technically not involved in daily life with background process. By using of Image processing Technique, it was done in an easier and identified by accurately.

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