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Detection of Fake Currency using Image Processing

Ashik Shiby¹, Fevitha Francis², Philip Jose³, Rintu Augustine⁴

^{1, 2, 3}Dual Degree MCA, Department of Computer Science, De Paul Institute of Science & Technology, Angamaly, MG University

⁴Asst. Professor, Department of Computer Science, De Paul Institute of Science & Technology, Angamaly, MG University

Abstract: *In its definition, the term 'currency' defines an agreed-upon exchange item, the national currency being the legal entity used by the selected controlling entity. Throughout history, issuers have faced 1 common threat: counterfeit. In recent years fake money note has been printed that has resulted in significant losses and damage to society. Therefore, it becomes necessary to build a tool for earning money. This research project proposes a way to look at the note of counterfeit money distributed in our country through their image. After selecting an image use pre-processing. In pre-processing, the acquired image is cropped, smooth, and adjust. Change the image to grey-scale. After conversion use image separation. Features are extracted and reduce. Finally, compare the picture to be real or fake. Duplicate money has been a major problem in the market. There are currency counting machines available in banks and other trading venues to check financial authenticity. Most people do not have access to such programs which is why there is a need for fake money laundering software, which can be used by ordinary people. This proposed framework uses Image Processing to determine whether the money is real or counterfeit. The research project program is built entirely using Python's programming language. It has the methods such as grayscale conversion, edge detection, segmentation, etc.*

Keywords: *Fake Currency, Detection Methods, Image Processing, Grayscale Conversion, Edge Detection, Image Segmentation.*

I. INTRODUCTION

Manual testing of all transaction currency notes is time-consuming, an untidy process and there is a chance of tearing up while giving notes. No one can be 100% confident in personal recognition of original currency. Fake or counterfeit notes are one of the most biggest problems in money laundering. In a country like India, it is becoming a major obstacle. The advantages in printing, scanning technologies, it is easily possible for a person to print fake notes with the help of the latest hardware tools. Detecting fake notes manually takes time and an untidy process which is why there is a need for automated strategies where the process of identifying currency can be done efficiently.

The Reserve bank of India (RBI) is the only bank authorized to issue banknotes in India. However, some undesirable groups are willing to make fake money. For commercial properties, such as banks, shopping malls, jewelry stores, etc., etc. with a high sales value. These sites have been able to afford it and find the option to purchase a device with the help of ultraviolet light, and other methods to gain financial confidence and trust. However, for ordinary people, it is very difficult to find out whether the currency is fake or real, and they can be faced with a loss, especially in bank deposits or any transactions. Growing technological advancements have made it possible for the creation of fake money is distributed to the market to slow down in the global economy. Each of the tax years involved fictional or damaged notes. How to manage a team of counterfeit notes of some of the problems. Therefore, the equipment has to be made with the help of human experts, which is the process of identifying the notes is simpler and more efficient. With the purchase of counterfeit notes to a bank, for example, you will need to identify the system, and each and every time they have to make use of one thread with ultra-violet light. The banker's store, the paper notes, on your device, and is trying to determine whether or not it is an identifier, serial number, and other features of the banknotes in order to detect for the system to check whether it is valid. This will rise the workload of the staff. Therefore, the bank, the owner of the system to be used, then the result will be more accurate. The same is true for places such as shopping centres, and investment companies for which such programs cannot be used. We have an urgent need for a simple way for you to make notes.

Therefore, the automatic identification of money with the help of image processing techniques will be useful in this area. Digital image processing is the use of computer algorithms to perform image processing in a digital image. As a subcategory or field of digital signal processing, digital image processing, has more advantages over analogue image processing. This will allow you to make use of a much wider range of algorithms for the processing of the input data, and it helps to prevent problems such as noise generation, and signal interference during its operation. Since images are defined over two dimensions (perhaps more) digital image processing may be carried out as a multi-dimensional system. Prior to the advent of paper money, the most prevalent method of counterfeiting was a mix of base metals with pure gold or silver. The banknotes can be controlled with the help of an image processing system. This article describes some of the various aspects of the production of the Indian national banknotes.

II. EXISTING FRAMEWORK

Today, the currency is composed of a combination of coins, paper money, and other electronic data, but it can still be a false threat was made possible by the ongoing technological advancements in the printing equipment is available to the general public. The stability of a society depends to some extent on the confidence that we have in our currency, and it is this trust that is directly related to the Veiligheid. The challenges for the translation of the state, are many, and the effort that is required for the detection of counterfeit money is directly linked to the level of those who produce counterfeits, which shows no signs of stopping. It is clear that the detection is not a trivial task, in order to criminalistic ally determine the genuineness, you will need to have a deep understanding of the full range of functions. Copies of the central banks are a relatively new one, traditional private banks, many of which produce their own form of currency. After decades of instability and the non-compliance of the currency, and large-scale fraud, the central banks have been set up for the company currency of the issue and the administration of the policy. These entities are endowed with the necessary legal rights, which vary from country to country.

The physical currency is to be subject to wear and tear, so that makes it even more difficult to control, this fall was wrong. For example, the ink may wear out more quickly, in some areas of the paper currency to the other, and the euro is in warmer climates are known to wear out faster than in colder climates. It is to be noted that in contrast, the benefit of this is due to the specific pollutants in certain areas of technology, and the creation of the distribution, the invisible, and the detection is more difficult. To minimize and control the circulation of counterfeit banknotes, bank of central and sorting of banknotes contain the software to recognize banknotes. This is a software that combines image processing, machine learning, and pattern recognition and how to test it on some of the security features with the help of communication barriers. Thresholds, and serve as examples of the values, stacks of bills, which don't meet the set threshold value, or forged, or to be used, and is then withdrawn from circulation. The exact value of money is what is abstract and subjective, electronic money, is composed of electronic publishing, which may be substituted in the same manner as a physical currency, such as banknotes and on the coins, but it's not consistent or uniform. This is an inconsistent and, sometimes, inconsistent array of stored values and electronic payment systems, which are difficult to regulate.

A decade of development, the market has grown to become one of the foundations of society's existence is, to the best of our knowledge. Thus, it has grown to be an important factor for the effective and efficient use of resources, resulting in the development and survival of all. So that people will start using money as a medium of communication, as well as the existence of different currencies, and exchange rates. In this case, counterfeit currency causes a lot of problems in the implementation of the transaction. For the conversion of the investigation, as well as for the determination of the currency denominations, with the help of image processing, it is a great way to get. In the previous papers, the authors have proposed a variety of methods to identify, classify, and to determine whether a coin is fake or not, with the help of algorithms, such as feature extraction, image recognition, FAST neural networks, SIFT and LBP, etc., in addition to these algorithms, which is a new technology available that will allow you to decide on the currency, as well as to his true nature. The methods of pattern recognition, and neural network mapping was used to map and then search for the currency, value of each and every one of them.

Table 1.0: Techniques for detection of Counterfeit Currency

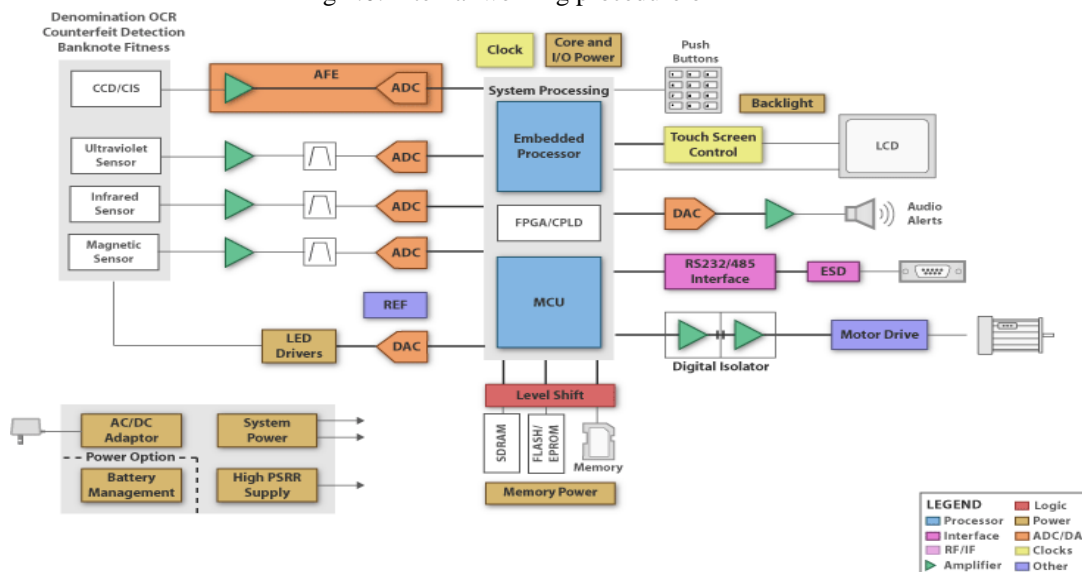
Authors	Year	Technique	Accuracy/Success rate	Applied on
Abba Almu and Aminu Bui Muhammad	2017	Application implemented using MS Access and Visual Basic	77%	Algorithm based on features comparison of Nigerian currency Naira 100, 200, 500, 1000
Jayant Kumar Nayak et. al.	2015	Chan-Vese segmentation, ROI, backpropagation algorithm	98% Average accuracy for both types of notes (average soiled and very soiled)	ROI segmented images of Indian currency denomination values 5, 10, 20, 50, 100, 500
Snigdha kamal et. al.	2015	SURF Descriptor and SVM Classifier	97%	Feature extraction and recognition based on Central Numeral, Ashoka emblem, Identification mark and colour band of Indian rupee 500

III. FRAMEWORK DEMONSTRATE

There are systems that are available, which are only open in the evening, that is. They are only intended for any commercial use. Technology is changing very fast these days. As a result, the banking industry is becoming more and more modern, every day. This creates a deep need for the automatic detection of counterfeit money, the machine, the cash register, and the slots on the seller's goods. Many researchers have asked the question, looking at the development of an effective and efficient automatic currency detection machine. In an automated machine that can detect banknotes, which is currently widely used in the dispensing of products such as sweets, soft drinks, bottled for the bus or train. Currency recognition technology, which is, in principle, aims to detect and remove it from the visible to the invisible the characteristics of the technology.

As for the common people, they go to the Bank or nearest CDM (Cash Deposit Machine) to verify the currency note. The bank and ATM use the same procedure for currency detection. The difference is in ATMs we manually do the procedure and it connects remotely to the bank server, on the other hand in the bank, with the help of the bank employee, we verify the currency notes. Here is the diagram for demonstrating the internal working of an ATM.

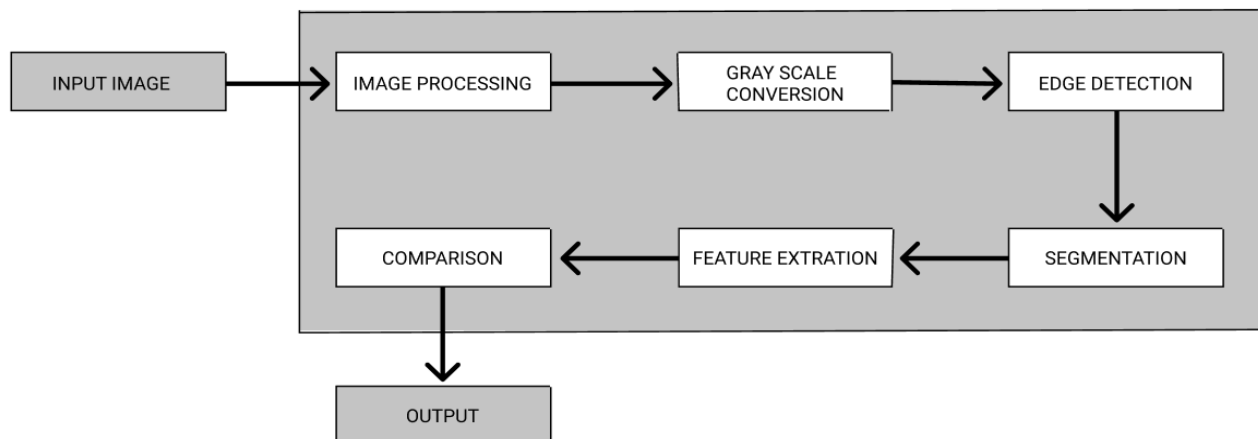
Fig 1.0: Internal working procedure of ATM



IV. THE PROPOSED SCHEME

The proposed method is a new approach that will help you in determining currency values are indicated by means of the capture of the picture." This is achieved with the help of a mobile camera, as well as a number of specific data sets. Here's a super-resolution method with a genetic algorithm, which is shown below. It all starts with uploading the picture directly to the system, and then convert it to grayscale. In the end, it is he who determines the value of the currency, as well as the question of whether this is fake or real. These algorithms attempt to explain the principle of operation of the technique is to be used. Due to an evaluation of new currency after denomination in India, it is necessary to check whether the arrival notes in the form of currency are genuine or not. An easy approach to extracting data contained in a currency image is to capture the variation in an image collection, regardless of any judgment of feature and use this data to encode and compare with fake currency images. The proposed method is using image processing to detect the currency. The captured input is a photographed or scanned image that is given to the system and the output tells whether the currency is genuine or not. The system works with two images, one is the original image, from the paper currency, and the second one is the test image, in which the verification is to be carried out. The proposed method takes advantage of the features of paper currency, which is used by humans to distinguish between different denominations of banknotes. Basically, first of all, people are not able to pay close attention to the details, and the precise characteristics of the notes are to recognize, however, we consider the general features of banknotes, such as the size, the color of the background, color, and consistency, and that in the notes. Thus, we are implementing a different method, or on the specific characteristics of the currency detector. Currency recognition technology based on image processing consists of several stages, such as the obtaining of an image, process it, and finally, the recognition of the transaction. The process contain techniques such as image pre-processing, grey scale conversion, edge detection, segmentation, feature extraction and comparison of feature.

Fig 2.0: Block diagram for Proposed System



V. FOCAL POINTS

A. Image Acquisition

In the first part of the vision system is the image acquisition stage. As soon as the image is received to the different processing methods can be applied to the image to review the implementation of the different dating and jobs. The running collection of photos on the processing of the pictures, it is the first of a series of steps of the workflow, as there is no image, the processing is not possible. There are a variety of ways to add an image, such as the use of a scanner or a digital camera. The acquired image must be retained on all of the features.

B. Pre-processing

The main purpose of the pre-processing is to improve the visual appearance of the image, and the improvement of the data set, and manipulation. Image pre-processing is the kind of activity that is generally required for the data analysis, the loading of the data. Image pre-processing, also known as image recovery, it goes to correct for the bias, the degradation, and the noise that is generated during the processing. Image processing can significantly improve the reliability of visual inspection. Multiple filtering operations, which increase a given image to the details to make it easier or faster to evaluate.

Image adjustments are made using frame interpolation. Interpolation is a method that is used for such tasks as resizing, rotation, compression, and geometric correction. The removal of noise is an important step in the processing of the image. However, the audio can have an impact on the segmentation and pattern recognition. When the anti-aliasing is a process, a pixel's neighbour, has been used to perform a specific transformation of a pixel. After that, a new pixel value is generated.

C. Gray Scale Conversion

The resulting image is in RGB color. Turned into a grey belt, because it carries information about the intensity, that is, it is easy to use, and in place of the handle of the three components of R (red), G(green) B (blue). take the RGB values of each pixel, and if the output value is a value that controls the brightness of the pixel. One of these methods is to find the average value of the contribution of each channel $(R+B+C)/3$. However, since the observed luminosity is often dominated by the green component, and a different, more 'human-centered' method is to use a weighted average, for example: $0.3 R + 0.59 G + 0.11 B$.

D. Edge Detection

Edge detection is the name for a set of mathematical methods which lead to identifying points in a digital image in which the image brightness changes drastically, or more formally, as it has a flood of tears. The points at which the image brightness changes drastically, are generally placed in a set of curved segments are called the edges. This is the same as the problem of finding vulnerabilities in 1D signals is known as step detection and the problem of finding a signal of vulnerability", while it is known as change detection. Edge detection is a fundamental tool for image processing, machine vision, and computer vision, particularly in the area of object detection, and object to load. Edge detection is an image processing technique for the determination of the boundaries of objects in an image. It works, it will detect an interruption in the brightness. Edge detection is used for image segmentation and data for use in areas such as image processing, computer vision, and machine vision.

On the basis of this 1D evaluation, in the theory, it is possible to be transferred to a two-dimensional, as long as there is an exact approach to the computation of the derivative of a two-dimensional image. The Sobel operator performs a two-dimensional measurement of the spatial gradient of the image. Typically, it is used to get the approximate absolute gradient value at each point in the original image to grayscale. The Sobel edge detector uses a variety of 3x3 convolution masks, one of which, the gradient in the x-direction (columns), and the second one evaluates the gradient in the y-direction (the verses/rows). The convolution mask is usually much smaller than the actual picture. As a result, the mask slides over the image, manipulating a square of pixels at a time.

E. Image Segmentation

Image segmentation is the process of splitting a digital image into multiple segments (sets of pixels, also known as super pixels"). The goal of segmentation is to simplify and/or change the picture to something more substantial and to make it easier to analyze. Image segmentation is typically used to determine the position of the objects and boundaries (lines, curves, etc.) in the photos.

F. Feature Extraction

Feature extraction is a special form of a reduction in size. Once the algorithm is that the input data is too large to be processed and it is believed that it has been greatly exaggerated, this input data is transformed to a small set of functions of the form. The process of converting the input data into a set of objects is called an object extraction. If the number of objects that are carefully selected and are of the item to be set, it is expected to extract the relevant information from the input data to achieve the desired task using this reduced representation instead of the full size of the input data.

VI. CONCLUSION

This project helps to detect the fake currency using image processing. This would eliminate the circulation of fake note in the system to some extent. It would provide an opportunity for the user to properly detect the authenticity of note actually without going to the banks. This project discussed a technique (two algorithms) for verifying Indian paper currency. This project is an effort to suggest an approach for extracting characteristics of Indian paper currency. The approach suggested from the beginning of image acquisition to converting it to gray scale image and up to the word segmentation has been stated. The work will surely be very useful for minimizing counterfeit currency.

This research project proposed fake currency detection using image processing. In image pre-processing the acquired image was cropped, adjusted and smoothed. Then the image converted into grey scale. After conversion the edges are detected. In edge detection used the Sobel operator. Next the image segmentation is applied. After segmentation the features are extracted. Finally compared and find out the currency is original or fake. In this investigation, we talked about different fake currency detection strategies, everyone has its own centrality.

In Future, Mobile application can be developed which would be useful for normal as well as visually impaired persons, the same system can be developed for the remaining Indian currency notes and other country's currency notes. Also, the app's interface can be further modified/developed as per the user requirements. In this research paper, an efficient approach is proposed to extract the features of Indian currency notes and recognize it. The research paper also contains the Counterfeit Currency Detection and Classification and authentication. Our future work will be concentrated on extraction of features from various currency notes belonging to different countries as well as recognition and classification. Our future scope will be the conversion of currency denomination.

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