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MULTIPLE INDIAN CURRENCY DENOMINATION AND RECOGNITION AND COUNTER

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ABSTRACT

This project deals with an intelligent automation for multiple currency recognition and counting in automated way. The Proposed system that can not only accept bank notes, but also detect the presence of counterfeit notes, separates notes based on artificial neural network, and gives the total amount deposited and hence provides a highly useful extension to existing ATMs and secure way cash deposits. This system is based on the computer communicates with the help of webcam, catches image frames which include the image of currency values and process them. The Indian currencies can be classified based on a set of unique non discriminating features such as color, dimension and most importantly the Identification Mark which is unique mentioned in RBI guidelines. Firstly the dominant color and the aspect ratio of the note are extracted. After this the segmentation of the portion of the note containing the unique I.D. Mark is done. From these segmented images, feature extraction is done using Fourier descriptor and shape of the currency classification can be by artificial neural network. Then the total currencies are recognized, denominated and counted. By using MATLAB software for the image processing which reduces the cost.

Keywords : Artificial Neural Networks ,Image acquisition, Denomination ,Recognition, Automation

1. INTRODUCTION

Paper money is still a widely accepted mode of money transaction besides so many alternates. The attractive feature of the paper currency includes privacy, simplicity, durability and complete control. But as a means of value transaction it lacks intrinsic value and mechanism of reversal in case of repudiation, except the credential support by the state. Recent phenomena of financial self-service being supported by the banks and other financial institutions have started various services of automated banking systems which have the currency recognition as its key activity making automated currency recognition and classification a key problem. Neural networks (NN) are widely used in the field of currency recognition. It is used for a random mask for preprocessing the data and used a multi-layer neural network as the classifier for recognition of paper currency.

It provides extracted the edge information on paper currency and then used a three-layer NN for recognition. Although the NN technology has the ability of self-organization, generalization and parallel processing, and has a good fit for pattern recognition, it also has some weakness. First, it needs a large number of training samples, which are used to avoid over fitting and poor generalization. Second, if the distribution of training sample is not uniform, the result will probably converge to a local optimal or will even diverge unreasonably. Therefore, the selection of the training set is a crucial issue for the NN. In currency circulation, the original information on paper currency may have a loss because paper currency may be worn, blurry, or even damaged. Furthermore the complex designs of different kinds of paper currencies make automatic currency recognition difficult to work well. So it is important how to extract the characteristic information from currency image and select proper pattern recognition algorithms to improve the accuracy of currency recognition. The method we present here has an excellent performance.

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2. EXISTENCE SYSTEM

The currency system is prevalent in India since a very long time. The Government of India introduced its first paper money issuing 10 rupee notes in 1861. These were followed by 20 rupee notes in 1864, 5 rupees in 1872, 10,000 rupees in1899, 100 rupees in 1900, 50 rupees in 1905, 500 rupees in 1907 and 1000 rupees in 1909. In 1917, 1 and 2½ rupees notes were introduced [1].The Reserve Bank of India (RBI) began note production in 1938, issuing 2, 5, 10, 100 and 1000 rupee notes, while the Government continued to Currently, the Indian currency system has the denominations of Rs. 1, Rs. 2, Rs. 5, Rs. 10, Rs. 20, Rs. 50, Rs. 100, Rs. 500, and Rs. 1000. All the above mentioned denominations are unique in one feature or the other. These features may be color, size or some identification marks etc. it is very easy to recognize these features for the sighted people but not for the visually impaired. These visually impaired people can distinguish between two different denominations using the different size on notes, but the size variation alone is not enough to flawlessly determine the currency note. In reality, the very little difference between the sizes of consecutive denominations makes them confused and unable to distinguish the currency notes from one another. The currency notes are provided with few special identification marks only for the blind people so that they may easily recognize the denomination correctly. Every currency note has its denomination.

3. PROPOSED SYSTEM

The proposed system that can not only accept bank notes, but also detect the presence of counterfeit notes, separate notes based on genuineness and denomination, and give the total amount deposited and give the total amount deposited and hence provide a highly useful extension to existing ATMs and a secure way of cash deposits. The entire system becomes user friendly. Thus, it reduces the drawbacks of existing system. The implementation of proposed system can be classified as

- Identification mark in each currency
- Shape and identification recognition
- Multiple denomination and automation process can be controlled by arduino controller.

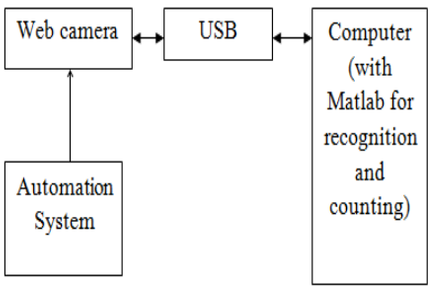

Figure.1 Over all block diagram of proposed system

The bundle of notes, to be counted will be placed in the note feeding unit. The user then pushes the START button in the GUI. The note feeding unit feeds the note, one by one, to the conveyor belt. Webcam are placed at various points on the conveyor belt, which detects the presence of the note. The conveyor is stopped when the note reaches the recognition, detection and counting unit. The unit checks the value of currency. Then the conveyor is restarted. After passing the image processing unit, the note move again on the conveyor until it will pass another sensor. This detects the presence of the note and stops the conveyor once the note is under the webcam. Once the note is under the webcam, data will be sent serially to MATLAB to start capturing the image of the note and do the image processing in MATLAB. Once processed, the data will be sent to controller serially from MATLAB ad controller will make decision about the category of the note. Once decision is made, the decision or signal will be sent to the twister to move the correct cabinet under the conveyor so that the note will fall into respective cabinet. The twister consists of on a rotating platform driven by a stepper motor. The stepper motor is controlled by the arduino microcontroller. Cabinets for various denominations are

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mounted on the twister. Once the process is completed, the recognition amount of the currency and the itemized bill are displayed on the Graphical User Interface (GUI).

The Indian currency system has the multiple denominations of Rs.5, RS.10, RS.20, Rs.50, Rs.100, Rs.500, and Rs.1000. All the denominations are unique. These features may be colour, Size and identification marks. The system based on the computer communicates with webcam, catches video frames which include a visible image of currency amount and process them. Various methodologies are used on the surface on image. The selected area of the image is processed and analysed with its paramaters. Once the image of the currency was detected, its digit is recognized. Each note is then stored in a cabinet reserved for that denomination.

3.1 IMAGE ACQUISITION

It is a process of acquiring image from a currency note by using digital camera. The image is stored for further processing. Here the image is acquired with a digital camera of 14MP. A database of 50 images of each Indian Currency notes (Rs.20,50,100,500,1000) consisting of old, new, blurred, faded notes, etc are taken for experimentation and testing.

Example Fig 3.1Hundred rupee note

Example Fig 3.2 Thousand rupee note

3.2 IMAGE PRE-PROCESSING

Image pre-processing is done to enhance some image features important for further processing and analysis. In image pre-processing size of the image is reduced and noise is removed that may have appeared in the image while transferring. Also the currency notes are localized while removing the background. Color Feature Extraction: Here the dominant color of the currency note is found. Then the dimensions are found and Aspect Ratio is calculated Image Segmentation: The Portion of the currency containing the I.D. Mark is segmented. I.D. Mark Detection.

The process of recognition starts with image processing techniques. The different steps in currency recognition are: Shape Classification: After the IMD feature extraction is done, the shape classification is done employing Artificial Neural Network. Decision Algorithm: Based on these three unique features a decision algorithm is finally employed to recognize the denomination of the Currency note.

3.2.1 COLOR FEATURE EXTRACTION

To determine the dominant color of Indian Currency notes. we firstly need to employ a color model and keeping into consideration the purpose the RGB model is the most adequate model. In RGB model each color appears with its primary spectral components of RED, GREEN and BLUE. The model is based in a Cartesian co-ordinate system; the RGB color space is represented as a cube where, black is located at the origin and white in the opposite

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corner to the origin. The RED, GREEN and BLUE components are the base vectors that form the RGB space. The colors are the points located inside the cube defined by the vectors that extend from the origin. For convenience we assume that all the colors vectors are normalized; The color of every pixel is a linear combination of the three dimensional base vectors RED, GREEN and BLUE. Thus based on experimentation on various currency notes we have found the dominant color of each currency.

3.2.2 ASPECT RATIO

Each Indian denomination has a unique dimension. So, we have considered this as also one of the feature for Classification. However wear and tear due to handlings sometimes reduces the original size of note, so we considered a threshold value based on experimentation. Unlike height and width, the aspect ratio of a currency note is independent of the distance from which the image is taken. In our experiment we have calculate the aspect ratio as:

ASPECT RATIO = Height of the note/ Length of the note

3.2.3 IMAGE SEGEMENTATION

Here firstly based on experimentation of window a particular dimension is selected in the note where the I.D mark is present. Then based on this dimension the portion of the currency where the I.D. mark is present is segmented.

3.2.4 I.D MARK FEATURE EXTRACTION

Once the segmentation is done, feature extraction is done using "Fourier Descriptor". Here we mainly focus on the shape of the I.D. Mark present in the segmented portion of the image. Many shape representations and retrieval method exist; however most of those methods either do not represent the shape well or are difficult for normalization (making matching hard). Among them Fourier Descriptors allow both well representation and well normalization

3.3 ARTIFICIAL NEURAL NETWORKS

Artificial Neural Network is a machine learning technique which functions same as human brain. Human brain is complex structures consist of billions of neurons connected with synapses. The same concept is used to build where perceptrons or nodes or neurons are connected in a network from input to output layer. Thus ANN is an interconnected group of nodes where each node represents an artificial neuron and arrow represents a connection from output of one neuron to input of all the neuron in the next layer. The connections are weighted and job for each node is to calculate some output value depending on weighted input values. Neural network basically consist of three layers i.e. input, hidden and output layer.

ANN works basically for approximation of unknown complex function and pattern recognition. Learning algorithm is used to train the network to function in a more desirable way. Training is a process to update the weights and tries to find values that give us good result. There are two types of learning methods to train a network depending on situation and application. The first method is unsupervised learning where we don't know if a certain input should map to some distinct output and let the network to train itself. The second method is supervised learning where we have a set of training data. The set contains some input examples connected with correct output and the output value is often referred to as target value. In our project feed-forward back propagation neural network has been used for pattern association, classification and mapping. Back propagation is a method where with the help of derivatives and mean square error of the output makes a gradient search to find new values to the weights.

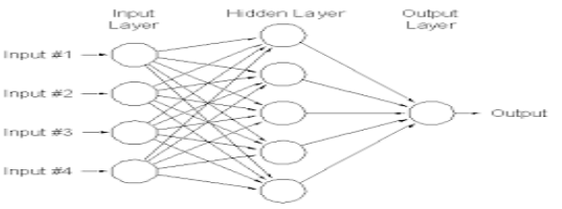

Fig 5.6 Structure of ANN

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3.4 OUTPUT

I. SHAPE AND IDENTIFICATION RECOGNITION

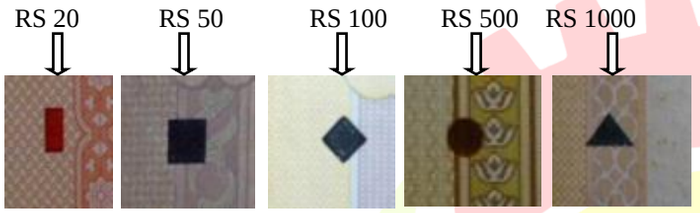

Fig 5.7 Shape extraction

II. HARDWARE REAL TIME OUTPUT

III. SIMULATION OUTPUT

4. CONCLUSION

The denominations of the currency notes are successfully identified by recognizing the counterfeit identification shape provides in each currency, which are in different shapes for different domination and it is analysed in the result provided in report. The method used for finding the denomination using these identification marks also helps in finding the counterfeit currency. Shape based recognition technique is used in MATLAB software, which is installed in the computer for finding the denomination and also reduces the cost because computer system is mandatory in all the organization. The proposed system would make payment more economical, flexible, and optimal and time saving which indeed is an asset to India to make it a developed country. Main purpose of this project to provide facility for depositing money 24X7 in a particular bank. The recognition method of Indian paper currency is quite simple, efficient, easy to be realized.

5. FUTURE WORK

The proposed system can be used to implement image intelligent ATMs. An intelligent deposit ATM scans deposited cash and check items as they are inserted into the ATM counts the items and total cash deposit for providing an image of each check and an itemized list of nodes deposited by denomination. Automated cash deposit machines significant benefits to both banks and their depositors. The machines can enable depositors to deposit cash at more convenient times and places than during banking hours at branches. At the same time, by automating services that were previously completed manually, CDMs can reduce the costs of servicing some depositor demands. These potential benefits are multiplied when bank share their accounts through a bank CDMs. Advantages of such system would be improved speed deposit and ease of use. It provides staff can be re-deployed to profitable activities and presents a revenue generating opportunity, and this would be fully automated and intelligent system

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