International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

INDIAN COIN SEPARATOR AND COUNTING MACHINE USING EDGE DETECTION TECHNIQUE

Amith Salehittal[1], Vijay D Shetti[2], Medha M Naik[3], Vartur Shreekumar Sharanya[4]

Department of Information Science and Engineering, Canara Engineering College
Benjanapadavu, Bantwal, Mangaluru-574219

Abstract: *The project focuses on the segregation and calculation of Indian currency. Almost all temples in India have a donation box. The separation of such coins requires more human intervention and can therefore be automated and as a result improves efficiency and reduces time consumption in the process. The project adopts automation for this time-consuming process. This includes the use of digital image processing technology that helps detect and separate coins; Thus, making the process more rapid and accurate. The purpose of this system is to identify and match Indian coins, finally counting the number of one rupee, two rupees, five rupees and ten rupee coins. There are various techniques for matching coins. The proposed system uses a digital image processing template matching algorithm, by which the value of the coin is identified and edge detection technique is also used to detect the edge of the coin. That is to read the computer's image and match the coins. Finally count the total value of the coins and display it on a digital monitor.*

Key words: Internet of Things, Metal Sensors, Server Motors.

1. INTRODUCTION

In our country, there are temples which have many donation boxes. Many people use them and include coins and currency notes as their religious donation. More human intervention is required to separate currency coins falling into the currency box (hundi). It is not reliable for today's fast world. Therefore, we have to take corrective action against this process. Sorting coins is a very time-consuming and boring task. There is no recording device for future use in the manual method of counting coins. This is not only happening in temples but also in banks which deal in large number of coins and currency every day. Banks use bill counting machines to count money. But when the customer wants to pay a large amount of cash in the bank, the bank employees can make mistakes to calculate the total value and the number of coins of one rupee, two rupees, five rupees and ten rupees. Some coins of different foreign currency look similar. So it is sometimes difficult to distinguish them using the human eye, especially for large quantities of coins. Furthermore, due to globalization, banks often receive foreign currency that employees cannot recognize. Donors face the same situation as the bank, as donors come from all over the world. It is therefore necessary to develop a system that can help them identify and calculate the money they receive. Also, the process will also require automation at this time. Automation with flexibility provides a good result. Automation provides efficiency and accuracy. No human intervention is needed for this. Coins and currencies vary at the time of donation entry. This is reducing the time to separate coins and currency. With the help of a blower, it separates the postures which are inserted into the donation box. The coins are then ranked according to their diameter. Counters are used for counting purposes. Counted values are displayed on a digital display for recording purpose. An electronic controller serves as the brain of the system that controls the sequence of operations. Separating and counting coins and currency is a time-consuming process that requires more manpower.

1.1 PROBLEM STATEMENT

The aim of this system is to identify and matches the Indian coins, finally count the number of one rupee, two rupees, five rupees, and ten rupee coins are used.

Most of the conventional identification methods used in slot machines, work by testing physical properties of coins such as size, weight and materials. However, if physical similarities exist between coins of different currencies, then the traditional coin testers would fail to distinguish the different coins.

1.2 OBJECTIVE

- To segregate coins and currency notes.
- To count each coin and display the total sum of it.
- To reduce man power and increase the level of accuracy.

1.3 SCOPE OF THE PROJECT

- To provide a user friendly application for Separation and Counting of Indian currency and coins.
- To identify and matches the Indian coins, finally count the number of one rupee, two rupees, five rupees, and ten rupee coins are used
- To decrease human inefficiencies by creating an automated system.
- To count each coin and display the total sum of every denomination.
- Low cost automation and Less time consumption

1.4 PURPOSE

- The purpose of this project is to automatethe manual method of counting the coins
- This system will help them to recognize and calculate the money that they receive.
- Coins and currencies are separated at the time of insertion of donation itself.
- The proposed system utilizes the digital image processing which will speed up the process of separation.

2. LITERATURE SURVEY

There are several techniques used to distinguish such coins from different denominations. Parameters such as parameters, size, weight, and material have been used to analyze and identify the value of the coin. Various programming languages such as C, C ++, C #, Java, Python etc. are also used.

Rotational invariant neural pattern recognition system for coin recognition. [1] In this work they have created a multilevel neural network and the preprocessor consists of several slabs of neurons. This preprocessor was used to obtain rotational inductive inputs for multilevel neural networks. For the weight of neurons in the preprocessor, the concept of circular array was used instead of square array. In 1993 tried to achieve 100% accuracy for coins. In this work he has used back propagation and genetic algorithms to design neural networks for coin recognition. Back propagation is used to train the network.

To classify Indian coins of different denominations recently issued and to count the total value of coins in terms of Indian national rupees [2] The purpose of this work is to separate recently issued Indian coins. It is to classify into denominations and calculate the total value. Coin with reference to Indian National Rupee (INR) [1, 2].

Systems include Robert's edge detection method (93% accuracy), Gaussian edge detection method (94% accuracy), canny edge detection method (97.5% accuracy) and multi-level counter progression neural network (ML-CPNN) based approach (99.5% accuracy)). Parameters such as size, shape, surface, weight etc. are considered and Matlab is used as a medium for simulation and obtaining results. Comparisons between existing techniques were summarized by Modi et al., Specifically using image processing techniques and found that a maximum accuracy of 99.7% was obtained for Canadian coins using decision trees in 1996 .

Indian currency recognition and coin fall [3] The system used the FLA (Field Processed Gate Array) controller which together with MATLAB detects currency notes to check for incorrect and counterfeit notes. If the notes are real, the value of the currency is counted using artificial neural networks. There is a DC gun for the sorting process.

Indian coin detection and sorting using the SIFT algorithm [4] The proposed system using the SIFT algorithm in addition to the MATLAB tool for coin detection. It uses feature extraction techniques to differentiate between coins. Similarly, he used edge detection algorithms to detect coins.

Coin classification using a novel technique to learn characteristic decision trees by controlling the degree of normalization [5] In this work, controlling the degree of normalization introduced an approach to coin classification using specific decision trees. Algorithms such as ID3 were unable to detect instances of the categories present in the set of decision tree training examples. Instead of being rejected, such examples are actually assigned to one of the classes present in the training set. Get 100% recognition accuracy rate. In the pre-processing stage, they have used a Gaussian filter to smooth the image and then gray level thresholding is performed to obtain a binary image. To extract the features, they have used a Harris-Hassian detector. Next, the limit value of the characteristic points of the coin is calculated. The Circle Hof transform is used for circle detection. After circle detection the coins are classified according to the radius and threshold value

Three color selective stereo gradient method for rapid topography recognition of metal surfaces. [6] Similar to our approach, translational invariance is achieved through transfection, whereas rotational invariance is a

consequence of a polar coordinate representation and correlation. Their system uses a special hardware to ensure that no fraudulent coins are accepted by the system. In our case there is no risk that fraudulent photographs of coins will be presented to the system. Therefore, the use of color seems to unnecessarily increase computational costs. The basic idea of a straight line detection method is discussed in the coin's image. The criteria for coin classification based on gray-level, color, texture, shape, model, etc., are discussed. Method that specifically addresses coin segmentation based on color or gray value. Many serious problems such as the size of the coin, the peak in the surface of the coins are attempted to be detected but, it does not produce much results.

Pattern matching using a rotation invariant coin identification system with a neural network. [7] This system is capable of collecting data and extracting coin characteristics. In the first stage the RGB coin image is acquired. The RGB image is then converted into a grayscale image. They have used the Sobel filter to detect edges from the image and to detect radius and center. In the next step they have generated a feature vector. This feature vector is then extended to trained neural networks. The neural network then classifies the coins.

Using the Indian coin recognition image subtraction technique [8] this system checks the radius and centroid of the coin's image and then applies coarse and fine subtraction to the input image. A subtraction is performed between the object image and the database coin image which provides rapid recognition and good accuracy.

In the Harris-Hessian algorithm [9] pre-processing step for coin anticipation, they have used a Gaussian filter to smooth the image and then gray level thresholding is performed to obtain a binary image. To extract the features, they have used a Harris-Hassian detector. Next, the limit value of the characteristic points of the coin is calculated. The Circle Hof transform is used for circle detection. After circle detection the coins are classified according to the radius and threshold value.

Coin recognition using artificial neural networks [10] They have used Sobel edge detection to detect the circular boundary. He has used the circular huff transform to remove shadows from the coin image. They applied discrete cosine transforms and discrete wavelet transforms to divide the image into smaller segments. The pattern average image is then generated. In the final stage vectors are generated and given as input to the neural network.

3. SYSTEM DESIGN

The purpose of the design phase is to plan a solution of the problem specified by the requirement document. The design of a system is perhaps the most critical factor affecting the quality of the software, and has a major impact on the later phases, particularly testing and maintenance. The output of this phase is the design document. The design activity is often divided into two separate phases. They are system design and detailed design

3.1 ARCHITECTURAL DESIGN

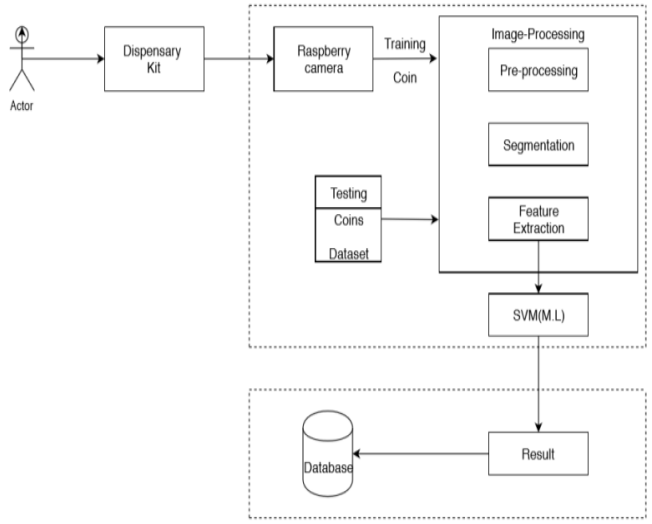

Figure 4.1: Architectural Designs

In this proposed system a raspberry pi cam captures the image and camera is fixed at a constant height. This information passed to raspberry pi segregate coins of one, two and five by extracting features like its size and shape. Output for coin dispensary kit is separated coins and counts are updated.

3.2 USE CASE DIAGRAM

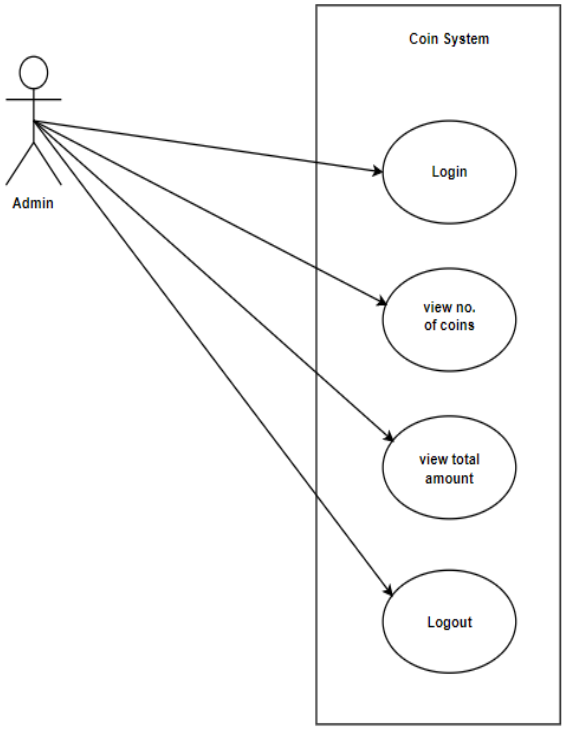

Figure 4.2: Use Case Diagram for Admin

A use case diagram is a graphic depiction of the interactions among the elements of a system. A use case is a methodology used in system analysis to identify, clarify and organize system requirements. Here Admin login to the system to update the counts of coin using username and password provided to them. After updating number of coin count is obtained from the system and finally admin logout.

3.3 FUNCTIONAL DESIGN

3.3.1 Data flow Diagram (Level 0)

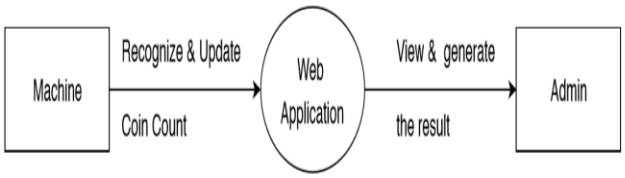

Figure 4.3.1: Data Flow Design for Level 0

Data flow Diagram (Level 1)

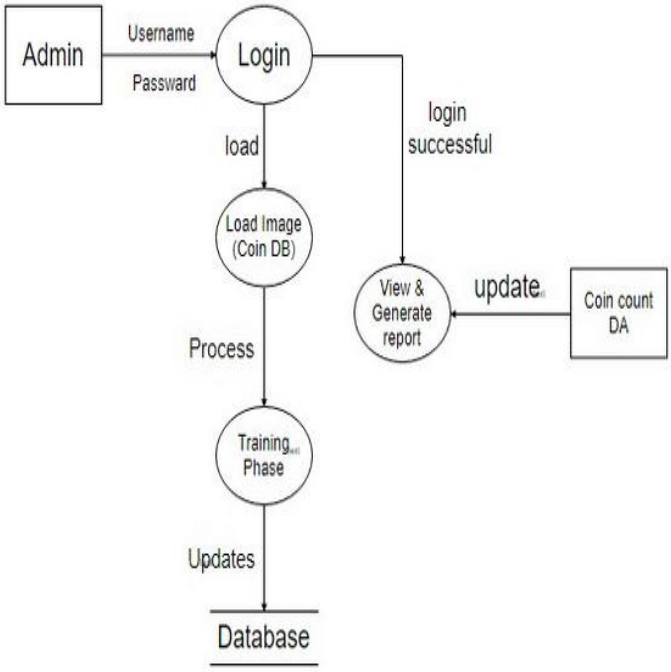

Figure 4.3.1: Data Flow Design for Level 1

A data-flow diagram is a way of representing a flow of a data of a process or a system. It also provides the information about the outputs and inputs of each entity and the process itself Coin system contains coin dispensary kit that differentiates coins according to its shape and size and the amount and number of coins updated by admin.

4.4 BLOCK DIAGRAM OF ENTIRE SYSTEM

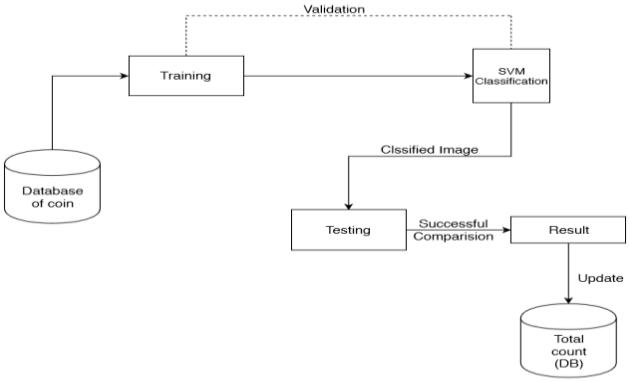

Figure 4.3: Block Diagram for Entire System

It is a Machine Learning algorithm that analyzes data for classification and regression analysis. It compares the test image feature and coin image with the trained dataset. Test image feature is a process which is having single image and that is obtained from training phase and coin image is obtained from trained database .Here 1:1 mapping is done between these two processes.

4.5 Sequence Diagram

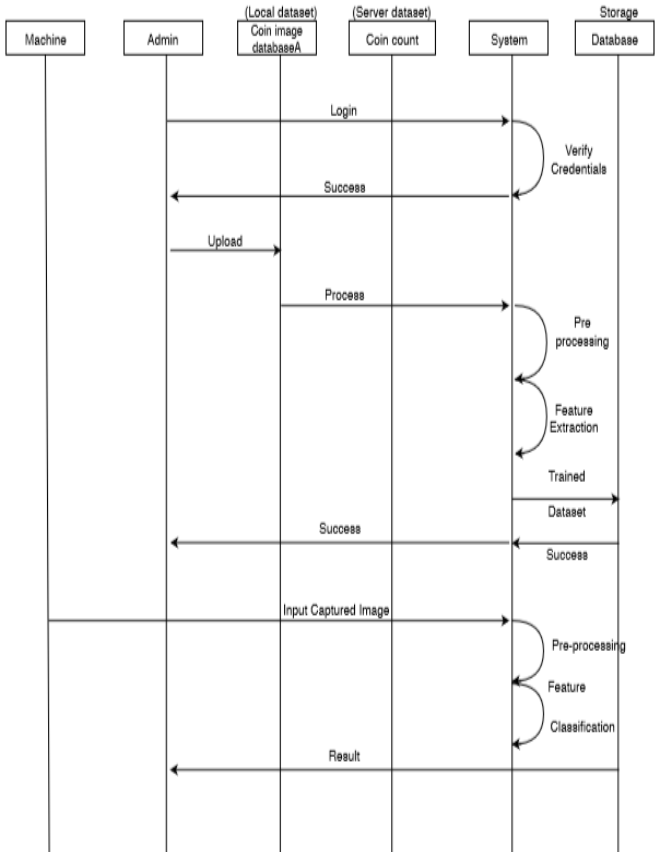

Figure 4.4: Sequence Diagram

A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place .Sequence diagrams describe how and what order the objects in a system function. In this proposed system mainly in process 1, admin login to the system if the username and password correctly given .In process 2, view number of coins and as response, set the count of classification of coins. In process 3, get total count and which admin checkout from the system.

4.6 Modular Design

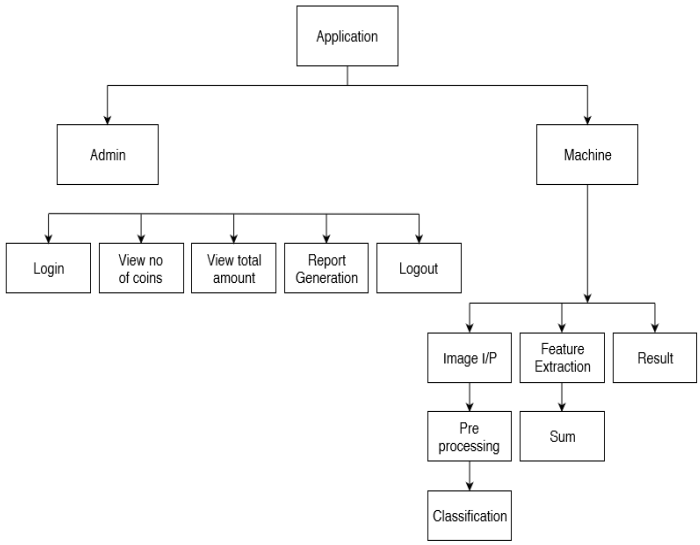

Figure 4.5: Modular Diagram

Design which subdivides a system into smaller parts called modules. Here the system is subdivided as coin system and its functionalities are specified. Coin system is divided as login where the admin try to login to the system where he can view the number of coins and also the total amount finally admin can logout.

5. PROPOSED APPROACH

The intent of this paper is to identify and match Indian coins, finally counting the number of one rupee, two rupees, five rupees and ten rupee coins. There are various techniques for matching coins. Edge detection technology was used in this system. That is to read the computer's image and match the coins. Finally count the total value of the coins. Techniques involved are image color segmentation, edge enhancement, edge detection, blob measurement, huef transformation. The proposed system uses digital image processing template matching algorithm, by which the value of the coin is identified. It also uses an edge detection algorithm to detect the edges of coins and count them if the coin goes up and down and is displayed on a digital monitor. It also matches the color of the coin to separate the coins, as the new 1 rupee and 5 rupee coins are more or less the same. Coins are ranked according to their diameter. Counters are used for counting purposes. Counted values are displayed on a digital display for recording purpose. This reduces man power and increases the level of accuracy.

6. ARCHITECTURE

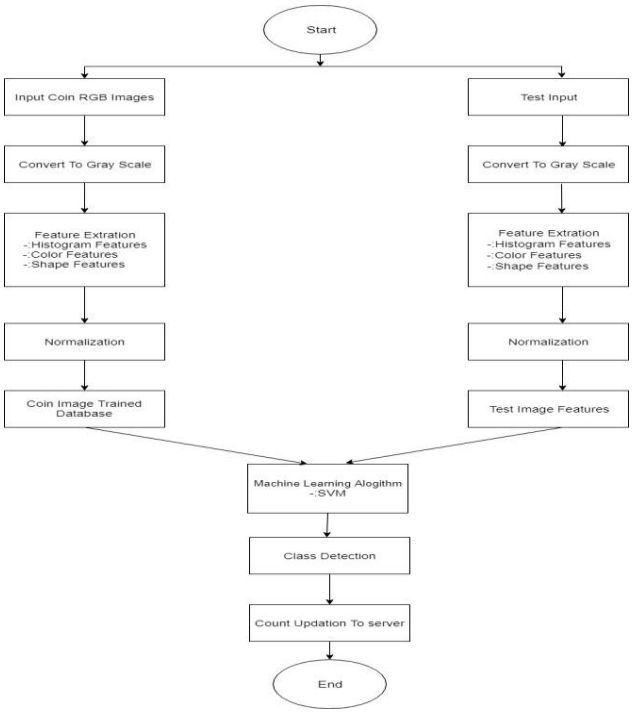

Figure 6: Training and Testing phase of coin detection

The proposed system consists following 7 steps as follows:

Step 1: Read input image
The captured image using Raspberry pi camera is taken as an input in testing phase.

Step 2: Convert input image into grey scale image
If there are color image then convert it into grayscale using weighted method.
The new equation that form is:

New grayscale image = ((0.3 * R) + (0.59 * G) + (0.11 * B))

According to this equation, Red has contributed 30%, Green has contributed 59% which is greater in all three colors and Blue has contributed 11%.

Step 3: Extract Features such as histogram, color feature and shape of the coin.
[counts,binLocations] = imhist(I) calculates the histogram for the grayscale image I. The imhist function returns the histogram counts in counts and the bin locations in binLocations. The number of bins in the histogram is determined by the image type. Optionally can compute the histogram counts and bin locations using a GPU (requires Parallel Computing Toolbox™). For more information, see Image Processing on a GPU.

Step 4: Perform normalization
After feature extraction, as it is the random process it create data redundancy. This can be overcome by normalization and this process also performs data integration of the coin and that data is sent to coin image feature trained database.

Step 5: Apply machine learning algorithm
Comparing the image features with the obtained coin image. Test image feature is a process which is having single image and that is obtained from training phase and coin image is obtained from trained database .Here 1:1 mapping is done between these two process using machine learning algorithm named SVM (Support Vector Machine) which is mainly used to solve classification or regression challenges.

Step 6: Perform class detection
Detecting the instance of a coin from a particular class .For example consider 3 classes, class1 ,class 2,class3 detecting for which class the particular coin belongs to and segregating the coins according to their respective class.

Step 7: Update count in server Updating the coin count of particular class. For example if 1 rupee is in class 1 then total count of class 1 is updated to the server.

7. RESULTS

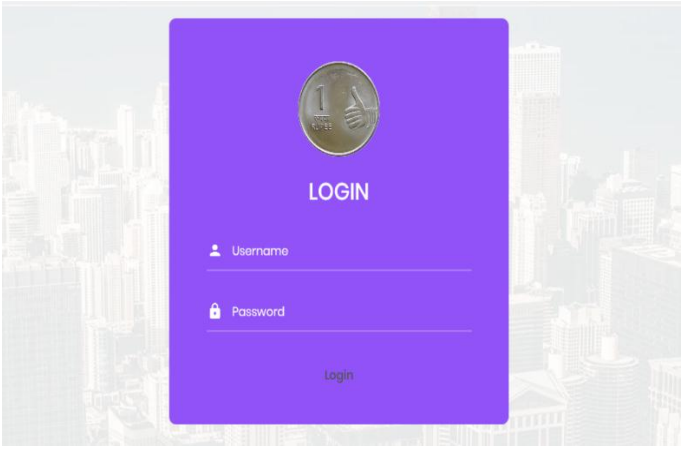

Figure 7.1: Login page of Admin

In above figure the user mainly refers to the admin or the person who monitors the whole system .He can view the

count of the coin and the updates the user details. The user makes use of his mail id as a username and his password to login and view the details.

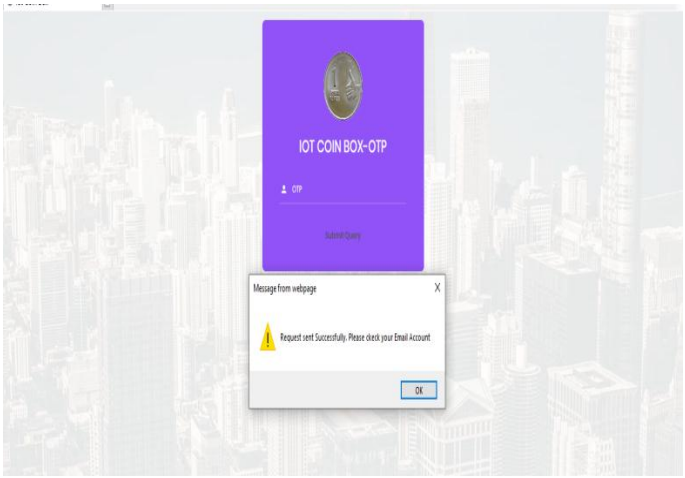

Figure: 7.2: Verification of user through OTP

The logged in user gets OTP to their registered user id via mail. The user needs to verify the OTP with the web page to view the coin details.

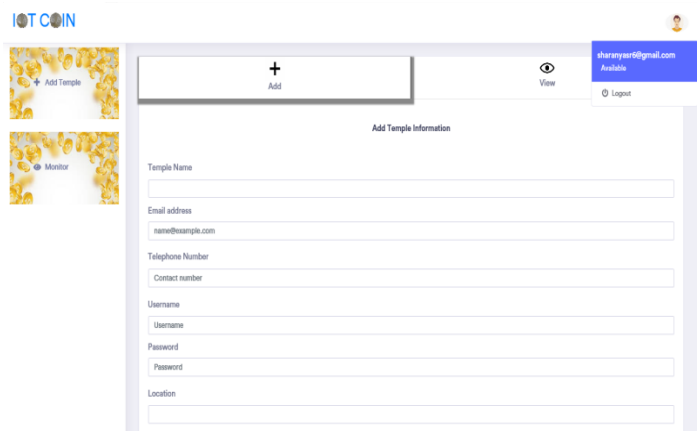

Figure 7.3: Add the temple details

In the figure the user can and the temple details like name of the temple address, contact details and so on for monitoring the count of the coin.

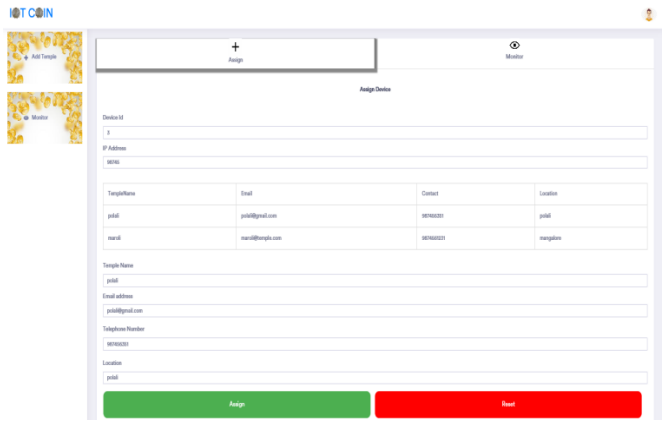

Figure 7.4: Add the temple details

Here the admin assigns the temple to a particular IP address and to monitor. The assigned temple details can be viewed.

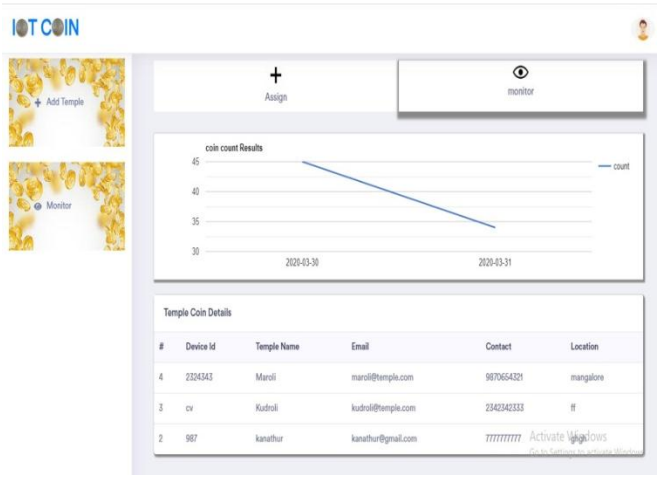

Figure 7.5: Monitoring the temple details

In this page the user can monitor the coin count of the assigned temple. It shows a graphical representation of the coin count.

8. FUTURE SCOPE

Implementation is done only for coins. Integration of both coins and notes can be done by implementing principles of Machine Learning Algorithm. Database can be created for each notes and coins .Automated system can be developed which is able to distinguish between coins and notes in and around the acrylic box, segregate them and put them in respective slot. Finally outputting the total sum of coins and separately.

9. CONCLUSION

Coin recognition using morphological operations shows positive signs for coin identification. Image segmentation used as the first step reduces total time requires executing the program. Machine Learning algorithm provides the clear edges of the coins to improve accuracy for coin detection. Different features such as histogram, color and shape are determined. Also blob measurements and normalization are performed which are used to provide and give precise results.

REFERENCES

[1] Minoru Fukumi, Sigeru Omatu, Fumiaki Takeda, and Toshihisa Kosaka," Rotation invariant neural pattern recognition system with application to coin recognition", IEEE Transactions on Neural Networks 3 (1992), no. 2, 272–279

[2] Velu CM, P.Vivekanadan , Kashwan K R, "Indian Coin Recognition and Sum Counting System of Image Data Mining Using Artificial Neural Networks". International Journal of Advanced Science and Technology. Jun 2011; 31, 67–80p.

[3] Anija KP, Afna mamu, Aisha Chandhni, Kavya Madhusoodhanan, "Recognition of Indian Currency and Denomination of Coin". International Journal for Scientific Research & Development. 2016; 4(1): 843–846p.

[4] Rohan S, Akshat G Poi, Sahil G Khorjuvekar, Vaibhav Naik, "Indian Coin Detection and Sorting using SIFT algorithm". International Journal of Science Technology & Engineering. Apr 2016; 2(10): 601–603p.

[5] Paul Davidsson, "Coin classification using a novel technique for learning characteristic decision trees by controlling the degree of generalization", Ninth International Conference on Industrial & Engineering Applications of Artificial Intelligence & Expert Systems (IEA/AIE-96), Gordon and Breach Science Publishers, 1996, pp. 403–412.

[6] M. Adameck, M. Hossfeld, and M. Eich, "Three color selective stereo gradient method for fast topography recognition of metallic surfaces", Proceedings of Electronic Imaging, Science and Technology (Martin A. Hunt and Jeffery R. Price, eds.), Machine Vision Applications in Industrial Inspection XI, vol. SPIE 5011, January 2003, pp. 128–139.

[7] Sabita Pal, Gaurav Kumar and Sovan Raj Meher, "Indian Coin Recognition using Image Subtraction Technique", IJCAES 2014

[8] Harveen Kaur and Neetu Sharma, "Modified coin identification using Neural Network", IJETAE 2014

[9] Saranya das.Y. M and R.Pugazhenthi, "Harris-Hessian Algorithm for coin Apprehension", IJARCET 2013

[10] Tushar N.Nimbhorkar and M.M.Bartere, "Coin Recognition by using Artificial Neural Network", IJCITB 2013