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DEPARTMENT OF COMPUTER ENGINEERING

All India Shri Shivaji Memorial Society

College of Engineering

Kennedy Road, Pune - 411001

A. Y (2021 - 2022)

A SEMINAR REPORT ON

"FAKE CURRENCY DETECTION USING IMAGE PROCESSING"

SUBMITTED TOWARDS THE PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING
(TE Computer Engineering)

BY

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Under The Guidance of

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CERTIFICATE

This is to certify that the Seminar Entitled

"FAKE CURRENCY DETECTION USING IMAGE PROCESSING"

Submitted by

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is a bonafide work carried out by students under the supervision of **Prof. Savitri Pawar** and it is submitted towards the partial fulfilment of the requirement of Bachelor of Engineering (TE Computer Engineering) Seminar and Technical Communication

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Chapter 1

Acknowledgement

In the accomplishment of this project successfully, many people have best owned upon me their blessings and the heart pledged support and this time I am utilizing to thank all the people who have been concerned with the project. Primarily I would like to thank god for being able to complete this project with success. Then I would like to thank our Principal, **Dr. D. S. Bormane**, and our HOD, **Prof. D. P. Gaikwad**, whose valuable guidance and support has been the one that helped me to patch this project and make it full proof success. His suggestions and instructions have served as the major contribution towards the completion of this project. I would also like to thank my Mentor, **Prof. Savitri Pawar**, for her valuable support and guidance throughout the completion of my project. Then I would like to thank my classmates who have helped me with their valuable suggestions, support and guidance which have been very helpful in various phases of completion of this project.

Chapter 2

Abstract

In recent years a lot of fake currency note is being printed which have caused great loss and damage towards society. So, it has become a necessity to develop a tool to detect fake currency. This project proposes an approach that will detect fake currency note being circulated in our country by using their image. There are lots of detection methods but with the advent of freely available image operation tools, it's a serious issue in the banking sector. There are lots of important regions which are present in currencies, finding out those for evaluation is the basic task. Classifiers can find out the extracted features either genuine or fake. Without classifiers, we can cross-check with the original note's region with the segmented currency image. But that alone can't help to identify the authentication of the particular image. Alignment and edges may not be the same if we segment the important portions, so fake currency note image(s) may be considered as original in some cases. To avoid that extracted features must be processed by the classifier(s) to get better results.
Keywords:- Fake Currency Detection, Image Processing, Security Feature Extraction, K-means Algorithm, Edge Detection

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Chapter 3

Introduction

Counterfeit money is currency produced without the legal sanction of the State or government, usually in a deliberate attempt to imitate that currency and so as to deceive its recipient. Producing or using counterfeit money is a form of fraud or forgery, and is illegal. The business of counterfeiting money is almost as old as money itself: plated copies (known as Fourrées) have been found of Lydian coins, which are thought to be among the first Western coins. Before the introduction of paper money, the most prevalent method of counterfeiting involved mixing base metals with pure gold or silver.

Fake Indian Currency Note (FICN) is a term used by officials and media to refer to counterfeit currency notes circulated in the Indian economy. On 8 November 2016, Prime Minister of India, Mr. Narendra Modi announced that the hitherto existing 500 and 1000 rupee notes cease to be legal tender. He said that the move is taken to curb black money and widespread counterfeit currency in the country. He introduced new Rs. 500 and Rs. 2000 notes, and discontinued the hitherto existing Rs. 1000 note.

Although fake currency is being printed with precision, the Crime Investigation Department (CID) says that they can be detected with some effort. Currency printed by local racketeers can be detected easily as they use the photographic

method, hand engraved blocks, lithographic processes and computer colour scanning. In counterfeit notes, the watermark is made by using opaque ink, painting with white solution, stamping with a dye engraved with the picture of Mahatma Gandhi. Then oil, grease or wax is applied to give the picture a translucent feel. In genuine notes, the security thread is incorporated into the paper at the time of manufacture. But in fake notes, the security thread is imitated by drawing a line with a pencil, by printing a line with grey ink, or by using aluminium thread while pasting two thin sheets of paper. Forgers find it difficult to reproduce the same shape of individual numbers again and again with accuracy. The alignment of figures is also difficult to maintain. Spreading of ink, smaller or bigger number, inadequate gaps, and different alignments in numbers should be regarded with suspicion. In counterfeit notes, the printed lines will be broken and there may also be ink smudges. In recent times it has been reported that FICN match 10 out of 14 security parameters adopted by the Indian government, with suggestions that the highest quality fakes could have only been produced by a nation state.

Chapter 4

Literature Survey

Sr. No.	Paper Title	Author and Publication Year	Conclusion
1.	A Study On Indian Fake Currency Detection YEAR - 2020	Devid Kumar and Surendra Singh Chauhan - 2020 By - Haryono Soeparnoa, Anzaludin Samsinga Perbangsab	In this study, they have discussed various currency detection techniques and currency security feature. By using said technique they have observed that extraordinary results can produced quickly.
2.	Fake currency detection: A survey YEAR - 2019	Arun Anoop M and Dr. K. E. Kannammal - 2020	The authentication of Indian banknote currency is described by applying some image processing methods. In primer research, only three features are considered and extracted including bleeding lines, identification mark and security thread from the image of the currency based on canny edge detection method.

Table 4.1: Literature Survey

Chapter 5

Objectives of System

The main objective of this project is to identify Fake Indian Currency Notes using Image Processing Algorithms with the help of Security Features provided on the Indian Currency Notes which are mentioned below:-

5.1 Features of Rs. 2000 Note

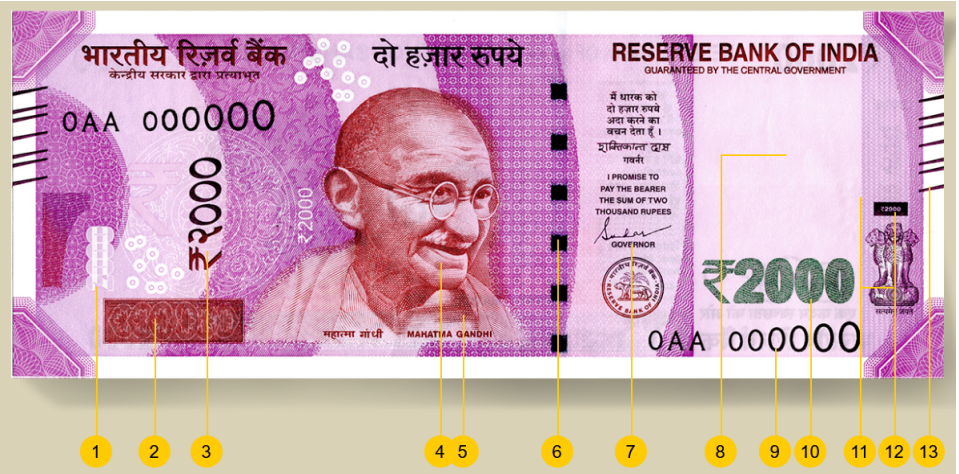

Figure 5.1: Security Features of Rs. 2000 Note (Front)

1. See through register with denominational numeral 2000
2. Latent image with denominational numeral 2000
3. Denominational numeral 2000 in Devnagari
4. Portrait of Mahatma Gandhi at the centre

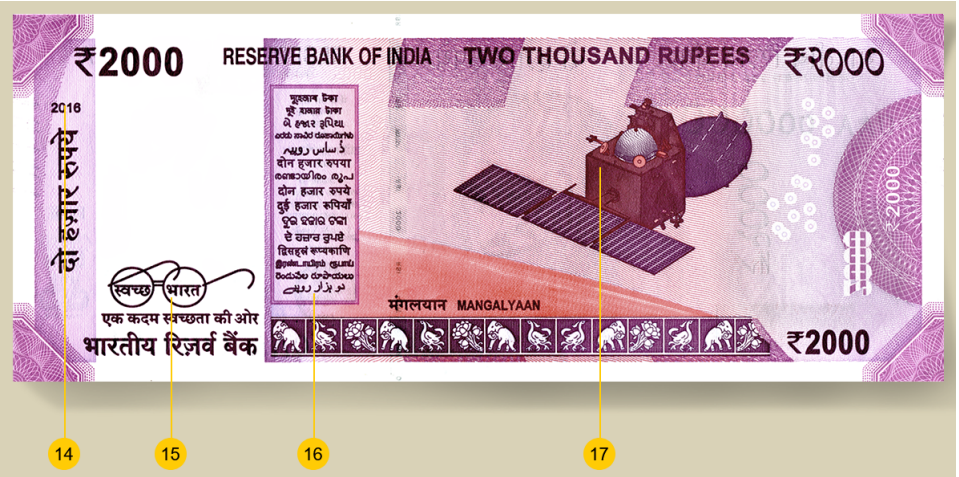

Figure 5.2: Security Features of Rs. 2000 Note (Back)

5. Micro Letters 'Bharat' and 'India'
6. Colour shift windowed security thread with incriptions 'Bharat', 'RBI' and '2000'. Colour of th thread changes from green to blue when the note is tilted
7. Guarnatee clause, Governer's signature wtih Promise Clause and RBI emblem towards right of Mahatma Gandhi's portrait
8. Mahatma Gandhi's portrait and electrotype (2000) watermarks
9. Number panel with numerals in ascending font on the top left side and bottom right side
10. Denominational numeral with Rupee Symbol
11. Ashoka Pillar emblem on the right
12. Intaglio or raised printing of Mahatma Gandhi protrait
13. Year of printing of the note on the left
14. Swachh Bharat logo with slogan
15. Language Panel

16. Motif of Mangalyaan
17. Denominational numeral 2000 in Devnagari

5.2 Features of Rs. 500 Note

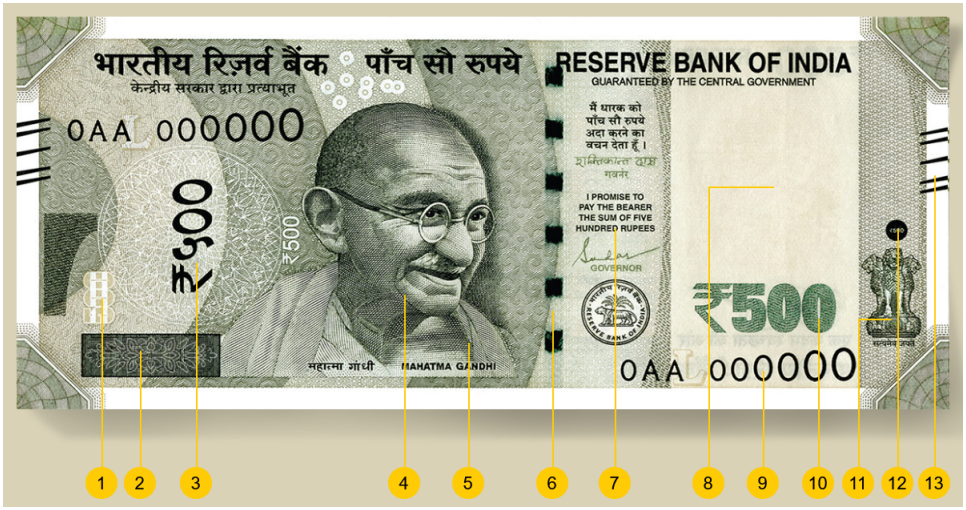

Figure 5.3: Security Features of Rs. 500 Note (Front)

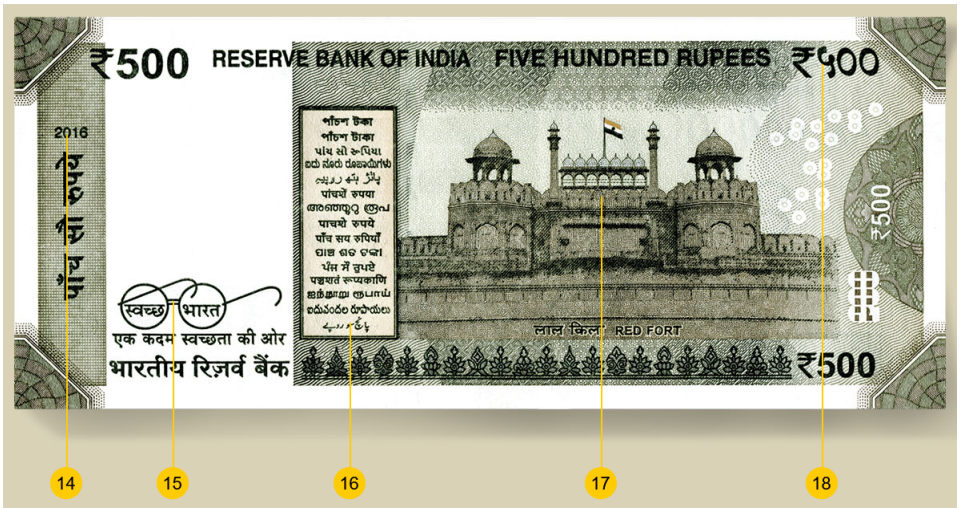

Figure 5.4: Security Features of Rs. 500 Note (Back)

1. See through register with denominational numeral 500
2. Latent image with denominational numeral 500
3. Denominational numeral 500 in Devnagari

4. Portrait of Mahatma Gandhi at the centre
5. Micro Letters 'Bharat' and 'India'
6. Colour shift windowed security thread with incriptions 'Bharat' and 'RBI'. Colour of th thread changes from green to blue when the note is tilted
7. Guarnatee clause, Governer's signature wtih Promise Clause and RBI emblem towards right of Mahatma Gandhi's portrait
8. Mahatma Gandhi's portrait and electrotype (500) water-marks
9. Number panel with numerals in ascending font on the top left side and bottom right side
10. Denominational numeral with Rupee Symbol
11. Ashoka Pillar emblem on the right
12. Intaglio or raised printing of Mahatma Gandhi protrait
13. Year of printing of the note on the left
14. Swachh Bharat logo with slogan
15. Language Panel
16. Motif of Red Fort
17. Denominational numeral 500 in Devnagari

Chapter 6

Problem Statement

To identify the fake currency notes by comparing the security features of notes with the security features stored in the database by using Image Processing Algorithms.

Chapter 7

System Architecture

Being roused by the ongoing improvements in the field of picture preparing and accessibility of ease picture procurement gadgets, we present a methodology for counterfeit money discovery dependent on picture handling. The proposed approach separates various highlights from Indian cash and uses them for counterfeit money discovery. The diagram of the proposed work is introduced in framework design. The image is procured utilizing picture obtaining strategy. The security highlights are removed utilizing different picture handling calculations and afterward format coordinating is done to recognize counterfeit money. The oddity of the methodology is in picture handling applied for extraction of security highlights from the given picture of cash. Another oddity is to utilize various securities includes as opposed to the single component.

7.1 Currency Features

The features extracted so far might be classified as general features. The general features are essentially application independent features, for example, surface, shading and differentiation, and shape. Counterfeit money detection system differs relying upon explicit features of notes of a nation.

For Indian notes following features are considered

1. Latent Image
2. Identification Marks

Figure 7.1: Features being used for Rs. 2000 Note

Figure 7.2: Features being used for Rs. 500 Note

Feature extraction refers to the retrieval of information about the image by applying image processing algorithms. The images of a currency note were acquired using a digital camera or scanning the currency using a scanner. After acquiring the image, first pre-processing and then feature extraction is done to extract features. Both the steps are described in this section:-

7.1.1 Pre-Processing

In pre-processing the operations normally initial to main data analysis and extraction of information. In this unwanted distortion are suppressed and enhance some image features that are important to further processing. It includes image adjusting and image smoothening. After these two pre-processing steps, the images of the currency were applied for feature extraction.

7.1.2 Feature Extraction

Feature extraction employs the selection and extraction of some of the Effective and important features, among the largest data set of the features which are extremely important for the recognition of fake currency. Some Features of an image are Latent image and Identification Mark. We first create a database of a number of authentic Indian notes and then extract their features. The extracted features are used for detection of fake currency.

7.2 System Block Diagram

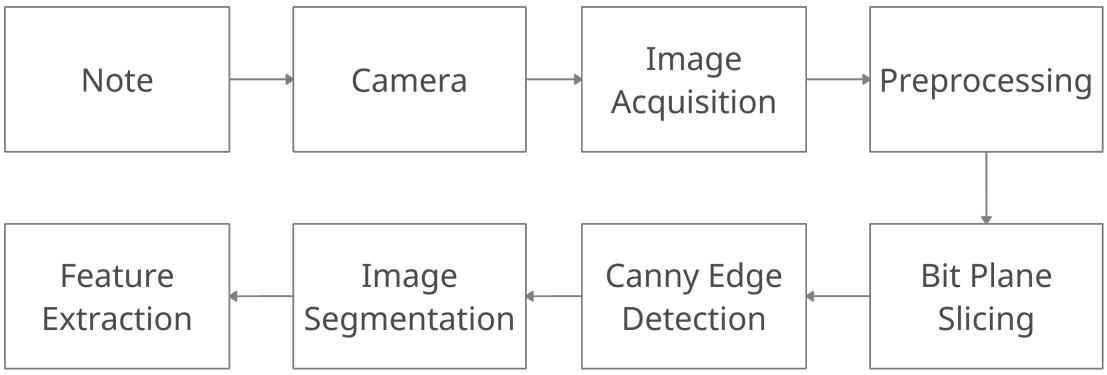

Figure 7.3: System Block Diagram

7.3 Steps of Implemented System

Image processing based currency detection technique consists of few basic steps like image acquisition, its pre-processing and finally recognition of the currency.

Image processing generally involves five steps:-

1. Image Acquisition: Importing an image with a webcam.
2. Performing Image pre-processing techniques such as:-

   i. Image Adjusting: Reduces the calculations and complexity of the size of the image and used for rotating, zooming, shrinking and for geometric corrections.

   ii. Image Smoothening: Reduces the noise introduced in the image.
3. Detect the edges of the note and partition it from the surrounding background of the image.
4. Perform feature extraction on the note to detect whether the note is real or fake by comparing the features of the note with the stored database.
5. After feature extraction, the application will detect and recognize the note. The final result will be an output.

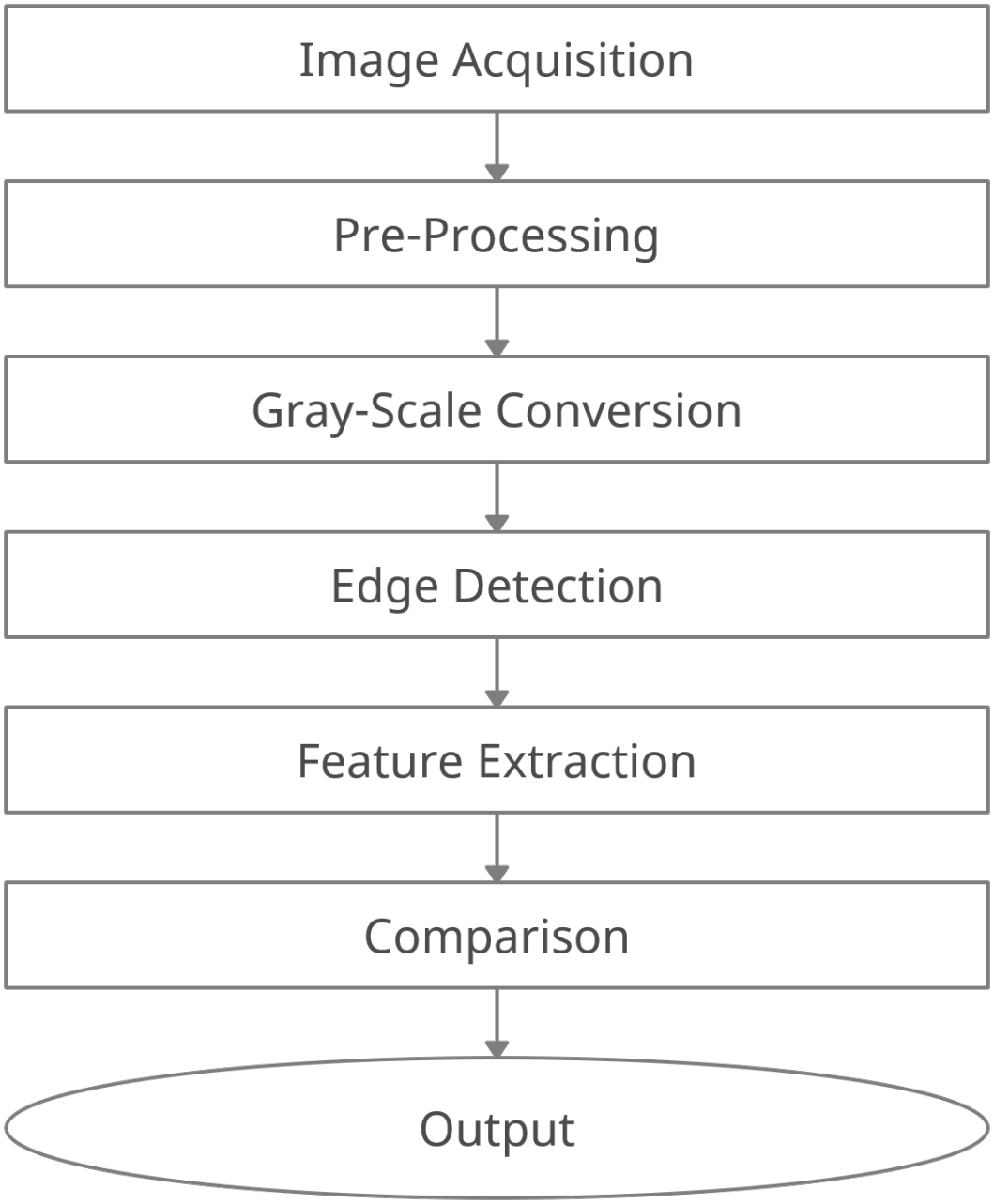

Figure 7.4: Major Units of the Proposed System

Chapter 8

Algorithms

8.1 K-means Algorithm

K-means algorithm is a strategy for vector quantization, initially from signal handling, that is main stream for group examination in information mining. K-means clustering intends to parcel n perceptions into k clusters in which every perception has a place with the group with the closest mean, filling in as a model of the bunch.
The algorithm has a free relationship to the K-means cluster classifier, a well known AI strategy for characterization that is frequently mistaken for k-means as a result of the k in the name. One can apply the 1-closest cluster classifier on the group communities acquired by k-intends to order new information into the current bunches. This is known as closest centroid classifier or Rocchio algorithm.

8.2 SVM Algorithm

In machine learning, support vector machines (SVMs, likewise support vector systems) are administered learning models with related learning calculations that investigate information utilized for grouping and relapse examination. Given a lot of preparing models, each set apart as having a place with either of two classes, a SVM preparing calculation constructs

a model that allots new guides to one class or the other, making it a non-probabilistic paired direct classifier (despite the fact that strategies, for example, Platt scaling exist to utilize SVM in a probabilistic grouping setting). A SVM model is a portrayal of the models as focuses in space, mapped with the goal that the instances of the different classifications are partitioned by an unmistakable hole that is as wide as could be allowed.

In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces. When data are not labeled, supervised learning is not possible, and an unsupervised learning approach is required, which attempts to find natural clustering of the data to groups, and then map new data to these formed groups. The clustering algorithm which provides an improvement to the support vector machines is called support vector clustering and is often used in industrial applications either when data are not labeled or when only some data are labeled as a pre-processing for a classification pass.

Chapter 9

Result

In the below images you can see the difference clearly between the Real and the Fake Note. Differences that are visible are:-

1. In the left white box it can be seen that the Latent Image is very different in both the images.
2. Similarly, in the right white box the identification mark is different in both the images.
3. Also various other parts of the image are completely different like:- Security Strip.
4. Also alignment and positioning of various features is different.

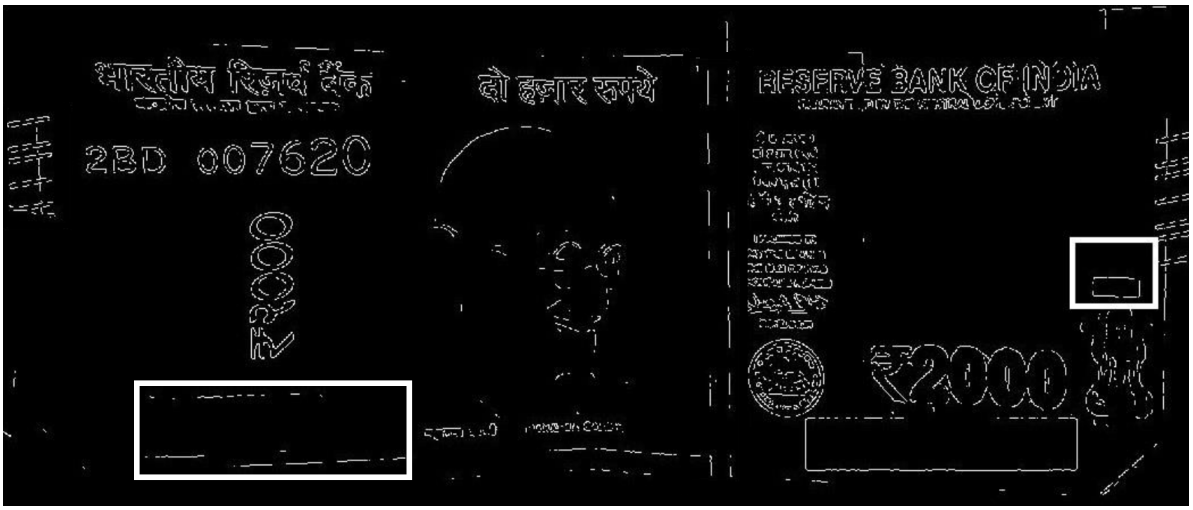

Figure 9.1: Real Note

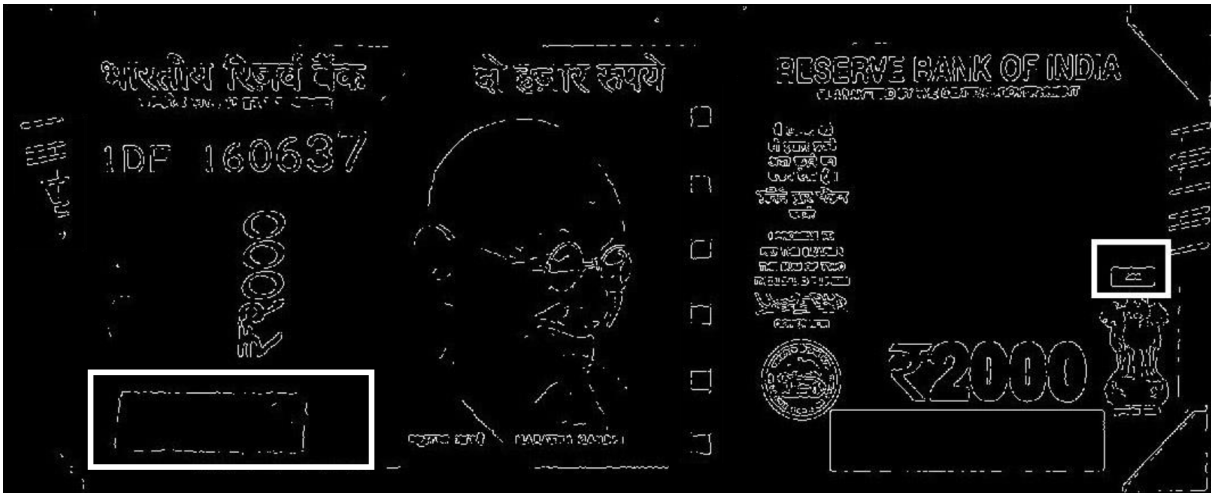

Figure 9.2: Fake Note

Chapter 10

Advantages and Disadvantages

10.1 Advantages

1. The differences are clearly visible as seen in the Result images above
2. Results are obtained quickly

10.2 Disadvantages

1. Cannot be performed by people at home

Chapter 11

Conclusion

Fake Currency is a serious worldwide issue affecting the economy of almost every country including India. It is now very common due to advanced printing and scanning technologies. To tackle this problem we have seen a Fake Currency Detection Method which uses Image Processing Algorithms to compare the Security Features like:- Latent Image and Identity Mark of Currency with the Security Features of real Currency stored in the database to identify the Fake Currency.

Chapter 12

References

- [1] Devid Kumar and Surendra Singh Chauhan, 2020, "A Study On Indian Fake Currency Detection"
- [2] Arun Anoop M and Dr. K. E. Kannammal, 2020, "Fake currency detection: A survey"