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Currency Recognition System using Image Processing

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Abstract: *Common people face many problems for the fake currency circulation and also difficult to detect fake currency, suppose that a common people went to a bank to deposit money in bank but only to see that some of the notes are fake, in this case he has to take the blame. As banks will not help that person. Some of the effects that fake currency has on society include a reduction in the value of real money; and inflation due to more fake currency getting circulated in the society or market which disturbs our economy and growth ˆa some illegal authorities an artificial increase in the money supply, A decrease in the acceptability of paper money and losses. Our aim is to help common man to recognize currency for originality. Proposed system is based on image processing and machine learning and makes the process automatic and robust. Shape information are used in our algorithm. Original Note Detection Systems are present in banks but are very costly. We are developing an image processing and machine learning algorithm which will extract the currency features and compare it with features of original note image. This system is cheaper and can provide accuracy on the basics of visual contents of note. So, as an output, people will get information provided the note image is original or duplicate.*

Keywords: Currency, Fake, Money, Image Processing, Accuracy.

I. INTRODUCTION

1.1 Overview

The paper currency counterfeiting is a big problem for the world. Almost every country has been badly affected by this which has become a very acute problem. The main purpose behind this study is to recognize Indian paper currency with this hybrid approach which is portable and making an application used on the go.

The methodology decided will work as shown in architecture diagram. Input currency images will undergo image processing and feature extractions and compared with dataset available. After that we will use machine learning algorithm to train the model and accuracy increase.

Automatic recognition of fake Indian currency note is important in many applications such as automated goods seller machine and automated goods tellerˆas machine. This system is used to detect the valid Indian currency note. The system consists of eight steps including image acquisition, grey scale conversion, edge detection, feature extraction, image segmentation, comparisons of images and output. Automatic machine more helpful in banks because banks faces the problem of counterfeit currency notes or destroyed notes. Therefore, involving machine makes note recognition process simpler and systematic. Automatic machine is more important to detect fake currency note in every country. The system designed to check the Indian currency note 100, 500 and 1000 rupees. The system will display currency is genuine or fake and currency denomination. It is very important to grow automated system to get feature and recognize Indian currency note in various area such as banking, ATM machine, shopping mall, Bus station and railway station.

1.2 Motivation

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.

Companies are not being reimbursed for counterfeits. This has led to companies losing buying power. As such, there is a reduction in the value of real money. Increase in prices due to more money getting circulated in the economyˆaan unauthorized artificial increase in the money supply.

A decrease in the acceptability of moneyˆapayees may demand electronic transfers of real money or payment in another currency.

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At the same time, in countries where paper money is a small fraction of the total money in circulation, the macroeconomic effects of counterfeiting of currency may not be significant. The macroeconomic ef- fects, such as confidence in the currency, however, may be large.

1.3 Problem Definition and Objectives

Problem Definition

The paper currency counterfeiting is a big problem for the world. Almost every country has been badly affected by this which has become a very acute problem. The main purpose behind this study is to recognize Indian paper currency with this hybrid approach which is portable and making an application used on the go.

Solving Approach

The methodology decided will work as shown in architecture diagram. Input currency images will undergo image processing and feature extractions and compared with dataset available. After that we will use machine learning algorithm to train the model and accuracy increase.

Efficiency Issues and Outcomes

Multiple algorithms for machine learning like SVM, Decision Tree and Neural Network will be checked to improve efficiency and comparative analysis. After model training the outcome will be more effective and applicable.

Objectives

1. To identify original currency note using Image processing techniques
2. System compares images of currency note to the stored images of original currency note images
3. To provide Cheaper and Accurate system to the user which can easily accessible and gives accurate
4. Recognition of currency note
5. To develop user friendly web application of currency recognition system.
6. To make available to common people quickly and easily so they can utilize anywhere and at any time

1.4 Project Scope And Limitations

Project Scope

The complete methodology works for Indian currency notes. The method is very simple and easy to implement. This technique is very adaptive to implement in real time world. The process begins from image acquisition and end at comparison of features. This project will be helpful to those people who don^at have any knowledge about currency, so basically this project will be developed by taking common man issues of currency related problem.

Limitations

1. Color Detection
2. Segmentation
3. Edge Detection
4. Template Matching At Higher Level

1.5 Methodologies of Problem Solving

The methodology decided will work as shown in architecture diagram. Input currency images will undergo image processing and feature extractions and compared with dataset available. After that we will use machine learning algorithm to train the model and accuracy increase.

Firstly we are going to create Dataset of tested currency images which are genuine, using Dataset we're going to compare the input currency image. When we take input currency image firstly the system will extract features of input image those features are going to compare with Dataset images using machine learning algorithm. Machine Leaning Algorithm will generate result based on comparison the result if the accuracy of input is 75% - 80% then it will consider as Genuine currency otherwise it will state that the input image is Counterfeit or fake.

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II. LITERATURE SURVEY

Topic: Design and implementation of Indian paper currency au- thentication system based on feature extraction by edge based segmentation using Sobel operator
Author: Tushar Agasti, Gajanan Burand Year:2018
In this paper, the authentication of Indian paper currency is described by applying image processing techniques. Basically three features are extracted including identification mark, security thread and watermark from the image of the currency.
In this system feature extraction is done by edge based segmentation in that the the segment separate into two or three regions but as we can see there are many features or identification marks on currency so with less features analysis we cannot say that the currency is genuine or not.

Topic: Gesture recognition of RGB-D and RGB static images using ensemble-based CNN architecture
Author:Rajesh George Rajan,P. Selvi Rajendran Year: 2019
Gesture-based recognition systems have always been a fascinating and distinct subject with the expo- nential growth in Computer Vision. It is a very complicated and daunting process to understand human expressions in the form of sign language. Different traditional approaches have increasingly been used to understand sign language, but attain high precision is still a difficult challenge and vision-based finger- spelling identification remains difficult, because of inter-class similarities and intra-class variability. The model considers two modalities, RGB and depth. Finger occlusion and hand shapes accurately detected and can be handled by depth information.
The Limitation of the system are, there are limitations on equipment used. Items from background or distinct features of the user may make reorganization more difficult. The distance from camera and cameras resolution and quality also causes variation in image reorganization accuracy.

Topic: Optical Character Recognition and Its Applications. In Detecting and Mitigating Robotic Cyber Security Risks
Author:Gupta R., Gupta D., Dua M. and Khari, M. Year: 2019
These feature extraction techniques are powerful enough to extract features of even distorted char- acters/symbols. For development of the neural classifier, a back-propagation neural network with two hidden layers is used. The classifier is trained and tested for printed Hindi texts. A performance of approximately 90% correct recognition rate is achieved.
Drawback of Optical Character Reorganization that it is not 100% accurate there are likely to be some mistake during the process. All images must be check carefully and manually corrected. This technology is costly.

Topic: Indian Currency Detection using Image Recognition Tech- nique
Author: Kalpna Gautam Year: 2020
In this paper, the hybrid algorithm based on PCA and LBP techniques here which basically increase the recognition accuracy by giving the 100% correct recognition. The database of the images should be enough large i.e., should contain the samples of different forms of currency Including the clean notes, dirty notes, torn notes.
The Problem is found that common people and economy of countries become badly affected because of currency counterfeiting .The Fake currency canˆat be recognize by human eyes.

III. SOFTWARE REQUIREMENTS AND SPECIFICATION

In this chapter we are going to have an overview on- problem definition; system requirements like software requirements, hardware requirements; and system features like text representation, machine learning algorithm.

3.1 Assumptions and Dependencies

Assumptions

User of the system should be trained. Pre-Trained Dataset should be provided for proper output.

Dependencies

- Trained Dataset Should Be Proper
- A Front-End Framework Used To Simplify User-Interface Development Efforts
- Django framework Used To Simplify Front-End Development

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3.2 Functional Requirements

3.2.1 System Feature

- Dataset Upload
- Model building
- Feature Extraction
- Decision Tree
- Classification

3.3 External Interface Requirements

3.3.1 User Interface

System GUI will be the User Interface.For User to interact with system and making it userfriendly to user we are making use of HTML,CSS.

3.3.2 Hardware Interface

Linux:

- GNOME or KDE desktop GNU C Library (glibc) 2.15 or later
- 2 GB RAM minimum
- 4 GB RAM recommended
- 1280 x 800 minimum screen resolution

Windows:

- Microsoft R Windows R 8/7/Vista (32 or 64-bit) 2 GB RAM minimum
- 4 GB RAM recommended
- 1280 x 800 minimum screen resolution
- Intel R processor with support for Intel R VT-x
- Intel R EM64T (Intel R 64) Execute Disable (XD) Bit functionality

Supportive Operating Systems:

The supported Operating Systems for client include:

- Windows XP onwards
- Linux OS Any Version

Windows and Linux are two of the operating systems that will support comparative website.

3.3.3 Software Interfaces

Python programming language of Django Framework provide software interface.

3.3.4 Communication Interfaces

GUI will be our communication interface.

3.4 Non-functional Requirements

3.4.1 Performance Requirements

Performance requirements for proposed system are as follows:

1. System will perform if proper database is been provided
2. System Will give better result if it has proper Dataset format input is given

3.4.2 Safety Requirements

No safety requirements is been needed as our system is purely software oriented

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3.4.3 Security Requirements

We are using login authentication methods for data privacy.

3.5 System Requirements

3.5.1 Database Requirements

- Django
- phpMyAdmin
- mySQL

3.5.2 Software Requirements

- Python
- HTML and CSS
- XAMPP Server
- PyCharm

3.5.3 Hardware Requirements

- Pentium IV or Higher
- RAM: 256 MB
- Space on Hard Disk: minimum 512MB

3.6 Analysis Models: SDLC Model to be applied

1. Planning:

This is the first phase in the systems development process. It identifies whether or not there is the need for a new system to achieve a business as strategic objectives. This is a preliminary plan (or a feasibility study) for a companyˆas business initiative to acquire the resources to build on an infrastructure to modify or improve a service. The company might be trying to meet or exceed expectations for their employees, customers and stakeholders too. The purpose of this step is to find out the scope of the problem and determine solutions. Resources, costs, time, benefits and other items should be considered at this stage.

2. Systems Analysis and Requirements:

The second phase is where businesses will work on the source of their problem or the need for a change. In the event of a problem, possible solutions are submitted and analyzed to identify the best fit for the ultimate goal(s) of the project. This is where teams consider the functional requirements of the project or solution. It is also where system analysis takes placeor analyzing the needs of the end users to ensure the new system can meet their expectations. Systems analysis is vital in determining what a business as needs are, as well as how they can be met, who will be responsible for individual pieces of the project, and what sort of timeline should be expected.

There are several tools businesses can use that are specific to the second phase. They include: CASE (Computer Aided Systems/Software Engineering) Requirements gathering Structured analysis.

3. Systems Design

The third phase describes, in detail, the necessary specifications, features and operations that will satisfy the functional requirements of the proposed system which will be in place. This is the step for end users to discuss and determine their specific business information needs for the proposed system. Itˆas during this phase that they will consider the essential components (hardware and/or software) structure (networking capabilities), processing and procedures for the system to accomplish its objectives.

4. Development

The fourth phase is when the real work begin particular, when a programmer, network engineer and/or database developer are brought on to do the major work on the project. This work includes using a flow chart to ensure that the process of the

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system is properly organized. The development phase marks the end of the initial section of the process. Additionally, this phase signifies the start of production. The development stage is also characterized by instillation and change. Focusing on training can be a huge benefit during this phase.

5. Integration and Testing:

The fifth phase involves systems integration and system testing (of programs and procedures)normally carried out by a Quality Assurance (QA) professional determine if the proposed design meets the initial set of business goals. Testing may be repeated, specifically to check for errors, bugs and interoperability. This testing will be performed until the end user finds it acceptable. Another part of this phase is verification and validation, both of which will help ensure the programˆas successful completion.

6. Implementation:

The sixth phase is when the majority of the code for the program is written. Additionally, this phase involves the actual installation of the newly-developed system. This step puts the project into production by moving the data and components from the old system and placing them in the new system via a direct cut over. While this can be a risky (and complicated) move, the cut over typically happens during off peak hours, thus minimizing the risk. Both system analysts and end-users should now see the realization of the project that has implemented changes.

7. Operations and Maintenance:

The seventh and final phase involves maintenance and regular required updates. This step is when end users can fine-tune the system, if they wish, to boost performance, add new capabilities or meet additional user requirements.

IV. SYSTEM DESIGN

4.1 System Architecture

A system architecture or systems architecture is the conceptual model that defines the structure, behav- ior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that sup- ports reasoning about the structures and behaviors of the system. A system architecture can consist of system components and the subsystems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture; collectively these are called architecture description languages (ADLs).

The methodology decided will work as shown in architecture diagram. Input currency images will undergo image processing and feature extractions and compared with dataset available. After that we will use machine learning algorithm to train the model and accuracy increase.

In System architecture there are 6 blocks namely Input Currency Image, Image Processing, Dataset, Machine Learning Algorithm, Model Training and Result.

Input Currency Image block:

In Input Currency Image Block we are going to give scanned currency note to the system to verify it is genuine or not.

Image Processing Block:

In Image Processing Block the features of input image is going extract for the extraction of image we are going to use OpenCV library.

Dataset:

In dataset the features related currency notes are stored these are the feature which is going to compare with the feature of input currency. In Dataset the features of currency like logo, number, amount etc are stored.

Machine Learning Algorithm:

In machine learning algorithm we are using Decision Tree algorithm it will compare all the features of input currency notes it will generate comparison result and send it to the Model Training.

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Model Training:

In model training the result of comparing will be send how many features are match then in model training it will convert into % then it will generate output based on comparison and send it to the user.

Results:

In this block whatever the comparison decision is that will show to the user.

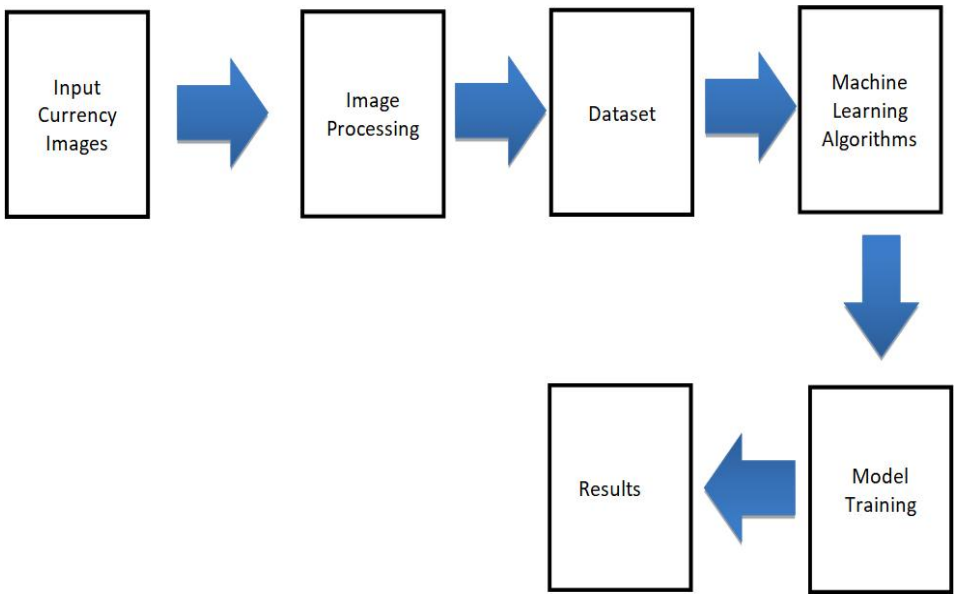

Figure 4.1: Proposed System

4.2 Mathematical Model

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modeling. Mathematical models are used not only in the natural sciences and engineering disciplines but also in the social sciences. Physicists, engineers, statisticians, operations research analysts and economists use mathematical models most extensively. A model may help to explain a system and to study the effects of different components, and to make predictions about behavior. Mathematical models can take many forms, including but not limited to dynamical system, statistical systems, differential equations or game theoretic models.

Set Theory

Set theory is the branch of mathematical logic that studies sets, which are collections of objects. Although any type of object can be collected into a set, set theory is applied most often to objects that are relevant to mathematics. A set is a collection of objects which are called the members or elements of that set. If we have a set we say that some objects belong (or do not belong) to this set, are (or are not) in the set. We say also that sets consist of their elements.

System Description

Let S be system having sets of parameter Set S= { { I } , { R } ,{ P } ,{ O }}

- I is set of all inputs giving to system.
- R is set of rules that drive your input set.
- P is set of all processes in system.
- O is set of output expected from system. Inputs (I) : I1 , I2

Where, I1 = User Info.

I2 = Currency Info.

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Rules (R) : R1 , R2
Where, R1 = Particular Information should only be displayed. R2 = Continuous Internet connection is required.
Processes (P) : P1 , P2 , P3 Where,
P1 = User Information should be updated.
P2 = Particular Module should only view currency information. P3 = Currency Info. should be continuous available.

Output (O) : O1 , O2 , O3
Where, O1 = Currency Prediction O2 = Dataset Modification O3 = Currency Description.
Venn Diagram

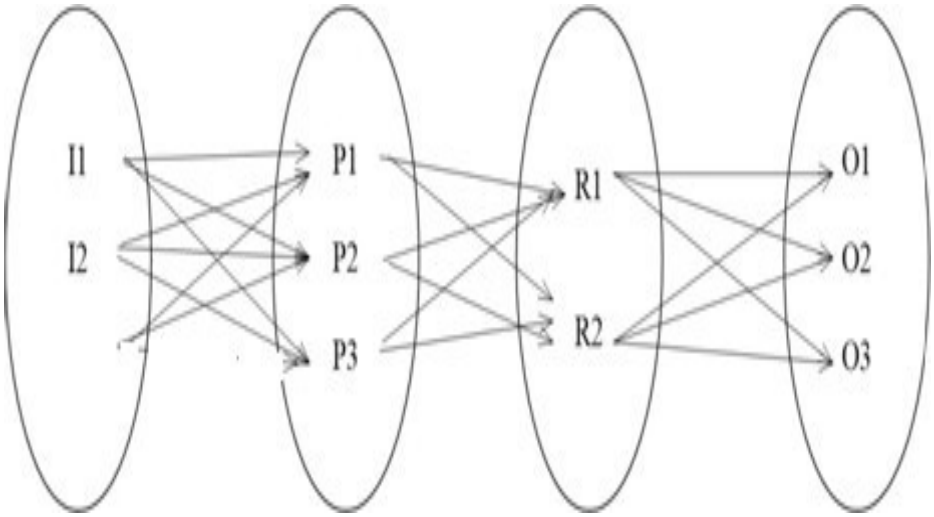

Figure 4.2: Venn Diagram

4.3 Data Flow Diagrams

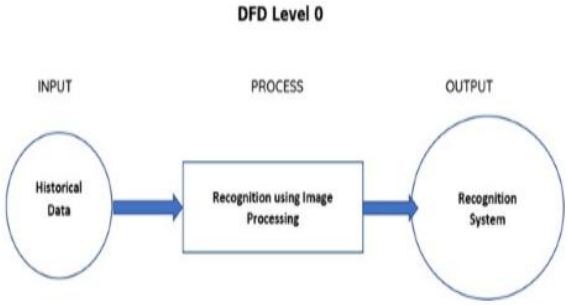

Figure 4.3: DFD 0

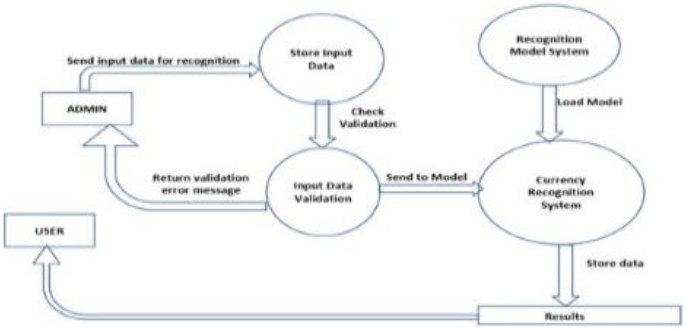

Figure 4.4: DFD 1

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Entity Relationship Diagrams

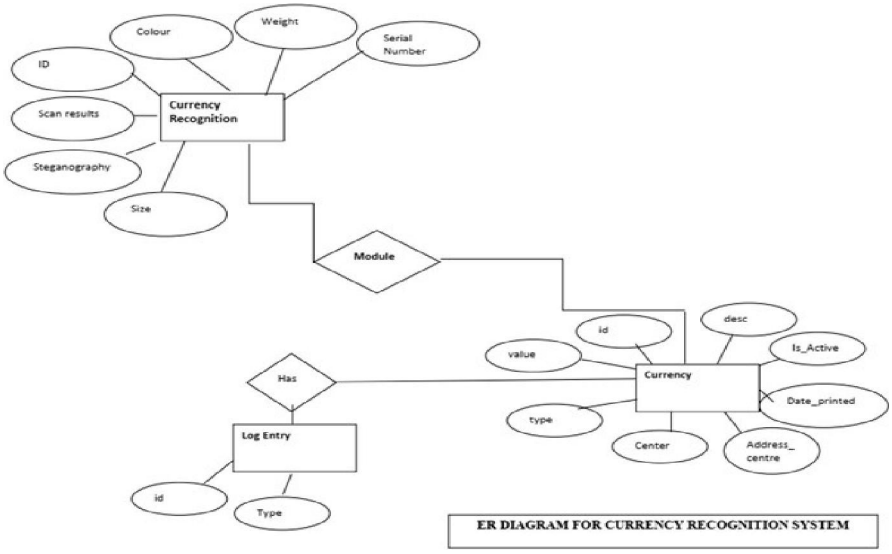

Figure 4.5: ER Diagram

4.4 UML Diagrams

This Section content nine UML Diagram, which clearly specify the exact functionality of the prototype and they are as follows,

1. Class Diagram
2. Use case Diagram
3. Activity Diagram
4. Component Diagram
5. Deployment Diagram

Class Diagram

The Class diagram shows the four classes namely User, Application, Receiver and Console. All Classes are related with each other by association relationship. The uses are bidirectionally connected with sys- tem.

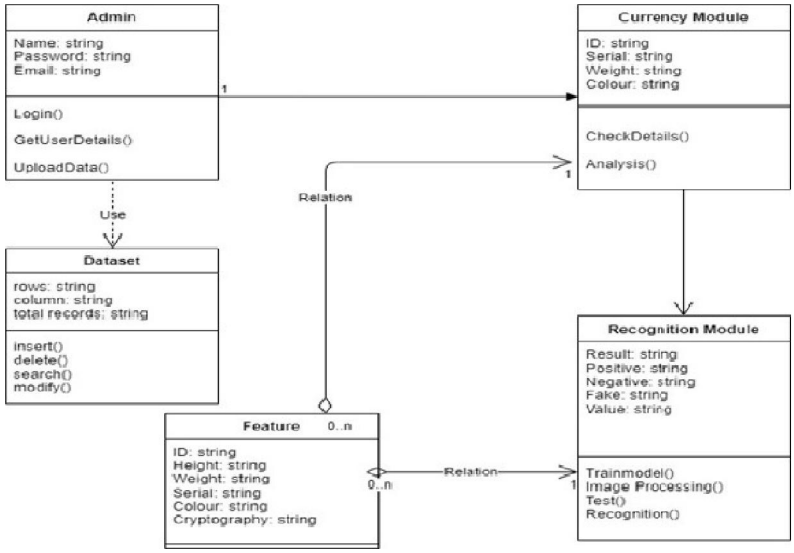

Figure 4.6: Class Diagram

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Use Case Diagram

The use case diagram shows the actual functionality of system, and how the Currency Detection System work and how the users are inter-connected with each other. This diagram gives the exact working of the Currency Recantation System.

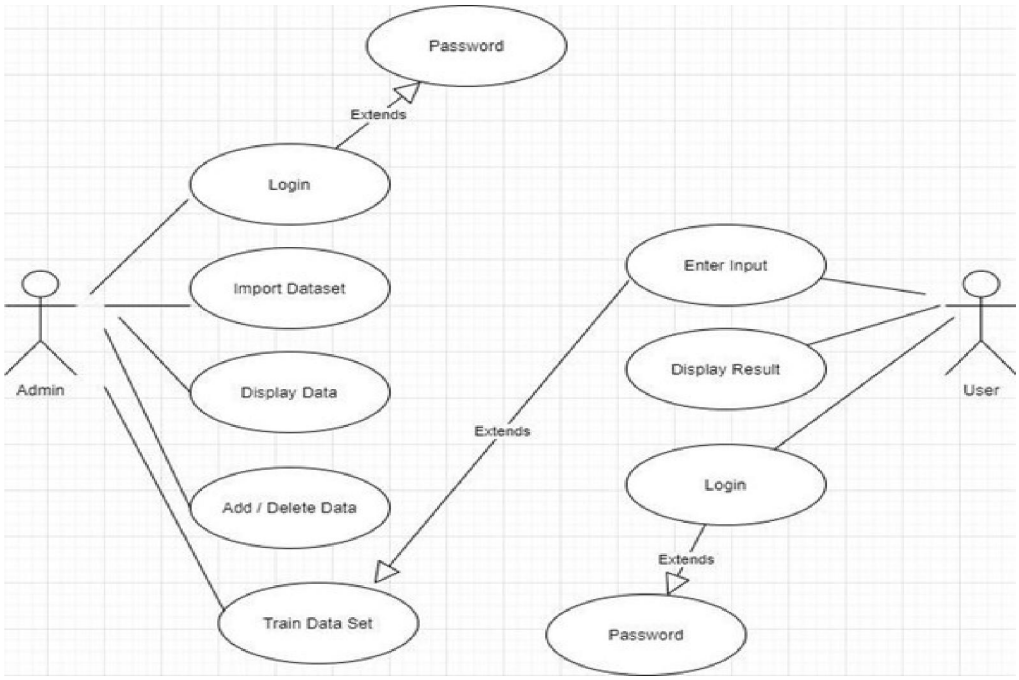

Figure 4.7: Use Case Diagram

Activity Diagram

The Activity diagram shows the overflow of the project. When user opens the application the first Step is towards Login or Register. When we give the input to the system the set of operations are going to perform on input currency and the detected currency detected.

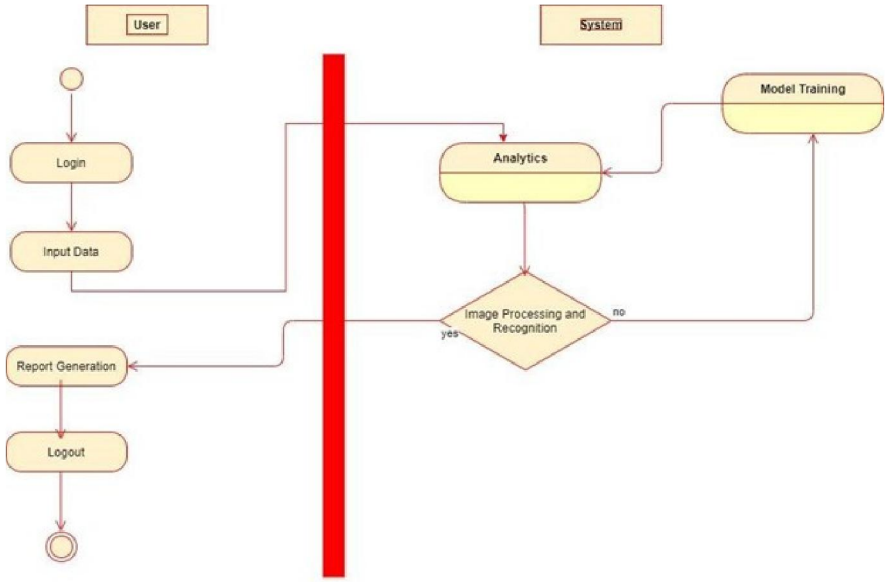

Figure 4.8: Activity Diagram

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Component Diagram

In Component Diagram there are three components. The relation and the dataflow between the com- ponents are figured out using this diagram.

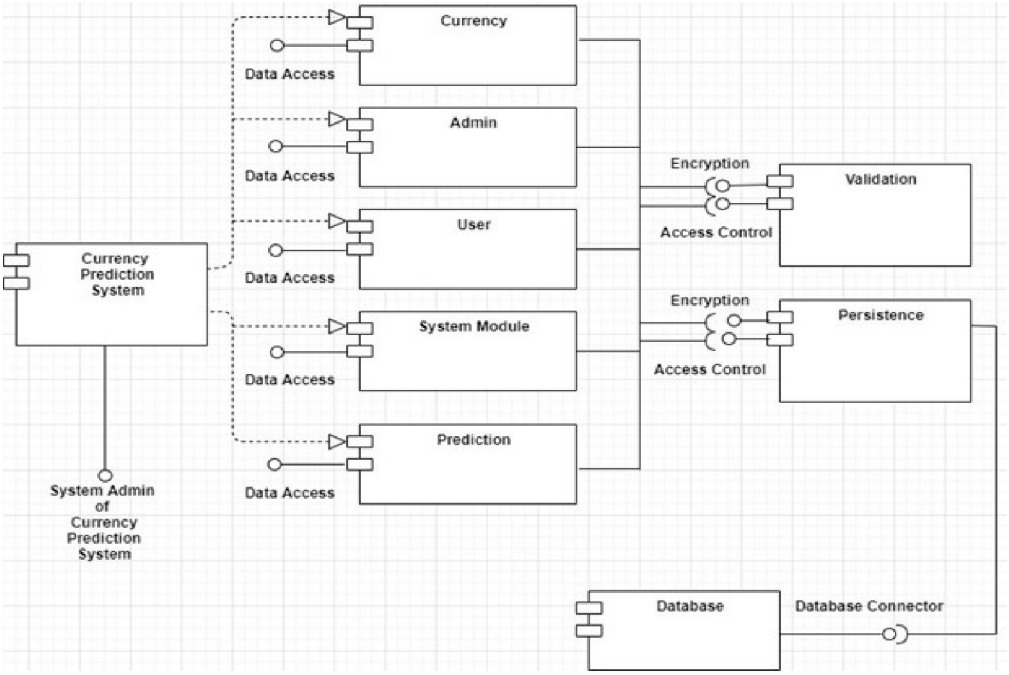

Figure 4.9: Component Diagram

Deployment Diagram

This deployment diagram shows the hardware requirement of the prototype. How this prototype is working with hardware is the main logic behind the deployment diagram.

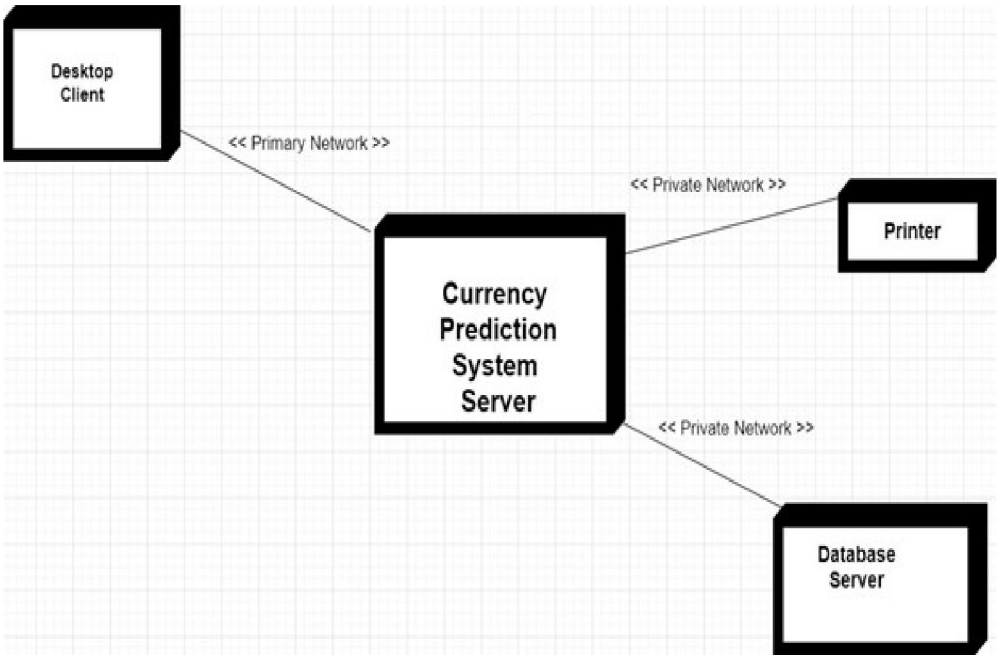

Figure 4.10: Deployment Diagram

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V. PROJECT PLAN

5.1 Project Estimate

5.1.1 Reconciled Estimates

Cost:

The cost of using the process can be as little as the cost of one or two days of a personˆas time up to a maximum of 5-10% of the management costs of the project, even this higher cost, as a percentage of the total project cost, is relatively small. It can be argued that the cost incurred is an investment if risks are identified during the process that may otherwise have remained unidentified until it was too late to react.

Time :

The time taken to carry out a risk analysis is partially dependent upon the availability of information. A detailed cost and time risk analysis usually requires anywhere from one to three months depending upon the scale and complexity of the project and the extent of planning and cost preparation already carried out. However, as indicated above, a useful analysis can take as little as one or two days.

5.1.2 Project Resources

The minimum resource requirement is obviously just one person within an organization with experience of using Project Risk Analysis and Management techniques. However, if expertise does not exist within the organization, it can be readily acquired from outside consultants. It is likely that once Project Risk Analysis and Management has been introduced to an organization, in-house expertise will develop rapidly. As stated, Project Risk Analysis and Management is relevant to all projects and is an integral part of project management. This can make it very difficult to separate the costs of performing it. Some organizations treat these costs as an overhead to the organization, and not to the project.

5.2 Risk Management

Project Risk Analysis and Management can be used on all projects, whatever the industry or environ- ment, and whatever the timescale or budget.

5.2.1 Risk Identification

What Is Project Risk Analysis and Management?

Project Risk Analysis and Management is a process which enables the analysis and management of the risks associated with a project. Properly undertaken it will increase the likelihood of successful comple- tion of a project to cost, time and performance objectives. Risks for which there is ample data can be assessed statistically. However, no two projects are the same. Often things go wrong for reasons unique to a particular project, industry or working environment. Dealing with risks in projects is therefore different from situations where there is sufficient data to adopt an actuarial approach. Because projects invariably involve a strong technical, engineering, innovative or strategic content a systematic process has proven preferable to an intuitive approach. Project Risk Analysis and Management has been developed to meet this requirement.

What It Involved?

The first step is to recognize that risk exists as a consequence of uncertainty. In any project there will be risks and uncertainties of various types as illustrated by the following examples:

- The management and financial authority structure are not yet established
- The technology is not yet proven
- Industrial relations problems seem likely Resources may not be available at the required level
- All uncertainty produces an exposure to risk which, in project management terms, may cause a failure to:
- keep within budget
- The technology is not yet provenience the required completion date achieve the required performance objective

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5.2.2 Risk Analysis

This stage of the process is generally split into two 'sub-stages'; a qualitative analysis 'sub- stage' that focuses on identification and subjective assessment of risks and a quantitative analysis 'substage' that focuses on an objective assessment of the risks.

Sr.No	Risk Description	Probability	Schedule Impact	Quality Impact	Quality Impact
1	Internet Connection not available	Low	Low	High	High
2	False Review	Low	Low	High	High
3	Incorrect Input	Low	Low	High	High

Table 5.1: Risk Table

Probability	Value	Description
High	Probability of occurrence is	75%
Medium	Probability of occurrence is	26 - 75%
Low	Probability of occurrence is	25%

Table 5.2: Risk Probability definitions

5.2.3 Overview of Risk Mitigation, Monitoring, Management

Project Risk Analysis and Management is a process designed to remove or reduce the risks which threaten the achievement of project objectives. The next section of this Guide describes the benefits which Project Risk Analysis and Management can bring to a project and also the wider benefits to the organization and its customers. It should be regarded as an integral part of project or business manage- ment and not just as a set of tools or techniques.

Risk ID	1
Risk Description	Change of Requirements
Category	Software requirement risk
Probability	Low
Impact	High
Response	Mitigate
Risk Status	Occurred

Table 5.3: Overview Table of Risk

Risk ID	2
Risk Description	Human Errors
Category	Software Scheduling Risk
Probability	Low
Impact	High
Response	Mitigate
Risk Status	Identified

Table 5.4: Overview Table of Risk

The Project Risk Analysis and Management Process

Experienced risk analysts and managers hold perceptions of this process which are subtle and diverse. In order to simplify the process, it is divided into:

- Risk Analysis
- Risk Management

5.3 Project Schedule

5.3.1 Project Task Set

Major Tasks in the Project stages are:

Task 1: Paper Selection

Task 2: Make Literature Survey Task 3: System Architecture Task 4: Algorithm

Task 5: Mathematical Model Task 6: Construction

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Task 7: Testing
Task 8: Deployment

5.3.2 Task Network

5.3.3 Timeline Chart

Task No.	Task Name	Start Date	End Date
1	Preliminary Survey	02-08-2021	03-08-2021
2	Introduction and Problem Statement	06-08-2021	10-08-2021
3	Literature Survey	13-08-2021	25-08-2021
4	Project Statement	28-08-2021	30-08-2021
5	Software Requirement and Specification	31-08-2021	31-08-2021
6	System Design	04-09-2021	07-09-2021
7	Partial Report Submission	30-09-2021	10-12-2021
8	Architecture Design	20-12-2021	27-12-2021
9	Implementation	20-12-2021	28-02-2022
10	Deployment	03-03-2022	09-03-2022
11	Testing	10-03-2022	15-03-2022
12	Paper Publish	25-03-2022	12-04-2022
13	Report Submission	24-04-2022	-

Table 5.5: Timeline Chart

VI. PROJECT IMPLEMENTATION

6.1 OVERVIEW OF PROJECT MODULES

Image Acquisition

Performing image acquisition in image processing is always the first step in the workflow sequence be- cause, without an image, no processing is possible. After the image has been obtained, various Methods of processing can be applied to the image to perform the many different vision tasks. There are various ways to acquire image such as with the help of camera or scanner. Acquired Image should retain all the features.

Pre-Processing

The main goal of the pre-processing to enhance the visual appearance of images and improve the ma- nipulation of data sets. Image preprocessing, also called image restoration, involves the correction of distortion, degradation, and noise introduced during the imaging process. Interpolation is the Technique mostly used for tasks such as zooming, rotating, shrinking, and for geometric corrections. Removing the noise is an important step when processing is being performed. However noise affects segmentation and pattern matching.

Feature Extraction

Feature extraction is a special form of dimensional reduction. When the input data to an algorithm is too large to be processed and it is suspected to be very redundant then the input data will be trans- formed into a reduced representation set of features. Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

Modules

1. Graphical User Interface
2. Dataset Upload
3. Image Processing Module

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Graphical User Interface

Users interact with the system by means of a GUI to set up and to provide the input. The GUI of the application is user friendly so that it can be easily access by anyone.

Dataset Upload

Data are observations or measurements (unprocessed or processed) represented as text, numbers, or multimedia. A dataset is a structured collection of data generally associated with a unique body of work.

In Dataset the parameters and features related to the currency note we have to store them for compar- ison with input currency note.

Image Processing Module

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.

6.2 Tools and Technologies Used

OpenCV Library

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV is a free open source library used in real-time image processing OpenCV is a great tool for image processing and performing computer vision tasks.It is an opensource library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.

In this application OpenCV library we are using for Feature extraction of the Indian Currency. Feature extraction is a special form of dimensional reduction. When the input data to an algorithm is too large to be processed and it is suspected to be very redundant then the input data will be transformed into a reduced representation set of features. Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

6.3 Algorithm Details

6.3.1 Algorithm 1: Decision Tree

Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other super- vised learning algorithms, the decision tree algorithm can be used for solving regression and classification problems too.

The goal of using a Decision Tree is to create a training model that can use to predict the class or value of the target variable by learning simple decision rules inferred from prior data (training data).

In Decision Trees, for predicting a class label for a record we start from the root of the tree. We compare the values of the root attribute with the recordˆas attribute. On the basis of comparison, we fol- low the branch corresponding to that value and jump to the next node. The decision of making strategic splits heavily affects a treeˆas accuracy. The decision criteria are different for classification and regression trees. Decision trees use multiple algorithms to decide to split a node into two or more sub-nodes. The creation of sub-nodes increases the homogeneity of resultant sub-nodes. In other words, we can say that the purity of the node increases with respect to the target variable. The decision tree splits the nodes on all available variables and then selects the split which results in most homogeneous sub-nodes.

Step-1: Begin the tree with the root node, says S, which contains the complete dataset. Step-2: Find the best attribute in the dataset using Attribute Selection Measure (ASM). Step-3: Divide the S into subsets that contains possible values for the best attributes.

Step-4: Generate the decision tree node, which contains the best attribute.

Step-5: Recursively make new decision trees using the subsets of the dataset created in step -3.Continue this process until a stage is reached where you cannot further classify the nodes and called the final node as a leaf node.

In this application Decision tree Algorithm we are going to use for comparing the features of Indian Currency.

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VII. SOFTWARE TESTING

7.1 Type of Testing

1. Unit Testing
2. Integration Testing
3. System Testing
4. Performance Testing

Unit Testing

In computer programming, unit testing is a procedure used to validate that individual units of source code are working properly. A unit is the smallest testable part of an application. Unit testing is typically done by developers and not by software testers or End-users.

Integration Testing

Integration testing is the phase of software testing in which individual software modules are combined and tested as a group. It follows unit testing and precedes system testing. Integration testing takes as its input modules that have been Unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing.

System Testing

This phase of testing is a series of various tests, it includes regression testing. These various tests work to verify that system elements have been properly integrated and perform allocated functions. During this phase of testing all the functional requirements will be validated against and their realization verified.

Performance Testing

Performance testing is the process of determining the speed, responsiveness and stability of a computer, network, software program or device under a workload. Performance testing can involve quantitative tests done in a lab, or occur in the production environment in limited scenarios. Typical parameters include processing speed, data transfer rate, network bandwidth and throughput, workload efficiency and reliability.

7.2 Test Cases And Test Results

Sr.No	Description	Input	Expected Result	Actual result	Status
1	User Login	Authentication	Authentication Successful	Authentication Successful	Pass
2	Admin Login	Authentication	Authentication Sucessful	Authetication Successful	Pass
3	Dataset Upload	Dataset	Uploading Successful	Uploading Successful	Pass
4	Output	Process	Expected Outcome	Expected Outcome	Pass
5	Graphic Output	Outcome	Expected Graphical Outcome	Expected Graphical Outcome	Pass

Table 7.1: Test Case and Result Table

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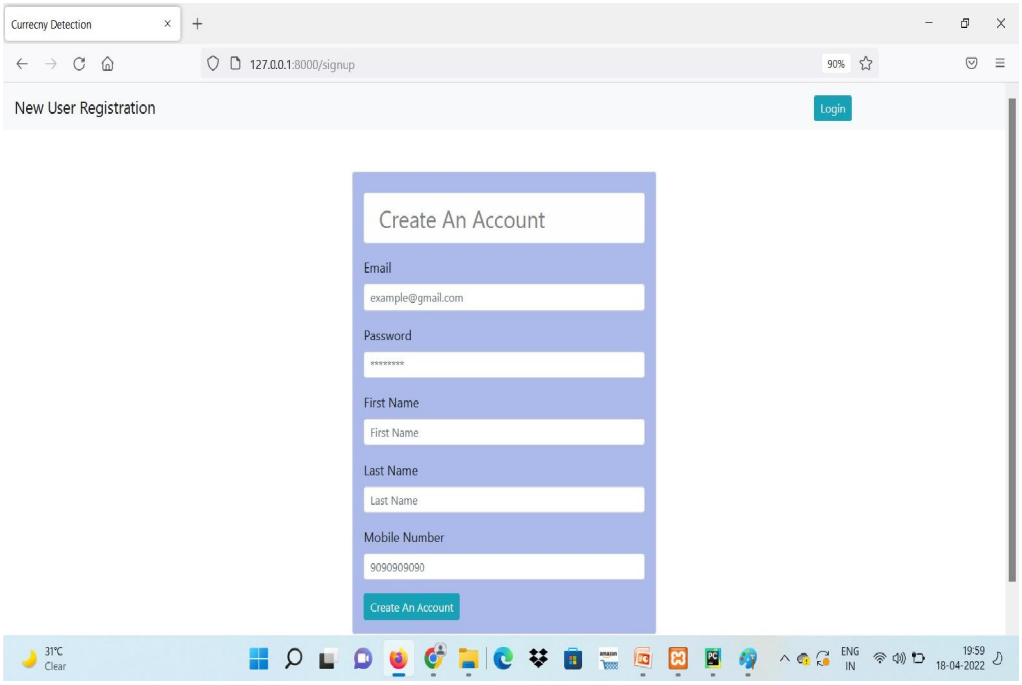
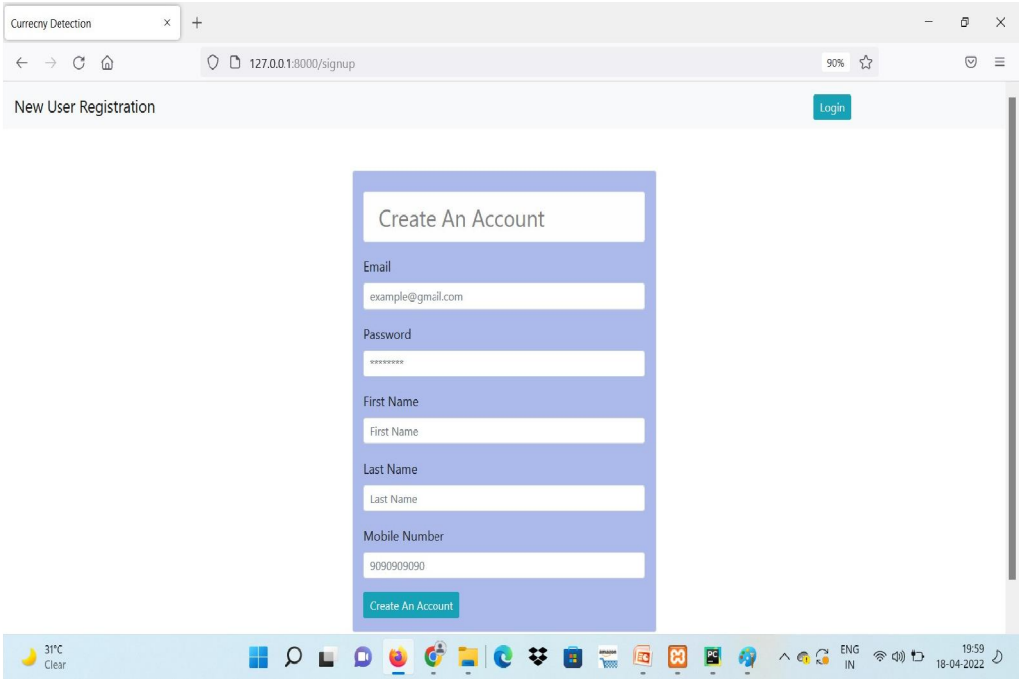
VIII. RESULTS

8.1 Outcomes

We are planning to detect the authentication of currency and preparing a machine learning model to increase the efficiency of the process.

8.1.1 Screen Shots





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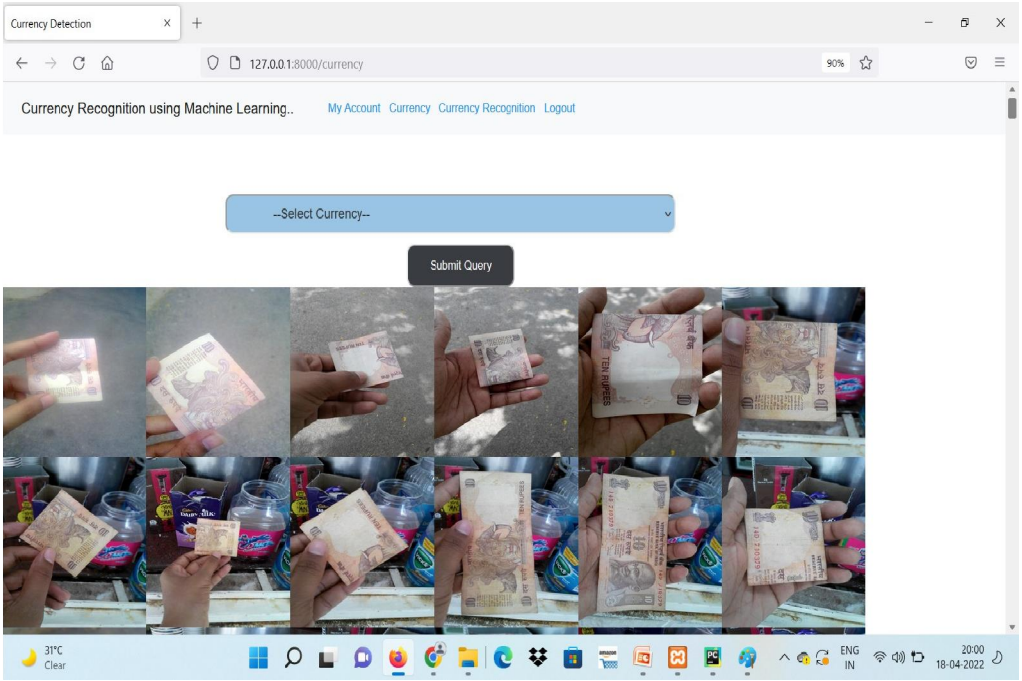
Welcome to dashboard

User Details

First Name	Nayna
Last Name	Ramvanshi
Mobile Number	9999999999
Email	nayna@gmail.com



IX. CONCLUSION

9.1 Conclusion

The paper currency counterfeiting is a big problem for the world. Almost every country has been badly affected by this which has become a very acute problem. The main purpose behind this study is to recognize Indian paper currency with this hybrid approach which is portable and making an application used on the go. The methodology decided will work as shown

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in architecture diagram. Input currency images will undergo image processing and feature extractions and compared with dataset available. After that we will use machine learning algorithm to train the model and accuracy increase. We are planning to detect the authentication of currency and preparing a machine learning model to increase the efficiency of the process.

9.2 Future Work

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 conversion of currency denomination.

9.3 Applications

1. Society
2. Government Regulatory Bodies

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