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Currency Recognition System

Mohini Rathod[1], Ketki Saitwal[2], Mansi Shinde[3], Bhavna Arora[4]

[1,2,3]Student, Department of computer Engineering University of Mumbai, Atharva College of Engineering, Malad, Mumbai, India
[4]Assistant Professor, Department of computer Engineering University of Mumbai, Atharva College of Engineering, Malad, Mumbai, India

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Abstract *At present the Currency denomination recognition has become a dynamic topic for researchers in different potential applications. Financial exchange is an essential piece of our daily activities. But the visually impaired individuals especially suffer in financial exchanges. But they are not ready to adequately recognize different denominations and are frequently betrayed by other individuals. Hence a reliable currency recognition system could be useful as a part of any division wherever money related exchange is of concern. Accordingly, there is a need to outline a framework that is useful in recognition of paper money notes accurately. Currency detection is a measured area of exploration and huge advancement has been accomplished through the years. Android applications can be proven very useful while creating such applications. The Android mobile platform has developed from its first phone in October 2008 to being the most popular smartphone operating system in the world by 2012 and explosive growth of the platform has been a significant win for consumers with respect to competition and various features. The market has been booming in the past few years and there are now over 1,195,932 applications on the Android market. Due to the wide usage, it is necessary to provide users with security applications to manage the data in their personal smartphones.*

***Key Words*: Android application, Currency denomination detection, Currency Denomination recognition, Currency recognition system**.

1. INTRODUCTION

Currently, India has many currency notes like 1,2,5,10,20,50,100,500,2000 Rupees. These notes have their own unique characteristics. Every note has different size, shade and different proof imprints. These peculiarities can be perceived by common people. But the real challenge lies for the visually impaired people. Until now, the variety of characteristics of these notes is insufficient for unsighted people to recognize the notes. Infact, the difference between sizes of continuous categories is confusing and cannot be really distinguished. There is a special section at the upper right corner of the note which is delicate to touch. This is usually used by visually impaired people to identify the notes. But the imprint blurs away with time. Hence, this makes trouble for unsighted individuals to accurately focus on the coin note's category. Hence, considering these problems we have designed a Currency Recognition System which can be used by visually impaired individuals. Our **Currency Recognition System** is an android application which can be used by unsighted people to recognize the type of currency. As much research is done in this field, we have created an android application which can be used by common unsighted people, easily.

2. PROBLEM STATEMENT

Unsighted people face the problem of not being able to recognize the paper currency due to similarity of paper texture between the different categories. These people face a lot of difficulty in their money transactions. In order to find a solution to this problem, we need to develop a technical solution which is cost effective and efficient to use for people

3. LITERATURE SURVEY

3.1. "Application Development Research Based on Android Platform"[1]

This paper presents the architecture of Android platform with methods and classes required in android app development. The paper takes an example of video and audio procurement which introduces us to the design and development of android programs. It mainly applies to the Open CORE and Media Recorder class. They also include classes application, program design, development and analysis. The paper explains the Workflow Diagram of Media Recorder Class. Programs for recording audios applies to the MediaRecorder class several times, so we will introduce it firstly. MediaRecorder is applied for audio/video sampling. It can execute recording for any length and lead users to stop. The workflow of MediaRecorder class is shown as

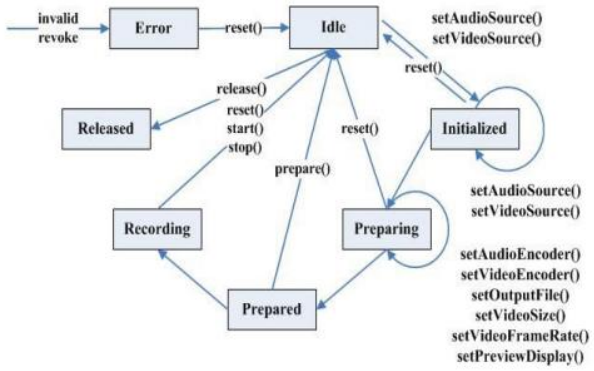


Fig 1.Waterflow Diagram of MediaRecorder Class[1]

3.2. "Design and Implementation of Paper Currency Recognition with Counterfeit Detection"[2]

This paper proposes a system for verification and classification of Indian currency by using image processing. Only paper currencies are considered by the system. This system compares input notes with the reference parameters of the original note. The system claims to give 90% accurate results. The system is specific to Indian currencies only.

The image captured consists of the banknote on a white background. To increase the efficiency of both detection algorithms, the image is subjected to a preprocessing system, which extracts the regions of interest and converts them into a binary form. For example, to analyse parameters such as hue calculation, the RGB image is converted into HSV format while mean pixel intensity is calculated over a grayscale image.

3.3. "Research on Development of Android Applications" [3]

This paper introduces the Android platform along with the features of Android applications, they gave a thorough detailing of Android application framework from a developers' perspective. They illustrated the basic working process of Android application components with an example of a music player with interactive mode among its components. This paper provides guidance to understand Android apps and their operating mechanisms. The paper explains layered architecture of Android system, Dalvik virtual machine in Android system, the lifecycle of an activity.

3.4. "Currency Recognition System Using Image Processing"[4]

This paper proposes an image processing based automated currency recognition system which recognizes value of the paper note as well as country. This method uses characteristics of different notes in the same country such as color, size and texture. Firstly, they identify the country by using templates of and then they identify the value of note. A pixel-by-pixel brute force comparison of the mean square distance for each image is used in this paper. 93% of success rate and 5.3 seconds of average time is claimed by this paper.

4. METHODOLOGY

We have used a waterfall model for the linear sequential flow of the application. Also, the waterfall model has provided good management due to the rigid models. By using this model, we were able to complete the phases of our process simultaneously. The model gave clearly defined stages. The milestones like speech recognition, currency recognition and training the model were easily completed. The processes and results of our project are well documented.

- In the first phase, software and hardware requirements for the project were decided. The application is developed using android studio and language used is core java. The azure API was decided to use for training the models.
- Use cases were decided. User will login to the application and provide a speech input.
- The Block Diagram, Flow Diagram and software architecture were decided in the design stage.
- We started with collecting the data set for the application. We captured photos of the valid currency and started training our azure model.

The application was the installed on an android device and tested for bugs. The system comprises of one major module with their sub-modules as follows:

A. USER:

- Currency Detection: As the name suggests, the currency detection sub-module detects the currency denomination. For detection purposes, Azure Vision API is used. The Azure Vision API is a cloud based computer vision API. It provides different services like image processing algorithms. For training a particular module, images with tag names need to be added to our API. The Computer Vision API will select the best machine learning algorithm based on its understanding. It is faster and more robust to use than other image processing algorithms.

USE CASES:

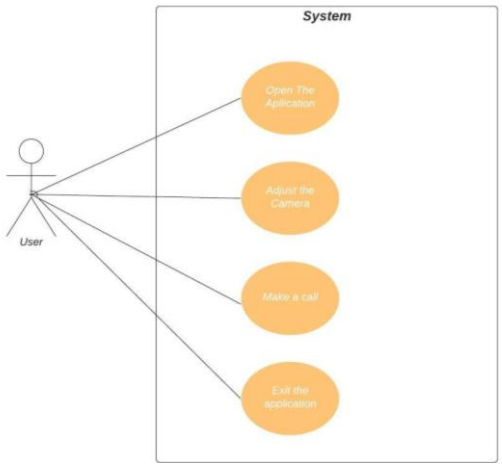


Fig.2 Use Case Diagram

Case ID	**UC_1**
Actor	User
Description	User will open the application.
Pre-Condition	The application should already be installed on user's mobile phone.
Post-condition	User should have a moderate source of light.

Table 1: Use Case UC_1

Case ID	**UC_2**
Actor	User
Description	User will adjust the camera approximately above the currency note.
Pre-Condition	The camera should be already loaded in the mobile phone.
Post-condition	Object Placed in the front of camera is detected.
Success scenario	The currency note is detected.
Remarks	The currency will be recognized successfully.

Table 2: Use Case UC_2

Case ID	**UC_3**
Actor	User
Description	User will make a call to his contact.
Pre-Condition	The contact should be present in the phone's phonebook.
Post-condition	Call is established to a contact person from the phonebook.

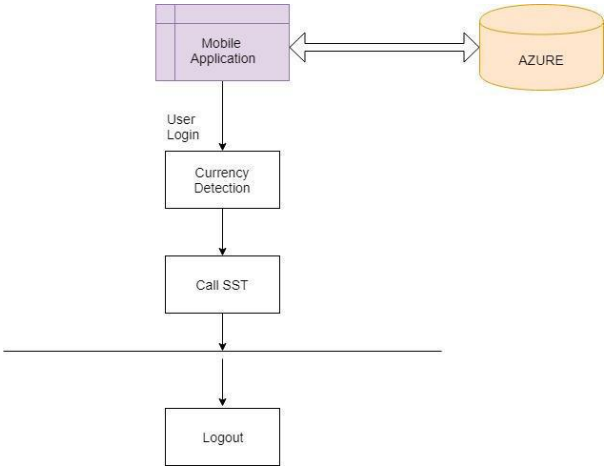
Table 3: Use Case UC_3

5. BLOCK DIAGRAM

EXPLANATION:

The system is accessed by one entity namely, User.

Users can perform tasks such as blind people can speak and give commands to open the camera and the camera will click the picture of note and tell the user by speech medium how much rupee note it is. This system uses speech to text to convert commands given by blind people. Speech recognition is the interdisciplinary subfield of computational linguistics that develops methodologies and technologies that enables the recognition and translation of spoken language into text.



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language into text. The unsighted people can open the application on their mobile easily by using google accessibility. They have two options after opening the application. One option is to make a call through the application. Another one is to detect the currency denomination which is also one of the important modules of our project. A voice command is provided to the user to guide him/her to make a call or detect a currency. In case an individual opts to make a call, the user will be asked to speak out the contact name to the application. If the contact exists in the phonebook of the android phone, the call will be connected. In case the contact does not exist, the voice command will prompt the user that contact does not exist.

When the user opts for currency detection, the mobile application will interact with the Speech Recognizer class. The user will be provided with the timer of three seconds before the application clicks the photo of the currency. The image can be then processed. After Currency Detection option is selected, the speech to text module will interact with the Azure Vision API and produce the denomination in a form of voice command

For the result purpose this system has text to speech concept which helps to read the value of note and then it converts the text value into speech. Android allows to convert your text into voice but Not only you can convert it but also allows you to speak text in different languages.

After the denomination is announced, user can again either make a call, detect a currency. This will be rightly prompted by speech command. We also have the option to exit the system, if the user no longer desires to do any of the provided tasks.

6. IMPLEMENTATION:

We have implemented the project using following software:

6.1 Android Studio:

The Project application is loaded in Android Studio. We used Android Studio for Design and Coding of project.

6.2 Azure Vision API:

The models are trained by using azure vision API. It is a cloud-based API that performs image processing by using advanced machine learning algorithms. The images of notes are uploaded with valid tags and trained.It'll make predictions and produce the output in text to speech format.

6.3 Structure:

The project contains one or more modules with source code files and resource files.

Types of modules include:

i. Android App module

ii. Library Module

iii. Google App Engine Modules

iv. Multiple APK Support:

It allows the efficient creation of multiple APKs based on screen density or ABI. For example, we can create separate APKs of an app for hdpi and mdpi screen densities, while still considering them a single variant and allowing them to share test APK, javac, dx, and ProGuard settings.

6.4 Debug and Profile Tools:

We have used the inline debugging to enhance the code walk-through in the debugger view with inline verification of references, expressions and variable values.

6.5 Code inspection:

Code inspection is done by using The Lint Tool. It checks the Android Project source files for potential bugs and optimization improvements for correctness, security, performance, usability, accessibility and internationalization.By default the android studio displays the project files in the Android Project view as shown in the figure 3

6.6 Project View

The file builds of the project are visible at the top level under Gradle Scripts and each app module contains the following folders:

- Manifests: Contains the AndroidManifest.xml file.
- Java: Contains the java source code files including unit test code.
- Res: Contains all non-code resources, such as XML layouts, UI strings and bitmap images.

The system is mainly constituted of following files:

i. MainActivity.java

ii. CallActivity.java

iii. CameraView.java

iv. ImageHelper.java

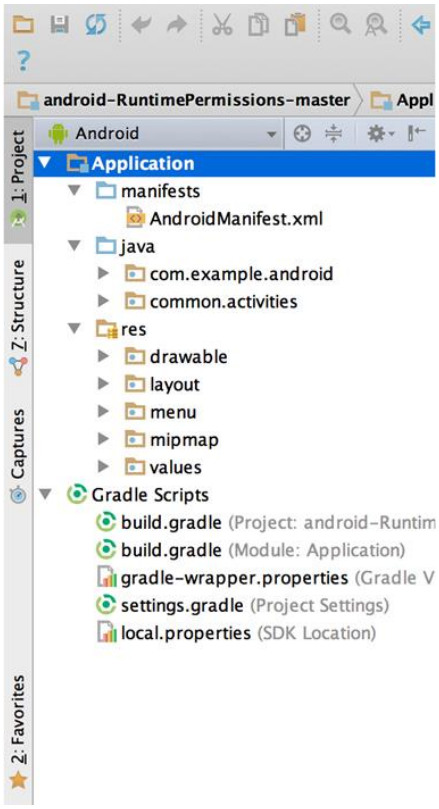

Fig 3:- Project View

MainActivity.java is the entry point of the system. All the other functions are called here. All the text to speech conversion, currency detection and results are included in this file.The android SDK Speech Recognizer is used to convert the speech to text. When a user speaks for a particular number, it'll be converted to text by this inbuilt class, for further operations. The CameraView.java file handles all the camera related operations(clicking the photo, pre capture wait.). The photo will be temporarily saved. Once the photo of currency is clicked, it'll be then compared and analysed with the images uploaded in Azure API with appropriate tags. The Azure API's ML algorithm will predict and return appropriate value for the currency note. An appropriate response will be sent by the application in the form of speech to the user.

7 Requirment

7.1 HARDWARE REQUIREMENT:

- Laptop or PC
- i3 Processor Based Computer or higher
- 1GB RAM
- 5 GB Hard Disk
- Android Phone or Tablet
- 1.2 Quad core Processor or higher

7.2 SOFTWARE REQUIREMENT:

- Laptop or PC
- Windows 7 or higher.
- Java
- Android Studio
- Android Phone Or Tablet
- Android v5.0 or Higher

8 APPLICATIONS AND FUTURE ENHANCEMENTS:

8.1 Applications:

This particular android application can be used in mobile phone by normal as well as visually impaired people.

This application can be used in Bank note counting machine.

It can also used in software of ATM Machines.

8.2 FUTURE SCOPE

The currency recognition system can be improved by adding the fake currency detection mechanism. The fake currency detection system can be then used by common people.

CONCLUSION:

This was our project of System Design about "Currency Recognition" developed in Android application based on Java programming language. The Development of this system takes a lot of efforts from us. We think this system gave a lot of satisfaction to all of us. Though every task is never said to be perfect in this development field even more improvement may be possible in this application. We learned so many things and gained a lot of knowledge about development field. We hope this will prove faithful to us.

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