

## Currency Note Recognition and Authentication for Visually Impaired Users

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### ABSTRACT

Physical Currency is an integral part of our daily life's each and every transaction. Major portion of physical currency transaction happened in the form of currency note exchange. Different currency note denominations can be easily recognized by sighted people by seeing the value on currency note. However, it is very difficult for visually impaired people to identify correct value of currency note without proper and prolonged training. The major issue is with the authenticity of the currency note. All the currency notes come with some authenticity feature which can be felt by visually impaired people by touch, but these features can be sunken for older currency notes. Also, if any new currency note is introduced or existing currency note is replaced, then visually impaired people have to again go through whole process of getting familiar with the new currency note. Hence, it is of vital importance to device a technique or feature which can identify the denomination of currency note and at the same time validate its authenticity. In this seminar, we are studying several currency note identifying techniques or feature currently available. These features are available for currencies of different countries.

**Keywords** – Currency Recognizer, Touch Screen Mobile Phone, Visually Impaired

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### I. INTRODUCTION

According to census 2011, the total population of India was 102 million. Out of this total population around 2.1% people are disabled as sums to around 23 million. The major portion of disabled population is visually impaired with 48.5% of total disabled count and stands at 11 million [7].

One of the major difficulties faced by visually impaired people during daily routine is performing transaction using physical currency. This difficulty is due to the struggle visually impaired people face in identifying the exact value of the various currency notes. The difficulty has increased even more after the demonetization on 8 November 2016. After the demonetization, new currency notes were introduced with different dimension than demonetized currency note. This forced visually impaired people to start over the process of getting familiarized with these not and memorizing its features. This issue can be resolved by providing an accessible application to visually impaired users which can identify the currency note. Even the Reserve Bank of India, in the press release dated 12th May 2019, has urged Technology firms to develop such an application for identifying currency notes [8].

#### 1.1. Visually Impaired Users

Visually impaired users can be sub-grouped as partial visually impaired users and total visually impaired users. The visual acuity of the partial visually impaired user is less than 6/18, but equal to or better than 3/60, or a corresponding visual field loss to less than 20 degrees in the better eye with best possible correction. The visual acuity of total visually impaired user is less than 3/60, or a corresponding visual filed loss to less than 10 degrees in the better eye with best possible correction [4].

The estimates of World Health Organization (2010) depicts that the total number of visually impaired people in world is 285 million, out of which 39 million are total blind and 246 million are partial blind. Estimates also shows 90% of the visually impaired population lives in developing countries.

#### 1.2. Accessible Interface

The increasing number of mobile phones had made it the major means of communication as well as source of information. Hundreds and thousands of applications are developed daily and placed in Google Play for users to download. However, visually impaired users cannot access all these applications. These users face tremendous

difficulties in accessing touchscreen mobile phones unlike the sighted users. These users had to adapt to the error-prone strategies to use mobile phones or find accessible alternatives. The inaccessibility of the mobile phones is due to interaction techniques that require the user to visually locate objects on the screen. This problem can be solved by the accessible interface. Accessible interface enables visually impaired user to access mobile phones with ease. Android version 1.6 had introduced the feature of accessibility. The accessibility has been constantly improving thereafter in later versions. Android based mobile phones provide a self-voice interface upon which programmers / developers can build their own applications [8]. However, currently there are few accessibility applications and features available. These features are still in developing phase and still improving to provide better accessibility. Therefore, it is of vital importance to design accessibility features or an effective interaction technique to make mobile phones accessible for visually impaired users.

## II. CURRENT RECOGNIZER

Currently there are few currency note recognizer available for visually impaired. These applications are in different phases of development, some are freely available in Google Play Store while some are still in development phase. Six such applications are studied from different countries.

### 2.1 Sri Lanka

Sanjaya Perera et. al. in their paper proposed a currency note recognizer for Sri Lankan currency - Sri Lankan Rupee. They used K-Nearest Neighbours Algorithm for currency recognizer [1]. The accuracy of 84.72% was observed during testing results.

### 2.2 Malaysia

Rashidah Funke Olanrewaju et. al. in their paper proposed a currency note recognizer for Malaysia currency - Malaysian Ringgit. They used RGB Value Detection for currency recognizer [2]. The accuracy of 93.33% was observed during testing results.

### 2.3 Myanmar

Khin Nyein Nyein Hlaing et. al. in their paper proposed a currency note recognizer for Myanmar currency - Myanma kyat. They used Hough Transform, Preprocessing, GLCM and k-NN for currency recognizer [3]. The accuracy of 99.2% was observed during testing results.

### 2.4 Saudi

Anas M. Ali Fattouh in the paper proposed a currency note recognizer for Saudi currency -

Saudi Riyal. They used Non-Parametric approach for currency recognizer [4]. The accuracy of 90% was observed during testing results.

### 2.5 Egypt

Noura A. Semary et. al. in their paper proposed a currency note recognizer for Egypt currency - Egyptian Pound. They used Image acquisition, Pre-processing, Segmentation, Histogram equalization, ROI Extraction and Template Matching for currency recognizer [5]. The accuracy of 89% was observed during testing results.

### 2.6 America

Wei Q. Yan et. al. in their paper proposed a currency note recognizer for America currency - Dollar. They used Feedforward Neural Network (FNN) for currency recognizer [6]. The accuracy of 98.6% was observed during testing results.

## III. COMPARISON STUDY

Table 1 and 2 shows that comparative study of the six currency note identifiers of different countries. In this table, six applications are compared on the basis of their techniques, accuracy and denomination tested. This comparison can be used for further development.

TABLE I. COMPARISON TABLE 1

Country	Sri Lanka	Malaysia	Myanmar
Currency	Sri Lankan Rupee	Malaysian Ringgit	Myanma kyat
Technique	K-Nearest Neighbours Algorithm	RGB Value Detection	Hough Transform, Preprocessing, GLCM and k-NN
Accuracy	84.72%	93.33%	99.2%
Denominations Tested	20, 50, 100, 500, 1000 and 5000	1, 5, 10, 20, 50, 100, Nigerian Naira and Blank Paper	100, 200, 500, 1000 and 5000

TABLE 2 COMPARISON TABLE 1

Country	Saudi	Egypt	America
Currency	Saudi Riyal	Egyptian Pound	Dollar
Technique	Non-Parametric Approach	Image acquisition, Pre-processing, Segmentation	Feedforward Neural Network (FNN)

		tion, Histogram equalization, ROI Extraction and Template Matching	
<b>Accuracy</b>	90%	89%	98.6%
<b>Denominations Tested</b>	50, 100 and 500	5, 10, 20, 50, 100 and 200	5, 10, 20, 50 and 100

#### IV. CONCLUSION

In this paper, study of various currency notes recognition and authentication technologies and applications available is done. All the studied work was available for foreign currencies and none of those was for Indian currency, we should develop some application for it. Moreover, Reserve Bank of India has also urged for development of such application. Hence, this study can help for the development of new Android application which will assist visually impaired in recognition and authentication of currency notes.

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