MEKELLE UNIVERSTY

MEKELLE INSTITUTE OF TECHNOLOGY-MIT

MINI PROJECT PROPOSAL ON

CURRENCY RECOGNITION SYSTEM FOR VISUALLY IMPAIRED

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COURSE NAME: MINI PROJECT

DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING

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SUBMISSION DATE: 19/3/2021

Contents

Abstract

In this paper we introduced a mobile system for currency recognition that recognizes Ethiopian currency in different view and scale. In this paper, we developed a dataset for Ethiopian currency on an Android Platform. After that we applied automatic mobile recognition system using a smart phone on the dataset using scale-invariant feature transform (SIFT) algorithm. SIFT has been developed to be the most robust and efficient local invariant feature descriptor.

Colour provides significant information and important values in the object description process and matching tasks. Many objects cannot be classified correctly without their colour features. One of the most important problems come up against visual impaired people is currency identification especially for currency note. In this system we introduce a simple currency recognition system applied on Ethiopian banknote.

Introduction

The ability to identify currency (both coins and bills) without human input is unfavourable for a number of applications. Probably the most important one is assisting visually impaired people. As we have gathered the data's from Ethiopian association of disabled people the number of visually disabled persons was found to be higher [1]. About 50 persons per area persons were visually disabled. Among them 61 percent were blind and 29 percent had low vision [1]. Recent development of mobile platforms makes the idea of currency recognition with a smart phone an appealing one. In this study we develop a simple approach of template matching with SURF key point detector for Android platform.

We are representing an app in which currency is recognized by app and result is sent through audio devices. One of the main problems resist by people with visual impaired is the incapacity to identify the paper currencies due to the approximation of paper texture and size between the different currencies. Hence, the role of this system is to develop a solution to resolve this trouble to make blind people feel safety and determination in the financial approach.

There are two types in currency recognition research field; Scanner-based and Camera-based [2]. Scanner-based systems supposed to scan the whole paper. Such systems are suitable for the equipment of currency counters. While camera-based systems except capturing the currency by a camera which may capture a part of the currency [3]. Most related works in documentation assign with the scanner-based type [2-5]. For visual disabled usage, it's assume to enable users to capture any part of the currency by their mobile phone and let the system identify it and notify the currency value. In this paper, camera-based Ethiopian currency is trained to be identified using very simple image processing equipment's what makes the processing time is very short with allowable authority.

We first obtain a dataset of currency images taken by blind and normally sighted subjects. From this dataset, we manually label and extract the text regions. Next we perform statistical analysis of the text regions to determine which image features are

reliable indicators of text and have low entropy (i.e. Feature response is similar for all text images).We obtain weak classifiers by using joint probabilities for feature responses on and of text. These weak classifiers are used as input to an Ada Boost machine learning algorithm to train a strong classifier. In practice, we trained a cataract with 4 strong classifiers containing 9 features.

An adaptive binarization and extension algorithm is applied to those regions selected by the cascade classifier. Commercial OCR software is used to read the text or reject it as a non-text region. The overall algorithm has a success rate of over 90 percent.

Literature Review

This system gives an algorithm for detecting and reading text in natural images [4]. There are three main categories of these systems: electronic travel aids (ETAs), electronic orientation aids (EOAs), and position locator devices (PLDs). This system presents a comparative survey among portable/wearable obstacle detection/avoidance systems (a subcategory of ETAs) in an effort to inform the research community and users about the capabilities of these systems and about the progress in assistive technology for visually impaired people. The survey is based on various features and performance parameters of the systems that classify them in categories, giving qualitative- quantitative measures. Finally, it offers a ranking, which will serve only as a reference point and not as a critique on these systems. The current system presents a novel texture-based method for detecting texts in images. A support vector Machine (SVM) is used to analyse the textural properties of texts. No external texture feature extraction module is used, but rather the intensities of the raw pixels that make up the textural pattern are fed directly to the SVM, which works well even in high-dimensional spaces. Next, text regions are identified by applying a continuously adaptive Mean shift algorithm (CAMSHIFT) to the results of the texture analysis. The combination of CAMSHIFT and SVMs produces both robust and ancient text detection, as time-consuming texture analyses for less relevant pixels are restricted, leaving only a small part of the input image to be texture-analysed.

Independent travel is a well-known challenge for blind or visually impaired persons. In this system, we propose a computer vision based indoor way finding system for assisting blind people to independently access unfamiliar buildings. In order to find Different rooms (i.e. and once, a lab, or a bathroom) and other building amenities (i.e. an exit or an elevator), we incorporate door detection with text recognition [5].

First we develop a robust and ancient algorithm to detect doors and elevators based on general geometric shape, by combining edges and corners. The algorithm is generic enough to handle large intra-class variations of the object model among different indoor environments, as well as small inter-class differences between different objects such as doors and elevators.

Next, to distinguish once door from a bathroom door, we extract and recognize the text information associated with the detected objects. We first extract text regions from indoor signs with multiple colours. Then text character localization and layout analysis of text strings are applied to filter out background interference. The extracted text is recognized by using of-the-shelf optical character recognition (OCR) software products. The object type, orientation, and location can be displayed as speech for blind travellers [7]

Problem Statement

The billing system for ethiopian visualy impired people is very difficult.untill now it follows a traditional way. There are so many cases for this system to be difficult.When the visual impired man wants to deal with his currency he asks another person, this consumes human labour,time and there is phychological effect , in addition to this cheating the money from the victim,pisychological disblife are occurred.,time consumeing for the person who try to help the blind person.

Such problems could be solved by ethiopian currency recongnition system .the visualy impaired people can use the system at any place and time they want.

Research questions

1) Is Ethiopian currency recognition system good replacement for current billing system?
2) Why visually impaired people hesitate current billing system
3) How can currency recognition system solve various problems of current billing system

Overview

In this content, the source of data methods of collection, the evaluation of the existing billing system and the organization structure of the system problem are presented .it includes specific methods which were used in order to achieve the objectives of the project such as preprocessing the data set, feature extractions using grab cut algorithms, and particular
requirements for implementations of the project and a brief explanation of why such methods were used for implementing the proposed system

Objective and Aim

Aim

The overall objective of currency recognition system is for the provision of improving the billing system for visually impaired people through fast, timely convenient billing system by insuring the visually impaired person the birr you see it is the one you bill it .

Objective

The specific objectives of the project include:

- ⇨ We collect the data reviewing the existing /current billing system in Ethiopia.
- ⇨ We develop a model to come up with an Ethiopian currency recognition system.
- ⇨ Implementing an Ethiopian currency recognition
- ⇨ Validating the system to insure that a visually impaired person satisfies by the system we develop.
- ⇨ Analysing the proposed system by comparing with traditional way of billing system.

Methodology

Overview

In this content, the source of data methods of collection, the evaluation of the existing billing system and the organization structure of the system problem are presented .it includes specific methods which were used in order to achieve the objectives of the project such as pre-processing the data set, feature extractions using grab cut algorithms, and particular requirements for implementations of the project and a brief explanation of why such methods were used for implementing the proposed system.

Source of data

The required information concerning with working currency recognition system for visually impaired was gathered both qualitative and quantitative types of data .that means to evaluate the Ethiopian currency recognition system we use quantitative data and to express and analyse the proposed system we use qualitative data. Then these data were gathered by using both primary and secondary data sources.

Collection of data

In our project we have used various ways of collecting data. We use those methods of data collection from the stakeholders of the system those include:

- Visually impaired people
- Association of disabled people

We use the following methods of data collection to gather the data for the system requirement to analyse from the stack-holders of the system.

Questionnaires

A questionnaire is a method to collect data from the target users in a specific knowledge domain. According to Peerce et al Questionnaire is a well-known technique to collect demographic data and users' opinions. The design of a questionnaire is important because it addresses the research questions and hypothesis on which data is to be collected. The questions can be closed or open ended. The initial part in a questionnaire is mostly concern with demographic and experiential information. This information could be used to find out the users' experience with the current system.

Some of the major areas covered by the questionnaires were:

- Shortcomings associated with the current use of currency for visually impaired
- Views on currency recognition system
- The proposed system
- Characteristics of a good output with regard to the system we administered the questionnaires to visually impaired people.

Interviews

Interviews are used to gain more insight into the user requirements. They involve having face to face conversations with various stakeholders and getting more information. One advantage of using interviews was that participants' unique point of view can be explored in detail and any point of misunderstanding was clarified. We administered the interviews on some visually impaired people. They all were mostly open ended and semi structured to allow the users provide as much information as possible without feeling pressured.

Observation

This involves observing the various stakeholders and their various roles they perform in the process of using the currency recognition system.

Documentation

Studying documentation involved studying the companies' (institutions) for example governmental organizations (e.g. association of disabled people) documented procedures (rules) for transacting business, implement the system procedure.

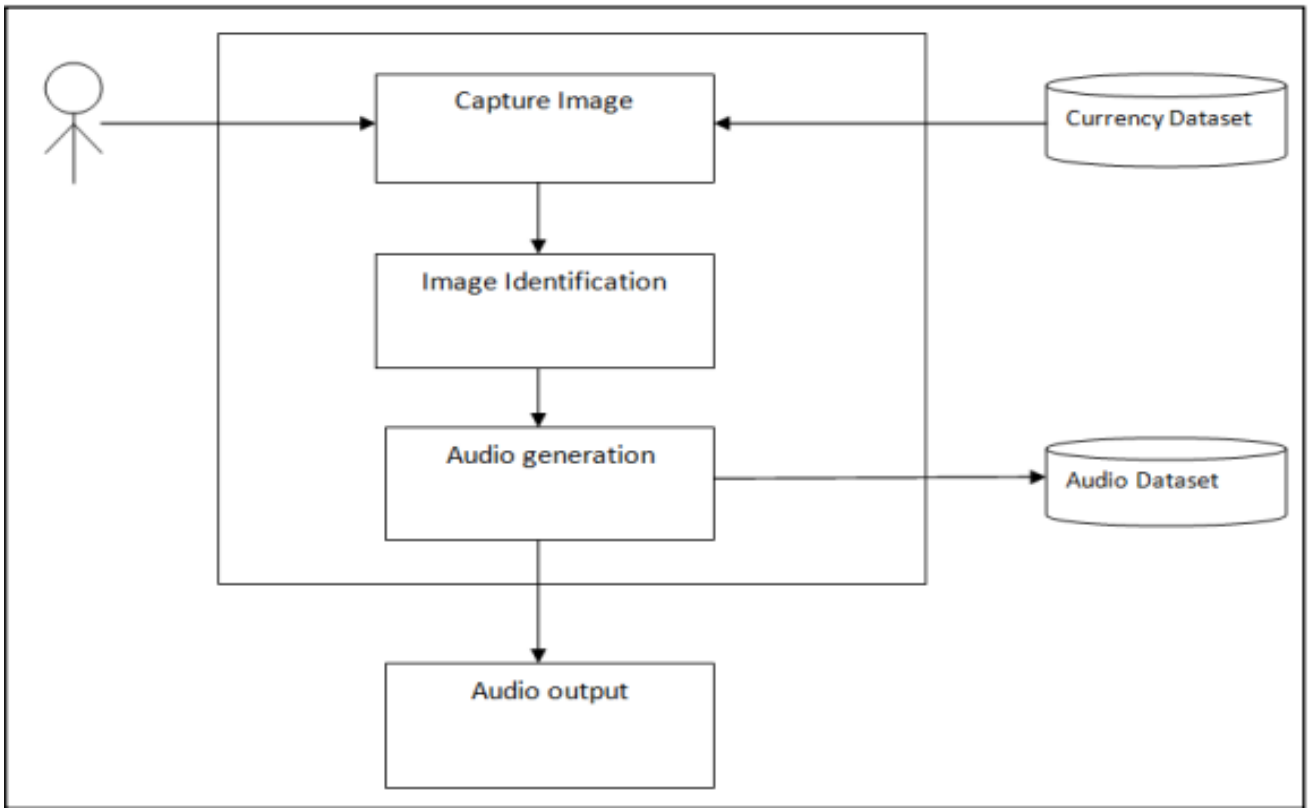
It involved studying the documents that have to be filled in, It also involved getting to know from association of disabled people what the necessary steps are in order for one visually impaired people to use the system.

Through the documentation, we were able to see what inputs were required for the purpose of using currency recognition for visually impaired people.

Data Analysis method

After we necessarily collect both the primary and secondary data, we will analysis and design the data using models and diagrams.

The most popular language used to analysis and design data into diagrams is Unified Modelling language (UML).



Architecture

Image retrieval

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different tasks. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible. There are various

ways to obtain image such as with the help of camera or scanner. Acquired image should keep all the features.

Pre-processing

The main goal of the pre-processing to increase the visual appearance of images and improve the impact of datasets. Pre-processing of image are those operations that are normally required earlier to the main data analysis and extraction of information. Image pre-processing, also called image restoration, and involves the correction of distortion, degradation, and noise introduced during the imaging process. Image pre-processing can notably increase the accuracy of an optical inspection. Image Adjusting is done with the help of image interpolation. Interpolation is the technique mostly used for tasks such as zooming, rotating, shrinking etc. Removing the noise is an important step when image processing is being performed. However noise can affect segmentation and pattern matching. When performing smoothing process on a pixel, and neighbour of the pixel is used to do some conversion. After that a new value of the pixel is created.

Remove background

As illustrated in architecture, the images are captured in a wide variety of environment, in association to lighting condition and background while the currency in the image itself could be damaged. Image segmentation is important for reducing the data to process and remove unwanted features (background region) that would involve the decision-making. We start with a fixed rectangular region of interest (ROI) which is forty pixels smaller from all four sides than the image itself. We assume that a major part of the currency will be present inside this region. Once this region is obtained, it must be extended to a segmentation of the entire image. For removing the unwanted background here we are use Grab cut algorithm.

Feature Extraction

Feature extraction is a special type of dimensional reduction. When the input of an algorithm is too large to be processed and it is not needed then the input data will be converted 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 selected it is supposed to the features set will extract the related information from the input data to perform the required task using this reduced representation instead of the full size input.

Match input image with datasets

In order to confirm image similarity, we check whether the key points in the test image are in spatial consistency with the retrieved images. We use the popular method of geometric verification (GV) by fitting fundamental matrix (adopted from [16]) to find out the number of key points of the test image that are spatially consistent with those of the retrieved images. 5) Classification: In the voting mechanism, each retrieved image adds votes to its image class (type of bill) by the number of spatially consistent key points it has (computed in the previous step). The class with the highest vote is declared as the result.

Audio output generation

The recognized text codes are recorded in script files. Then we employ the text to speech converter to load these files and display the audio output of text information. Blind users can adjust speech rate, volume and language according to their preferences.

Tools and technologies used

The currency recognition system for visually impaired person was developed as an electronic system used to access the billing system conveniently for visually impaired person.

SOFTWARE

In our project the software we have used:

1) Anaconda: we use anaconda software for prepossessing and analysing of the dataset.

2) Ms Word: we use MS word for providing our proposal.

3) Python language: we use python language for backend of the currency recognition system.

4) HTML: -This is currently the core of the web world, it is a language used to makeup web page. So we use it for front end system build.

HARDWARE

Desktop or laptop with at least 2.0 GHz Processor speed, At least 40 GB Hard Disk Capacity and 512 RAM and Printer.

Android based smart phone with more than 8 GB memory capacity.

Work plan

In our research proposal we produced a work plan. We arrange the tasks (vertical) within a week time (horizontal). We planned our total tasks to end within 5 weeks, for more clarification the table below is produced:

Time / Activity	Week / duration	1	2	3	4	5
Literature Review	8/2/2021-15/2/2021					
Problem Formulation	16/2/2021-23/2/2021					
Data collection	24/2/2021-27/2/2021					
Design	28/2/2021-3/3/2021					
Analysis and testing	4/3/2021-13/3/2021					
Documentation	8/2/2021-13/3/2021					

Table1: Work plan/ time table

Expected results

We expect our system will help to solve different problems of the current paper- based billing system for visually impaired people in Ethiopia, and we suggested replacing this with an electronic system to solve these issues. We also expect our system will help to suggest that every visually impaired person should have an android based smart phone automatically to work the currency recognition system efficiently.

REFERENCES

[1]. A report on "DISABLED PERSON" based on data collected in state survey.

[2]. P. Viola and M. J. Jones, “Robust real-time face detection,” In IJCV 57(2), pp. 137–154, 2004.

[3]. S. Singh, S. Choudhury, K. Vishal and C. V. Jawahar, Currency Recognition on Mobile Phones, 22nd International Conference on Pattern Recognition (ICPR), Sweden, (24 August 2014), pp: 2661-2666, IEEE

[4]. “10 facts about blindness and visual impairment”, World Health Organization: Blindness and visual impairment, 2009. www.who.int/features/factfiles/blindness/blindness_facts/en/index.html [5]. S. Kumar, R. Gupta, N. Khanna, S. Chaudhury, and S. D. Joshi, “Text Extraction and Document Image Segmentation Using Matched Wavelets and MRF Model,” In IEEE Trans on Image Processing, Vol. 16, No. 8, pp. 2117-2128, 2007.

[6]. H. Shen and J. Coughlan. "Grouping Using Factor Graphs: an Approach for Finding Text with a Camera Phone." In Workshop on Graph-based Representations in Pattern Recognition. pp. 394-403, 2007.

[7]. Z. Solymár, A. Stubendek, M. Radványi, and K. Karacs, "Banknote recognition for visually impaired," in Circuit Theory and Design (ECCTD), 2011 20th European Conference on, 2011, pp. 841-844

Appendices

Questionnaire

1. How many visually impaired people are in Ethiopia?

2. What affects the visually impaired people to use the paper money?

3. Efficient way of using proposed system to replace the current use of bill note

4. Which kind of problems do you faced when you see the paper money by your habit not by the electronic system?

Glossary

Bill note	Ethiopian birr
HTML	Hypertext mark-up language
Anaconda	a software used to pre-process data
ROI	Rectangular region of interest
SIFT	Scale invariant feature transform