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OPTICAL CHARACTER RECOGNITION USING ANDROID

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ABSTRACT

The paper deals with the development of a mobile application based on Android platform for capturing digital photography and its subsequent processing by OCR (Optical Character Recognition) technologies. The developed solution provides capability of calculating equations and getting synonyms of difficult words.

KEYWORDS: ABBYY's Engine, Android OS, Optical Character Recognition (OCR)

INTRODUCTION

In today's world of automation, time is equivalent to money. Doing the work on the go is the need of the hour. The major problem these days arises in the organization is, for performing even the small task the user has to input the data manually into the corresponding software on the computer. This becomes very time consuming and tedious task for the user. Results for strategic decisions are required every now and then, but, on the other hand, it takes a long time for the user to obtain the results. Archaic aims on solving all the above problems on the go by just using their mobile phones.

The project aims at using scanning and comparing techniques intended to identify printed text and equations into a digital format, in other words, getting answer of equation and meaning of words. In comparison with other calculation software's that are available for PCs and mobiles, Archaic has the potential to give the output just by scanning the data taken as input in the form of equations or words from a mobile camera rather than making the user input the data manually.

This Project is being implemented with the following aim in mind

- **Calculator:** The Calculator feature help users by calculating answers to the equations involving mathematical calculation like addition, subtraction, multiplication and division by just capturing the image by mobile camera and getting the solution immediately.
- **Dictionary:** The Dictionary feature is used to provide users to understand what they are reading and hence provide with the meaning of the particular word by just clicking a picture of it.

EXISTING MOBILE APPLICATONS BASED ON OCR

- **SnaPanda**

SnaPanda is an entertaining and educational Smartphone application for those who seek to enrich their English. SnaPanda's API was designed to integrate with any Android application. Developed by Edulan, it has following features: Tactically extract a word from a physical document (newspaper, magazine), obtain the definitions and expressions of that English word, and personalize new vocabulary lists.

- **Camera Dictionary OCR**

An application [1] for cell phones with Android, Symbian and Windows Mobile systems. It operates on the basis

of recorded text recognition and its immediate translation to another language. Even though, this recorded language is available in Chinese or English, the translation is extended by couple of other languages. Furthermore, it enables the text recording with consequent signing of the translated text or so called "Video" regime during which the cursor appears on the screen. The text below the cursor is immediately translated. However, the main disadvantages are the price and the necessity of internet connection when used.

- **Babel Reader-LE**

Babel Reader-LE [2] is a particular version of Babel Reader for Windows Mobile distributed as a freeware. It enables capturing of an image and subsequent storing of this image in a form of text. Babel Reader-LE is a very simple application. Moreover, it is possible to adjust the captured image before the actual recognition e.g. by background noise removal. As in the case of Nokia solution a clipboard and keyboard option is not possible.

PROBLEMS OF EXISTING MOBILE OCR SOLUTIONS

SnaPanda Applicaion crashes frequently and it's not compatible with respect to the GUI. Camera Dictionary OCR is a commercial application which is very specialized and not free. Finally, the last mentioned application called Babel Reader was only invented for text recognition. The selection of these applications with OCR for cell phones is significantly limited and the broader application with OCR, which would work as an alternative for a virtual keyboard, is still missing. These reasons lead us to develop a new application which is described in this article. We expect to develop a solution which fills a space on current market.

METHODOLOGY

Due to the extent of this application, it is planned to use the existing OCR engine. Following types of engines were chosen as the most suitable:

- Tesseract OCR [9] – OCR Engine developed by HP Company in since 1985 until 1995. Nowadays, it is being improved by Google. It is offered in C/C++ language.
- Ocrad [10] – another open-source OCR engine. One of his main advantages is mainly an automatic transformation of an input image. It does not accomplish post-processing on the basis of language dictionaries. It is written in C/C++ language.
- Puma.NET [11] – an engine for implementation in C# projects with .NET framework.
- ABBYY Mobile OCR Engine [12] – a commercial engine used here just for comparison of results. Not available for end users, tested by ABBYY FineReader Online service.

The ABBYY's OCR engine was selected due to following reasons:

Compact and undemanding but efficient and powerful – these are the key features of ABBYY Mobile OCR Engine. With ABBYY Mobile OCR Engine you can make your products more valuable to customers, upgrade and expand the functionality and areas of use of your application:

- Choose the ABBYY Mobile OCR SDK, which is based on the world-renowned FineReader OCR technology, and **receive high accuracy and quality of recognition combined with sophisticated OCR functionality**.
- Evaluate the effectiveness of ABBYY Mobile OCR: **low resource requirements, optimized memory management, and efficient loading for high performance**.

- Widen your markets with ABBYY Mobile OCR Engine's **multiple OS support**: Android, iOS (iPhone), Mac, Windows.

Implementation Steps of ABBY

In this paper, we propose a text detection / recognition translation algorithm as represented in Figure 1 that consists of following steps:

- Image Import and Processing.
- Document Analysis.
- Optical Character Recognition
- Result Processing

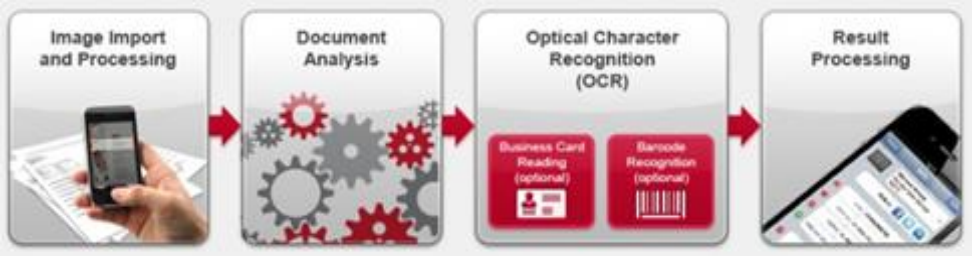

Figure 1: ABBYY Mobile OCR Engine Processing

Step 1: Image Import and Processing

The image is loaded from memory and prepared for OCR. Image binarisation as shown in Figure 2 separates text from the background, producing a black-and-white image that is much smaller in size than the color original. Additional skew correction and document orientation detection can be applied.

Figure 2: Image Binarisation

Automatic Image Skew Correction Function

When you take photographs with a mobile device camera or scan images with a portable scanner on-the-run, image skews occur fairly often, which has a negative impact on the recognition quality. ABBYY Mobile OCR Engine allows detection and correction of skews within one degree of precision, which results in a significant improvement of the quality and accuracy of mobile OCR.

Document Orientation Detection Function

Image pre-processing automatically detects the orientation of a page of text to be recognized

Step 2: Document Analysis

Document Analysis is a set of algorithms that analyses the image — it detects letters, joins the letters into words, then into lines of text, and finally, into paragraphs. Additionally, the reading area is cleaned and noise removed.

Hyphenation Support

If the engine encounters a part of a hyphenated word (e.g. *Mon*-) on one line and the second part (e.g. *day*) on the next line, it will join them into one (*Monday*) as shown in Figure 3.

Figure 3: Hyphenation

Preserving Multi-Column Text

In the previous versions of ABBYY Mobile OCR Engine, text was recognized left to right top to bottom strictly, which resulted in placing all the recognized data into one linear massive. ABBYY Mobile OCR Engine 4.0 has a function called «Paragraph Assembly», thanks to which the new DA identifies text block borders and recognizes each block separately, recognizing text left to right and top to bottom only within a separate block, thus preserving the format of a multi-column text, paragraphs, and text segmenting.

Preserving Character Fonts

ABBYY Mobile OCR Engine identifies the font properties of a source text, i.e. «bold type», «italic» or «underlined».

Confidence Level Indicator

This function shows the level of certainty for recognized text, allowing developers to set flexible criteria for implementation of proofreading and verification functions.

Spell Checking

During text recognition also considerably improves the quality of the output text

Step 3: Optical Character Recognition (OCR)

Then the detected blocks on the image are recognized using the special language and pattern definitions. If dictionaries are available, then the texts are also compared to improve the overall recognition quality. Recognition results are the set of characters with coordinates united in lines. Each character has the level confidence which show how recognition engine was sure in final character choice.

Two Mobile Recognition Modes

- Fast mode of express recognition – it is most convenient when the image is of good quality and allows cutting down the time required for its recognition and processing.
- Full mode for accurate recognition – it is best for low-quality images, when more time is required to achieve the optimal result.

Step 4: Result Processing

The recognition results can be processed and exported. The developer of the application has full control over the OCR results.

RESULTS

Calculator Implementation

The Figure 4 represents the working and the User Interface of Calculator on an Android Mobile Phone and following are the steps for implementation:

- Read the text from "result.txt" file which consist of the recognized text of the imageConvert the Infix text into postfix expression.
- Evaluate the postfix expression from the "output.txt"
- Display the result.

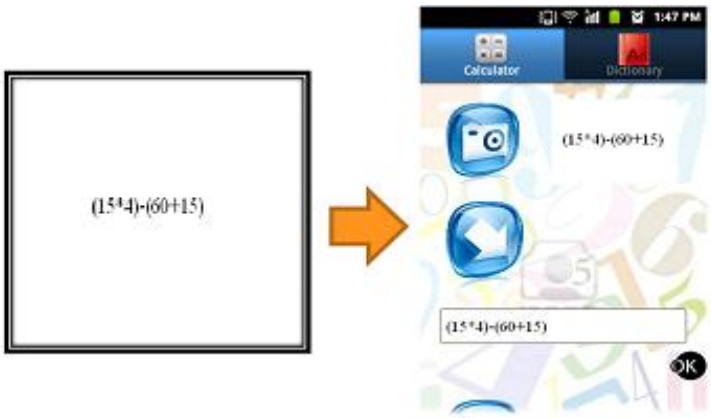

Figure 4: Calculator Interface in Android Mobile

Dictionary Implementation

The Figure 5 represents the working and the User Interface of Dictionary on an Android Mobile Phone and following are the steps for implementation:

- Read the text from "result.txt" file which consist of the recognized text of the image
- The word is searched in the existing database and the meaning of the word is sent to the user.

Figure 5: Dictionary Interface in Android Mobile

DISCUSSIONS

This application can be further extended by integrating various other features to the existing application like:

- Finding the price of various products by just clicking the picture of it.
- Identifying the location of the place by clicking the image of its name.
- It can also enhanced by converting handwritten image to text.
- Calculating complex equations.

CONCLUSIONS

We have implemented the Application based on OCR Technology where user can either perform normal calculation or find meaning of a particular word.The existing application to implement OCR such as OCR TEST didn't serve to be helpful since the provided user interface was not easy and simple to use. The OCR TEST requires a large amount of RAM. If your device doesn't have enough RAM, the application will quit during OCR. The OCR Test is a very useful application, but lack of controlling flash causes poor performance in low light. Also the other available application SNAPANDA crashes frequently and it does not fit on many Android phones like Samsung s3, Motorola atrix 4 etc. ARCHAIC tries to overcome all the shortcomings from the existing applications. As it uses ABBYY's algorithm, the following steps required for OCR such as image processing, text recognition and document analysis is faster and accurate. The GUI of the application is user-friendly and the user wouldn't need any special training to run the application. The calculator provided by the application serves to be very useful to the user since it makes the user's work simpler by solving large tedious equations faster and without errors. The dictionary provided helps the user to find the synonym of the words which are difficult. As all this takes place in the user's Android phone, he can use it anywhere and anytime.

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