

# Making Learning Ubiquitous With Mobile Translator Using Optical Character Recognition (OCR)

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**Abstract**—This paper reports on an ongoing project related to learning in tourism. A mobile technology is used in a translator system called Mobile-Translator. The paper starts by addressing some background statements leading to the ideas of Mobile-Translator. The methods involved in carrying out the works are discussed next, followed with discussions on the design and developments part. It includes also some facts on the Mobile-Translator. Then, the testing of the system is discussed in which it involved 30 international students if Malaysia. Briefly this study found that users accept the Mobile-Translator well. Finally, the paper is closed with some discussions and conclusion that includes some limitations of this study.

## I. INTRODUCTION

The learning technologies in electronic environment have evolved from CD-based to online with desktop. Later, the ubiquity of learning availability expands with mobile devices. It was more ubiquitous when the networking technologies work wirelessly [5]. Now, the opportunities in learning are very pervasive. The efforts on aiding learning are not only on providing contents, but also on other aspects related to gaining knowledge.

The advancement of learning activities in this digital age have shown that sophisticated technologies such as Wireless Application Protocol (WAP) and mobile devices are utilized [2, 11, 12]. The WAP technology can eliminate the gap between mobile devices such as mobile phones, palmtop computers, and personal digital assistant (PDA) with special operating system and the Internet and then can provide mobile services.

The technologies available for gaining knowledge have been absorbed into various domains such as manufacturing, medication, and tourism. In relation, current trends in tourism involve travellers move from a country to others. In Malaysia, tourism is very popular and has been one of the country's main agenda for economic development since more than ten years. The number of tourists is growing every year.

In addition, the Ministry of Tourism reported that more than 23.6 million tourists visited Malaysia in 2009 [9]. More interestingly, the tourists came from various countries such as the Middle East, China, Australia, Great Britain, and America.

In relation, the tourists have to use the local language for daily transaction. When 20 tourists were asked about their familiarity with local language, they found that it was one of the major difficulties when travelling. Even interesting environment could change to be opposite when communication is broken down. Moreover, when there is no one available to refer to when looking for directions and some written information.

Hence, one possible solution to the problem as suggested by the tourists is by using a tool that translates the local words into the preferred words. When the available sufficient technologies such as electronic dictionaries and other translation technologies were suggested, the tourists argued that they cost money and time. In fact, they also disagreed to use those technologies in response to the need for buying the special device themselves, but they really prefer if the translation engine is incorporated in their existing mobile devices.

Based on the problems and findings as addressed in the above paragraphs, this study is carried out, with the objective to propose a solution to enabling local words translated into preferred words using mobile phones. Hence, the aim of this paper is (1) to design and develop a mobile translation application using optical character recognition (OCR) and (2) to evaluate the user acceptance of the propose mobile application. Further, the study recommends that the application is called Mobile-Translator. Some related works supporting the idea of the Mobile-Translator are discussed in the following sections.

## II. RELATED WORKS

Paul and his colleagues [6] report two new multilingual translation services on mobile phones

that specify the text elements based on state-of-the-art text-to-text translations. The study concerns on translating the Japanese text elements as well as English conversational spoken language in the travel domain into 17 languages. The main method that has been adopted in this study was statistical machine translation technologies. The second issue was raised to optimize distributed speech recognition with noise suppression for recognizing speech contents between Japanese and English for real environments. Then the study found that Text Translation Markup Language (TTML) enables flexible connections between internal and external translation resources like text recognition and translation servers via a network. Figure 1 depicts the TTML stages in term of translating.

Earlier, a study by Gong and Jason [3] on the Virtual Data Translation (VDT) architecture as depicted in Figure 4 aimed at determining the entered data contents using the OCR techniques for checking the content quality along with end-to-end live network connections which connected with various computation units has been reported. Fig. 2 shows the translation process of data contents in term of OCR, data indexing, and data quality. They found that the OCR helped to customize these contents in more manageable way [3].

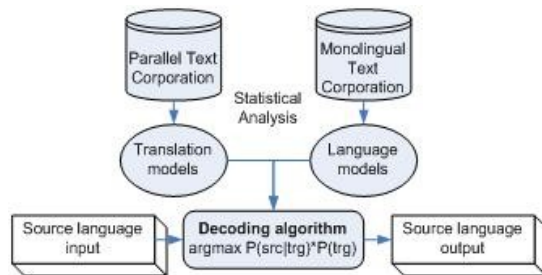


Fig. 1. TTML process.

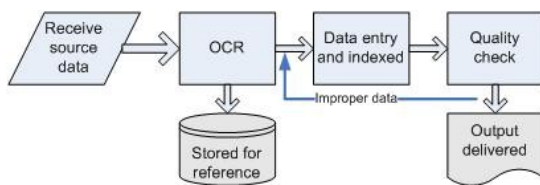


Fig. 2. Virtual Data Translation.

Another study by Jagannathan and Jawahar [4] describes a prototype that determines and customizes the text contents in images, scanned or captured by phone-camera and provides access to the content in a different language. This study applies two Indian languages i.e. Hindi and Tamil for the study that aims at detecting the text elements. The system was developed based on the use of off-the-shelf components, and in house developed algorithms.

The translation process of the system starts to match the captured data with the server, which corrects the perspective distortions, detects recognizes, and then translates the text. The translated text is sent back to the phone-camera in a suitable form [4] as depicted in Fig. 3.

In this study, the services as found in works by Jagannathan and Jawahar [4] is within the concern. To achieve the objectives as outlined earlier and supported with the above model, the methods as elaborated in the following section were made use.



Fig. 3. Indian Dictionary System.

### III. METHOD

This study involves a series of works. The activities are divided into three major steps which are adapted from Vaishnavi and Kuechler [10] and modified by Dalle [13] as illustrated in Fig. 4. The suggestion and conclusion steps are eliminated to simplify the process.



Fig. 4. Summary of research methodology.

The works in understanding the problem has been discussed briefly in the previous section. Hence, this section elaborates on the design and development part, while the evaluation is detailed in the following section.

#### A. Design

The Mobile-Translator combines three processes i.e. capturing image, extract text, and translate text as illustrated in an architecture depicted in Fig. 5.

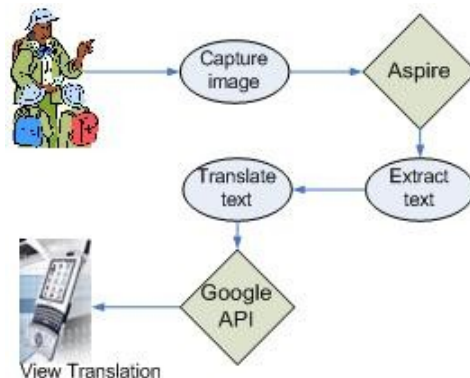


Fig. 5. The system architecture.

Fig. 5 explains that the Mobile-Translator applies Aspire which works as the OCR program for extracting the text elements from the selected image. The extracted text will be saved into the system database. The proposed mobile translation system will retrieve and translate the captured text and translating it by using Google translator API.

Additionally, the proposed application can translate any words that contain English alphabetic to any language. Hence, the following are the functionalities provided in the proposed Mobile-Translator:

- Select image
- Navigate Content
- Extract text
- Translate the extracted text
- View text translation

Besides the functional requirements, this study has also decided that the Mobile-Translator should comply with certain non-functional requirements such as those to make the interface usable [1, 7].

*B. Development*

The design as described above lead to the development of the Mobile-Translator. In the development works, certain hardware and software were necessary. Details of software and hardware requirements for developing the Mobile-Translator are listed in Table I.

TABLE I  
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<b>Hardware</b>	<ul style="list-style-type: none"> <li>• Mobile device with minimum capacity</li> <li>• Processor within 150 MHZ</li> <li>• Memory 1 GB</li> <li>• Able to provide a batch processing, run under Wi-Fi and mobile based platforms and take full advantage of the graphical user interface and able to process the graphical captures.</li> </ul>
<b>Software</b>	<ul style="list-style-type: none"> <li>• OCR capability software for mobile devices.</li> <li>• Java Server Pages (JSP)</li> <li>• MySQL</li> <li>• Google translation API</li> <li>• Aspire</li> <li>• Macromedia Dreamweaver</li> </ul>

*C. The Mobile-Translator and Testing*

The Mobile-Translator has been successfully developed, and functionally tested. This study has piloted the translation from Malay to English and Arabic, in which both are supported with illustrations in Fig. 6 and 7.

Further, user acceptance testing has also been carried out. It involved 30 international students of a public university in Malaysia. They were employed into the testing because they were all new in the country, and were not good at the local language.



Fig. 6. (Top) the form for instruction, (bottom) the result: translating from Malay to Arabic.

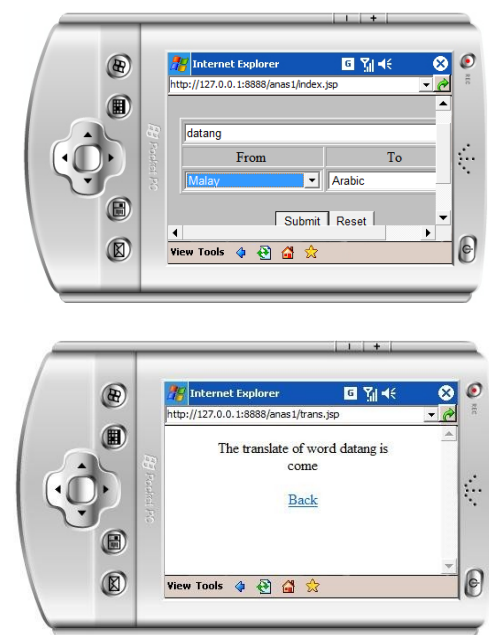


Fig. 7. Translating from Malay to English.

Each of them was given equal opportunities to have experienced the Mobile-Translator at their own convenience. They were observed when using the Mobile-Translator around the university campus.

Qualitative findings show that all of them were excited with the prototype. Some of them kept the prototype for a day to use in different places such as in the library, administrative offices, and sports complex. They found that the Mobile-Translator helps them a lot especially in understanding the signage around the university.

#### IV. DISCUSSION

The Mobile-Translator developed in this study helps non-native people to understand the Malay language by translating the words into preferred language. It helps a lot, especially for quick knowledge acquisition. Besides well functioning, the prototype has also been proven acceptable by the potential users. International students are potential to utilize the system because they need to quickly grab the local language for them to adapt into the local customs. This is very important because they will stay for a long time to finish their study.

On the other hand, when people from Asian countries visit places or go study in the European countries, this kind of system will be very helpful. Translation from their native language into the preferred one is important because the people in European countries speak very little in different languages.

In this kind of application, the user interface is also very important. Hence in this study, emphasis on the interface was also considered. So, simple and minimal layout was selected to maintain the readability, understandability, ease-of-learn, ease-of-use, and efficiency [7, 8].

#### I. CONCLUSION

The Mobile-Translator has been developed by adapting the previous models. In this study, it is developed specifically for use in Malaysia, in which the native language is Malay. Although it has been tested in terms of functionality and user acceptance, it still has a number of limitations. First, the native language can be translated into either English or Arabic only. Other languages are not supported by the system. It happens because each language catered in the system needs to be configured first for use. Second, quantitative testing has not been systematically carried out. It is important to have the system been systematically tested, so that the findings are more accurate and strengthened. Then, the usability aspect has not been measured also. Hence, in the near future, this study seeks to continue with the

suggested tasks as addressed.

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