Design and Evaluation of a Multilanguage Instant Messaging Application

Ahmed Nabeel Ahmed, Suwannit Chareen Chit, and Mohd. Hasbullah Omar
Universiti Utara Malaysia, Malaysia, cpu_cs1@yahoo.com; {chareen, mhomar}@uum.edu.my)

ABSTRACT

Recent growth in mobile Internet has resulted in the emergence of instant messaging (IM) applications. These applications now allow users to communicate via text and voice messaging, as well as sending attachments to their intended recipients. While these applications now support multiple languages, they, only allow users to communicate using the same language. A communication barrier and breakdowns occur when users do not speak the same language. This paper describes the design of Multilingual Instant Messaging Application (MIMA), and measure the level of acceptance of the application. Respondents agree that MIMA is both useful and easy to use, and this application is an essential tool to bridge the communication gap between speakers of different languages.

Keywords: Mobile Application, Machine Translation, Technology Acceptance.

I INTRODUCTION

The mobile Internet technology has paved ways for the emergence of various applications. One of the main applications is Instant Messaging (IM). IM applications such as WhatsApp("WhatsApp," n.d.), WeChat ("WeChat Messenger," n.d.), Line ("Line Messenger," n.d.), Telegram ("Telegram Messenger," n.d.) and Viber ("Viber Messenger," n.d.) allow users to communicate via text messaging, voice and video calls as well as allowing users to append attachments to their intended recipients. These applications also support multiple languages, and they have now gained huge popularity among IM users.

These applications however, do not feature machine translation (MT) capabilities thus limiting its use to only users speaking the same language. This is a limiting factor which poses communication barriers if users do not speak the same language thus hindering the growth of IM applications. MT is therefore an essential feature for IM applications today.

In this paper, we design the Multilingual Instant Messaging Application (MIMA) which incorporates MT in its functionality. MIMA intends to allow users who do not speak the same language to communicate effectively. This is achieved by using of a real-time MT function that is embedded in our application. We also conducted a survey to gauge the usefulness and ease of use of MIMA. The results of this survey indicate that MIMA is both useful and very easy to use.

In this paper, we relate our experience in developing the MIMA. This paper is organized as follows: The following section (Section II) reviews existing IM applications. We also review some existing work on MT. In Section III and Section IV, the design and development of MIMA is presented. We describe the survey we conduct in Section V. Section VI discusses our findings and we conclude this paper in Section VII.

II BACKGROUND

IM applications have gained tremendous popularity driven by the impressive growth of mobile Internet technology. However, most of these applications only allow users of the same language to communicate, resulting in a communication barrier between users who speak different languages. To break the language barrier, MT is therefore a favourable feature in most IM applications today. In this section, we review some of these IM applications as well as some related work to MT. We also briefly discuss the Technology Acceptance Model (TAM) that we used to measure the acceptance level of MIMA.

A. Instant Messaging (IM) Applications

3rd Generation (3G) network made its debut in 2001 and that marks the beginning of mobile Internet technologies. Ever since then, 3G networks have paved ways for the emergence of various applications including instant messaging (IM). These applications can be operated on a desktop computer, notebook, tablet and/or smartphone. Generally, these applications allow text messaging (inclusive the use of fancy *emojis* and icons), voice and video calls, and delivery of attachments. Multiple languages are supported by these applications. IM applications provide users a ubiquitous and cheaper means of communication as they normally require Internet connection and are free for download and use. As a result, a number of IM applications exist and they are highly popular and these applications have changed how we communicate and work. WhatsApp, WeChat, LINE, Telegram and Viber are instances of IM applications widely used globally and we have

performed a comparative analysis of these applications. The scope of comparison includes platforms, personalization, communication feature, file transfer, cost, language and others. The comparative analysis is presented in Table 1.

Table 1. Comparison of Existing IM Applications

Application	WhatsApp	WeChat	Line	Telegram	Viber
Platform	iOS, Android, BlackBerry, Windows, Symbian	iOS, Android, BlackBerry, Windows, Symbian	iOS, Android, BlackBerry, Windows	iOS, Android, BlackBerry, Windows	iOS, Android, BlackBerry, Windows
Personalization	✓	✓	✓	✓	✓
Communication					
• **Text**	✓	✓	✓	✓	✓
• **Voice Call**	✓	✓	✓	✓	✓
• **Video Call**	X	✓	✓	X	✓
• **Group**	Maximum 256 members	Maximum 500 members	Maximum 200 members	Maximum 5000 members	Maximum 200 members
File Transfer	✓	✓	✓	✓	✓
Cost	Free	Free	Free	Free	Free
Games	X	✓	✓	X	X
Others					
• **Requires Registration**	✓	✓	✓	✓	✓
• **Contacts**	Automatically updated from device contact	WeChat ID & Automatically updated from device contact	Line ID & QR Code	Automatically updated from device contact	Automatically updated from device contact
• **QR Code Scanning**	X	✓	✓	X	X
• **Multilingual support**	✓	✓	✓	✓	✓
• **Real-time Machine Translation**	X	X	X	X	X

As presented in Table 1, the features in IM application vary. It can particularly be noted that in all of these applications, real-time MT is absent. The absence of the MT feature provides a gap for us to further improve IM applications.

B. Machine Translation (MT)

Machine Translation (MT) is a widely researched area that began two decades ago (Koehn & Philipp, 2010) and is still gaining a lot of attention particularly in its accuracy in translating texts in specific domains. In law for example, MT tools are found to be inefficient to translate legal documents (Yates, 2006). However, several studies conducted have revealed that efficiency of MT is strongly linked to users' expectation. In a research on the comprehensibility of Spanish to English translations made by SYSTRAN the respondents' feedback showed that 10 out of 12 texts could be understood, which suggests 83% accuracy (Aiken, Vanjani, & Wong, 2006). The authors therefore linked accuracy to understandability.

In another study, researchers used Polyglot II study the accuracy of Google Translate. The research was conducted on 41 languages and their findings suggest that overall accuracy was 86% for all languages. An interesting observation the researchers was machine translation worked better with some languages such as Italian, Serbian and Russian, than with some others like Filipino, Japanese and Hindi (Aiken & Ghosh, 2009).

Calefato, Lanubile and Minervini (2010) used two real-time MT services: Google Translate and Apertium to study the efficiency and accuracy of MT when stakeholders discuss software requirements. In their study, a 4-point Likert scale as a scoring scheme is used, anchored with the following values: 4 being "completely inadequate," and 1 being "completely adequate." They found that Google Translate produces significantly more adequate translations from English to Italian than Apertium and that both services can be used in text-based chat without disrupting real-time interaction (Celefato, Lanubile, & Minervini, 2010). Aiken and Balan (2011) also focused on the accuracy of Google Translate by reviewing several studies comparing Google Translate with other MT systems. They concluded that although accuracy rates vary across languages, "translations between European languages are usually good" (Aiken & Balan, 2011).

Another study measured the level of clarity and accuracy in real-time chat messages. These messages are translated immediately by translation bots

embedded in GoogleTalk. This study was conducted between speakers who have Russian and English native language. The overall evaluation for this study shows that 83.57% of the translations were intelligible and 75.20% were accurate (Sahin & Duman, 2013).

C. Interlingual Machine Translation (IMT)

Interlingual Machine Translation (IMT) is an example of the rule-based machine-interpretation procedures. In IMT, the text of the source language is converted into an interlingual representation, known as "language neutral" which is independent of any language. The interlingual then generates the target language, as shown in Figure 1. One of the most vital benefits of this approach is that the interlingua can become more and more valuable if there is increasing in the number of target languages (Monem, Shaalan, Rafea and Baraka, 2008). The English language has been selected as the interlingual in this study.

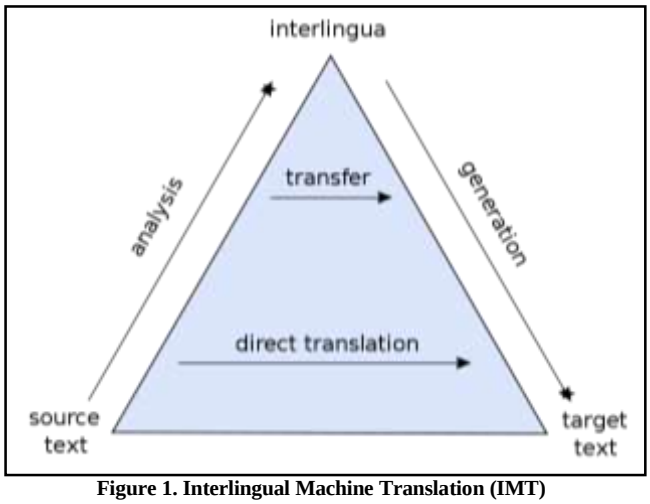

Figure 1. Interlingual Machine Translation (IMT)

D. Google API translator

Google Translate is a free multi-lingual measurable machine interpretation administration gave by Google to decipher constant recordings, addresses, pictures, and messages from one dialect to the next. It offers a mobile interface for Android and iOS, a web interface, and an API translator which developers may use for developing browser extensions, applications and other type of software. Up to this time, i.e., February 2016, Google Translate underpins 103 dialects at numerous levels and serves more than 200 million individuals day by day (Groves and Mundt, 2015; Shankland, 2013).

E. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) has been widely used to measure user's acceptance and uptake of technology (Venkatesh, Morris, Davis, & Davis, 2003) Generally, the TAM measures the acceptance of technology based on a 2-dimensional perspective, namely usefulness (Perception of Usefulness - POU) and ease-of-use (Perception of Ease Of Use – POEU). TAM also suggests that there exist several factors which influence a user's decision to uptake and use a specific technology.

III MIMA DESIGN

The MIMA prototype is developed using the Java programming language on the Eclipse Integrated Development Environment (IDE). MIMA is presently developed to operate on an Android device featuring the basic functionalities as per Table 1, incorporating the MT feature. MIMA database uses the SQLite tools.

The real-time MT feature is accomplished by embedding in the text messaging functionality the Google Translate Application Programming Interface (API) as shown in Figure 2.

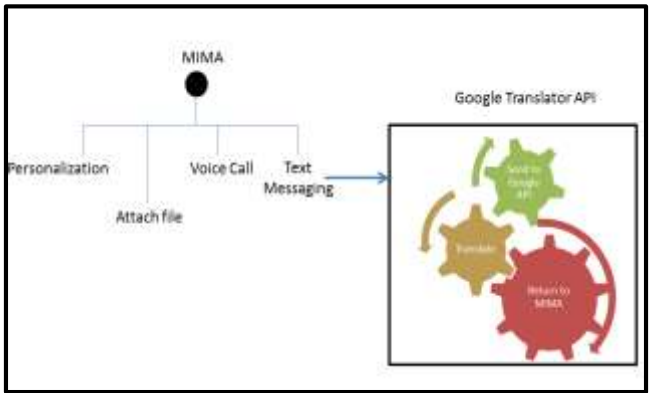

Figure 2. MIMA Concept

In the first place, the design must be completed; this incorporates the outlining assignments to guarantee that the capacities were legitimately organized under the class of antiquities, for example, the use case diagram, active diagram, sequence diagram and state diagram. Keeping in mind the end goal to outline the model, the UML (Unified Modeling Language), which is a graphical dialect for envisioning, determining, fabricating and archiving the ancient rarities of programming concentrated frameworks (Booch, 2005), was utilized as a part of this study. Other than that, the configuration rule that make the application simple to utilize were additionally thought about through the investigation of existing application.

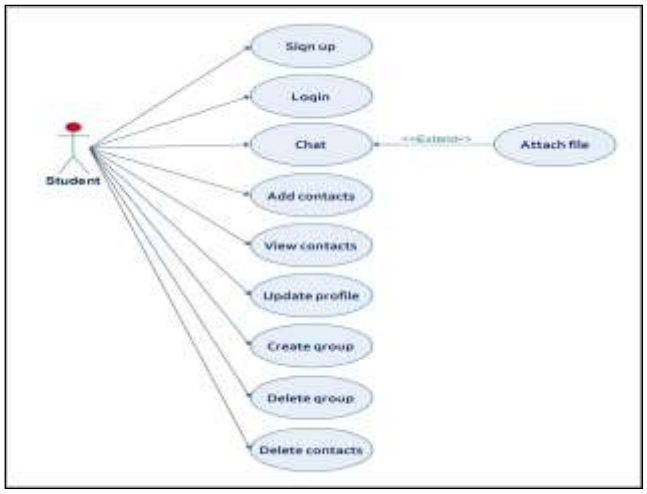

Figure 3. MIMA Use Case Diagram

Figure 3 show MIMA Use Case diagram. The Use Case diagram is one of the modeling methods which describe what does a certain application from an external observer standpoint. The main goal of using use case diagram is to understand app functions and what it does; an actor is involved in doing app functions (AbdulWahid, 2015; Banire, Jomhari, & Ahmad, 2015).

IV MIMA DEVELOPMENT

In general, there are numerous principles for implementing and design of useful and successful mobile application. In order to design a mobile chat application that helps students in breaking the language barrier, the design principles lead to produce a creative and effective application, while these principles have been previously conducted and analyzed in details. This study utilized the RAD strategy (Rapid Application Development) to build up the application (Anderson, Patel, Preedy, & Martin, 2014).

In order to develop the prototype for this study, the JAVA development tool (JDK) has been used under Android platform, and for the database it was used SQLite tools. Additionally, Eclipse (IDE) tool is used to develop the prototype (Murphy, Kersten and Findlater, 2006). Figure 4 shows MIMA chatting interfaces.

Figure 4. MIMA Chatting Interfaces

It was clearly seen, the first user selected Arabic language, and he can send and receive messages in Arabic. On the other hand, the second user selected Malay language, and he can send and receive messages in Malay language.

V EVALUATION

This section discusses the procedure of acceptance test that was carried out to illustrate the usability of MIMA.

A. Acceptance Test

The acceptance test is conducted to ensure that users feel the MIMA is useful and is easy to use. In this study, a survey was conducted involving 30 Universiti Utara Malaysia (UUM) students from various nationalities to collect their perceptions on the ease of use and usefulness of MIMA. They were asked to use the MIMA application, and answer the questionnaires which were handed to them.

The questionnaire used what adapted from previous acceptance tests. Users were asked to rate the MIMA using a Likert scale from 1 to 7, with 1 being "Strongly Disagree" and 7 being "Strongly Agree". The items in the questionnaire are as shown in Table 2.

Table 2. Questionnaire Items

Question	Item
U.Q1	MIMA allows me to communicate effectively.
U.Q2	Using MIMA could save my time.
U.Q3	Using MIMA could save my efforts.
U.Q4	MIMA makes it easier for me to communicate.
U.Q5	MIMA would facilitate my communication with people who speak different languages.
U.Q6	I would find MIMA useful in my communications.
E.Q7	MIMA is easy to use.
E.Q8	MIMA is flexible to use.
E.Q9	MIMA is simple to use.
E.Q10	It is user friendly.
E.Q11	Learning to use MIMA is easy.
E.Q12	I learned to use MIMA quickly.
E.Q13	I can use MIMA without written instructions.
E.Q14	It would be easy for me to become skillful at using

	MIMA.
E.Q15	Interaction with MIMA is flexible.
E.Q16	My interaction with MIMA is clear.
E.Q17	I can accomplish what I want to do with MIMA easily.
E.Q18	Overall, I am satisfied with this application.

VI RESULTS & FINDINGS

In the survey conducted, the following result is gathered and the frequency table is tabulated in Table 3.

Table 3. Frequency Table

Item (n = 30)	Strongly Disagree (%)	Disagree (%)	Slightly Disagree (%)	Neutral (%)	Slightly agree (%)	Agree (%)	Strongly Agree (%)	Percentage (%)
UQ1	0	0	0	0	18.7	50.0	31.3	100
UQ2	0	0	0	6.3	43.7	37.5	12.5	100
UQ3	0	0	0	9.4	31.2	50.0	9.4	100
UQ4	0	0	0	0	21.9	46.9	31.2	100
UQ5	0	0	0	9.4	15.6	43.8	31.2	100
UQ6	0	0	0	0	18.7	68.8	12.5	100
EQ7	0	0	0	3.1	25.0	43.8	28.1	100
EQ8	0	0	0	9.4	15.6	53.1	21.9	100
EQ9	0	0	0	6.3	34.3	53.1	6.3	100
EQ10	0	0	0	3.1	28.1	28.1	40.7	100
EQ11	0	0	0	12.5	18.7	43.8	25.0	100
EQ12	0	0	0	9.4	40.6	31.3	18.7	100
EQ13	0	0	0	6.3	37.5	43.8	12.4	100
EQ14	0	0	0	9.4	37.5	28.1	25.0	100
EQ15	0	0	0	9.4	18.7	50.0	21.9	100
EQ16	0	0	0	3.1	15.6	56.3	25.0	100
EQ17	0	0	0	9.4	37.5	50.0	3.1	100
EQ18	0	0	0	0	28.1	50.0	21.9	100

More than 50% of the respondents agree that MIMA allows them to communicate effectively (UQ1), and approximately 37.5% agree that MIMA saves time (UQ2) when the users try to communicate with another user who speaks a different language. The MIMA also requires minimal effort (UQ3) as reported by 60% of the respondents. In terms of usefulness (UQ6), 81% of the respondents agree that MIMA is useful while 78% responded that MIMA makes communication easier (UQ4) and 75% responded that MIMA facilitates better communication (UQ5).

In terms of ease of use, 78% agree that MIMA is easy to use (EQ7). Most of the respondents (78%) also find that the application is user friendly (EQ10), where 59% believe it is flexible to use (EQ8) and 69% agree that the application is simple (EQ9).

The respondents also agree that learning to use MIMA is easy. Overall, 72% of the total respondents are satisfied with the application. We feel there is room to further improve MIMA particularly in terms of making MIMA easier to learn.

The descriptive statistics of our survey are presented in Table 4 below.

Table 4. Descriptive Statistics

Question	Item	Mean	Standard Deviation
U.Q1	MIMA allows me to communicate effectively.	6.13	.707
U.Q2	Using MIMA could save my time.	5.56	.801
U.Q3	Using MIMA could save my efforts.	5.59	.798
U.Q4	MIMA makes it easier for me to communicate.	6.09	.734
U.Q5	MIMA would facilitate my communication with people who speak different languages.	5.97	.933
U.Q6	I would find MIMA useful in my communications.	5.94	.564
E.Q7	MIMA is easy to use.	5.97	.822
E.Q8	MIMA is flexible to use.	5.88	.871
E.Q9	MIMA is simple to use.	5.59	.712
E.Q10	It is user friendly.	6.06	.914
E.Q11	Learning to use MIMA is easy.	5.81	.965
E.Q12	I learned to use MIMA quickly.	5.59	.911
E.Q13	I can use MIMA without written instructions.	5.63	.793
E.Q14	It would be easy for me to become skillful at using MIMA.	5.69	.965
E.Q15	Interaction with MIMA is flexible.	5.84	.884
E.Q16	My interaction with MIMA is clear.	6.03	.740
E.Q17	I can accomplish what I want to do with MIMA easily.	5.47	.718
E.Q18	Overall, I am satisfied with this application.	5.94	.716

The results in Table 4 show that all questions have high mean score, which is approximately 6. Besides, the standard deviations are small, which is less than 1. It can therefore be deduced that all statements regarding the MIMA in the questionnaire are agreed by the subjects with very small bias or influence of other factors.

A reliability test was also conducted on the questionnaire items and the results are presented in Table 5 below.

Table 5. Reliability test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.687	.680	18

VII CONCLUSION

The advancement of the computers and its technology have paved ways for the emergence of instant messaging applications and Machine Translation (MT) tools. These tools allow real-time text translation with reasonable precision and accuracy. In this study, a Multilanguage Instant Messaging Application (MIMA) is presented. The MIMA is an instant messaging application which incorporates the MT tool, as well as other features which appeal to the demands of mobile users today. The application is developed using Java, and runs on most Android platforms. A usability and usefulness test was carried out. In this survey, 81% agree that the MIMA is useful, and is more than 75% agree that is it easy to use. Overall, 72% of the users are satisfied with MIMA.

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