

Android-Based Surigaonon Dictionary and English-Sinurigaonon Translator Application

Karen T. Plaza, MSIT, Warner R. Guyano Jr. MIT, Lorraine Mae Maturan, Van Charlz Sabio,
Program Chair, College of Business and Technology, St. Paul University Surigao,
Surigao City, Philippines

Abstract

Surigao is well known in terms of Tourist spots especially Siargao. A lot of tourists –local and foreigners are attracted of its beautiful scenery. However, they have difficulty in conversing with the locals since most of them do not know how to communicate using the English language. This study aimed to develop an Android-Based Surigaonon Dictionary and English-Surigaonon Translator Application for guest and travelers coming in and out of Surigao City. It was designed in an offline application platform so that users of smartphones do not have to worry in terms of internet connection. Descriptive developmental research design was utilized. The researchers used the different object-oriented modeling tools to design the system. There were 25 surigaonons, 13 tourists and 12 Information Technology experts evaluated the system using a modified 4 point-Likert scale questionnaire to determine the performance of the system in terms of Accuracy, Efficiency and Reliability. The evaluators of the study found out that the system is very accurate, efficient, and reliable for the users who wished to know more about the Surigaonon dialect.

Keywords: *Information Technology, Android-Based, Application, Translator, Surigaonon, Dictionary, Philippines*

Introduction

English is the third most widely-spoken language in terms of native speakers, of which it has at least 330 million words. But if you count the people who speak it as a second language, it's the most popular language in the world (Kroulek, 2016). Nowadays, to ensure that everybody understands each and every language, different methods were used like dictionaries and computer-based or mobile-based translators.

In Surigao City, Surigaonon dictionary is available only in the library of schools and if not in museums. However, it was noticed that it is not readily accessible to all who needs it. It was also observed that locals of Surigao City have difficulty in understanding and translating their spoken Sinurigaonon words into English. There are cases where children and kids of todayeven have difficulty speaking and finding correct and proper Sinurigaonon words or sentences. There were even incorrect usage and translation of the Sinurigaonon words. At the same time, most foreigners who visit Surigao have no reference and guide as to the different meaning of the spoken dialect of Surigao. With the help of Sinurigaonon Dictionary which was made by Fredesuendo G. Ong, to be used as our reference in developing the said Application and also to ensure the reliability of the content of this study.

The researchers conducted this study entitled Android-Based Surigaonon Dictionary and English-Surigao Translator Application to providean aide or tool to Surigaonons, guest and travelers of Surigao City. It would help the users of the application understand and learn easily Sinurigaonon words.

Framework

The design and development of an English dictionary mobile application and translator for the purpose of providing an aide or tool for better understanding and communication.(Buet and Nyxcore, 2017)

The following terms were presented in the flow of the study.

Sinurigaonon words. It refers to the Philippine regional language spoken by Surigaonon people in the



province of Surigao del Norte.

Android Smartphone. It refers to mobile phones with an advanced mobile operating system that combines features of a personal computer operating system with other features useful for mobile or handheld use that would be utilized as the main platform for the application to be developed

Java. It refers to a general-purpose computer programming language that is concurrent, class-based, object-oriented, and designed to have as few implementation dependencies that would be used as the primary programming language tool or software in the design and development of the proposed system

Android Studio. It is the official integrated development environment (IDE) that would be utilized for the Android platform

Class Diagram. It represents a detailed view of single use case, shows the classes that participate in the use case, and documents the relationships among the classes. This would be used to provide an overview of the proposed system study by describing the objects and classes requirements inside the system.

Use Case Diagram. It visually represents the interaction between users and the information system in order to help the proponents understands the functions of the system as well as to organize the services of the proposed system in a summary format.

Sequence Diagram. This shows the sequential interactions between objects that occur during the flow of events of a single scenario or used case. This would be used to show how the object and classes of the proposed system study interacts and how the process operates with one another.

Use Case Specification. It is a document used to capture the specific details of each use cases in the use case diagram. At the same time, it outlines the name of the use case, describes the use case, presents the actors, and presents the work flow or flow of events, precondition and post-condition. This would be used to describe the details of the proposed system.

User Interface Design. It focuses on anticipating what user might need to do and ensuring that the interface has elements that are easy to access, understand and use to facilitate those actions. It is the concept from interface design, visual design and information architecture.

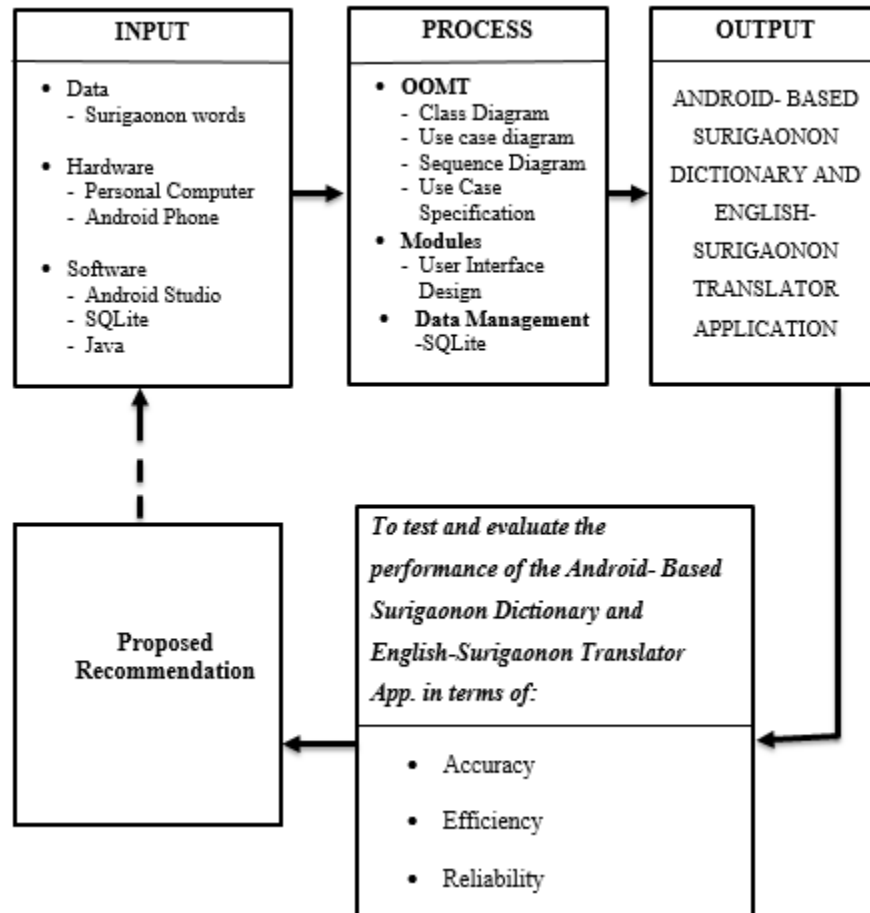
SQLite. It is an in-process library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. This would be utilized in order to develop a database for the proposed system that is reliable.

Accuracy. The performance of the system study is evaluated in order to check the degree to which the result of a measurement, calculation, or specification conforms to the correct value or a standard of an ideal system.

Efficiency. It is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. The design capability of the proposed system to processed instruction successfully and without waste.

Reliability. It refers to the ability of the system study to consistently perform its intended or required function or mission, on demand without degradation or failure.

Figure 1 shows the flow of the study.



Literature Review

Filipinos are greatly attached to their smartphones for varying reasons – whether for communication, entertainment, or productivity. The infographic contains valuable facts and statistics about Filipino smartphone users. Almost 81% of Filipinos uses android in their smartphones and only 19% IOS users in the Philippines (Habaradas, 2016). Being user friendly, android becomes the most famous platform. For developers and users android has the highest probability rate to be chosen. The researchers relate this article as the basis of choosing the platform to be use in the study.

In English Cebuano Dictionary mobile app you can search both English and Cebuano words. This is not only a Dictionary but also a learning tool. You can use this dictionary when you have no internet connection. There is auto suggestion so you need not type full words. You also can use Speech to text feature. When you start typing, you will see some words starting with the letters you typed. The dictionary searches in a database for the matching words. This can slow down typing in small handsets. Therefore in settings there is an option to turn that off. So low profile mobile handsets can turn off Auto search to type quickly. You will see a Dictionary icon on the notification bar to start the app quickly (Buet, 2017). Conversation Translator is a language translator for conversations with foreign people. An interpreter for dialogues with local people. Easy communicate with foreigners. Ask questions in

other languages. For travel, vacations or business trips. It can translate words or phrases (Nyxcore, 2017). This article relates to our study because of the similarities of its functions. Since our study contains a translator and a dictionary.

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on Jet Brains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development. As an IDE then, Android Studio's job is to provide the interface for you to create your apps and to handle much of the complicated file-management behind the scenes. The programming language you will be using is Java and this will be installed separately on your machine. Android Studio is simply where you will write, edit and save your projects and the files that comprise said projects. At the same time, Android Studio will give you access to the Android SDK or 'Software Development Kit (Eason, 2017).

Developing mobile applications are much easier now because of the latest IDE's such as the android studio. It gives the developers an easy process in creating applications with its features. In relation to our study, this article gives us the Idea on what to use in creating our system.

Java is a computer programming language. It enables programmers to write computer instructions using English-based commands instead of having to write in numeric codes. It's known as a high-level language because it can be read and written easily by humans. Like English, Java has a set of rules that determine how the instructions are written. These rules are known as its syntax. Once a program has been written, the high-level instructions are translated into numeric codes that computers can understand and execute (Leahy, 2017).

Java increases security because both the platform and the Java language were developed from the primary day with the issue of security at hand. The platform allows users to obtain codes from the internet and later on run them on Java without infecting the host system with any threats such as virus or malwares. Also you cannot write files from the disk drive on Java, making it extremely protect for use in mobile application development. Java can be kept up limited permission thus will not hurt your computer system. Through the different audits carried out by security experts Java has actually been inspected and its security is guaranteed (Geoviz, 2015). In terms of choosing the programming language to be use, it should be java. Java is the most famous programming language. It is the best language to use when it comes to mobile apps. This article helps us decide to which language to use in creating our system.

In the simplest terms, SQLite is a public-domain software package that provides a relational database management system, or RDBMS. Relational database systems are used to store user-defined records in large tables. In addition to data storage and management, a database engine can process complex query commands that combine data from multiple tables to generate reports and data summaries. Other popular RDBMS products include Oracle Database, IBM's DB2, and Microsoft's SQL Server on the commercial side, with MySQL and PostgreSQL being popular open source products. The "Lite" in SQLite does not refer to its capabilities. Rather, SQLite is lightweight when it comes to setup complexity, administrative overhead, and resource usage (Kreibich, 2018).

A Class Diagram in the "Unified Modelling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects." Although this definition is pretty clear, you have to understand that Class Diagram are part of the system model's Logical View (Potty, 2014). Sequence diagrams, commonly used by developers, model the interactions between objects in a single use case. They illustrate how the different parts of a system interact with each other to carry out a function, and the order in which the interactions occur when a particular use case is executed. A sequence diagram is structured in such a way that it represents a timeline which begins at the top and descends gradually to mark the sequence of interactions. Each object has a column and the messages exchanged between them are represented by arrows (Thuraliya, 2010). A use case diagram is a dynamic or behaviour diagram in

UML. Use case diagrams model the functionality of a system using actors and use cases. Use cases are a set of actions, services, and functions that the system needs to perform (Smartdraw, 2018). 19

According to Adams (2015), Usability is a measure of the interactive user experience associated with a system such as a business system, website, or mobile application and is a focus of fields of the Human Factors Psychology and Human-Computer Interaction (HCI) fields of study. Reliability is the ability of a system to remain operational over time. Reliability is measured as the probability that a system will not fail to perform its intended functions over a specified time interval (Microsoft, 2018). Accuracy refers to a judgment of whether the system contains the correct value. Two aspects of completers are noted. First refers to whether all needed data items are stored in the system, and the second refers to the relevant time periods are attached to data item (Barbara, 2010). Efficiency is “a set of attributes that bear on the relationship between the level of performance of the software and the amount of resources used, under stated conditions” ,(Spriestersbach and Springer, 1991).

The Oxford Dictionary of English is the mobile app based on the original title by Oxford University Press and widely accepted as one of the highest authorities in the study of English with more than 150 years of research behind it. Regarded as one of the flagship products in MobiSystems' large catalog of dictionaries the app features advanced search and language tools designed by a developer vastly experienced in the creation of dictionaries and learning tools (MobiSystems, 2018). Filipino Dictionary offline and free. You can search both English and Filipino words. You can search words directly from "Internet Browser" or other Applications by using Sharing option. In the sharing option you will find "Filipino Dictionary" and choosing "Filipino Dictionary" will open the dictionary with the shared word so you need not type. Exiting from the dictionary will return you to "Internet Browser" or other Applications again. This is not only a Dictionary but also a learning tool. You can use this dictionary when you have no Internet connection (Innovative-software, 2018).

Method

This study employs the descriptive developmental research design using the quantitative approach. This study documents the technical design and specifications of the System in terms of *Input, Process and Output*, Design and develop the system , and Test and Evaluate the system .An evaluation sheet was used to determine the performance of the system in terms of *accuracy*-which refers to a judgment of whether the system contains the correct value, *efficiency*- the relationship between the level of performance of the software and the amount of resources used, under stated conditions and *reliability*-the probability that a system will not fail to perform its intended functions over a specified time interval. Object oriented modeling tools were utilized like the *Use Case Diagram, Use Case Specification, Sequence Diagram, and Class Diagram*. These tools were important in organizing and planning the procedure, presenting the different activities of the system, and presenting the attributes of the system in a step-by-step manner. Data were analyzed using the Mean and Standard Deviation.

Results and Discussion

Performance of the System

The following is the result of the evaluation on the performance of the system in terms of its accuracy, efficiency and reliability. The evaluators rated the system based on the performance of the system.

Table 1.

Performance of the Android Based Surigaonon Dictionary and English-Surigaonon Translator Application in terms of Accuracy.

	1. Accuracy	M	SD	VI	QD
1.1 The application displays correct data		3.58	0.57	SA	VA
1.2 The application displays searched information		3.52	0.58	SA	VA
1.3 The application gives correct translations		3.60	0.70	SA	VA
1.4 The mobile application can translate English to Sinurigaonon and Vice-versa		3.70	0.58	SA	VA
1.5 The application displays the data in a sorted manner		3.56	0.54	SA	VA

1.6 The buttons work according to its intended functions	3.46	0.58	SA	VA
1.7 The application consumes less amount of storage	3.44	0.61	SA	VA
1.8 The application displays readable texts	3.66	0.57	SA	VA
1.9 The icons and texts are properly positioned	3.58	0.57	SA	VA
2.0 The speech-to-text feature displays relevant input	3.48	0.74	SA	VA
AVERAGE	3.56	0.37	SA	VA
Scale	Parameter	Verbal Interpretation	Qualitative Description	
4	3.25-4.00	Strongly Agree(SA)	Very Accurate	
3	2.50-3.24	Agree(A)	Accurate	
2	1.75-2.49	Disagree(D)	Less Accurate	
1	1.00-1.74	Strongly Disagree(SD)	Not Accurate	

The table shows the performance of android based Surigaonon Dictionary and English-Sinurigaonon Translator Application in terms of *Accuracy*. The overall performance of the system is *Very Accurate* based on the evaluation of the participants. The average mean of the system is 3.56 and the average standard deviation is 0.37

The indicator that got the highest mean of *Accuracy* is, *The mobile application can translate English to Sinurigaonon* and vice-versa with the mean of 3.70 which is *Very Accurate* because it can be used in English to Sinurigaonon both translator and dictionary. Next is *The application displays readable texts* with the mean of 3.66 which is *Very Accurate* because the application has readable text and font size. Then, *The application gives correct translations* with the mean of 3.60 which is also *Very Accurate* because the application responds correct translator. Next is *The application displays correct data* with 3.58 which is *Very Accurate* because the words search is correctly displayed. Then, *The icons and texts are properly positioned* with the same mean of 3.58 which is *Very Accurate* because its design is in proper position. Next one is *The application displays the data in a sorted manner* with the mean of 3.56 which is *Very Accurate* because it is sorted from A to W. Then, *The application displays searched information* with the mean of 3.52 which is *Very Accurate* because it displayed the searched information well and the next one is *The speech-to-text feature displays relevant input* with the mean of 3.48 which is *Very Accurate*. Next is *The buttons work according to its intended functions* with the mean of 3.46 which is *Very Accurate*. The indicator that got the lowest mean is *The application consumes less amount of storage* with the mean of 3.44 which is *Very Accurate* also.

According to Kevin Carr 2018 that accuracy represents how close a measurement comes to its value. This is important because bad equipment, poor data processing or human error can lead to inaccurate results that are not very close to truth. The performance of the system study is evaluated in order to check the degree to which the result of a measurement, calculation, or specification conforms to the correct value or a standard of an ideal system.

Table 2.

Performance of the Android Based Surigaonon Dictionary and English-Surigaonon Translator Application in terms of Efficiency.

2. Efficiency		M	SD	VI	QD
2.1 The application gives the user an ease access to the information needed	3.58	0.54	SA	VE	
2.2 The application can be accessed anytime	3.56	0.64	SA	VE	
2.3 The application can be function offline	3.68	0.51	SA	VE	
2.4 The application process the data in a short period of time	3.52	0.68	SA	VE	
2.5 The speech-to-text feature gives the user an alternative way of inputting data	3.56	0.64	SA	VE	
2.6 The search box displays suggestions from inputted text	3.60	0.49	SA	VE	
2.7 The application serves as an alternative for Surigaonon dictionary	3.60	0.57	SA	VE	
2.8 The application teaches the user on proper translation of Surigaonon	3.44	0.70	SA	VE	

Words into English words					
2.9	The application serves as a communication tool for guest or travelers In Surigao City	3.66	0.48	SA	VE
3.0	The application does not have ads popping out.	3.62	0.64	SA	VE
AVERAGE		3.58	0.38	SA	VE
Scale	Parameter	Verbal Interpretation	Qualitative Description		
4	3.25-4.00	Strongly Agree(SA)	Very Efficient		
3	2.50-3.24	Agree(A)	Efficient		
2	1.75-2.49	Disagree(D)	Less Efficient		
1	1.00-1.74	Strongly Disagree(SD)	Not Efficient		

The table shows the performance of android based Surigaonon Dictionary and English-Sinurigaonon Translator Application in terms of Efficiency. The overall performance of the system is Very Efficient based on the evaluation of the participants. The average mean of the system is 3.58 and the average standard deviation is 0.38 to come up with Very Efficient result.

The indicator that got the highest mean of Efficiency is that *The mobile the application can function offline* with the mean of 3.68 which is Very Efficient because it can be accessed offline. The second one is *The application serves as a communication tool for guest or travellers in Surigao City* with the mean of 3.66 which is Very Efficient because the application has translator and dictionary for guest and travelers so that they can be able to speak surigaonons and third one is *The application does not have ads popping out* with the mean of 3.62 which is Very Efficient because the application is offline no ads.

The fourth one is *The search box displays suggestions from inputted text* with the mean of 3.60 which is Very Efficient and the fifth one is *The application serves as an alternative for Surigaonondictionary* with the same mean of 3.60 which Very Efficient. The sixth one is *The application gives the user an ease access to the information needed* with the mean of 3.68 which is Very Efficient because it's portable reference and the seventh one is *The application can be accessed anytime* with the mean of 3.56 which Very Efficient because the application is offline and the eighth one is *The speech-to-text feature gives the user an alternative way of inputting data* with mean of 3.56 which is Very Efficient. The ninth one is *The application process the data in a short period of time* with the mean of 3.52 which is Very Efficient because the application is offline the process not hassle and waiting for long loadings. The ninth one is *The application teaches the user on proper translation of Surigaonon words into English words* with the mean of 3.44 which is Very efficient because some words are not properly translate. According to MKOREN 2018 from enotes that it is very important for management to be efficient and effective. Successful in business are the ones that are very efficient. When management uses resources efficiently. They are able to maximize production, the use of the workforce and profits. It is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. The design capability of the proposed system to processed instruction successfully and without waste.

Table 3.

Performance of the Android Based Surigaonon Dictionary and English-Surigaonon Translator Application in terms of Reliability

3. Reliability		M	SD	VI	QD
3.1	The application saves bookmarked words.	3.68	0.51	SA	VR
3.2	The information displayed by the application are correct	3.64	0.53	SA	VR
3.3	The application contains all needed information.	3.56	0.61	SA	VR
3.4	The application translates a lot of words or sentences	3.48	0.65	SA	VR

3.5 The application can be used as a reference for communication	3.40	0.61	SA	VR
3.6 The application does not crash whenever it process too many data	3.40	0.57	SA	VR
3.7 The data stored in the application are correct.	3.58	0.50	SA	VR
3.8 The application retains the recent displayed page whenever user opens a different application.	3.64	0.53	SA	VR
3.9 The application prompts the user a confirmation box when closing the application.	3.58	0.50	SA	VR
4.0 The application never had a system failure.	3.56	0.61	SA	VR

		AVERAGE		3.55	0.36	SA	VR
Scale	Parameter	Verbal Interpretation	Qualitative Description				
4	3.25-4.00	Strongly Agree(SA)	Very Reliable				
3	2.50-3.24	Agree(A)	Reliable				
2	1.75-2.49	Disagree(D)	Less Reliable				
1	1.00-1.74	Strongly Disagree(SD)	Not Reliable				

The table shows the performance of android based Surigaonon Dictionary and English-Surigaonon Translator Application in terms of Reliability. The overall performance of the system is very reliable based on the evaluation of the participants. The average mean of the system is 3.55 and the average standard deviation is 0.36 to come up with very reliable result.

The highest mean of reliability is *The application saves bookmarked words* with the mean of 3.68 which is Very Reliable because can be saved to bookmark. The second one is *The information displayed by the application are correct* with the mean of 3.64 which is Very Reliable because the application displayed correct information well and the third one is *The application retains the recent displayed page whenever user opens a different application* with the mean of 3.64 which is Very Reliable because the application retains the recent. The fourth one is *The data stored in the application are correct* with the mean of 3.58 which is Very Reliable and the fifth one is *The application prompts the user a confirmation box when closing the application* with the same mean of 3.58 which is Very Reliable.

The sixth one is *The application contains all the needed information* with the mean of 3.56 which is Very Reliable and the seventh one is *The application never had a system failure* with the mean of 3.56 which is Very Reliable and the eighth one is *The application translates a lot of words or sentences* with mean of 3.40 which is Very Reliable because the application is 8.9 MB only. The ninth one is *The application can be used as a reference for communication* with the mean of 3.40 which is Very Reliable the tenth one is *The application does not crash whenever it process too many data* with the mean of 3.40 which is Very Reliable because the data are not heavy to process. According to Lund Research Ltd. 2013 reliability is like validity is a way of assessing the quality of measurement procedure used to collect data in a dissertation. In order for the results from a study to be considered valid, the measurement procedure must first be reliable. It refers to the ability of the system study to consistently perform its intended or required function or mission, on demand without degradation or failure.

CONCLUSIONS

Based on the findings revealed in this study, it is therefore concluded that the Android-Based Surigaonon Dictionary and English-Surigaonon Translator Application was running well in terms of Accuracy, Reliability and Efficiency of the system and could be used by guests and travelers coming in and out in Surigao City even to the Surigaonon's who have difficulty in speaking and finding correct and proper Sinuriganon words or sentences. Thus, it is therefore recommended that this application be implemented in Surigao City because it is useful not only to locals but also to the tourists as well. Future researchers should enhance this system by adding features to make it more user friendly.

REFERENCES

- [1] Adams, A. (2015). *Interview Questions for Business Analysts and Systems Analysts*. Retrieved from <http://www.modernanalyst.com>
- [2] Buet S. (2017). *Plays Store, English Cebuano Dictionary*. Retrieved from <https://play.google.com/store/apps/details?id=com.dictionary.ceb>
- [3] Clement, A. (2013). *A case study in mobile application development for student advisement in the W. P. Carey School of Business*. Retrieved from <https://www.grin.com/document/273323>
- [4] DepEd. (2016). *Mother Tongue-based learning makes lessons more interactive and easier for students*. Retrieved from Department of Education. Retrieved from <http://www.deped.gov.ph/press-releases/mother-tongue-based-learning-makes-lessons-more-interactive-and-easier-students>
- [5] Eason (2017). *Android Studio 3.0*. Retrieved from <https://android-developers.googleblog.com/2017/10/android-studio-30.html>
- [6] Geoviz, S. (2015). *Benefits of java for mobile application development*. Retrieved from <https://www.geo-viz.com/blog/benefits-of-java-for-mobile-application-development>
- [7] Habaradas, S. (2016). *Profile of Smartphone Users in the Philippines*. Retrieved from <https://jaypeeonline.net/mobile/profile-smartphone-users-philippines/>
- [8] Kendall, J. & Kendall, K., (2008). *Software Analysis and Design* (7th Edition): Pearson Education Inc.
- [9] Kroulek (2016). *Why Translation is Important in a World Where English is Everywhere*. Retrieved from <http://www.73k-international.com/blog/why-translation-is-important/>
- [10] Kreibich, D. (2018). *Using SQLite*. Retrieved from <https://www.safaribooksonline.com/>
- [11] Leahy S. (2017). *Computer Programming Language*. Retrieved from <https://www.britannica.com/technology/Java-computer-programming-language>
- [12] Liang, Daniel (2012). *Introduction to Java Programming, Comprehensive Version, Student Value*. Prentice Hall PTR
- [13] Microsoft (2018). *Quality Attributes (Chapter 16)*. Retrieved from <https://msdn.microsoft.com/en-us/library/ee658094.aspx>
- [14] MobiSystems (2018). *Filipino Dictionary*. Retrieved from <https://play.google.com/store/apps/details?id=com.mobisystems.msdict.embedded.wireless.oxford.dictionaryofenglish&hl=en>
- [15] Ong, F. (2011). *Surigaonon Dictionary: Johann Publications*, ISBN: 9789719433248
- [16] Roth S., Dennis W., Wixom U., (2013). *Systems Analysis and Design* (5th Edition): John Wiley & Sons Inc.
- [17] Sommerville (2001). *Software engineering* (6th Ed.): Pearson Education Asia Pte Ltd.
- [18] Smartdraw. (2018). *Use Case Diagram*. Retrieved from <https://www.smartdraw.com/use-case-diagram/>
- [19] Smith. (2013). *Why developers choose Android*. Retrieved from <https://www.androidauthority.com/why-developers-choose-android-285774/>
- [20] Smyth, C.S and Neil S. (2015). *Android Studio Development Essentials – Android* (6th Ed.). Create Space Independent: Publishing Platform.
- [21] Priestersbach, F., and Springer S., (1991). *Quality Attributes in mobile Web Application Development*. Retrieved from <https://pdfs.semanticscholar.org>
- [22] Techopedia Inc (2018). *Mobile Application*. Retrieved from <https://www.techopedia.com/definition/2953/mobile-application-mobile-app>
- [23] Phillips, Q., Bill J., Stewart P., Chris R., Marsicano T, Kristin A., (2017). *Android Programming: The Big Nerd Ranch Guide* (3rd Ed.): Big Nerd Ranch Guides, 2017, ISBN: 0134706056, 9780134706054