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ANDROID-BASED MALAY ENCYCLOPEDIA USING PATTERN MATCH METHOD

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ABSTRACT

Malay is spoken in the archipelago and the Malay Peninsula, becoming the official language in Indonesia, Brunei, and Malaysia. It is the national language of Singapore and the working language of Timor Leste and several other ASEAN countries. The Malay language is valuable and should be preserved so that future generations, especially in Indonesia, recognize the diversity of languages that the Indonesian people have. One way to keep it is to document the Malay language in an encyclopedia, usually a thick book. Because thick books are not practical to carry everywhere and are not friendly for quick searches, the author developed a mobile application using the Android platform to make it easier for users to access information about the Malay language. The method used in this paper is A Pattern Match, a pattern search on a text string. The pattern match method is developed using System Development Life Cycle (SDLC), a common approach to application development. In this paper, the application only focuses on the Indonesian-to-Malay and Malay-to-Indonesian translation dictionary features and the poem search feature based on the keywords entered. The development of this system implements a client-server application that must connect the device to the Internet to access the server's data. The keyword search uses a pattern match, which produces output based on keywords that have similar patterns. Ten respondents utilized usability testing and showed that 85.71% thought it was good, 6.12% thought it was neutral, and 8.16% thought it was poor.

1. INTRODUCTION

Culture generates language, and language significantly influences cultural norms and practices. Furthermore, Malay is a regional language in Indonesia. One type of language used in the world is Malay. Before the Dutch came to the archipelago, Malay was already used as a liaison and trade language whose spread had passed through the archipelago. Portuguese

people who wanted to do business emphasized the importance of knowledge of the Malay language to achieve good results in their commerce. The Malay language, which he calls the Latin language of the East, is used for practical purposes, namely conveying the mission of religion, trade and commerce, and related education. Each region in Indonesia has its regional language. However, the Indonesian language used today is the former Malay language, but certain accents have changed. Strong Indonesian - Malay accents are still commonly found in the Sumatra region because this location borders Malaysia, Singapore, and Brunei (Emawati, 2018; Sahril, 2020).

Malay-Indonesian is an Austronesian language that is spoken in a variety of forms in Southeast Asia. The native name of the language is Bahasa Melayu (the Malay language). However, the standard language and some regional colloquial variations in Indonesia are referred to as Bahasa Indonesia (the Indonesian language). The national languages of Indonesia, Malaysia, Brunei, and Singapore are all variants of standardized Malay-Indonesian. Standard Malay, spoken in Malaysia, will be referred to as Malaysian (Tadmor, 2018). Even though the Indonesian language in Indonesia is derived from the Malay language, there are differences in the current terms and the use of different accents, for example, when we come to Malaysia, Brunei, and Singapore. The language terms used by residents there are very different because a language barrier often makes it difficult for us to communicate with citizens of these countries (Umami, 2020).

For this reason, Indonesian people still need to understand Indonesian – Malay. In addition to overcoming the language barrier, Indonesian people do not understand their native language. Malay-Indonesian, with its original vocabulary, will disappear from Indonesian society if Indonesians do not know and are lazy to learn it. What is happening now is that Indonesian people prefer to use a mixed language of Indonesian – English. For this reason, a container is needed to ensure the survival of the Malay language. We must provide a venue where individuals from all walks of life can learn more about Malay.

Nowadays, technology can make everyday life easier. Technology can also help humans to communicate, and now humans can use technology to translate language. Several language translator programs, including Google Translate, have been found using computer technology(Bourne, 2014; Doherty, 2016). Smartphones are the most popular form of media consumption in this era of rapid technological advancement, and dictionaries and encyclopedias are the most valuable resources for learning about other cultures and languages. Therefore, digital encyclopedias are becoming increasingly popular for accessing this information. The lack of digital media as a source of information to search for translations of Malay words and search for Malay poems based on the entered keywords inspired the development of this digital encyclopedia. It does not imply that there is no more exhaustive medium, but rather that the digital encyclopedia we have developed will display search results based on the initial pattern of the searched word and then save the keyword for future use if it is not found, as a means of expanding the database to accommodate the next search. In addition, digital applications can be a more convenient alternative to books, which are impractical to carry everywhere and make it more time-consuming to find the information that one is seeking.

Through quick searches of translation dictionaries and rhymes, this application aims to make it simpler for individuals to learn about Malay culture. Through the keywords they enter, users indirectly contribute to the growth of the application's database. In terms of technology, this application is intended to employ a pattern-searching algorithm so that search results include words containing the entered keywords and words with prefixes similar to the keywords. In designing this system, we have focused on two major features: translating words from Indonesian to Malay and from Malay to Indonesian and adding a feature to search for Malay poems based on the words contained within the poem or the category in which it is located. Through the use of a pattern search algorithm, keyword writing errors can be reduced.

1.1. Previous Research

Several studies have discussed the importance of using applications in translating a language. Research Resmawan et al. (2015) developed a Balinese – Indonesian dictionary application. Utami et al. (2016) developed an English-Indonesian translator application using optical character recognition. Research by Martoyo et al. (2018) developed a dictionary application for the Siau regional language using an open-source system. Santoso (2017) developed an application for translators from Indonesian to Javanese using the waterfall development model. Setiawan et al. (2016) developed a translator application from Javanese to Indonesian using Java 2 Micro Edition. Research by Maslan et al. (2016) developed an android-based Sulawesi language translator application using the waterfall model. There have been several previous studies that have developed translator application models. However, the methods are different.

Meanwhile, this research uses the Sequential Search method, which refers to Iskandar et al. (2022) using the sequential search method as a reference. However, there are differences between this study and (Iskandar et al., 2022). The following is a comparison of previous and current research :

Table 1 Research comparison

	Previous research	This research
Platform	Web	Android
Method	Sequential Search	Pattern Match
Features	Word, Sentence, Suggestion, Conversation, Login	Dictionary, poem, Keyword Record, Without Login
Technology	PHP, MariaDB	Java, PHP, MariaDB

1.2. Pattern Match

Based on research from Resmawan et al. (2015); Utami et al. (2016); Martoyo et al. (2018); Santoso (2017); Setiawan et al. (2016); Maslan et al. (2016); Iskandar et al. (2022) mainly developed on a web-based basis with the sequential search method which consumes much memory and tends to have high execution times, although their development is also waterfall-based. While this research uses mobile (android) to make it more practical to use and uses pattern matches, whereas pattern matches search based on patterns.

A Pattern Match is a pattern search on a text string in which, if the string pattern is present, the first occurrence of the string pattern within the text string must be located. The technique of searching a given string for patterns is known as patterns (Krishna, 2012). The effectiveness of the search is contingent on the number of comparisons made. Pattern Match is one of the most frequently employed query optimizations when indexes fail—LIKE-formatted query statements for performing pattern matching in a lookup database. In a query statement that uses LIKE to run the query, the index will not work if the first character of the matched string is "%," so only "%" that is not indexed in the first position will work.

1.3. Encyclopedia

The encyclopedia is a collection of writings that contain a broad, complete, and easy-to-understand explanation of various kinds of scientific information or specifically about a particular branch of science, which are arranged alphabetically or by category and printed in the form of a book, which serves to enrich knowledge, especially knowledge that is not contained in the main book (Magfiroh & Fajar, 2022).

1.4. Technology

The technology in previous and current research increases the use of android as an application user access. While android most commonly uses Java and Kotlin, this study uses Java. PHP is used for the backend, and MariaDB is used for the database.

1.4.1. *Hypertext Preprocessor (PHP)*

Hypertext Preprocessor (PHP) is a free, open-source server-side scripting programming language (Muqorobin & Rais, 2022). As a scripting language, PHP executes program instructions dynamically. Depending on the data handled, the results of the instructions will inevitably vary. PHP is a server-side programming language; therefore, PHP scripts will be handled on the server. Apache, Nginx, and LiteSpeed are popular server types used in conjunction with PHP.

1.4.2. *Java*

Java has been among the most in-demand and well-known languages for almost 25 years. James Gosling and his team at Sun Microsystems first proposed the programming language Java in 1991, which was released in 1995. Java's most notable characteristic is that it is stage-independent. When Java was initially presented, it was referred to as OAK. OAK was introduced as a programming language that serves as a connection platform for devices such as VCRs and televisions (Cutting & Stephen, 2021). In 2010, Oracle Corporation acquired Sun Microsystems and became the owner of Java. Java is an ordered language that is statically composed, meaning variables must be declared before assigning values. Java-based projects execute faster than Python but are slower than C++. Airbnb, Uber, LinkedIn, Pinterest, Groupon, Spotify, Eclipse, and Hadoop are typically based on the Java programming language.

1.4.3. MariaDB

MariaDB is an open-source Database Management System (DBMS) that supports many users, multiple threads, and extensive access. According to the above notion, SQL is a database query language in which sublanguages can produce and alter data. This refers to a Relational Database Management System (Rina Noviana, 2022).

2. METHODS

2.1. System used

This study uses Pattern Match. The System Development Life Cycle (SDLC) program is used to interpret Pattern Match, a common approach to application development. It refers to standard procedures for developing information systems, such as planning, analysis, design, implementation, and maintenance. As a planning and control framework for producing information systems, the SDLC concept is widely used in software development.

The Waterfall method is one of the SDLC (System Development Life Cycle) methods that require each phase to be completed before moving on to the next. This means that the focus on each phase can be maximized because parallel work is uncommon in the waterfall, even though parallelism can occur. This assertion is supported by empirical research conducted by Nurcahya et al. (2022).

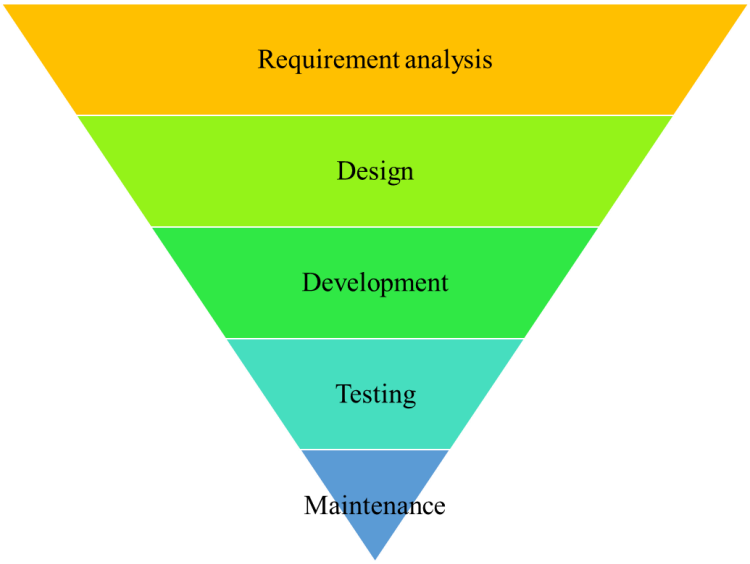

Figure 1 Waterfall Method
Source : Nurcahya et al., (2022)

2.2. Questionnaire technique

This study uses a Likert scale to determine the scale of the questionnaire assessment. The Likert scale is a psychometric scale commonly used in questionnaires and is the most widely used scale in survey research. There are two forms of Likert: positive questions to measure positive interest and negative ones to measure negative interest. The Likert scale answer consists of strongly agree, agree, disagree, and strongly disagree (Taluke et al., 2019; León-Mantero et al., 2020).

Table 1 Criteria of Likert Scale Score

Respondent's Answer	Score
Strongly agree (SA)	5
Agree (A)	4
Neutral (N)	3
Disagree (D)	2
Strongly Disagree (SD)	1
Source : (Creswell, 2016))	

2.3. Determination of research sampling

Determination of respondents in this study using the snowball sampling method. Snowball Sampling or serial reference sampling is defined as a non-probability sampling technique in which the sample has properties that are rarely found. It is a sampling technique in which the existing subject provides referrals to recruit the required sample for the research study. This sampling method involves the primary data source nominating other potential data sources who will be able to participate in the research study. The Snowball Sampling method is purely referral-based, which is how a researcher can generate a sample. Therefore this method is also called the chain-referral sampling method (Naderifar et al., 2017; Kirchherr & Charles, 2018).

In this study, one expert was used as a respondent to test the application. Then this expert spreads it to his colleagues, who are also experts to test the application. So, ten experts were obtained as respondents who tested this application for one month.

2.4. Application Development Procedure

In the study, the following procedures were used for development: (1) Requirement Analysis: There are various hardware and software needs in developing this android-based encyclopedia application. The needs are as follows: (a) Hardware Requirements (b) A processor having x86 64 CPU architecture; 2nd generation Intel Core or later (c) At least 8 GB of free disk space (d) The minimum RAM requirements are 8 GB; (2) Software Requirements: (a) Operating System: 64-bit Microsoft Windows 10 (b) Android Studio version 2021.3.1.16 (Java, Gradle, Android SDK) (c) CodeIgniter version 4 (PHP) (d) MariaDB version 10.4.24

2.5. Design

2.5.1. *Splash Screen and Main Menu*

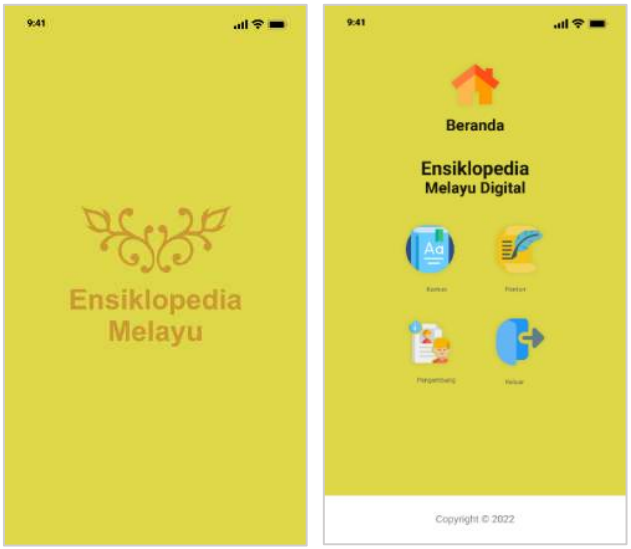

Figure 2 Splash Screen and Main Menu

The splash screen is the first page that appears when the application is opened. Then the main menu page appears, which consists of options in the application, including a dictionary, rhymes, developer info, and an exit button.

2.5.2. *Dictionary, Poem, and Developer*

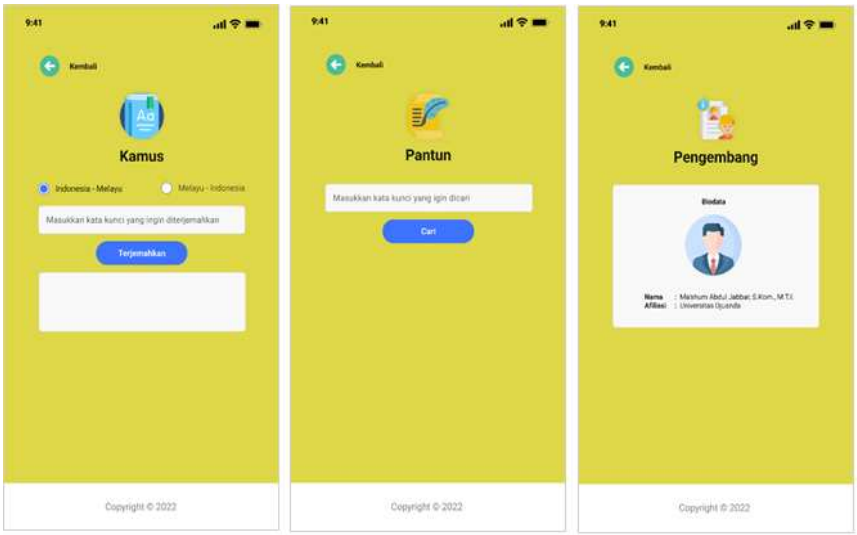

Figure 3 Dictionary, Poem, and Developer

The dictionary page is one of the features in the encyclopedia application, where users can search for translations from Indonesian to Malay or vice versa according to their choice, and the results that come out depend on the keywords the user inputs by utilizing the pattern method, the user only needs to type the prefix pattern.

2.6. Application Programming Interface Design

The following is an Application Programming Interface (API) design that will be used to exchange data from an Android application to the server that provides the data.

2.6.1. *API Dictionary*

Table 2 API Dictionary

URL	{{baseURL}}/dictionary/translate
Method	POST

Body	<pre>{
	"keyword": "saya," "initial ": "Indonesia," "destination ": "Melayu."
	}</pre>

Success	<pre>{
	"status": 200,
	"code": "Success,"
	"message": "1 Result ditemukan.",
	"data": [
	{
	"result": "saya : saye, aku"
	}
	]
	}</pre>

Failed	<pre>{
	"message": "Keyword not found."
	}</pre>

2.6.2. *API Poem*

Table 3 API Poem

URL	{{baseURL}}/poem/search
Method	POST

Body	<pre>{
	"keyword": "adat"
	}</pre>

Success	<pre>{
	"status": 200,
	"code": "Success,"
	"message": "1 Result ditemukan.",
	"data": [
	{
	"category": "POEM ADAT,"
	"content": "Adat menyuluh sarang lebah\n
	Kalau berisi tidak bersambang\n Adat penuh tidak melimpah\n
	Kalau berisi tidaklah kurang"
	}
	]
	}</pre>

Failed	<pre>{
	"message": " Keyword not found."
	}</pre>

2.7. Algorithm

The following is the algorithm used in the keyword search.

2.7.1. *Pattern Match Algorithm for Dictionary*

```
keyword <- INPUT()
count <- 0                                                    (1)
REPEAT WHILE(initial_language LIKE 'keyword%')
```

```
{
     IF('keyword'==destination_language){
               result <- CONCAT(destination_language)
               count++
     }
}
IF(count > 0){
     DISPLAY(result)
}else{
     DISPLAY("Keyword not found")
}
```

2.7.2. *Pattern Match Algorithm for Poem*

```
keyword <- INPUT()
count <- 0
REPEAT WHILE(category LIKE 'keyword%' OR content LIKE 'keyword%')
{
     IF('keyword'==category){
               result <- CONCAT(category)
               count++
     }
     IF('keyword'==content){
               result <- CONCAT(content)
               count++
     }
}

IF(count > 0){
     DISPLAY(result)
}else{
     DISPLAY("Keyword not found")
}
```

(2)

These two algorithms are called pseudocode. the script is a series of algorithms for the search feature in making this application so that it is in the form of an algorithm written using pseudocode, so it is not a program source code. Pseudocode is a description of a computer programming algorithm that uses the simplified structure of some programming language, but that language is only intended to be human-readable. The difference lies in how it is delivered, and pseudocode uses words to explain an algorithm (Ernawati et al., 2019).

2.8. Development

The development phase describes the short code used in making this application. API testing using Postman and the application's final result that usually runs will be published to Google Playstore.

2.8.1. *Indonesian to Malay translation*

The following script is used for Indonesian to Malay translation.

```
<?php
public function translateIndonesiaToMalay($keyword = null){
   $query = "SELECT CONCAT(a.indonesia_dictionary,' : ',a.melayu_dictionary)
AS result FROM ensiklopedia_dictionary a WHERE a.indonesia_dictionary LIKE
'$keyword%'
   ORDER BY a.indonesia_dictionary ASC";
   $query=$this->db->query($query);
   return $query->getResult();
}
?>
```

(3)

2.8.2. *Malay to Indonesian translation*

The following script is used for Malay to Indonesian translation.

```
<?php
public function translateMalayToIndonesia($keyword = null){
   $query = "SELECT CONCAT(a.melayu_dictionary,' : ',a.indonesia_dictionary) AS
result FROM ensiklopedia_dictionary a WHERE a.melayu_dictionary LIKE '$keyword%'
```

(4)

```
    ORDER BY a.indonesia_dictionary ASC";
    $query=$this->db->query($query);
    return $query->getResult();
}
?>
```

2.8.3. *Poem Search*

The script used to search for a Malay poem is as follows.

```
<?php
public function poem($keyword = null){
    $query = "SELECT a.category_poem AS category, a.isi_poem AS poem
    FROM ensiklopedia_poem a
    WHERE a.category_poem LIKE '%$keyword%' OR a.isi_poem LIKE '%$keyword%'
    ORDER BY a.isi_poem ASC";
    $query=$this->db->query($query);
    return $query->getResult();
}
?>
```

(5)

2.8.4. *API Testing*

The backend built using PHP will first be tested using Postman as one of the popular API testing tools.

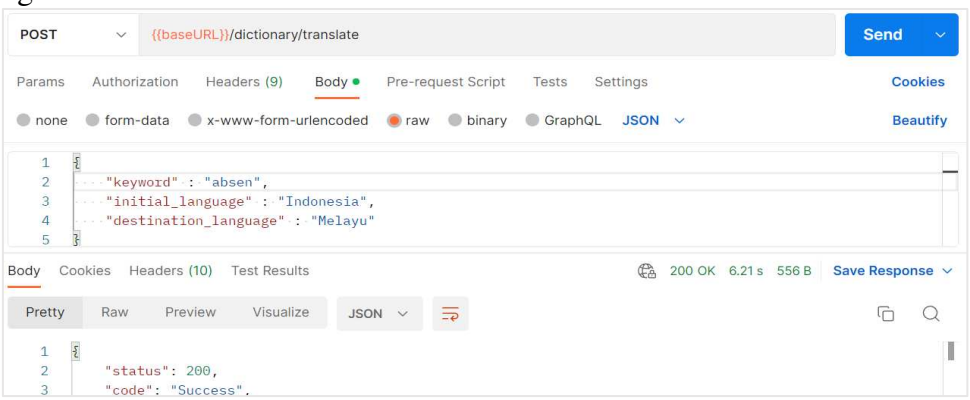

Figure 4 API Testing

2.9. Deployment

Completed applications are subsequently released to the Google Playstore so that the general public can test them on their Android devices in real time.

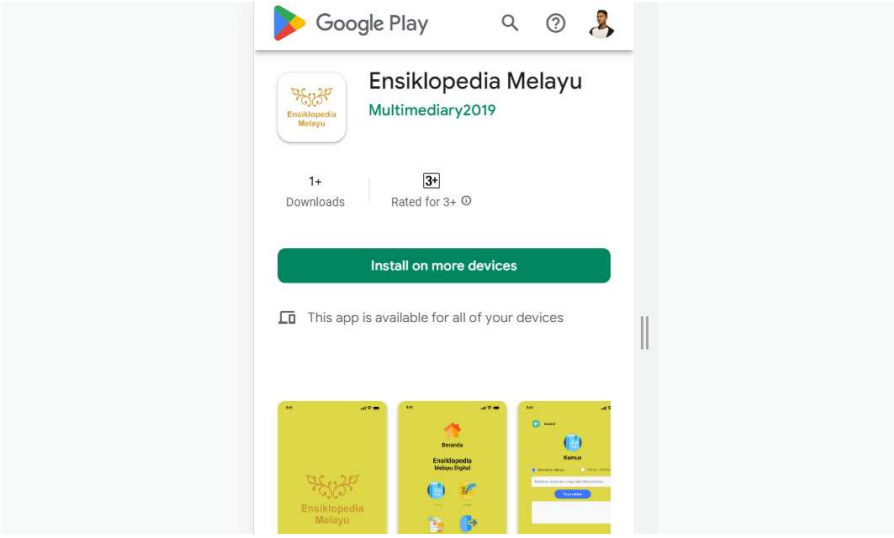

Figure 5 Apps in Playstore

2.10. Testing

The testing strategy utilized in this study is usability testing with unmoderated testing, in which the tester is provided with a link to the application's download page and then allowed to test it without receiving any usage guidance. Following the test, the examiner was given a Google Form questionnaire to fill out, and they were instructed to respond following the test results. This questionnaire was adapted using a Likert scale with the criteria from strongly disagree to strongly agree. The Likert scale is a psychometric scale commonly used in questionnaires and is the most widely used scale in survey research. There are two forms of Likert: positive questions to measure positive interest and negative ones to measure negative interest. Positive questions were scored 4, 3, 2, and 1; the negative question forms were scored 1, 2, 3, and 4. The Likert scale answer forms consisted of strongly agree, agree, disagree, and strongly disagree (Taluke et al., 2019; Pranatawijaya et al., 2019; León-Mantero et al., 2020).

Table 4 Questionnaire

ID	Question & Answer				
1.	Is the app easy to use?				
	○ Strongly disagree	○ Disagree	○ Just agree	○ Agree	○ Strongly agree
2.	Can the information displayed in the application be captured quickly and clearly?				
	○ Strongly disagree	○ Disagree	○ Just agree	○ Agree	○ Strongly agree
3.	Does the application have an attractive appearance?				
	○ Strongly disagree	○ Disagree	○ Just agree	○ Agree	○ Strongly agree
4.	Was the dictionary search feature in the app beneficial?				
	○ Strongly disagree	○ Disagree	○ Just agree	○ Agree	○ Strongly agree
5.	Is the rhyme search feature in the application beneficial?				
	○ Strongly disagree	○ Disagree	○ Just agree	○ Agree	○ Strongly agree

3. RESULTS AND DISCUSSION

The results of this survey depend on the individual perspective of each participant, and the proportional value will undoubtedly be affected by the number of respondents. Because the application requires an internet connection and a production environment that depends on free public services, interference will probably occur throughout the application testing process.

3.1. Results

This study used snowball sampling, with one expert as the initial respondent. Then this expert spread it to his colleagues, who are also experts to test the application. So for one month, ten experts were obtained. The following are the results of a review of the Android-based Malay Encyclopedia application that ten respondents downloaded from Google Playstore. The application can be found here https://play.google.com/store/apps/details? id=id. encyclopedia.melayu.

In terms of ease of use, 70% of users rated the application's simplicity as "very simple," 20% as "simple," and 10% as "very tough," according to the following chart.

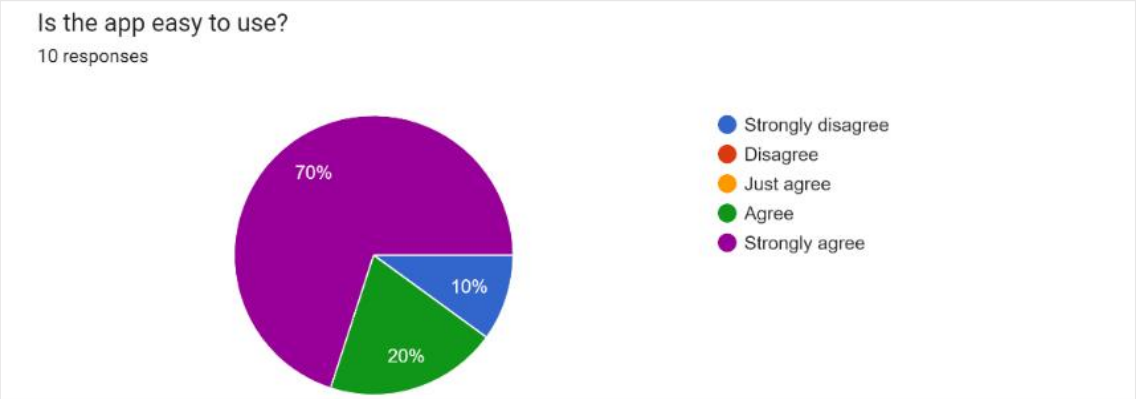

Figure 6 Ease of use value

Based on the information displayed, 30% rated it very clear, 60% rated it clear, and 10% rated it very unclear.

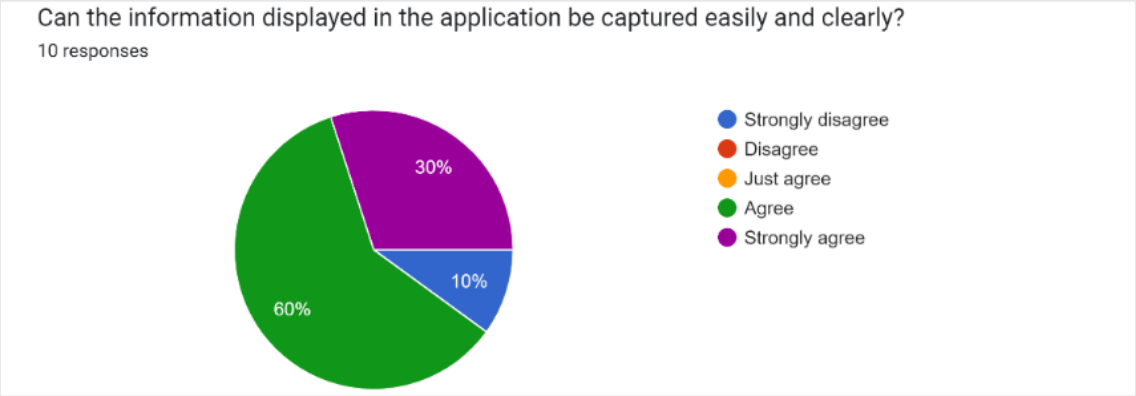

Figure 7 Information clarity value

Based on the appearance of the application interface, 30% rated it very attractive, 60% rated it attractive, and 10% rated it very unattractive.

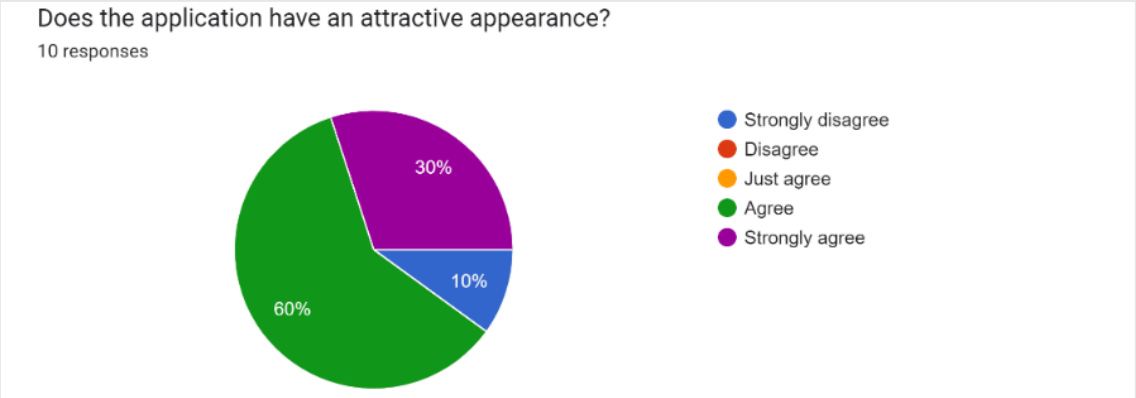

Figure 8 Appearance value

This dictionary function is rated 50% extremely helpful, 30% helpful, and 20% fairly helpful. No one in this rating offers an application a poor rating.

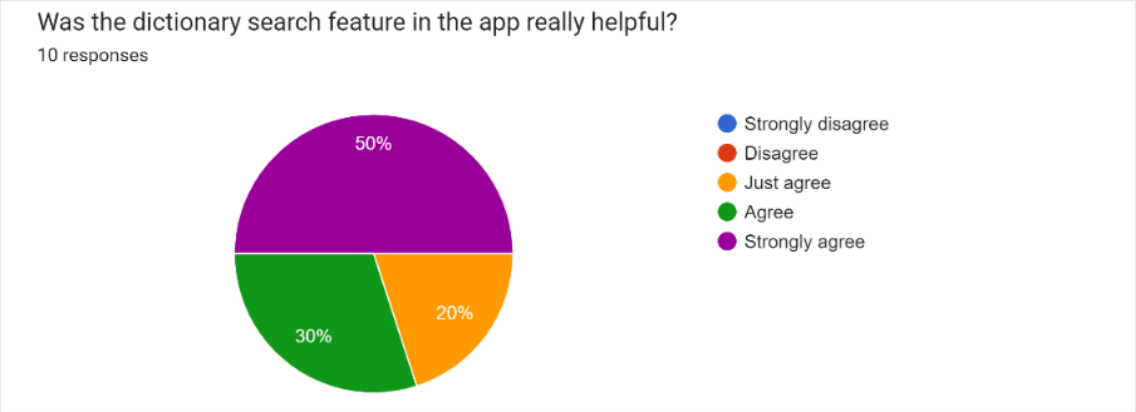

Figure 9 Dictionary Search Value

This poem function is rated as 70% helpful, 10% quite helpful, 10% rated unhelpful, and another 10% rated very unhelpfully.

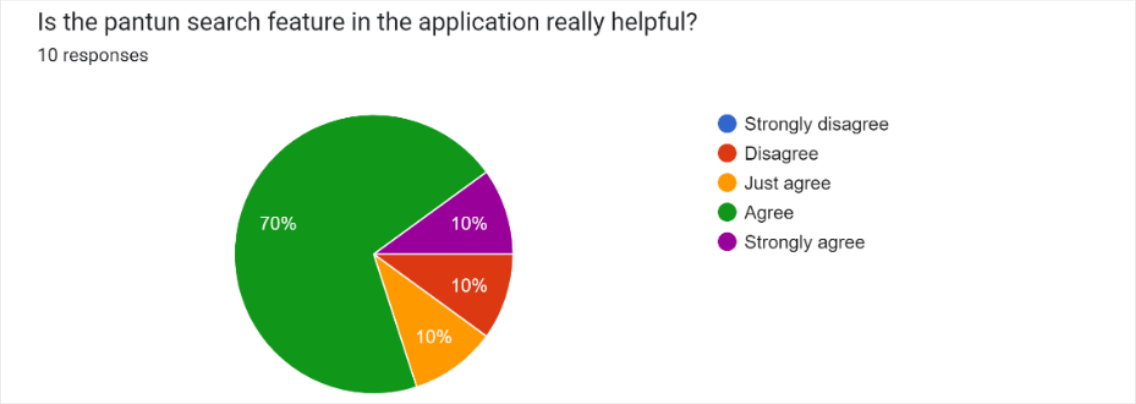

Figure 10 Poem Search Value

After receiving each evaluation, we attempt to classify the values into three categories: Good, Neutral, and Poor. This category is obtained by calculating the incoming questionnaire data using a Likert scale by calculating the median value of each category concerning the method used by Budiaji (2013). The following table groups these values together.

Table 5 Score Grouping

Evaluation	Score Each Question						Percentage		Description
	1	2	3	4	5	Total	Single	Grouping	
Strongly agree	70	30	30	50	10	190	38.78%	85.71%	Good
Agree	10	60	60	30	70	230	46.94%		
Just Agree				20	10	30	6.12%	6.12%	Neutral
Disagree						0	0.00%	8.16%	Poor
Strongly disagree	10	10	10		10	40	8.16%		

3.2. Discussion

From the results of the application evaluation using expert opinion, it is known that they stated that this application would help the community. They thought this application still needed some improvements and adjustments with the addition of other features so that it could be said to be an encyclopedia. The encyclopedia is comprehensive and even equipped with

pictures using attractive colors. This application needs to be upgraded by adding visuals, sounds, and cultural perceptions. Several studies have revealed several criteria for being a good encyclopedia (Erawati et al., 2020; Schopflin, 2014; Yasa et al., 2020).

For now, it still seems to be just a dictionary, even though there is a little addition to the poem menu because the encyclopedia is broad, not just about dictionaries. Extensive use of algorithms is needed to create a good encyclopedia, as presented by Tang (2021); Mahmudova (2018) regarding algorithm features for compiling language programs. In addition, many of the vocabularies sought still need to be found because this is related to the word database. In the future, this application has been set to collect words that users often search for, and if later they are not found, then the admin, through the backend, will add these new words.

This research certainly still needs much improvement because a good application is an application that is constantly updated both from existing features and when new features are added. Moreover, this application is called an encyclopedia. It is not enough if it only contains a dictionary and rhymes. In addition, this application is very closely related to data or search keywords. The more people use the application and perform searches, the more references for researchers to add keywords that have yet to be found for future data updates. One of the reasons for displaying results based on a pattern is so that adjacent or similar keywords appear immediately, thereby reducing keyword logging. If anyone is interested in developing it, do not hesitate to contact the author.

4. CONCLUSION

The algorithm used in this study uses pattern matching, where this pattern matching algorithm is an algorithm used to find out whether a specific string pattern occurs in a text string. The advantage is, of course, by giving a pattern to what we are looking for, the computer will find what we are looking for faster because we do not need to search in its entirety, but the disadvantage is that because what is read is a pattern, the search results found that appear are not only the words we are looking for but the words which have a similar pattern will also appear. However, in this application, product creators also take advantage of the word similarity feature in searches, where product creators deliberately participate in displaying search results that have the same pattern so that users can simultaneously learn other words that are similar to the keywords they are looking for, although initially, the user may not need the information. This application must be developed so that it becomes more exciting and is ready as an encyclopedia, a medium for communicating with the Malay family, a medium for preserving Indonesian-Malay, and a medium for learning languages.

This Malay Language Encyclopedia application can serve as a resource for all levels of society to study the Malay language and poems. This application has been made available to the public and may be accessed via mobile devices. The more new searches that have yet to be found, the more information sources will be added to this application. The importance of the application's usability and simplicity is demonstrated by the level of satisfaction given by the test results. Again, this research still requires refinement and the addition of future-developable aspects of Malay culture.

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