Application of the Binary Search Method to the Arabic - Indonesian Translator Application

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ABSTRACT

Language is an access for students to understand information and knowledge. Among Islamic boarding schools, the foreign language that is often found in it is Arabic. In this case, Arabic translation is needed to make it easier to find the meaning of Arabic words and understand Arabic. The development of technology is currently moving rapidly, especially in the field of information technology, making more and more applications appear with technology that resembles human capabilities even better than human abilities, one of which is a word data search engine or commonly called a dictionary application. In the case of Arabic, there is still little research on making dictionaries using Arabic as the target language. Therefore, the researchers tried to make a translator application using Arabic as the target language and using translation Indonesian. Researchers use the binary search method to be applied to the word data search process. The binary search method is a method that is applied by sorting the data first. The sorted data is then divided into two parts until the data you are looking for is found. The result of this research is a system for translating Arabic words into Indonesian with a search feature using the binary search method. From the search results, the accuracy of the search using this method is 95%.

Keywords: Language, Language Translation Application, Arabic, Binary Search

1. INTRODUCTION

Language is one of the accesses for students to understand information and knowledge. The lack of knowledge of foreign languages among students is currently a factor obstacle in the difficulty in receiving information sourced from outside Indonesia.

Language translation to be supported in obtaining information and increasing knowledge, especially information in foreign languages. Among Islamic boarding schools, the foreign language that is often encountered is Arabic. In reality, Arabic is a complicated language. Often students who do not understand Arabic have difficulty receiving information or receiving Arabic lessons. Students are required to open a dictionary or other translation media to find the meaning of the Arabic word they want to know. In dictionaries, in general, Arabic words are often not included, making it difficult for users to translate the words they are looking for. In this case an Arabic translation is needed to make it easier to find the meaning of Arabic words and understand Arabic. Technological developments are currently moving rapidly, especially in the field of information technology, making more and more applications appear with technology that resembles human abilities and even better than human abilities, one of which is a word data search engine or commonly called a dictionary application. Several studies related to the discussion of translator systems or dictionaries have been tested using Indonesian as the target language and the binary search method is used as a data search method. This study is entitled Designing a Sundanese Indonesian Dictionary Application with the Android-Based Binary Search Method. Review by Dinar Sugiri, Hanny Hikmayati and Aries Suharso. The conclusion from the results of research conducted by Dinar Sugiri and friends is that this application is made using Android. Studio tools with SQLite database so that the Sundanese-Indonesian dictionary can be used on Android 4. 0 and up. The application of the binary search algorithm lies in searching data in the database. This test is done on the application and the user. Test the application with a black box and white box. while the presentation tests used by

users to determine ratings include very good 68.75%, good 21.25%, enough 10% and less from 0%.

The method used to search for words in the application to be made is the Binary Search method. The Binary Search method can be applied to data that has already been sorted (Ascending/Descending). The binary search method is a search method for sorted data. In this method, all sorted data elements are divided into two parts until the required element is found. Searching for sorted data will lead to a fast search. This algorithm is used to find requirements quickly.

From the studies that have been carried out, until now there is still little research on language translation systems that use Arabic as the target language. If we look again, Arabic is the superior language in the world of Islamic boarding schools and educational institutions. From the above problems, a study was created with the title "Application of the Binary Search Method in Arabic - Indonesian Translator Applications". From this research it is hoped that it can help and simplify the process of learning Arabic, especially in finding the meaning of Arabic words without having to know the basic words of the words you are looking for.

1.1 Formulation of the problem

1. How to design an Arabic to Indonesian translator application?
2. How to apply the binary search method to the Arabic to Indonesian translator application?

1.2 Research purposes

1. Create a system for translating Arabic text into Indonesian using the Binary Search method

2. Generate translations that match the words you are looking for without finding out the origin of the words entered first.
3. Produce a language translator application
.

2. LITERATURE REVIEW

This research was driven by the results of previously completed research. Discusses research on language translation systems using the binary search method.

1. Research from Dinar Sugiri, Hanny Hikmayati and Aries Suharso which was published in the Journal of Computer Science and Information Technology at Singaparna Karawang University, on April 1 2019. This research discusses the translation of Indonesian and Sundanese using the binary search method. The results of designing an Indonesian Sundanese dictionary application using the binary search method are equipped with translations, sentences, word input to add vocabulary to dictionaries and applications that provide Indonesian Sundanese dictionary information according to Sugiri, Hikmayanti and Suhaso [1]

2. Research from Rusydi Umar et al published in the journal National Seminar on Information and Communication Technology (SEMANTIKOM) in 2017. This research discusses the application of the binary search algorithm to speed up searching for root words in the Qur'an on Android applications. The result is the application of the concordance of the contents of the Koran which is expected to be useful as an alternative in learning to understand the Koran according to Umar, Riadi, and Muthohirin [2]

From the two studies, there are several differences with the research conducted, namely the author discusses how to make a translation system for Indonesian and Sundanese using the binary search method and implementing the binary search algorithm in the Al-Quran concordance application.

2.1 Binary Search

Binary search is a search method and data sorting. In this method, all sorted data elements are tested one by one until the required elements are found. Sorted data search will result in a quick search. This algorithm is used to quickly find requests. The working principle of the search algorithm is to divide the data into two parts. Binary search is a technique used to find a specific value stored in an array. This binary search is performed to minimize the number of comparison operations between the data to be searched for and the data in the table. The principle is to repeat the division of the search space until the data sought is found or cannot be divided again, that is, the data sought cannot be found according to Andri [3]. According to Umar, Riadi, and Muthohirin, quoted from Aslam (2015),

1. If target data K is immediately found, then the room division process stops. Then print the index data elements in the array.
2. If the target data is K <A[middle], then the search can only be limited by searching the left side of the array starting from A[middle]. All elements on the right can be ignored.
3. If the target data is K>A[middle], a right side only search will be faster. If all data has been searched but not found, provide a value, for example -1.

Styles can be applied using the style palette available within the template. To activate it the press Ctrl+Shift+s. Apply the style as required based on the content and context. (Please don't highlight your text in yellow.)

3. RESEARCH METHODOLOGY

In this research method described the various stages that the author did when conducting this research. The process is shown in Figure 1.
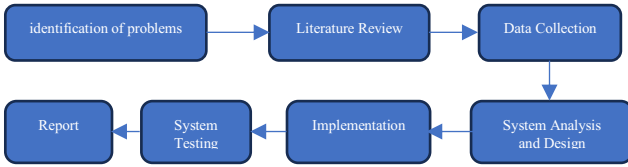

Figure 1. Research procedure.

3.1 Needs Analyst

3.1.1 Functional Requirements

In this Arabic to Indonesian translator system, there are two users, namely, admin and user. Both have their respective roles in accessing information
The functional requirements of this system include:

  a) The system can display data according to the data desired by the user.

  b) The system runs in the browser application.
  c) The system can input user data.
  d) The system can input email and password from the admin.
  e) The system can display visitor data.
  f) The system can display login validation as admin.

3.1.2 Functional Requirements

The minimum specifications required for software engineering to function optimally are as follows:

1) Hardware

  a) Laptop/computer with a minimum Intel Core i3 processor and at least 4GB of RAM.
  b) Capacity hard drive minimum 128 GB - Modem/Wifi.

2) Software (software)

  a) Use Visual Studio Code and a text editor for sublime text.
  b) Using the PHP programming language and the Laravel framework according to Lutfi [4].
  c) SQL database

3.2 Needs Analyst

3.2.1 System Flow

This translator application translates the words entered into the system. Furthermore, each letter/character in the word entered is processed by the system using the ASCII code so that the computer can read the entered character. After the Unicode process is carried out, the search for data in the database is carried out by applying the binary search method. The system process flow of this translator application can be seen in the flowchart of Figure 2.
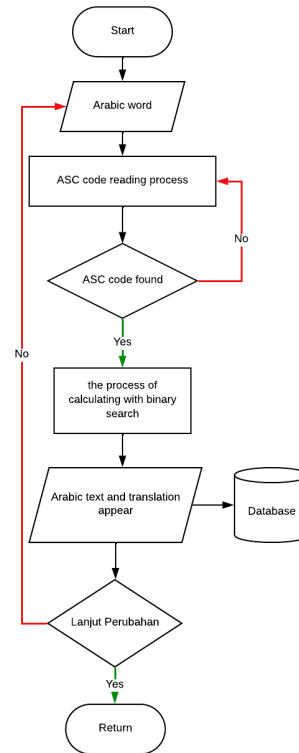

Figure 2. Search system flow.

3.2.2 Use Cases

Use cases are flowcharts proposed by researchers and specifications for interactions between users and systems. While simple system usage involves only some interaction with system users, more complex use cases involve lots of interaction with system users. More complex use cases also involve multiple actors. To describe the use cases in the system, it is best to start by focusing on the user and the actions performed in the system. Each use case describes a series of interactions between the administrator and the instructor and the system, as in Figure 3.
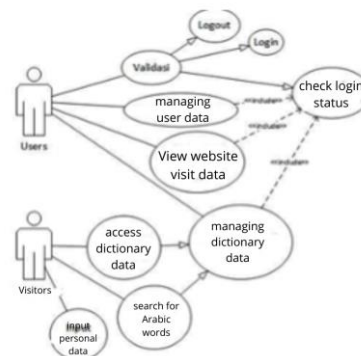

Figure 3. Use Cases.

Figure 2 illustrates the number of system users, explained in the use case diagram there are two users, namely users and guests. Each user has their own access rights in the web-based translation application which are described by arrows.

3.3 Database Design

The database design illustrates the relationships between tables, in which there are 11 tables that will be used to store data. These tables include: table mode_has_roles, table mode_has_permission, table visitors, table dictionary, table users, table roles, table permissions, table role_has_permission, table password_reset, table tem_search, and table migrations.
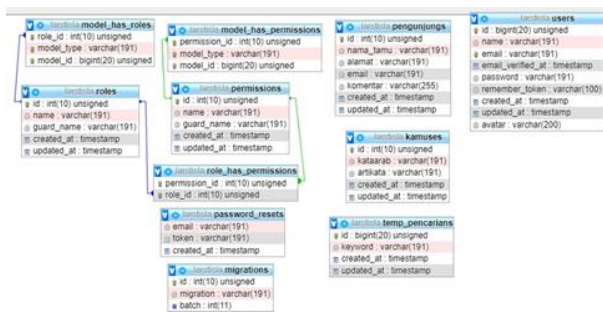

Figure 4. Figure Relationships Between Tables.

3.4 Implementation

At the implementation stage, namely the stage of making the system and applying the methods that will be used in making the system. At this stage the researcher uses Visual Studio Code software and uses the PHP programming language with the Laravel framework.

3.5 System Testing

The testing phase is the stage that aims to see whether the application system is running properly. Testing in this study using black box testing. According to an explanation written by Febriharsa et al. [5], black box testing is a type of software testing, namely testing application functions that do not involve internal structures or internal structures without the requirement of knowledge of application code and programming. Testing is within the scope of specifications and requirements, as appropriate. Testing uses the external description of the software, including specifications, requirements, and design, to derive test cases (tests). Usually these tests are functional tests, but there are also non-functional tests. The test designer selects valid and invalid inputs and determines the correct output without knowing the internal structure of the test. This approach can be applied to all levels of software testing such as unit, functional, integration, system and user acceptance. Black box testing is carried out to find several types of errors, namely:

1) Missing or incorrect function;
2) Interface or display design errors;
3) Data structure or external database access error;
4) Performance error;
5) Initialization and termination errors.

RESULT AND DISCUSSION

3.6 Research Result

The results of the research on the Arabic -
Indonesian Translator Application are as follows:

1. Knowing the implementation of the binary search method in searching dictionary data.
2. Admin can manage dictionary data and visitor data using the system.
3. Users can search for Arabic words that are inputted into the system.
4. Users can provide feedback or comments regarding how the system works.

4.2 System Implementation

The Arabic – Indonesian translation system can run if there is a server computer that has the MySQL database and Apache server installed. The system that has been created is website-based which in its manufacture uses the PHP Framework Laravel language in its manufacture and can run in every browser. The following is an implementation of the Arabic – Indonesian translation system using the binary search method according to Nugroho, RA, Adji, TB, and Hantono [6] [7]

4.2.1 Homepage

The home page functions to carry out the process of translating Arabic words into Indonesian. This page consists of 3 menus, namely the home page, dictionary, login form according to Hastang [8]. In the home menu there are several forms, namely the dictionary data search form and the comments form.

1. Home Menu

The home menu page has 3 kinds of forms, namely the form for entering the word to be searched for, the form for the results of the word you are looking for along with the translation or meaning igures and tables should be placed either at the top or bottom of the page and close to the text referring to them if possible.

Figure 5. View Menu Home The start

page is the main page

when a visitor enters the system. On the main page when the user enters the system, he is given a search menu option to search for the word Arabic Binary Search, a dictionary, a visitor data entry form, and login. On the main page of the Dictionary there is a data search process using Binary Search and the results of the search will be displayed in the search results form.

The following is an explanation from Figure 5:
1) Title
    The title of this application is Arabic – Indonesian Dictionary
2) Virtual keyboard keys
    This button serves to display the keyboard
3) Word input form
    This form serves as a place to enter the Arabic word you want to search for.
4) Search button
    The search button in the early part of the system functions as a button to search for data that has been entered in the form
5) Data result table
    The data result table is a tabular form that contains the results of the data search process using the binary search method, if the data sought is not in the database, a message will appear with the words "the data sought does not exist".
6) Visitor data entry form
    In the visitor data content form, it is used to fill in the application user data that has been created, which then the data will be stored in the database.

2. Dictionary Menu

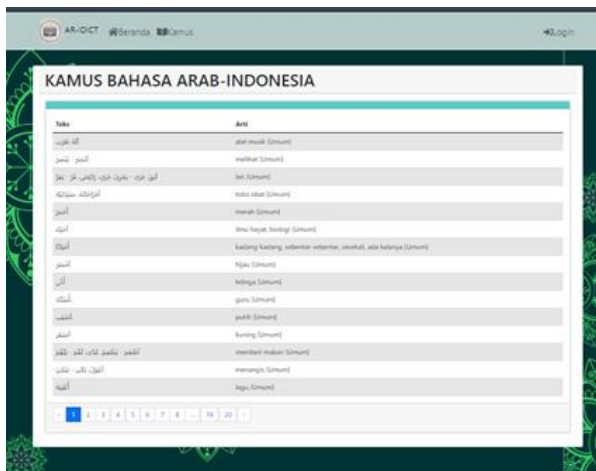The dictionary menu page contains a dictionary data table that has been stored in the database. As shown in Figure 6.

Figure 6. View Menu Dictionary.

4.2.2 Admin Page

1. Admin Login Form Page

Before logging in to the admin dashboard access is required in the form of a password and email that has been registered as an admin in the database, as shown in Figure 7.
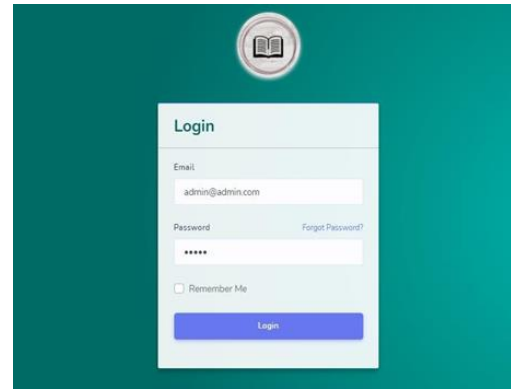

Figure 7. Admin Login Form.

The verification process begins after the administrator fills in the email and password form and clicks the login button, if the email and password are incorrect then the login will fail. If the login is successful, the main management page will appear. System testing in Table 1 is described below.

Table 1. Table of Testing the Admin Login page.

Function Name	Form Testing	Results	Testing
Page *Login*	E-mail and *password* invalid	Will displays message Check *E-mail* and *Passwords* You.	Verification wrong, system will displays Check message e-mail and word your password.
	E-mail and *valid password*	*System* will accept login access and display main page admin	Correct verification, system will get login access and Admin can enter on page management main.

2. Page Dashboard Admin

Admin Dashboard main menu page shown as in Figure 8 below which shows the users menu,
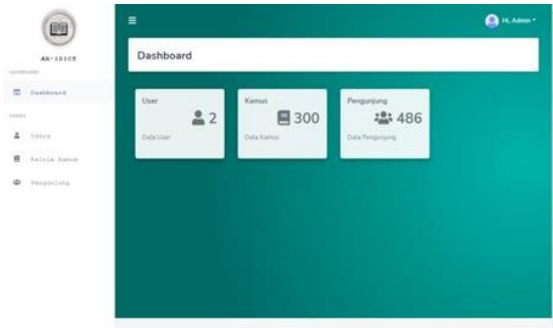
Figure 8. Admin page dashboard.

4.3 Black Box Testing

The next stage is to enter the testing stage to see the results of the run time search for Arabic to Indonesian translator application data according to Susanti, Josi, A., and Desi, F [9]. Testing the performance of this system is carried out to find and repair if there is an error in the performance of the system that has been made. Tests conducted by researchers using a black box. The following will explain some of the results of system performance testing.

Table 2. Testing login system performance.

No	Test Description	Expected results	Appearing Results	Information
1	Enter the correct email and password then press the login button	If the email and password entered are correct, the system will automatically enter the page *dashboards*	Managed to enter the dashboa rd page if the login is successful	In accordance
2	Entered the wrong email and password then pressed the login button	If the email and password are entered incorrectly, the system will display a notification that the login failed, the system will back to login menu	Successfully displaying failed login notification and the system will return to the login menu	In accordance

Table 3. System performance testing on the users menu.

No	Testing psi description	Expected results	Appearig Results	Information
1	Pressing the menu users	The system displays data *users in* table format and System can do Action CRUD data	Successfully displayed an table data users, and there is a button for processing data.	In accordance
2	Press the "Add" button	The system will display a form for add data users or who have access rights.	Successfully displayed an *form* inputs data *users*new.	In accordance
3	Pressing the "Update e" button	The system will save data changes.	Successfully saved data changes.	In accordance
4	Pressing the trash icon h / delete button	The system will delete the data.	Successfully deleted data	In accordance

Table 4. Testing system performance on the manage dictionary menu.

No	Test Description	Expected results	Appearing Results	Information
1	Press the manage dictionary menu	The system will display a dictionary data table containing the Arabic word and the meaning of the Arabic word. Inside menus This the system also displays a few buttons that work to process dictionary data such as add data, edit data, and delete data	Successfully displays the table data dictionary, and there are buttons to process the data.	In accordance
2	Press the "Add Data" button	The system will display a form For add dictionary data.	Successfully displays the form inputs new dictionary data.	In accordance
3	Pressing the "Update" button	The system will save the changes data.	Successfully saved changes data.	In accordance
4	Pressing the trash icon / delete button	The system will delete the data.	Successfully deleted data	In accordance

Table 5. Testing system performance on the visitor menu

No	Description Testing	Expected Results	Appeared Results	Description
1	Pressing the visitor menu	The system will display an table visitor data g Which contains names, addresses, emails and comments of application visitors. Inside menus This system also displays a data clear button.	Successfully displayed antilewisite data g, and There are buttons to process data.	In accordance
2	Hitting the trash icon/button wipe	The system will delete the data.	Successfully deleted data.	In accordance

Table 6. Testing the performance of the word search system in the dictionary.

No	Description Testing	Results Expected	Results Appear	Information
1	Enter Arabic word what you are looking for in the search field	Showing say Arab along meaning he said from the search results carried out in the search form	Succeed display word Arab along meaning he said from the search results carried out in the search form	In accordance
2	Enter words Which No There isin the database	A table appears in the form of that information data Which searching for not found.	Successfully provide information that the data No There isin the *databases*	In accordance

Table 7. Testing system performance on the input form for comments and visitor data   .

No	Test Description	Expected results	Appearing Results	Information
1	Enter comments about the dictionary along with the dictionary user's personal data.	The data is stored in the database and provides notification that the data has been retrieved stored.	Successfully storing data into the database and providing information that the data has been stored	In accordance
2	Using a virtual keyboard	Disp lays Arabic keyboard to enter Arabic words into *for* Arabic word input.	Successfully enable Arabic keyboard and it can work.	In accordance

Based on the test results described in table 2, it can be seen that users other than those registered in the database cannot enter the system. Proves that the login section has run as expected.

The testing process is carried out using the black box method to make it easier to see how the system is running. Testing the application on the data search menu was carried out 10 times to test the Arabic word data search along with the explanation as follows:

Table 8. Table of search trials.

	Search word	Searched Results	Time Duration
Testing 1	أْح:OBJ	Data ditemukan! Teks / Arti / ilmu hayat, biologi [Umum]	0.875 s
Testing n 2	حَي.و.ي	Data ditemukan! Teks / Arti / penting, esensial, rumit [Umum] / vitalitas, tenaga, energi [Umum]	0.798 s
Testing n 3	إِشَأرة	Data ditemukan! Teks / Arti / indikasi	0.859 s
Testing 4	اقَراد' ي	Data ditemukan! Teks / Arti / individual [Umum]	0.944 s
Testing 5	ږصنَاعاي		0.866 s

	Search word	Searched Results	Time Duration
Testing 6	دُعاء		0.864 s
Testing 7	قَلَم		0.933 s
Testing 8	تِلْمِيْذ		0.976 s
Testing 9	كِيْوِي	**Data ditemukan!** Teks / Arti: كِيْوِي — buah kiwi [Umum]	0.809 s
Testing 10	عُصارة	**Data ditemukan!** Teks / Arti: عُصارة — sari buah [Umum]	0.806 s

From the trial results of Table 8, the average time is obtained with the following formula. From the formula above, it is obtained average score average time efficiency:

$$\text{Time Efficiency} = \frac{7.87}{10} = 0.787 \qquad (1)$$

From the calculation above, it is found that the average time efficiency in the experiment table 4.6 is 0.787 seconds.

5. CONCLUSION

Based on the results of the author's discussion of the application of the Binary Search method to the Arabic to Indonesian translator application, the following conclusions are drawn:

1. The stages carried out by researchers in applying the binary search method to an Arabic to Indonesian translator application are: first the researcher makes a translator application design, then makes a database design. After making several designs, the next step is the data collection stage obtained through the internet and books. From the data collected, then input into the database, the next process is to test the data search system on the application. The results of the search using the binary search method will display the data you are looking for, found or not found.

2. Testing system performance with the binary search method for searching Arabic words on the language translator system shows a more efficient time in the search process. Prior to the Arabic word search process, the data is sorted so that the method can be implemented into a system that has a very large amount of dataThe title "AUTHORS' CONTRIBUTIONS" should be in all caps.

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