Enhanced shalat and wudhu learning media through speech recognition application

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Abstract. Nowadays, learning methods on the procedure of shalat and wudhu are found everywhere, both formal institutions, non formal and through learning media such as books and smartphones. However, these media are considered not interest children to learn the procedures of shalat and wudhu. This work proposes an enhanced shalat and wudhu learning media through speech recognition feature on input method of searching search material of shalat and wudhu. This technology allows a device to recognize and understand the word that spoke by someone to digitizing words and matching those digital signals to a specific pattern that was stored in the media stored. Knuth Morris Pratt was chosen as an algorithm used for the matching of keywords with the material for shalat and wudhu. In limited test, this app was using by 10 kids, with 7-9 years old. The result, 7 of 10 kids interested to learn shalat and wudhu using this app. The searching modul with Knutt Morris Pratt has working properly with 80% accuration.

1. Introduction

Android is one of the mobile devices that can be operated and widely used in the world [1][2]. Not only to do work or entertainment, this mobile device can be used as a means of learning, especially learning the procedure of shalat and wudhu for children. There are several similar applications in both multimedia-based market [3][4][5][6]. The app packed with features of the app is as attractive as possible, it is expected to interest the child to learn easily and fun in several media [7][8][9][10][11]. Therefore, a learning media need to impoved to interest children [12][13][14][15].

The purpose of this research is to implement one of the latest technologies of technological development now is speech recognition. Speech recognition is a technology that allows commands to devices owned by voice commands. The words are converted into digital signals by converting sound waves into a set of numbers and then adapted to certain codes which will be matched to a pattern stored in a device [16].

The Knuth-Morris-Pratt algorithm is a string search algorithm for searching text in sequence from left to right. The algorithm will match the pattern or word order to be searched from left to right at the beginning of the text and then shift the wording until the wording is at the end of the text. This work impelement Knuth Morris Pratt algorhytm in order to search kontent of shalat and wudhu using keyword that input by text or voice [17].

2. Literature review

2.1. Rational unified process

This work implement Rational Unified Process (RUP) as software development life cycle. RUP is a recurrent, architecture-centric, and use case-driven software development approach. RUP is a clear and well structured software engineering process. Clearly who is responsible, how it is done, and when to do it. The RUP also provides a well defined structure for the lifecycle of the RUP project it self [18].

2.2. Speech recognition

Speech recognition also known as automatic speech recognition (ASR) is a development of techniques and systems that allow computers to receive input in the form of spoken words [19][20]. This technology allows a device to recognize and understand spoken words by digitizing words and matching those digital signals to a specific pattern stored in a device [21].

Spoken words are converted into digital signals by converting sound waves into a set of numbers that are then adapted to certain codes to identify those words. The results of the spoken word identification can be displayed in written form or can be read by a technology device as a command to perform a job, such as pressing a button on a handset automatically by voice command [22][16].

2.3. Knutt morris pratt

The Knuth-Morris-Pratt algorithm was developed by D. E. Knuth, along with J. H. Morris and V. R. Pratt. The algorithm is the development of the previous string search algorithm, the Brute Force algorithm. Brute-Force is the simplest basic algorithm in solving string matching problems that searches for each position in text between 0 and n, where n is the text length / number of filenames stored on the computer and m is the character length of a pattern (words to search). In previous research, Knuth-Morris-Pratt can reduce search time significantly.

Systematically, the steps taken by the Knuth-Morris-Pratt algorithm when matching the string:

a. The Knuth-Morris-Pratt algorithm begins to match the pattern at the beginning of the text.
b. From left to right, this algorithm will match the characters per character pattern with characters in the corresponding text, until one of the following conditions is filled: The characters in the pattern and in the comparison text do not match and all characters in the pattern match. Then the algorithm will notify the discovery in this position.
c. The algorithm then shifts the pattern according to the next table, then repeats step 2 until the pattern is at the end of the text.

3. Experimental method

3.1. Inception

In this work, we integrated shalat and wudhu learning media and speech recognition feature on input method of searching search material of shalat and wudhu. This technology allows a device to recognize and understand the word that spoke by someone to digitizing words and matching those digital signals to a specific pattern that was stored in the media stored.

3.2. Elaboration

Elaboration is the stage to complete the design based on the analysis results in the inception stage. This stage describes the system architecture design and system modelling. Application architecture becomes an application design consisting of components that interact with each other. The application architecture determines the technology to be used to implement one or more information systems. It functions as an outline for detailed design, construction, and implementation and the principles used by physical data streams.

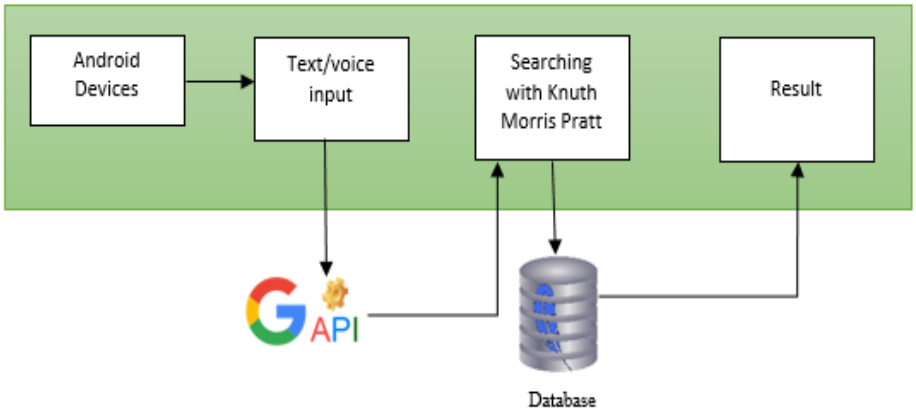


Figure 1. System architecture.

Figure 1 is an overview of the system with the use of algorithms in each module of this shalat and wudhu learning applications with text and voice input, the word will be processed will be input through voice and processed through Google Speech API, after which, the result of string is then processed using KMP Algorithm, KMP algorithm runs on string matching function. The entered word will then be matched against the existing word in the SQLite database.

The detailed steps of Knutt Morris Pratt implemented in this study are described in the following figure:

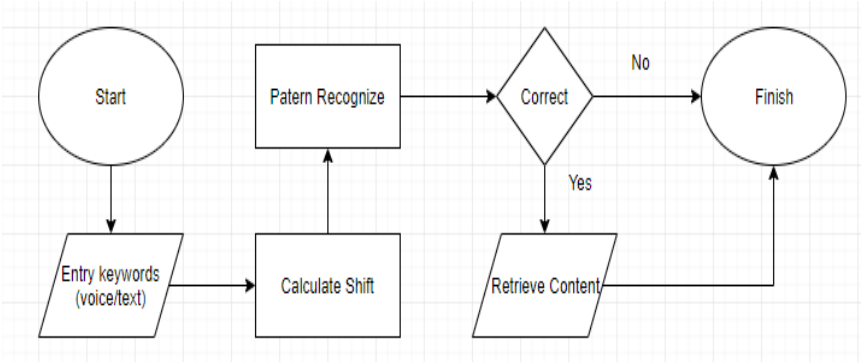


Figure 2. System architecture.

Figure 2 is a system flowchart using the Knuth-Morris-Pratt algorithm. The algorithm runs on the learning menu in the application of shalat and wudhu learning. The working steps of this algorithm is first input the word with sound, the sound will be processed to produce string, then the algorithm do pre-processing by calculating the distance shift.

Once the matching distance is identified, the word searched is compared to the corresponding word in the database, after which, if the word matches, the desired page will appear. If the word matches, then the page will be displayed, otherwise it will not be displayed.

Use case diagram describes the interaction that occurs between the actors who become the initiator of the system interaction itself with the existing system, a use case is represented by a simple step sequence. Figure 3 describe use case diagram of the enhanced shalat and wudhu learning media:

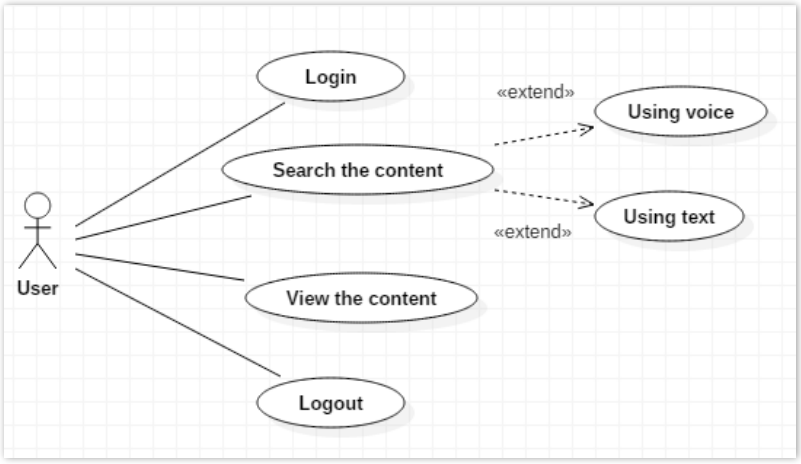


Figure 3. Use case diagram.

Class diagram is a static model that describes the structure and description of the class and its relationship between classes. Class diagram of the application of shalat and wudhu learning can be seen in figure 4.

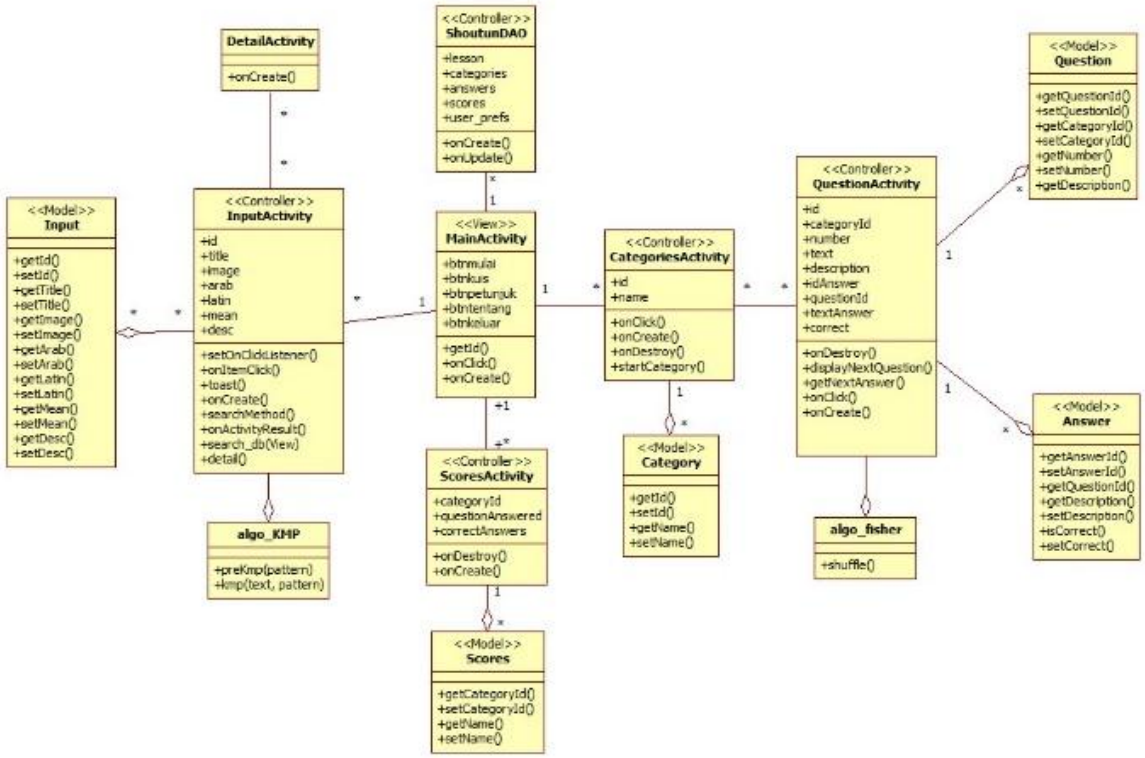


Figure 4. Class diagram.

Activity diagram of voice input is a step through which to enter the sound input menu of this application. Activity diagram selecting voice input can be seen in figure 5.

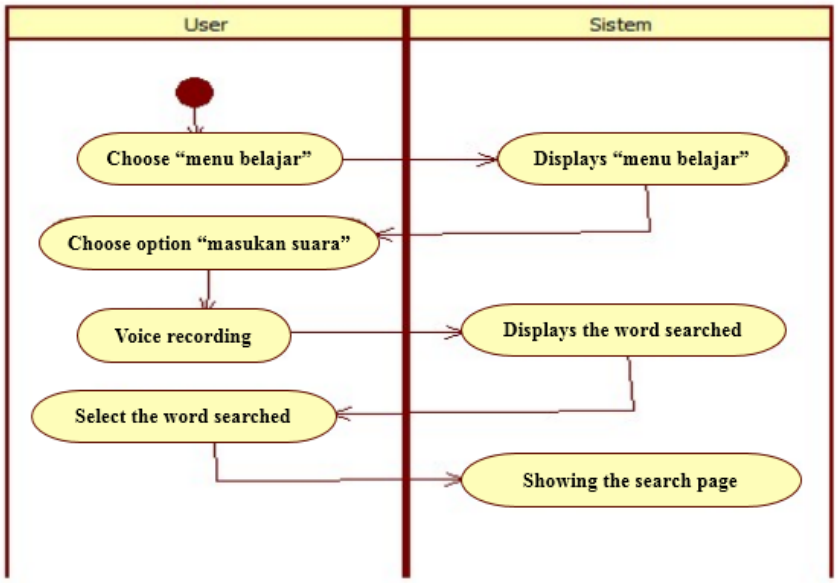


Figure 5. Activity diagram.

Figure 6 illustrates the sequence diagram of the study menu. The user selects the learning menu which will then input the sound that will be processed into a word.

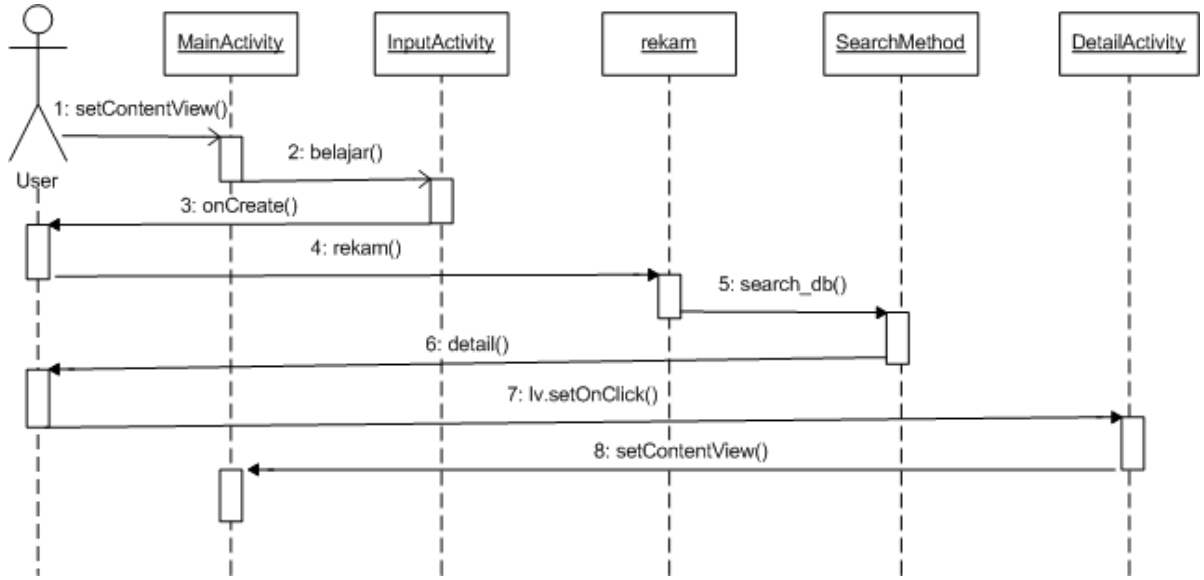
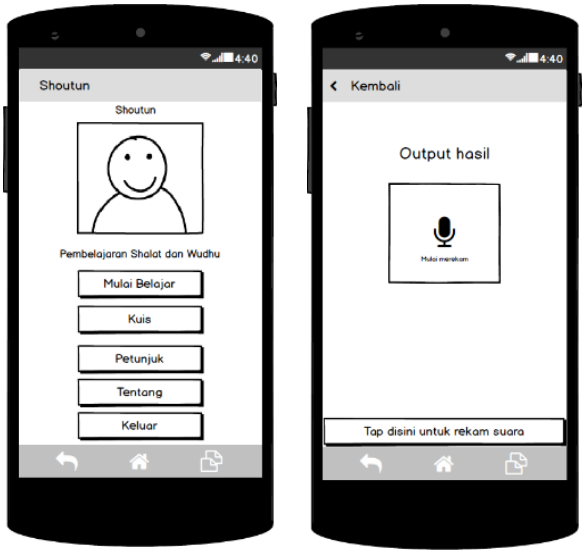


Figure 6. Sequence diagram of voice recognition.

3.3. Construction

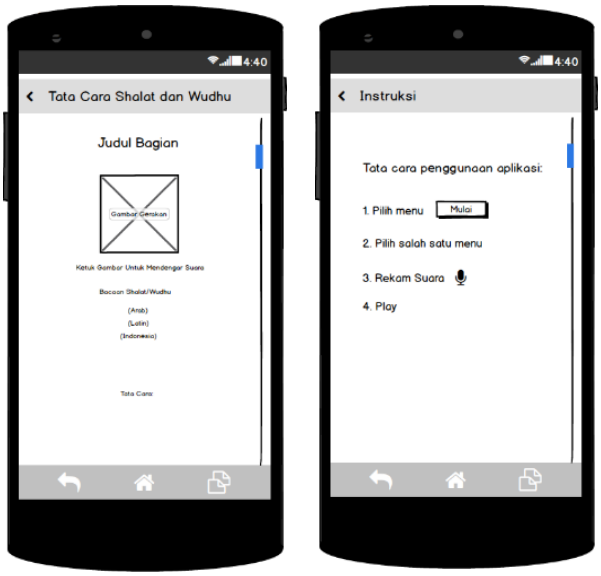
In construction state, this work develop several part of android application including mockup. Figure 7 describe that there are several moduls in app as follow searching, help, etc.



(a) (b)

Figure 7. Mockup of main menu and input keyword.

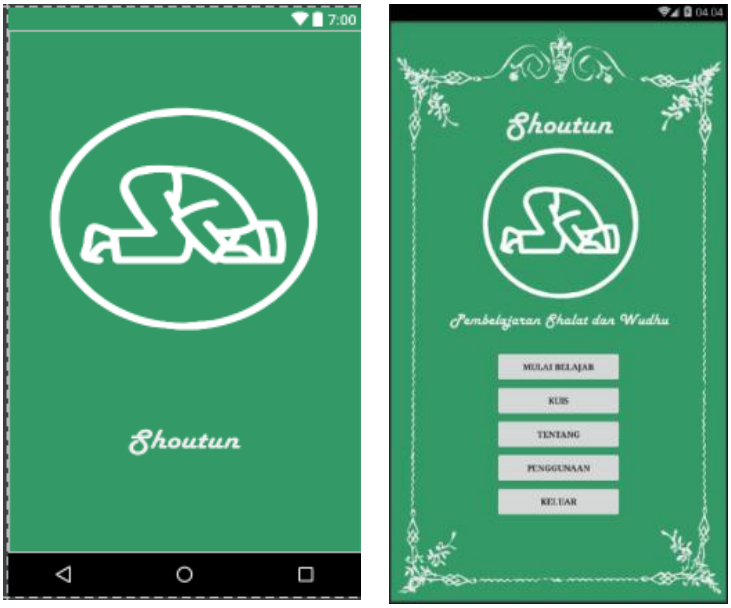
Figure 8 is a mockup of the results of keyword that have been entered first. The right is an application usage introduction or helm menu.



(a) (b)

Figure 8. Mockup of result view and help.

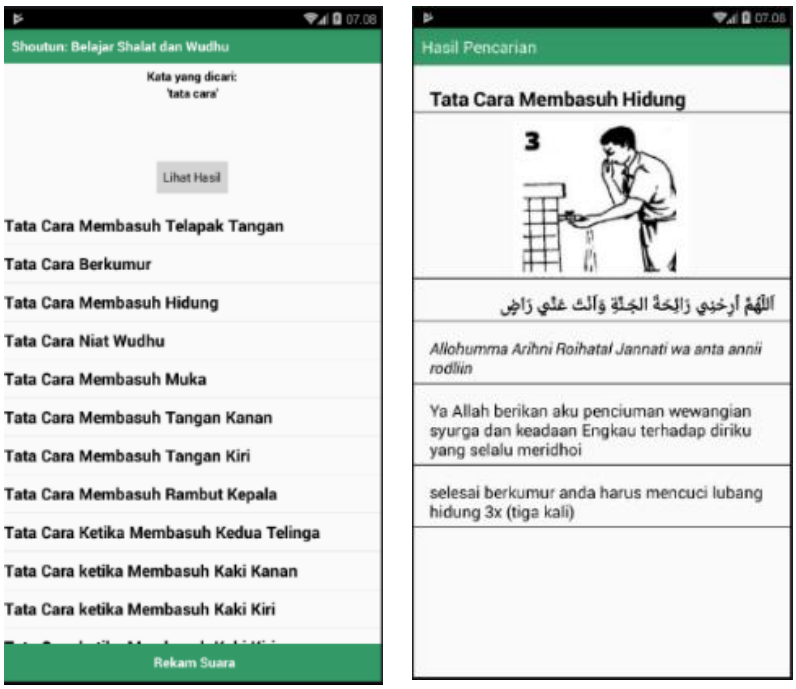
Figure 9 (a) and (b) are the final display of this work. (a) describes the initial display when the application will run also know as splash screen. (b) is the starting page when entering the application.



(a) (b)

Figure 9. Interface of splash screen and main menu.

Figure 10 is an advanced image of figure 9. Figure 10 (a) describes the Start Learning page where the user will input text and voice data by pressing the 'record voice' button and then the Recoginzer Intent will appear. Whereas (b) It is the result page of the word search process.



(a) (b)

Figure 10. Interface of searching model and shalat and wudhu content.

4. Result and discussion

In this stage, this app tested by exactly 100 varied keyword, the result show that 80% is matching. The implemented Knuth Morris Pratt was effectively [23] to handle searching module [24][25]. Furhermore, the current app was using by 10 kids, with 7-9 years old. The result, 7 of 10 kids interested to learn shalat and wudhu.

5. Conclusion

According to limited test result, this app interested Muslim children to learn shalat and wudhu using this app. Knuth Morris Pratt was working properly with 80% accuration. There is limitation of this app: content limited to picture without any following media (animation, video, etc). Further study, we suggest to add augmented reality to improve their interest and add an evaluation module.

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