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Design And Build A Mikrotik Network Learning Media Using The Waterfall Method And Randomizing Questions Using The Fisher-Yates Shuffle Method

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Abstract

The development of the world of information today is increasingly entering various fields that are trying to take advantage of today's information technology. The problem of developing the quality of education and helping school facilities to produce smart children and assisting teachers in teaching, as well as making teachers creative and helping children learn smart, this technology is also very helpful for children to actively study at home so they can save costs and tools used , and this learning application can divert the habits of children who previously only played cellphones but now can play cellphones while studying so that students don't get bored.

Keywords: Learning Media, Mikrotik Network, Fisher Yates Shuffle

INTRODUCTION

Along with the rapid development of technology in today's era, the internet has become a major need in everyday human life where almost all activities that humans do use the internet. Utilization of the internet network has entered various elements, especially in the world of education, where the importance of the internet network is very much needed in improving the quality of education that can support the academic process for the better.

A good internet network can be used to access various information, especially those related to the academic process, especially in this case, students from Vocational Schools majoring in Computer and Network Engineering (TKJ) who need lessons in building a Mikrotik-based hotspot network. Mikrotik itself is a Mikrotik Router Operating System (OS). to establish authentication and billing systems. Such systems are used to create security, billing, and user administration on internet-connected networks. Mikrotik is also used to limit the use and allocation of bandwidth for each user on a hotspot network. To implement a hotspot network as a lesson for vocational students, especially the Computer and Network Engineering (TKJ) major, using Mikrotik requires some hardware which of course costs money.

which is not small. Mikrotik-based internet network learning media that will be built in this study is an android-based learning media. Where learning media with android-based media can be accessed by anyone and anywhere.

In building a learning media, of course, it will not be complete if there are no questions related to the subject matter. Each item given will be in the form of multiple choice, in each multiple choice question it will certainly not be challenging if each item has the same order, therefore a method of randomization of questions is needed in the learning media. Fisher-Yates Shuffle is an algorithm that is used to take random numbers of permutations without repetition so that the

questions displayed will be randomized and do not appear repeatedly. By utilizing this method, the learning media built will look more attractive.

Based on the description above, the author will build an Android-based Mikrotik network learning media which is a solution to reduce excessive costs in purchasing devices for learning Mikrotik practice in schools, therefore the author makes a thesis with the title "Designing Microtic Network Learning Media With Waterfall Method And Rushing Questions Using The Fisher-Yates Shuffle Method"

RESEARCH METHODS

The research location was conducted at SMKS Tunas Pelita on Jalan Perintis Kemerdekaan No.166, Kebun Lada, Kec. North Binjai, Binjai City, North Sumatra. The author chose this location because the author himself is a teacher who has taught at SMK Tunas Pelita so he understands very well about the learning media needed by students majoring in Computer Network Engineering (TKJ). Computer Network (TKJ) .

The Fisher-Yates Shuffle (after Ronald Fisher and Frank Yates), also known as the Knuth Shuffle (after Donald Knuth), is an algorithm to generate random permutations of a finite set, in other words to shuffle the set. A variant of the Fisher-Yates Shuffle, it can be used to generate a random cycle of length n instead. The basic process of Fisher-Yates is choosing and then moving similar to choosing a deck of cards at random (Prasetyo, Batubulan, and Sujudi 2020).

Fisher Yates shuffle is an algorithm that generates random permutations from a finite set. There is an overview of the fisher yates shuffle algorithm system, which can be seen in the figure (Sidik, Maylawati, and Setiawan 2021).

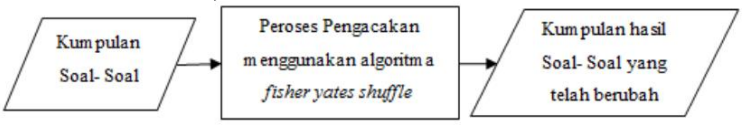

Figure 1. Fisher Yates Shuffle Algorithm System Overview

The fisher-yates randomization algorithm, also known as knuth randomization or fisher-yates-knuth randomization, has a working method as shown in Figure 2.

```
const fisherYatesShuffle = (deck) => {
  for (var i = deck.length - 1; i > 0; i--) {
    const swapIndex = Math.floor(Math.random() * (i + 1))
    const currentCard = deck[i]
    const cardToSwap = deck[swapIndex]
    deck[i] = cardToSwap
    deck[swapIndex] = currentCard
  }
  return deck
}
```

RESULTS AND DISCUSSION

System Analysis

System analysis is defined as the decomposition of a complete system into its component parts with a view to identifying and evaluating the expected needs so that improvements can be made if they are not in accordance with the initial description.

1. Analysis of Learning Media to be Built

The learning media that will be built is in the form of an Android-based Mikrotik network learning media, where this learning media is developed using Unity3d software development. This learning media was built as a more effective alternative in terms of cost reduction or the cost of carrying out the practice of building a network with a mikrotik router. With the construction of this learning media, it is hoped that it can be an effective solution to existing problems in terms of learning and teaching internet networks in schools. The features that will be made in this learning media are as follows.

1. The material is in the form of a pdf.
2. Material in the form of video.
3. Quiz questions.
4. Simulation of building a hotspot network using a mikrotik router.

2. Score Analysis on Quiz

In the Mikrotik network learning media, there is a quiz section after completing the practice section, on the quiz page it will display 10 questions that match the material previously displayed. In this section the user is required to answer each question and after the user has answered all the questions, the system will display a score based on the user's correct and incorrect answers. The resulting score will be stored in the system so that the results of the quiz will not be lost as long as the application remains installed on the user's device or in the sense that it is not uninstalled.

3. Fisher-Yates Shuffle . Algorithm Analysis

The Fisher-Yates Shuffle algorithm was chosen because this algorithm is a better randomization method or can be said to be suitable for randomization with fast execution times and does not require a long time to perform randomization.

Fisher-Yates Shuffle is an algorithm to generate a random permutation of a finite set. The results of randomization using the Fisher-Yates Shuffle algorithm will not be one-sided, so that every random permutation has the same probability.

The Fisher-Yates Shuffle algorithm is implemented with the following flow.

1. Start the quiz
2. Initialize the questions in the learning media
3. Randomize the position of the questions using the Fisher-Yates Shuffle
4. Displaying questions that have been scrambled

Figure 3. is a picture of how the flowchart of the Fisher-Yates Shuffle Algorithm works in conducting the randomization process on the Mikrotik network learning media.

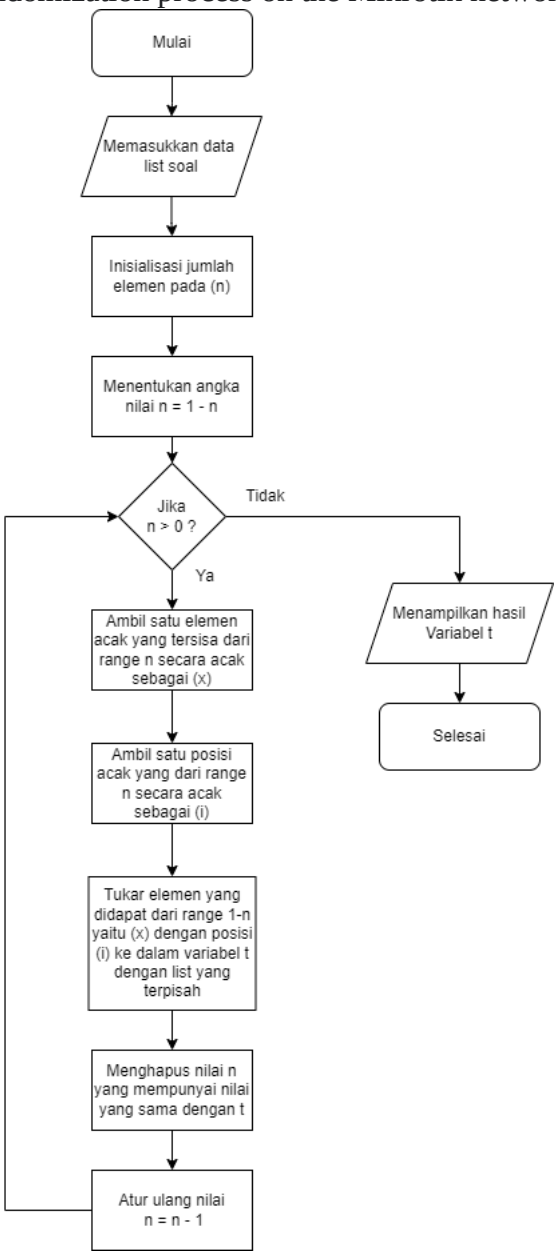

Figure 3. Fisher Yates Shuffle Algoritma Algorithm

Description of Figure 3 :

1. The developer enters the data list of questions that have been compiled.
2. Initialize the number of elements in (n) where the value (n) is taken from the total data list of questions.
3. Determine the value of (n) where (n) is minus 1.
4. Then if (n) is greater than zero, then the system will take a random element from the range 1 to (n) and store it in the variable (x).
5. Then take a random position from (n) that corresponds to the sequence (x) and then store it in the variable (i).
6. Enter the elements obtained from the range 1 to (n), namely the value (x) with position (i) into the variable t with a separate list.

7. Delete the value of n which has the same value as (t).
8. Reset the value of (n) where (n) is minus 1.

In order to make it easier to understand how the process of applying the Fisher Yates shuffle algorithm on the Mikrotik network learning media in conducting the randomization process of questions contained in the Mikrotik Network learning media can be seen in Table 3.

Table 4. Fisher-Yates Shuffle . Algorithm Iteration Table

range	i	x	t	Isi *Array*setelah diacak (n)	*Array*yang sudah di fix (t)
				0, 1, 2, 3, 4, 5, 6, 7, 8, 9	
1-10	7	6	9	0, 1, 2, 3, 4, 5, 9, 7, 8	6
1-9	0	0	8	8, 1, 2, 3, 4, 5, 9, 7	0, 6
1-8	1	1	7	8, 7, 2, 3, 4, 5, 9	1, 0, 6
range	i	x	t	Isi *Array* setelah diacak (n)	*Array* yang sudah di fix (t)
1-7	2	2	9	8, 7, 9, 3, 4, 5	2, 1, 0, 6
1-6	2	9	5	8, 7, 3, 4, 5	9, 2, 1, 0, 6
1-5	1	7	4	8, 4, 5, 3	7, 9, 2, 1, 0, 6
1-4	1	4	3	8, 3, 5	4, 7, 9, 2, 1, 0, 6
1-3	1	3	5	8, 5	3, 4, 7, 9, 2, 1, 0, 6
1-2	1	5	5	8	5, 3, 4, 7, 9, 2, 1, 0, 6
1-1	0	8	8		8, 5, 3, 4, 7, 9, 2, 1, 0, 6
Hasil Akhir Pengacakan :					8, 5, 3, 4, 7, 9, 2, 1, 0, 6

From the fisher yates shuffle algorithm stage, here is the manual calculation of the randomization where n = 10, then the array n = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9] and the results and manual calculation methods are as follows .

a. Determine the value of n ; n= {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
b. Choose a random number (x), 1 <= x<= n;
c. Choose a random position (i), i <= x;
d. The value (x) is determined from the calculation of the position of array(i) where later this value (x) will be exchanged at the end of the array. For example, the current value of (i) is 7 then the value of x from n = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} is 6 then the value of n becomes { 0, 1, 2, 3, 4, 5, 7, 8, 9, 6}
e. Then the value (x) is transferred to the variable t = 6
f. Reset the value of n where the value of n = n-1

So what is processed is n-1, namely {0, 1, 2, 3, 4, 5, 9, 7, 8} because the value of n has been moved to the value of t, the number 6 in the value of n is no longer available. If n still meets the requirements, namely (n > 0) then the process can be repeated by choosing a random number (x) where 1 <= x <= n next process.

N now is n -1, 10 – 1 = 9
I = 0 &X = 0
Then, n {8, 1, 2, 3, 4, 5, 9, 7}
T = 0.6
N now is n -1, 9– 1 = 8¬
I =1&X = 1
Then, n {8, 7, 2, 3, 4, 5, 9}
T = 1, 0, 6

N now is n -1, 8 – 1 = 7¬
I = 2&X = 2
Then, n {8, 7, 9, 3, 4, 5}
T = 2, 1, 0, 6
N now is n -1, 7 – 1 = 6¬
I = 2 & X = 9
Then, n {8, 7, 5, 3, 4}
T = 9, 2, 1, 0, 6
N now is n -1, 6 – 1 = 5¬
I = 1 & X = 7
Then, n {8, 4, 5, 3}
T = 7, 9, 2, 1, 0, 6
N now is n -1, 5 – 1 = 4¬
I = 1 & X = 4
Then, n {8, 3, 5}
T = 4, 7, 9, 2, 1, 0, 6
N now is n -1, 4 – 1 = 3¬
I = 1 & X = 3
Then, n {8, 5}
T = 3, 4, 7, 9, 2, 1, 0, 6
N now is n -1, 3 – 1 = 2¬
I = 1 & X = 5
Then, n {8}
T = 5, 3, 4, 7, 9, 2, 1, 0, 6
N now is n -1, 2 – 1 = 1¬
I = 1 & X = 8
Eat {}
T = 8, 5, 3, 4, 7, 9, 2, 1, 0, 6
If the value of n has been exhausted then the value of n¬ <= 0 or null so that randomization can no longer be continued
Table III.2 Stages and Steps of the Fisher-Yates Shuffle Algorithm

CONCLUSION

1. The results of the encryption of this learning application can be concluded that the practice provided is only a simulation of making a Mikrotik network so that it cannot practice like the original network.
2. The Fisher-Yates Shuffle method of randomization of this question was carried out only a few times, so it was possible that the questions would appear the same as before if they were repeated many times.

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