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Multiplayer Quiz Adventure Educational Game Arts and Culture Using the Fisher-Yates Shuffle Algorithm

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Abstract

The rapid development of games, with a wide variety of genres, includes strategy, adventure, arcade, puzzle, sports, and more, packaged in PlayStation games, PC games, and mobile devices. Games with educational content are better known as educational games. These educational games aim to stimulate interest in learning the subject matter while playing, so that with a sense of enjoyment, it is hoped that it will be easier to understand the material presented. As we know, arts and culture play a crucial role in shaping a nation's identity. Appreciating arts and culture has a positive impact in helping society understand the historical roots, values, and cultural heritage that form the basis of cultural diversity. However, often the teaching of arts and culture in educational environments does not create sufficient appeal and does not meet expected standards. Therefore, creative and innovative approaches are needed so that the younger generation can be more actively involved in learning and appreciating arts and culture in an interesting and interactive way. The author hopes that this video game will be an interesting alternative to traditional learning approaches. This game itself uses the Fisher-Yates Shuffle algorithm to randomize quiz questions so that each game has a different order. In this game, players are invited on an adventure to overcome the obstacles presented. Furthermore, players are expected to answer questions about arts and culture, which will broaden their knowledge and understanding. Furthermore, players will find these questions entertaining and challenging.

Keywords: game, quiz, culture, multiplayer, online

1. Introduction

In the digital era, technology has had a profound impact on various aspects of life, including education. Educational games have become an effective tool in introducing knowledge and skills to players. Interactive and fun games can now be utilized as engaging educational tools, motivating players to learn while having a good time [1]. The Fisher-Yates Shuffle Algorithm is a randomization method used to randomize the order of questions in a quiz[2]. The use of this algorithm in online multiplayer quiz games ensures that the questions posed to each player are random and distinct, making each game unique and challenging [3].

Arts and culture are an integral part of a nation's identity. Appreciating arts and culture helps people understand the history, values, and traditions that underpin cultural diversity. However, arts and culture instruction in schools is often uninteresting and inadequate. Therefore, a creative and innovative approach is necessary to engage the younger generation in learning about arts and culture engagingly and interactively [4].

Based on the problems above, the author is interested in creating a video game that incorporates elements of Arts and Culture in the form of learning media, titled "Creating a 2D Educational Game Adventure Multiplayer Arts and Culture Quiz Using the Fisher-Yates Shuffle Algorithm." The author hopes that this video game will serve as an engaging alternative to traditional learning approaches.

2. Methods

This research employs the Fisher-Yates Shuffle Algorithm, a technique used to shuffle the elements in an array. This algorithm is particularly useful in the context of games, especially when we need to randomize the order of elements, such as cards in a card game or items in a game. This algorithm works by randomly swapping array elements[5]. The process starts from the last element in the array and then iteratively loops backward to the previous elements. At each step, the algorithm randomly selects one of the unprocessed elements and swaps its position with the element currently in that position. This is done until all elements in the array are correctly shuffled.

A. Use Case Diagram Design

A use case diagram is a type of diagram commonly used in software modeling. This diagram illustrates the interactions between the software system being developed and the various external actors that interact with the system.

1. Use Case Diagram

A use case diagram depicts the user's interaction with a system or application. The use case diagram is shown in Figure 1.

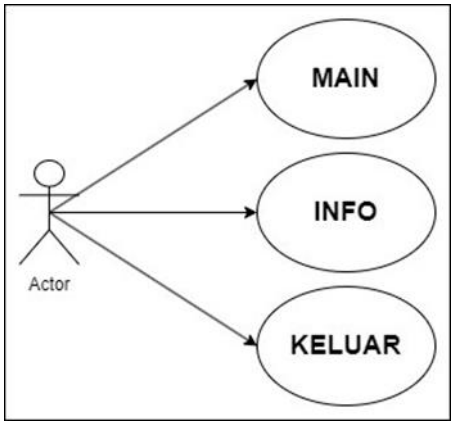


Figure 1. Use Case Diagram

As explained in Figure 1, a Use Case Diagram is a display within the initial menu of a game application.

2. Activity Diagram

An Activity Diagram is a visual representation of a process or how an application operates within a system. Single Player Activity Diagram as shown in Figure 2, illustrates that when a user opens the application, the initial menu appears. In the initial menu, the user presses the "Single Player" button.

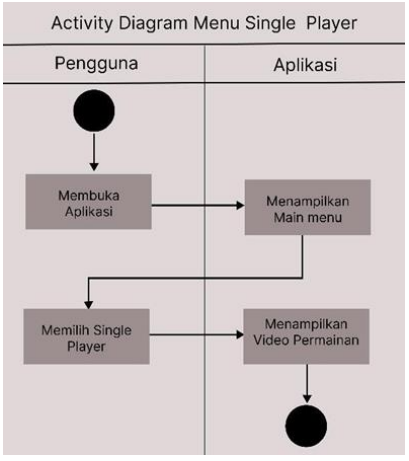


Figure 2. Activity Diagram Single player

b) Multiplayer Activity Diagram

The image below illustrates how, when a user opens the application, the initial menu appears. In the initial menu, the user presses the "Multiplayer" button, which displays a list of waiting players. Once a player joins, they are automatically entered into the game. Figure 3 show activity diagram multiplayer.

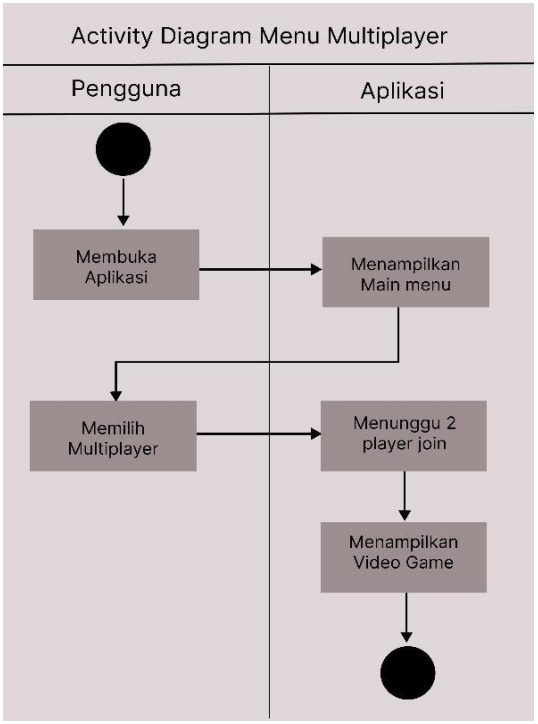


Figure 3. Activity Diagram Multiplayer

c) Game Info Activity Diagram

The image below illustrates that when a user opens the application, the initial menu will appear. In the initial menu, the user presses the "Info" button. Figure 4 display information about the game's creator.

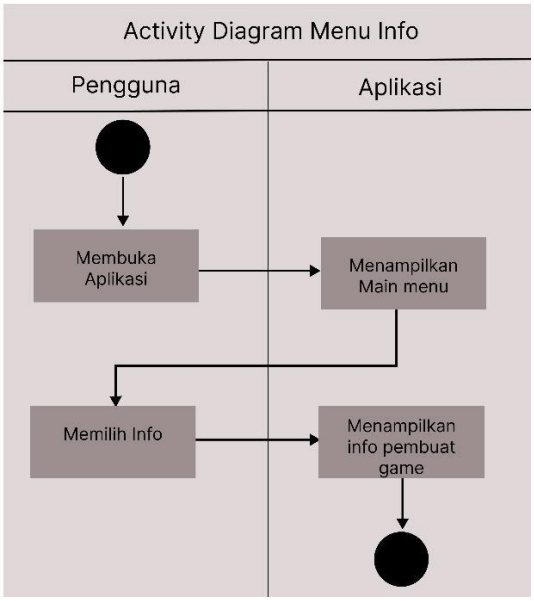
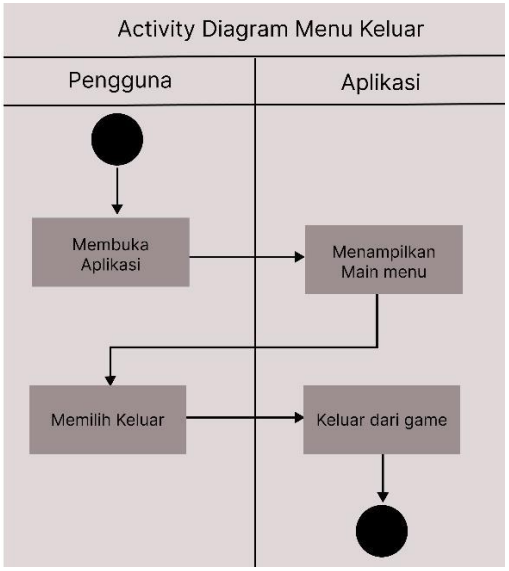


Figure 4. Game Info Activity Diagram

d) Exit Activity Diagram

The image below illustrates how, when a user opens the application, the initial menu appears. In the initial menu, the user presses the "Exit" button to exit the game.



Gambar 5. Game Exit Activity Diagram

3. Fisher-Yates Shuffle Algorithm Flowchart

The research method to be used can be illustrated in the form of a flowchart, as shown in Figure 6.

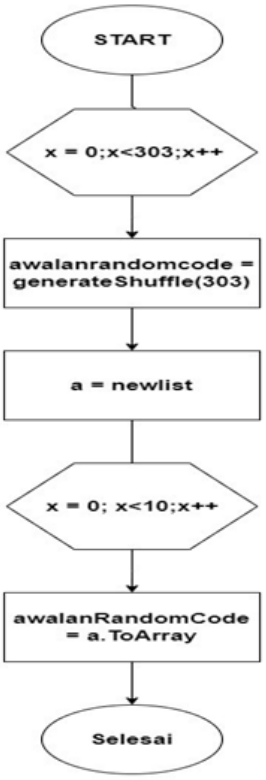


Figure 6. FlowChart Fisher Yates Shuffle Algorithm

- A for loop runs from x = 0 to x < 303. This means the code will be executed 303 times.
- Inside the loop, an if condition checks whether a specific element of the enswerr array does not contain a corresponding element from the jwbBnr array after both elements have been converted to lowercase and without spaces. If it does not contain a corresponding element, a message is printed containing the index number. The element from Enswerr and the element from jwbBnr that do not match.
- After the first loop, a call to generateShuffle(303) is made, which generates a random sequence of numbers from 0 to 302. These values are assigned to the variable prefixRandomCode.
- A List<int> is then created named a.
- There is a second for loop that runs from x = 0 to x < 10. In this loop, the first 10 values of the initialRandomCode are inserted into List<int> a.
- The initialRandomCode variable is converted back into an array based on the contents of List<int> a.

3. Result and Discussions

3.1. Software Implementation

1) Main Menu Display

The Main Menu Display is the initial display when the game is opened. The Main Menu contains several buttons: play, info, and exit.

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. Results can be presented in figures, graphs, tables and others that make the reader understand easily [14], [15]. The discussion can be made in several sub-sections.

Figure 7. Main Menu

2) Single Player & Multiplayer Selection

Single player and multiplayer selection refers to the choice of video game or online game mode. Single player means players will play alone and face the game's challenges or story without interference from other players. Meanwhile, multiplayer allows for interaction with other players in real-time, either working together in teams or competing against each other.

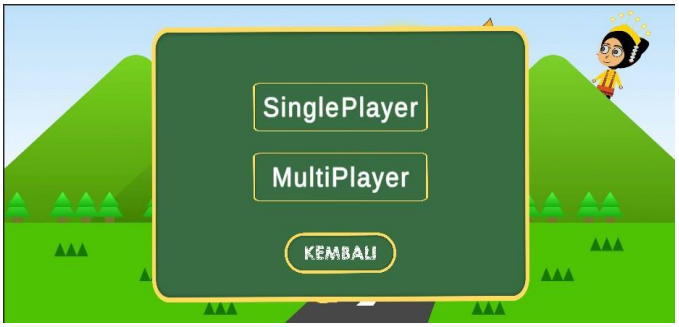
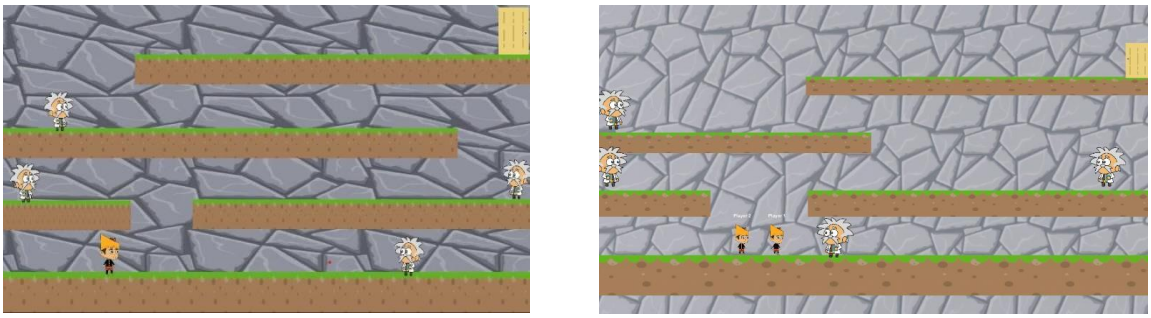


Figure 8. Single-player and Multi-player

3) Single Player and Multiplayer Gameplay
The gameplay displays an art and cultural quiz adventure. Figure 9 shown GamePlay in Single and Multi Player.



a. Single Player b. Multi Player

Figure 9. GamePlay Single Player and Multi Player

4) Quiz Question Display
The quiz questions appear when the player approaches an NPC. Quiz windows shown in Figure 10.

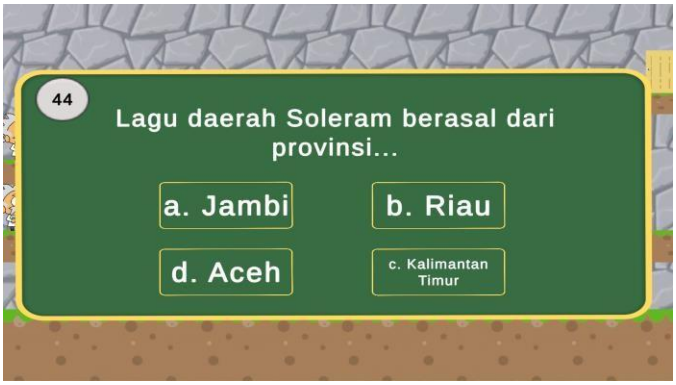


Figure 10. Quiz Windows

5) Score Results Display
The score results display will appear when the player has completed the questions at levels 1 and 2. Figure 10 shown Figure 11.

Figure 11. Score windowd

B. Testing the Fisher-Yates Shuffle Algorithm
The following are the results of three tests on one NPC, which produced different random permutations:

Table 1. Test Results on NPC 1

Element	No Soal	Soal Kuis
0	260	Tuan Amin adalah salah satu contoh karya teater modern yang merupakan hasil karya.
1	231	Tari Topeng Betawi berasal dari provinsi
2	187	Baju yang digunakan oleh para penari pakarena adalah baju
3	244	Tari Gandrung Sewu berasal dari daerah
4	217	Tari Enggang berasal dari daerah
5	87	Tari Serimpi biasanya ditampilkan dalam acara
6	158	Pencipta lagu anak-anak berupaya mengajarkan (mendidik) anak-anak berperilaku sopan, halus, hormat kepada orang tua, cinta keindahan, saying tanaman dan binatang, patuh pada guru dan sebagainya. Hal ini merupakan bukti bahwa musik nontradisional Nusantara memiliki
7	168	Secara singkat istilah drama dapat diartikan sebagai
8	44	Lagu daerah Apuse berasal dari suku
9	277	Berikut ini yang paling berpengaruh dalam keberhasilan sebuah pementasan drama adalah

From the results in Table 1, we can see that the Fisher-Yates shuffle algorithm test results show a list of elements with randomized question numbers. The Fisher-Yates shuffle algorithm is commonly used to randomize the order of elements in an array. In the test results above, each question number has been randomized into a new sequence. From the results, it can be seen that the randomized question numbers range from 0 to 302 (303 randomized questions). Each question number in these results represents its original position or index before being randomized.

C. Network Test Results

The design and development process for this 2D educational game, a multiplayer arts and culture adventure quiz, used the Fisher-Yates shuffle algorithm. The testing phase utilized QOS, a method used to measure network quality. The test results are presented in the Table 2. Packet loss refers to the number of packets that fail to reach their intended destination. When packet loss is high, it indicates a network that is either busy or overloaded. Based on theory and observations during measurements, the packet loss measurement involved three tests: 10 minutes, 15 minutes, and 20 minutes. The results are shown below.

Table 2. P*acket loss Test*

No	**Experimen**	**Packets**	**Displayed**
1	10 minute	18049	86 (0.5)%
2	15 minute	19082	67 (0,4)%
3	20 minute	24890	121 (0,5)%

The results of network measurements using QOS show that, although there was some packet loss, the percentage of packet loss that occurred in all tests was relatively low (below 0.5%). This is a positive sign because low packet loss indicates that network connectivity during gameplay was relatively stable.

4. Conclusion

Based on the author's research, the development of a 2D educational game—a multiplayer arts and culture adventure quiz utilizing the Fisher-Yates shuffle algorithm—was successful. The following conclusions are drawn:
1. From the test data provided, it can be seen that the randomized question numbers range from 0 to 302 (representing 303 randomized questions). Each question number in the test results represents its original position or index before the randomization process took place.
2. The results of network measurements using QOS show that, although there was some packet loss, the percentage of packet loss that occurred in all tests was relatively low (below 0.5%). This is a positive sign because low packet loss indicates that network connectivity during gameplay was relatively stable. Small amounts of packet loss may not significantly impact the gaming experience. However, if packet loss increases, this can result in lag or pauses in gameplay, as

Some data is not being sent or received successfully.

REFERENCES

[1] M. Sigala, A. Beer, L. Hodgson, and A. O'Connor, *Big Data for Measuring the Impact of Tourism Economic Development Programmes: A Process and Quality Criteria Framework for Using Big Data*. 2019.

[2] G. Nguyen *et al.*, "Machine Learning and Deep Learning frameworks and libraries for large-scale data mining: a survey," *Artif. Intell. Rev.*, vol. 52, no. 1, pp. 77–124, 2019, doi: 10.1007/s10462-018-09679-z.

[3] C. Shorten and T. M. Khoshgoftaar, "A survey on Image Data Augmentation for Deep Learning," *J. Big Data*, vol. 6, no. 1, 2019, doi: 10.1186/s40537-019-0197-0.

[4] R. Vinayakumar, M. Alazab, K. P. Soman, P. Poornachandran, A. Al-Nemrat, and S. Venkatraman, "Deep Learning Approach for Intelligent Intrusion Detection System," *IEEE Access*, vol. 7, pp. 41525–41550, 2019, doi: 10.1109/ACCESS.2019.2895334.

[5] K. Sivaraman, R. M. V. Krishnan, B. Sundarraj, and S. Sri Gowthem, "Network failure detection and diagnosis by analyzing syslog and SNS data: Applying big data analysis to network operations," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 9 Special Issue 3, pp. 883–887, 2019, doi: 10.35940/ijitee.I3187.0789S319.

[6] A. D. Dwivedi, G. Srivastava, S. Dhar, and R. Singh, "A decentralized privacy-preserving healthcare blockchain for IoT," *Sensors (Switzerland)*, vol. 19, no. 2, pp. 1–17, 2019, doi: 10.3390/s19020326.

[7] F. Al-Turjman, H. Zahmatkesh, and L. Mostarda, "Quantifying uncertainty in internet of medical things and big-data services using intelligence and deep learning," *IEEE Access*, vol. 7, pp. 115749–115759, 2019, doi: 10.1109/ACCESS.2019.2931637.

[8] S. Kumar and M. Singh, "Big data analytics for healthcare industry: Impact, applications, and tools," *Big Data Min. Anal.*, vol. 2, no. 1, pp. 48–57, 2019, doi: 10.26599/BDMA.2018.9020031.

[9] L. M. Ang, K. P. Seng, G. K. Ijemaru, and A. M. Zungeru, "Deployment of IoV for Smart Cities: Applications, Architecture, and Challenges," *IEEE Access*, vol. 7, pp. 6473–6492, 2019, doi: 10.1109/ACCESS.2018.2887076.

[10] B. P. L. Lau *et al.*, "A survey of data fusion in smart city applications," *Inf. Fusion*, vol. 52, no. January, pp. 357–374, 2019, doi: 10.1016/j.inffus.2019.05.004.

[11] Y. Wu *et al.*, "Large scale incremental learning," *Proc. IEEE Comput. Soc. Conf. Comput. Vis. Pattern Recognit.*, vol. 2019-June, pp. 374–382, 2019, doi: 10.1109/CVPR.2019.00046.

[12] A. Mosavi, S. Shamshirband, E. Salwana, K. wing Chau, and J. H. M. Tah, "Prediction of multi-inputs bubble column reactor using a novel hybrid model of computational fluid dynamics and machine learning," *Eng. Appl. Comput. Fluid Mech.*, vol. 13, no. 1, pp. 482–492, 2019, doi: 10.1080/19942060.2019.1613448.

[13] V. Palanisamy and R. Thirunavukarasu, "Implications of big data analytics in developing healthcare frameworks – A review," *J. King Saud Univ. - Comput. Inf. Sci.*, vol. 31, no. 4, pp. 415–425, 2019, doi: 10.1016/j.jksuci.2017.12.007.

[14] J. Sadowski, "When data is capital: Datafication, accumulation, and extraction," *Big Data Soc.*, vol. 6, no. 1, pp. 1–12, 2019, doi: 10.1177/2053951718820549.

[15] J. R. Saura, B. R. Herraez, and A. Reyes-Menendez, "Comparing a traditional approach for financial brand communication analysis with a big data analytics technique," *IEEE Access*, vol. 7, pp. 37100–37108, 2019, doi: 10.1109/ACCESS.2019.2905301.

[16] D. Nallaperuma *et al.*, "Online Incremental Machine Learning Platform for Big Data-Driven Smart Traffic Management," *IEEE Trans. Intell. Transp. Syst.*, vol. 20, no. 12, pp. 4679–4690, 2019, doi: 10.1109/TITS.2019.2924883.

[17] S. Schulz, M. Becker, M. R. Groseclose, S. Schadt, and C. Hopf, "Advanced MALDI mass spectrometry imaging in pharmaceutical research and drug development," *Curr. Opin. Biotechnol.*, vol. 55, pp. 51–59, 2019, doi: 10.1016/j.copbio.2018.08.003.

[18] C. Shang and F. You, "Data Analytics and Machine Learning for Smart Process Manufacturing: Recent Advances and Perspectives in the Big Data Era," *Engineering*, vol. 5, no. 6, pp. 1010–1016, 2019, doi: 10.1016/j.eng.2019.01.019.

[19] Y. Yu, M. Li, L. Liu, Y. Li, and J. Wang, "Clinical big data and deep learning: Applications, challenges, and future outlooks," *Big Data Min. Anal.*, vol. 2, no. 4, pp. 288–305, 2019, doi: 10.26599/BDMA.2019.9020007.
[20] M. Huang, W. Liu, T. Wang, H. Song, X. Li, and A. Liu, "A queuing delay utilization scheme for on-path service aggregation in services-oriented computing networks," *IEEE Access*, vol. 7, pp. 23816–23833, 2019, doi: 10.1109/ACCESS.2019.2899402.
[21] G. Xu, Y. Shi, X. Sun, and W. Shen, "Internet of things in marine environment monitoring: A review," *Sensors (Switzerland)*, vol. 19, no. 7, pp. 1–21, 2019, doi: 10.3390/s19071711.
[22] M. Aqib, R. Mehmood, A. Alzahrani, I. Katib, A. Albeshri, and S. M. Altowaijri, *Smarter traffic prediction using big data, in-memory computing, deep learning and gpus*, vol. 19, no. 9. 2019.
[23] S. Leonelli and N. Tempini, *Data Journeys in the Sciences*. 2020.
[24] N. Stylos and J. Zwiegelaar, *Big Data as a Game Changer: How Does It Shape Business Intelligence Within a Tourism and Hospitality Industry Context?* 2019.
[25] Q. Song, H. Ge, J. Caverlee, and X. Hu, "Tensor completion algorithms in big data analytics," *arXiv*, vol. 13, no. 1, 2017.