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Video Game Data Synchronization and Preservation using Blockchain

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Abstract. As live-service games proliferate, game availability starts to concern player due to the need to fund the game servers. Game companies had been known to remove games at will, frequently for financial reasons. Players and others are scrambling to figure out how to preserve games and make it available offline. Our goal is to allow synchronization and preservation of game data. We propose using blockchain technology and we are building a game as proof of concept of this proposal. We found that we could preserve and allow synchronization of game data to our blockchain that could be maintained among several players.

1. INTRODUCTION

With the proliferation of live-service or always online games, concerns arose with regards to game availability [1]–[4]. On the other hand developers must bear the cost of server maintenance. As the game ages, revenues will eventually drop to unsustainable levels, making always-online games financially untenable. The most economical answer is obviously to shut the game server down, leaving fans of the game losing access to their game that they invested time and money in the game [5]–[8]. Thus, we are considering a method to preserve our game.

Players who grow fond of such games had made many attempts to preserve online games by making them into offline single-player games [9]–[13]. However, such preservation efforts were either offline-based game or fans decided to make a dedicated server for their preservation effort on their own accord. The latter of which essentially returns back to the original reliance of an always-online server. Thus, we resolved to build some way to preserve games for both always-online and offline-ready in which the data can be accessed and used locally. Our target is to make the game accessible both online and offline.

We expect the impact of our research to primarily be of practical value in which we are using well-known technology, in this case blockchain, to achieve our goal of video game data synchronization and preservation.

We should address challenges facing game preservation, namely obsolescence, media degradation, and legal hurdles [14]–[19]. Obsolescence and media degradation could be easily solved by using emulation, such as RetroPie which allows older games to run on Raspberry Pi [20]–[23]. Legal challenges are also answered by presenting the game preservation attempt as either museum, library, or archive preserving games that are "no longer reasonably available in the commercial marketplace, solely for the purpose of preservation of the game in a playable form" [24], [25]. We could interpret this reasoning as to "preserve online games that are closed to ensure the game remains playable". However, our preservation effort is in a legal gray area due to opposition from the industry [26], [27].

Nakamoto in [28] once proposed a way to allow progress to be tracked using Blockchain technology. As a concept, Blockchain is designed with decentralization and resistance to tampering in mind [28]. It achieves this through dispersal of a record list called ledger which everyone in the network can access. In order to update data in blockchain, a majority of network users have to acknowledge and approve of such updates. This makes tampering difficult[29]. Thus, we can use this technology to allow for game preservation through blockchain technology. Most video games that incorporate blockchain currently mostly lean into NFT aspects and implementation [30]. The games use NFTs and use them as in-game assets. In addition, player's may trade or exchange their assets

outside of the game itself. One of the earliest games to merge blockchain technology and video games was CryptoKitties, a pet simulator where NFTs represent a player's pets. Core gameplay of CryptoKitties mainly involves taking care and breeding these virtual pets [31].

2. METHOD

The main focus of this project will be developing a blockchain-based database that stores data of a player's progress within a video game. Both the blockchain platform and the client will be written using the Python programming language and developed to run under computers running under Windows x86- based platforms. The blockchain will be able to issue accounts to new players. For existing players, they may retrieve their latest progress within a game and save their progress after a session. General interaction with the blockchain will be done using the client, therefore the user interface will be implemented on that client. Note that every screen of the client will be used as a user interface to interact with the blockchain.

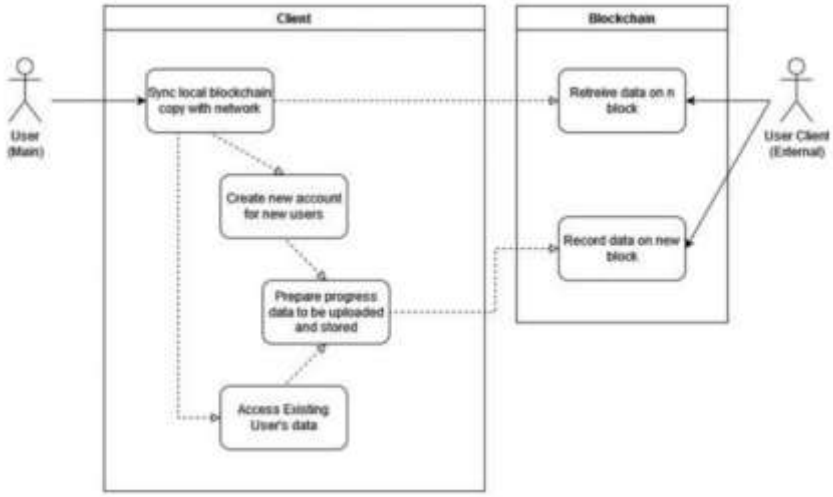

Figure 1: Use Case Diagram for the application

Figure 1 describes how the application interacts with main user and external users in the blockchain. We used blockchain to preserve the player's data and allow changes to player data be tracked by everyone in the chain, obviating the need for a dedicated server. The main user serves as the owner of the copy of the game and the external users serve to validate the block added to the chain.

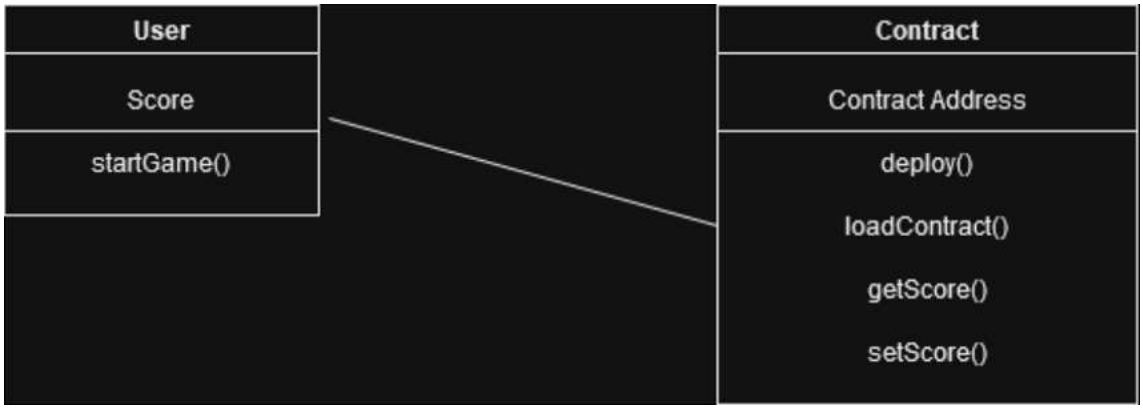

Figure 2: Class Diagram for the application

The Game Client is the primary way a user interacts with the whole system. The Client consists of a Program Window which incorporates a menu bar, game canvas/area. The Server incorporates

blockchain technology to retrieve data and record newly generated data. Figure 2 describes classes that are being used in the scheme which involves user generating the score in the game

Using Ganache, a local Ethereum provider, we developed a game as proof of concept for this approach. We assumed that the game is a reverse-engineered version from the original into a single-player offline version. As a simulation, we are developing an asteroid avoidance game. In our case, we modified the game code to link to localhost for the sake of game progress and score preservation.

3. RESULTS AND DISCUSSION

Figure 3: The implementation of sample game

Upon startup of the program, the user is shown a black screen with menu bar. To start a game or configure a contract, the user may pick one of the menu options within the menu bar. Figure 3 shows the main interface where the player will interact with the program. The key feature here is in the Contract menu in which it is designed to allow loading of game data to the blockchain. The program is able to save and read player progress data from local blockchain provider. Table 1 further examines the data storage in the blockchain assuming the Ganache works as delivered.

Table 1. The testing results

No.	Scenario	Expected Result	Result
1	Application retrieves user's data upon startup	Application retrieves the user's previous high score	As expected
2	Application saves user's high score if a higher score is achieved	Application saves the user's high score	As expected
3	Application does not save user's score if a higher score is not achieved	Application does not overwrite a lower score to high score	As expected

We found that the technology allows the user to capture the data for offline use and occasionally add new data to everyone's block. Using blockchain openness, we can say with near-certainty that everyone can audit the game data being added to the blockchain. In addition, we found out that the system can be implemented for different types of games as long as the person in charge of preservation and synchronization knows what type of data needs to be stored in the server, and the blockchain by extension. By extrapolating the game module, we find that this approach is introducing another interface layer on top of the game. This approach shall be intended to format the game data being synchronized across the blockchain. We find this approach to be conveniently useful for preservation as well.

4. CONCLUSION

We conclude that we achieved the same goals as what live-service games servers does which includes security from tampering and accessibility to individual users provided an internet connection is available. What moving to the proposed system allows for is continual usage and access to this data

regardless of the original developer or publisher's support for the game. So long as the blockchain is maintained by some groups of users, their data will still be still be accessible and no longer susceptible to a complete shutdown or deactivation of the game. In addition, we also conclude that the game itself can be preserved locally provided that the game interfaces with local blockchain provider. Furthermore, we are considering to host the game in local network server strictly for archival purpose. As long as the game is not rented nor displayed commercially, we are confident that we are not violating any law. Works that may improve upon this project include encoding more data while also reducing overall size of the data so that the user may require less funds to store their data in the blockchain. Security and privacy may also be areas of future improvement by incorporating encryption before storing or updating data. Then, we also suggest allowing one game client to store their data across several federated blockchains to allow for one player to join different preservation groups.

REFERENCES

[1] E. Bektic, "Game Preservation," in *Savegame: Agency, Design, Engineering*, R. R. S. W. Elmenreich, F. Schniz, S. Gabriel, G. Pölsterl, and W. B. Ruge, Eds., Wiesbaden: Springer Fachmedien, 2019, pp. 207–223.

[2] S. Gharbi, "The Artificial Scarcity and Preservation of Video Games as Digital Goods," South Eastern Finland University of Applied Science, 2021.

[3] M. Swalwell, A. Ndalianis, and H. Stuckey, Eds., *Fans and videogames: histories, fandom, archives*. New York: Taylor & Francis, 2017.

[4] M. J. Wolf and B. Perron, *The Routledge companion to video game studies*, 2nd ed. New York: Taylor & Francis, 2023.

[5] R. W. Gehl and M. Stevenson, "The Afterlife of Software," in *A Networked Self and Birth, Life, Death*, S. Papacharissi, Ed., New York: Taylor & Francis, 2019, pp. 190–208.

[6] R. Guins, *Game after: A cultural study of video game afterlife*. Massachusetts: MIT Press, 2014.

[7] D. Guay-Bélanger, "Assembling auras: towards a methodology for the preservation and study of video games as cultural heritage artefacts," *Games Cult*, vol. 17, no. 5, pp. 659–678, 2022.

[8] A. De Kosnik, "Piracy is the future of culture: Speculating about media preservation after collapse," *Third Text*, vol. 34, no. 1, pp. 62–70, 2020.

[9] J. Barwick, "Where have all the games gone? An exploratory study of digital game preservation," Loughborough University, 2012.

[10] O. Sköld, "Documenting Videogame Communities : A Study of Community Production of Information in Social-Media Environments and its Implications for Videogame Preservation," Department of ALM, Uppsala University, 2018.

[11] C. Heiberg, "Building a Strategy for Digital Game Preservation Based on the Practices of Communities of Players," Chapel Hill, 2013.

[12] K. Le, "Unrecognized Legacy: an exploration of video game preservation as cultural heritage," Aalto University, School of Business, 2023.

[13] J. Barwick, A. Muir, and J. A. Dearnley, "Where have all the games gone? Explorations on the cultural significance of digital games and preservation (Version 1)," 2009. [Online]. Available: https://hdl.handle.net/2134/5325

[14] J. Yee, "Incompatible: The Challenges in Preserving Taiwanese Video Games," in *2021 Pacific Neighborhood Consortium Annual Conference and Joint Meetings (PNC)*, IEEE, 2021, pp. 1–8.

[15] A. Nakamura, K. Hosoi, K. Fukuda, A. Inoue, M. Takahashi, and M. Uemura, "Endeavors of Digital Game Preservation in Japan-A Case of Ritsumeikan Game Archive Project.," in *14th International Conference on Digital Preservation*, Sep. 2017.

[16] P. Gooding and M. Terras, "'Grand theft archive': a quantitative analysis of the state of computer game preservation," *Int J Digit Curation*, vol. 3, no. 2, pp. 19–41, 2008.
[17] N. Nylund, P. Prax, and O. Sotamaa, "Rethinking game heritage–towards reflexivity in game preservation," *International Journal of Heritage Studies*, vol. 27, no. 3, pp. 268–280, 2021.
[18] J. McDonough, "A tangled web: Metadata and problems in game preservation," *The Preservation of Complex Objects*, vol. 3, pp. 49–62, 2013.
[19] J. Barwick, J. Dearnley, and A. Muir, "Playing games with cultural heritage: A comparative case study analysis of the current status of digital game preservation," *Games Cult*, vol. 6, no. 4, pp. 373–390, 2011.
[20] C. Johansson, "Video Game Preservation and Emulation from Three Perspectives: Developers, Archivists, and Gamers," Södertörn University, 2023.
[21] M. Swalwell, "Towards the preservation of local computer game software: Challenges, strategies, reflections," *Convergence*, vol. 15, no. 3, pp. 263–279, 2009.
[22] D. Monnens, A. Armstrong, J. Ruggill, K. S. McAllister, Z. Vowell, and R. Donahue, "Before it's too late: A digital game preservation white paper," *Am J Play*, vol. 2, no. 2, pp. 139–166, 2009.
[23] B. Dym, E. Simpson, O. Fong, and L. Strieg, "The Internet Is Not Forever: Challenges and Sustainability in Video Game Archiving and Preservation," *Journal of Electronic Gaming and Esports*, vol. 1, no. 1, pp. 1–12, 2023.
[24] M. Kamal and X. Vogel, "The Legality and Morality of Video Game Emulation (Research-In-Progress)," in *SAIS 2020 Proceedings*, 2020, p. 14.
[25] Y. H. Lee, "Making videogame history: videogame preservation and copyright law," *Interactive Entertainment Law Review*, vol. 1, no. 2, pp. 103–108, 2018.
[26] S. Gosman, L. A. Ringhand, K. Kisska-Schulze, J. T. Holden, and S. P. Bair, "Would You Like to Save Your Game?: Establishing a Legal Framework for Long-Term Digital Game Preservation," *Ohio State Law J*, vol. 81, no. 3, pp. 567–604, 2020.
[27] J. Newman, "Illegal deposit: Game preservation and/as software piracy," *Convergence*, vol. 19, no. 1, pp. 45–61, 2013.
[28] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008.
[29] M. Belotti, N. Božić, G. Pujolle, and S. Secci, "A vademecum on blockchain technologies: When, which, and how," *IEEE Communications Surveys & Tutorials*, vol. 21, no. 4, pp. 3796–3838, 2019.
[30] T. Min, H. Wang, Y. Guo, and W. Cai, "Blockchain games: A survey," in *2019 IEEE conference on games (CoG)*, IEEE, Aug. 2019, pp. 1–8.
[31] X. J. Jiang and X. F. Liu, "Cryptokitties transaction network analysis: The rise and fall of the first blockchain game mania," *Front Phys*, vol. 9, pp. 57–68, 2021.