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The Integration of Computer Systems into the expansive field of Video Games

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ABSTRACT

In today's day and age, the recent generations are the targets of video game companies. Most companies asociated have goals that correspond with their target market. The companies create what the consumers want, which are video games. Everyone knows what are video games, but what are its comprised components? With that said, this research paper aims to provide information to the field of computer systems, more specifically, its integration with video games. Another objective of this paper is to give awareness of how computer systems work to give video games an extraordinary feel. This is important because individuals need to understand the various topics tackled by video games. These topics would include various computer systems like Spatial imaging, which is the ability to interact with 3D objects in a specific environment. Artificial neural networking and electronic sensors are some of the few computer systems to be tackled. The applications will be further studied so that the information on these systems can help give knowledge to people.

Key words: video games, technology, computer systems, algorithms, engines.

1. INTRODUCTION

In the modern world of technology, video games have gone a long way. From the old, classical 8-bit games like Snake, Tetris, and Mario, to the latest, high powered graphics games such as Shadow of the Tomb Raider, Grand Theft Auto V (GTA V) and Metro Exodus. Previously, the gaming experience for older games was linear and repetitive, in a way that most games utilize the same concepts which would result in less appreciation in games. Today, video games are capable of more complicated tasks to create an immersive experience that is unique among other games of its type. This is due to the evolution of technology which helped to create better computer systems for game creation. The innovation allowed gaming to expand their capabilities and their platforms to the public. One of the new features of the present time is that the games are more open to exploring. Games have been carefully exercised by the creators that they added a lot of extra detail that would make the experience lifelike. Also, the designs of the present-time video game systems are so advanced that some game engines could recreate objects and that could closely visually replicate true-to-life spaces from reality whether it is an urban city or a mountain landscape into 3D rendered spaces. Other than the design, the decision-making capabilities of Non-Player Characters (NPCs) are either up par to or even better than some choices of user-played characters.

According to Hadzinky (2014) [1], games today are great because there is an expectation to beat by companies that are set by the consumer and creator. In the past, media and technology were limited, thus games never really had an expectation to beat but to sell a lot of copies of their products. Games in the past were harder to play and due to certain limitations of technology that hinders the game to be great. Unlike now, released games are great because the expectation of the audience of video games is errors in a game are kept at a minimal since there is no perfect digital system.

2. BACKGROUND OF THE STUDY

Video gaming is a category that paved its way into the entertainment industry. In the previous years, it was something that didn't get much time in the spotlight, but in 2019, video gaming is seen and treated as a general form of entertainment that is being enjoyed by billions of people and is currently a billion-dollar worth industry. From its small beginnings to its current-day status. Video games play a huge role in pop culture and can be used as a media to express various beliefs and be a platform to express an individual or a collective's limitless creativity. Present-day video games offer far more superior virtual engines and designs than the old ones.

Due to its increasing capabilities, video gaming has proved itself to be an asset to different professional fields. According to Anderton (2017), Gamer's Outreach provided the video game "Go Karts" to various hospitals for children to cope with their anxiety and social skills. Video games don't only aid the younger generations, but also the seniority. In a report

discussed by Prior (2019) [3], a VR (Virtual Reality) game called "Sea Hero" serves as a platform to elderly individuals who exhibit the early signs of Alzheimer's. This game has proven to be more capable of detecting the early signs of the disease compared to traditional methods. Video games do not only offer great things, they also offer a powerful force of addiction which is experienced by avid gamers. The addiction aspect of video games relieves the user's sense of reality, resulting in dysfunction in their life in reality. Because of this, video gaming addiction is now considered as sickness. According to the WHO (2018) [4], gaming disorder is defined as a pattern of gaming behavior characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences. This indicates that gaming is an activity that should be done sparingly as to not lose touch with the real world.

Generally, video games do have their share of positive and negative aspects. It is shunned by most of the elderly generations as it is seen as a waste of time rather than a craft that needs to be worked on or be perfected in order to serve us in many different ways.

3. STATEMENT OF THE PROBLEM

With the continuous advancement of video games, various complex algorithms are made to create unique experiences. These unique experiences include being able to simulate a world that can be interacted by the end-user, enable global interaction with others that play the same game, and allow the use of other peripherals to enhance one's immersion in the narrative of the video game. Some unique experiences can be found from the mechanics of gameplay, graphical rendering, or handling of various data during gameplay.

Each algorithm is capable of performing certain complex processes that can also be found in other applications. One prime example is NVIDIA's GeForce RTX technology to create realistic lighting in 3D environments in real-time. At the same time, GeForce RTX also offers deep learning artificial intelligence to provide better-rendered images while also performing twice as fast as the previous GPUs using conventional anti-aliasing techniques. [5]

In this paper, the researchers are to identify how video games are capable of applying concepts found in Spatial Imaging, Rough Set Theory, Electronic Sensors, Logic Scoring of Preference, Artificial Neural Network, Database Monitoring, and Data / Information Transfer, Learning Content, Social Dimensions, Personal Dimensions, and Cultural Dimensions.

4. SIGNIFICANCE OF THE STUDY

The computer systems integrated into video games can be seen as innovative milestones for each achievement in technology. With video games being a more common source of entertainment and therapy, learning its mechanisms can serve us better significantly and can be a beacon of extensive technological learning's. This type of media can serve as an engaging type of information sharing. The various computer systems that are currently present in technology are all present in video games. Their presence is simply a huge part of the entirety of one game. Computer systems in the real-world do serve us well. They make our lives easier because of their various kinds of innovations. Computer systems are also fundamental to the current events happening in the modern world of technology. The enhancement of the man-made, artificial neural networking system or the AI (Artificial Intelligence) plays a big role in the future of our global industries. Having knowledge of these things can show the path onto an innovative future with fewer deterrents. Starting from a sufficient amount of data can help identify each computer system easier as compared to a worldwide scope. As the future of technology is very bright, the knowledge that grows with it will never fade and will keep on growing.

5. DESCRIPTION OF THE SYSTEM

Pokemon Go is an AR (Augmented Reality) mobile game created by Niantic that is available for Android and iOS. It has reached a peak of 50 million downloads in the first week of its release. The game requires the use of location data to play. The mechanics of the game involve physically repositioning oneself to different locations in order to find and capture the in-game creatures called "Pokemon." The game promotes real-world navigation to be able to enjoy the game to the fullest. [6]

Sea Hero is a VR mobile Android game that is developed by Oculus that is designed to be played by people who have dementia. It was designed by British game company called Glitchers in 2016 in association with Alzheimer's Research UK, University College London and the University of East Anglia and with funding from Deutsche Telekom. Its gameplay simply consists of simple memory problems that can serve as an easy-to-use platform for people of all ages. [7]

God of War 4 is an action RPG game that is exclusively created for the Playstation 4 console. It consists of a story with heart and brutal combat that adjusts to the player's ability. With a combat system so engaging, the Artificial Intelligence dealing with the NPC's read and adapt the player's patterns of attack, resulting in more challenging gameplay that forces the player to rethink their tactics when combating various types of enemies. This is one of the games to implement this type of gameplay as other games are the type that the A.I. is only programmed to follow a linear path. [8]

6. METHODOLOGY

The information that is in the paper comes from the collaboration of general information given to the public and personal experiences. The video games specifically studied are the ones that exhibited the seven types of computer systems. A lot of video games are free to the public for access; hence it is easy to study. There is no shortage of video games as every day a new game comes out from companies or indie developers. Most of the games included in the study are a huge part of the gaming culture as they have their own franchises. It means that, as more and more sequels are created, the bigger the audience they would have. An example of this franchise is the God of War series. This game has appealed to many individuals due to its grotesque nature and its unique take on mythology. Due to this nature, the desired audience of the game is implemented within the age gaps of teen to adult. During these years, the mind is at its peak performance, making its cognitive skills unparallel compared to the minds of younger people. Also, the game implements an A.I. system that adapts to the player's patterns. Games like Go Karts and Sea Hero serve more of a medical tool to help both young and old patients. With the growth of Gamers Outreach, they have expanded their services to more hospitals resulting to almost 200,000 children benefiting from their project.

7. REVIEW OF RELATED LITERATURE

Spatial Analysis covers the principle that some spatial components can be found in data. It is associated with Spatial Resolution in Digital Images. Using spatial analysis, an image can be improved to look better. It increases pixels as the photo improves in quality. The emergence of spatial analysis in computer sciences started from a multidisciplinary crossroad approach wherein ideas emerged from the crossing of different disciplines. An example application of spatial analysis is OpenStreetMap which is a collaborative project to collect geographical data of the entire world. The data provided by OSM is used in various services in the public, private, and commercial areas. Some particular examples of the services that use OSM are traffic management, disaster management, environmental research, and educational purposes. [9,10, 11]

Rough sets: past, present, and future by Skowron and Dutta (2018) [12]. Rough Set Theory is a way of dealing with a different kind of knowledge. This kind of knowledge is imperfect and has vague concepts. Its use associates with AI, most importantly in machine learning and adaptive systems. Rough sets are not binary, which in a sense, has only two options. Rough set approach of machines has certain degrees with actions to do in a specific degree, respectively.

Electronic Sensors are tools capable of translating physical traits into data. In research by Lakhiar, Jianmin, Syed, Chandio, Buttar, and Qureshi (2018) [13]. They delved into the possibility of using wireless sensors to detect early faults and diagnostics to an aeroponics system. This is taking into consideration that aeroponics requires ideal temperature, humidity, light level, water nutrient solution level, pH and EC, CO_2 concentration, atomization time, and atomization interval time to allow the plants to flourish.

According to Allen, Amundsen, Dujmovic, and Messer, logic scoring of preference is a rigorous scientific technique made for computer science applications. It is able to create its own project selection criteria and weightings that accurately represent human reasoning. It also ensures that the calculated benefits are accurate to the intent of the decision-makers [14, 15].

Evolving Neural Network Agents in the NERO Video Game by Stanley, Bryant, and Miikkulainen (2005) [16] delved into the possibility of using Artificial Neural Network in video games. Artificial Neural Network refers to the continued learning capability of Artificial Intelligence within a system. This network imitates the workings of a human's brain in a digital environment. It is a study of the possibility of using an artificial neural network in games. The particular idea of the game is that the end-user, called the player, is tasked to teach the skills to the Non-Playable Characters (NPCs). This is to demonstrate the possibility of using machine learning to create an AI that is not scripted as a means to create a unique and fun experience.

Database Monitoring is the capability of being able to monitor the current condition of a database. In a research paper by Curino, Jones, Madden, and Balakrishnan, [17] they explored the possibility of using a resource monitor in managing their database consolidation program Kairos. As a part of Kairos, the resource monitor built-in is capable of collecting statistics on how much resources are consumed without causing any overhead. Information collected includes CPU, RAM, and disk I/O, buffer pool utilization, and log flushes. This information is then used by Kairos to optimize the consolidation engine and maximize performance gains. The means in which Kairos manages to gain performance is through the research of Brown, Varey, DeWitt, Mehta, and Naughton. The paper proposes that new algorithms be used to enhance performance gains in mixed database workloads. [18]

Data / Information Transfer is the capability of computer systems to transfer information from one terminal to another. In a paper by Parekh, Shah, and Bhattacharjee [19], they made use of the wireless board, ZigBee, to relay information wirelessly to display messages in public places. The information is sent from a PC and is transmitted to the ZigBee board to be sent to the ATMEGA16 controller for processing in a graphical LCD. ZigBee is a standard for data communication in businesses and consumer devices. [20] It is built around a low-cost low power model making it an efficient machine for wireless networking.

Significance of Video Games and The Process of Coding One in a project, a class of fourth-graders programmed different

games for other students that are younger in their community. The class does this task to learn about concepts in programming such as conditionals, loops, and tail recursion. Students have a procedure to create a structure in the part of questioning in their problems. The improvement of the students in the class is remarkable in computational practices such as creating and solving problems in programs when compared to the other students who were only learning Logo programming for smaller projects that are not even related to gaming. The evaluations on student's learning in-game creation are limited but it opens up on the effects of programs, gaming programs or not, to students. It also opens up on the effects of time spent on programming that exhibits the student's productivity in a given period. The findings in Palumbo's review confirms that there are factors that matter for a student to learn to program efficiently [21, 22].

There are games made that focuses on academic learning for subjects that are present in the K-12 curriculum. The concept of constructionist gaming and the understanding of programming are valuable to each other and it engages in personal expression that would help an individual to be more knowledgeable. In the 1980s, Papert's success was huge in introducing the idea of computer programming to academic institutions. The approach of explaining code created a different way for mathematics to be understandable. Papert's idea influenced other individuals to explain code as mathematical proofs gave a stronger foundation in learning mathematics [23, 24].

The social dimensions of video gaming examine the collaborations and communities that involve game making ranging from local collaborations, extensive programming design, setting up international rivalries, and numerous online communities that are controlled by numerous programmers. Moreover, a few of these social designs have been the cornerstone of consequential research such as the studies on pair programming, which was designed by Denner and Werner. Their success brought the pair programming approach to younger students who aspire to create video games. Most of the studies covered by Kafai and Burke does not provide a proper analysis of the learning outcomes of the student [25].

Unlike other experiments, Werner and Denner's research on pair programming was the exception. Significant improvement in coding was observed when the coders operated in pairs. One of the pairs being the primary writer of the code while the second servers as the one that checks the code for accuracy. Furthermore, the students were observed to be able to attempt troubleshooting the problem for longer periods of time before seeking aid from an instructor.. [26, 27] Most of the game designs covered by the researches that Kafai and Burke analyzed were all programmed and designed by students. Their created games are then exhibited and played by their colleagues who play their roles as both the audience and the critic. Owston and his colleagues discovered that Quiz-based video games were the preferred genre of the student programmers. As a result, significant improvements to spelling, grammar, and punctuation were observed due to the possibility that the students are adjusting it for the sake of their peers who will be playing the game. Using videogames as a device to instill education within the minds of younger individuals proved to be an effective way of teaching children as the process was entertaining yet informative. This also promotes collaboration among students which enable the improvement of the individuals coding skill. [28, 29]
Reynolds and Chiu conducted an experiment which exposed students to the platform of Globaloria, a learning platform utilizing Flash and ActionScript, as a means for them to design their own homemade video games as part of their requirements for school. The experiment lasted for one entire year. Reynolds and Chiu found out that the participants, most notably those with parents that have less post-secondary education, had a stronger sense of self-efficacy. The participants also exhibited more gains in self-efficacy than those who were exposed to an after-club school setting. It is evident that working on applications like Flash and ActionScript played an important role in boosting the confidence of the participants. One of the most important observations is that the programs that the students have designed also contained significance and meaning outside of their school. [30]. For the system database administration is important [31,32,33].

8. THEORETICAL CONSIDERATIONS

Over the course of this study, various video games will be analyzed for indications that certain computer systems were used. A qualitative approach will be done to assess the implementation of certain computer systems in games.

9. ANALYSIS OF DATA

Over the course of observing the three games, we have identified how some of them manage to integrate computer systems into their primary mechanics. Each game offers various gameplay mechanics which brings about unique ways to play these games. To give these unique experiences, each game focuses on certain fields. The game is created with each of their focus fields in mind.

In the case of Pokemon Go, it capitalizes on the use of spatial analysis. The central gameplay mechanic of Pokemon Go revolves around being able to navigate spatially to traverse within the game. The position of the character being the equivalent of its position in a digital map of the real world. The game is also capable of Database Monitoring in some way. This is observable in the vast amounts of data it must handle such as the items of a player's inventory, the Pokemon they have managed to capture, friends registered in their friend list, and much more. Ensuring that the system is able to maintain all this information, some form of database monitor and management is in place to prevent data loss and corruption. The data information and transfer are also

apparent in this game as the client program requests data from a master server.

Sea Hero is a game that focuses on memory retention. It is set in a tropical background wherein the player is a captain of a ship. The player ventures through various locations by completing tasks. Majority of the tasks require the player to have a strong memory in order to complete them. As it is a Virtual Reality game, it makes use of electronic sensors to detect movement and position. These sensors are capable of relaying to the game where should the in-game camera move.

God of War is the first-ever game to implement an enemy Artificial Intelligence that adapts to the character's actions. With the help of neural networks, the various foes in the game are allowed to give out a set of actions towards the player. With the neural network implemented within the enemy A.I., the rough set theory gives the A.I. the ability to counter the actions of the player and would allow the enemy to recognize established attack patterns and does their best to counter the repetitive moves of the player.

10. CONCLUSION

The integration of computer systems in video games provided an expansive foundation that increased the capabilities of modern-day video gaming. The various innovative mechanics being added in current-day gaming give newer games an edge in the market. These computer systems make video gaming a more approachable media that can be used by anyone no matter their age.

Each of the seven computer systems plays an integral part when implemented in a video game. The system, spatial analysis can improve the quality of a picture. This computer system can also be used to track a user within a specific location. This system is seen as an innovative step as it is integrated into our current day traffic systems and mobile applications. The rough set theory is vague yet plays an integral part when dealing with Artificial Intelligence. The theory focuses on the adaptive systems and the machine learning aspect of Artificial Intelligences, these aspects are the determining factors of which limits the actions of the machine. This computer system deals with adaptive Artificial Intelligence in video games. To interact with the on-screen environment, electronic sensors allow the user to act within the game. This is important not only in video games but also in our modern-day technology. Concerning modern-day technology, electronic sensors are used in various agricultural innovations. Logic Scoring Preferences are a huge part of modern-day technology as it can accurately represent human reasoning. Due to this system, the chance for committing human error is relatively lower than normal. Artificial Neural Networks when integrated into a smaller scale i.e., video games. It allows the artificial intelligence to continuously learn from the player's actions. Artificial Neural Network has yet to reach a global scale as this type of computer system is somewhat unpredictable to read as this type of A.I. thinks for itself. Database Monitoring is used to collect data from any database. The data is used to optimize engines and allows the machine to work at its full capacity. Lastly, Information Transfer, a computer system that allows the transferring of data to one site to another. This proves useful when giving away data to another user may it be wired or wireless. All these systems are implemented in video gaming as they can provide a fun and smoother experience.

11. RECOMMENDATIONS

Over the course of this study, all data that was collected as a result of observation. To further reinforce the idea that computer systems are at play in video games, it is important to gain access to the source code of these entertainment programs. The source codes of the video games contain how the developers approached in the implementation of computer systems. The unique and complex gameplay mechanics that are found in these kinds of games make it all the more important to be able to get a firsthand analysis on the algorithms of the games. A deeper look into the algorithms of these games can provide further insight into how these games managed to capitalize on a certain feature to create unique gameplay experiences.

Furthermore, the research would have benefitted from having more time to collect information and analyze video games. Different kinds of video games exist and each is capable of demonstrating a unique implementation of computer systems to its gameplay mechanics. The complexity found in certain games makes it all the more important to allot more time for observation. Having more time to observe and identify implementations of computer systems can enable a more accurate paper.

A wider collection of games to examine can help reinforce the notion that video games are capable of implementing the different kinds of computer systems. As each game is able to implement a certain concept of computer systems in a unique way, being able to identify similar implementations can help in making the claim that video games are capable of implementing computer systems to be stronger. The uniqueness and complexity of the gameplay mechanics of each game make a wider scope of video games to analyze more desirable. A greater scope of games to analyze can allow a more accurate and precise analysis of how computer systems can be implemented in video games.

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