

Institiúid Teicneolaíochta Cheatharlach



At the Heart of South Leinster

Computer Games Development Project Report Year IV

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And finally, I thank all my lecturers at IT Carlow over the years who gave me the skills and knowledge to create a project I can truly be proud of.

Project Abstract

Blockchain games' rise to relevance in the last few years have brought them to many headlines, with companies big and small trying to invest in the area in its early days. Blockchain is not merely a new genre in gaming, as it introduces many new layers not seen in games in the past.

Despite this popularity, blockchain games are fairly formulaic, all doing relatively the same thing as the competition before them. With this project I aimed to understand how blockchain games are made through the development of my own game, while also bringing something new to the table.

'Mecha-Miners', the game I developed for this project, is made with the Godot game engine and uses Enjin's blockchain services to provide user authentication and cryptocurrency transactions within the game. The project also includes advanced features such as procedurally generated worlds, intelligent AI, and online multiplayer.

This project taught me that blockchain games come with many difficulties, both technical and design focused, that don't often come up in regular games. The economy of such games is a difficult thing to get right, and the entirely monetary oriented nature of blockchains can make these games expensive to develop, maintain, or even play, if not done right.

During the process of developing a blockchain game, I've developed a reusable Enjin SDK for Godot allowing any future blockchain developments to skip the hardship of integrating a foreign API into their game. Additionally, I've written detailed documentation on Enjin's structure in the Technical Design Document which should be able to make up for the lack of any up to date official documentation on the platform.

Project Introduction and/or Research Question

Blockchain technology has seen a massive surge in relevance over the past few years, and with the boom in the cryptocurrency market over the pandemic, blockchain games have also seen a significant rise in popularity. These games come in many forms, but nearly all primarily revolve around their blockchain aspects, with many of the rest of the features not getting the attention necessary to make a great game. Though, this isn't without reason, as the demographic who tend to play these games usually do so with only the thought of making a profit.

With this project, I aimed to investigate the process of making a blockchain game and the technical challenges of such, while also trying to develop something that not only created the potential for players to earn money through play but also a game that people would come back to purely out of enjoyment.

In Mecha-Miners, the game I developed for this project, procedural generation and intelligent AI is used to add more depth and variability to the blockchain core of the game. The game can be played offline or with friends, where there's no push to either cooperate or compete, but instead players are free to choose their own play style.

This project takes the blockchain nature of many other popular games and adds more gameplay around such aspects. The game is played in real-time with blockchain transactions (earning/losing crypto) happening only at the start and end of each round, as the player returns to their ship. Unlike most other blockchain games, Mecha-Miners aims itself more at the regular player opposed to those aiming only to play to make money, while still allowing for such people to enjoy their time with the game.

In the following paper, I discuss the sources of inspiration for this project, including what I consider to be the most relevant work I've come across in this field. I cover playtesting feedback and how I could use such feedback to improve the game in the future. The main technical achievements are covered here at a high level, with greater depth given to them in the project's technical design document. Finally, I explain where I believe the project went right, and where it went wrong, including how my scheduling and plans worked out in the end, finishing with my opinion of where this topic could be taken in the future.

Literature Review

Blockchains and Games

A blockchain [1][2] is a form of digital distributed ledger made of ‘blocks’, which are encrypted records of transactions. Each block contains data not just about the transaction itself, but also about the blockchain as a whole, allowing each subsequent block to be validated in regards to the entire chain. Blockchains are typically maintained across several computers in a peer-to-peer fashion, with no authority governing the validity of transactions, but instead using cryptographic algorithms to validate each record.

Built on top of cryptocurrencies are tokens [3], which are essentially a currency of themselves with backing from their parent currency. Tokens come in two forms, Fungible Tokens (FT) and Non-Fungible Tokens (NFT).

- **Fungible Tokens** are like any other currency, each token is worth the same as any other token, and can be exchanged for the same number of the same type of token without any loss of value.
- **Non-Fungible Tokens** each have a unique value that is not predefined but instead has a value dependent on external sources. NFTs are often used to declare ownership of a digital work of art, with the value being decided by the highest bidder for such a piece, much in the way traditional art is traded.

A ‘Blockchain Game’ [4] generally refers to a game using cryptocurrencies and Non-Fungible Tokens as gameplay mechanics. While blockchain games are in no way new, the rise in interest in cryptocurrencies over the past few years has accelerated the growth and popularity of blockchain games, with many AAA studios looking to invest in the industry.

Trends in the Industry

Most blockchain games take on a business model of “Play to Earn” [5] or ‘P2E’, where players play games that involve winning or losing cryptocurrencies dependent on both skill and luck.

While most of these games are free to play, they all require an entry fee to get started in the game, this can come in the form of hiring a team, buying gear or vehicles necessary to play. This initial investment is essentially their stake in the game, where if they wish to continue playing the game, they not only have the potential to earn more, but also risk losing their initial investment.

As the game’s components, such as currency and items, have real world value behind them, players are free at any time to trade what they have for money, or vice-versa - assuming there are other players willing to make that trade.

From my research, it seems the most successful blockchain games [6][7] come in three main types:

1. The first is those that model real world games that already involve monetary investments, such as horse racing, or trading card games (E.g. Silks, Splinterlands, Gods Unchained).
2. The second, are games that feature simple but addictive mechanics, similar to mobile games such as Candy Crush or Color Road (e.g. Cryptopop, Jelly Squish).
3. And the third are farming games, similar to the cult classic, FarmVille, as the dynamic of buying seeds and planting them, waiting for them to grow, and the potential of crop failure or low return on produce fits the mechanics of cryptocurrencies well.

As the hit new thing, many companies have quickly jumped on the blockchain bandwagon to earn a quick source of profit, and as a result many blockchain games tend to feel empty, or in the worst case, even predatory as they use addictive gameplay paired with a pay-to-play model that creates a result resembling something similar to gambling.

Other games offer little more than the possibility of earning money, giving a monotonous play experience in exchange for small commissions, which to me looks a lot like a survey app that pays for you for each survey completed [8].

Are these even Games?

Seeing as players engage with these games for alternative reasons than to enjoy themselves, it brings into question if these should even be considered games at all. The debate on what defines something as a game is long and unanswered, but I believe many would agree that games should be played primarily for fun. Jesse Schell in his book ‘The Art of Game Design’ [9] defines a game as:

- *“a problem-solving activity, approached with a playful attitude.”*

During my research for this project, I’ve heard the claim that many of these games provide the opportunity for the financially disadvantaged to make a living through play, but with the expensive barrier for entry that most of these games provide, those lacking money are either refused the opportunity, or join organisations that pay for your entry, at the cost of a percentage of your earnings.

These organisations often take such a high percentage that the participants earn far below minimum wage, despite working long hours, which even brings into question the legality of such. This topic and many similar are discussed in great detail in a brilliant video by Dan Olson [10].

In such cases as mentioned above, it brings into question where the line should be drawn between play and work when it comes to blockchain games. Such a question is complex, and one I don’t feel qualified to answer.

The Potential for Blockchain Games

Despite my so far scathing opinions on the blockchain gaming industry, I feel it is an area with massive potential for greatness, if used right.

As is the way with products, games being no different, companies usually make decisions with profits put before all else. I believe that while these games are designed in this way, nothing significant will be created, and until crypto features are taken as an opportunity to add new dimensions to gameplay, such projects will continue to fall into the trap of predatory behaviour and shallow experiences.

The cost barrier for entry into these games could so wonderfully be used to add a whole new layer of risk to every interaction. Roguelike games are built around the idea of perma-death, where all progress is lost upon running out of health, and could be given far greater depth with the potential of losing real world money.

Alongside adding more weight to risks, the rewards can also be far greater. There's nothing quite like the feeling of leaving a difficult boss fight victorious after hours of preparation and build up, and adding a monetary reward to such could only make that experience much better.

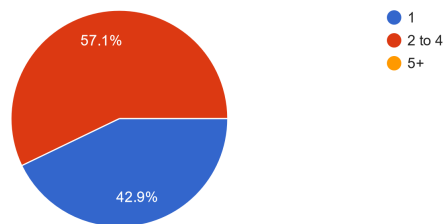
Irrelevant of the monetary aspects of these games, blockchain technology itself offers some unique capabilities out of the box. As each transaction is recorded publicly on the blockchain, items in the form of NFTs will have their ownership history recorded, which could be used to add more depth to each item (for example a royal sword that has been traded throughout time and harnessed by the most skillful fighters), as discussed in the Extra Credits video on blockchain games [11].

With this project I have aimed to bring something new to the table of blockchain gaming, providing an experience that doesn't revolve solely around transactions and uses cryptocurrencies only to add to the existing experience, not to be the experience itself.

Evaluation and Discussion

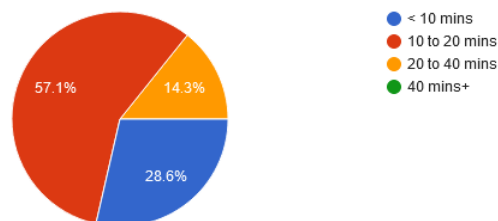
The game was generally received well by playtesters, each giving positive feedback. Many enjoyed interacting with the AI, and played a couple levels even despite the lack of content. In the first playtesting sessions, no leading questions were asked, and there was no mention of the cryptocurrency in the feedback, leading me to believe not many even noticed it.

How many rounds of the game did you play?
7 responses



How long approximately did you play the game?
7 responses

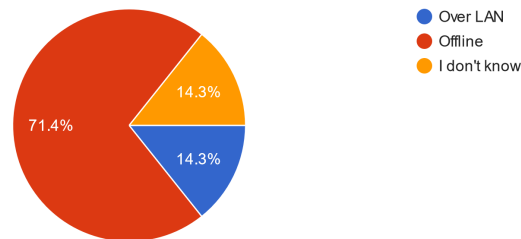
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I got some remarks that the game struggled with clarity, where I have to agree. There's little feedback upon attacking or being attacked, with enemies just spontaneously dying after receiving enough damage. Some also mentioned the AI seemed unbalanced, with the ability to instantly aim at the player at all times, the AI had an unfair advantage despite having the same damage, health, and fire rate.

Slowing the AI's fire rate or giving them a random inaccuracy chance could help improve this. Additionally adding health bars or hit effects could improve the clarity. The original plan was to have miners let off sparks upon being hit and start smoking when heavily damaged, but this was dropped due to time constraints.

Did you play the game over LAN or offline?
7 responses



Most played the game in offline mode, which I would suspect is due to the lack of accessibility of other players within their LAN to play with. A hosted server could have better helped this, though players would still need to coordinate to play online at the same time.

Despite the lack of players who played online, there were multiple responses giving feedback on the cryptocurrency aspect, which means either that was a lack of clarity between the difference in the offline currency and the online cryptocurrency or they were giving feedback based on my explanation of the blockchain aspect (I had talked to all the participants about the game prior to the playtesting session).

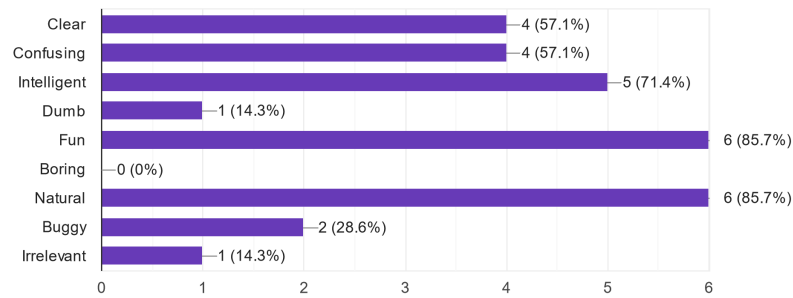
What are your thoughts on the use of cryptocurrency?
7 responses

Cool but a little bit useless
didn't notice it
Could be better integrated into the gameplay
i don't know waht this means
It's novel but a little bit pointless
I didn't use it
I played offline

Additionally, the responses I did receive in regards to the cryptocurrency were just as I had expected, with most saying they didn't see a use for it in the game or thought it needed to be expanded on to have a purpose.

How would you describe the AI?

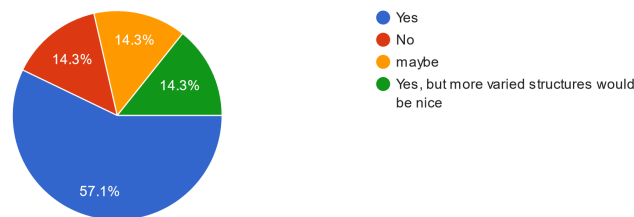
7 responses



Most seemed to enjoy the AI and reported it looked natural, though some also said the AI were confusing or buggy. Without further elaboration, I can't tell how the AI were taken as confusing, but some visual indicators of their decision making process may have aided clarity. Additionally, it would be advantageous to maintain some level of confusion around the AI, as they're meant to fill in for other players, who themselves would act erratically and unpredictably.

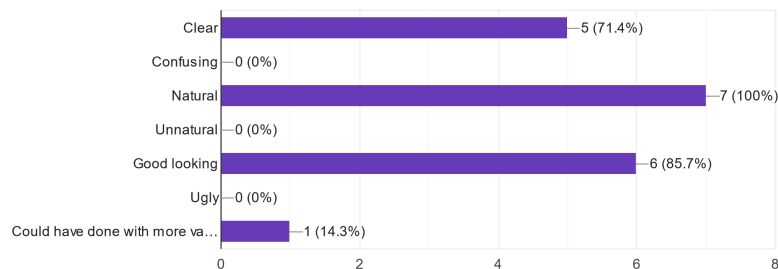
Did you find unique worlds encouraged you to play again?

7 responses



How would you describe the uniquely generated worlds?

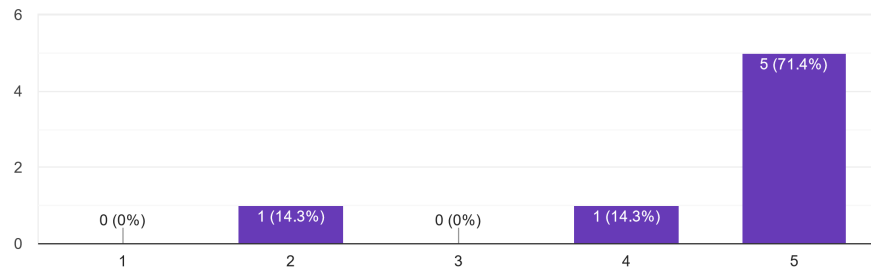
7 responses



The responses in relation to the world generation were overwhelmingly positive, with the only criticism being a lack of variety in structures. Adding old mine shafts, factories and different types of caves could be a welcome addition to amend this.

How did you find traversing the caves?

7 responses



(1 = Difficult to traverse, 5 = Easy to traverse)

Something I would note though, is that most found traversing the caves to be very easy, while this could be taken as positive feedback, I feel this area could be improved to add more challenge to movement and could add a layer of strategy in including the environment in battles, as players could draw their enemies into more dangerous areas to gain an advantage.

Project Milestones

While I never set hard deadlines or milestones for the project, I did have some general goals for progress.

I planned to have an early multiplayer prototype of the main features early into development and managed to deliver on this. Within the first two or so months I had created a game with a tile-based world, movement, tile destruction, and LAN multiplayer. Having this basic structure helped the rest of the project evolve nicely around this centre without having to refactor much later on.

Procedural world generation and AI dragged on longer than I had hoped, taking a week or more each but were finished with time to playtest and add additional features in April.

I have planned on adding blockchain features much earlier into development, but as I struggled to find a service that could link in with the Godot Enjin, it ended up being one of the final features to reach the game.

In the last month or so of the project, I put a lot more focus on scheduling and set mini deadlines for myself, which massively helped not only deliver work on time, but also kept me motivated to, as I could plan out an even mix of difficult and easy/satisfying features. If I were to start this project again, I would like to put a much larger focus on proper scheduling.

Major Technical Achievements

I put a lot of effort into the procedural world generation, and even more into the AI and believe I achieved a very impressive result. The generated worlds feel both natural and fun to explore, while coalescing well with the game's other features, and the AI fits in nicely with the world and other players.

The world generation uses Open Simplex Noise and many generation techniques to create believable and natural terrain which can easily be fine tuned in the editor, receiving feedback from the changes in real time.

The AI feels real and intelligent, they have the right balance of predictability and randomness, while also each showing character. The earlier versions of the AI often got stuck or made stupid decisions, but nearly all of the reported flaws have been ironed out for a very satisfying effect.

To achieve this effect, the AI uses a prioritised multi-leveled state machine, decision trees, and sensors to observe the state of the world. Each AI has its own randomly generated stats that feed into its decisions to give each a unique character. Limiting the AI's knowledge to sensors allowed them to act more organically opposed to tracking down high priority players from the other side of the world. Using prioritised states allowed for the AI to switch flawlessly between states while prioritising those that are most important (e.g. not stopping to mine resources while fleeing from a threat).

The multiplayer aspects of the game started simple, but grew in complexity as more features were added. Using the Godot engine's built-in multiplayer capabilities, the match data, player and world data are synced across all clients during online play.

And finally, the blockchain API implementation wasn't the most complex feature ever, but given the lack of any documentation and learning through trial and error, I'm incredibly proud of what I've created, and am excited to share it with others to use and see what can be done with it in the future.

The API started as a separate addon for Godot but was later moved into the project for quicker development, as such, it's built for flexibility and contains very little related to this project specifically. After submission, I plan to extract the API from the project and publish it for others to use.

Project Review

While the game could still use some refinement and polish, the final outcome is quite desirable. The game contains many fun and unique features that can stand on their own, or be developed further into something even greater.

The core gameplay loop started as a simple concept for a game jam, but was expanded into something far more. The game takes inspiration from many other great games in the industry and pulls aspects from them all, while delivering a new twist.

While I'm thrilled with where the game is now, I'm even more excited with where it could be taken in the future with further development. A greater focus on the blockchain aspect, delivering quirky and fun upgrades and equipment in the form of NFTs could really elevate the game to another level.

If I were to start from the very beginning again, I'd definitely put a far greater focus on planning and sticking to deadlines. With all the other work I had to deliver during the academic year, the project often took a backseat when it probably shouldn't have. I would also like to further refine my priorities and try to better plan for unforeseen delays and complications.

While using the Godot engine probably made the blockchain integration far more difficult than it should have been due to the lack of existing support for the feature, I'm grateful to be able to give back to such an amazing community of open source developers and software and provide something that's yet to be attempted with the engine. Had I chosen a more common web technology, such as a JavaScript library, adding blockchain would probably have been a walk in the park, though I'd have contributed nothing but another crypto game, which are not in short supply nowadays.

Conclusions

Making a blockchain game introduces a whole new array of complexities that are not immediately apparent, beyond the purely technical aspects.

- Including cryptocurrency in your game will mean that the economy of such will have to be carefully planned out, as flaws in its design could lead to exploits that could cause you, or other players, serious financial losses.
- Giving the players the opportunity to earn monetary rewards, means they will have to stake something in exchange. Creating this barrier of entry will turn many players away from the game, and will need to be accounted for.
- Beyond the monetary boundary, the complexities of setting up a wallet and understanding how cryptocurrencies work will exclude a lot of players from your game.

When making a blockchain game, the available tools and libraries should be assessed before committing to any particular engine or library, as even though blockchain technology is popular, it's still somewhat niche, and is not properly supported everywhere.

As most blockchain games are multiplayer, it's an important note that you should try and ensure that the networked aspects of the game are implemented early and kept up to date throughout the whole lifecycle of the app's development or you risk a massive backlog of last minute tasks and bugs.

If attempting a project such as this, proper scheduling is necessary to achieve a desired result, for without it, you face potentially missing out on important features that should have been given priority.

Future Work

Web 3.0 [11] could have a massive impact on blockchain games, not only in how they're designed, but how the users interact with them as a whole. As the use of blockchain technologies increase with the new version of the web, blockchain games could become far more commonplace, and even integrated with non-game services in some form.

The use of crypto currencies and such could be an interesting area to experiment in gamified educational tools, such as Duolingo, serving as an additional motivation in a sort of "Learn-to-Earn" type model. One such project I found that is already experimenting with such an idea is StackUp [12].

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Appendices

Playesting Form used: <https://forms.gle/Fp6kkoCpkzqTuhAVA>