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Title (No Title Yet…)

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Abstract: The advancement and acceptance of new technologies often hinges on the level of understanding and trust among potential users. Blockchain technology, despite its broad applications across diverse sectors is often met with skepticism due to a general lack of understanding and incidents of illicit activities in the cryptocurrency domain. This study aims to demystify blockchain technology by providing an in-depth examination of its application in a novel blockchain-based card game centered around renewable energy and sustainable resource management. This paper introduces a serious game that uses blockchain to enhance user interaction, ownership, and gameplay, demonstrating the technology's potential to revolutionize the gaming industry. Notable aspects of the game, such as ownership of virtual assets, transparent transaction histories, trustless game mechanics, user-driven content creation, gasless transactions and mechanisms for in-game asset trading and cross-platform asset reuse are analyzed. The paper discusses how these features, not only provide a richer gaming experience but also serve as effective tools for raising awareness about sustainable energy and resource management, thereby bridging the gap between entertainment and education. The case study offers valuable insights into how blockchain can create dynamic, secure, and participatory virtual environments, shifting the paradigm of traditional online gaming.

Keywords: blockchain; blockchain game; gaming; serious game; decentralized systems; smart contract; Dapp; meta transaction;

1. Introduction

This study is a foray into the application of blockchain technology within the gaming industry, more specifically, through a card game revolving around renewable energy and sustainable resource management. The digital gaming industry is a fertile ground for blockchain adoption [] , with its inherent synergy with virtual currency ecosystems and potential to grant players true ownership of virtual assets. These assets are non-fungible, exchangeable, inheritable, and free from the influence of the game service provider [2 ✓], thereby transforming the gaming experience.

Although the application of blockchain technology within the gaming industry is in its nascent stages, its potential to revolutionize this space is substantial [3,4]. While there are examples of blockchain-integrated games like Cryptokitties [5 ✓] and Axie Infinity [6 ✓] demonstrating the technology's potential, comprehensive explorations into blockchain gaming remain limited [7 ✓]. This study aims to contribute to this field by examining a blockchain-integrated card game.

Serious games, defined as games designed primarily for purposes other than entertainment [8 ✓], represent a significant discipline within the gaming industry. The fusion of serious games with blockchain technology represents an innovative approach to

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enhancing player engagement and fostering blockchain education [9 ✓]. The game at the heart of this study serves a dual purpose: introducing players to the complexities of managing renewable resources and familiarizing them with the workings and advantages of blockchain technology.

Given the fast-paced development of blockchain technology, it's essential to regularly refresh the research data available. Thus, this study embarked on an exploration of the top 150 blockchain games, with the goal of furnishing up-to-date data in this field. The investigation primarily concentrates on the underlying blockchain platforms, instead of focusing solely on the individual games.

Despite the acknowledged potential of blockchain, its benefits within the realm of gaming, and specifically in serious games, remain underexplored. To address these gaps, this study investigates:

1. The benefits that blockchain technology can bring to the gaming industry.

2. How these benefits extend to serious games, which primarily aim to educate or train.

3. How blockchain technology incorporation in our game facilitates players' understanding and engagement.

To answer these questions, we have conducted an in-depth analysis of a blockchain-integrated serious game developed for this study. This game's secondary goal is to raise awareness of sustainable energy and resource management. Data from player questionnaires has also been collected to assess their understanding and perception of blockchain technology in the game context. This dual approach provides a comprehensive examination of the potential and impact of blockchain technology in gaming.**2. Materials and Methods**

The Materials and Methods should be described with sufficient details to allow others to replicate and build on the published results. Please note that the publication of your manuscript implicates that you must make all materials, data, computer code, and protocols associated with the publication available to readers. Please disclose at the submission stage any restrictions on the availability of materials or information. New methods and protocols should be described in detail while well-established methods can be briefly described and appropriately cited.

Research manuscripts reporting large datasets that are deposited in a publicly available database should specify where the data have been deposited and provide the relevant accession numbers. If the accession numbers have not yet been obtained at the time of submission, please state that they will be provided during review. They must be provided prior to publication.

Interventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code.

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

3.1. Subsection

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Bulleted lists look like this:

- First bullet;
- Second bullet;
- Third bullet.

Numbered lists can be added as follows:

1. First item;
2. Second item;
3. Third item.

The text continues here.

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All figures and tables should be cited in the main text as Figure 1, Table 1, etc.

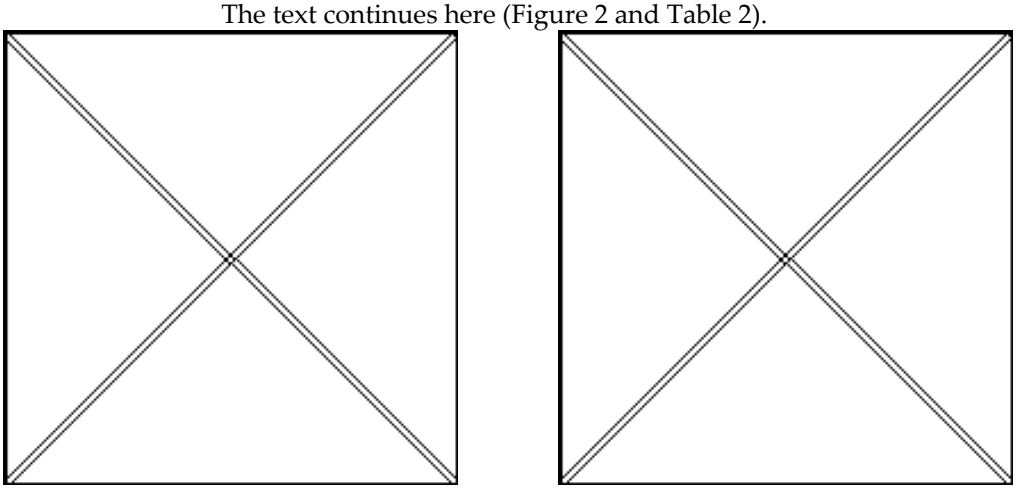
Figure 1. This is a figure. Schemes follow the same formatting.

Table 1. This is a table. Tables should be placed in the main text near to the first time they are cited.

Title 1	Title 2	Title 3
entry 1	data	data
entry 2	data	data [1]

[1] Tables may have a footer.

The text continues here (Figure 2 and Table 2).



(**a**) (**b**)

Figure 2. This is a figure. Schemes follow another format. If there are multiple panels, they should be listed as: (**a**) Description of what is contained in the first panel; (**b**) Description of what is contained in the second panel. Figures should be placed in the main text near to the first time they are cited.

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Title 1	Title 2	Title 3	Title 4
entry 1 *	data	data	data
	data	data	data
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entry 2	data	data	data
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entry 3	data	data	data
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	data	data	data
	data	data	data
entry 4	data	data	data
	data	data	data

* Tables may have a footer.

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This is example 1 of an equation:

$$a = 1, \tag{1}$$

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

This is example 2 of an equation:

$$a = b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u + v + w + x + y + z \tag{2}$$

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

Theorem-type environments (including propositions, lemmas, corollaries etc.) can be formatted as follows:

Theorem 1. *Example text of a theorem. Theorems, propositions, lemmas,* etc. *should be numbered sequentially (i.e., Proposition 2 follows Theorem 1). Examples or Remarks use the same formatting, but should be numbered separately, so a document may contain Theorem 1, Remark 1 and Example 1.*

The text continues here. Proofs must be formatted as follows:

Proof of Theorem 1. Text of the proof. Note that the phrase "of Theorem 1" is optional if it is clear which theorem is being referred to. Always finish a proof with the following symbol. □

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Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

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This section is not mandatory but may be added if there are patents resulting from the work reported in this manuscript.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: title; Table S1: title; Video S1: title.

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Appendix A

The appendix is an optional section that can contain details and data supplemental to the main text—for example, explanations of experimental details that would disrupt the flow of the main text but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

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References

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1. Author 1, A.B.; Author 2, C.D. Title of the article. *Abbreviated Journal Name* **Year**, *Volume*, page range.
2.