IoT-Driven Big Data Analytic to Automate Blockchain Adaptation

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Abstract: The convergence of Internet of Things (IoT), big data analytics, and blockchain technology presents a transformative paradigm for automating and enhancing blockchain adaptation. By leveraging IoT-driven big data analytics, organizations can seamlessly integrate and analyze vast volumes of data generated by interconnected devices. This wealth of data provides valuable insights into real-world processes, enabling informed decision-making and precise identification of areas where blockchain can bring significant benefits. The interconnected nature of IoT devices facilitates the creation of a transparent and secure data ecosystem, and the data generated becomes the fuel for blockchain adaptation. Through sophisticated analytics, patterns, trends, and anomalies within the data can be identified, informing the development of smart contracts and decentralized applications (DApps) tailored to specific use cases. This approach not only automates the integration of blockchain but also ensures its optimal utilization, addressing challenges such as scalability and interoperability. As a result, the synergy between IoT, big data analytics, and blockchain fosters a dynamic environment where decentralized systems can evolve organically, driven by real-world data insights and adaptive to the evolving needs of diverse industries. Present research is considering total supply, brand, stacking cost and royalty during big data analytic to automate the adaptation of blockchain.

Keywords: IoT, Big data, Automate, Blockchain adaptation, NFT

1. Introduction

IoT driven   big data analytic plays crucial role in automating block chain adaptation. The combination of Internet of Things (IoT) technology and individualized marketing methods has transformed digital retail user engagement.

This study examines how IoT data might be used to customize marketing and transform the online purchasing experience. A massive ecosystem of linked endpoints has grown around IoT devices like smart wearables and connected home gadgets. These gadgets continuously create data, giving merchants new insights into consumer habits, preferences, and context. The richness of real-time data and sophisticated analytics and machine learning allow merchants to create tailored marketing campaigns that really connect with users. This study examines online

retail IoT-driven tailored marketing solutions. We provide case studies and examples to show how merchants may use IoT data to suggest, promote, and market products. We'll also examine how location-based services improve marketing campaigns' contextual relevance, guaranteeing timely and targeted contact between merchants and users.

Role of Internet of things

Many parts of the retail industry are undergoing changes due to the Internet of Things (IoT). These include automated shopping processes, improved product tracking, personalized marketing promotions, and streamlined inventory management. End users are loving these changes, so retailers can't afford to ignore them. The term "Internet of Things" (IoT) refers to a system that links various electronic devices together via sensors that may exchange data, perform computations, and more. Connected devices and services glean information about their physical environments and transmit it to servers in the cloud for analysis. By 2030, there will reportedly be 125 billion linked devices globally. Truly, it is an enormous sum!

However, the rapid expansion of the Internet of Things is fascinating. Through the introduction of powerful and user-friendly applications, the Internet of Things (IoT) has established a distinct place in several industries, including healthcare, logistics, education, hospitality, finance, and automotive. This is also true in the e-commerce sector. Actually, brick-and-mortar stores are getting ahead of the competition by discovering new methods to use the

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Internet of Things (IoT) in online shopping. By transferring to more convenient platforms, they have completely changed the way people buy. To monitor stock levels and consumer habits, for example, stores are already making use of internet-connected devices by installing sensors. Online retailers have emerged as a formidable rival to traditional brick-and-mortar establishments in the retail industry.

They are able to improve their marketing tactics and decision-making processes with the aid of IoT. Both the efficiency and the personalization of user support have increased. Thanks to technological advancements, merchants have been able to create a supply chain that is both more open and less cluttered. They can tell that this industry is going to make a lot of progress since worldwide eCommerce sales are predicted to reach $6.4 trillion by 2024.

Web-based application a solutions

1. **Online smart stores:** With the advent of IoT cameras and sensor-based devices, retailers may now enhance the shopping experience for their users. Shoppers are able to better engage with both merchandise and sales associates as a result.

2. **Customizing the user experience:** Retailers that embrace the Internet of Things get a long-term edge over their competitors. According to a survey by Salesforce and IDC, businesses may increase engagement, loyalty, and profitability by providing users with individualized experiences. Reason being, they can trigger massively scalable data-driven solutions to individual client engagements thanks to IoT.

3. **Streamlined inventory management:** IoT solves the problem of merchants' inventory management. Supply and demand tracking allows them to optimize the supply chain. By automatically restocking all items as needed, IoT systems save expenses and boost consumer satisfaction. Automated stock monitoring is possible with technologies like radio frequency identification tags or proximity sensing beacons, so nothing ever goes out of stock.

4. **Automated checkout lines:** Users hate waiting in line at brick-and-mortar stores, and stores end up hiring more people to handle peak hours. By automating the checkout process, stores can save money, make it easier for users, and maximize sales. With the help of automated PoS systems that are built on IoT, consumers who would rather not wait in line may now self-checkout. Using NFC technology, the system scans product tags and then charges the authorized account of the buyer.

5. **Intelligent retail fulfillment:** IoT can help stores manage their inventories. Smart ordering that takes demand into account and optimizes delivery routes not only streamlines the process but also reduces expenses. Retailers can always have the correct quantity of a product on hand with smart fulfillment.

6. **Personalized sales:** Beacon technology for aisle analytics helps enhance a store's layout. On the other hand, it works well for sending personalized alerts to users about sales or in-store promotions. To increase conversion rates, for instance, stores might use IoT systems to provide user-specific discounts.

7. **Enhanced product tracking:** With the help of IoT technology, stores can keep tabs on goods from the moment it leaves the warehouse to the moment it reaches the storefront. Even house deliveries can be tracked in real-time, and they can easily find any items that have gone missing. Retailers may get data like traffic conditions, weather forecasts, inventory health reports, and location thanks to GPS, RFID, and Internet of Things (IoT) devices.

8. **Procedures for automated purchasing:** Amazon Go and other new automated checkout systems are changing the way people shop forever. Users are allowed to freely enter and exit businesses because to this. They are no longer reliant on physically withdrawing cash or using a credit card. In order to save time, high-tech sensors have been placed at the exit to automatically bill all transactions. With automated checkout, users never have to wait in line or at the billing counter again.

This study will also examine how IoT-driven tailored information management affects consumer engagement, conversion rates, and brand loyalty. It is understanding how IoT-enabled devices affect user interactions helps businesses meet and anticipate digital consumers' changing expectations, creating a more meaningful and seamless shopping experience. We will discuss data privacy, security, and ethics throughout this research. Personalization and user privacy must be balanced to develop and sustain trust in an age when data drives online retail operations. This study explores how IoT-driven tailored information management might alter online shopping. Retailers can create a user-centric paradigm that goes beyond conventional information management by using IoT devices and data-driven insights to make online shopping a truly personalized and enriching experience for each user.

2. Literature Review

Despite the fact that the notion of customization lies at the heart of the field of information management, it continues to be interdisciplinary in nature since it overlaps with other fields such as business management, computer science,

decision science, information system (lies), and psychology. In cognitive and social psychology, the use of artificial intelligence (AI) and machine learning (ML) is included into the process of customization, as stated by Zanker et al. (2019) [1].

Adomavicius and Tuzhilin (2005) progressed the process of customization by reducing the initial processes to two stages (namely, knowing the client and delivering the tailored products) and introducing a third stage as an assessment of the impact of personalization. This was done in order to advance the process [2]. According to Vesanen and Raulas (2006), the process of customization may be expanded to a larger level as a process of value co-creation for both users and marketers [3]. The importance of customization in information management is increased when you take into account the heterogeneity of your users by taking into account their value, expertise, orientation, and relationships. According to Dawn (2014), the old four "Ps" (i.e., product, price, location, and promotion) have been turned into five "Is" as a result of personalization. These five "Is" are identification, individualization, interaction, integration, and integrity [4].

The need of developing new tactics has increased as a result of the growing competitiveness among businesses, particularly in the information management departments of such businesses. According to Kim (2002), personalized information management is utilized in the context of extracting a fraction of a massive body of information that is relevant to only one individual or a group of persons [5]. This can be done for a single individual or for a group of individuals. Personalization in information management has been defined in a number of different ways over the course of its history.

According to the findings of the study that was conducted by Gupta, M. et al (2023), the way of life that was offered by 9NFTMANIA is referred to as NFT culture. They gave this term to the way of life. In this society, non-fungible tokens (NFT) would be utilized for a wide range of functions, including but not limited to greetings, invites, certifications, and membership cards, among other things. It would be possible to carry out a safe transfer of digital assets if things were done in this manner, and the value of this non-fungible token would be determined by a given standard. This is something that should be done regardless of whether the individual wishes to express gratitude to another individual or simply wish them a good morning. The transmission of non-fungible tokens (NFT) to the wallet of another individual is something that should be done. Additionally, there would be a restriction set on the supply of such greeting NFT, which would mean that there is still the possibility of a spike in the price of the thing that is being purchased. Additionally, when web 3.0 technologies are utilized to confirm NFT holders in

Metaverse, those who own NFT will be able to acquire access to premium online services [6]. This is the opposite of what is now the case. Because holders of NFTs would be subject to verification, this would be feasible. The blockchain concept was first proposed by M. Gupta and colleagues in 2023. Since then, non-fungible tokens, also known as NFTs, have garnered a large amount of interest, particularly in the realm of digital assets and decentralized technology. The strong connection that exists between these two ideas has led to a growth in their popularity, which has been accompanied by this link. The technology known as blockchain is the underpinning technology that makes it possible for non-fungible tokens, also known as NFTs, to operate as digital assets that are completely unique. This connection between blockchain technology and NFTs (Non-Fungible Tokens) is advantageous for both parties involved. On the other hand, non-fungible tokens, which are sometimes referred to as NFTs, are a type of digital money that utilize blockchain technology to alleviate the age-old problem of establishing ownership and validity in the digital arena. The issue of digital scarcity can be remedied by the utilization of non-fungible tokens, which are also referred to as NFTs. Because they are able to represent one-of-a-kind assets on the blockchain, they are able to circumvent this obstacle. Creators, like as musicians, game developers, and painters, are able to tokenize their digital works and sell them as limited-edition, one-of-a-kind commodities [7]. This capability is made possible by the blockchain technology. An example of digital asset management is the process of tokenization. An investigation into the environment of decentralized financial ecosystems was carried out by R. Gupta and colleagues (2023). In their findings, the authors indicated that liquidity pools are an essential component in the process of maintaining the value of tokens. One of the most significant ways in which liquidity pools contribute to the preservation of stability is through the utilization of arbitrage (also known as arbitrage). When it comes to contributing processes, this particular one is among the most significant ones that liquidity pools are involved in. It is common for consumers to make purchases in circumstances when the value of a token is relatively low. On the other hand, sales are made possible when the item is priced at a level that is greater than the average level. Arbitrage is made feasible by the existence of liquidity pools, which allow traders to carry out these transactions directly on decentralized exchanges. This results in the possibility of arbitrage. Because of this, arbitrage is a very real and viable industry. As a result, arbitrage is a business that has the potential to be profitable. Arbitrageurs exert persistent pressure, which contributes to the token's value returning to its target peg. This, in turn, helps to grow greater stability through the cultivation of additional stability [8]. In their discussion of the outcomes of the research that was done, D. Gupta and colleagues (2023)

came to the conclusion that the most significant component that determines the value that is given to greetings is the degree of popularity that they enjoy. Additionally, it has been discovered that the Love Emogie is only available in a limited number. This is something that has been discovered. The restricted availability of just 43 Love Emojie has been a contributing factor, and one of the contributing elements has been the increased demand for non-fungible tokens (NFTs). The reason for this is that non-fungible tokens (NFTs) are considered to be inherently scarce. On the other hand, it is essential to emphasize that the issues of cost and use case have a significant impact on the outcome of the situation. It is [9]. In the year 2023, R. Issalh and his colleagues came up with the idea for a cryptocurrency project that they called Pi Network. The creative approach that Pi Network takes to mining and accessibility is one of the reasons why it is so well-known. The site, which was established in 2019, gives users the option to mine the network's native digital currency, which is known as Pi, directly from their mobile devices. This possibility was made available to users of the site. Through the process of democratizing the mining process and making participation in cryptocurrencies more accessible to a wider range of users, the platform intends to achieve its objectives. An aspect that is particularly intriguing is the fact that the block chain that Pi Network employs is built on the Stellar Consensus Protocol. The principles of security, decentralization, and transaction speed are all given equal weight in this protocol's hierarchy of priorities. Despite the fact that Pi Network is still in the early phases of its development, it places a significant amount of significance on the participation of the community. [10] [10] It does this by giving individuals with resources, which in turn motivates them to actively participate in the project and contribute to it. The significance of non-fungible token avatars in the metaverse was the subject of an inquiry that was carried out by A. Duggal and colleagues (2023). The researchers concentrated their attention primarily on the function that these avatars play in redefining several aspects of digital ownership, including self-expression and user involvement. The research also explores the difficulties and roadblocks that are related with the information management of NFT avatars. This is in addition to the previous point. It takes into account a broad variety of aspects, including the dynamics of the market, the obstacles provided by technology, and the acceptance of the product by users, among other things. The research that is now being carried out takes into consideration a broad variety of non-fungible tokens (NFTs) that have been generated by a number of different NFT Brands. In the future, it is feasible that this NFT will be deployed in the Meta verse. This possibility exists at some point in time. An NFT that has been given the name "Sizzling monster" has been the focus of a case study that has been constructed at the conclusion of the research article. Numerous non-fungible token (NFT) companies have previously purchased it from Young Parrot Platform in the beginning of its existence [11]. These corporations have acquired it in the past. The number of people who can obtain this NFT is severely restricted. As a call to exercise caution, perform research, and commit to responsible investing, the advise given by M. Gupta et al. (2023) to refrain from engaging in speculation in the cryptocurrency market during NFT transactions is a call to action. It is the adoption of these principles that will lead to the construction of an ecosystem that is more trustworthy and sustainable. This ecosystem will eventually make it feasible for the block chain technology that enables it to accomplish its promise beyond the limited scope of short-term market swings once it is in place. It is essential to have a strategy that is not just cautious but also well-informed while engaging in speculation in the cryptocurrency market. This is especially true when dealing with transactions that include non-fungible tokens (NFT). The market for cryptocurrencies is characterized by a substantial level of inherent volatility, which is further worsened by the presence of non-fiat currencies in the region. One of the most notable elements of the bitcoin market is the fact that this takes place. Due to the fact that prices are prone to sudden and unanticipated fluctuations, it is essential for investors to exercise caution and refrain from giving in to the temptation of speculating. This is because prices are prone to changes that are not predicted, which is the reason why this result is observed. It is not traditional fundamentals that determine the value of non-fungible tokens (NFTs); rather, the value of NFTs is determined by variables such as the perceived scarcity of the tokens, the demand for them, and the cultural significance of the tokens [12].

3. Problem Statement

The implementation of IoT-driven personalized information management in online retail presents several notable challenges that demand careful consideration. One primary concern is the ethical use of user data, as the extensive collection of information through IoT devices raises privacy issues. Striking a balance between providing personalized experiences and respecting consumer privacy is crucial to maintain trust. Additionally, achieving seamless integration and interoperability among diverse IoT devices and platforms poses a significant technological challenge for retailers. The rapid evolution of IoT technologies may lead to compatibility issues and require continuous updates to keep pace with advancements. Security concerns also loom large, as the vast amount of data transmitted between devices becomes a potential target for cyber threats. Moreover, there is a risk of consumer pushback if personalized information

management efforts are perceived as intrusive or overly invasive. Successfully navigating these challenges is essential for retailers to harness the full potential of IoT-driven personalized information management while ensuring a secure, ethical, and user-centric online retail experience.

4. Proposed Work

Implementing IoT-driven personalized NFT (Non-Fungible Token) information management in online retail involves a strategic and step-by-step process. Here's a guide on how to execute this:

1. Define Objectives: Clearly define the objectives of incorporating IoT-driven personalized NFT information management in online retail. This could include enhancing user engagement, increasing sales, or building brand loyalty.

2. Understand User Preferences: Use IoT devices to gather data on user preferences and behaviors. This can include data from smart devices, wearables, and online interactions.

3. Create Personalized NFTs: Develop NFTs that reflect user preferences and behaviors. This may involve collaborating with artists to create unique digital assets.

4. Blockchain Integration: Choose a suitable blockchain platform for creating and managing NFTs. Ethereum and Binance Smart Chain are common choices and Integrate blockchain technology to ensure the authenticity and scarcity of NFTs.

5. IoT Integration: Connect IoT devices to the online retail platform to collect real-time data. This data can include location, browsing history, purchase history, and other relevant information.

6. User Segmentation: Analyze the collected data to segment users based on their preferences and behaviors. This segmentation will be used to tailor NFT information management campaigns.

7. Personalized NFT Campaigns: Develop personalized NFT information management campaigns for each user segment. This could involve offering exclusive discounts, limited edition NFTs, or special promotions based on individual preferences.

8. Interactive Shopping Experiences: Use IoT devices to create interactive shopping experiences. For example, users could use augmented reality (AR) or virtual reality (VR) applications to visualize how NFTs might look in their homes.

9. Loyalty Programs with NFT Rewards: Implement loyalty programs where users earn NFTs as rewards for their purchases or engagement with the brand.

10. Cross-Channel Integration: Ensure that personalized NFT information management is integrated across various online and offline channels. This includes social media, email campaigns, and in-store experiences for omnichannel consistency.

11. Data Privacy and Security: Implement robust security measures to protect user data, especially when dealing with personalized information gathered from IoT devices.

12. Educational Content: Provide educational content about NFTs and blockchain technology to enhance user understanding. This can foster trust and increase engagement.

13. Feedback Mechanism: Establish a feedback mechanism to gather user responses and opinions on the personalized NFT information management campaigns. Use this feedback to refine future strategies.

14. Measure and Analyze: Utilize analytics tools to measure the effectiveness of personalized NFT information management campaigns. Monitor key performance indicators (KPIs) such as conversion rates, user retention, and NFT engagement.

15. Iterative Improvements: Continuously iterate on the personalized NFT information management strategy based on data analysis and user feedback. Keep adapting to changing market trends and user preferences.

16. Legal Compliance: Ensure compliance with legal regulations related to NFTs, blockchain, and data privacy in the regions where you operate.

17. Documentation: Document the entire process, including strategies, technologies used, and outcomes. This documentation can be valuable for future reference and improvements.

By following these steps, online retailers can leverage IoT-driven personalized NFT information management to create engaging and unique experiences for their users, fostering brand loyalty and potentially increasing sales.

5. Result and Discussion

During this simulation NFT reward program conducted over young parrot has been considered. Following figure is presenting the NFT "I LOVE YOU" where stacking of this NFT is yielding return of 20M YPC tokens weekly. There are overall 17 NFTs that are stacked.
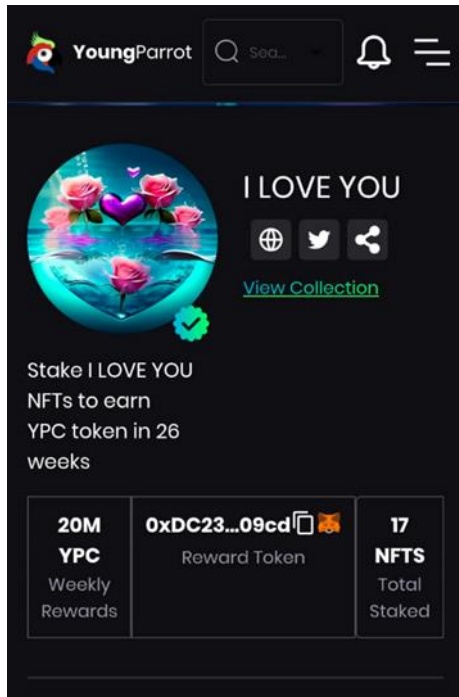
Fig 1 Royalty program for "I Love You"

In same way there is another NFT named "GAME OF CARDS" where 130 NFTs have been stacked and reward of 10.00M is equally distributed to its holders.
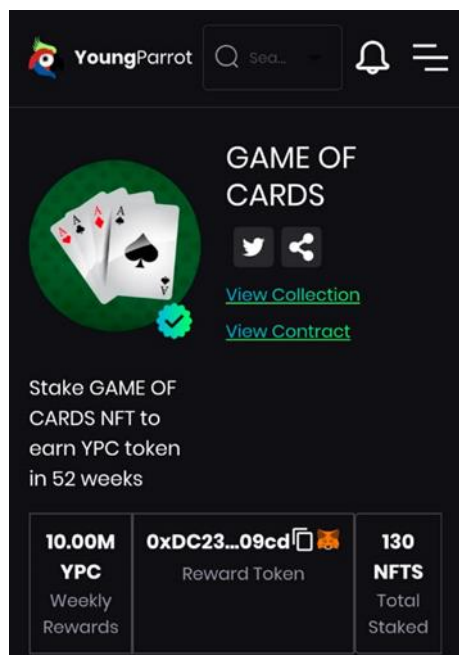

Fig 2 Royalty distribution of Games of Card

In order to conduct research different criterias are considered that influences sale in personalized information management. Following table is presenting the voting obtained by survey conducted.
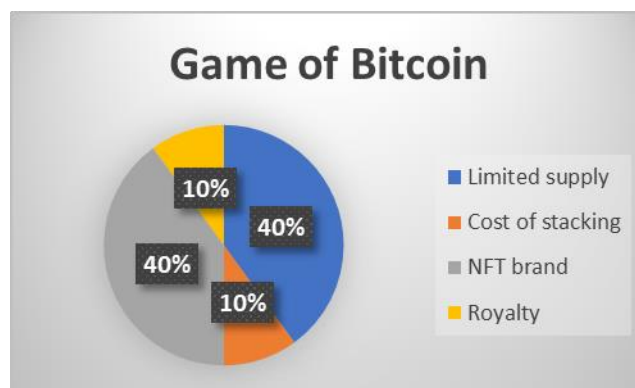
Table 1 Personalized information management in online NFT retail

	Limited supply	Cost of stacking	NFT brand	Royalty
I Love you	30	10	30	30
Game of Card	10	10	60	20
Avengers	20	30	30	20
Game of Bitcoin	40	10	40	10

Considering above table following pi chart have been obtained to represent the impact of different factors of sale of NFT.
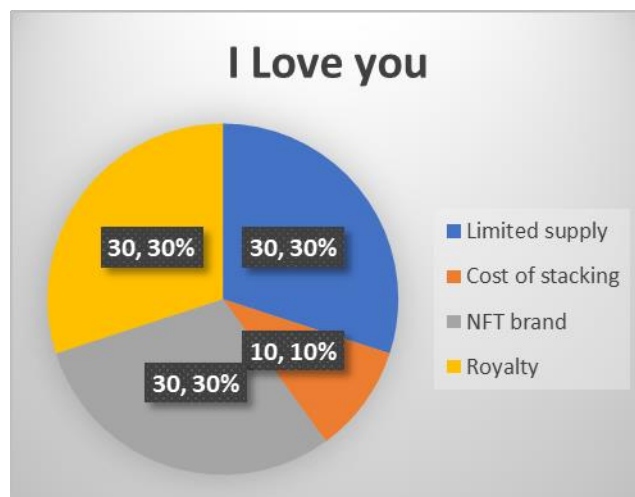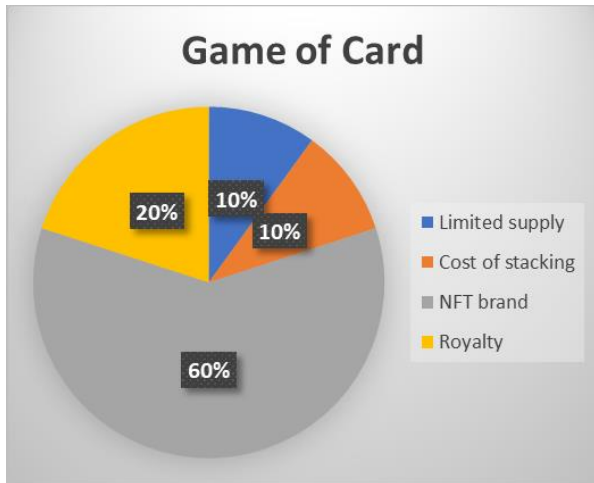

Fig 3 Distribution personalized information management factors that effected online retail of "I Love you" NFT
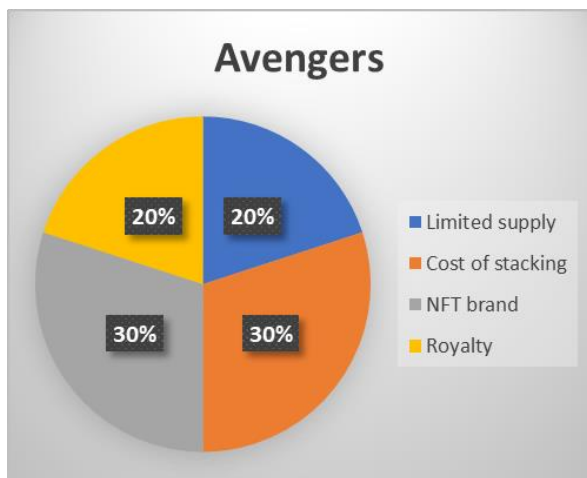

Fig 4 Distribution personalized information management factors that effected online retail of "Game of Bitcoin" NFT

Fig 5 Distribution personalized information management factors that effected online retail of "Game of Card" NFT

Fig 6 Distribution personalized information management factors that effected online retail of "Avengers" NFT

6. Conclusion

It has been observed that analysis of sentiment of user creates major impact on personalized information management. Personalized NFT campaign plays crucial role in decision making. Moreover, there is need to analyse the collected data to segment user based on their preferences and behaviours. IoT devices might be used to build interactive shopping experience. Loyality program conducted with NFT reward may improve the sale of NFT product. Factor such total supply, NFT brand, Royalty benefits and cost of stacking influence user sentiment while decision making.

7. Future scope

The future scope for IoT-driven personalized information management in online retail holds immense potential for revolutionizing the user shopping experience. As technology continues to advance, the integration of IoT devices offers the prospect of even more refined and context-aware personalization. Retailers can leverage real-

time data from interconnected devices to anticipate user preferences, enabling the delivery of highly targeted and individualized information management messages. The incorporation of artificial intelligence and machine learning algorithms further enhances the ability to analyze intricate patterns of consumer behavior, providing retailers with actionable insights for more effective personalized information management strategies. The evolution of augmented reality (AR) and virtual reality (VR) technologies may introduce immersive shopping experiences, allowing users to virtually try products or visualize items in their own spaces. Additionally, as IoT ecosystems expand, the integration of voice-activated devices and smart assistants may become increasingly prevalent, offering retailers new channels for personalized engagement. However, to unlock this future potential, retailers must navigate challenges related to data privacy, security, and the ethical use of consumer information, ensuring that the benefits of IoT-driven personalized information management are harnessed responsibly and in ways that enhance the overall online retail experience.

Conflicts of interest

The authors declare no conflicts of interest.

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