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GO-Alpha: Metaverse-Based Accounting Information System for Enhancing the Quality of Accounting Information

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Abstract

The paper aimed to discuss and investigate the impact of implementing a Metaverse-based on accounting information system to fill the gap between applying Metaverse and performing accounting functions. Moreover, the study investigates the importance of Metaverse in accounting system and using virtual ecosystem to perform accounting tasks and enhancing the quality of accounting information. The researchers developed a tool called GO-Alpha[1] for helping users to immerse themselves virtually within Metaverse to perform their accounting tasks virtually with depending on a Metaverse platform called Spatial.io for enhancing the immersive characteristic. The study concluded that adopting such generative tool can help the accounting information system to perform its stages such collecting, processing and storing data remotely and more efficient than traditional systems. The researchers used GO-Alpha for performing multiple functions based on AI mechanism such as analyzing financial data, performing an interactive data, making a prediction of stock prices of companies that have NFTs or existence in Metaverse. The model used in the developed tool is based on using TensorFlow.js for making an accurate prediction by ML algorithms with using AI model from google (Gemini) to access a high volume of data at any time.

Keywords: Metaverse Technology, Industry 5.0, Generative AI (GAI), Accounting Information System (AIS), Accounting Information Quality.

[1] Acknowledgement: The authors have developed the **GO-Alpha** application, which has been officially registered at the Intellectual Property Rights Office of ITIDA Egypt under the registration number 4667.

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1. Introduction

In the current digital era, there is a real need to make a connection process between the virtual world and the physical world, which leads to adopting Metaverse. This process to be operated needs to have an ecosystem to help users enter and interact within Metaverse. Therefore, Industry 5.0 technologies, in addition to IT infrastructures with Metaverse platforms can help to support operating mechanisms under Metaverse by creating a meta-ecosystem. The ecosystem serves as a foundational support system for the complete operation of Metaverse, creating avatars and content generation (Rawat & EL Alami, 2023).

On the other hand, Metaverse has a virtual economy in which users can buy or sell digital goods and services to other users. So, there is an economic exchange, and accounting practices will be needed to protect limited resources in Metaverse, while generating new digital assets will require accurate measurement tools and specific disclosure procedures. Therefore, it is argued that there is a real need to apply accounting information system (AIS) in Metaverse (Al-Gnbri, 2022). Moreover, the virtual accounting work in Metaverse is achieved by simulating traditional accounting transactions and linkage between actual world and digital world, such as allowing for better workplace for accounting teams based on Virtual Reality (VR). Users of AIS visualize 3D financial statements and get better understanding of company's financial position (Chukwuani, 2022).

Metaverse environment also plays a significant role in accounting information quality by developing AIS components quality, through using of computerized systems based on technologies such as IoT and blockchain technologies. Metaverse presents an ideal setting for AIS quality by offering high encryption for safeguarding virtual data inputs (Al-Gnbri, 2022). Moreover, it integrates with Industrial Revolution 5.0 technologies, serving as an efficient tool for processing accounting data.

The research seeks to fill the gap between using AIS and immersing within Metaverse. In this context, the researchers developed a Generative Artificial Intelligence (GAI), which called GO-Alpha for helping all participants in Metaverse to interact and immerse themselves. Additionally, the developed GAI depends on using a Metaverse platform called Spatial.io to make the integration process between the physical and virtual transactions to be smooth, which can reflect on the quality of accounting information after using GO-Alpha software.

2. Research Problem

Metaverse is a suitable environment for embedding the real world and the digital world based on technologies such as VR and Augmented Reality (AR). Moreover, it allows users to interact with each other by using their digital representation. For building Metaverse, it needs to have integrated technologies, and Industry 5.0 includes key elements like Machine Learning (ML), blockchain and recently, the emergence of ChatGPT. Accordingly, Metaverse becomes a mirror to simulate any company in many different industries performing activities in the physical world. Metaverse is considered as a vision for future industries because of

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attracting the attention of large sectors of investors and enterprises in many fields like businesses and entrainment (Huang, Sun, & Zhang, 2022).

It is argued that accountants would have new roles and opportunities because of growing the virtual experiences in Metaverse; they can develop new lines of business inside Metaverse by enhancing the mechanism of meetings without any physical places. Accountants can also develop new methods based on the nature of Metaverse. These methods could be used for monitoring costs and returns on investment, such as Non- Fungible Tokens (NFTs) and other digital assets (Egiyi, 2022). Furthermore, Metaverse can be the main reason for designing accounting rules which suitable for economic events that occur, such as ownership of digital assets and transferability of these assets will be developed and differentiated from what can occur with physical assets; by developing these rules, then financial statements can reflect the financial position of business entities in Metaverse (Akin & Akin, 2024).

Therefore, there is a need to adopt AIS in Metaverse based on a tool that help accountants and other users to perform their tasks in Metaverse virtually. In this regard, the research problem could be stated in the main question as follows: **Would applying GO-Alpha help users to perform their accounting functions virtually in Metaverse?**

The main research question will be divided in the following sub-questions:

1. To what extent can GO-Alpha application enhance user interaction and collaboration within Metaverse?
2. How does the integration of GO-Alpha affect the efficiency of users' task performance in Metaverse?
3. How does GO-Alpha enhance the timeliness and accessibility of accounting information in Metaverse-based systems?
4. To what extent does integrating GO-Alpha improve the accuracy and reliability of accounting information generated in Metaverse?

3. Research Objectives

The main purpose of this research is to improve the quality of accounting information in Metaverse by filling the gap between AIS and Metaverse; this objective is achieved by adopting the developed GAI tool (GO-Alpha) to help users of AIS to use AI features in interpreting and predicting financial and non-financial transactions virtually. The main objective can be achieved by satisfying the following sub-objectives:

1. Designing and implementing the GO-Alpha tool as a Metaverse-based AIS for enhancing the quality of accounting information.
2. Evaluating the role of GO-Alpha in enhancing the accuracy, reliability, and timeliness of accounting information in Metaverse.
3. Enabling AIS to utilize AI features in GO-Alpha for interpreting and predicting financial and non-financial transactions.
4. Examining how the integration of GO-Alpha enhances functionality and performance of AIS in Metaverse.

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4. Research Methodology

This research followed a deductive approach to develop the theoretical framework. According to inductive approach, the researchers followed this approach to be used in developing and implementing the GAI (GO-Alpha). Researchers developed this software that tested in the research. Moreover, the researchers used the Industry 5.0 tools such as AI, blockchain and they used the predictive mechanisms by using TensorFlow.js for enhancing the ML predictions and accounting data encryption process based on Secure Hash Algorithm 256 (SHA-256).

5. Literature Review

Metaverse is a suitable environment for adopting different accounting transactions virtually based on using both AR and VR and other Industry 5.0 technologies. Therefore, (Egiyi, 2022) stated that VR and AR technologies can provide a wide participation, immersive experience, and active learning in accounting; because these tools can support the dynamics of global accounting systems, in addition to their ability to trace various big issues that caused by unexpected events in the accounting field.

Moreover, Metaverse offers a real-time communication between users by allowing them to get accurate feedback during various events. Furthermore, the nature of Metaverse, which consists of a huge volume of data and the different sources of information with allowing Metaverse to help all users collect and analyze data from different sources, whether structured or unstructured data (Shaju, 2023). In this context, Metaverse is an important link among accounting tasks such as outsourcing of several accounting functions, visualization and explanation of accounting information to end users such as stakeholders. Metaverse can provide a core information that helps accountants to get a new confirmation of accounting information rather than reporting about traditional information related to tangible assets (Zadorozhnyi, Muravskyi, Humenna-Derij, & Zarudna, 2022).

However, it is necessary to adopt tools and regulations within Metaverse to control all transactions applied in this environment. In this context, (Pandey & Gilmour, 2023) conducted that the concept of revenue recognition has been challenged by the applied transactions within Metaverse; the study concluded that the valuation of assets and recording of transactions within Metaverse are core issues. The study stated that using blockchain technology can create a new of digital assets that need to be tracked, recorded, and reported but these processes would largely fall outside of the traditional regulations and applied accounting rules.

(Al-Gnbri, 2022) emphasized the significance of adopting modern and VR technologies within accounting and AIS. The study revealed that integrating VR technologies can support the redesign of AIS to align with Metaverse environment, thereby enhancing the accuracy and reliability of financial data. Moreover, the adoption of such tools contributes to minimizing information manipulation, reducing opportunities for fraudulent activities, and ultimately improving the overall quality of AIS components and outputs.

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Therefore, the adoption of technical tools specially AI in Metaverse is a curial point; because AI in the accounting industry will improve the nature of computerized accounting systems to be more intelligent, and help accounting staff solve various problems, such as poor timeliness of accounting information and high rates of accounting information (Jin, Qu, Xiao, & Fan, 2023). On the other hand, (Loh, Ng, Lee, Y.M., & Foo, 2023) stated that applying AI for AIS enhances the work efficiency, but it can lead a reduction of headcount which is essential in the workplace.

6. The Theoretical Framework

According to this section, the researchers introduce the relationship between using Metaverse and accounting field, benefits of adopting Metaverse in AIS, and the role of applying the Metaverse in enhancing the quality of AIS and its information.

6.1 The Relationship between Adopting Metaverse and Accounting Field

According to (Hassan, Hashem, R.E., & Abu-Musa, 2025), Metaverse can be defined as "the digital world is supported by tools such as VR, AR, and blockchain for performing financial and non-financial transactions based on using NFTs and cryptocurrencies". According to the financial and nonfinancial transactions, the accounting needs to be applied in the Metaverse because of the existence of economic exchange between users, which can exist in Metaverse, where several participants can buy and sell their digital assets among them (Al-Gnbri, 2022).

Furthermore, applying accounting in the era of Metaverse can enhance the awareness of accountants about what should be done in the multiple cases related to digital assets, the level of information quality, and then the confidence of clients and influence on their decisions (Jader, 2023). So, the relationship between accounting and Metaverse is essential for helping to deal with all economic events that would occur in the new accounting environment.

There is an emerging potential for implementing accounting practices within the Metaverse through the integration of VR and AR technologies. Moreover, financial institutions are increasingly seeking to expand their digital presence by enhancing accounting procedures and practices through Metaverse platforms to provide more efficient client engagement and payment services. For instance, customers can now manage their financial activities using VR headsets, enabling a more immersive and interactive banking experience (Nesrine & Mohammed, 2023).

(Al-Gnbri, 2022) indicated that companies utilizing VR for financial reporting may experience a reduction in the comparability of their disclosures compared to firms that do not employ such advanced tools. Furthermore, any delays resulting from the limited processing speed of VR systems could negatively effect on the timeliness of information dissemination, thereby influencing the decision-making effectiveness. However, adopting Metaverse-based technologies in accounting disclosure is expected to enhance the overall value and usefulness of accounting information.

Additionally, AR and VR can allow accounting systems' users to immerse themselves in the huge volume of synthesized data, in addition to using less

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paperwork for maintaining and updating all records of daily events visually, like dashboards for helping end-users to understand their financial positions. AR also enhances the overall productivity of businesses and protects the entire process of accounting data to be information by using accounting data visualization; this option can help internal and external users understand the state of their business in the past, the current, and the future ((Perkhofer, Hofer, Walchshofer, Plank, & Jetter, 2018); (Chukwuani, 2022); (Egiyi, 2022).

Moreover, the quality of accounting and financial information can be improved based on adopting VR and AR technologies for interacting with accounting data in Metaverse. VR can impact on characteristics of accounting information, such as the comparability and understandability. According to understandability, VR can help users to understand the financial information of economic events, while accounting units can be compared for previous years virtually to provide useful accounting information for external users (Hashim & Shihab, 2022).

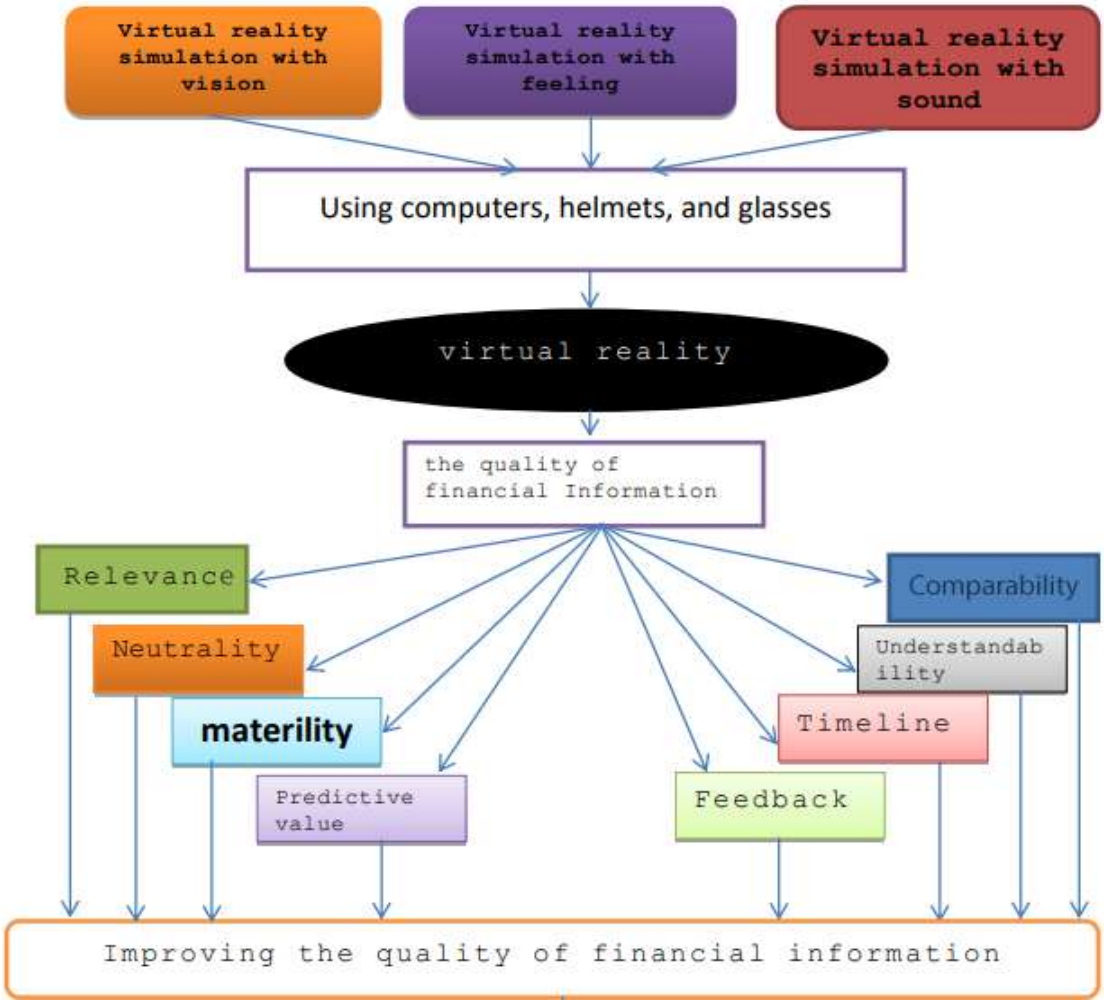

Figure (1) Virtual Reality and the Quality of Financial Information

Source: (Hashim & Shihab, 2022).

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6.2 Benefits of Adopting Metaverse in AIS

Metaverse represents the main evolution for all accounting systems because of its ability to provide an interactive environment, which can be used for performing accounting procedures and learning (Al-Gnbri, 2022). Moreover, Metaverse may cover all types of accounting information because of depending on the integrated technologies. Accordingly, this feature can increase the quality of the accounting software and meet all requirements of AIS users (Rabie, 2023). Therefore, there are benefits of adopting Metaverse that can be clarified as follows:

6.2.1 Implementation of Accounting Data Visualization

Data visualization is used to convert data into graphics and images that are easily understood by users. It can also transform complex data into easier patterns. Data visualization is more related to Metaverse by focusing on the visual representation of analyzing data (Cheng, 2023).

Therefore, VR and AR can help accountants visualize data from financial statements for making important investment and core decisions based on complex data. By using such technologies, accountants can enhance their experience of managing the high volume of data to be quick and easy to view and manage by displaying complex data and information in both 2D and 3D formats (Egiyi, 2022). Moreover, Metaverse helps accounting systems to provide dashboards and visualizations of financial data to be clearer and more meaningful (Schiopoiu, Popovici, & Panait, 2023).

6.2.2 Increasing the Efficiency in Accounting Data Analysis

According to studies (Li, 2021); (Nesrine & Mohammed, 2023), there is a positive impact of adopting Metaverse on data analysis within the accounting field. Moreover, cloud computing has a vital role in analyzing accounting data because of its ability to process a high volume of data in a short time and perform more accurate analysis of this data. Additionally, the virtualization of accounting data can improve the ability to summarize and analyze data. On the other hand, ChatGPT can also enhance the process of analyzing data by identifying this data with providing valuable insights about the financial performance of the business (Hacker, 2023).

Furthermore, ML and data mining for analyzing data within Metaverse have multiple uses. One of these methods can be used to examine the high volume of accounting data to evaluate and identify fraud indicators, which enhances the efficiency of the process of analyzing data (Pham & Vu, 2024).

6.2.3 Virtual Collaboration and Remote Work

One of the primary advantages of utilizing the Metaverse in accounting is that it enables users of accounting systems to perform their work remotely because the current situation of working remotely is more comfortable than before (Al-Gnbri, 2022). Moreover, VR and digital environments can allow users of accounting systems, like accountants to work from anywhere remotely. VR enhances the user experience to

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develop operational efficiency and meet the satisfaction of end-users about how to work remotely with each other (Chukwuani, 2022).

Additionally, adopting Metaverse makes accounting procedures to be performed without any direct connection with any outsources unlike the physical world; because using smart contracts with another participant becomes the essential method for providing accounting services within Metaverse (Zadorozhnyi, Muravskyi, Humenna-Derij, & Zarudna, 2022); (Nesrine & Mohammed, 2023). Metaverse can also help in performing real-time collaboration to facilitate the connection and eliminate barriers presented in digital places. Therefore, accountants can share information and monitor the performance without any effort of cost or time; they can use AR headsets and voice commands for sharing and displaying data and information (Egiyi, 2022).

6.2.4 The Ability to Track Virtual Assets and Handle Reports

In Metaverse, there is an ability to track and manage virtual assets. Moreover, the quality of financial reports can be enhanced because the main characteristics of digital reports inside Metaverse are cost-efficient, accessible, and credible. Therefore, there is a possibility to handle and represent various financial reports easily and more accurate representation (Rabie, 2023); (AL-Hawamleh, Altarawneh, Hikal, & Elfedawy, 2024).

Accountants emphasize the importance of adopting modern technologies such as blockchain for tracking and handling reports of digital assets within Metaverse. Blockchain provides any industry in Metaverse with more transparency for tracking digital assets. Therefore, developing systems for tracking and recording digital assets can provide more valuable information within the financial reports (Al-Gnbri, 2022).

Accordingly, the quality of accounting information can be affected by applying AIS in Metaverse; because adopting real-time applications of blockchain can enhance the accuracy and reliability of financial reports by increasing the transparency for tracking the digital assets within Metaverse (Pandey & Gilmour, 2023).

6.3 The Role of Applying Metaverse in Enhancing the Quality of AIS and its Information

The system's quality means its ability to meet the user expectations, and this can reflect the ability of AIS to control the quality level of information and utilize the existing resources to provide integrated, flexible, and easy access to financial and non-financial information (Sunarta & Astuti, 2023). Moreover, the concept of AIS quality is used to show the integration of AIS components with each other, the quality level of AIS operations, and satisfaction of users (Meiryani, Jajat, & Mat, 2020).

Furthermore, the high quality of AIS has a positive impact on the accounting information quality, and organizations depend on the quality of AIS because it plays a core role as a provider of accounting information quality to help the organizational management optimally perform its duties. Therefore, the success or failure of any business entity depends on AIS quality because of its ability to support the decision-making process optimally and enhance the organizational performance (Sunarta &

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Astuti, 2023); (Sari, Afifah, Susanto, & Sueb, 2019). Therefore, AIS quality is a successful indicator of the good application of information systems within the organization and then providing useful information (Rapina, 2014).

According to (Grossi, Biancone, Secinaro, & Brescia, 2021), applying digital platforms can provide accounting an overall view of various priorities between users, by identifying users' needs and perceptions. Furthermore, Metaverse as a huge digital world has different and multiple transactions. So, platforms under Metaverse have the responsibility to monitor and report transactions that occurred in these platforms, which refers to the importance of using platforms as the main method for dealing with all transactions that happen (Pandey & Gilmour, 2023).

Moreover, all virtual and digital places inside Metaverse can support the accounting systems' nature and financial transactions by depending on various versions of platforms. Therefore, the most important factor is the main goal of chartered accountants in the different virtual worlds in Metaverse to use platforms for delivering effective accounting and financial services, such as maintaining financial records, and adopting visualization of accounting data based on the nature of the platform adopted (Shitole, Patil, H.G., Jadhav, & Jadhav, 2023).

There is a real need to adopt an encryption process for dealing with all accounting transactions. Therefore, it is important to implement authentication at every stage of operating systems in Metaverse to ensure the integrity and security of this digital environment (Parlar, 2023). Moreover, developing an accounting system can depend on the integration among modern technologies, such as IoT data authentication for providing decentralized identity verification for performing the implementation of audit trails and managing smart contract transactions (Aldweesh, 2023).

Metaverse can impact on AIS quality in collecting data process. According to (Rabie, 2023), the role of the Metaverse in the data collection stage of AIS is crucial, as many firms are now operating within virtual environments where data entry and encryption are integral processes. Therefore, accountants must ensure that the large volume of data collected within the Metaverse is both relevant and reliable to maintain the integrity and accuracy of accounting analyses.

Moreover, Metaverse significantly influences AIS by enabling the prompt processing of accounting data through real-time synchronization between the individual entity databases and the cloud-based systems. Furthermore, the Metaverse allows accountants to execute accounting transactions remotely and facilitates the processing and analysis of financial data without incurring additional operational costs Li, M.; (Rabie, 2023).

The integration of Metaverse technologies with modern digital tools can enhance the overall usefulness of accounting information. In this regard, the advancement of contemporary accounting systems, particularly those utilizing cloud-based technologies, enables the automation of data processing and the provision of real-time accounting information (Muravskyi, V.; Denchuk, P.; Reveha, O., 2022); (Alkan, 2022); (Al-Gnbri, 2022).

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The accounting information will be enhanced by using Metaverse and other Industry 5.0 tools. In this context, accountants can efficiently process data to derive meaningful insights by understanding predefined accounting information structures. Furthermore, the integration of blockchain technology as a core component within the Metaverse can enhance the availability and transparency of accounting information, thereby increasing the reliability and credibility of financial reports (Pandey & Gilmour, 2023); (Rabie, 2023); (AL-Hawamleh, Altarawneh, Hikal, & Elfedawy, 2024).

Consequently, accounting practices in the digital era are expected to influence the overall level of transparency in both accounting processes and information dissemination. Hence, emphasizing transparency and the disclosure of accounting information has become a critical requirement for accountants operating within the Metaverse environment (Al-Gnbri, 2022); (Maulidiya, A., Rohamadani, & Pandin, 2023).

7. The Conceptual Framework for Developing GO-Alpha: A Metaverse-Based Accounting Information System

In this section, the researchers discuss the designing stage of GO-Alpha GAI and the selection model with training it. Moreover, they illustrate the model of applied software and investigate the benefits and limitations of adopting such software.

7.1 Designing Stage of GO-Alpha GAI

GO-Alpha is a GAI which is a web-based application using programming language such as JavaScript and designing languages such as Hyper Text Markup Language (HTML) and Cascading Style Sheet (CSS). HTML can be used to develop a website and create the fundamental structure for building the website because HTML is the backbone of building the website structure; CSS will be integrated with HTML to enhance the user interface (UI) while enhancing the user experience (UX) and the visual appeal (Mal, Astava, Pandey, & Mishra, 2024).

For designing the AI model suitable for dealing with accounting transactions, GO-Alpha depends on using JavaScript (JS) to help researchers enhance the process of creating the various functions, and one of the most important functions is developing and training a custom AI model for dealing with Metaverse transactions.

7.2 Selecting and Training AI Model for AIS Transactions

The researchers depend on using the Gemini AI model as a raw and pure source of data. Gemini AI is a generative AI developed by Google that is based on using the Pathways Language Model (PaLM), in addition to adopting the Language Model for Dialogue Applications (LaMDA). Gemini can help users by giving them accurate results based on the Massive Multitask Language Understanding (MMLU) (Pinto, Abreu, Costa, & Paiva, 2024). GO-Alpha will depend on using the raw data from Gemini to increase its knowledge base and enhance the process of training the developed AI model. In this context, the researchers depend on using the Application Programming Interface (API) technology.

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API is a set of various functions that allow developers to get all data from the main source, and this technology can be integrated with all fields, such as API banking. API is a suitable reason for the researchers in this study because it plays a vital role in AIS; because if all AIS transactions data are stored in a database, and there is a real need to access data, it can be done by using the private API key for specific developers and users ((Omotayo & Olusegun, 2023). This is the main reason for the researchers to protect the security and privacy of AIS data at each generated content, as shown in the figure (2).

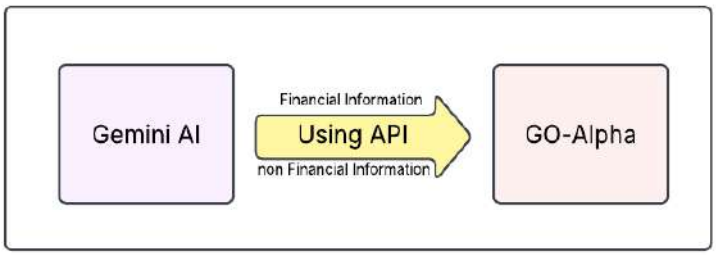

Figure (2) Adopting API for GO-Alpha (Source: The Researchers)

According to training the custom AI model, the researchers depend on TensorFlow.js Library. This library is used to build and execute the ML algorithms by using JS language, that allows developers to integrate among Python and JS ecosystems for building new ML models (Smilkov, et al., 2019). The researchers depend on the TensorFlow.js to learn the custom AI model for dealing with various accounting transactions and questions generated from users, and each time that GO-Alpha receives data from user, it will provide more accurate and specific information related to AIS topic.

Figure (3) Accounting Commands to Assist End-Users (Source: The Researchers)

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According to the figure (3), there are ready accounting functions for users. Therefore, each time user clicks on any command then the AI will give the user accurate answer than the previous request based on training the AI model to receive data from users. Moreover, Go-Alpha makes integration between the Gemini AI model and TensorFlow.js for dealing with the accounting keywords, such as financial statements, the auditing process, financial transactions, and AIS stages.

For dealing with the Gemini AI model, the researchers allow the GO-Alpha to use the API key as mentioned above. This process allows the software to deal directly with the main source of information, which is Google. In this context, the researchers focused on adopting specific questions to allow users to enhance their experience before using Metaverse, and these questions are related to the following aspects:

1- The relationship between accounting staff and the Metaverse world.
2- How to use Metaverse platforms in accounting tasks?
3- The flexibility to generate accounting information, such as virtual financial statements for end users.
4- The ability to use the Industry 5.0 tools in AIS by applying Metaverse with low costs.
5- The ability to use the AI model for generating accounting information based on different and changing events.
6- Applying the AI model for giving recommendations based on the nature of the applied sector, whether physical or virtual.

7.3 The User Interface of GO-Alpha Application

To enter the GO-Alpha website, it is available at the following URL: https://goalphaa.github.io/Go-Alpha/.

After loading the page and all functions are ready for users, the next page, it will be opened to all users to select specific questions or enter their requests. Go-Alpha has seven buttons, and each button creates a specific function that is suitable for accurate data and provides an easy experience for users. These buttons can be shown in figure (4) as follows:

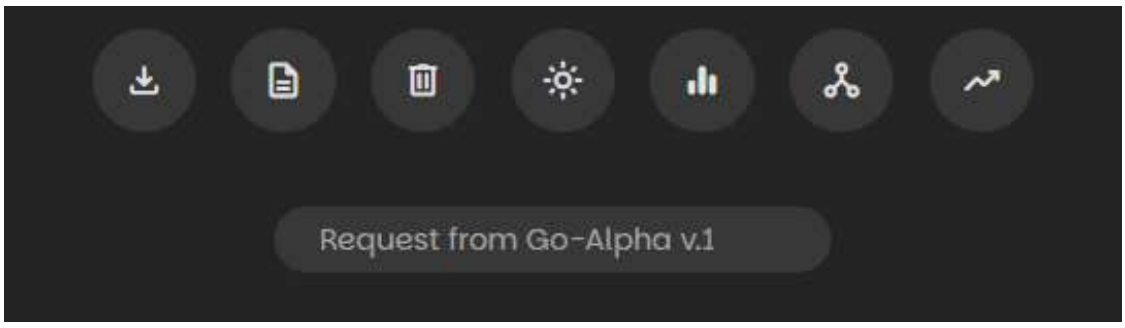

Figure (4) The Main Functions of GO-Alpha (Source: The Researchers)

According to figure (4), the first button is specified to allow users to download the chat between GO-Alpha and the user in a PDF format, and it is more secure

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because the researchers used a JS library that is called jsPDF with version 2.4.0 to enhance the process of downloading the generated information. In this context, there is no limit or number of downloads; it is unlimited.

The second icon of the website is used to generate any content in the Excel sheet by using the xlsx format. The researchers adopted this feature by using a JS library called xlsx js. When GO-Alpha generates information, the end user has the option to convert this generated accounting information, especially within numbers into Excel format. As shown in figure (5), if the user clicks on yes then all generated accounting information will be converted to an Excel.

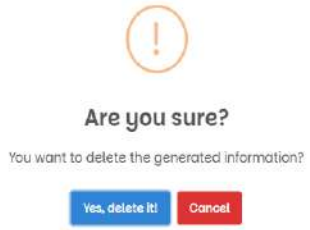

Figure (5) Data in Excel Format Popup (Source: The Researchers)

The third and fourth buttons are related to deleting the chat and dark/light modes sequentially. Go-Alpha is not storing any data. If the user chooses to delete all previous data, then he will not have any option to retrieve it again. Therefore, the website asks the user if he wants to delete the generated content or not, as shown in Figure (6):

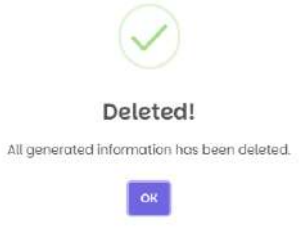

Figure (6) Deleting Generated Information Popup (Source: The Researchers)

The fifth icon is related to generating an interactive chart for dealing with accounting information in more flexible ways, as a 3D interactive chart within Metaverse. For this reason, the researchers allow users to convert only generated

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contents within numbers in an interactive chart because there is unnecessary information that must not be converted to charts, as shown in the figure (7).

Figure (7) Error Message of Invalid Data in Charts (Source: The Researchers)

On the other hand, if the generated content is in numbers, then GO-Alpha will convert the generated content to an interactive chart when the user selects any axes, and then there will be a description for each selected point to help the user recognize the data and interact with it.

Figure (8) Accounting Information in Interactive Chart (Source: The Researchers)

The sixth icon is related to creating a custom blockchain for storing data in these blocks and then securing all generated accounting information based on using the algorithm Secure Hash Algorithm 256 (SHA-256). According to this algorithm, it is a compression mechanism for any message which has a length less than 264, and the length of the hash value within the blockchain will be 256 bits (Wang, Liu, Chen, & Wang, 2020). This mechanism was used to secure the accounting information generated by GO-Alpha before entering the Metaverse platform. The following figure (9) illustrates the mechanism of using SHA256 in the GO-Alpha software.

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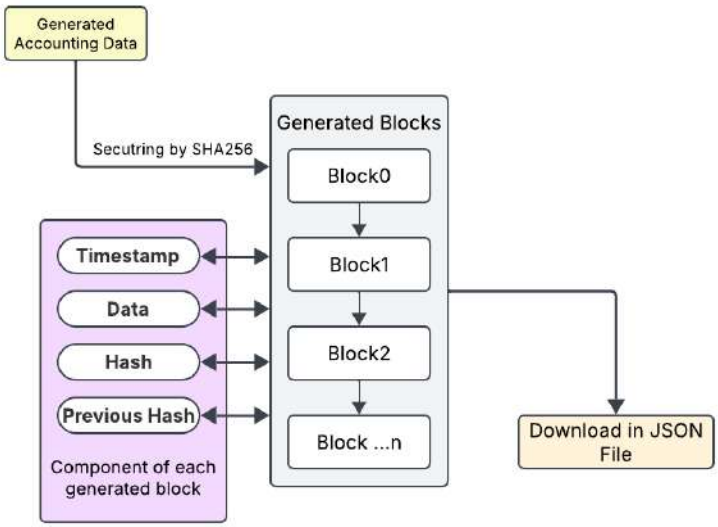

Figure (9) SHA256 Mechanism in Generative Blockchain (Source: The Researchers)

According to figure (9), any accounting data generated from GO-Alpha can be stored within the generated blockchain by using the Crypto js library for dealing with the SHA256 algorithm. Each block will contain a timestamp that includes the date of generated this block, the data of the block will be the name or the ID of the sender and receiver, in addition to the amount of message or its length size. Moreover, there are two components which are the hash and the previous hash, that contain a series of numbers and characters to make a secure process for storing data.

Figure (10) Generated a Blockchain Information (Source: The Researchers)

The final icon is related to predicting the stock market price of the big 20 companies in the world. This option is dependent on integration between Gemini API, TensorFlow.js, and Financial Modeling Prep (FMP) API. According to FMP, it is a live site for providing accurate financial data in the market; the researchers have chosen these companies to make a simulation about the prediction of stock prices in Metaverse because some of these companies tend or already have investments in Metaverse.

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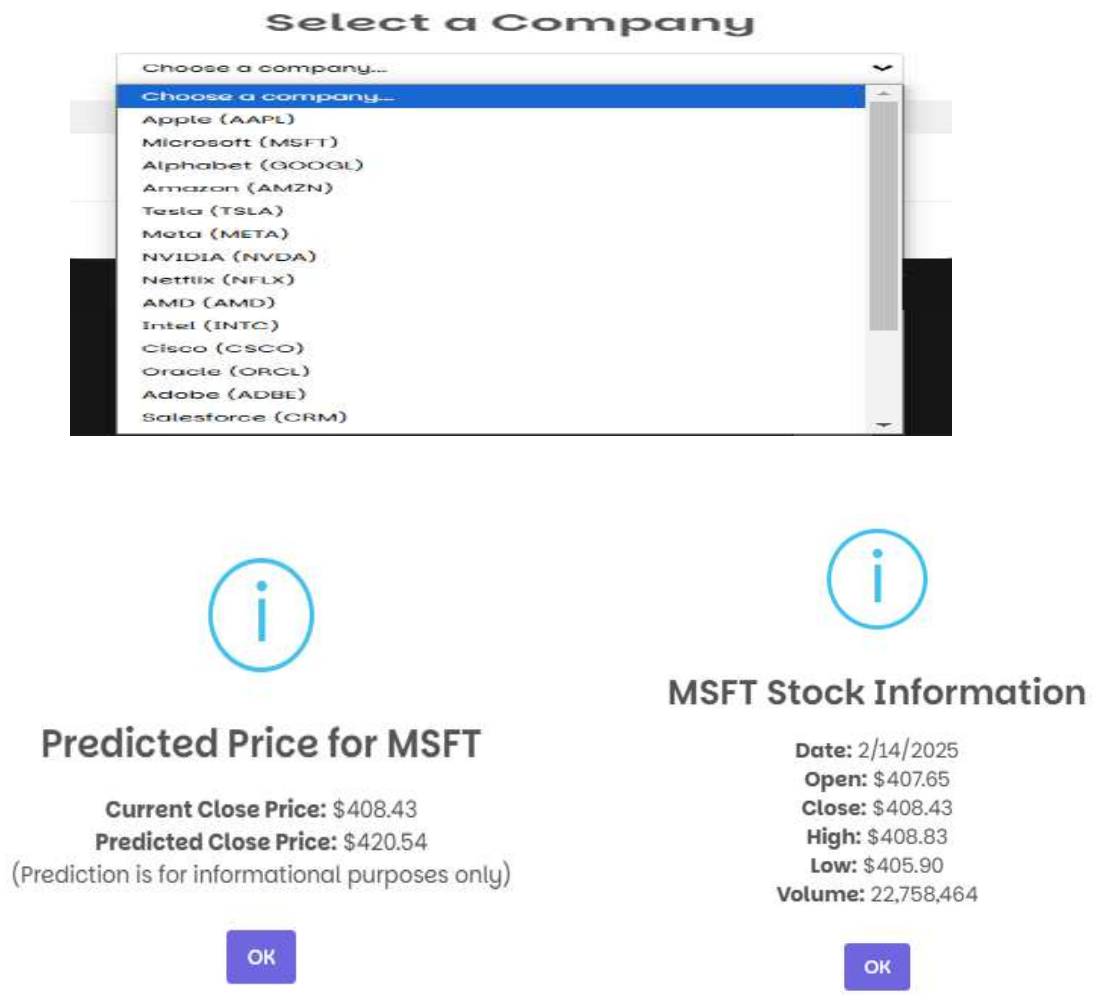

Figure (11) Predicting the Stock Prices (Source: The Researchers)

After illustrating the main functions of GO-Alpha, the user can extract this data to be used in Metaverse platforms, and one of these platforms is Spatial.io. This platform is designed to help users, whether they are content creators or users to create their own experiences in Metaverse. Therefore, the researchers made a connection between GO-Alpha and Spatial.io to help participants in immersing themselves within Metaverse by virtual accounting workspace is available at this URL: https://www.spatial.io/s/Accounting-Workspace-in-Metaverse-6731b8dd372ce33708e54371?share=8186900507849318543

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Figure (12) Participants Discussion in Metaverse (Source: The Researchers)

According to figure (12), users can immerse themselves within Metaverse by using the Spatial.io platform. Moreover, they can use the generated information from GO-Alpha to be shared within Metaverse with the ability to share 3D financial reporting with a free time collaborative. Therefore, Spatial.io was the best choice as a Metaverse platform.

7.4 The Software Model

In this section, the researchers illustrate the mechanism of applying GO-Alpha from entering data to extract the information to be used in the Metaverse environment, which is represented at the Spatial.io platform as shown in the figure (12). In this context, the software will operate based on the applied process, which is designed by the researchers, and then the output will be suitable for the user, especially those who work in the accounting field, because the input data and data generated by the user will be detected by the software as mentioned above.

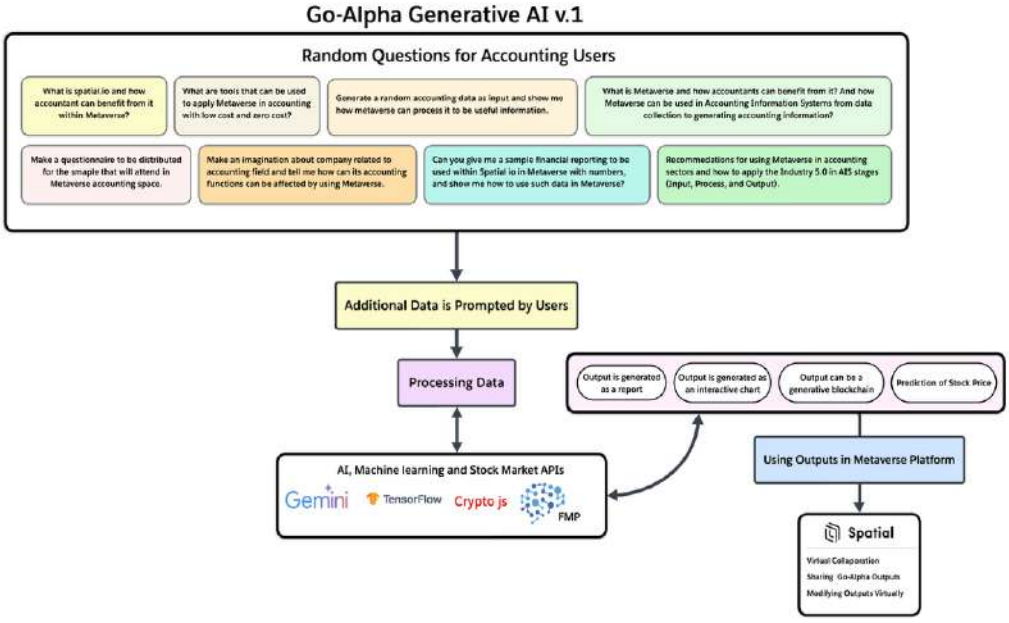

Figure (13) GO-Alpha Mechanism Model (Source: The Researchers)

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According to the figure (13), there is a sample of questions that can help the users to get enough information about the most relevant data of the AIS and its role with Metaverse. There is another option that the user can prompt about his data, whether financial or non-financial and the software will detect this data and then make a processing based on the ML and stock market APIs. These APIs will provide accurate and changeable data based on the current economic events.

The output of software can be used as a financial report, storing its content within blockchains generated by the software itself or converting the content to an interactive chart. The core step is using the data as output from GO-Alpha to be an input within the Spatial.io platform.

7.5 Benefits and Limitaions of Adopting GO-Alpha in AIS Quality

In general, adopting AI in the accounting industry will improve the nature of computerized accounting systems to be more intelligent, and help accounting staff solve various problems, such as poor timeliness of accounting information and high rates of accounting information (Jin, Qu, Xiao, & Fan, 2023). On the other hand, the importance of applying AI in enhancing work efficiency, but it can lead to a reduction of headcount which is essential in the workplace (Loh, Ng, Lee, Y.M., & Foo, 2023). Therefore, the researchers adopt GO-Alpha software with Spatial.io to make it easy for users to share accounting information virtually.

7.5.1 Benefits of Applying Go-Alpha within Metaverse on AIS Quality

In this section, the researchers illustrate the benefits of applying GO-Alpha in the Metaverse environment as follows:

A) **Enhancing the Ability to Generate Information:** GO-Alpha will help the accounting staff generate specific and accurate accounting information based on using ML and training algorithms for dealing with financial and non-financial information.
B) **Interactive Accounting Information:** Based on the JS libraries adopted within this software. So, it's possible to show the accounting information, such as the financial statements in 3D charts that can be used within Metaverse platforms.
C) **Updated Financial Information:** GO-Alpha based on using API of AI models and financial markets helps users to be updated.
D) **Simple User Interface:** This benefit allows a high segment of users to deal with Metaverse options without a high level of knowledge.

7.5.2 Limiations of Adopting GO-Alpha in Metaverse on AIS Quality

Although the adoption of AI tools, including GO-Alpha, provides various benefits, users whether accounting staff or IT specialists may still encounter certain challenges. The researchers illustrate some of the challenges as follows:

A) **High Volume of Random Data:** By using this software and most AI models, there is a big issue in which generating high volumes of data may have irrelated information of the user's purpose.

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B) Little Human Tasks: The process of preparing financial statements and financial reports will depend on the AI models in high percentage, because of their ability to generate accounting information in a few seconds which will reflect on the dependence of accounting staff on doing their tasks based on AI models such as GO-Alpha.

8. Research Conclusions and Recommendations

This study aimed to use the developed GAI with using ML and all AI features to fill the gap between adopting Metaverse ecosystem and applying AIS. The study found that Metaverse platforms are the core driver in this task because the generated accounting information will be used in the Spatial.io platform for immersing users within the Metaverse environment by using the generated information from the GO-Alpha software. Therefore, the integration of AI, ML, and Metaverse will be achieved.

Moreover, the stages of AIS have been significantly influenced by the adoption of Metaverse technologies. The data collection process has been enhanced through the utilization of Industry 5.0 tools such as AI and blockchain, which enable the remote acquisition and integration of accounting data from multiple sources within the Metaverse environment. Furthermore, the data processing stage has been transformed by the application of AI-based tools, such as the GO-Alpha system developed in this study. Finally, the presentation and dissemination of accounting information can now be achieved in immersive 3D formats through Metaverse platforms like Spatial.io, thereby improving user interaction and the overall quality of financial reporting.

Based on the above discussion and deliberation, it is recommended that:

- Organizations are encouraged to adopt Metaverse-based environments to enhance real-time interaction, collaboration, and transparency in financial reporting processes.
- Integrating Artificial Intelligence and blockchain within Accounting Information Systems is essential to improve automation, accuracy, and the overall reliability of accounting data.
- Accountants should receive continuous training to effectively operate within virtual environments and utilize Metaverse-based tools such as GO-Alpha.
- Researchers and developers are advised to design customized Metaverse-based AIS applications that ensure scalability, flexibility, and compliance with accounting standards.
- Cybersecurity frameworks and data privacy regulations must be strengthened to safeguard sensitive accounting and financial information in virtual ecosystems.

It is also recommended to conduct further future research on the era of Metaverse in accounting for example:

1- Investigate the impact of using GAI within Metaverse in accounting functions.
2- Examine the effect of adopting Metaverse technology in generating financial information.
3- Analyze the role of using GO-Alpha software in enhancing the quality of accounting information within Metaverse.

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4- Discuss the impact of integration between Metaverse and Industry 5.0 on the quality of AIS and its information.

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