



Virtual National Telecom Public Company Limited Shop for Commercial, Public Relations, Services: Chaeng Watthana NT Shop

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บทคัดย่อ

งานวิจัยนี้นำเสนอการวิเคราะห์เชิงลึกเกี่ยวกับบทบาทของร้าน Virtual National Telecom Public Company Limited (NT) ในการเปลี่ยนแปลงการมีส่วนร่วมของลูกค้าในสภาพแวดล้อมที่กำลังเติบโตของ Metaverse โดยใช้วิธีการวิจัยทั้งแบบเชิงปริมาณจากแบบสอบถามและเชิงคุณภาพจากการสนทนากลุ่ม งานวิจัยประเมินระดับความคุ้นเคยของผู้ใช้กับ Metaverse ประสิทธิภาพของแพลตฟอร์มนี้ในด้านการโฆษณา และศักยภาพในการสร้างนวัตกรรมบริการลูกค้าในอุตสาหกรรมโทรคมนาคม ผลการวิจัยชี้ให้เห็นถึงการรับรู้ที่เริ่มเกิดขึ้นของ Metaverse ในหมู่ผู้ใช้ โดยลักษณะที่ดื่มด่ำของแพลตฟอร์มนี้สามารถดึงดูดความสนใจได้อย่างมาก อย่างไรก็ตาม งานวิจัยยังชี้ให้เห็นถึงความจำเป็นที่สำคัญในการเพิ่มการเข้าถึงเพื่อให้ผู้ใช้เข้าถึงได้กว้างขวางยิ่งขึ้น งานวิจัยเน้นบทบาทที่มีศักยภาพของ AI chatbot และคุณลักษณะการสื่อสารแบบเรียลไทม์ในฐานะเครื่องมือแปลงโฉมสำหรับการบริการลูกค้าในอนาคต ความคิดเห็นจากการสนทนากลุ่มเน้นถึงข้อดีเฉพาะของร้าน Virtual NT เช่น การเข้าถึงง่าย การให้ข้อมูลที่มีประโยชน์ และประสบการณ์การช้อปปิ้งที่มีการปรับแต่งเฉพาะบุคคล ซึ่งอวดตาเชิงโต้ตอบใน Metaverse เป็นตัวช่วยที่สำคัญ ผู้เข้าร่วมรายงานถึงระดับความพึงพอใจสูงกับฟีเจอร์ที่เป็นนวัตกรรมใหม่นี้ โดยสรุป ร้าน Virtual NT นำเสนอเป็นโมเดลแห่งอนาคตที่ปรับนิยามใหม่ให้กับประสบการณ์ค้าปลีกมาตรฐาน และมีนัยสำคัญต่อการพัฒนาของการค้าดิจิทัลในสาขาโทรคมนาคม งานวิจัยแนะนำว่าการปรับปรุงกลยุทธ์ด้านการใช้งานและการเข้าถึงทางเทคโนโลยีเป็นสิ่งสำคัญในการเพิ่มศักยภาพเต็มที่ของ Metaverse และให้ทิศทางที่มีคุณค่าสำหรับการพัฒนาแอปพลิเคชันใน Metaverse ในอนาคต

คำหลัก: แพลตฟอร์มบริการเสมือน, การมีส่วนร่วมของลูกค้าในระบบดิจิทัล, นวัตกรรมบริการโทรคมนาคม, การเปลี่ยนแปลงทางดิจิทัล, ประชาสัมพันธ์, เทคโนโลยีสนับสนุนลูกค้า

ABSTRACT

The study presents an in-depth analysis of the Virtual National Telecom Public Company Limited (NT) Shop's role in transforming customer engagement within the burgeoning Metaverse environment. Utilizing both quantitative surveys

and qualitative focus group methodologies, the research evaluates the current level of user familiarity with the Metaverse, the effectiveness of this platform in advertising, and its capacity for customer service innovation in the telecommunications industry. The results indicate a budding recognition of the Metaverse among users, with the platform's immersive nature proving to be highly engaging. However, the study also pinpoints a critical need for enhancing accessibility to ensure broader user adoption. The research highlights the promising role of AI chatbots and real-time communication features as transformative tools for future customer service paradigms. Feedback from focus groups underscores the unique advantages offered by the Virtual NT Shop, including its accessible, informative, and personalized shopping experience, facilitated by interactive avatars within the Metaverse. Participants reported a high level of satisfaction with these novel features. In essence, the Virtual NT Shop emerges as a forward-thinking model that redefines the standard retail experience, with implications for the evolution of digital commerce in the telecommunications field. The study suggests that strategic improvements in the platform's usability and technological access are essential for maximizing the Metaverse's full potential, providing valuable direction for ongoing and future developments in Metaverse-based applications.

Keywords: Virtual Service Platforms, Digital Customer Engagement, Telecom Service Innovation, Digital Transformation, Public Relations, Customer Support Technologies

1. Introduction

In an era marked by rapid technological evolution and shifting consumer expectations, the National Telecom Public Company Limited (NT) embarks on a pioneering journey into the Metaverse, charting a new course for the future of telecommunications and digital service innovation. This ambitious project is propelled by a multifaceted rationale, rooted in the recognition of the Metaverse's transformative potential to obliterate the boundaries between virtual and physical realities. By embracing this nascent technology, NT underscores its commitment to leading technological progress and offering innovative solutions to its customers [1–2].

The essence of this project is driven by the vision to elevate customer experiences to a new zenith of interaction and immersion [3]. Integrating the Metaverse platform with NT's services aims to revolutionize the way customers connect, interact, and engage across the globe, fostering more authentic and participatory experiences. This leap towards enhanced interaction not only aims to bolster customer engagement and satisfaction but also positions NT as a modern, customer-centric service provider, redefining the standards of service delivery in the digital age [4].

Beyond the enhancement of customer experience, the Metaverse platform empowers NT to extend its service offerings into new domains, including healthcare, agriculture, and transportation. This expansion leverages the Metaverse to deliver impactful communication and digital services, creating tangible benefits for individuals' lives. Furthermore, NT's initiative to introduce efficient social services through the Metaverse reflects a commitment to contributing to the public good and national development, showcasing the potential of technology to drive societal progress [5].

The strategic adoption of the Metaverse places NT at a competitive advantage within the telecommunications and digital industry. As an early adopter and provider of Metaverse services, NT distinguishes itself from competitors, establishing itself as a leader in delivering cutting-edge solutions. This strategic move not only attracts new customers but also retains existing ones by offering unparalleled, immersive experiences that differentiate NT in the marketplace [6].

Moreover, this project aligns with governmental policies promoting technological innovation and digital transformation. By advancing the Metaverse technology, NT supports the government's vision of fostering a digitally advanced nation, contributing to sustainable economic growth and business development.

The initiative also opens avenues for collaboration and partnership within the Metaverse ecosystem, allowing NT to work with content creators, developers, and industry players to craft immersive Metaverse experiences and broaden its service offerings. These collaborations can lead to new revenue streams and foster innovation, creating a mutually beneficial ecosystem that drives progress within and beyond NT.

The "Metaverse Platform in Services for National Telecom Public Company Limited" project represents NT's forward-thinking approach to harnessing the Metaverse as a transformative tool for customer engagement and service innovation. This initiative underscores NT's commitment to redefining how people interact, work, and access services in a digital-first world. By pioneering this platform, NT not only positions itself at the forefront of the telecommunications industry but also anticipates and adapts to the shifting technological landscape and evolving customer expectations. With a strategic focus on technological advancement, customer-centric service, and industry collaboration, NT is poised to lead in the digital age, setting new standards for immersive customer experiences and sustainable growth in the telecom sector.

2. Materials and Methods

2.1 Literature Reviews

The concept of the Metaverse has gained substantial traction in recent years, evolving from a speculative vision into a burgeoning platform for a wide array of commercial activities. The term "Metaverse," initially coined by Neal Stephenson in his 1992 science fiction novel "Snow Crash," refers to a collective virtual shared space, created by the convergence of virtually enhanced physical reality, augmented reality (AR), and the internet [7]. Recent advancements in technology have begun to turn this fiction into reality, offering unprecedented opportunities for commercial shops to engage with customers in innovative ways [8].

The Metaverse presents a paradigm shift in consumer behavior, offering a digital environment where users can interact with each other and the environment in real-time. Ref. [9–12], in their 2020 report, highlighted the potential of the Metaverse to transform shopping experiences, allowing consumers to explore products in three-dimensional spaces, virtually try on clothing, or test products in a virtual world that mirrors the physical world's complexity and richness. This immersive shopping experience not only enhances customer engagement but also opens new avenues for personalized marketing and sales.

The Metaverse also redefines public relations and brand engagement strategies. Traditional PR activities, focused on one-way communication through press releases or media coverage, evolve into dynamic, interactive brand experiences within the Metaverse. Ref. [13–15] suggests that the Metaverse enables companies to host virtual events, product launches, or interactive brand experiences that foster a deeper emotional connection with the audience. Such engagement is not confined by geographical boundaries, allowing commercial shops to reach a global audience with reduced overhead costs.

Service delivery and customer support can also be revolutionized through the Metaverse. Virtual service representatives and AI-driven avatars can provide personalized customer service, troubleshooting, and support within the virtual environment [16]. Gartner predicts that by 2025, 50% of the population will be active daily users of multiple Metaverse environments, offering services ranging from entertainment to education, health care, and retail [17]. This transition signifies a shift towards more interactive, responsive, and engaging customer service models, leveraging the capabilities of AI and virtual reality technologies.

However, the integration of commercial activities into the Metaverse is not without challenges. Issues related to data privacy, security, and the digital divide pose significant concerns. Ensuring secure transactions, protecting consumer data, and providing equitable access to the Metaverse are paramount for businesses venturing into this new digital frontier [18]. Additionally, the environmental impact of powering extensive virtual worlds is a growing concern that needs to be addressed by developers and businesses alike.

The Metaverse offers a new horizon for commercial shops, redefining the boundaries of commerce, public relations, and service delivery. As this virtual landscape continues to evolve, businesses that adapt to its possibilities stand to gain a competitive edge, offering immersive experiences that enhance customer engagement, brand loyalty, and service innovation. However, navigating this new realm requires careful consideration of the technological, ethical, and environmental challenges that accompany its vast opportunities.

2.2 Objectives and Usage Environment of the Virtual National Telecom Public Company Limited Shop

The National Telecom Public Company Limited (NT) is pioneering the future of digital commerce and service provision through the development of a Metaverse platform, based on a web-based architecture, aimed at revolutionizing the way products and services are presented in a three-dimensional virtual world. This initiative, anchored at the NT store in Chaeng Watthana with a showroom and a product demonstration room, represents a strategic leap towards embedding digital innovation at the core of NT's operations. The primary objectives of creating this Metaverse include:

Offering a virtual platform for showcasing NT's diverse range of products, such as TV set-top boxes and mobile SIM cards, alongside services including fiber internet, data services, and fixed-line telephony, within an immersive 3D environment. This digital transformation facilitates a unique and engaging way for customers to explore and interact with NT's offerings, breaking free from the constraints of physical space and time.

Providing real-time customer service through the presence of NT staff in the form of avatars within the Metaverse. This approach allows for interactive and personalized guidance on products and services, enhancing customer support and engagement through a novel, virtual interface.

Enhancing awareness and accessibility among the public and NT employees to the benefits of efficient product and service management. The Metaverse aims to optimize operational efficiency, reduce redundancy, and drive revenue growth by cutting costs. This digital ecosystem not only positions NT as a leader in telecommunications innovation but also serves as a model for how businesses can leverage virtual environments to improve service delivery and customer satisfaction.

By venturing into the Metaverse, NT sets a new standard for the telecom industry, illustrating the potential of virtual platforms in enhancing business operations, customer interaction, and service innovation.

2.2.1 Traditional National Telecom Public Company Limited Shop

For customers visiting a Traditional National Telecom Public Company Limited Shop, the process involves several steps that can sometimes prove to be inconvenient. Initially, customers need to locate the store's address, which requires some research. Upon deciding to use the services, they must travel to the shop, often facing the challenge of finding parking. Entering the shop, customers are greeted with the task of assessing the store's environment and may need to inquire with staff about the services they seek.

To access specific services, customers press a button to receive a queue number, then search for or ask about the service counter's location. Waiting for service involves finding a place to sit and biding time until a staff member becomes available

to assist. Services encompass a range of activities, including purchasing products like SIM cards and communication devices, asking questions about product usage, inquiring about how to operate the SIM or device, making payments, and seeking various forms of assistance or information related to the store's offerings and activities.

The traditional in-store experience presents multiple inconveniences such as the journey to the shop, unfamiliarity with the store layout leading to uncertainty about where to begin, difficulty in finding parking, confusion about whom to approach for service, the process of obtaining a queue number, the wait for service, incomplete information receipt, insufficient staffing, inadequate service points, incomplete information provided by staff, a high volume of customer inquiries, among other issues.

Figure 1 shows the layout and environment of a traditional NT shop, highlighting various aspects of the physical customer experience. The images depict seating areas for waiting customers, service counters, and displays of products and promotional materials. Customers in such a setting need to navigate through the store, often waiting in queues and interacting directly with staff to complete transactions or receive assistance. This conventional setup, while functional, can be time-consuming and may lead to congestion, particularly during peak hours. The figure visually underscores the limitations of a physical store environment, where customers must rely on in-person service and endure potential wait times, which can impact overall satisfaction and convenience.



Figure. 1 Traditional Activity in National Telecom Public Company Limited Shop.

2.2.2. The Developed Virtual National Telecom Public Company Limited Shop for Commercial, Public Relations, Services

The Virtual National Telecom Public Company Limited (NT) Shop has been innovatively crafted to address specific challenges inherent in the traditional retail model while simultaneously enhancing the utility and efficiency of these conventional spaces. This virtual evolution is a strategic initiative, meticulously designed to transform and elevate the customer interaction and service delivery paradigm.

In the realm of traditional NT shops, customers often grapple with the logistics of physical access—navigating to the store, finding parking, and moving within the space can be time-consuming and, at times, frustrating. This physical journey, coupled

with the limitations of store capacity and the availability of staff for personalized assistance, can deter the optimal service experience. Recognizing these challenges, the Virtual NT Shop emerges as a revolutionary solution, meticulously engineered to transcend physical barriers, thereby offering a seamless and accessible customer experience.

By migrating the shop into a virtual environment, NT effectively eliminates the geographic and temporal constraints that customers face. The virtual platform offers an immersive 3D exploration of NT's product suite and services, enabling customers to interact with and understand offerings in ways that a physical environment could never facilitate. This not only enriches the customer's journey through engaging and interactive elements but also broadens the accessibility of NT's offerings to a global audience, irrespective of their physical location.

Furthermore, the integration of real-time customer service through avatars within the Metaverse significantly enhances the quality of customer support. This innovative approach ensures that customers can receive personalized, interactive guidance on products and services at their convenience, fostering a stronger connection between NT and its customers. The virtual representatives are adept at providing detailed information and support, mirroring the personalized attention traditionally sought in physical stores but often hindered by human resource constraints.

Moreover, the virtual shop serves as an educational and operational platform, enhancing the awareness and understanding of efficient product and service management among both the public and NT employees. This strategic focus on operational efficiency not only streamlines NT's internal processes, reducing redundancy and costs, but also educates customers on the benefits and functionalities of various services, thereby driving informed decision-making and fostering a more satisfied customer base.

The Virtual NT Shop stands as a testament to NT's commitment to leveraging digital innovation for the enhancement of customer service and operational efficiency. It addresses the innate limitations of traditional retail environments by offering an accessible, engaging, and efficient alternative. This digital transformation not only positions NT as a leader in telecommunications innovation but also exemplifies the potential of virtual environments to redefine the landscape of service delivery and customer satisfaction in the digital age. Through this virtual shop, NT not only solves the logistical challenges faced by customers but also enhances the overall quality and accessibility of its services, setting a new standard for the future of retail in the telecommunications industry.

To achieve the objectives of the platform, a virtual platform has been created, designed for accessibility through the internet from multiple locations. This development significantly enhances convenience by eliminating the need for physical travel. The platform is user-friendly and navigable for all, enabled by specially developed software that operates seamlessly within a standard web browser environment [19–21].

The system architecture of the virtual shop platform, illustrated in Figure 2, is engineered for compatibility with web browsers on any computer. These computers can run on various operating systems, including Windows, iOS, Linux, and Ubuntu, all of which are known for being developer friendly. Such compatibility ensures access to extensive developer support and resources, facilitating the creation of a high-quality virtual shop platform that is both cost-effective and compatible with 5G wireless networks. This setup promotes a wire-free, user-friendly experience, offering users the freedom to move and interact within the virtual environment without constraints.

The Virtual National Telecom Public Company Limited Shop, hosted on the company's server equipped with robust specifications including 4 CPUs, 16 GB of RAM, 500 GB of storage, and 2 VMs, ensures ample computational power for the platform's

operations. Leveraging the MQTT (Message Queuing Telemetry Transport) protocol, it facilitates smooth communication between the server and devices, while the device software is designed for seamless integration with both the server and therapists' computers, incorporating real-time and multiplayer functionalities. This architecture supports communication via intranet IP, providing a responsive and interactive user interface that allows real-time control from specified devices, thereby enhancing the platform's flexibility and accessibility.

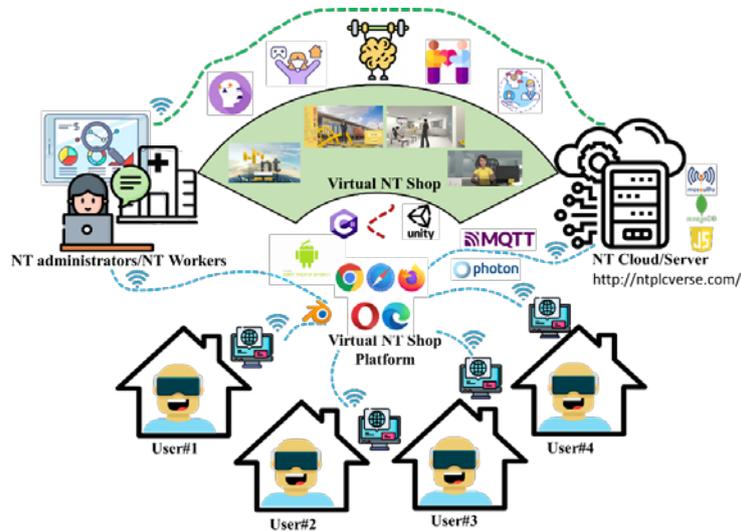


Figure. 2 The Architecture of the Virtual Reality Rehabilitation Platform.

2.3. Virtual NT Shop Setup

2.3.1. Overview

The Virtual NT Shop Platform comprises three subsystems: (1) Main Server, (2) Web Client, and (3) Computer. Figure 3 illustrates these platform subsystems.

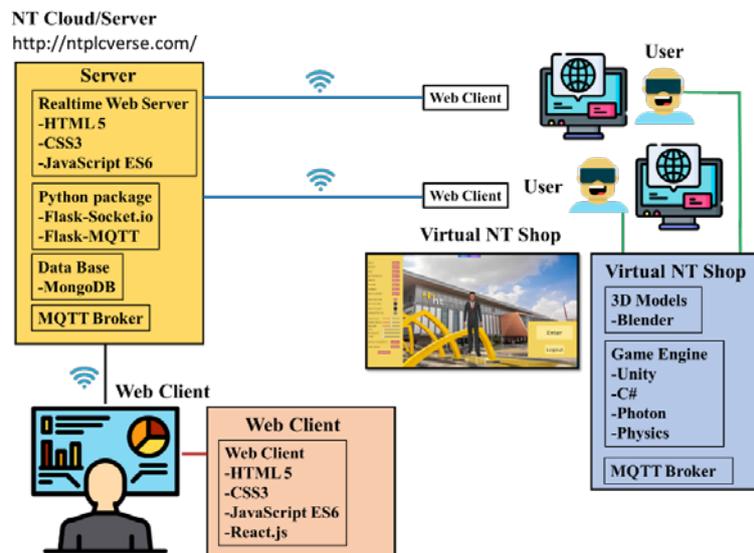


Figure. 3 The Overview Components of the Virtual NT Shop Setup Platform.

Figure 3 illustrates the architecture of the Virtual NT Shop platform, detailing the system's main components and their interactions. The setup comprises a central server hosted on the NT Cloud, which includes a real-time web server developed with HTML5, CSS3, and JavaScript ES6, along with a Python package supporting Flask-socket.io and Flask-MQTT for interactive communication. The server connects to a MongoDB database and an MQTT broker, facilitating efficient data management and device communication. Users access the Virtual NT Shop via web clients, where the front-end is developed using technologies like React.js, ensuring a responsive user interface. Within the virtual shop, 3D models are created using Blender and managed through a game engine built on Unity, C#, and Photon for multiplayer functionality. This comprehensive architecture enables real-time interactions, allowing multiple users to engage within the virtual environment, providing an immersive and accessible experience.

2.3.2. Main Server

The primary server, which is configured with a quad-core CPU, 16 GB of RAM, 500 GB of storage, and hosts two virtual machines (VMs), is under the supervision of the university's administrator. This server facilitates the installation of the Mosquitto MQTT broker [22–24] and supports both the backend and frontend components of web applications or clients.

MQTT, a protocol tailored for machine-to-machine (M2M) or device-to-device communications [25], utilizes a Client/Server structure based on a hub-and-spoke topology and operates over TCP/IP. This configuration simplifies device communication, offering a more efficient alternative to the traditional HTTP protocol. By adopting a Publisher/Subscriber model managed by a Broker, MQTT achieves reduced bandwidth consumption and enables event-driven operations. Figure 4 provides a visual representation of the MQTT framework. Within this initiative, MQTT is strategically used to delineate the communication channels between the backend web application and the device hardware, incorporating advanced features like retained messages, last will and testament, clean session management, and keep-alive functions to enhance usability and reliability. The backend web application functions as a server linked to MQTT, enabling the retrieval of data and information from the physical hardware. Its communication with MQTT is facilitated through Socket.IO.

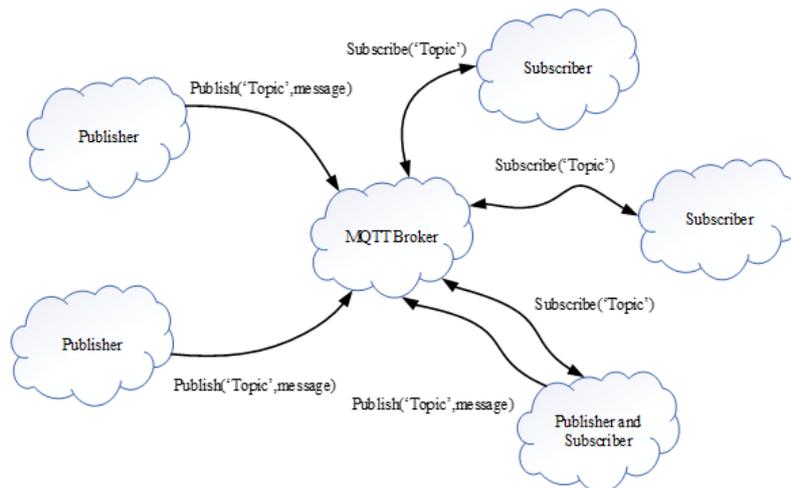


Figure. 4 MQTT: Publish, Broker, Subscribe.

SocketIO, a package specifically engineered for facilitating real-time, bidirectional communication across different platforms, acts as a swift conduit for connecting the server to the HTML web interface. At its core, SocketIO is a library focused on WebSocket capabilities, utilizing an event-driven architecture to ensure efficient performance with its minimal package footprint.

Alongside the primary server, the backend web application is deployed, integrating MongoDB as its database to support the application's needs. MongoDB, a NoSQL database system, is selected for its adaptability in data management, especially for storing diverse application data such as game scores, playing times, and non-sensitive user details. Its document-oriented approach to data storage, distinct from traditional relational databases, is particularly adept at handling unstructured or semi-structured data. This makes MongoDB an excellent choice for the efficient storage and retrieval of game-related information, thereby facilitating the effective collection and management of data essential for the application's functionality.

2.3.3. *Web Client*

The Web Client functions as the interface for therapists, psychologists, or doctors to observe elderly activities, hosted on the main server [25]. This front-end application is constructed using a trio of core programming languages: HTML, JavaScript, and Python, tailored for seamless real-time interaction with VR devices. HTML lays the foundation for content presentation in browsers, while JavaScript enriches the web with interactive elements, supported by browsers' dedicated engines for script execution. Although CSS plays a role in styling, it's not the focus of this discussion. For crafting a dynamic real-time web interface, the Python Flask framework is employed, leveraging an event-driven programming model to efficiently respond to user interactions, such as clicks, with minimal real-time data transfer.

On the server side, specific code handles the "Start" EVENT, prompting the server to relay the 'start_val' to the MQTT server, which resides on the same server. This operation utilizes two distinct programming languages to ensure smooth data flow from the web interface input to the MQTT server. Connected physical devices then act on the MQTT server's messages. Utilizing MQTT, a protocol designed for event-driven message handling, facilitates effective message management within this setup. Changes in VR game EVENTS prompt communication between the VR device and the MQTT server. Python on the server side connects to MQTT, passing messages to the client side via Socket IO, where JavaScript updates the interface in response to the EVENT. This system allows healthcare professionals to track elderly activities in real time, enhancing monitoring and intervention strategies.

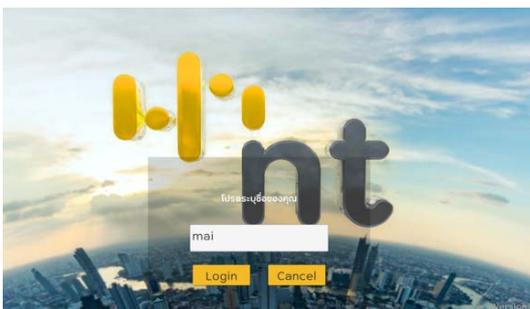
2.3.4. *Virtual NT Shop*

The Virtual NT Shop features a comprehensive array of functionalities designed to simulate a realistic shopping experience for users, incorporating the essence of NT's Chaeng Watthana branch. Key features of the Virtual NT Shop include:

- **Virtual Reality World:** An immersive virtual representation of NT's Chaeng Watthana branch complete with a product showroom and a product demonstration room, offering users a realistic and interactive exploration of the physical store's environment from anywhere in the world.
- **Avatars for Product and Service Information:** Virtual representatives provide detailed information about NT's products and services, enhancing customer interaction and support within the virtual shop.
- **Product Samples in the Virtual World:** Three product samples are available for virtual viewing, allowing customers to explore and understand the features of these products in a three-dimensional space.
- **Service Demonstrations in the Virtual World:** Four services are showcased through interactive demonstrations in the virtual environment, offering insights into how these services can benefit users.
- **Virtual Product Usage Examples:** Two products are presented with usage demonstrations, enabling customers to visualize how these products work and their practical applications in a virtual context.
- **Multiplayer System:** The virtual world supports a multiplayer system, allowing multiple users to interact within the same virtual space, enhancing the social aspect of the virtual shopping experience.

- Communication System Among Players: A built-in feature facilitates communication between users in the virtual environment, fostering a community of NT customers and enhancing user engagement.
- Login System with Data Storage: A secure login system ensures personalized user experiences, with data storage capabilities for managing users' login information and preferences.
- Real-time Chat box: This feature enables live communication among users, providing a platform for instant messaging and interaction within the virtual shop.
- Chatbot for FAQs: A service desk chatbot is available to answer frequently asked questions, offering instant support and guidance to users navigating the virtual shop.
- New Showroom Room: The virtual shop includes a newly designed showroom room at the NT Chaeng Watthana branch, showcasing the latest products and services in an innovative and engaging virtual environment.

These features collectively establish the Virtual NT Shop as a cutting-edge platform that not only simulates the physical shopping experience but also enhances it with the convenience, interactivity, and accessibility of a virtual environment. The example Virtual NT Shop images are shown in Figure 5.



(a) Login System



(b) Avatar



(c) NT Counter



(d) NT Shop



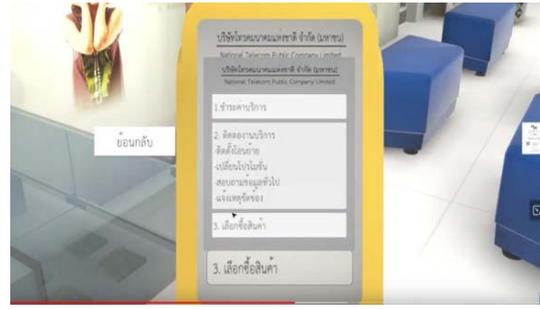
(e) New Showroom Room



(f) Demo Station



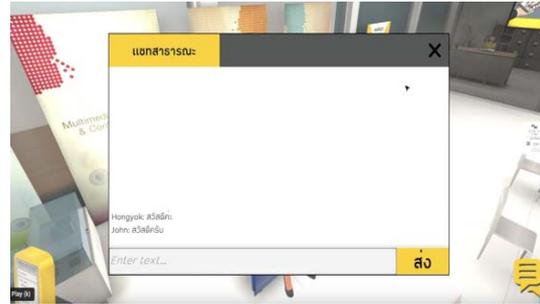
(g) Avatar Chatbot



(h) Queue Station



(i) Sell Product



(j) Chat log



(k) Demo Product



(l) Product Demo Manual

Figure. 5 Virtual NT Shop.

3. Results

To comprehensively evaluate the platform's effectiveness, a two-part evaluation strategy was implemented:

User Satisfaction Surveys: The survey sample consisted of 50 participants selected through random sampling to ensure a diverse representation of user backgrounds, capturing a broad spectrum of perceptions and experiences. These tailored surveys collected valuable feedback on user-friendliness, accessibility, content relevance, and overall satisfaction, providing quantitative insights into how well the platform aligns with user needs and preferences. The survey findings, summarized in Table 1, offer a balanced view of user satisfaction and engagement with the Virtual NT Shop.

Focus Group Sessions: Focus group sessions with selected users were organized to gain qualitative insights, allowing for open discussions on experiences, challenges, and suggestions. This qualitative feedback provides a deeper understanding of specific user sentiments and highlights areas for improvement. The results of these discussions are detailed in Section 3.2.

This combined evaluation approach, encompassing both quantitative and qualitative data, ensures a comprehensive view of the platform's performance and guides enhancements in usability, content relevance, and overall user satisfaction.

3.1 Surveys

The survey results in Table 1 provide insights into user perceptions and engagement with NT's Virtual Shop in the Metaverse. For instance, an average score of 3.37 on familiarity with Metaverse platforms suggests that users have moderate awareness, indicating an opportunity for NT to further educate users about the benefits and functionalities of the Metaverse. The perceived effectiveness of Metaverse advertisements, rated at 3.18, shows that users find this advertising medium somewhat effective but might not yet fully appreciate its potential over traditional methods. This implies that there is room for improvement in how advertisements are presented within the virtual environment to better engage the audience.

Table 1: Surveys.

Topics	Average Score [0–5]	SD Score	Range [Min– Max]
Familiarity with Metaverse Platforms	3.37	0.669	[2–5]
Perceived Effectiveness in term of Metaverse advertisements	3.18	0.616	[1–5]
Engagement Levels in term of 3D Metaverse advertisements	3.79	0.907	[2–5]
Target Audience in term of attraction	3.76	0.767	[2–5]
Innovative Appeal in term of Metaverse Platform	3.34	0.808	[1–5]
Customer Interaction in term of opportunities for interactive customer engagement	3.63	0.916	[1–5]
Brand Perception in term of Metaverse positively influence	3.57	0.669	[1–5]
Budget Considerations in term of Metaverse advertising provides a good return	3.5	0.850	[1–5]
Technology Accessibility in term of Metaverse Platform	2.78	0.647	[1–5]
Future Trends in term of Metaverse advertising	4.16	0.669	[1–5]
Real–Time Chat Interaction in term of enhance customer experience and engagement in a Metaverse environment	4.16	0.686	[2–5]
AI Chatbots in Metaverse Advertising in term of effectiveness of AI chatbots for customer service and engagement within Metaverse advertising platforms	3.93	0.616	[2–5]

High scores in engagement levels (3.79) and target audience attraction (3.76) highlight the immersive appeal of 3D advertisements within the Metaverse, indicating that users are captivated once they engage with the platform. Additionally, the rating of 3.63 for customer interaction shows that users appreciate the opportunities for interactive engagement, underscoring the

platform's potential to facilitate meaningful brand interactions. However, the lower score of 2.78 in technology accessibility points to existing barriers, such as hardware limitations or user interface complexity, which NT may address to broaden accessibility and ensure a seamless experience for all users.

Furthermore, high scores on future trends (4.16) and real-time chat interactions (4.16) suggest strong confidence in the Metaverse's role in transforming future advertising and customer service. These results reflect a positive outlook on the platform's capabilities to enhance customer experiences and indicate that with improvements in accessibility and advertising effectiveness, NT's Virtual Shop can set a new benchmark in digital customer engagement

3.2 Focus Group

Based on the feedback gathered during the focus group survey:

User Experience

- **High Engagement:** Participants reported high levels of engagement while navigating the Virtual NT Shop. The immersive virtual reality world, especially the detailed product showrooms and demonstration rooms, were highlighted as particularly captivating. One participant shared, *"It felt like I was actually in the store. I didn't expect to spend so much time just exploring different rooms and products."*

- **Positive Reception to Avatars:** The use of avatars for personalized assistance was well-received. Participants appreciated the human-like interactions, noting that avatars added a friendly touch to the virtual shopping experience and made the platform more navigable.

- **Realism and Interactivity:** Users praised the realistic representation of the NT Chaeng Watthana branch, mentioning that the virtual environment closely mimicked the physical store. The interactivity provided by product samples and service demonstrations in the virtual world was seen as a valuable feature that enhanced their understanding of NT's offerings. *"I could see the products and even try out some demos – it gave me a much better sense of what NT has to offer,"* shared a participant, highlighting the virtual environment's ability to deepen product understanding.

Usability

- **Ease of Use:** The Virtual NT Shop was generally found to be user-friendly, with participants noting the intuitive navigation and straightforward interface. However, some participants suggested that additional tutorials or guidance for first-time users could be beneficial. As one participant mentioned, *"A quick tutorial would help first-timers get familiar with everything faster."*

- **Technical Performance:** Feedback on the technical performance of the platform was positive, with users experiencing minimal lag or technical issues. The seamless integration of multiplayer systems and communication features was particularly commended. *"Everything ran smoothly, even with multiple users – it made the experience feel much more dynamic and real,"* noted a user.

- **Accessibility:** The platform's accessibility via standard web browsers on various operating systems was praised for facilitating easy access. Nonetheless, a few participants recommended optimizing the platform for mobile devices to enhance accessibility further. *"Being able to access this on my phone would be a huge plus, especially when I'm not near my computer,"* suggested one participant.

Effectiveness

- **Enhanced Product Exploration:** Participants agreed that the virtual shop effectively enhanced product exploration, offering deeper insights into products and services than traditional online catalogs or websites. As one user stated, *“I felt like I understood the products better because I could see them in action and even explore different options.”*
- **Support and Information:** The real-time chatbox and chatbot for FAQs were highlighted as effective tools for immediate support and information, enhancing the decision-making process for users. A participant commented, *“The chatbot was quick and helpful – I didn’t need to search around for answers.”*
- **Community Building:** The multiplayer system and communication features were seen as effective in building a community of NT users, fostering a sense of belonging and enhancing the overall shopping experience. One user reflected, *“It was nice to see other people in the virtual store – it felt like a shared experience, which made it more enjoyable.”*

4. Discussion

4.1 Virtual NT Shop Platform Satisfaction

Based on the data presented in Table 1, we can draw several conclusions and engage in a discussion about the perceptions and effectiveness of Metaverse platforms in the context of advertising and customer engagement.

Familiarity with Metaverse Platforms: With an average score of 3.37, there appears to be a moderate level of familiarity with Metaverse platforms among the survey participants. This suggests that while Metaverse platforms are gaining traction, there is still room for growth in public awareness and understanding.

Perceived Effectiveness of Metaverse Advertisements: The perceived effectiveness of Metaverse advertisements scores slightly lower, with an average of 3.18. This indicates that while users are somewhat familiar with the Metaverse as an advertising medium, they may not yet be fully convinced of its effectiveness compared to more traditional forms of advertising.

Engagement Levels and Attraction: The higher scores for engagement levels (3.79) and target audience attraction (3.76) suggest that once users are interacting within the Metaverse, the immersive nature of the platform is effective at engaging them. This is an encouraging sign for advertisers considering the Metaverse as a potential space for marketing campaigns.

Innovation and Customer Interaction: With scores of 3.34 for innovative appeal and 3.63 for opportunities for interactive customer engagement, the data reflects a positive response to the innovative prospects of the Metaverse and its capacity to facilitate interactive experiences. This underscores the Metaverse's potential as a unique platform for dynamic customer-brand interactions.

Brand Perception and Budget Considerations: Brand perception in the Metaverse (3.57) and budget considerations for advertising (3.5) received moderately positive responses. This could indicate a cautious optimism about investing in Metaverse advertising, balancing the novel opportunities against the cost.

Technology Accessibility: The lower score of 2.78 for technology accessibility indicates that there may be perceived barriers to accessing Metaverse platforms, such as hardware requirements or user-friendliness. This is a critical area for development to ensure broader adoption.

Future Trends and Real-Time Interaction: Future trends in Metaverse advertising (4.16) and the impact of real-time chat interaction (4.16) received the highest scores, suggesting a strong belief among participants that these aspects will play significant roles in the evolution of advertising and customer service within the Metaverse.

AI Chatbots Effectiveness: Lastly, the effectiveness of AI chatbots within Metaverse advertising platforms received a solid score of 3.93, demonstrating a high level of confidence in the potential of AI to enhance customer service and engagement.

In summary, while the Metaverse is perceived as an innovative and engaging platform with promising applications in advertising and customer service, certain areas need to be addressed to improve its effectiveness and accessibility. The potential for future growth is evident, particularly with the expected advances in AI chatbots and real-time interaction capabilities. However, the lower score for technology accessibility suggests that for the Metaverse to reach its full potential, it must become more user-friendly and accessible to a broader audience.

4.2 Focus Group Surveys

In conclusion, the Focus Group study of the Virtual NT Shop revealed positive feedback on the platform's user experience, usability, and effectiveness. Participants appreciated the innovative approach to virtual shopping and provided constructive suggestions for further enhancing the platform. The findings indicate that the Virtual NT Shop has the potential to significantly transform the retail experience for NT's customers, offering an engaging, accessible, and informative platform that extends beyond the limitations of physical and traditional online shopping environments.

5. Conclusions

The insights gathered from the Virtual National Telecom Public Company Limited (NT) Shop's user feedback suggest a burgeoning acceptance and engagement with Metaverse platforms. While the current familiarity with the Metaverse indicates a nascent stage in its adoption, the positive responses to its interactive and immersive capabilities highlight a significant opportunity for growth in user experience and customer service innovation. The data reflects a cautious optimism towards the Metaverse's potential for advertising and its dynamic customer-brand interaction spaces, despite some perceived barriers in technology accessibility.

Constructive feedback from focus groups suggests a path forward centered on enhancing usability and expanding accessibility, essential for mainstream adoption. The enthusiasm for AI chatbots and real-time interactions within the Metaverse underscores the platform's future promise in revolutionizing customer engagement. As NT continues to refine the Virtual NT Shop, incorporating these insights, it positions itself at the forefront of digital transformation in the telecommunications sector, ready to meet and shape the future needs and preferences of its customers. The Virtual NT Shop, with its innovative approach, has the potential to set new standards for retail in the digital age, making it a model for others in the industry to follow.

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