

The virtual Human's application and outcome research in NetEase --- a case study of the game Nishuihan

Wenye Zhang *

School of Central South University of Forestry and Technology, Changsha, China

* Corresponding Author Email: ZhangWenye0416@outlook.com

Abstract. The article describes the application of virtual humans in the Net Ease and mainly uses a case study of the game *Nishuihan*. The main purpose is to provide reference to other enterprises that are conducting relevant research on virtual humans or having virtual humans in business and the media nowadays or in the future and offer proposals. The article describes the development and application of virtual humans in NetEase. From the development and application, the research provides some suggestions and directions for reference that may help the enterprise improve in the future. The article uses the way of literature review to explore virtual humans' application and outcome research. The summary shows the benefit and the insufficient of using virtual humans, the direction in the future to develop the virtual humans and the expectations of virtual humans. It describes the way to use the technology effectively and the limitations of the article.

Keywords: Virtual humans; NetEase; Game *Nishuihan*; Artificial Intelligence.

1. Introduction

With the development of technology and Artificial intelligence increasingly being applied in a wide range of applications, people applying production are closely connected to electronics, like the internet, applications, and the media. The responses about the internet application are no longer the mechanical replies of the past. Since the COVID-19 pandemic in 2020, the requirement for online communication has been a significant leap in quality because of long-term remote work. Virtual humans have better support in technology in this background. In the field of artificial intelligence, the domain of digital humans has flourished in recent years, recognized, developed, and applied by numerous companies, and it holds a significant position in future development. The "14th Five-Year Plan for Digital Economy Development" lists "virtual reality and augmented reality" as a core component of digital economy growth. The digital marketing model of "brand + virtual digital human" has gradually permeated various industries, becoming an essential part of many brands' digital marketing strategies [1]. iiMedia Research issue 2023 China Virtual Human Industry Development and Commercial Trends Research Report shows that in 2022, the industrial market size and core market size driven by virtual digital humans in China reached 186.61 billion CNY and 12.08 billion CNY, respectively, demonstrating significant growth potential and an upward trend [2]. This also indicates that virtual digital humans will occupy a substantial market share in the future and generate considerable revenue and economic benefits for businesses. NetEase is a significant internet enterprise in China that has a certain representation in the use and the research in the virtual human. *Nishuihan* is the representative mobile game in NetEase and uses many technologies of virtual humans. In *Nishuihan*, it can find the chief present about virtual humans. The article's first part introduces the reason for choosing virtual humans and NetEase as examples. The second part describes the definition and development of virtual humans. The third part is about the application of the virtual human in NetEase. The fourth part describes the research of virtual humans on NetEase. The last is the conclusion of the article.

2. The Definition and Development of the Virtual Human

2.1. The Definition

Virtual human (Digital human), using computer technology, is a virtual character image created by real people. According to the definition provided in the 2020 Virtual Digital Human Development White Paper released by the China Artificial Intelligence Industry Development Alliance and the Zhongguancun Digital Intelligence Artificial Industry Alliance, a virtual digital human should possess the following three characteristics: First is Human-like Appearance, second is Human-like Behavior, and last is Human-like Thinking [3].

As a concrete way of a communicative agent, virtual humans combine the capabilities of conversational agents (e.g., chatbots and communication avatars) with a real human appearance. They utilize facial expressions and body language in verbal interactions with users, enabling more natural human-computer communication and facilitating stronger rapport building [4].

The virtual human creates a whole character image through Stylized Generation, Multimodal Drive, and Used Interaction. They have a tightly logical relationship. The first thing is that Stylized Generation produces a unique character and feature. The second is to make the virtual human more comprehensive and learn about the users deeply through the Multimodal Drive and realize more intelligence. The last is that Used Interaction can lead to the improvement and development of Stylized Generation and Multimodal Drive [5].

The virtual human can carry out different classifications. Their classification uses the dimensions of the function, the identity type, and the service type. The identity type is used in the virtual idol and the brand spokesperson. The virtual idols *Hatsune Miku* and *Luo Tianyi* and brand spokespersons like Intime Department Store created the virtual YouTuber *Yinxiaotai*. The Service type is applied in the enterprise IP, which uses the virtual human instead of the real person as the virtual employee. For example, *Xiaopu*, the AI government service assistant in Shanghai Pudong, is used in smart guidance and policy push, etc.

2.2. The Development

The virtual human began from the National Library of the United States in 1989, and the Federation of American Scientists (FAS) integrated the previous relative plans about the virtual human in 2001 and formulated the virtual human plan. With the development of dynamic technology, the use of the virtual human is becoming possible.

In 2007, *Hatsune Miku* was launched in Japan as the first virtual idol. From 2010 to 2020, the virtual human completes the technology accumulation and industry penetration. Meta (Facebook) pulled out the Horizon worlds so that the users can build the Avatar there in 2021. The example of Meta is a piece of evidence that proves the integration of digital humans and the metaverse in the early 2020s. In the Scientific Enlightenment report article *The World's First Digital Human Had Been Born* in the 11th magazine in 2019, the American writer Andrew Caruvalan chose to become the first virtual human in the world on September 2nd, 2019.

On April 23rd, 2019, Shanghai Pudong Development Bank (SPDB) hosted the digital human concept launch named Hello Future and put forward the concept of virtual human for the first time. At the same time, SPDB made a virtual human cooperation plan with Baidu and China Mobile [1]. In 2023, the industry of virtual humans in China had faster development. The platform for preserving and protecting the intellectual property rights of digital humans in China was launched on June 17th, 2023 which means virtual humans received further support and attention.

3. The Application of Virtual Human in NetEase

3.1. Application Background

NetEase is an internet enterprise that has a large scale. It has always been at the forefront of China's internet technology. At the same time, it is the core player in the way of Chinese Virtual humans. To develop the technology of virtual humans for the better, NetEase set up the first dedicated AI research institution in China, NetEase *Fuxi*. The dual mission of establishing the institution is to create better experiences for next-generation players and advance AI technology and research verticals including reinforcement learning, virtual humans, user portraits, robotics cloud platforms, and so on[7].

Fuxi Laboratory is the top institution which is research specializing in AI and wide entertainment. *Fuxi* Lab has research verticals in reinforcement learning and motion imaging synthesis, virtual interaction, natural language processing, and user portrait. It has many industry-leading technologies in AI face crafting, AI content generation, anti-cheat AI, smart matching competitive robots, etc[8].

Since the *Fuxi* laboratory was built in 2017, the ICCV conference accepted the paper about AI face crafting from *Fuxi* Lab in 2019. In 2020, the *Fuxi* IP animation editing platform won the *Jiqizhixin* annual award. At the same time, the virtual humans combined with the NetEase *Yaotai* (the metaverse platform built by NetEase) to establish the first immersive cloud game conferences. Since then, it has cooperated with many universities and has achieved many accomplishments in papers continuously. In 2023, the virtual humans were used on China Central Television for the first time.

In virtual humans, *Fuxi* Laboratory uses AI technology, including natural language processing (NLP), speech synthesis, motion capture, affect computing, and more. AI technology supports the intelligent interaction of virtual humans. For example, the *Youling* Virtual Human Platform offers a whole chain of tools from modeling to driving. Relying on AI technology, virtual humans in NetEase achieve in-time expression, action interaction, and multilingual language interaction like the virtual customer service staff "*Xiaoyi*", which provides personalized service through language interaction and emotion analysis.

3.2. Application Mode

NetEase *Fuxi* laboratory includes five productions: NetEase *Lingdong*, NetEase Robot, *Youling* *Tiangong*, *Youling* *Zhongbao*, and *Youling* Agent. NetEase *Lingdong* mainly researches the loading robot and the excavate robot. The NetEase robot researches medical treatment. *Youling* *Tiangong* serves the video game artist in terms of the game and provides support in the technology of the character creation in the NetEase game.

The application mode of the virtual human in NetEase is divided into two types: self-use and outsourcing. For example, in self-use, *Youling* *Tiangong* is used in the NetEase Game, the character creation of *Ye Xueqing* in the game named *Nishihan*, and the virtual spokesperson *Lin Yaoyao* of the NetEase *Yanxuan*'s sixth anniversary. Young agent's AI built an open world with a vast number of intelligent NPC. The NPC has its own personality and behavioral logic responding to the player's actions and environment changes and engaging in continuous conversations with players.

In outsourcing, for instance, NetEase used the technology of virtual humans to make McDonald's virtual human *Jin Kaixin*. The loading robot of the NetEase robot had been applied in the work on the *Ya'an-Linzhi* section of the Sichuan Tibet Highway, providing certain assistance to the railway infrastructure construction in the southwest of China. It has also helped PepsiCo attract customers by combining AI with music, enhancing fun and brand awareness.

4. The Research of Virtual Human in NetEase

4.1. The Research of Nishuihan

Since the game *Nishuihan* was pushed out on June 30th, 2023, the character used the AI face creation technology of the virtual human, highly intelligent NPC, and the high degree open playing

method which creates a breath world for the players and attracts many players. In July, the profit from the game had reached 3 billion and both the American stock market and the Hong Kong stocks of NetEase presented a rising trend. Take the Hong Kong stock market as an example, the stocks of NetEase increased 13.13% in the 25 cumulative trading days from June 30th to August 4th. At the same time, the stocks of Hang Seng Bank Limited's growth index were only 3.20%. Making a simple conversion, NetEase's Hong Kong stocks exceeded nearly 10 points against the super-large-cap stocks benchmarking the top Hong Kong gaming company stocks (cumulative increase is 2.94%). One of the top a shares gaming companies (cumulative decrease is 9.98%). Compared to these two companies, the performance of NetEase is outstanding [9]. Except for the stocks, the time of NetEase's delivery revenue is two months. The revenue from *Nishuihan* can be presented in the financial report for the second and third quarters.

According to NetEase's financial report from the second quarter and the third quarter of 2023, the mobile game *Nishuihan* logged in at the top of the best-seller list and download list in IOS. The net earnings in the third quarter of 2023 was 272,704 million CNY (373,770 million USD), the last quarter was 240,113 million yuan and the same period in the last year was 244,268 million CNY. The net revenue of the game and the related value-added services in the third quarter of 2023 was 217,799 million CNY (298,520 million USD), the last quarter was 18,798.6 billion yuan and the same period in the last year was 186,991 million CNY. This quarter, the net revenue of the online game is 93.7% of the total net earnings. Last quarter's proportion was 91.7% at the same period's proportion in the previous year was 92.9%. The net revenue of the mobile game's proportion was 77.6% of the earnings of the online game. The previous quarter's proportion was 73.6% and the same period's proportion in the last year was 68.6%. The gross profit of the game and the related value-added service were quarter-on-quarter economic growth data. The quarter also emphasizes the giant profit of the new game.

4.2. Other Research

NetEase's share proportion in China's game AI virtual human market is nearly 35% and the main competitors are Tencent and Mihoyo. Their share proportion are 40% and 15%. In the virtual idol industry, NetEase's virtual singer segment holds a 10% market share, while Tencent dominates with 50%, and ByteDance follows with 30% (industry estimates). However, in the B2B enterprise services sector, NetEase's market share is below 5%, with domestic giants like Alibaba and SenseTime leading the space. NetEase has above 30% head-game penetration rate in the AI virtual human coverage in-game. The rate is higher than Tencent, and it is in the leading position. The contribution of digital humans to the revenue of NetEase Game is approximately 8% to 10%, which is at a medium level in the industry. Tencent's figure is around 12%.

Tencent and Alibaba are the other two representative enterprises that research virtual humans. The virtual human in Tencent uses the Application Platform as a service (APaaS) combined with WeChat, QQ, and Honor of Kings, like social apps and games to be applied in entertainment and social contact. Aliyun's virtual human uses the Platform as a service (Paas) combined with the outstanding technology of Aliyun that be applied in business and finance and has deep research in e-commerce, enterprise training and service for the public, and so on.

NetEase has a wide market in the AIGC-related area that binds deeply with the game scene. It relied on the mobile game *Nishuihan* to get the players' support and approval, open a new way of the virtual in China, and increase the influence of NetEase's virtual humans. However, compared to Tencent, NetEase still needs to strengthen its influence in the C-end consumer market. Tencent's virtual idols have built independent IPs like the virtual idol *Xingtong*, which has the fans more than 5,000,000 fans. However, the virtual idol of NetEase *Linghua* only has fans of less than 500,000 fans. Meanwhile, relative to Alibaba, its applications in commercial sectors are still limited and overly focused on gaming and entertainment ecosystems while lacking development in other areas. If NetEase wants to develop new things about virtual humans, it will need customized products for at least a two-week production cycle. However, Aliyun's virtual humans can be used directly by

Software as a Service (SaaS). Further expansion is needed in the future. NetEase relies on the revenue in the game. At the same time, the mode of realizable wealth is single. Relying on verticality, NetEase avoids direct competition with Tencent and Ali. It allocates funds and talents to high-return fields. Compared to Tencent's virtual idols and Ali's e-commerce commission, NetEase lacks multiple sources of income. Aliyun and Tencent have the underlying computing power support, but the service market share of NetEase is less than 5%. If NetEase wants to carry out a large-scale deployment of digital humans, it will face cost pressure.

4.3. Shortcomings and Suggestions

NetEase secured its position as a market leader in China only after Tencent. However, it primarily focuses on C-end (consumer) users, with limited attention and development efforts directed toward B-end (business) users. At the same time, it allows businesses and the government to use it. The virtual human is tightly connected with the scene. It also limits the development of the virtual human's NetEase in other ways to some degree. The future development direction of NetEase may continue developing in the Artificial Intelligence Generated Content (AIGC), open the AIGC cooperation that is not just being restricted to the use of games, improve the digital optimization of NPC, and expand the B-end (business) and other areas market. Opening AIGC cooperation can expand the field to other areas and solve the question of the lack of horizontality. At the same time, the verticality of NetEase should continue to deepen.

The suggestion is as follows: The first is the company needs to invest in research and development actively to stay ahead of technological trends. The company should monitor both the domestic and global markets, gain initiative in the market, and strengthen competitiveness. The second is that the company should adopt the customer, drive the market, and not limit itself to the traditional application but expand the diverse fields.

5. Conclusion

The article was written to research the application and outcome of virtual humans in NetEase. The article describes the definition of virtual humans, development, and outcome research of virtual humans in NetEase. The article uses the method of literature review. From the research, NetEase rounds its unique niche by combining the strengths of highly immersive digital humans integrated with immersive scenarios, particularly in gaming and entertainment. NetEase spends a lot of time and effort developing technology for virtual humans. It has taken up a certain share of the game and music markets. The development of virtual humans brings lots of profit to NetEase. Nowadays, virtual humans are developing swiftly and highly and have a wide market in the future. Moreover, NetEase has the potential to expand the application of virtual humans into more niche markets. However, with the virtual human flood to the market, the competition is intensifying. Even the most advanced virtual human faces the risk of rapid obsolescence [10]. In the future, NetEase still needs more efforts in the technology of virtual humans. The article only researched NetEase and the online game *Nishuihan*. This means the article has few limitations because the research scope is relatively narrow. The outcome of this study is unable to be copied fully.

References

- [1] CHEN F, FAN J (2024). Virtual digital spokesperson empowering the realization of enterprise and customer community—A case study based on Watson's virtual digital spokesperson "Wilson", *Journal of University of Electronic Science and Technology of China(Social Science Edition)*, 26(4): 84-9.
- [2] Xu, J., Wu, J. (2023). Research on the Role Construction of Virtual Digital Humans and Innovative Paths, *Marketing Models. Publishing Perspective*, (20): 54-59..
- [3] Cheng, Y. (2023). Research on the Current Status, Issues, and Optimization Strategies of Virtual Digital Human Marketing Practices from the Perspective of 4I Marketing Theory, Shanghai Normal University.

- [4] Ham, J., Li, S., Looi, J., & Eastin, M. S. (2024). Virtual humans as social actors: Investigating user perceptions of virtual humans' emotional expression on social media. *Computers in Human Behavior*, 155, 108161.
- [5] Pan, Y., Li, S., Tan, S., Wei, J., Zhai, G., & Yang, X. (2024). Advances in digital characters stylization, multimodal animation and interaction. *Journal of Image and Graphics*, 0(0), 1–24.
- [6] Gao Y, Feng P. (2023). Analysis of Digital Marketing Model of Virtual Human——Take AYAYI, a MetaHuman for an Example Foreign Trade, China's Foreign Trade, (01): 35-38.
- [7] NetEase Yaotai. (2023, December 21). *NetEase Fuxi digital virtual humans*. NetEase Yaotai. <https://yaotai.163.com/cs/metaverse/ltGlqIsBLmgvlgK6Udb0.html>
- [8] *Fuxi Laboratory_ specializes in the research and application of AI in the fields of gaming and pan-entertainment*. (n.d.). NetEase Fuxi. <https://fuxi.163.com/laboratory>
- [9] NetEase. (2023, August 4). *First-month revenue exceeding 3 billion? How did Justice Online Mobile break industry records?.NetEase Copyright Ownership*. <https://www.163.com/dy/article/IBAVP88D0511CVBI.html>
- [10] [Zhang, L. Y., & Shen, Y. Q. (2025). The application landscape, challenges, and innovations of virtual digital humans in the online audio-visual field. *Guizhou Social Sciences*, 01, 64-72.