E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

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REVOLUTIONISING VIRTUAL REALITY: ENABLING HUMAN-LIKE NPC INTERACTIONS THROUGH MICROSOFT AZURE OPENAI-POWERED LARGE LANGUAGE MODELS

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ABSTRACT

This project is planned to produce an AI-powered NPC dialogue system that significantly enhances user engagement and learning outcomes in Virtual Reality (VR) Delivering Bad News Module Application. This research and development effort aims to improve user-NPC interactions in VR environments by adding Large Language Models (LLMs). The Delivering Bad News module will be the focus, with the goal of allowing NPCs to engage in realistic and contextually relevant dialogue. This VR is to help user to practice how to handle challenging and difficult situations when communicating with difficult employees. Many VR systems now display NPC interactions that are unrealistic or changeable/static, making them less effective at reproducing real-world scenarios. These limits are addressed with advanced LLMs such as Azure OpenAI's Generative Pre-Trained Transformer (GPT), which provides a more engaging user experience. The project employs an Agile methodology, with an iterative development process that incorporates continuous feedback and testing to improve the NPC dialogue system and evaluation. The usage of LLMs is expected to assist NPCs understand and respond to user inputs in a more lifelike manner, increasing realism and engagement in the VR environment. To ensure that users and NPCs interact smoothly, the system includes extensive speech recognition, natural language processing, and text-to-speech functions. Collaboration with the PETRONAS Leadership Centre on the project provides industry insights and ensures that the curriculum meets genuine requirements. The purpose of the project is to provide professionals with a realistic and efficient training tool to improve their communication skills in a controlled context.

Keywords: Artificial Intelligence (AI), virtual reality, large language models, GPT, Non-Player Character (NPCs), delivering bad news

1. INTRODUCTION

Virtual Reality (VR) has developed significantly over the last few decades. Firstly, VR is primarily connected to gaming and entertainment, providing an immersive experience that transports users to a fantastic world. However, its applications have expanded to a variety of fields, including education, vocational training, healthcare, and more (Sherman & Craig, 2018). With the integration of Artificial Intelligence (AI) in VR technology, it has further improved compatibility and realism. In addition, non-Player Characters (NPCs) play a critical component in VR technology, particularly simulations for training and educational purposes. Realistic NPC interactions can improve user commitment and immersion, making learning experiences more effective (Lester et al., 1999).

Despite major advances in VR and AI, existing systems still struggle to provide realistic and contextually appropriate interactions between users and NPCs. NPC interactions in VR are monotonous and predictable, with limited contextual awareness and dynamic adaptation being one of the problems. Existing NPC dialogue systems in VR frequently use prepared scripts or restricted branching speech trees, resulting in repetitive and predictable encounters. Other than that, unnatural and contextually

unrelated NPC dialogue in VR reduces user commitment and impedes effective learning outcomes which is also an issue.

The primary goal is to enhance NPC interactions in VR environments by leveraging LLMs to generate more genuine and contextually relevant dialogues. This involves developing and implementing Azure OpenAI to enable NPCs to deliver natural responses, exhibit appropriate behaviors, and express emotions effectively.

2. METHODOLOGY

2.1 Development method and tools.

Given the dynamic nature of software development, this project adopts the Agile methodology within the Software Development Life Cycle (SDLC) framework. The Agile methodology is structured into several key phases, including Planning, Design, Development, Testing, Deployment and Review. In the design phase, the foundational blueprint for the project is created, ensuring a robust and scalable system architecture that integrates LLMs into VR environments to enhance user-NPC interactions.

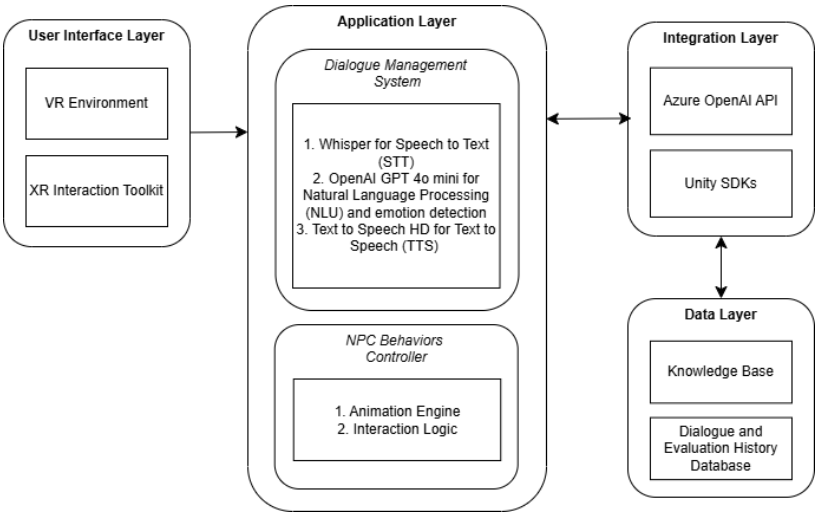

Figure 1 System Infrastructure of AI Driven VR Technology

Azure OpenAI service from Microsoft is used mainly for pre-prompting and AI set-up in this project. It offers access to several powerful LLMs, such as GPT-4o for various applications like natural language processing, speech recognition and text-to-speech service which are needed. Unity is also used for modelling and rendering in Virtual Reality and Azure Blob Storage is for storage and databases.

2.2 Delivering Bad News Module.

This research primarily focuses on a case study related to delivering bad news. Specifically, the module aims to enhance managers' and supervisors' non-technical skills in handling and managing employees within an organisation. The module will particularly highlight two scenarios: Bad Performance Rating/ Downgraded and Handling Difficult Employees. This interaction illustrates how the system captures user speech, processes it, generates an appropriate response, and delivers it back to the user in the chosen scenario, then evaluated.

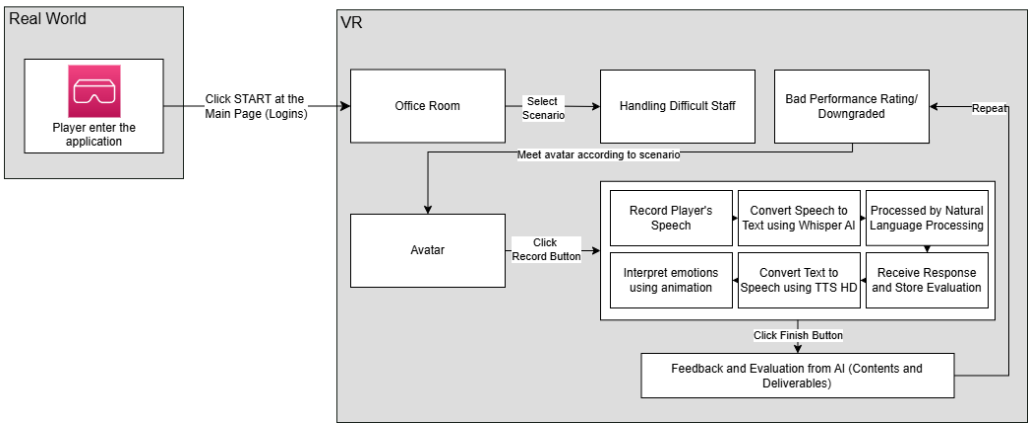

Figure 2 Technology Flow of AI Driven VR Delivering Bad News Module Application.

In the real world, the user, represented as a PETRONAS employee, logs into the system using a VR headset. Upon successful login, the user selects a module and then a scenario to interact with. This setup transitions the user from the real world into the virtual environment where the interaction process begins. An example of interaction will be a user might say, *"Michael, I noticed you've been upset in meetings. If there's something bothering you, let's talk about it openly."* The NPC, powered by the AI-driven dialogue management system, might respond, *"Talk about it? What's the point? You never actually listen! I keep saying I need support, but nothing changes!"*

3. FINDINGS

This section illustrates the final product of the AI-Driven VR Delivering Bad News Module Application. The NPC is successfully integrated with the GPT-4o model to provide scenario-based responses and to deliver scoring and feedback on user interactions. The evaluation is divided into two categories: Content and Delivery Style, which reflect how effectively the user engages with the NPC in addressing the given scenario. In each category, a specific rubric and feedback framework developed by Subject Matter Experts (SMEs) are provided to the AI, enabling it to rate users based on trusted evaluation criteria. This demonstrates the achievement of the project's objective: to enhance NPC interaction and communication, making them more genuine through AI technology's ability to provide appropriate responses and feedback.

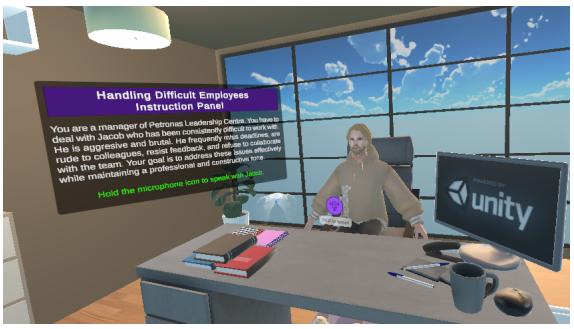

Figure 3 Communication Panel of AI Driven VR Delivering Bad News Module Application.

Figure 4 Content Evaluation Panel of AI Driven VR Delivering Bad News Module Application.

4. CONCLUSION

In conclusion, the integration of advanced AI technologies, specifically LLMs, into VR environments for delivering bad news represents a transformative step in enhancing user engagement and realism. This project has demonstrated the potential of LLMs to create more natural and contextually relevant interactions between users and NPCs, addressing the limitations of traditional NPC dialogue systems that often rely on predefined scripts and limited adaptability. The use of LLMs allows NPCs to understand and react to user inputs in a more lifelike manner, significantly improving the immersive experience. Ultimately, this project sets a precedent for future developments in AI-enhanced VR applications, providing a robust framework for continuous innovation in professional training, development and its evaluation to prove the validity of the training.

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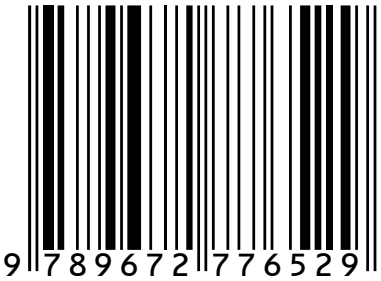

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