

A Research Proposal On

LearningverseVR: A game-based learning platform using generative artificial intelligence and virtual reality technologies

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Abstract

Generative AI and virtual reality (VR) has been quickly taking over education and gaming industry. They enhance various fields like education and gaming by creating innovative solutions like enhancing online learning with interactive simulations or developing immersive gaming experiences. However, we still lack immersive game-based learning platforms that fully integrate these technologies. Given this, the article proposes the creation of "LearningverseVR", an innovative immersive game-based learning platform that integrates generative AI and VR technologies. It aims to feature AI-driven NPCs with diverse personalities for dynamic interactions and VR to further enhance the learning experience of the users. This platform utilizes Unity as the client and uses Python, Flask, and MySQL for backend. "LearningverseVR" offers a unique approach to digital education by merging AI and VR to create an engaging, interactive learning environment.

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Introduction

The rapid evolution of generative artificial intelligence (AI) and virtual reality (VR) technologies are transforming various fields, including education and gaming industries. Artificial intelligence (AI) is the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns[1].

In recent years, generative AI has been used more in education to improve personalization and engagement. For instance, it enhances digital game play by making it more customized and realistic, and it simplifies scriptwriting by automating test processes. In digital gaming, generative AI has the ability to create non-player characters (NPCs) with diverse personalities and life backgrounds. In addition, large language models (LLMs) are used to simulate human behaviors giving NPCs more lifelike characteristics. It can generate real-time dialogue and behavior for NPCs based on player interactions and the game environment, allowing for a more free and flexible gaming experience. Generative AI can also adjust the personalities and behaviors of NPCs based on player preferences and behavioral habits, providing each player with a unique gaming experience. [2]

Virtual reality (VR) has also been widely used in a variety of areas such as education, military, sports, health, etc over the past decade. Virtual Reality (VR) is the employment of computer technology to develop an artificial environment. Rather than just glimpsing a screen in front of them, the users are engaged and allowed to converse with 3D worlds. By replicating most of the senses like vision, touch, smell, and hearing, the computer is molded to serve as a doorway into an artificial world.[3]

VR enhances presence, immersion, and interactivity by creating shared, simulated spaces where users interact as avatars. When combined with generative AI, it can create realistic virtual environments and characters. This combination boosts learners' engagement, motivation, and knowledge creation. However, research on integrating both VR and generative AI in digital game-based learning is still limited.[2]

Thus, this study aims to develop an immersive game-based learning platform “LearningverseVR” with VR and generative AI technologies to enhance learners’ immersive and interactive experiences, and provide novel perspectives on digital game-based learning.

Background of the study

Generative artificial intelligence (AI) and virtual reality (VR) are rapidly transforming fields like education and gaming. AI involves creating computer systems that can perform tasks requiring human intelligence, such as speech recognition and pattern identification. Recently, generative AI has been increasingly used in education to enhance personalization and participation. Using generative AI, digital game-play can be more realistic and interactive, and automates tasks like scriptwriting. AI also allows creation of non-player characters (NPCs) with diverse personalities and backgrounds, simulating human behaviors and allowing for real-time, adaptable interactions based on player preferences.[2]

VR on the other hand, creates immersive 3D artificial environments. VR has been applied in various fields, including education, military, and health. It engages users in simulated spaces where they interact as avatars, enhancing their sense of presence and participation. When combined with generative AI, VR can create realistic virtual environments and characters, further boosting engagement and motivation. This powerful combination helps improve learning experiences by making them more interactive and personalized, thus supporting better knowledge creation and user involvement.[3]

SIGNIFICANCE OF THE STUDY

The goal of this research is the creation of “LearningverseVR,” an innovative and immersive game-based learning platform by effortlessly combining generative AI and virtual reality (VR) technologies. This platform aims to transform the educational experience by combining the interactive and engaging elements of gaming with advanced AI-driven personalization and VR immersion. “LearningverseVR” will use AI to generate unique, interactive characters with different personalities and behaviors, and VR will provide an engaging 3D virtual environment for users to explore. By integrating these technologies, “LearningverseVR” seeks to provide a highly interactive and customized learning experience, fostering deeper engagement and enhanced educational outcomes for users.

Literature Review

Generative artificial intelligence (AI) and virtual reality (VR) are making big changes in education and gaming. This review looks at how these technologies are being used, what benefits they offer, and some of the challenges they face, based on recent research.

Artificial Intelligence (AI) is making significant changes in education. This technology uses algorithms and data to provide effective and interactive learning experiences. It helps personalize lessons for each student, facilitates tasks like grading, and makes learning more interactive with fun tools. AI can also assist with language learning and give instant feedback.

In gaming, generative AI is used to make non-player characters (NPCs) with different personalities and backgrounds. Karaca et al. (2023) show that AI can make NPCs behave in more lifelike ways, moving beyond fixed scripts. Large language models (LLMs) help NPCs act more like real people, making interactions more realistic and engaging (Park et al., 2023). AI also helps game developers by automating repetitive tasks like writing scripts and running tests, saving time and effort (Prasetya et al., 2022).[2]

Virtual reality (VR) is used in many areas, including education, military, sports, and health. VR creates immersive, 3D environments that feel real. It engages users by simulating multiple senses, such as sight and touch, allowing them to interact with virtual worlds as if they were real. With VR, students can explore virtual worlds, conduct experiments, and practice skills in a realistic, simulated setting, making complex concepts easier to understand. This approach enhances engagement and motivation for the students. Additionally, VR provides opportunities for experiential learning that traditional methods cannot offer, such as virtual field trips and simulations of historical events. Overall, VR enriches education by making learning more dynamic and accessible.

In gaming, VR allows players to enter a 3D virtual world where they can interact with the environment and characters as if they were physically present. This technology enhances engagement by making games more realistic and thrilling, allowing players to experience games from a first-person perspective and perform actions with physical movements. VR also supports multiplayer interactions, where players can team up or compete in shared virtual spaces. Overall, VR transforms gaming by offering deeper immersion, more interactive game play, and a greater sense of presence.

STATEMENT OF THE PROBLEM

Even though generative artificial intelligence (AI) and virtual reality (VR) have great potential for improving education and gaming, they are not often used together effectively. Many systems do not fully use AI to create dynamic, personalized content and interactions, and VR experiences may not be as engaging as they could be with better AI integration. This limits the ability to offer customized, interactive, and immersive experiences that could greatly enhance learning and gaming. Solving this problem is important for creating a platform that combines AI and VR to make education and gaming more effective and enjoyable.

PURPOSE OF THE STUDY

The purpose of this study is to create a game-based learning platform combining generative artificial intelligence (AI) and virtual reality (VR) technologies. The goal is to use AI to make learning content more interactive and personalized, while VR provides an immersive environment. It aims to feature AI-driven NPCs with diverse personalities for dynamic interactions and VR to further enhance the learning experience of the users. This study aims to make learning more engaging and effective by developing a platform that uses both technologies together.

SCOPE OF THE STUDY

The scope of this study involves several key areas. First, it includes the development of a game-based learning platform that integrates generative artificial intelligence (AI) and virtual reality (VR) technologies. This involves designing and building the platform to combine AI's ability to create personalized and interactive content with VR's immersive environments.

Second, the study will explore how effectively AI and VR can be integrated to enhance the learning experience. This includes examining how AI can generate dynamic content and interactions within VR settings to make learning more engaging and personalized.

Third, the study will check how well the platform works by looking at how engaged users are, how interactive the experience is, and what they learn from it. This involves gathering feedback from users and analyzing how well the platform meets educational and gaming objectives. Additionally, the study aims to identify and address any technical or practical challenges encountered while integrating AI and VR.

Finally, the study will conduct user testing to refine the platform based on real-world feedback. This includes assessing the overall impact of the platform on learners and players to determine its effectiveness and identify areas for improvement.

METHODOLOGY

SOURCE OF DATA AND ITS USE

To assess the effectiveness of the platform, the study will use various types of data. User feedback will be gathered through surveys and interviews to see how engaging and satisfying the platform is. Performance metrics will track how often users interact with different features. Learning outcomes will be measured by looking at quiz results and other assessments to see if the platform helps users learn effectively. Technical data will help identify and fix any issues with the platform. Expert reviews will provide professional opinions on its usability and educational value. Finally, comparisons with similar tools will help identify ways to improve the platform.

TOOLS AND TECHNOLOGIES INVOLVED

For the development of the game-based learning platform, the following backend tools are used:

- Python is used for scripting and managing the backend logic of the platform. It handles tasks such as data processing, user management, and integrating with other services.
- Flask is a web framework for Python that is used to build and manage the server-side application. It helps handle HTTP requests, manage sessions, and serve data to the Unity client.

- MySQL is used as the database system to store and manage data. This includes user information, game progress, educational content, and other relevant data.

For the game-based learning platform, the frontend tools and technologies used include:

- Unity serves as the primary frontend tool for creating and managing the virtual reality (VR) environments. It provides the interface where users interact with the 3D worlds, educational content, and game elements. Unity handles the visual rendering, user input, and interaction within the VR environment.
- VR SDKs and Plugins specific to VR, such as Oculus SDK or SteamVR, are integrated with Unity to enable VR functionality. These tools ensure compatibility with VR hardware and enhance the user experience by providing support for VR-specific features like motion tracking and spatial audio.
- User Interface (UI) Tools and components are used to design interactive elements such as menus, buttons, and information displays within the VR environment. These tools help create an intuitive and user-friendly interface for navigating the learning platform.

These frontend and backend tools work together to deliver an immersive and engaging experience for users, making it possible to interact with educational content in a virtual reality setting.

For the game-based learning platform using VR, we use meta quest 3.

- Meta Quest 3 is a standalone VR headset with advanced features like high-resolution displays, improved processing power, and a variety of sensors for precise tracking. It does not require a PC or external sensors, making it a versatile and user-friendly option for immersive experiences.

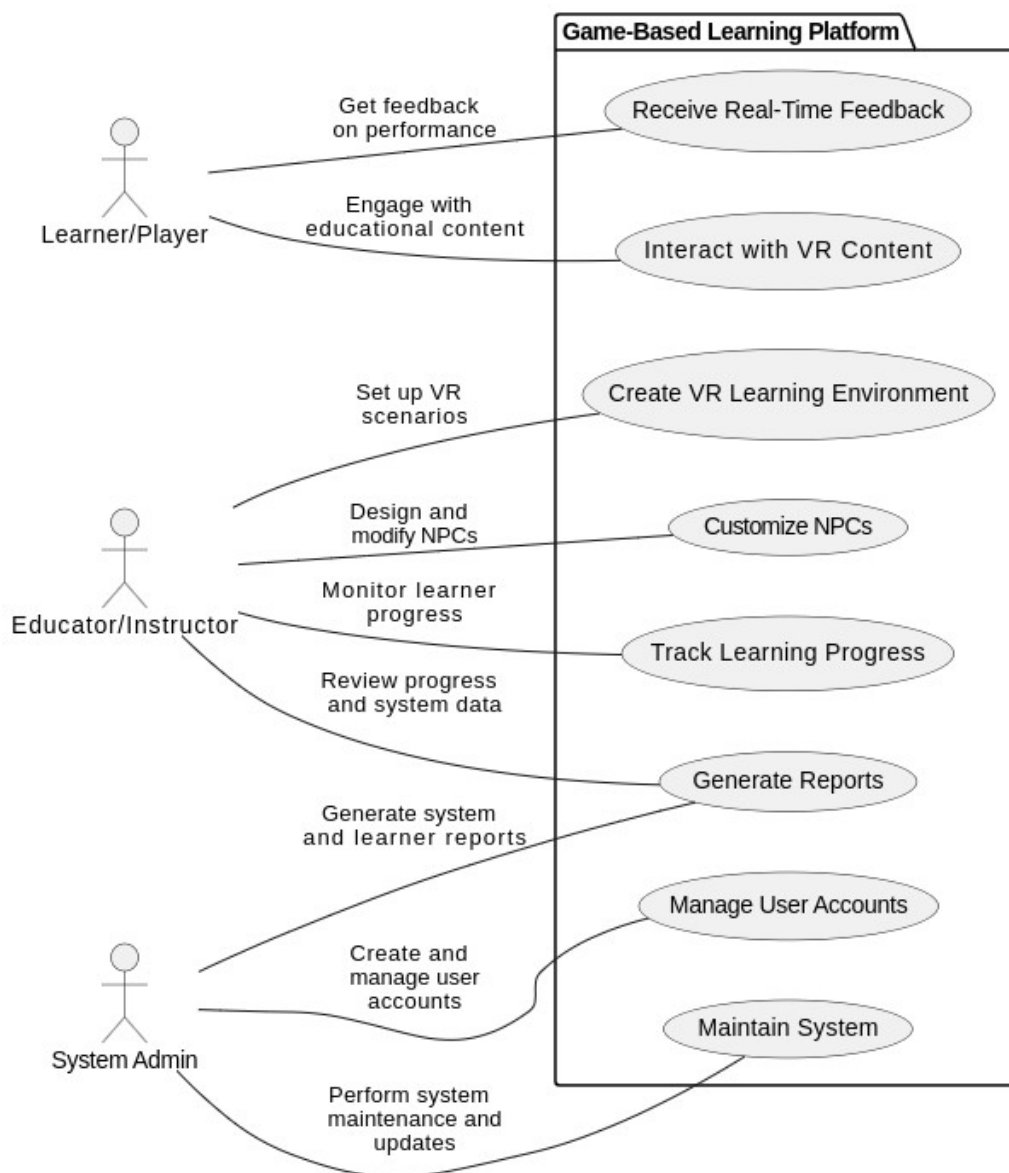
Key Features: Enhanced graphics, comfortable design, built-in sensors for spatial awareness, and a wide range of compatible VR applications.

By using the Meta Quest 3, the game-based learning platform can offer a seamless and immersive educational experience, combining advanced VR technology with generative AI to enhance learning outcomes and engagement.

BLOCK DIAGRAMS

Use case diagram:

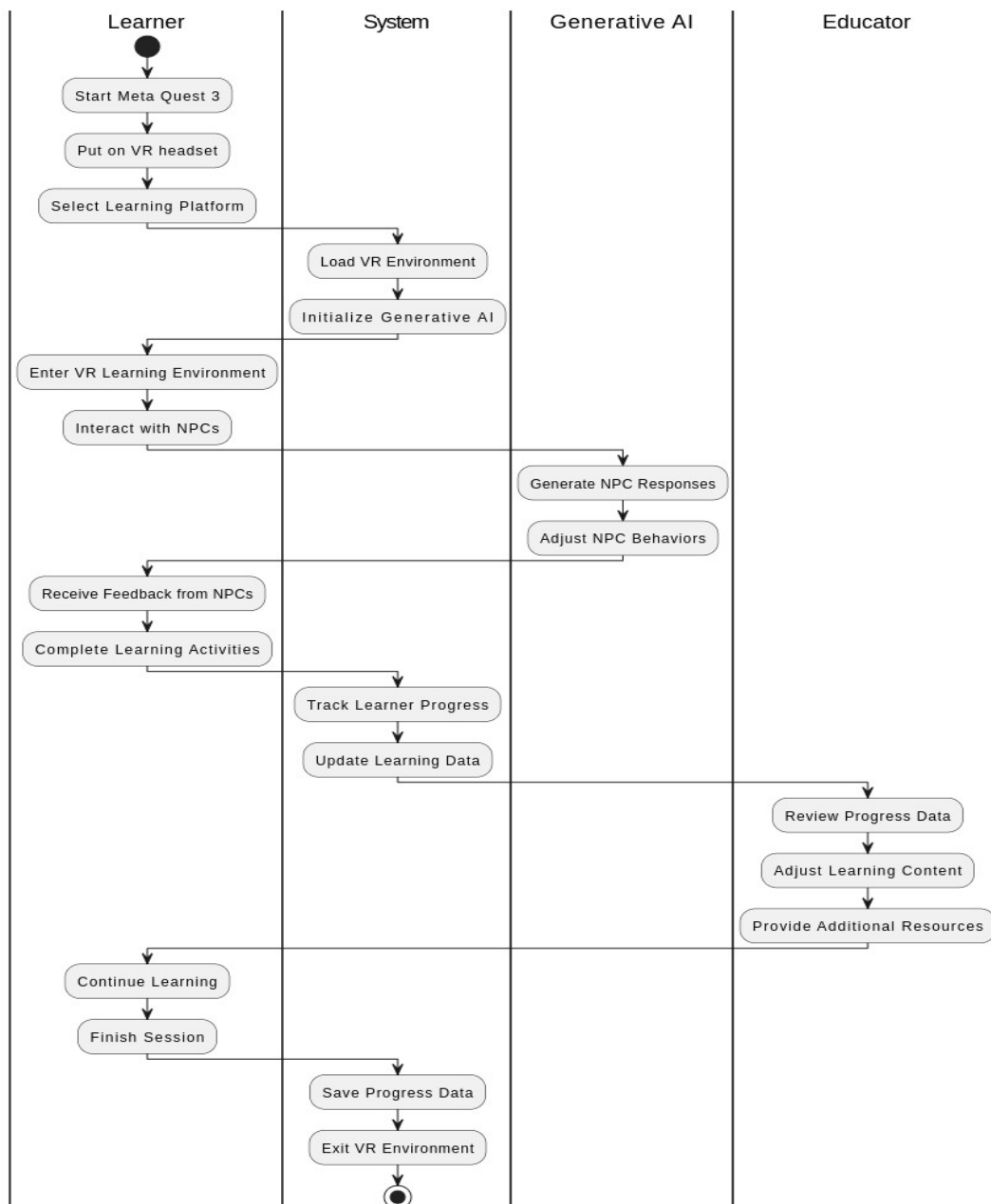
Use-case diagrams describe the high-level functions and scope of a system. These diagrams also identify the interactions between the system and its actors. The use cases and actors in use-case diagrams describe what the system does and how the actors use it, but not how the system operate internally.



[4]

Activity Diagram

Activity Diagrams are used to illustrate the flow of control in a system and refer to the steps involved in the execution of a use case. We can depict both sequential processing and concurrent processing of activities using an activity diagram i.e, an activity diagram focuses on the condition of flow and the sequence in which it happens. It visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling.

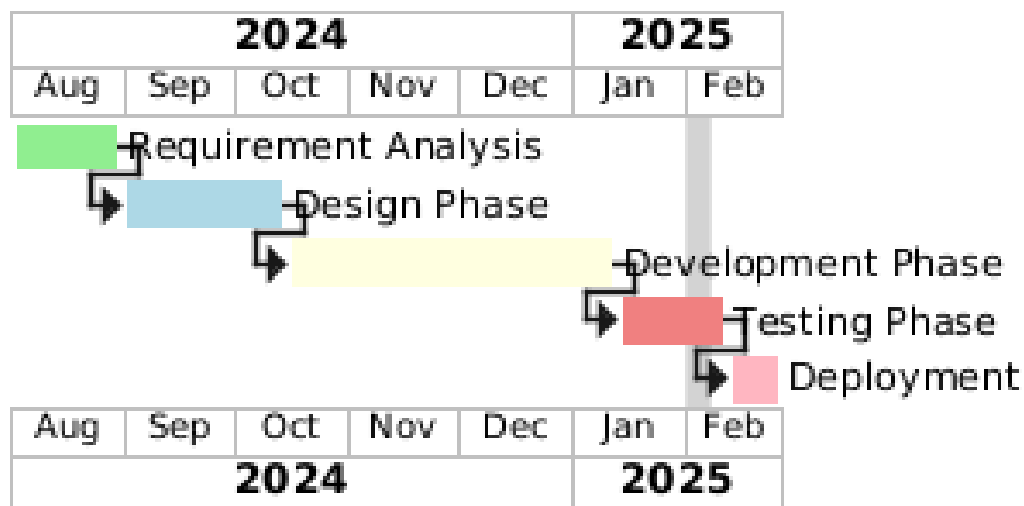


[4]

Expected Outcomes

The game-based learning platform “LearningverseVR” is expected to greatly improve education. Learners will find their experience more engaging and motivating because of the immersive VR environments and interactive NPCs created by the AI. This setup helps them understand and remember the material better, thanks to immediate feedback and interactive activities. The platform also encourages teamwork by allowing multiple users to interact in the same virtual space. Educators will get useful data to help tailor their teaching, and the use of Meta Quest 3 makes it easy and accessible for more people. Overall, these innovations will make learning more engaging, personalized, and effective.

TIMELINE



1. **Requirement Analysis:** August 1, 2024 to August 30, 2024
2. **Design Phase:** August 31, 2024 – October 14, 2024
3. **Development Phase:** October 15, 2024 – January 14, 2024
4. **Testing Phase:** January 15, 2024 – February 14, 2024
5. **Deployment Phase:** February 15, 2024 – March 1, 2024

[4]

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