AI NPC

"Bringing Artificial Intelligence to Gaming": Engage with an Interactive NPC Powered by OpenAI

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Repository: Link
Video: Link
Project: Link

Abstract:

Since the emergence of OpenAI's ChatGPT in 2022, there has been a noticeable surge in the advancement of AI and its implementation across a multitude of sectors. Customer service, healthcare, finance, education, and gaming are just a few examples of the diverse range of industries that have embraced AI technology. In this project, we have created an innovative and cutting-edge Artificially Intelligent Non-Player Character (NPC) capable of answering a wide range of questions within specific parameters. This NPC utilizes the OpenAI API and is capable of answering an extensive range of questions within specific guidelines, making it a versatile and invaluable tool for a variety of applications. By leveraging the power of AI, our project aims to push the boundaries of what is possible and further unlock the potential of this exciting field.

Introduction:

The gaming industry has become a global sensation, captivating players from all corners of the world. As the potential of AI continues to evolve, we can expect the gaming industry to experience unprecedented growth and development. Already, AI has been implemented in gaming in various ways such as content generation, adaptive difficulty, and intelligent bots. In this project, we aim to take AI implementation in gaming to the next level with an Intelligent NPC powered by OpenAI. By leveraging the advanced capabilities of the Unreal Engine 5 software, we will create a dynamic and interactive gaming environment that enables players

to engage with intelligent NPCs that behave realistically and respond to their actions. Through the integration of a Python script that utilizes OpenAI's API, we will push the boundaries of what is possible in gaming and help shape the future of this exciting industry. In this project not only will a A.I. NPC be built but also observe how each OpenAI's engine behaves, how the output changes depending on the temperature settings.

Methodology:

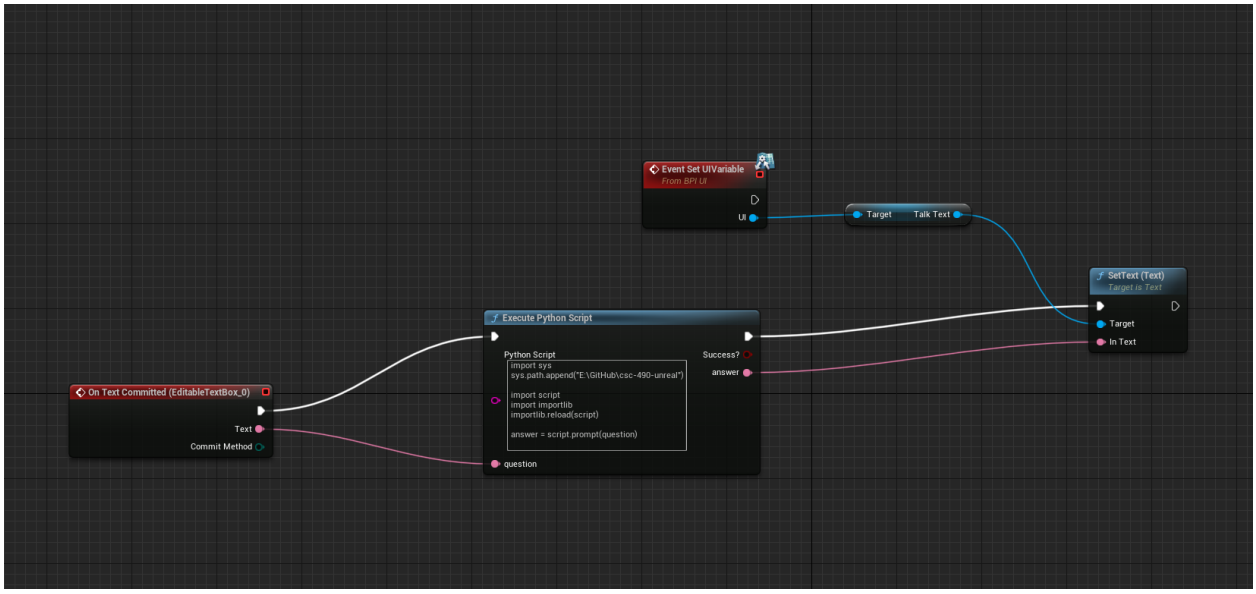
For this project, we will employ the advanced capabilities of Unreal Engine 5, developed by EPIC Games, to create a stunning and versatile landscape where we can deploy actors or NPCs for players to interact with. To enable our NPCs to exhibit intelligent behavior, we will leverage the power of the OpenAI module by using the OpenAI API through a custom-written python script.

To begin, we must install the necessary Python module, which can be accomplished by navigating to the `Edit` option in the top right corner and selecting `Plugins`. From there, search for Python and activate the plugin by clicking the corresponding button. Once the software is restarted, access the `cmd` option, which is located to the right of the `Content Browser`. If there is a Python option available proceed with the installation.

Before we can install the OpenAI library, we must first determine the drive on which Unreal Engine 5 is installed (e.g. C drive or another drive). Next, we need to navigate to the following path: `UE/Engine/Binaries/Win64/Thirdparty`, where we will find the Python executable file. We will copy this folder path (e.g. “UE/Engine/Binaries/Win64/Thirdparty/python.exe”) into a terminal, encapsulate it within double quotes, and add a space after the closing quote, followed by the command pip -m install OpenAI to install the required OpenAI library.

With the OpenAI module successfully installed, we can begin crafting our python script utilizing the OpenAI API syntax outlined on the OpenAI website. Once the script is complete, we can activate it through the Tools drop-down menu by selecting Activate Python Script. This will enable our NPCs to exhibit intelligent behavior, enhancing the player experience.

Finally, we can proceed with creating the necessary widgets to enable players to interact with the NPCs in a seamless and immersive manner.



Using the graphing capabilities of Unreal Engine, we employ the various modules provided by the Python plugin to craft a dynamic script that can read and process input strings and generate personalized responses with the OpenAI API. The versatility of Python and the OpenAI platform allow us to tailor the AI to match the medieval castle setting of our game. By incorporating specific information, such as the coordinates of hidden items within the level, our script can provide helpful hints to players when prompted. Additionally, we can further enhance the immersive experience by infusing the AI's dialogue with medieval language and terminology, bringing the game world to life in a unique and engaging way.

```
How can I assist thee today?: How can i lose weight?
 To lose weight, one must consume fewer victuals and engage in physical activity
```

If I input data about where an item is on the graph and give instructions but not the full answer:

```
How can I assist thee today?: Where can I find the Dragon Egg?
 Tis near the Eagle fountain at the edge o' the West Chest Library
```

Result:

The outcome of this project is a highly interactive NPC, empowered by OpenAI, that elevates the gaming experience to the next level. Players can now

engage in a more realistic and immersive conversation with the NPCs, who are capable of holding a dialogue, providing instructions based on the given information, and responding in a conversational tone that is easier to understand. The visual representation of the NPC's responses is demonstrated in the accompanying pictures below.

Set Backs:

In the initial stages of this project there were many setbacks, The first setback was the hardware setback. Some of the basic hardware requirements to run the game engine are:

- OS: Windows 10 64-bit
- Processor: Quad-core Intel or AMD processor, 2.5 GHz or faster
- Memory: 8 GB RAM
- Graphics Card: DirectX 11 compatible graphics card
- Storage: 200 GB of free disk space

The second challenge we faced was the limited flexibility of Unreal Engine 5 in implementing the OpenAI API directly. To overcome this, we leveraged the versatility of the Python language to integrate the API and make modifications to the A.I. NPC.

The third challenge is with the space and version control. This relates to the challenges we faced when implementing an Unreal Project with a Git repository. We ran into an issue where assets that we imported from Quixel Bridge, a library of Megascans that can be used in Unreal Projects, were too big to commit to Git. This made matching versions between different working PCs challenging. Two ways that we are aware of that can solve this issue is to use Git LFS, which is not something we are familiar with. Another way is to simply avoid assets that would be too big for Git.

Future:

The research project at hand has laid a solid foundation for exploring the integration of AI-powered NPCs in the gaming realm. With the remarkable results achieved thus far, there are numerous captivating paths to embark upon for future development and expansion. Here are some intriguing avenues that can be explored:

- Accessibility and Improvement:
    - To take the project to new heights, an exciting integration can be implemented by incorporating a voice-to-voice interaction using an advanced API such as Conformer-1 by AssemblyAI. By leveraging this API, the script can convert a player's voice command into text and seamlessly transmit it to the AI NPC. Similarly, employing another API for text-to-speech conversion will further enhance the immersive experience, allowing the NPC to respond with an authentic and lifelike voice.

- Dynamic Learning and Adaptation:
    - Infusing machine learning algorithms into the intelligent NPC will unleash its potential for dynamic learning and adaptation. By capturing and analyzing player interactions and feedback, the NPC can continuously evolve and refine its conversational abilities, decision-making processes, and overall behavior. This evolution will result in a more personalized and responsive NPC experience that adapts to each player's unique style and preferences.
- Multiplayer Interaction:

    - Expanding the project to encompass multiplayer interaction is a compelling direction to pursue. Enabling the AI-powered NPC to engage with multiple players concurrently, participate in group conversations, and respond to complex multiplayer scenarios will elevate the social dynamics within the game world. Drawing from concepts found in social network analysis and collaborative filtering, this expansion will foster more immersive and engaging multiplayer experiences.
- Enhanced Context Awareness;
    - Augmenting the NPC's context awareness is another captivating avenue for future development. Incorporating techniques such as sentiment analysis, emotion recognition, and environmental awareness will enable the NPC to better grasp and respond to player emotions, adapt its behavior to different in-game situations, and deliver more contextually relevant and captivating interactions. This heightened sense of context will further enhance the immersive and realistic nature of the NPC experience.

These are just a few examples of the exciting possibilities that lie ahead for the project. By venturing into these avenues, the research project can continue to push the boundaries of AI-powered NPCs in gaming, unlocking new levels of immersion, adaptability, and engagement for players.

Conclusion:

In conclusion, this research project has successfully demonstrated the potential of integrating artificial intelligence into gaming through the creation of an innovative Artificially Intelligent Non-Player Character (NPC) powered by OpenAI. By leveraging the advanced capabilities of the Unreal Engine 5 software and the OpenAI API, the project has achieved a highly interactive NPC that enhances the gaming experience by providing realistic and immersive conversations with players.

While facing setbacks such as hardware requirements and limited flexibility in integrating the OpenAI API, the project has successfully overcome these challenges by leveraging the Python language and making necessary modifications to the AI NPC.

Looking to the future, there are several intriguing avenues for further development and expansion of AI-powered NPCs in gaming. These include incorporating voice-to-voice interaction, dynamic learning and adaptation through machine learning algorithms, multiplayer interaction, and enhanced context awareness. By venturing into these areas, the project can continue to push the boundaries and unlock new levels of immersion, adaptability, and engagement for players.

Overall, this research project has laid a solid foundation for the integration of AI-powered NPCs in the gaming industry. The advancements achieved in this project showcase the immense potential of AI in revolutionizing the gaming experience and pushing the boundaries of what is possible. By leveraging the power of AI, the future of gaming holds exciting possibilities for enhanced interactions, realistic behavior, and immersive gameplay, further cementing AI's role in shaping the future of this dynamic industry.