XRForBrain - PROJECT SUMMARY

Intro to Virtual and Augmented Reality - Fall 2022

MOTIVATION

Education is one of the crucial sectors of humanity. Quality education has been the priority for so long, and education standards improve daily, enhanced by technological innovations. Immersive technologies like Augmented Reality (AR) and Virtual Reality(VR) can add a dimension to teach students by engaging them to the best possible extent. The Social Good addressed through the project XRForBrain is to teach the brain's anatomy by bringing them interesting visualization that cannot be experienced otherwise.

GOALS

While some concepts are easier to perceive, others cannot be understood clearly, even with a detailed explanation. It's been known that traditional textbook education aided with immersive experiences since involving senses like audio, visual and tactile can significantly improve the student's understanding and retention capacity. Anatomy is one subject that most students clearly understand by looking at animated videos. Our goal is to make that animation feel real and allow interactivity with the brain and the organ parts in the immersed virtual environment. The primary targets are teaching, interactivity, and evaluation of the concepts taught in the system.

FEATURES

The project comprises three main sections for guiding the students through the brain's anatomy. Firstly, a Virtual Reality Environment that explains the anatomy with a voiceover presenting the 3D model of the brain and its parts. The VR environment has an instruction button that gives information about ways students can interact with virtual objects. Some of them include zooming in & out, rotating, clicking, and dragging. Secondly, an Augmented Reality space where virtual 3D models are displayed when appropriate images are tracked. The same set of interactions with the virtual objects is also possible in AR space. Thirdly, an evaluation section comprises two subsections: Multiple Choice Questions (MCQs) and parts identification. Students can navigate through and in between sections and analyze the results, which score their understanding of the concepts from the system. Facilities are provided to identify the section they are currently in, and navigation to the main menu is made more accessible.

IMPLEMENTATION

Unity 3D (2021.3.9f1) is the platform chosen to develop and deploy all the sections of the virtual system. We scripted the functionalities in C#. The model used in the Virtual Reality section is downloaded from a legally accessible source on the internet. The objects include the brain model and the virtual hand used as a cursor. The way the model rotates till the audio plays in the background and the guiding buttons appear after the audio finishes playing is controlled by timeframe count. The tasks are coded to execute between the pre-observed time frames recorded by the unity engine. The way users can control the objects' rotation, and virtual hands is governed by the keyboard inputs received. The Virtual hand replaces the traditional cursor, and the implementation of clicking and dragging of the objects is done by scripting them to follow the position of the actual cursor, which involves the conversion of the screen and world coordinates. Raycast is another essential feature implemented to notify the users that they are in the right direction to reach a specific set of objects. We also have options for users to take control over playing, pausing, and stopping the audio played in the background. However, it is initially set to play upon activating the VR environment. Further, we chose to keep the Virtual Reality environment as simple and non-distracting as possible. The Vuforia developer API is used to implement the fiducial tracking in the AR system. Images of all the brain parts are stored in the database, which, when tracked, displays the virtual object of the corresponding part. The Evaluation section relies on the C# scripting. The questions and the correct answers are stored in arrays compared against the user's input to the answer box. Coordinating the appropriate questions and previously entered answers while moving forward and backward with the buttons are also dealt with by designating relevant control variables.

FUTURE SCOPE

A significant way to improve the project is to include Audio command recognition in AR and VR environments using Machine Learning (ML) APIs. We tried to have model targets in the AR system but couldn't accomplish that due to the monotonic structure of the 3D-printed target brain model. If the 3D-printed physical target can be modified to be tracked by AR extensions like Vuforia or AR Kit, that will increase student engagement. Further, the Event system can be used instead of using Timeframes to determine the sequence of actions. That is one of the efficient coding techniques in virtual gaming environments. A valid text summarization score can be calculated for the summary provided by the student in the evaluation section by using other ML extensions to improve the evaluation section of the system.