Create a VR Game Character

Web Development

Time: 60 mins

Introduction

In this class, students learn about the concept of virtual reality, how to design a VR world using A-Frame web framework with HTML and create a 3D game character.

HTML Tags & CSS Properties Introduced

- <a-entity> — A-Frame represents an entity via the `<a-entity>` element.
- <a-scene> — A scene is represented by the `<a-scene>` element. The scene is the global root object, and all entities are contained within the scene.
- <a-plane> — Creates flat surfaces
- <a-box> — Creates shapes such as boxes, cubes, or walls.
- <a-cylinder> — Create tubes and curved surfaces.
- <a-sphere> — Creates spherical or polyhedron shapes.
- position=" " — The position component places entities at certain spots in 3D space.
- rotation=" " — The rotation component defines the orientation of an entity in degrees.

Vocabulary

- **Virtual reality:** A simulated environment in three dimensions that enable the users to interact with virtual surrounding giving the user the impression of being immersed in their surroundings.
- **Web framework:** Web frameworks are a set of resources and tools which can be used to design and manage web applications.
- **Entity-Component System**
  Entity: An entity is a distinct object in the VR world. All the visible "things" in the game's universe are entities. It does not have actual data or behavior. For ex, a shooting bubble in the game is an entity.
  Component: A component provides a unique behavior when assigned to an entity. For ex. A component such as size influences the magnitude of the shooting bubble. A color component influences appearance.
  System: The system is basically the logic that operates on the components.

Learning Objectives

Student/s should be able to:

- ***Understand*** what is virtual reality and three-dimensional (3D) space.
- ***Explain*** how to use the A-Frame web framework to create virtual worlds using HTML.
- ***Modify*** the appearance, position, and orientation of the objects in a VR scene.
- ***Create*** a simple virtual world with a basic character.

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Activities

1. **Class Narrative:** *(2 mins)*
    - Brief the student/s that the VR Gamers website wants to open their online slot bookings services. But they want players to get a glimpse of their games before booking a game slot so that they can make an informed decision as to which game they would like to play at the studio. In this class, we will begin to create a VR experience for the site visitors by creating a character for the VR game.

2. **Concept Introduction Activity:** *(10 mins)*
    - Explain the entity-component system. An example of a ball being used as a cricket ball and also as a football can be stated. Mention that the cricket ball is heavy in weight and football is light weight and filled with air feature wise.
    - Encourage the student/s to explore the VR world and the game character.
    - Inform that by clicking on the VR button on the bottom-right corner of the screen, they can get into the VR world.
    - Encourage the students to observe the shapes the character is made of, its positioning, and appearance by moving the character on their screens using their mouse and arrow keys or using their mouse and WSAD keys.
    - Ask the student to point out the different entities in the 3D shapes.
    - Using the slides, explain they will learn:
        - how to create a VR scene using A-Frame with HTML.
        - use the entity-component concept to create a VR game.
        - create a game character using the primitives of A-Frame.

3. **Activity 1:Add a VR Scene and a Ground:** *(12 mins)*

    Teacher Activity: *(5 mins)*
    - Explain how the A-Frame framework is loaded into the index.html file using the <script> tag. Demonstrate how to create a VR scene using <a-scene> and add a flat surface using <a-plane>. Explain the need for rotating the plane so that it forms a ground for the character.
    - Explain the 3D space in detail using the right-handed coordinate system. Show how to use the right hand rule to modify the orientation of an object.

    - **Student Activity:** *(7 mins)*
    - Guide students to add <a-scene> and create a VR scene.
    - Guide the student/s to add a plane using <a-plane>.
    - Guide the student/s to rotate the plane by 90 degrees along the negative x-axis direction.

4. **Activity 2:Add the face body and protective gear:** *(10 mins)*

   Teacher Activity: *(10 mins)*

- Explain how the different shapes that form the character are created using a combination of primitives.
- Explain how the position attribute of a primitive is used to modify the position of an object.
- Describe the <a-entity> and the fact that they are the base of all objects in the scene.
- Illustrate that the face and the body of the character are overlapping due to their default positioning in 3D space.
- Discuss the parent and child entities and gradually the relative positioning of a child entity with respect to the parent entity. Highlight the fact that in the given example on slide, the child entity 1 has the same position as that of its parent entity.
- Demonstrate how the left eye and the mouth of the character can be created.

  Note: To observe the output after TA2.1 keep pressing on the down arrow key. You will eventually see the boxes coming into view on the screen. This is because the boxes are created at default position, before we reposition them.

  Student Activity: *(10 mins)*

- Guide the student/s to add another eye and parts of the helmet to the character.
- Explain how relative positioning is used to place different character objects at a specific point in 3D space.
- Encourage the students to try different values for position attribute and inspect the change in the position of character objects in the VR world.

5. **Activity 3: Add the Arms and Limbs :** *(15 mins)*

   Student Activity: *(8 mins)*

- Guide the student/s add the arms and limbs for the character thereby completing its look.
- Guide the students to understand the concept of nested use of primitives.

6. **Introduce the Post class project:** *(3 min)*
   - Add the right eye, extend the hair length, and add an air gun to add additional features to the character.

7. **Test and Summarize the class learnings:** *(5 mins)*
   - Check for understanding through quizzes and summarize learning after respective missions.
   - Summarize the overall class learning towards the end of the class.

8. **Additional activities:**
   - Complete the face of the character by adding the eyes.
   - Add the layers of hair to the character to complete its look.

9. **State the Next Class Objective:** *(1 min)*
   - We will use the world library to create a 3D game world with themes like jungle, dream, volcano, etc.

U.S. Standards:

Links Table		
Activity	**Activity Name**	**Link**
Class Presentation	Create a VR Game Character	https://s3-whjr-curriculum-uploads.whjr.online/bdea4c01-2416-4089-9048-98f77f581b39.html
Explore Activity	: Explore Activity	https://tynker.com/code/project/63d9dc11b98a03697b7a40e2
Teacher Activity 1	Add a VR Scene	https://tynker.com/code/project/63d9a0cad8f5a1101d28b7d2
Teacher Activity 1 Solution	Add a VR Scene - Solution	https://tynker.com/code/project/63d9a077be76c2335070c402
Student Activity 1	Add a VR Scene	https://tynker.com/code/project/63d9974782f3693e065c6032
Teacher Reference: Student Activity 1 Solution	Add a VR Scene - Solution	https://tynker.com/code/project/63d99e043c688d2978508823
Teacher Activity 2.1	Create the Head and Body	https://tynker.com/code/project/63d9dad8c0df885b78064522
Teacher Reference: Teacher Activity 2.1 Solution	Create the Head and Body - Solution	https://tynker.com/code/project/63d9db3565610032de2902a3
Teacher Activity 2.2	Create the Head and Body	https://tynker.com/code/project/63d9db4cc0df885b78064525
Teacher Reference: Teacher Activity 2.2 Solution	Create the Head and Body - Solution	https://tynker.com/code/project/63d9db66ed5a142fee3ad3b2
Student Activity 2	Create the Head and Body	https://tynker.com/code/project/63d9d60bd93c567e074ab012
Teacher Reference:Student Activity 2 Solution	Create the Head and Body - Solution	https://tynker.com/code/project/63ca1eca352e3616041514d2
Student Activity 3	Add the Upper and Lower Limbs	https://tynker.com/code/project/63d9db88c9ad2f7239584872
Teacher Reference: Student Activity 3 Solution	Add the Upper and Lower Limbs - Solution	https://tynker.com/code/project/63d9dc11b98a03697b7a40e2
Student's Additional Activity 1	Add the Eyes	https://tynker.com/code/project/63d9dc570a320552437b1712
Teacher Reference: Student's Additional Activity 1 Solution	Add the Eyes - Solution	https://tynker.com/code/project/63d9eaa305acc3680f0af692
Student's Additional Activity 2	Add the Hairline	https://tynker.com/code/project/63d9dcc10d453e123375b382

Teacher Reference: Student's Additional Activity 2 Solution	Add the Hairline - Solution	https://tynker.com/code/project/63d9eab73987fe0f993311e2
Post Class Project	Customize the Character	https://tynker.com/code/project/63dbadbbd1d7fb5057693082
Teacher Reference: Post Class Project Solution	Customize the Character - Solution	https://tynker.com/code/project/63dba8fe77749e08401884d2