

Topic	INTRODUCTION TO WEB AR	
Class Description	Students will understand Augmented reality. Students will learn to create the basic web based AR scene using A-Frame. Students will learn to render objects using marker based AR.	
Class	C166	
Class time	45 mins	
Goal	<ul style="list-style-type: none"> • Learn about Augmented reality Web Apps. • Learn to create a basic web based AR app using Hiro markers. • Learn to render 3D models as AR scenes. 	
Resources Required	<ul style="list-style-type: none"> • Teacher Resources <ul style="list-style-type: none"> ○ Visual Studio Code Editor ○ laptop with internet connectivity ○ smartphone ○ earphones with mic ○ notebook and pen • Student Resources <ul style="list-style-type: none"> ○ Visual Studio Code Editor ○ laptop with internet connectivity ○ smartphone ○ earphones with mic ○ notebook and pen 	
Class structure	Warm-Up Teacher-led Activity Student-led Activity Wrap-Up	5 mins 15 mins 20 mins 5 mins
WARM-UP SESSION - 10 mins		
<u>CONTEXT</u> <ul style="list-style-type: none"> • Web based A-Frame AR introduction. 		



Teacher Starts Slideshow

Slide 1 to 4

Refer to speaker notes and follow the instructions on each slide.

Hey <student's name>. How are you? It's great to see you!
Are you excited to learn something new today?

Following are the WARM-UP session deliverables:

- Greet the student.
- Revision of previous class activities.
- Quizzes.

ESR: Hi, thanks!

Yes I am excited about it!

Click on the slide show tab
and present the slides

WARM-UP QUIZ

Click on In-Class Quiz



Continue WARM-UP Session


Slide 5 to 17

Following are the session deliverables:

- Appreciate the student.
- Narrate the story by using hand gestures and voice modulation methods to bring in more interest in students.

Class Steps	Teacher Action	Student Action
	<p>From Class 145 to 165, we have made virtual reality web applications using A-Frame.</p> <p>Can you tell me what virtual reality is?</p> <p>In simple terms, virtual reality is a 3D artificial environment in which a person can interact with the virtual objects in the scene with the help of some goggles or headsets devices.</p>	<p>ESR: Varied.</p>

	<p>That means you can totally immerse in a very different environment with the help of these devices.</p> <p>These devices help you experience a completely different environment which is very similar to a real environment.</p> <p>That's the best part of having virtual reality applications as you can imagine anything and bring it to reality to be a part of it.</p> <p>Well that's quite a great achievement by humans!</p> <p>Have you wondered if you could make a giant bird sit on your hand?</p> <p>Or maybe you too could have a tiger pet in your living room and you could play with him?</p> <p>Or maybe you could learn something from a digital instructor like dance moves or something else?</p> <p>That would be so cool, right?</p> <p>This can be done using augmented reality. In short we call it AR.</p> <p>We are going to learn about augmented reality now.</p>	<p>ESR: Varied.</p> <p>ESR: Varied.</p> <p>ESR: Varied.</p> <p>ESR: Yes.</p>
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	<p>In upcoming classes, we will be learning how to make web based and mobile based augmented reality applications.</p> <p>Augmented reality applications help to enhance the real world by adding virtual objects into that.</p> <p>Let's understand how augmented reality is different from virtual reality.</p> <p>In simple terms, augmented reality is adding digital objects in the real world generally using the camera of the smartphone, but in virtual reality, the physical world is completely replaced by the virtual environment with the help of VR headset devices.</p> <p>Today we will be learning how to create a web based Augmented reality application.</p> <p>Are you excited?</p>	<p>ESR: Yes.</p>
	<p>Let's get started then.</p>	
<div>  <p>Teacher Ends Slideshow</p> </div>		
<p>TEACHER-LED ACTIVITY - 15 mins</p>		
<p><u>CHALLENGE</u></p> <ul style="list-style-type: none"> ● Create A-Frame Web AR scene. ● Render the 3D models in the AR scene using Hiro Marker. 		

<p>Step 2: Teacher-led Activity (15 mins)</p>	<p><i><The teacher clones the code from the Teacher Activity 1.></i></p> <p><u>[Teacher Activity 1]</u></p> <p>We have been making virtual reality with the help of the A-Frame framework.</p> <p>To make augmented reality, we have to use a library which can help us to create augmented reality scenes.</p> <p>For this, we are going to use AR.js.</p> <p>This library is specially designed to make augmented reality applications.</p> <p>With the help of this library, we can make three types of web-based AR application:</p> <ul style="list-style-type: none"> • Marker tracking based AR. • Image tracking based AR. • Location tracking based AR. <p>We will be learning how to make marker tracking based AR in today's class.</p> <p>Here I have the basic scene in A-Frame.</p>	<p>ESR: Using the animation component.</p>
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```
<!DOCTYPE html>
<html>

<head>
  <title>My First AR Application</title>
  <script src="https://aframe.io/releases/1.0.4/aframe.min.js"></script>
</head>

<body>
  <a-scene >

  </a-scene>
</body>

</html>
```

The first step would be adding the **aframe-ar.js** library.

Let's add the library src link in the <head>.

Link:

<https://raw.githubusercontent.com/AR-js-org/AR.js/master/aframe/build/aframe-ar.js>

```
<head>
  <title>My First AR Application</title>
  <script src="https://aframe.io/releases/1.0.4/aframe.min.js"></script>
  <script src="https://raw.githubusercontent.com/AR-js-org/AR.js/master/aframe/build/aframe-ar.js"></script>
</head>
```

Now we can attach **embedded ar.js** to the scene element to initialise **ar.js** and set its properties for the camera and tracking permissions.

```
<body style="margin : 0px; overflow: hidden;">

  <a-scene embedded arjs>

</a-scene>

</body>
```

```
<a-scene embedded
  arjs="sourceType: webcam; debugUIEnabled: false;trackingMethod:best"
  vr-mode-ui="enabled: false;">
</a-scene>
```



Let's quickly include the 3D glTF models src file in the Asset Management.

```
<a-assets>
  <a-asset-item id="tiger" src="./assets/tiger_run/scene.glTF"></a-asset-item>
</a-assets>
```

Now to display any object in our surrounding, we will have to tell A-Frame to use ar.js camera. This can be done with the help of <a-marker> tag.

But let's first understand why we need markers to display objects in our surroundings.

Since we are going to display the object in our real physical world, we need something to tell the computer program where it needs to start displaying.

	<p>So the marker is nothing but the starting point of the coordinate system where the object can be displayed.</p> <p>You can understand it as a reference point to create the coordinate system in the real physical world where the object can be displayed.</p> <p>That means wherever we will place the marker that will become the origin(0,0,0), that will be the starting point of the coordinate system.</p> <p>There are two most popular markers available: hiro and kanji markers.</p>	
<p>Hiro Marker</p> 		<p>Kanji Marker</p> 
	<p>To tell which type of marker to use, we will be using preset property.</p> <p>Let's add the <code><a-marker></code> tag and create a gltf-model entity as a child of the <code><a-marker></code> and test the output.</p>	


```
<!-- Hiro Marker -->
<a-marker preset="hiro">

</a-marker>
```

```
<!-- Hiro Marker -->
<a-marker preset="hiro">

  <a-entity id="model" position="-0.5 0 0" gltf-model="#tiger" rotation="0 -90 90" scale="2.5 2.5 2.5">
  </a-entity>

</a-marker>
```

To see the output:

- Use **ngrok** to run the application.
- Open **HTTPS URL** in your smartphone/laptop and give permission to use the camera.
- Open the **hiro marker image** and point the camera towards it.

***Note 1:** Make sure only ONE instance of ngrok is running and the local server is running on the same port as ngrok.*

***Note 2:** The object might not appear based on the camera position and Hiro marker at the user side. Adjust the positions, scale and rotation to set the orientation properly.*

***Note 3:** The marker image can be printed out for better AR experience.*

It will allow us to place the marker anywhere.

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
1: powershell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

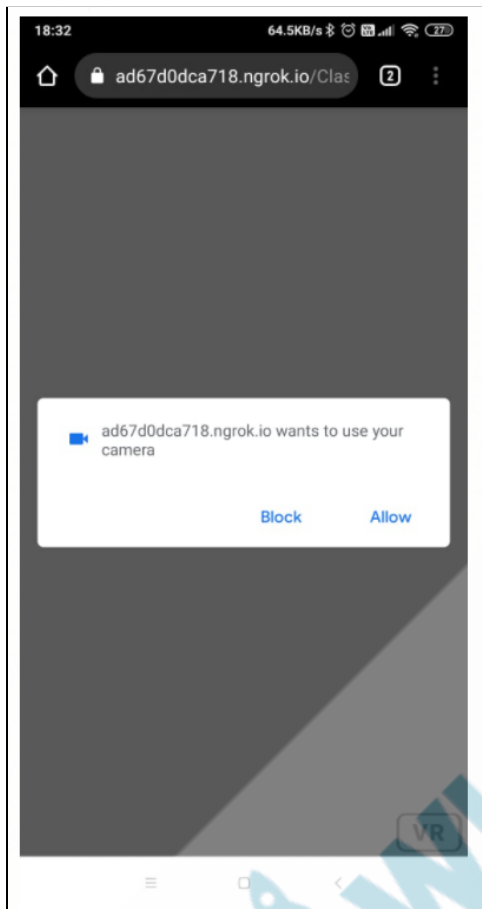
PS D:\WhiteHatJr\Classes> ngrok http 5500
```

Whole Image 513x509 18.20KB Port : 5500

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
1: ngrok
ngrok by @inconshreveable

Session Status      online
Account             pwhitehat6@gmail.com (Plan: Free)
Version             2.3.35
Region              United States (us)
Web Interface       http://127.0.0.1:4040
Forwarding           http://ad67d0dca718.ngrok.io -> http://localhost:5500
Forwarding           https://ad67d0dca718.ngrok.io -> http://localhost:5500
```

Whole Image 513x509 18.20KB Port : 5500



Do you remember which component we use to add the animation which is present in the model itself?



Amazing!

This component is part of the A-Frame extras library which we have used already.

Let's attach the component and see a running tiger in our room.

[Output Reference Link](#)

ESR: We use animation-mixer.

	<p>It was pretty cool to see things coming out of the phone in our real world.</p> <p>Now you will create an AR scene and render a cartoon superhero model.</p> <p>Are you excited?</p>	ESR: Yes!
Teacher Stops Screen Share		
	<p>Now it's your turn. Please share your screen with me.</p>	
<p>Teacher Starts Slideshow </p> <p>Slide 18 to 20</p> <p>Refer to speaker notes and follow the instructions on each slide.</p>		
<p>We have one more class challenge for you. Can you solve it?</p> <p>Let's try. I will guide you through it.</p>		
<p>Teacher Ends Slideshow </p>		
STUDENT-LED ACTIVITY - 20 mins		
<ul style="list-style-type: none"> • Ask the student to press the ESC key to come back to the panel. • Guide the student to start screen share. • Teacher gets into fullscreen. 		
<p><u>ACTIVITY</u></p> <ul style="list-style-type: none"> • Create an A-Frame Web AR scene. • Render 3D animated model in the AR scene. 		

Step 3: Student-Led Activity (20 mins)	<p><i>The teacher guides the student to clone the code from Student Activity 1.</i></p> <p><u>[Student Activity 1]</u></p> <p><i>Note: The student will repeat some activity performed by the teacher.</i></p>	
	<p>What should we do to start making the AR scene?</p> <p><i>Guide the student to add the aframe-ar.js library and attach the embedded arjs component to the scene element.</i></p>	<p>ESR: Add the supported library in the A-Frame scene.</p>

```
<title>AR Dance</title>

<script src="https://aframe.io/releases/1.0.4/aframe.min.js"></script>
<script src="https://raw.githack.com/AR-js-org/AR.js/master/aframe/build/aframe-ar.js"></script>
<script src="https://cdn.jsdelivr.net/gh/donmccurdy/aframe-extras@v6.1.1/dist/aframe-extras.min.js"></script>
<script src="https://raw.githack.com/whitehatjr/ar-gesture-handler/main/index.js"></script>
```

```
<body style="margin : 0px; overflow: hidden;">

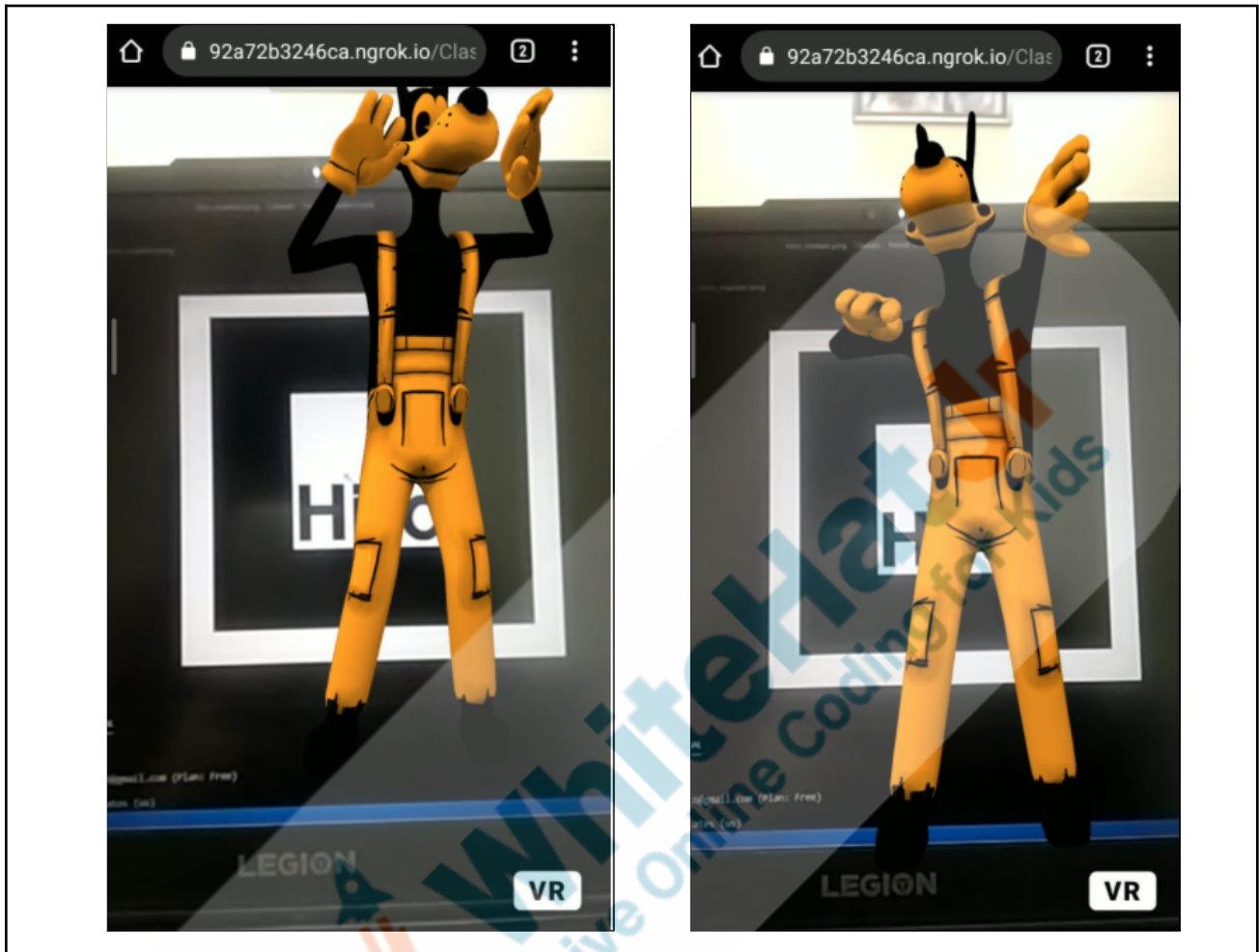
  <a-scene embedded arjs>

</a-scene>

</body>
```

```
<a-scene embedded
  arjs="sourceType: webcam; debugUIEnabled: false;trackingMethod:best"
  vr-mode-ui="enabled: false;">
</a-scene>
```

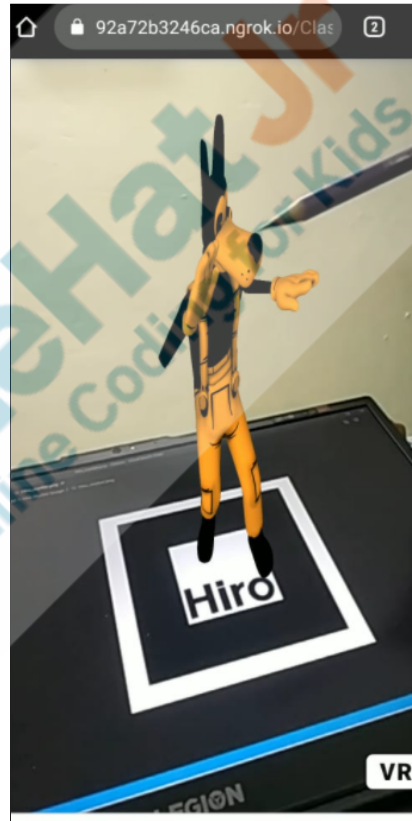
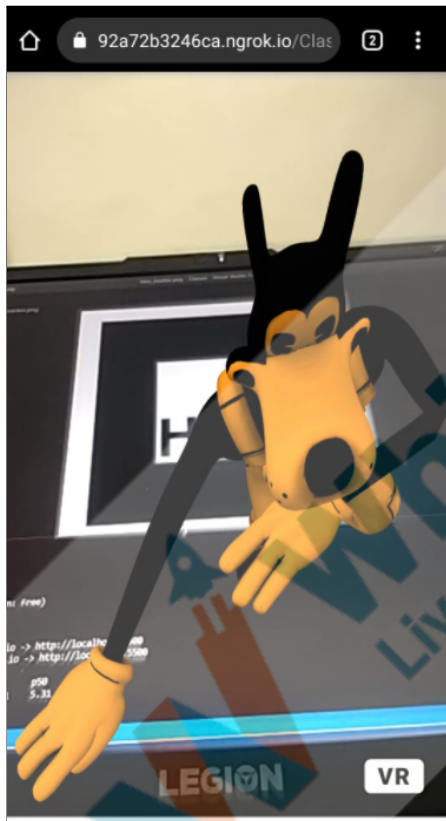
	<p>What should we do now?</p> <p>Yes.</p> <p><i>Guide the student to add the marker and gltf-model entity and its orientation.</i></p>	<p>ESR: Add the marker and the model entity.</p>
<pre><a-assets> <a-asset-item id="hero" src="./assets/samba_dancing_boris/scene.gltf"></a-asset-item> </a-assets></pre> <pre><!-- Hiro Marker --> <a-marker preset="hiro"> <a-entity id="model" position="-0.1 0 0" gltf-model="#hero" rotation="-90 0 0" scale="10 5 5" animation-mixer> </a-entity> </a-marker></pre>		
	<p><i>Guide the student to run and test the application using the https ngrok URL.</i></p>	
 <p>The screenshot shows the ngrok terminal interface. At the top, it says 'ngrok by @inconshreveable' and '(Ctrl+C to quit)'. Below that, 'Session Status' is shown as 'online'. Account details include 'pwhitehat6@gmail.com (Plan: Free)', 'Version 2.3.35', and 'Region United States (us)'. The 'Web Interface' is at 'http://127.0.0.1:4040'. Forwarding rules are listed: 'http://92a72b3246ca.ngrok.io -> http://localhost:5500' and 'https://92a72b3246ca.ngrok.io -> http://localhost:5500'. A 'Connections' table shows 263 total connections, 7 open, and various round trip times. At the bottom, 'HTTP Requests' are being tracked. The status bar at the very bottom indicates 'Ln 32, Col 8', 'Spaces: 2', 'UTF-8', 'CRLF', 'HTML', and 'Port : 5500'.</p>		



With no default position and rotation orientation the marker has to be horizontal.

```
<!-- Hiro Marker -->
<a-marker preset="hiro">

  <a-entity id="model" position="0 0 0" gltf-model="#hero" rotation="0 0 0" scale="10 5 5" animation-mixer>
  </a-entity>
</a-marker>
```



Teacher Guides Student to Stop Screen Share

WRAP UP SESSION - 5 mins

Teacher Starts Slideshow
Slide 21 to 24



Activity details

Following are the WRAP-UP session deliverables:

- Appreciate the student.
- Revise the current class activities.
- Discuss the quizzes.

WRAP-UP QUIZ
Click on In-Class Quiz

Continue WRAP-UP Session
Slide 25 to 30



Activity Details

Following are the session deliverables:

- Explain the facts and trivia
- Next class challenge
- Project for the day
- Additional Activity (Optional)

FEEDBACK

- Compliment the student for her/his effort in the class.
- Encourage the student to think and come up with their own solutions.

You get a "hats-off".

Alright. See you in the next class.

Make sure you have given at least 2 Hats Off during the class for:

Creatively Solved Activities  +10

Great Question  +10

Strong Concentration  +10

PROJECT OVERVIEW DISCUSSION

Refer the document below in Activity Links Sections

✕ End Class

Teacher Clicks

Additional Activities

Encourage the student to add a gesture handler component.

The student explores the functionality of the gesture handler.

To be able to move the models with the help of the touch, we will have to add many functionalities.

The **gesture-detector** and **gesture-handler components** have been written to handle touch gestures on the smartphone to **scale up/down** and **change the positions** of the models.

The component is added in the below library link.

Link:

<https://raw.githubusercontent.com/whitehatjr/ar-gesture-handler/main/index.js>

We can directly use the component names to enable those functionalities:

- Attach gesture-detector to the scene element.
- Attach gesture-handler to the gltf-model entity.

```
<script src="https://raw.githack.com/whitehatjr/ar-gesture-handler/main/index.js"></script>
```

```
<a-scene embedded arjs gesture-detector >
```

```
<a-entity id="model" position="-0.5 0 0" gltf-model="#tiger" rotation="0 -90 90" scale="2.5 2.5 2.5"
gesture-handler
animation-mixer>
</a-entity>
```

Activity	Activity Name	Links
Teacher Activity 1	Boilerplate Code	https://github.com/whitehatjr/PRO-C166-Boilerplate
Teacher Activity 2	Teacher Activity Ref	https://github.com/whitehatjr/PRO-C166-Teacher-Activity
Teacher Activity 3	Teacher Reference Code	https://github.com/whitehatjr/PRO-C166-Teacher-Ref
Teacher Activity 4	Output Reference 1	https://curriculum.whitehatjr.com/PRO+Asset/PRO+166+Output+Ref+1.mp4
Teacher Activity 5	Output Reference 2	https://curriculum.whitehatjr.com/PRO+Asset/PRO+166+Output+Ref+2.mp4
Teacher Activity 6	A-Frame AR.js Link	https://raw.githack.com/AR-js-org/AR.js/master/aframe/build/aframe-ar.js
Student Activity 1	Boilerplate Code	https://github.com/whitehatjr/PRO-C166-Boilerplate
Teacher Reference 1	Ngrok Updates	https://docs.google.com/document/d/1dlMry188lIEJl6rHEc3AkBashQSOWGQ40HQft29S8vQ/edit?usp=sharing
Teacher Reference 2	Project Document	https://s3-whjr-curriculum-uploads.whjr.online/038a6d59-e365-47d3-b17b-195e7

		8aca3e6.pdf
Teacher Reference 3	Project Solution	https://github.com/whitehatjr/PRO-C166-Project-Solution
Teacher Reference 4	Visual-Aid	https://s3-whjr-curriculum-uploads.whjr.online/10e2bb49-986a-4423-81fb-5c4aa0a50f01.html
Teacher Reference 5	In-Class Quiz	https://s3-whjr-curriculum-uploads.whjr.online/95d66901-11b4-4539-a63c-df1dda42d2ba.pdf