

# **CURRENT TRENDS IN SOFTWARE ENGINEERING**

**SE4010**



**Mixed Reality Assignment**

**Group ID: 55**

B.Sc. (Hons) in Information Technology Specializing in Software Engineering

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## **1. Introduction**

This report presents the development of a mixed reality application designed to immerse users in a dynamic warzone scenario, commemorating the victory over LTTE. The AR experience vividly simulates a high-intensity combat encounter where a soldier leaps from a helicopter to intercept a moving armored jeep, strategically surrounded by two tanks and a BRDM (armored reconnaissance vehicle). Utilizing marker-based technology, the application seamlessly integrates 3D animated models rendered in real time through the mobile camera, delivering an interactive and lifelike augmented reality experience.

## **2. Scenario**

The chosen scenery for the AR application is a warzone battlefield, designed to provide a visually immersive and dynamic experience. The scene features:

- **A helicopter rotating in a fixed position**
- **Soldiers jumping from the helicopter**
- **A moving armored jeep, two tanks, and a BRDM (armored reconnaissance vehicle)**
- **All elements are animated and accompanied by realistic sound effects**
- **A thematically relevant background to enhance the overall atmosphere**

This carefully crafted setting combines visual appeal and dynamic interaction, aligning with the objectives of creating an engaging and realistic AR application.

## **3. Development Process**

### **1. Tools**

The following applications and utilities were utilized for developing, hosting, and managing the project:

- **Visual Studio Code (VS Code)**
- **Web Browser (Google Chrome/Safari)**

## **2. Technologies**

The following programming frameworks and languages served as the foundation for our AR application:

- **A-Frame**
- **AR.js**
- **HTML5**
- **GLB (GL Transmission Format)**
- **JavaScript**

## **3. Steps Followed**

### **1. Marker Setup:**

- Utilized the HIRO marker preset from AR.js for scene detection and tracking.

### **2. Model Integration:**

- Imported .glb models for vehicles and characters, adjusting scale, position, and rotation for a realistic setup.

### **3. Animations:**

- Implemented movement animations for tanks, jeep, and BRDM, along with jump/rotation animations for the soldier and helicopter.

### **4. Sound Integration:**

- Integrated positional looping sound effects for each 3D object using <a-sound> components.

### **5. Background Layout:**

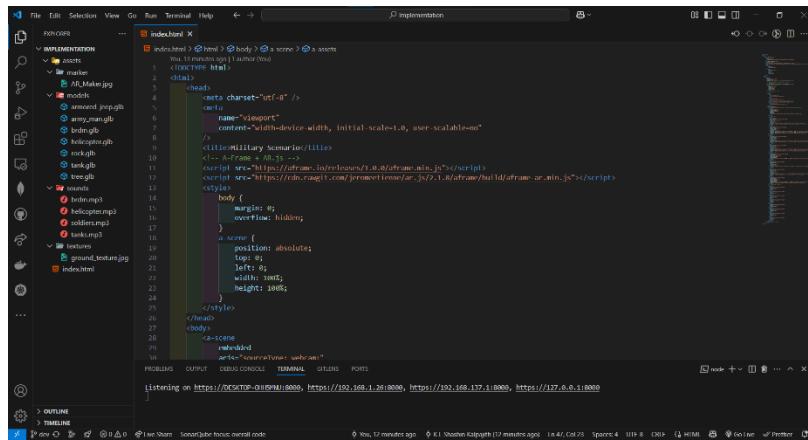
- Designed the background with textures, rock, and tree models to enhance realism.

### **6. Testing and Deployment:**

- Hosted the project using ws and tested it on a laptop device using a webcam, positioning the marker within the camera's view.

## 4. Implementation

### Folder Structure



The screenshot shows a code editor with the following folder structure:

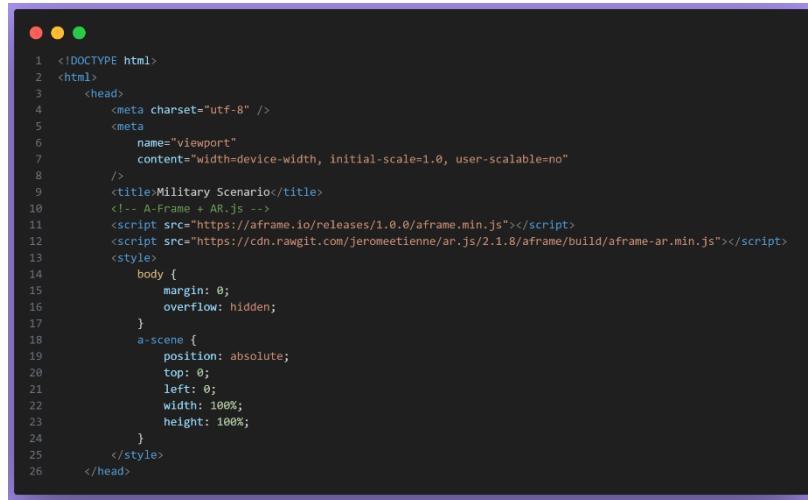
- IMPLEMENTATION
- assets
- marker
- models
- sound
- index.html

The `index.html` file contains the following code:

```
<!DOCTYPE html><html><head><meta name="viewport" content="width=device-width, initial-scale=1.0, user-scalable=no" /><title>Military Scenario</title><!-- A-Frame + AR.js --><script src="https://aframe.io/releases/1.0.0/aframe.min.js"></script><script src="https://cdn.rawgit.com/jeromeetienne/ar.js/2.1.8/aframe/build/aframe-ar.min.js"></script><style>body { margin: 0; overflow: hidden; }a-scene { position: absolute; top: 0; left: 0; width: 100%; height: 100%; }</style></head><body><a></a></body>
```

The terminal below shows the server is running on port 8000.

### Code Segments



```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8" />
    <meta
      name="viewport"
      content="width=device-width, initial-scale=1.0, user-scalable=no" />
    <title>Military Scenario</title>
    <!-- A-Frame + AR.js -->
    <script src="https://aframe.io/releases/1.0.0/aframe.min.js"></script>
    <script src="https://cdn.rawgit.com/jeromeetienne/ar.js/2.1.8/aframe/build/aframe-ar.min.js"></script>
    <style>
      body {
        margin: 0;
        overflow: hidden;
      }
      a-scene {
        position: absolute;
        top: 0;
        left: 0;
        width: 100%;
        height: 100%;
      }
    </style>
  </head>
```

```

1 <body>
2   <a-scene
3     embedded
4     arjs="sourceType: webcam;"
5     gesture-handler
6     renderer="colorManagement: true; physicallyCorrectLights: true;" 
7   >
8     <!-- Renderer properties for better color & light -->
9     <!-- Lighting -->
10    <a-light type="ambient" intensity="1" color="#FFFFFF"></a-light>
11    <!-- White ambient light -->
12    <a-light
13      type="directional"
14      intensity="0.8"
15      position="0 2 1"
16      color="#FFFFFF"
17    ></a-light>
18    <!-- White directional light -->
19
20    <!-- Assets -->
21    <a-assets>
22      <audio
23        id="helicopter-sound"
24        src="assets/sounds/helicopter.mp3"
25      ></audio>
26      <audio
27        id="soldier-sound"
28        src="assets/sounds/soldiers.mp3"
29      ></audio>
30      <audio id="brdm-sound" src="assets/sounds/brdm.mp3"></audio>
31      <audio id="tank-sound" src="assets/sounds/tank.mp3"></audio>
32      
36    </a-assets>

```

```

1 <a-marker preset="hiro">
2   <!-- LARGER Terrain Plane with material settings for original color display -->
3   <a-plane
4     id="ground-plane"
5     position="0.5 0.01 4"
6     rotation="90 0 0"
7     width="30"
8     height="30"
9     material="src: #ground-texture; repeat: 30 30; roughness: 1; metalness: 0;" 
10   >
11   </a-plane>
12   <!-- Helicopter -->
13   <a-entity
14     id="helicopter"
15     gltf-model="assets/models/helicopter.glb"
16     gesture-handler
17     scale="0.002 0.002 0.002"
18     rotation="0 90 0"
19     position="-0.5 2.5 0"
20     animation="property: rotation; to: 0 450 0; loop: true; dur: 8000; easing: linear"
21     sound="src: helicopter-sound; autoplay: true; loop: true; positional: true; volume: 0.9"
22   ></a-entity>
23   <!-- Soldier [1] -->
24   <a-entity
25     gltf-model="assets/models/army_man.glb"
26     gesture-handler
27     scale="0.15 0.15 0.15"
28     rotation="0 90 0"
29     position="-0.5 1 0"
30     animation="property: rotation; to: 0 450 0; dur: 6000; loop: true; easing: linear"
31     animation_move="property: position; to: -0.5 -3 0; dur: 3000; dir: alternate; loop: true; easing: linear"
32     sound="src: soldier-sound; autoplay: true; loop: true; positional: true; volume: 0.9"
33   ></a-entity>
34   <!-- Soldier [2] -->
35   <a-entity
36     gltf-model="assets/models/army_man.glb"
37     gesture-handler
38     scale="0.15 0.15 0.15"
39     rotation="0 90 0"
40     position="-0.5 1 0"
41     animation_rotate="property: rotation; to: 0 450 0; dur: 6000; loop: true; easing: linear"
42     animation_move="property: position; to: -0.5 -3 2; dur: 3000; dir: alternate; loop: true; easing: linear"
43   ></a-entity>
44   <!-- Soldier [3] -->
45   <a-entity
46     gltf-model="assets/models/army_man.glb"
47     gesture-handler
48     scale="0.15 0.15 0.15"
49     rotation="0 90 0"
50     position="-0.5 1 0"
51     animation_rotate="property: rotation; to: 0 450 0; dur: 6000; loop: true; easing: linear"
52     animation_move="property: position; to: -0.5 -3 4; dur: 3000; dir: alternate; loop: true; easing: linear"
53     sound="src: soldier-sound; autoplay: true; loop: true; positional: true; volume: 0.9"
54   ></a-entity>

```

```

1 <!-- Armored Jeep -->
2   <a-entity
3     gltf-model="assets/models/armored_jEEP.glb"
4     gesture-handler
5     scale="0.006 0.006 0.006"
6     rotation="0 270 0"
7     position="0 0 2"
8     animation="property: position; to: 0 0 6; dur: 7000; dir: alternate; loop: true; easing: linear"
9   ></a-entity>
10  <!-- Tank [1] -->
11  <a-entity
12    gltf-model="assets/models/tank.glb"
13    gesture-handler
14    scale="0.2 0.2 0.2"
15    rotation="0 90 0"
16    position="1 0 1.5"
17    animation="property: position; to: 1 0 6.5; dur: 16000; dir: alternate; loop: true; easing: linear"
18  ></a-entity>
19  <!-- Tank [2] -->
20  <a-entity
21    gltf-model="assets/models/tank.glb"
22    gesture-handler
23    scale="0.2 0.2 0.2"
24    rotation="0 90 0"
25    position="-1 0 1.5"
26    animation="property: position; to: -1 0 6.5; dur: 16000; dir: alternate; loop: true; easing: linear"
27    sound="src: #tank-sound; autoplay: true; loop: true; positional: true; volume: 0.9"
28 ></a-entity>
29 <!-- BRDM -->
30 <a-entity
31   gltf-model="assets/models/brdm.glb"
32   gesture-handler
33   scale="0.15 0.15 0.15"
34   rotation="0 180 0"
35   position="0 0 5"
36   animation="property: position; to: 0 0 8; dur: 17000; dir: alternate; loop: true; easing: linear"
37   sound="src: #brdm-sound; autoplay: true; loop: true; positional: true; volume: 0.9"
38 ></a-entity>

```

```

1   <!-- Environmental Elements -->
2   <!-- Trees -->
3   <a-entity
4     gltf-model="assets/models/tree.glb"
5     scale="0.5 0.5 0.5"
6     position="2 0 3"
7   ></a-entity>
8   <a-entity
9     gltf-model="assets/models/tree.glb"
10    scale="0.5 0.5 0.5"
11    position="4 0 6"
12  ></a-entity>
13  <a-entity
14    gltf-model="assets/models/tree.glb"
15    scale="0.5 0.5 0.5"
16    position="1 0 8"
17  ></a-entity>
18  <a-entity
19    gltf-model="assets/models/tree.glb"
20    scale="0.5 0.5 0.5"
21    position="-3 0 5"
22  ></a-entity>
23  <!-- Rocks -->
24  <a-entity
25    gltf-model="assets/models/rock.glb"
26    scale="0.3 0.3 0.3"
27    position="5 0 5"
28  ></a-entity>
29  <a-entity
30    gltf-model="assets/models/rock.glb"
31    scale="0.3 0.3 0.3"
32    position="6 0 2"
33  ></a-entity>
34  <a-entity
35    gltf-model="assets/models/rock.glb"
36    scale="0.3 0.3 0.3"
37    position="3 0 7"
38  ></a-entity>
39  <a-entity
40    gltf-model="assets/models/rock.glb"
41    scale="0.3 0.3 0.3"
42    position="-2 0 4"
43  ></a-entity>
44  </a-marker>
45  <a-entity camera></a-entity>
46  </a-scene>
47  </body>
48 </html>

```

## Working Application



VR



VR

## 4. Creative Features

The AR application incorporates the following creative features to enhance user engagement and realism:

- **Animations:**

All 3D models are dynamically animated. Vehicles move back and forth, the soldier performs a rotational jump, and the helicopter continuously rotates mid-air.

- **Sound Integration:**

Each object is paired with a corresponding sound effect (e.g., engine hum, helicopter rotor noise, battle ambiance). The sounds are spatially positioned and seamlessly loop throughout the AR experience.

- **Realistic Scene Composition:**

The scene is meticulously crafted with accurate scaling, precise object placement, and well-defined movement paths, contributing to a heightened sense of realism and immersion.

## 5. Conclusion

This warzone-themed AR application exemplifies the potential of marker-based augmented reality, leveraging the robust capabilities of A-Frame and AR.js. By integrating animated 3D models, interactive movements, and immersive sound effects, the project delivers a highly engaging and realistic experience.

Throughout the development process, valuable hands-on skills were acquired in AR development, 3D asset management, animation, and webcam-based web testing. The outcome is a webcam-accessible, web-based AR application that vividly simulates a dynamic battlefield scene in real time.

## **Team Members and Contribution**

### **Team Members**

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### **Contribution**

Registration Number	Contribution
IT21378270	Selected and imported animated 3D BRDM models, integrated movement and action animations, embedded sound effects, designed the layout, and generated the final report.
IT21377358	Selected and imported animated 3D Jeep models, integrated movement and action animations, embedded sound effects, designed the layout, and generated the final report.
IT21355196	Selected and imported animated 3D helicopter with soldiers' models, integrated movement and action animations, embedded sound effects, designed the layout, and generated the final report.
IT21356018	Selected and imported animated 3D tank models, integrated movement and action animations, embedded sound effects, designed the layout, and generated the final report.

### **Git Repository Link**

<https://github.com/Shashin99/Mixed-Reality.git>

### **Video Demonstration Link**

<https://drive.google.com/file/d/1wA8oizB9lXEEFthYqGHKYvNew9VwTVhR/view?usp=sharing>