

# Deliverable G

## Prototype II and Customer Feedback

**Team F13**

Alex Laver, Bilal Siddiqi, Kaden MacCrimmon, Remi Thomas-Richard, Tiantian Wang

March 12<sup>th</sup>, 2023

## **Abstract**

In Prototype II, the team focused on developing the environment and user interface experience – including interactive features and animations. The menu screens have been improved upon, including pause and end menus and improving the buttons with a laser component. Testing of Prototype II was completed and the results of testing show that all elements are working as they should. In Prototype III, the team will focus on finalizing the environments, user interface, and story board. Audio components will also be added to improve the realism and emotionality of the experience.

## Table of Contents

List of Figures .....	2
1. Introduction.....	3
2. Customer Feedback.....	3
3. Prototype I.....	3
3.1 Storyboard.....	<b>Error! Bookmark not defined.</b>
3.2 Environment.....	3
3.3 User Interface.....	5
4. Bill of Materials .....	9
5. Prototyping Test Plan.....	10
5.1 Testing Summary .....	10
5.2 Summary of Prototyping and Testing .....	12
5.3 Testing Results & Comments .....	13
6. Prototype II .....	13
7. Conclusion .....	13

## List of Figures

Figure 1 View of user's house and the general view of the neighborhood layout.....	3
Figure 2 Close up front view of the user's house with party banner. ....	4
Figure 3: Graveyard scene environment .....	4
Figure 4: End menu.....	5
Figure 5: Pause menu coding.....	6
Figure 6: AI control script.....	7
Figure 7: Animated characters running.....	8

## 1. Introduction

For this deliverable, our team completed our Prototype II. The goal of this deliverable was to expand on our Prototype I: all environments were completed, and the UI of the experience was refined. Tests completed to date have been successful. In Prototype III, the team will focus on completing the design of each scene, adding audio elements, and cutting all scenes together. Testing will be conducted by the team with users to obtain outside feedback of the experience.

## 2. Customer Feedback

In client meeting 2, the client was presented with prototype I, including videos of the experience that has been recorded. It was explained how the product development has been progressing and what the next design steps are. The client did not offer any specific feedback in the meeting but expressed that they are happy with the product so far and are excited to see the final experience.

## 3. Prototype I

### 3.1 Environment

The house scene environment was started. This environment includes many assets combined to create a custom neighborhood that the user lives in. The user will be sent to this scene after the office scene and will be getting ready to give a birthday present to their child. They will then be interrupted by killer robots rushing onto the front yard as they think the child is holding a gun, but instead it is a water gun. The purpose of this scene is to aid the user to visualize the concerns about the integration of killer robots into society. The user will witness how a simple error and misrecognition by the robot can have dire consequences.



*Figure 1 View of user's house and the general view of the neighborhood layout*

Next steps for this scene is adding more textures to the objects, as well as completing one neighborhood block to make the scene more realistic for the user. Improvements that can currently be made to the scene are enlarging the front yards to accommodate for the party materials that will be there. Some more vegetation and fences will be added to create more depth to the scene and improve its quality.



*Figure 2 Close up front view of the user's house with party banner.*

The graveyard scene environment was created, which includes the graveyard itself, writing on one of the gravestones, and a bouquet of flowers that the user will interact with and place on the ground in front of the gravestone. The purpose of this scene is to make the user feel a sense of realness upon completion of the experience. The death of a child is horrible, and the purpose of the scene in the graveyard is to force the user to see a real consequence of the use of autonomous killer robots.



*Figure 3: Graveyard scene environment*

The final environment that was made was the End scene where the user is given the choice to restart or leave the experience. Restarting will put the user back in the office and the leave will bring them back to the main menu. In the end scene, the user is also provided with a link to the stop killer robots website to reference for additional information about the issues relating to the legalization of autonomous killer robots.

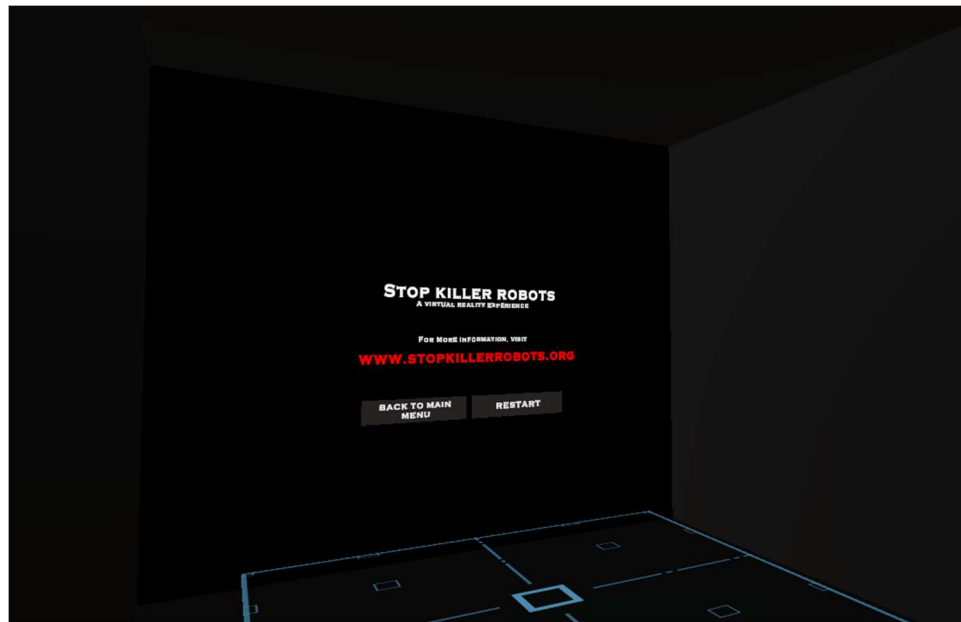


Figure 4: End menu

### 3.2 User Interface

For Prototype II, we expanded on the UI for the experience. During the experience, the user can press on the 'Menu' button to open a pause menu which gives the user the option to either go back to the experience or go back to the main menu. To do this, a new input bind had to be added via the SteamVR application which, when pressed, runs a script that activates the pause canvas. In Figure 5, when the scene starts, the pause menu is not activated. When the 'Pause ()' function is called by the 'Menu' button being pressed, the canvas appears. The 'Update' function makes the menu appear in front of the user and updates its position every frame.

```

public class PauseScript : MonoBehaviour
{
    public GameObject PauseMenu;
    public Camera VRCamera;
    public GameObject TeleportingArea;

    public SteamVR_LaserPointer laserPointer;

    void Start()
    {
        PauseMenu.SetActive(false);
        TeleportingArea.SetActive(true);
        laserPointer.PointerClick += PointerClick;
    }

    public void PointerClick(object sender, PointerEventArgs e)
    {
        if (e.target.name == "BackCube")
        {
            PauseMenu.SetActive(false);
            TeleportingArea.SetActive(true);
        }
        else if (e.target.name == "MenuCube")
        {
            SceneManager.LoadScene("MainMenu");
        }
    }

    public void Pause()
    {
        PauseMenu.SetActive(true);
        TeleportingArea.SetActive(false);
    }

    void Update()
    {
        PauseMenu.transform.position = VRCamera.transform.position + VRCamera.transform.forward * 1;
        PauseMenu.transform.rotation = new Quaternion(0.0f, VRCamera.transform.rotation.y, 0.0f, VRCamera.transform.rotation.w);
    }
}

```

Figure 5: Pause menu coding

Also, a laser pointer has been added to the menus, so the user does not have to use the teleport methods to get close to the buttons. This code is visible in (code figure) where when the scene starts, the Laser Pointer component is called. In the 'PointerClick' function, if the user clicks when the pointer is colliding with a button cube, it will do what that button is meant to do.

### 3.3 Animations

For prototype II, we explored character movement and the associated animations to make the movement look functional. These movements and animations will be represented during the party scene where the user's child and their friends are seen running around the yard playing with a water gun before the autonomous weapon attacks. To do this, we followed the Unity tutorial for creating a crowd, but only used select elements from the tutorial to create what we desired. Characters were placed in the environment and given the NavMesh agent component. Once this was added, we implemented the AI Control script after making a few changes to allow the characters to have the running animation. Finally, cubes were placed slightly above the surface of the plane and tagged as "goal" so the NavMesh agent characters would know to move to one of the "goal" objects. The last step was to add an if statement to allow the characters to move to another "goal" once they reached their first target "goal". The AI Control script can be seen in Figure 6.

```

AIControl > Update()
1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4  using UnityEngine.AI;
5
6  public class AIControl : MonoBehaviour {
7
8      GameObject[] goalLocations;
9      NavMeshAgent agent;
10     Animator anim;
11
12     void Start() {
13
14         agent = this.GetComponent<NavMeshAgent>();
15         goalLocations = GameObject.FindGameObjectsWithTag("goal");
16         int i = Random.Range(0, goalLocations.Length);
17         agent.SetDestination(goalLocations[i].transform.position);
18         anim = this.GetComponent<Animator>();
19         anim.SetTrigger("isRunning");
20     }
21
22
23
24     void Update() {
25         if (agent.remainingDistance < 1)
26         {
27             int i = Random.Range(0, goalLocations.Length);
28             agent.SetDestination(goalLocations[i].transform.position);
29         }
30     }
31 }

```

Figure 6: AI control script

The last thing we added was a first-person camera prefab with a NavMesh Object capsule collider so the NPC's run around the camera you are controlling as if you were a person. Figure 7 shows a screenshot of the characters in motion.



*Figure 7: Animated characters running*

## 4. Bill of Materials

An updated bill of materials can be seen in table 4.1. From Deliverable F, a few assets have been added which include scene-specific object including a keychain for the office scene, party decorations for the home scene, and flowers for the graveyard scene.

Table 4.1

Bill of Materials

Bill of Materials					
Item Number	Item Description	URL	Quantity	Unit Price (\$)	Extended Price
1	Steam VR	<a href="https://store.steampowered.com/vr/">https://store.steampowered.com/vr/</a>	1	\$-	\$-
2	Unity	<a href="https://unity.com/">https://unity.com/</a>	1	\$-	\$-
3	HTC Vive (VR Headset)	<a href="https://www.htcvive.com/">https://www.htcvive.com/</a>	1	\$-	\$-
4	Computer/Laptop		1	\$-	\$-
5	Office Background	<a href="https://assethub.unity.com/3d/environments/office-background">https://assethub.unity.com/3d/environments/office-background</a>	1	\$10.00	\$10.00
6	Home Background	<a href="https://assethub.unity.com/3d/environments/stylized-sunroom">Stylized Sunroom</a>	1	\$6.99	\$6.99
7	Cemetery Background	<a href="https://assethub.unity.com/3d/environments/cemetery">https://assethub.unity.com/3d/environments/cemetery</a>	1	\$9.90	\$9.90
8	Patrol Drone	<a href="https://assethub.unity.com/3d/environments/drone">https://assethub.unity.com/3d/environments/drone</a>	1	\$-	\$-
9	Autonomous Weapon	<a href="https://assethub.unity.com/3d/environments/autonomous-weapon">https://assethub.unity.com/3d/environments/autonomous-weapon</a>	1	\$-	\$-
10	Characters and Animations	<a href="https://leapfrog.com/">https://leapfrog.com/</a>	N/A	\$-	\$-
11	Animations 2	<a href="https://www.youtube.com/watch?v=...">https://www.youtube.com/watch?v=...</a>	1	\$-	\$-
12	Screaming Audio		1	\$-	\$-
13	Party Audio	<a href="https://assethub.unity.com/3d/environments/party-audio">https://assethub.unity.com/3d/environments/party-audio</a>	1	\$-	\$-
14	Machine Gun Audio		1	\$-	\$-
15	Present Asset	<a href="https://assethub.unity.com/3d/environments/present-asset">https://assethub.unity.com/3d/environments/present-asset</a>	1	\$-	\$-
16	Party pack	<a href="https://assethub.unity.com/3d/environments/party-pack">https://assethub.unity.com/3d/environments/party-pack</a>	1	\$-	\$-
17	Keychain	<a href="https://assethub.unity.com/3d/environments/keychain">https://assethub.unity.com/3d/environments/keychain</a>	1	\$4.99	\$4.99
18	Grass texture	<a href="https://assethub.unity.com/3d/environments/grass-texture">https://assethub.unity.com/3d/environments/grass-texture</a>	1	\$-	\$-
19	Car	<a href="https://assethub.unity.com/3d/environments/car">https://assethub.unity.com/3d/environments/car</a>	1	\$-	\$-
20	Flowers	<a href="https://assethub.unity.com/3d/environments/flowers">https://assethub.unity.com/3d/environments/flowers</a>	1	\$5.00	\$5.00
21	Forest	<a href="https://assethub.unity.com/3d/environments/forest">https://assethub.unity.com/3d/environments/forest</a>	1	\$-	\$-
Total					\$36.88

## 5. Prototyping Test Plan

### 5.1 Testing Summary

Tests conducted for Prototype II are explained in Table 5.1.1. Prototype II consisted of testing the character animations, testing improved features of the menus, and testing the emotional aspects of the experience.

Table 5.1.1

Prototype II Test Descriptions

Test ID	Test Objective (Why)	Description of Prototype used and of Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1	Learning how to create character animations	Focused Physical, NPC's were added to an environment and given the NavMesh agent component. This allows them to roam freely in the defined space from each of the set "goal" locations. The Crowd animator was then added to give the characters animation such as idle/standing still, walking, and running. The next step was to add the AI Control script and manipulate it to set an animation to the character when they moved. For our purposes, we manipulated the code such that the characters would be given the running animation. Finally, "goal" locations were set using cubes tagged "goal" so that the NPC's would move to those	Are the characters moving/walking? Are the characters moving how they should?	Est. ~ 3 hours  Saturday, March 11, 2023

		locations freely and randomly. To test it all, we ran the unity program and observed the NPC's behaviour. We also tried various "goal" locations and animations on the characters to ensure it all worked together.		
2	Expanding on the User Interface	<p>Focused Physical, Interactive user interface: The menus will now include a laser pointer to make it easier to the client to click on buttons. The LaserPointer is added to the Hands objects of the user. This laser is attached to the users' right hand.</p> <p>Pause Menu: In the experience, the user can now press a button on their controllers to open the menu. The user is given the choice to return to the experience or go back to the main menu.</p>	<p>Can buttons be pressed using the laser?</p> <p>Can the buttons be</p>	<p>Sunday, March 12, 2023</p> <p>Est. ~ 3 hours</p>
3	Incorporating an Emotional Element	<p>Focused Physical,</p> <p>The scene in the graveyard environment is designed to enhance the emotional response of the user upon the death of the child in the experience. The graveyard environment is notably more realistic</p>	<p>Is the experience emotional?</p> <p>Does the user feel sad/angry/happy upon completion of the experience?</p>	<p>Saturday March 11, 2023</p> <p>Est. ~ 0.5 hours</p>

		looking and more “grim” which creates a contrast with the office and home scenes where the environment is more cartoon-like and artificial.		
--	--	---	--	--

## 5.2 Summary of Prototyping and Testing

A summary of tests conducted for Prototypes I and II is seen in Table 5.2.1.

Table 5.2.1

### Summary of Prototype I and II Testing

Prototype					Tests		
#	Type	Objective	Fidelity	Feedback	Objective	Result	Time
1	Focused Physical	Interactive Elements (User Interface)	Low	No client/user involved	Picking up Objects	Yes	2 hours March 5, 2023
1	Focused Physical	Menus (User Interface)	High	No client/user involved	Pushing Buttons, Scene Transition	Yes	2 hours March 12, 2023
1	Focused Physical	Required Area	Low	No client/user involved	Area Required	1m2	1 hours March 5, 2023
2	Focused Physical	Character Animations	Low	No client/user involved	Animating Character Movements	Yes	2.5 hours March 11, 2023
2	Focused Physical	Improve the Menus (User Interface)	High	No client/user involved	Add pause and end menus, use a laser to push buttons	Yes	3 hours March 12, 2023
2	Focused Physical	Add Emotional Elements	Low	No client/user feedback	Incorporate Emotional Elements	Needs Improvement	0.5 hours March 11, 2023

### 5.3 Testing Results & Comments

A summary of results obtained during testing can be found in Table 5.3.1.

Table 5.3.1

#### Testing Results

Functional Requirement	Measured Value	Target Value	Comment
Interactive	Yes	Yes	The interactive functions tested are functioning
<b>Non-Functional Requirement</b>			
Emotional	2/10	7/10	The emotional portion of the scene in the graveyard will be improved once all scenes of the experience are incorporated
<b>Constraint</b>			
Required Area	1m2	4m2	Meets Target Value

## 6. Prototype III

The next step in the project is Prototype III. This will be our final prototype with the goal of finishing the experience and receiving user feedback to refine the product. For Prototype III, the environment and user interface of each scene will be completed, the scenes will be pieced together with appropriate transitions, and audio will be added. Testing will be conducted to find and resolve any issues.

## 7. Conclusion

With the completion of Prototype II, the user interface and environments for each scene have been improved upon. All scenes have been established with their corresponding assets. To complete the experience, each scene will be completed, audio will be added, and all scenes will be cut together. Finally, user testing will be conducted to identify bugs in the coding and to determine the general reception of the product. With feedback from testing, some alterations will be made.