

GNG1103
Design Project User and Product Manual

Virtual Reality for Ban

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List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition
3D	Three Dimensional
BOM	Bill of Materials
AR	Augmented Reality
VR	Virtual Reality

Table 2. Glossary

Term	Definition
Autonomous	Refers to the ability of a system or entity to act independently or self-govern without external control or influence.
Dehumanizes	Means to treat someone or something as if they are not human, to deprive them of their dignity, rights, or respect.
Joycons	A type of detachable controller that features motion sensing, vibration, and a variety of buttons and joysticks.
Moral Agency	Is the capacity of an individual or group to make moral decisions and be held responsible for their actions. It is the ability to act according to one's own moral principles and values.

1 Introduction

The context of the work is a VR game that was created to raise awareness about the dangers of autonomous weapons and encourage the public to take action to prevent their development and use. The game aims to educate players about the potential consequences of autonomous weapons and to promote public engagement and activism on this issue.

Assumptions made for this work include that players have access to a VR headset. The document is organized into several sections that include an introduction, overview, getting started, using the systems, and other sections for the purpose that others may maintain or reproduce the project. Each section will cover different aspects of the VR project and will simplify the layout of the project.

The scope of activities covered in the document is limited to playing the VR game and participating in advocacy efforts related to autonomous weapons. The intended audience for this document is anyone who is interested in learning more about the dangers of autonomous weapons and wants to take action to prevent their development and use. This may include students, activists, policymakers, and members of the general public.

Security and safety considerations associated with the use of the User and Product Manual include ensuring that players have access to appropriate safety equipment when using the VR headset, such as padded flooring and safety barriers to prevent falls or collisions. Additionally, players should be aware of the potential risks associated with prolonged use of VR technology, such as eye strain, dizziness, and nausea. Privacy considerations may include ensuring that player data is collected and stored securely and that any personal information is protected in accordance with applicable privacy laws and regulations.

2 Overview

The main problem with our future and autonomous weapons, is that these weapons are programmed and have no choice and say in terms of deciding what to do in violent scenarios. This could involve someone innocent being killed, or even an entire massacre happening just because something is programmed wrong. The dangers of autonomous weapons need to be identified since they act without any human intervention and human judgment. In general, these robots could cause chaos to our future if not prevented. This problem also needs to be solved since it's being debated across the globe among politicians and other officials.

Mines Action Canada needs an informative 2-5 minute virtual reality experience that evokes emotion and conveys the user to take a position opposing the use of autonomous weapons.

Our product is different from other products due to the sheer factor that our product both educates and also inflicts emotional damage to the user. This is shown by having posters that the user can read and interact with, but also having a destroyed city that is used to show emotion.



The main features above show the destroyed city that was caused by autonomous weapons. In the second picture, on the bottom right is a bunker where you can interact with the community of the former beautiful city. The third picture shows the room of posters being bombed by these autonomous planes that were misprogrammed.

The main architecture consists of autonomous robots and a city that they destroyed. The city contains citizens inside a bunker, fire, broken windows, ruined buildings, and lots of smoke. The button on the controller helped the character in the game move in first-person mode.

2.1 Conventions

No conventions were used in this document.

2.2 Cautions & Warnings

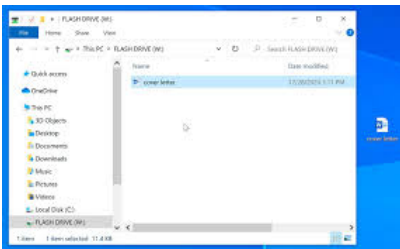
Currently, our virtual reality experience has no warnings as it should be suitable for anyone to watch and understand the message. The virtual reality experience is suitable for anyone of any age, there is no gore, no harsh language, only emotions that may be affected after going through the experience.

3 Getting started

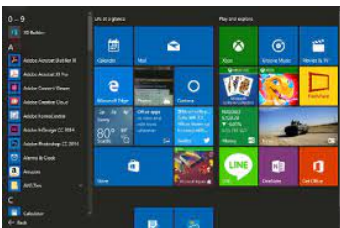
1. Setup: The first step in using the VR game prototype is to set up the VR headset and controllers. This typically involves connecting the headset to a computer or gaming console, and calibrating the headset and controllers to ensure that they are working properly. Make sure to have a certain amount of free space to avoid bumping into equipments or other people.



2. Download the game: Once the VR headset and controllers has been set, download the game is case you havn't already. This can be done by uploading the files that was stored in the USB flash.



3. Launch the game: Once the VR headset and controllers are set up, the next step is to launch the game. This can typically be done from within the VR headset or from the computer or gaming console.



4. Navigate the game environment: After launching the game, players will need to navigate the game environment using the VR controllers. This typically involves moving around within the game world, interacting with objects and other characters.



5. Play the game: The main objective of the VR game prototype is to raise awareness about the dangers of autonomous weapons and to encourage players to take action to prevent their development and use. This is accomplished through a navigating through the city and witnessing the destructions caused by the autonomous weapons.



6. Exit the game: Once players have completed the objectives of the game, or when they are ready to exit the game, they can typically use the PC's keyboard to exit the game by pressing Control+Alt+Delete and exiting the game.

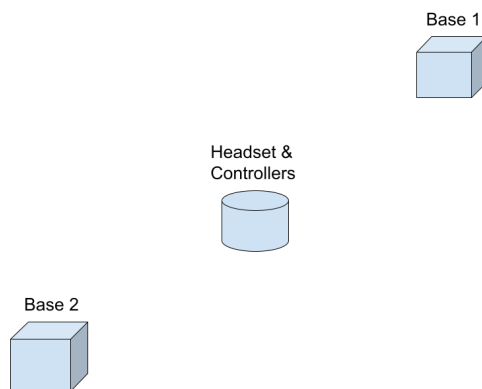


3.1 Configuration Considerations

Required devices:

- HTC VIVE headset
- HTC VIVE controller(s)
- HTC VIVE base station and stand set
- personal audio device with 3.5mm aux

Base station set up: Each base station must be above the users head and pointed down towards the playing field.



(figure 1)

3.2 User Access Considerations

The users of the VR experience can remotely be anyone, but the experience is targeted towards parliamentarians and officials to raise awareness of the dangers of autonomous weapons. The following are some restrictions placed for those who have some type of disability:

- Epilepsy: The prototype is suitable for those with epilepsy.
- Handicapped: Those in a wheelchair should have minimal difficulty as the prototype does not require the user to walk or even stand.

3.3 Accessing/setting up the System

1. Turn on the computer
2. Open unity hub and then open the project “F23Final”

3. Open Steam and then open “steam vr” by searching for it in the game library.
4. Go back into unity and press the play button in the top center of the screen.

3.4 System Organization & Navigation

The system consists of two scenes which the user transitions between. The first scene, The City, is loaded when the game is first launched. The second scene, The Bunker, is loaded after the user finds and pushes the button. The transition itself is controlled by a script and an event trigger in the button.

3.5 Exiting the System

Turning off the system is simple, first press the play button on the top center of the screen (this must be done on the computer and cannot be done while playing the game). Next, close unity and steam and shut down the computer.

4 Using the System

The player begins their journey in the town and must navigate their way to the bunker by utilizing the teleportation feature and following the designed paths until they reach their destination. Once they arrive at the bunker, they can use the left and right turn buttons to access and open the door by pushing an emergency button.



5 Troubleshooting & Support

This section focuses on any problems users may have when using the VR and the VR system.

5.1 Error Messages or Behaviors

See Appendix II, Table 4: Error Codes

5.2 Special Considerations

Listed below are some common issues that may arise on Unity, and simple ways that you may troubleshoot these issues

Slow Framerate and/or Visual Artifacts

This may occur if your video card drivers are not up to date. Make sure you have the latest official drivers from your card vendor.

Script opens in default system text editor, even when Visual Studio is set as the script editor

This happens when Visual Studio reports that it failed to open your script. The most common cause for this is an external plugin displaying a dialog at the startup, requesting input from the user. This causes Visual Studio to report that it failed to open.

Shadows

Shadows on Android and iOS have limitations: soft shadows are not available, and in forward rendering path only a single directional light can cast shadows. There is no limit to the number of lights casting shadows in the deferred rendering path.

GameObjects do not cast or receive shadows

An object's Renderer must have Receive Shadows enabled for shadows to be rendered onto it. Also, an object must have Cast Shadows enabled in order to cast shadows on other objects (both are on by default).

Only opaque objects cast and receive shadows. This means that objects using the built-in Transparent or Particle shaders will not cast shadows. In most cases it is possible to use Transparent Cutout shaders for objects like fences, vegetation, etc. If you use custom written Shaders, they have to be pixel-lit and use the Geometry render queue. Objects using VertexLit shaders do not receive shadows but are able to cast them.

5.3 Support

For any support needed for the virtual reality experience, you may visit <https://unity.com/support-services> or contact unity support directly at the following email: unityads-support@unity3d.com. Enter "Unity Mediation Help" in the subject line, and ensure that you include the following details: Logs, error messages, and steps to reproduce the issue

For support from members of our team you can contact either Griffin May at gmay035@uottawa.ca or Joshua Rose at jrose046@uottawa.ca .

6 Product Documentation

The final prototype for this project was made using Unity, an online platform used to create real-time interactive content in various forms such as 3-D. Using our design considerations, we split the prototype into three design categories; emotional experience, educational content and interactive experience.

Emotional Environment Design

This category focuses on the emotional experience of the user while in the virtual reality simulation. This will include using a 360-degree visual with life-like sound effects from the unity asset store listed in the bill of materials, to create an immersive and evocative environment. The goal is to evoke empathy, sadness, and a sense of urgency in the user, making them feel the impact of autonomous weapons on humanity and the environment. The emotional experience will be designed to be unbiased and highlighting the broader humanitarian impact of the issue.

Educational Content Design

This category focuses on the educational content, providing the user with factual information about autonomous weapons, their development and deployment, and the implications for international security and human rights. This will include the use of infographics, created with Canva, displayed throughout the virtual reality. The educational content will be designed to be neutral and will be reviewed thoroughly to ensure accuracy.

Interactive Experience Design

This category focuses on creating an interactive experience for the user, allowing them to explore the virtual reality environment and engage with the educational content as well as non-player characters in the experience. This will include interactive elements such as clickable objects, decision-making scenarios and talking to people in virtual reality. The interactive experience will be designed to encourage the user to reflect on their own views and opinions on autonomous weapons, and to consider taking action to support the ban on autonomous weapons.

6.1 Emotional Environment Design

6.1.1 BOM (Bill of Materials)

Below is everything bought for the virtual reality experience.

Bill of Materials				
Item #	Item description	Quantity	Unit Price (CAD\$)	Extended Price (CAD\$)
1	Post apocalyptic city pack	1	\$8.99	\$8.99
2	Drone 3D model	1	\$5.00	\$5.00
3	City ruins asset set	1	\$20.00	\$20.00
5	People asset set	1	\$49.00	\$49.00
6	Fire and smoke	1	\$15.00	\$15.00
7	Explosion sounds	1	\$0.00	\$0.00
8	Vintage hospital props	1	\$13.00	\$13.00
Total before tax (\$)				\$110.99
Total after tax (13%)				\$125.42

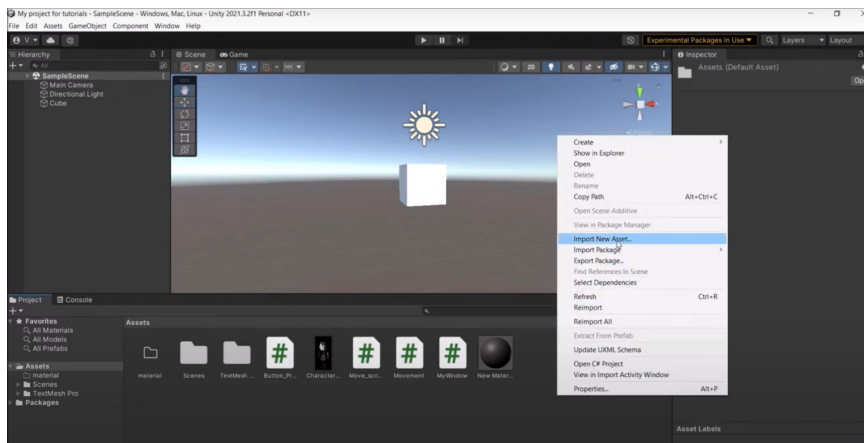
6.1.2 Equipment list

Below is all the equipment used to make the virtual reality experience.

<u>Item name</u>	<u>Description</u>	<u>Type</u>	<u>Source</u>
VR system (headset & equipment)	To test VR	Equipment	Makerspace
Unity Hub + Installer	To create VR	Software	https://unity.com/download
Laptop/ computer	To create VR	Equipment	Personal belongings/ Makerspace
Headphones	To test VR sound	Equipment	Personal belongings/ Makerspace

6.1.3 Instructions Ruined City

1. Download Unity from the link above and download the editor version version [2021..3.20fl].
2. Open Unity and create a new project by choosing your Unity version [2021..3.20fl] under the 'Projects' tab. Give your project a name and in template choose '3D'.
3. Click on 'Create' at the bottom right to create your project.
4. Go to the Unity asset store and buy the assets linked in the BOM.
5. After purchasing the assets, download them to your computer.
6. In your Unity project, right click and click on import assets.



7. Your file explorer will open and click on the Low Poly Apocalyptic city first to set the base.

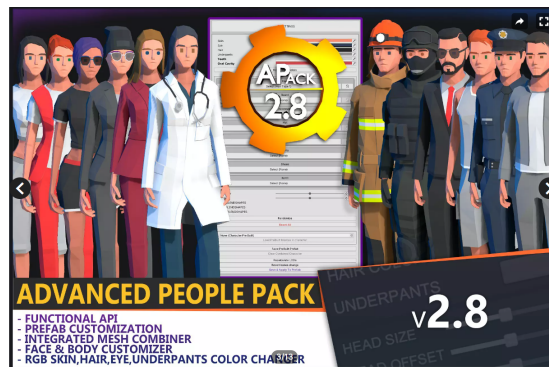


- Next you may want to import the rest of the assets one by one (Drone 3D model, City ruins asset set, Fire and smoke and explosion sounds), and place them around the city to create the ruined city environment.

Don't forget to save your work by clicking 'File' and 'Save Scene'

Bunker

- When the outside city is finished, you may start the bunker where the user will take refuge from the attacks. To make this new scene, go to 'File' and click 'New Scene' to call the New Scene dialog.
- In the Dialog box, select '3D' template and enable 'Load Additively' to load your new scene for multi-scene editing.
- Click 'Create' to create a new scene.
- In the scene, add walls from the Low Poly Apocalyptic city asset making a square type configuration, to create the room which is the bunker. You can make the size of the bunker to your liking.
- Now, import the Vintage hospital props and people asset set to add hospital beds and people inside the bunker.



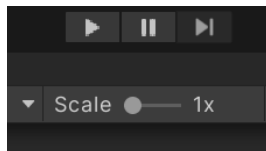
- To add the bunker inside the ruined city, we must create a button inside the city for the scene transition. First, we need to create a door for the bunker and an emergency button next to it to "open" the door. To do this, go into one of the enterable buildings in the city and create a door by right clicking on the Hierarchy window and choose '3D Object' then 'Cube'. Place the cube along a wall to mimic a door.
- To make the button right click on the Hierarchy window and choose '3D Object' then 'Cylinder'. Place the button next to the door.

- To make the button function to transition scenes, right click on the Hierarchy window and click 'UI' then 'Button-Text/MeshPro' and position the button in place.
- Next, in the Asset tab, right click and click 'create' then 'c#script' and enter the following code:

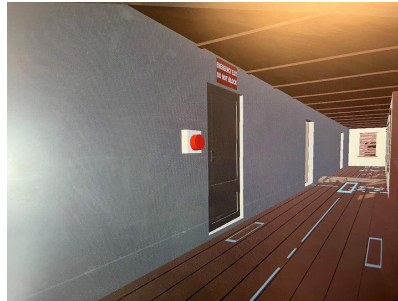
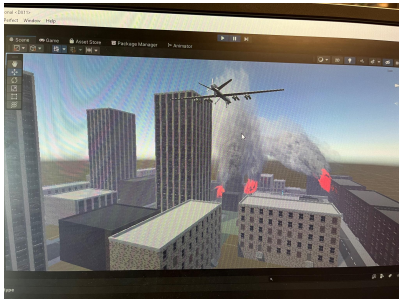
```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;
public class Scene : MonoBehaviour
{
    public void Second()
    {
        SceneManager.LoadScene("Scene 2");
    }

    public void First ()
    {
        SceneManager.LoadScene("Scene 1")
    }
}
```

- Finally, test the game in Unity by clicking 'Play' and use the VR gear. Don't forget to save the project.



Pictures of the final product:



6.2 Educational Content Design

6.2.1 BOM (Bill of Materials)

Nothing was bought for this subsystem.

6.2.2 Equipment list

Below is all the equipment used to make the educational content.

<u>Item name</u>	<u>Description</u>	<u>Type</u>	<u>Source</u>
Canva	To create infographics	Software	https://www.canva.com/
Laptop/ computer	To create VR	Equipment	Personal belongings/ Makerspace
International Committee Of The Red Cross Website	For research	Website	https://www.icrc.org/en/document/what-you-need-know-about-autonomous-weapons
Future of Life Institute Website	For research	Website	https://futureoflife.org/project/lethal-autonomous-weapons-systems/

6.2.3 Instructions

1. Open Canva on laptop/computer and click ‘Create a Design’ then ‘Infographic’.
2. Find a template available in the Canva inventory under ‘Templates’.
3. Do research about autonomous weapons using the links above/in the bibliography.
4. Insert the findings by clicking on ‘Text’.
5. Add images from Google by copy and pasting them.
6. Add stickers (under the ‘Elements’ tab) to the template to finish off infographics.
7. Repeat steps 1-6 with two different templates.
8. Translate words to French.

Final product:
English

**DANGER:
AUTONOMOUS
WEAPONS**
Why they should be avoided in warfare

Autonomous weapons are unethical and desensitize & dehumanize life-or-death situations

Unpredictable and dangerous for civilians, the injured and those who surrender

Challenge International humanitarian law

Ban autonomous weapons now before chaos ensues

**AUTONOMOUS WEAPONS:
RISKS &
CONCERNS**

Why autonomous weapons should be banned

LEGAL CONCERNS
Under the International humanitarian law, combatants must follow through only on specific attacks for legal evaluation of judgment purposes, which autonomous weapons cannot precisely deliver.

Ethical concerns
Autonomous weapons remove moral agency, which desensitizes and dehumanizes life-or-death situations that is present with human soldiers.

Risks

- Risk of encoded bias when it comes to gender and race
- Increased risk of civilian danger due to lack of human judgment

Disadvantage of autonomous weapons
Autonomous weapons are unpredictable by design. The black box model, the machine learning software often used, restricts information of the internal processes of the AI.

If we stop together, we will create a better future

Take action and ban autonomous weapons

**AUTONOMOUS WEAPONS:
WHAT THEY ARE AND WHY BAN THEM**

WHAT ARE AUTONOMOUS WEAPONS?
Autonomous weapons are categorized as any type of weapon that acts without human intervention. They use artificial intelligence and sensors to apply force onto targets.

HOW AUTONOMOUS WEAPONS WORK
Once activated by a human, the autonomous weapon takes complete control, not allowing the person to see specifically who and what is targeted nor when and where it will happen. The autonomous weapons' use sensors and various software to match target profiles to the external environment.

THE THREAT AUTONOMOUS WEAPONS' IMPOSE
The threat with autonomous weapons is the loss of human judgement when it comes to identifying and engaging in targets. For example, engaging in targets when civilians are around or distinguishing similarities to targets profiles and the external environment, are weaknesses the autonomous weapons cannot overcome.

WHY BAN THEM
Autonomous weapons are hazards awaiting to happen due to their unreliable nature when it comes to judgment and accuracy, and their desensitizing aspects. They pose a threat to innocent civilians, those injured and those who surrender in battlefield settings.



6.3 Interactive Experience Design

6.3.1 BOM (Bill of Materials)

Nothing was bought for this subsystem.

6.3.2 Equipment list

Below is all the equipment used to make the interactive experience.

<u>Item name</u>	<u>Description</u>	<u>Type</u>	<u>Source</u>
Laptop/ computer	To create VR	Equipment	Personal belongings/ Makerspace
Google Docs	To write interaction scripts	Software	https://docs.google.com/document/

6.3.3 Instructions

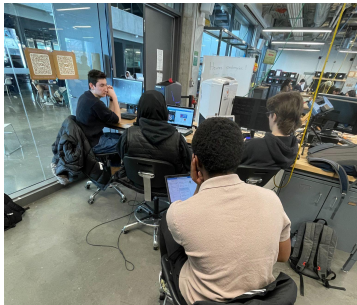
1. Open Google docs on laptop/computer.
2. Write a script with the user interacting with the guide character helping them throughout the city.
3. Write a script where the user interacts with a teacher and a child inside the bunker.
4. Translate the words to French.

Final product:

https://docs.google.com/document/d/1M8b9_C9-jaGDz2Xrw1LbFVmh5tSA8OuRdEwRkRSaw4Y/edit?usp=sharing

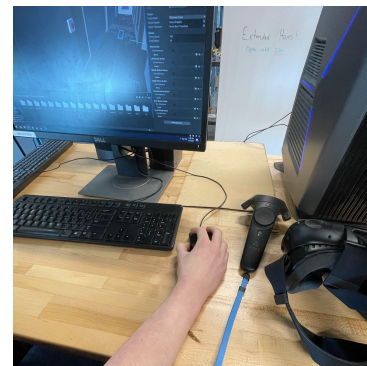
6.4 Testing & Validation

All the testing was done using the VR system, the HTC Vive headset and joycons, in the makerspace as seen in the images. After editing the project on Unity, the edits were tested right after to decrease the chances of issues in our final prototype.



The results attained helped fix issues in the experience, such as teleportation within the virtual reality and the movement of non-player characters. The sound was also tested using

headphones. These tests were implemented for the validation of our final prototype to ensure everything worked as it was supposed to.



7 Conclusions and Recommendations for Future Work

The lessons learned while conducting this project is how to use Unity and VR equipment. We did not quite accomplish everything that we were hoping to due to lack of time. Some avenues of future work for this project and things we would have liked to add to complete our experience would be more interaction with non-player characters in the VR and actual conversation with theses characters, physical autonomous robots walking around the virtual reality city instead of only using autonomous drones, and the use of a guide to help the user navigate themselves in the experience and educate them on the attack imposed by the autonomous weapons. With these additions to our VR experience, it would create a more compelling environment helping the user side with the client, Mines Action Canada, on the banning of autonomous weapons.

8 Bibliography

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<https://futureoflife.org/project/lethal-autonomous-weapons-systems>.

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<https://www.icrc.org/en/document/what-you-need-know-about-autonomous-weapons>.

Sendbird. “Error Codes: Chat Unity SDK.” *Sendbird Docs*,

<https://sendbird.com/docs/chat/v3/unity/guides/error-codes>.

APPENDICES

9 APPENDIX I: Design Files

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Deliverable B - Needs Identification and Problem Statement	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Jan 29, 2023
Deliverable C - Design Criteria	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Feb 5, 2023
Deliverable D - Conceptual Design	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Feb 12, 2023
Deliverable E - Project Plan and Cost Estimate	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Feb 19, 2023
Project Deliverable F: Prototype I and Customer Feedback	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Mar 5, 2023
Project Deliverable G: Prototype II and Customer Feedback	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Mar 12, 2023
Project Deliverable H: Prototype III and Customer Feedback	https://makerepo.com/sarah/1478.gng110 3f23virtual-reality-for-ban	Mar 19, 2023

10 APPENDIX II: Other Appendices

Table 4. Error Codes

Error	Code	Description
ERR_INVALID_INITIALIZATION	800100	The initialization of the <code>SendBird</code> instance failed because the assigned value to the <code>appId</code> parameter of the initializing method isn't valid.
ERR_CONNECTION_REQUIRED	800101	The request from a client app failed because the device isn't connected to the server.
ERR_CONNECTION_CANCELED	800102	The connection is canceled or the disconnecting method is called while the <code>SendBird</code> instance is trying to connect to the server via the connecting method.
ERR_INVALID_PARAMETER	800110	The parameter of the method specifies an invalid value.
ERR_NETWORK	800120	The connection failed due to the unstable network or an unexpected error in the Chat SDK network library.
ERR_NETWORK_ROUTING_ERROR	800121	The request routing to the server failed.
ERR_MALFORMED_DATA	800130	The data format of the server response is invalid.
ERR_MALFORMED_ERROR_DATA	800140	The data format of the error message is invalid due to the problem with the request.
ERR_WRONG_CHANNEL_TYPE	800150	The specified channel type in the request is invalid.
ERR_MARK_AS_READ_RATE_LIMIT_EXCEEDED	800160	The interval between the successive mark-messages-as-read requests

		is less than a second.
ERR_QUERY_IN_PROGRESS	800170	A retrieval request is arriving while the server is still processing the previous retrieval request for channels, messages, or users, and in preparation to send the response.
ERR_ACK_TIMEOUT	800180	The server fails to send a response for the request in 10 seconds (timed-out).
ERR_LOGIN_TIMEOUT	800190	The server fails to send a response for the <code>SendBird</code> instance's login request in 10 seconds (timed-out).
ERR_WEBSOCKET_CONNECTION_CLOSED	800200	The request failed due to being submitted while disconnected from the server.
ERR_WEBSOCKET_CONNECTION_FAILED	800210	The websocket connection to the server failed to establish.
ERR_REQUEST_FAILED	800220	The server fails to process the request due to an internal reason.