**University of Ottawa**

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**GNG 1103: Engineering Design**

**Deliverable D –**

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**Abstract**

*This is a basic technical document template for Engineers. The document makes use of the features that are available in Microsoft Word and is intended as a basic example of a technical report* *for first-year students in engineering*. *The main purpose is to improve the professional quality of documents that are produced at different times during the four years of an undergraduate engineering program.*

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# Introduction

The project aims to create a compelling narrative that explores the impact of killer robots on society by utilizing Audio, Visual, and Storyline in VR. To achieve this, we will first identify and generate concepts for each subsystem and then combine them to create three fully functional solutions. These solutions will be evaluated using a selection matrix, and the best concept will be chosen for further development.

# Main Subsystems

1. The final functional solution should have a minimum of three subsystems. You should clearly define the boundaries between those subsystems, so that conceptual designs for each subsystem are inter-changeable.
* Audio:
* Visual (Background, Models, Colours, etc.)
* Storyline

# Main Concepts

## Concepts for Subsystem Audio

1. Music
2. Voice
3. Music and voice
4. Sound effects (ex: footsteps, wind)
5. Silence
6. Focus on ambient noise (wind, leaves, etc.), no music.

## Concepts for Subsystem Visual:

1. Dark, desaturated tones like grays, blacks, and deep reds.
2. Architecture style (ex: ruined, brutalist)
3. People with umbrellas and masks to hide themselves/their identity.
4. Human and robot expressions. Humans cry, helplessly, robots are cold and expressionless.
5. Adaptive infrastructure (Barricades, makeshift overhangs, checkpoints, etc.)

## Concepts for subsystem Storyline:

1. Show the present with no killer robots and do a jump to the future and show the differences in the environment.
2. Show how a human and a robot deal with situations differently using two scenes.
3. Invasion of a country/dictatorship - News flash
4. Jumping from clip to clip (equivalent to transportation in VR)
5. Police robots
6. Inside a military command center losing control of a robot(s)

## Benefits

### Concepts for Subsystem Audio

1. Music
	1. Emotional Impact: Music can help move the audience’s emotions.
	2. Memorability: Familiar music can help the audience remember the memories associated with the music.
	3. Aesthetic Appeal: Music will make the video more enjoyable to watch.
2. Voice
	1. Individuality and Authenticity: One of the primary advantages of having a distinct voice is that it allows individuals to express themselves authentically. It gives people a unique way to communicate their thoughts, ideas, and emotions, fostering a sense of individuality.
3. Music and voice
	1. Combination: The use of both music and voiced characters could be used to create a more cinematic experience, which can prove very powerful and is familiar to most people.
4. Sound effects (ex: footsteps, wind)
	1. Familiarity: Sound effects should mimic or be very similar to real-world noises to help the audience feel a more immersive experience.
	2. Variations: Repetition makes the experience boring and generic, therefore variation of sound use should be employes to keep the audience’s attention.
	3. Influence and Impact: A well-developed voice can have a significant influence on people, inspiring them to act, change their beliefs, or make decisions. This is particularly true for leaders, influencers, and public figures.
5. Silence
	1. Increased Focus: Forgoing the use of audio all together will then increase the viewer’s attention to the other aspects of the video, and on their other senses.
	2. Investment: Lack of audio would greatly decrease both the eventual cost of the project, and the required effort to complete it.
6. Focus on ambient noise (wind, leaves, etc.), no music.
	1. Atmosphere Building: Dependant on the storyline chosen, could be effective for focusing the viewer’s attention on the setting itself.

### Concepts for Subsystem Visual:

1. Dark, desaturated tones like grays, blacks, and deep reds.
	1. Mood Enhancement: Dark and desaturated tones can establish a moody and mysterious atmosphere; it sets the tone and engages the audience emotionally.
	2. Focus on Key Elements: By reducing the color palette, you can draw attention to specific objects, characters, or details in the video. This can help guide the viewer's eye and emphasize the most important elements of the scene.
	3. Consistency: Using a limited color scheme can help maintain a consistent look throughout the video. This is especially important for branding or conveying a specific theme.
2. Architecture style (ex: ruined, brutalist)

 a. Leading Lines: These help guide the viewer’s eyes toward specific locations, items, or themes. It ensures that viewer focus is always on the right place.

 b. Setting consistency: A specific time and place setting must be employed all throughout the project to avoid confusing or overstimulating the viewers with inconsistent themes

1. People with umbrellas and masks to hide themselves/their identity.
	1. Disconnect: The shrouding of people’s identifiable features, especially their faces, would make it difficult to create a connection to them, increasing feelings of isolation and unease.
	2. Fear: People are often scared of people hiding their identity, as the purpose of it is not often known and can potentially be interpreted as hostile more realistic movements and convincing facial expressions would keep us from facing the issue of the uncanny valley, asthey are very difficult aspects to model correctly, especially in a 3D environment.
	3. Public Life: Can show the disruption and difficulties affecting civilian life caused by potentially necessary adaptations arising from the existence of UARs
2. Human and robot expressions. Humans cry, helplessly, robots are cold and expressionless.
	1. Emotional Gap: Would greatly highlight the difference in human and robot behaviours, and the lack of emotion in the latter.
3. Adaptive infrastructure (Barricades, makeshift overhangs, checkpoints, etc.)
	1. Uncanny Valley: In the same way seeing things that try to mimic humans but only come close, unwelcome changes to a familiar setting can prove quite unsettling.

### Concepts for subsystem Storyline:

1. Show the present with no killer robots and do a jump to the future and show the differences in the environment.
	1. Visual Impact: The stark differences between the present and future environments can be visually captivating, making it easier for the audience to follow the narrative.
	2. Social and Ethical Commentary: The absence of killer robots in the future can serve as a commentary on the ethical and social concerns surrounding autonomous weapons, making the video thought-provoking.
2. Show how a human and a robot deal with situations differently using two scenes.
	1. False Positives: AI frequently misidentifies threats causing further damage. It is important to clearly portray the dangers of this consequence of unsubstantiated increase in casualties to the audience.
3. Invasion of a country/dictatorship - News flash
	1. Catastrophe: The exemplification of the possibility of a large-scale catastrophe like this one would inevitably cause concern in the viewer.
	2. Loss of Control: A politician presented a video such as that would be worried about this happening during his term, because the country with the dictatorship would be both a threat and could cause a loss in reputation if the decision to develop technology originated from them. They would also be concerned about the technology being in the wrong hands.
4. Jumping from clip to clip (equivalent to transportation in VR)
	1. Efficiency: It is much easier to show many more scenes and events in additional detail if the video cuts to the chase, as it only lasts for one minute.
5. Police robots
	1. Realism: The police robots are a more realistic future threat within Canada, as military is meant to be used to fight other countries. Also, it does not seem to likely to a politician’s eyes that Canada would be invaded anytime in the near future.
	2. Familiarity: The realism of police robots in Canada allows the video to not be far-fetched while also still seeming familiar to Canadians.
6. Inside a military command center losing control of a robot(s)
	1. Accountability: This scenario would focus the blame of possible accidents onto the military and government, as opposed to technical issues or non-state actors.

## Draw backs.

### Concepts for Subsystem Audio

1. Music
	1. Copyright issues: using copyrighted music without permission can lead to legal issues, so the only way is to get licenses which is expensive.
	2. Loading time: Music can increase the file size of a video, potentially causing slower loading times.
	3. Misuse: Poorly chosen or overly loud music can distract viewers from the video's message.
	4. Inconsistency: Inconsistent music choices throughout a video series can confuse the audience and dilute the message of the video.
2. Voice
	1. Actors: We are not voice actors and have very limited access to them. Voice acting can be attempted, but would highlight the amateur nature of the project
	2. Recording and sound quality issues: It is difficult to ensure that some audio from war zones can be preserved intact, and excessive noise in it may make the listener uncomfortable.
3. Music and voice
	1. See Music and Voice.
	2. Synchronisation: Effectively piecing both aspects of the soundtrack would be very difficult, requiring more precise sound mixing and timing of both parts.
4. Sound effects (ex: footsteps, wind)
	1. Alienation: A unique voice can sometimes alienate or exclude those who do not resonate with it. This can limit the reach and impact of one's message, especially if the voice is very specific or unconventional.
5. Silence
	1. Auditory Appeal: The audio aspect (Music, voice, sfx) would remain unused and therefore the video would ignore a significant element in communicating to the viewer.
6. Focus on ambient noise (wind, leaves, etc.), no music.

### Concepts for subsystem Visual:

1. Dark, desaturated tones like grays, blacks, and deep reds.
	1. Audience Appeal: Not all audiences respond well to dark and moody visuals. Using this concept exclusively might limit the appeal of the video.
	2. Technical Challenges: Achieving the desired look with dark tones can be technically challenging. It may require additional effort and resources.
2. Architecture style (ex: ruined, brutalist)
3. People with umbrellas and masks to hide themselves/their identity.
	1. Political: It might draw too many comparisons to the pandemic and its lockdowns, which would prove a problem with some people depending on their political stances towards it.
4. Human and robot expressions. Humans cry, helplessly, robots are cold and expressionless.
	1. Uncanny Valley: The animation of convincing human emotions can be a very large issue, especially dependant on the art style chosen, and failing to achieve it correctly would cause the opposite of the desired effect, making a viewer’s connection to the characters more difficult.
5. Adaptive infrastructure (Barricades, makeshift overhangs, checkpoints, etc.)

### Concepts for subsystem Storyline:

1. Show the present with no killer robots and do a jump to the future and show the differences in the environment.
	1. Complexity: Transitioning between two time periods can be challenging and may confuse the audience if not executed properly.
	2. Dependence on CGI: Creating futuristic environments can be expensive and may require a significant budget for CGI and special effects.
2. Show how a human and a robot deal with situations differently using two scenes.
	1. Ambiguity: It is difficult to predict what a robot would be capable of dealing with, such as social cues, words and threat detection.
3. Invasion of a country/dictatorship - News flash
	1. Realism: Some people might find Canada facing an invasion too unrealistic, depending on how it is portrayed.
4. Jumping from clip to clip (equivalent to transportation in VR)
	1. Focus: The sudden change in scenario (if applicable) would be confusing and sudden. This could disrupt the viewer’s train of thought and make the experience less engaging.
5. Police robots
	1. Political Animosity: Anti-police stances are not often viewed favourably by politicians.
6. Inside a military command center losing control of a robot(s)

## Solution one

Police/mercenary robots within Canada, plain life among the robots (Best case scenario)

* People stay in their houses.
* Children injuries because of violent-looking games and shouting.
* Cannot negotiate wrongful actions done by the robots.
* People shouting at the robots hopelessly.
* Switch from peaceful children playing, birds chirping, green vibrant colors (trees, grass) to red lights from the robots, red blood, parents getting shot while trying to help their children.
* Robots think people who hide themselves are a threat.
* Robots do not react, slaughtering with cold blood.
* “Who is responsible/liable?”
* Show policeman trying to help and getting threatened by the robot not to interfere.

## Solution two

Military invasion of Canada by killer robots (Dramatic scenario)

* News flash: Military coup, USA is dictatorship, takes control of killer robots, invades Canada.
* Chaos, mass murder due to resistance
* Nowhere is safe.
* Dramatic music
* Screaming
* Wrecked/deserted cities, all you can hear is the wind blowing and robots patrolling.
* Gray war-torn buildings and fires
* People try to hide in dark covered places/rubble, starving.
* Country goes to general chaos because people freak out and are very scared: economy is in ruins, people stealing from stores/each other, government has not control over the situation or anything else (no protection, no law)
* Makeshift small towns/fortresses and gangs (Mad Max style of situation)

## Solution three

Life in another country at war, killer robots deployed on the opposing side (Realistic scenario)

* Summary of events that lead to the current situation.
	+ China tries to secure Taiwan as part of their country.
	+ The United States try to stop China from doing so because Taiwan produces a large portion of the world’s computer chips and the US wants to keep control over it.
	+ The United States declare war against China.
	+ A killer robot war commences.
* People live in bunkers, use tunnels/covered trenches to get to places.
* Plenty of civilian casualties
* War documentary music
* Silence, because people lead depressing lives, and they don’t want to be heard.
* Many grey/cement colors and darkness
* People hide themselves with camo, get robots confuse them with soldiers.
* “This is what could happen if bad people get a hold of our killer robots.”
* Memories of the past, pictures of loved ones, etc.

# Selection Matrix:

Table 1: Selection Matrix

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Design Specification** | **Importance** | **Solution 1** | **Solution 2** | **Solution 3** |
| **Functional Requirements** |
| Simplicity | 3 | 4 | 2 | 2 |
| Emotionally focused situations | 5 | 2 | 4 | 3 |
| Avoids offence | 4 | 5 | 5 | 5 |
| Storytelling | 5 | 5 | 4 | 4 |
| Show the robot’s lack of emotion. | 3 | 5 | 4 | 2 |
| Show the robot’s lack of decision making | 3 | 4 | 4 | 2 |
| Modern living environment | 2 | 4 | 3 | 2 |
| Civilian’s lifestyle | 2 | 5 | 3 | 4 |
| **Constraints** |
| Length | 5 | 5 | 5 | 5 |
| Cost | 5 | 5 | 5 | 5 |
| Time | 5 | 5 | 5 | 5 |
| **Non-Functional Requirements** |
| Audio | 2 | 3 | 4 | 4 |
| Colour scheme | 2 | 4 | 4 | 4 |
| Graphical familiarity | 2 | 5 | 4 | 2 |
| Total | 211 | 247 | 206 |

# Technical Benchmarking

|  |  |  |  |
| --- | --- | --- | --- |
| **Benchmark Criteria** | **Importance** | **Nuclear Weapons** | **Laser Weapons** |
| **Destruction Capability** | **3** | High, capable of devastating entire cities | Limited, primarily for precision targeting |
| **Collateral Damage** | **3** | High, extensive collateral damage | Low, minimal collateral damage |
| **Delivery Time** | **1** | Minutes (ICBMs) to hours (bombers) | Near-instantaneous |
| **Cost** | **4** | Extremely high development and maintenance costs | Relatively lower operational costs |
| **Deterrence** | **2** | Effective in deterrence due to their devastating power | Limited as a deterrent but valuable in certain contexts |
| **Global Politics** | **5** | Highly regulated and subject to international treaties | Fewer international treaties and regulations |
| **Technology Challenges** | **3** | Requires advanced nuclear fission programs and materials | Requires high-power lasers and precision optics |
|  | **Green=2.5****Yellow=1** | **11.5** | **13** |

# Global Concept Choice

Police/non-state robots within Canada, life among the robots (Best case scenario)

We are choosing to go with this solution primarily due to its ability to combat possible counterarguments over the range of possibilities of what a future with UARs would look like. Many people when shown with a negative possible scenario would instinctively react with suggestions of possible fixes and claims that what they are seeing is too negative, generally minimizing what they’re presented with (American Psychological Association, 2023). We have chosen to go with what we believed to be the realistic best-case scenario to both help ground people who are considering the possible effects of these weapons, and to reduce the space for minimizing aspects of the scenario. Showing that even the best case would have a noticeable and detrimental effect on our society would potentially be more convincing than our less realistic but more emotionally impactful second concept of the use of UARs in an invasion of Canada. They would also place the threat directly into the lives of the decision makers we are trying to sway, as opposed to in current or future foreign warzones. This is to create a greater sense of personal urgency, as opposed to relying on their compassion for people not within their own borders, as doing so when dealing with politicians, and many people generally, is a gamble we wish to avoid.

# Conclusion

This process has been a pivotal step in shaping our multi-media project on killer robots. We've scrutinized subsystem concepts, and after evaluating them with the selection matrix, "Life in another country at war, killer robots deployed on the opposing side" emerges as our leading concept. It will be our focus as we move ahead, driven by our dedication to creating an engaging narrative on the societal and ethical complexities of killer robots.

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