

Homelessness Simulator for the Chicago Coalition for the Homeless



**CHICAGO COALITION
FOR THE HOMELESS**

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October 2023

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I Project Description

1 Project Overview

The project that the team proposes is a simulator-type game that demonstrates how it is like to experience homelessness. It would include a variety of different hazards that the player would have to keep track and be wary of—such as hunger, thirst, police awareness, and the weather—in order to survive as long as possible while exploring environments that non-homeless people would not have experience in.

2 The Purpose of the Project

The homelessness simulation, if handled with care and done properly, will demonstrate to the masses what it is like to be homeless and how stressful it can be, and hopefully change the perception of homelessness from being one of ridicule to one of sympathy.

2a The User Business or Background of the Project Effort

The Chicago Coalition for the Homeless (CCH) is a nonprofit organization that is dedicated to assisting those who are homeless and furthering efforts into eradicating homelessness in Chicago. Part of what the CCH does is raise awareness and give opportunities for those who are struggling to get on their feet and support them through their struggles. However, despite their contributions, many people still have misconceptions about homelessness and how it affects those who suffer through it, believing that homelessness is something that is the fault of the homeless.

2b Goals of the Project

The goal of the project was to have a way to simulate what it is like to be homeless to those who are not homeless in the form of a simulation game. This is so that more awareness is brought to the public about how dangerous being homeless is and how it should be prevented.

To assist the organization in demonstrating just what exactly homeless people experience, those who still have those misconceptions need to be able to see what homeless people go through. The CCH needs a way to bridge the gap between those who know nothing about homelessness, to those who do and need help to pull themselves out.

Considerations that should be taken into account when building the foundation for this project is to be aware that homelessness is a serious problem that is an unfortunate reality that many people face in Chicago. It should be portrayed as it is without sugarcoating it for those who have never experienced it, so that the CCH can emphasize what exactly they wish to prevent.

2c Measurement

A way that the success and goal achievement of the project can be measured is by the donations that the CCH receives after the simulator is launched.

If a noticeable increase in CCH's support and donations, especially donations that are repeated by the same donors, is recorded after launching the simulator, it can be said that the reason that for it was because players interacted with the simulator and swayed their thoughts on people who are homeless and decided to support the CCH.

The success of the simulator can also be measured by a survey before the user tests the simulator and after a user tests the simulator. The beginning survey would take the users previous thoughts and any additional information about previous donations they had made to organizations that help the homeless. After the user experiences the simulation, they will take an exit survey that records their experience and how they felt about it, and how it changed their previous notions. If the exit survey demonstrates a more sympathetic and changed perspective from their respective entrance surveys, it can be correlated to the simulator changing the user's perspective on how it is like to be homeless, which consequently makes it more likely that the user will assist the CCH with their mission by donation, or tell others about their experience to get others to do the simulation as well.

3 The Scope of the Work

The simulation developed will be used within the scope of the Chicago Coalition for the Homeless staff, who will be the main host for the simulator. The CCH will use the simulation as a means of demonstration and interactivity for their organization for others to experience as a way to show how the homeless have to live day by day.

3a The Current Situation

Currently, the CCH provides only a newsletter and webpage of upcoming events as a means of shedding light on the homeless of Chicago. While this certainly keeps those already invested in the cause informed, it doesn't do much to garner the attention of those uninitiated to the homelessness crisis. The goal of this project is to provide a more interactive means of bringing awareness to the struggles faced by homeless people, using technology that will allow users to experience the difficult choices homeless people must make in order to survive.

3b The Context of the Work

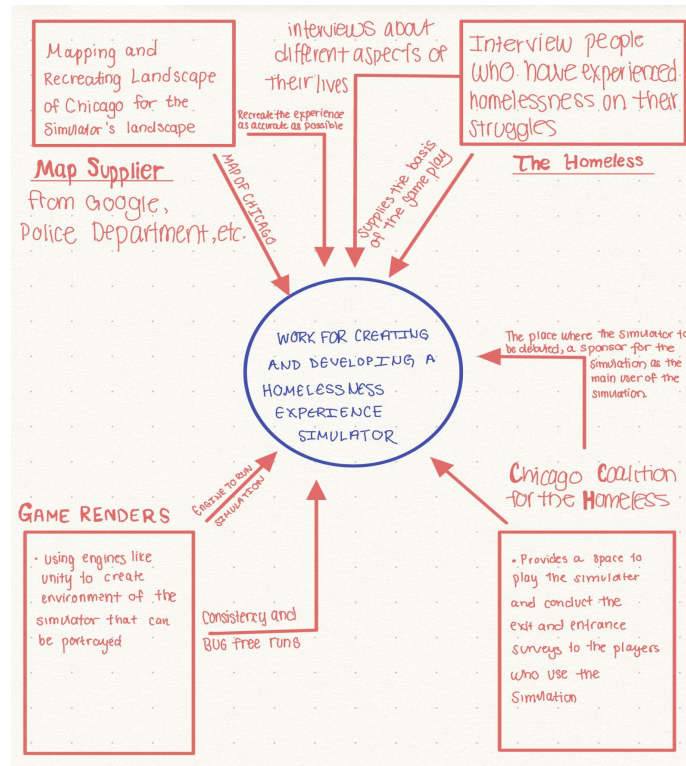


Figure 1 - A graphical representation (Hobson's Choice) of the work in context to the client it is meant to serve

The boundary of the work can be determined by how it can be expected to be used by the CCH. The CCH will not be expected to actually work on the simulation itself nor be responsible for major maintenance. The simulator will solely be a means of the CCH to bring people in to assist in their cause and provide knowledge from the homeless people that they assist for the simulator model and creation.

3c Work Partitioning

Event Name	Input/Output	Summary
Mapping landscape	Virtual environment -> out Map data -> in Weather/Time ->in	The Homeless Simulation will render a scene from a particular location the user chooses to enter using real map data, as well as factoring in in-game time and weather data.
Interview Homeless	Stories from real people -> in Simulated Scenario -> out	The Simulation will require the user to experience scenarios and make decisions that actual homeless people had to live through.
Game Renders	Game engine -> out	The Simulation will likely be built with an engine in order to render the various scenes as well as handle the user's input when handling game scenarios.
Chicago Coalition for the Homeless	Host space -> out	The CCH can provide a space for users to experience the simulation for themselves in order to have a better understanding of what the homeless have to endure every day.

Table 1 - A representation of how the work of the project is partitioned amongst the parties that are involved in its production

3d Competing Products

Another product the Chicago Coalition for the Homeless could choose to use is Hobson's Choice, a choice-based game where the user is presented with a dilemma represented with a picture, followed by 4 choices leading to further dilemmas. While our simulator may function in a similar “choose-your-own-adventure” format, the choices presented in Hobson's choice as well as the amount of situations for the user to be placed in is extremely limited. Our Homeless Simulation would include significantly more storylines and situations for the user to experience, as well as other variables to account for throughout the simulation, such as body temperature and hunger, which will affect the options available to the user as well as present new situations depending on their values.

4 The Scope of the Product

The Homeless Simulation serves the community outreach subset of the CCH's work. The primary goal of the program is to educate, specifically targeting individuals who are currently more distanced from the problems of homelessness so that they may be more sympathetic to the cause.

4a Scenario Diagram(s)

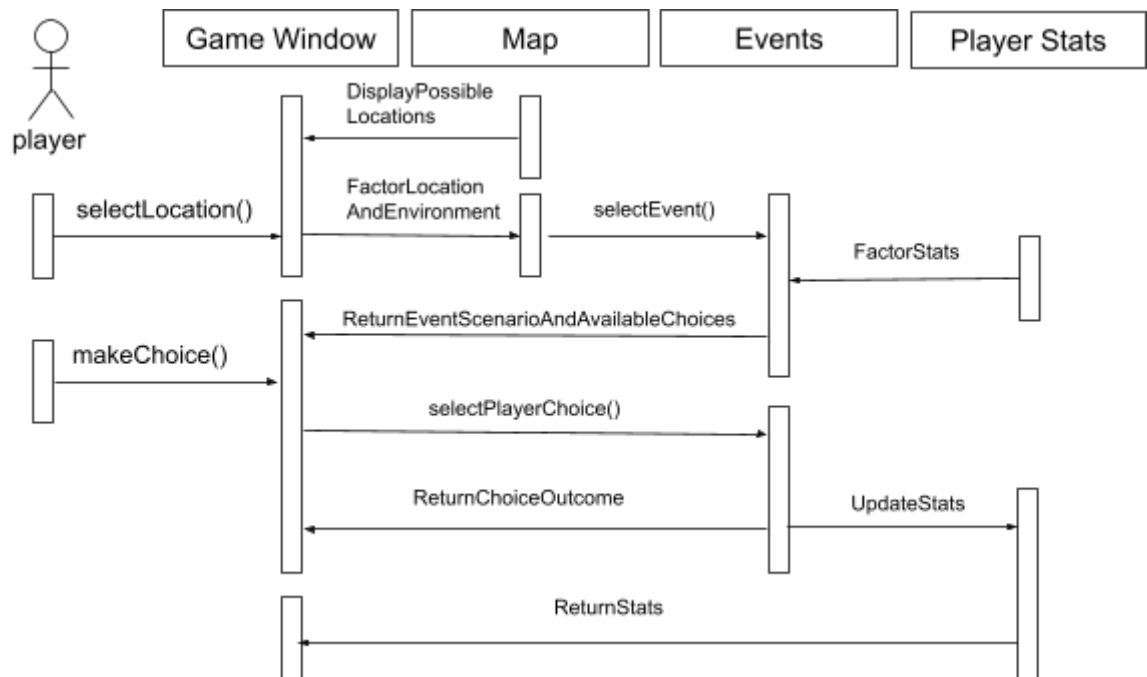


Figure 2 - A scenario diagram that demonstrates how certain elements of the game interact with one another.

4b Product Scenario List

Product Scenario	Actors Involved	External Information
Dynamic Environment	User, Game Environment	The environment unpredictability in relation to gameplay
Unpredictable Dilemmas	User, Game Events	Emulates scenarios that happen randomly
Difficult Choices	User, Game Scenarios, Player	One choice will have an

	Inventory, Stats	effect on other aspects of gameplay
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Table 2 - Product Scenario List of ventures to explore within the simulation

4c Individual Product Scenarios

Detailed below are different product scenarios elaborated in detail, which is representative of how the simulation would work.

Dynamic Environment: Morpheus is in the middle of a playthrough of the Homeless Simulation. He was having a fairly easy time not attempting to find a shelter, even thinking that he himself would be able to survive without a shelter in real life. But then the temperature in the game starts to decrease, and without shelter, his character gets sick. Now he must learn what the homeless must do in order to survive the colder seasons, gaining a new perspective.

Unpredictable Dilemmas: Neo, who prides himself on his logical thinking, begins a new playthrough of the Homeless Simulation. So far so good until he realizes that despite making many seemingly good decisions, his character gets robbed while on the street and he is back to square one. Now he must figure out how to recoup his losses while simultaneously protecting the little money he has.

Difficult Choices: Trinity was previously under the misconception that homeless people are in their situation because of their own poor decisions, until in her own playthrough of the Homeless Simulation in which her character is unable to afford groceries after losing her job and must choose either to sell her car which she uses for shelter, or risk jail time selling drugs again after a year of sobriety. Trinity is no longer sure that she knows the correct decision to make.

5 Stakeholders

5a The Client

The client of the product is the Chicago Coalition for the Homeless (CCH). The organization will be the main beneficiary of this simulation as they will be the organization that is supporting its creation.

5b The Customer

The customer for this product is the Chicago Coalition for the Homeless (CCH), who is also the client.

5c Hands-On Users of the Product

The main users would be organizations against homelessness, including the current client. These users are responsible for raising awareness about homelessness. They advocate for public policies that curb and prevent homelessness. They lead strategic campaigns and community outreach efforts to highlight the lack of affordable housing in their local communities. They press for equal access to education and job opportunities for the homeless. They provide resources for the homeless, such as temporary shelter, food, and medical care [5]. Due to the nature of their work, these organizations that aim specifically at combating homelessness are experts at understanding homelessness and its effects on those who struggle with it, since they work and interact with homeless individuals on a consistent basis. As a result, the technological experience that these organizations have with regards to their mission would characterize them as journeymen when it comes to utilizing software tools to aid in their goals. They often carry out their mission through in-person interactions rather than software tools. Other characteristics to know about the current users would be that the organizations are very serious when it comes to their work. They care very much about making sure the issue of homelessness isn't taken lightly.

Another group of users correlated with the project would be the general non-homeless US population who have not been homeless in the past. The vast majority of these users have jobs, their responsibilities being dependent on their occupation. The ones who do not have jobs are having their living accommodations paid for them by an individual who does. In either case, no one from this group has experienced homelessness. These users have little to no knowledge of homelessness and its true effects on those who suffer from it. Often, they do not interact or engage with homeless individuals. The technological experience of these users varies vastly, however, as of the time period of this report, a certain level of digital literacy is assumed or expected, and the large majority of these users will know how to install and use the product. Among these users, there exists a varying level of intellectual ability/education, so the simulation must be simple to understand/comprehend. Many of these users are expected to have preconceived notions regarding the homeless, so the simulation ought to address such notions. Many users from this group also speak other languages as their native language, making it highly ideal for the simulation to have multiple language options. Lastly, the users will vary in age and gender, and as such, the simulation should show homelessness as experienced by people of various ages/genders.

5d Maintenance Users and Service Technicians

No maintenance users or service technicians outside of the development team will be needed to maintain, update, and service the product. While the client and users will be the ones who are using the product the most, they will not be expected to know how to troubleshoot and maintain the simulation.

5e Other Stakeholders

The other stakeholders involved in this product would be homeless individuals, both as interviewees and the testers of the simulation. The project needs insight from real individuals experiencing homelessness to properly identify the various struggles and trials homeless people face on a recurring basis. Their first-hand accounts are valuable in identifying tribulations that are less commonly known or thought about. The developers of the project will work with the client to identify common hardships of homelessness to create a prototype of the simulation application. Homeless individuals are then asked to test the game and provide their feedback on the various hardships covered by the prototype, as well as offer other potential ideas for hardships not covered by the prototype. These homeless individuals and the ideas they have to offer will influence the product greatly, as the product is designed to accurately simulate their lives. In the case of other stakeholders having vested interest in the same homeless individuals for the same purposes as the client, the development team, client, and said stakeholders should look to cooperate with each other and dedicate some number of homeless testers to each. This is mutually beneficial due to the shared goal and mission of the stakeholders.

5f User Participation

During all phases of development, it is expected that the Chicago Coalition for the Homeless (CCH) sets aside a team dedicated to the project who will be able to meet with the project lead at least five hours each week to address the scope of what the organization does and what hazards/situations must be present in the simulation game, based on the organization's experience in working with the homeless.

During the development and post-development stage, it is expected that homeless individuals (those who are willing to test and suggest improvements) maintain a consistent and active level of participation. It is expected that these people will provide valuable feedback on how accurately the simulation represents homelessness and what vital experiences/struggles are missing.

Once a beta version of the project is completed, it is expected that volunteering non-homeless individuals test the application and provide the developers feedback on the ease-of-use of the simulator game. This feedback is crucial for building and improving upon the usability requirements of the application. It is also critical these users provide feedback on how engaging the simulation is, as the purpose of the application is defeated if the hands-on users of it do not find it interesting enough to play.

5g Priorities Assigned to Users

The key users would be the Chicago Coalition for the Homeless (CCH) & other organizations against homelessness. The client and similar organizations will use the product heavily in their efforts to bring mass attention to homelessness. They are very knowledgeable on the topic of homelessness and know what is needed from the application

to achieve their goals, and as such, their feedback is vital. These users take first priority.

In context of this project, the secondary users in this case would be the general non-homeless US population. These users, while their feedback is important and can bring about potential ideas for improvement, are not as knowledgeable about the topic of homelessness as the client. The feedback from these users will likely need to be filtered by the client, who will know what feedback will be effective without detracting from the overall goal of the simulation.

6 Mandated Constraints .

6a Solution Constraints

For one of the first solution constraints, the simulation shall operate on Windows 10. The rationale behind this is because the client uses Windows 10 systems and does not wish to change. While the client would wish for MacOS, Android, and iOS versions of the simulation as well, there is an understanding that the budget and time constraints may not allow for such to happen. Given the vast popularity of the Windows operating system, especially for games/simulators, it is the ideal operating system for the product and will allow for the largest possible user base. As of August 2023, the Windows 10 operating system makes up 72% of the global OS market share, so having the simulation support this operating system aligns with the client's goals of spreading homelessness awareness to as many individuals as possible [8]. The simulation shall be approved as Windows 10-compliant by the development testing group.

Another one of the solution constraints is that the simulation shall not have demanding minimum system requirements. The reasoning behind this is due to the fact that the simulation is to be played by a wide range of users on a wide variety of devices. The client wishes for those with lower-end systems to be able to play the game in order to maximize the player base and bring attention to the issue of homelessness to as many individuals as possible. The simulation should, as its minimum system requirements, support (run smoothly on) a machine with the following specifications:

CPU: Intel Core i3 3210 | AMD A8 7600 APU or equivalent

RAM: 4GB

Disk Space: At least 4GB

GPU: Intel HD Graphics 4000 or AMD Radeon R5 series | NVIDIA GeForce 400 Series or AMD Radeon HD 7000 series

OS: 64-bit Windows 10

Another solution constraint would be that the simulation must be capable of displaying at a 1080p (1920x1080px) resolution. The client will use 1080p displays when showcasing or demonstrating the product to audiences. Nearly all modern screens support 1080p; modern games are expected to output at this resolution. Part of the fit criterion would be that the image quality of the simulation does not decrease when shown on a 1080p display.

6b Implementation Environment of the Current System

The simulation will be installed on and operate on a Windows 10 machine with specs equivalent to or better than the minimum specs fit criterion specified in section 6a). It must interface with the user mouse and keyboard in order for the user to interact with and navigate the game.

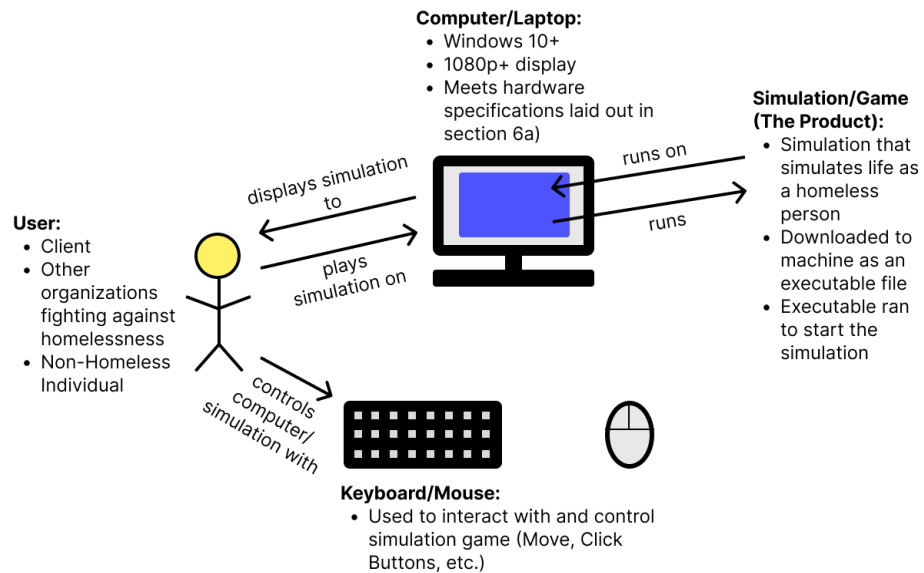


Figure 3 - A diagram that documents the requirements and constraints involved in how the simulation will be interacted with

6c Partner or Collaborative Applications

As a standalone application, the product will not need to be compatible with external applications or commercial packages.

6d Off-the-Shelf Software

As the developers will use a game engine (likely Unity or Unreal Engine) to build the simulation, the simulation must include the necessary software packages from the game engine. These software packages provide the framework for the simulation and include libraries pertaining to physics, graphics, and AI that the simulation cannot function properly without [4].

6e Anticipated Workplace Environment

The simulation, depending on the user, will be played in a vast variety of environments. Thus, we can assume some users will intend to play the simulation while out of home or on the move, which suggests the value in having a mobile version of the application. If a mobile version is to be made, then in-game models and text must be large enough to be easily visible and legible. The simulation may be played in noisy environments, and while it is ideal for a user to play the simulation in a quiet place so that in-game sounds can be heard, the simulation must not require that the user has to hear the in-game sound to effectively play/complete the game.

6f Schedule Constraints

A prototype of the simulation showcasing basic features and scenes must be completed by March 25th 2024 (in six months) to allow the client to assess where the project is headed and if any significant adjustments must be made. A beta version of the simulation must be released by September 25th 2024 (in one year) to allow for extensive testing by both the client and test groups. The final version of the simulation must be released by September 25th 2025 (in two years) so that it is ready for use during the winter season, a particularly rough time for the homeless, where generating support for them is even more imperative [3].

6g Budget Constraints

This project has a strict budget of \$250,000 for its development [1], [2]. Due to the nature of the client being a nonprofit organization, it was taken into consideration that the organization would be on a strict budget with what they can provide.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

In order to clarify what certain terms mean in regards to the product, the definitions of most used terms are provided below.

Hazard: Refers to a danger or risk. Does not refer to its usage when saying something (e.g.: Bob hazarded a guess).

Homeless: A term used to describe a person lacking reliable access to shelter, thereby forced to live outdoors “on the streets”. In the context of this project, it does not refer to persons

who are technically homeless but have access to shelter (e.g.: temporary shelter or “couch surfing”).

Hunger: A term used to describe the feelings of weakness and discomfort due to lack of sufficient food intake. In the context of this project, “hunger” is not used as a general term for desire.

Sugarcoat: To make something more attractive than it really is. Does not refer to adding a coating of sugar to food.

Thirst: Used to describe the feeling of a person to drink something in order to stay hydrated. Not used as a general term for a want or desire.

7b UML and Other Notation Used in This Document

This document aims to closely follow the UML 2.0 standard as specified by the Object Management Group. Any significant deviations from said standard shall be marked as such and given a sufficient explanation.

7c Data Dictionary for Any Included Models

Weather refers to the temperature, humidity and precipitation in the simulated environment. A data structure is to be implemented for the simulator that contains said weather conditions. The temperature property is to range from -20 degrees fahrenheit to 120 degrees fahrenheit. Humidity is to follow a percentage scale ranging from 0 to 100 percent. Finally, precipitation is to be represented by a descriptor of the precipitation type (e.g. rain, snow, etc) and the forecast of the amount is to be represented in inches, ranging from 0 to 12 inches.

There must also be a data structure to represent the player and the various properties related to them in the simulation. These properties include their health, hunger status, hydration status and money. The health property is to have a range from 0 to 100, with 0 representing death and 100 representing fully healthy. Hunger and hydration are to have a range of 0 to 5, with a 0 representing starvation and dehydration and 5 representing sufficient food and water intake. Money to range from 0 to 1000, with the range representing the dollar amount that the player has available to them.

8 Relevant Facts and Assumptions

8a Facts

Worldwide operating system market share is 39.16% Android, 30.15% Windows, 16.47% iOS and 8.78% MacOS [9].

Operating system market share in the United States is 38.8% Windows, 20.63% MacOS, 18.65% iOS and 14.03% Android [10].

Windows operating system statistics (Worldwide): Windows 10 (or newer) - 95.11% [8].

Windows operating system statistics (United States): Windows 10 (or newer) - 96.2% [7].

Low end personal computers account for 46.9% of the PC market [6].

High end computers account for only 6% of the PC market [6].

8b Assumptions

It is assumed that the user has at least one computer capable of running an application and that the user is able to sufficiently use their computer to, for example, navigate to the project website and download and install the executable for the simulator.

In order to cover all possible users, given the project budget, it is assumed that the users will be running the Windows 10 operating system or a newer version of said operating system.

It is assumed that the hardware possessed by the users will vary drastically, therefore low end and high end configurations must be supported.

It is also assumed that the game will use an off the shelf, easily obtainable and highly compatible game engine such as Unity to create the game.

Unity is assumed to be compatible with development needs for this project.

It is assumed that the target audience has little to no experience with video games or simulators. Therefore, the simulator needs to be easy to navigate and understand for users with no prior experience with video games and simulators.

II Requirements

9 Product Use Cases

9a Use Case Diagrams

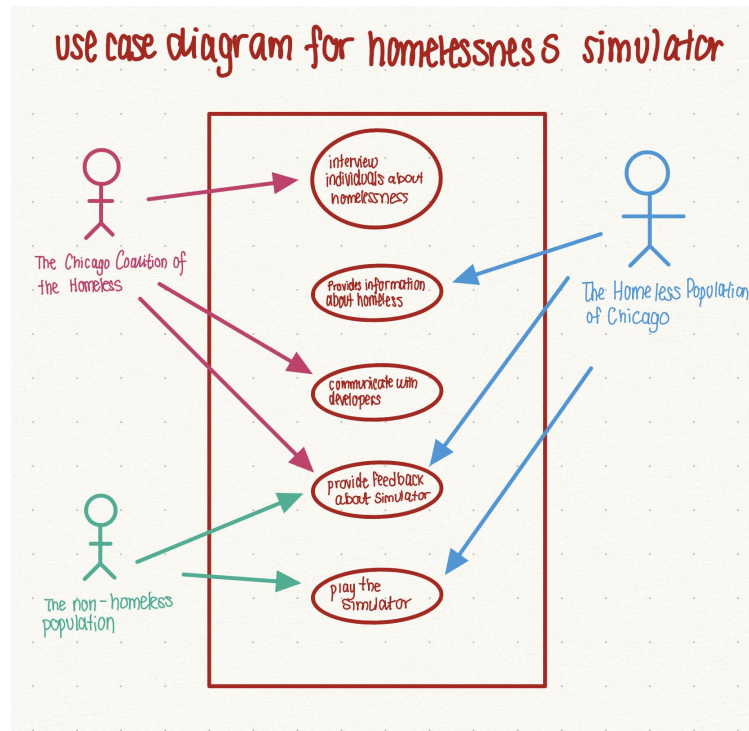


Figure 4 - Use Case Diagram of Homelessness Simulator

9b Product Use Case List

Use Case	By Whom?
Interviewing about experiences in homelessness	The CCH, Chicago's Homeless population
Communicate with the developers	The CCH
Playing the Simulation	Chicago's non-homeless and homeless population, the CCH
Providing feedback on simulation	Chicago's non-homeless and homeless population, the CCH
Providing experiences on homelessness	Chicago's Homeless population

9c Individual Product Use Cases

<p>Use case ID: 1 Name: Interviewing about experiences with homelessness</p> <p>Pre-conditions: Consent from interviewee</p> <p>Post-conditions: Insight gained about the homeless experience to apply to simulation</p> <p>Initiated by: The Chicago Coalition of the Homeless (CCH), Time</p> <p>Triggering Event: N/A</p> <p>Additional Actors: Chicago Homeless Population</p>
<p>Sequence of Events:</p> <ol style="list-style-type: none"> 1.) The homeless individual consents to be interviewed. 2.) CCH representative sets up an interview with the consenting individual 3.) The interview is conducted by the CCH representative 4.) The homeless interviewee responds to the questions in an honest manner 5.) The CCH representative passes along the information to the developers of the simulation 6.) The developers use the information to shape the content of the simulation
<p>Alternatives: The person who is interviewed could be someone who was formerly homeless</p> <p>Exceptions: N/A</p>

<p>Use case ID: 2 Name: Providing Feedback to Developers on Simulation</p> <p>Pre-conditions: The simulation was tested beforehand</p> <p>Post-conditions: Insight to revise the simulation</p> <p>Initiated by: The Chicago Coalition of the Homeless (CCH)</p> <p>Triggering Event: Issues with the Simulation with how it runs or what is portrayed</p> <p>Additional Actors: Chicago Homeless Population, Chicago Non-Homeless Population</p>
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Sequence of Events:

1. Non-homeless and homeless members of the population interact with the simulation
2. The CCH representatives observe the interactions with the simulation
3. One of the users finds something very strange with the simulation that they feel is inaccurate or buggy.
4. The CCH representative notes down the user's concern with the simulation.
5. The CCH representative passes along the information to the developers of the simulation
6. The developers use the information to improve the content of the simulation

Alternatives: The users can potentially send feedback after the user is done testing in the method of a form to the CCH representatives.

Exceptions: If the feature that was reported on was extremely important to the concept of the simulation based on prior interviews, especially if it was noted by one of the homeless individual's interviews, it should be kept in.

Use case ID: 3 Name: Playing the Simulation

Pre-conditions: Simulation has playable content

Post-conditions: Users are able to give feedback on what they did in the simulation

Initiated by: The Chicago Coalition of the Homeless (CCH)

Triggering Event: N/A

Additional Actors: Chicago Homeless Population, Chicago Non-Homeless Population

Sequence of Events:

1. The CCH representatives obtain a playable version of the simulation by the development team.
2. The CCH then sets up the simulation to allow users and their own representatives to test it out
3. The representatives and users, both homeless and not, are able to test the simulation
4. Feedback on the different scenarios is given during or after

testing is complete
<p>Alternatives: N/A</p> <p>Exceptions: N/A</p>

<p>Use case ID: 4 Name: Providing Feedback</p> <p>Pre-conditions: The simulation is playable</p> <p>Post-conditions: Feedback that is given is sent to the developers</p> <p>Initiated by: Users and Testers of the Simulation</p> <p>Triggering Event: The user ending their testing of the simulation or seeing something that seemed like a mistake during their testing</p> <p>Additional Actors: Chicago Homeless Population, Chicago Non-Homeless Population</p>
<p>Sequence of Events:</p> <ol style="list-style-type: none"> 1.) The simulation is at a stage at which it is able to be tested. 2.) The CCH representatives are able to set up the simulation for testing and call in users to test the simulation. 3.) Both homeless and non-homeless people alike test out the current stage of the simulation 4.) They note anything that is interesting, done well, or suspect in the simulation 5.) The users complete their testing of the simulation 6.) The users are then prompted to give their feedback, both good and bad, to the CCH representative, to send to the developers.
<p>Alternatives: N/A</p> <p>Exceptions: If the feedback is not explicit in its review, it may be asked to be elaborated on and otherwise discarded.</p>

<p>Use case ID: 5 Name: Providing experiences on homelessness</p> <p>Pre-conditions: The homeless individual has accepted to be interviewed</p> <p>Post-conditions: N/A</p> <p>Initiated by: The CCH</p> <p>Triggering Event: N/A</p> <p>Additional Actors: The Homeless Population of Chicago</p>
<p>Sequence of Events:</p> <ol style="list-style-type: none"> 1.) The CCH representative asks for the homeless individual's permission to be interviewed 2.) The individual consents to be interviewed. 3.) The CCH representative sets up a space for the interview to be conducted. 4.) The CCH asks questions to the interviewee 5.) The interviewee answers the questions truthfully until the interview is complete. 6.) The interviewee's answers will be kept confidential to their identity when being sent to the developers to assist in the creation of the simulation.
<p>Alternatives: N/A</p> <p>Exceptions: If the interviewee decides to withdraw consent of their experiences and answers to be used in the simulation's development, it will be respected and kept out of development.</p>

10 Functional Requirements

#F-1 - Interview Basis

Description: The simulation must be based off of interviews that are conducted with the homeless individuals who have consented for their experiences to be implemented for the simulation.

Rationale: This requirement is necessary because the simulation depends on data collected from interviews in order to be accurate to the experience of homelessness and will help to avoid inaccuracies and misconceptions.

Fit Criterion: The requirement can be deemed met if those who are interviewed for the simulation have noted that the simulation has been accurate to the general experience of homelessness during testing.

Acceptance Tests: Confidentiality, Accuracy, Informative - All interviews are conducted with the consent of each interviewee to use as the basis for the simulation.

#F-2 - Easy Set Up

Description: The simulation must be easy to set up even to those who never had to set up a system before.

Rationale: Due to the nature of the client's work as a nonprofit, it should be assumed that the knowledge to set up a complicated system is not commonplace among the CCH workers and volunteers.

Fit Criterion: The requirement can be deemed met if those part of the CCH are able to set up the simulation without intense instructions.

Acceptance Tests: Ease of Use, Accessibility - The simulation is able to be set up properly by a multitude of individuals with varying knowledge of setting up systems.

#F-3 Runs on Windows

Description: The simulation must be able to run on Windows 10.

Rationale: Windows is the most common operating system that the general public uses and the operating system that most people would recognize and know how to operate.

Fit Criterion: The requirement can be deemed met if the simulation is able to run smoothly without crashing on Windows 10 or better.

Acceptance Tests: Ease of Use, System Operatives, Accessibility - The simulation should be tested on Windows 10 and higher Windows updates to ensure that the simulation is able to run properly.

#F-4 - Feedback Returns

Description: The system must allow for users to submit feedback about the simulation in written form during on site use and via email during personal use.

Rationale: Due to the sensitivity of the material that the simulation will be recreating, it is important that those who test and play the simulation are able to give feedback, both good and bad, back to the CCH who will then send that feedback back to development.

Fit Criterion: The requirement can be deemed met if feedback is able to be sent back to the developers for consideration.

Acceptance Tests: Maintenance, Longevity, Accuracy, System Operatives, Consistency, Informative - Varying levels of feedback, good and bad, are noted, and the developers are able to read them and apply them.

11 Data Requirements

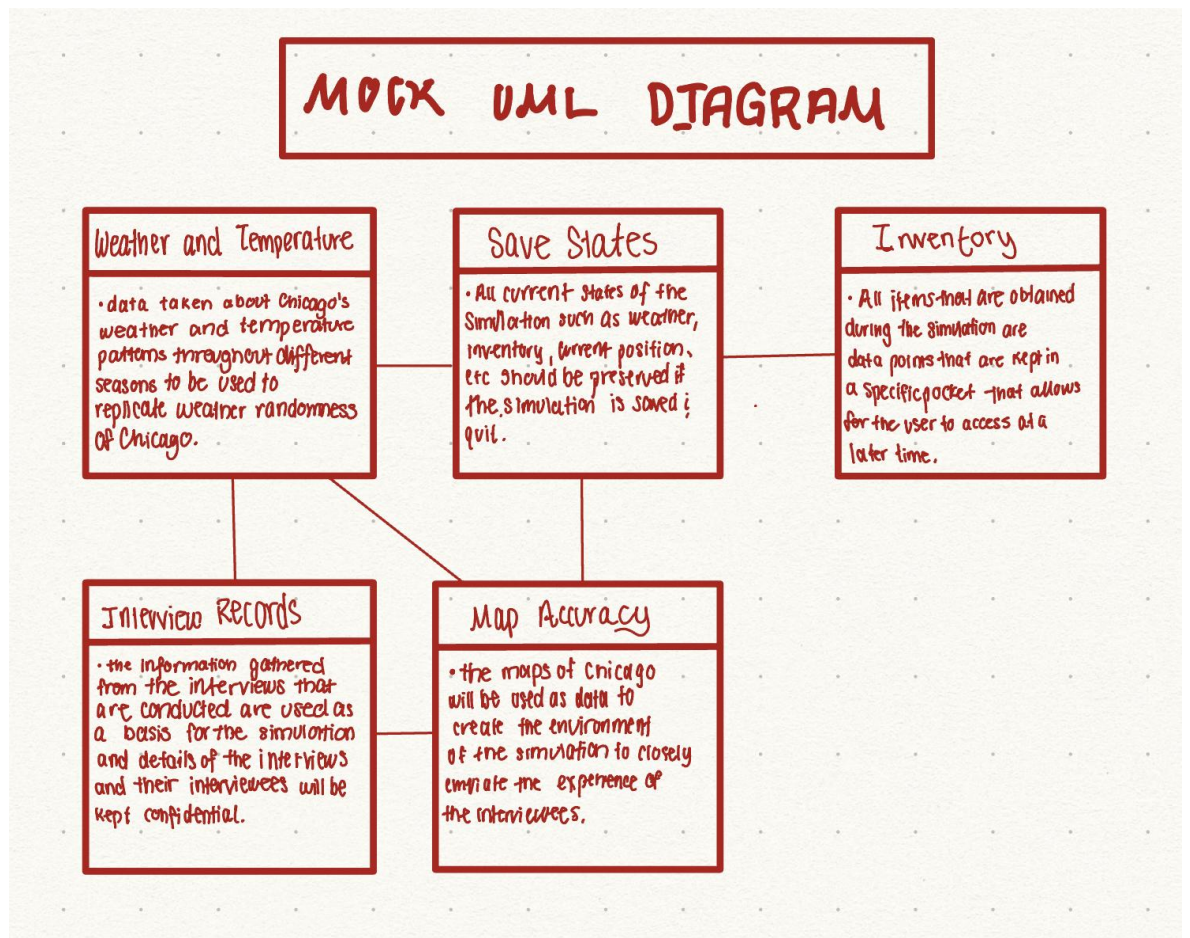


Figure 5 - A mock UML diagram that documents predicted classes and their purposes

For the purposes of this simulation, the term “data” is referred to as information that is recorded and saved for later use both within the simulation and not.

#D-1 - Interview Records

Description: The interviews that are conducted between the CCH and the homeless individuals will be kept confidential as to not put the interviewee at risk.

Rationale: The content of the interview will be very personal to the interviewee and despite being used for the basis and inspiration for the homelessness simulator, and should not be accessible to the public.

Fit Criterion: This requirement can be deemed met if the interviewees’ interviews are kept inaccessible to the public and securely stored away in order to keep them confidential.

Acceptance Tests: Confidentiality, Accuracy, Consistency, Informative - The interviews that are conducted are kept in a safe and confidential matter, #F-1

#D-2 - Saving the Simulation

Description: The simulation should be able to allow the tester/user to save the progress that has been made so far, which encompasses the current stats and items that the user may have picked up along the way.

Rationale: This is needed because while it is a simulation type system, there will be times where the user will need to stop and step away from the simulation but do not want to lose their progress/

Fit Criterion: This requirement can be deemed met if the user is able to save the simulation's progress, quit the simulation, and re-enter the simulation at the same point that they saved at before quitting the simulation.

Acceptance Tests: Storage, Ease of Use - Different types of items should be able to be placed inside of the inventory and still be there after saving, quitting, and restarting the simulation. The position where the user was last after saving and quitting the simulation should be the same position the user should be in when the simulation begins again.
#D-3, #D-4. #D-5

#D-3 - Map Accuracy

Description: The map of the simulation should be taken from real world data of the area of Chicago to create the map that the user traverses.

Rationale: Due to the fact that the client of this simulation is based in Chicago and will be primarily used by the population of Chicago, the map should reflect these experiences of those who the simulation should be based on.

Fit Criterion: This requirement will be deemed met if the map of the simulation is accurate enough to the area of Chicago that users can recognize certain landmarks, streets, and alleyways.

Acceptance Tests: Accuracy, Consistency, Informative - The streets and different areas of the simulation should be similar to the maps of Chicago, user is able to determine where they are in the simulation with relative accuracy, #D-1

#D-4 - Weather and Temperature Data

Description: The simulation should be able to store and make use of Chicago's weather and temperature patterns.

Rationale: In order to replicate the area of Chicago, it should be able to not only replicate the map of Chicago, but also replicate different aspects such as weather in order to accurately reflect the experiences of the homeless.

Fit Criterion: The requirement can be deemed met if the weather conditions that are randomized in the simulation are accurate enough to be believable to day-to-day weather

that both the homeless and non-homeless population experience.

Acceptance Tests: Accuracy, Consistency, Informative - The simulation is able to simulate different weather conditions and temperature patterns that are present in Chicago, the simulation is able to randomize weather patterns according to given weather data, #D-1

#D-5 - Inventory Data

Description: The simulation should be able to record the items that the user picks up during their testing and load that data into an inventory so that the data is recorded and can be utilized at any time in the future.

Rationale: One of the primary parts of the simulation is emulating the experiences of those who are homeless as closely as possible, which includes how the homeless individual manages their resources that they come around and how those resources are managed and when they're used.

Fit Criterion: The requirement can be deemed met if the simulation allows for the users to keep track of the resources that they encounter while testing and allows for those resources to be used later on when the user wishes.

Acceptance Tests: Storage, Ease of Use - Different items can be placed into the inventory and can be seen in the inventory screen later on for future usage, #D-1

12 Performance Requirements

12a Speed and Latency Requirements

#P-1 - User Input Latency

Description: The latency between receipt of a user mouse/keyboard input and the response of the simulation should not exceed 40 milliseconds.

Rationale: A 40 millisecond input latency is generally agreed upon as the threshold for comfortable casual gaming [12]. If it takes too long for the simulation to respond to a user's clicks and keypresses, the user will not have a good experience and will likely stop playing the simulation, which is counter to the CCH's goals. Too much latency may cause users to believe the simulation is bugged, or may deter them from ever running the simulation again.

Fit Criterion: Any response from the simulation to a user's keypress or mouse-click must come within 40 milliseconds of the time of the keypress/mouse-click.

Acceptance Tests: Latency, Ease of Use

#P-2 - Simulation Smoothness

Description: The simulation shall never drop below 30 frames per second.

Rationale: Modern games are expected to run with an average of 60 frames per second or better for a smooth experience. Anything below 30 frames per second becomes too slow, choppy, or laggy. FPSes below 30 will create a negative experience for the user and may be perceived to be unplayable.

Fit Criterion: Run the simulation for at least an hour, making sure to go to areas that load in many assets and data. Should the FPS drop below 30 at any point during the playtest, the simulation must be optimized.

Acceptance Tests: Latency, Ease of Use, System Operatives

#P-3 - Loading Screen Length

Description: No loading screen (the time in which the simulation gathers and loads assets for the upcoming scene) should not exceed 3 seconds.

Rationale: Long loading times can wear down a user's patience and can lead them to grow frustrated with the simulation, ultimately deterring them from ever launching the simulation again.

Fit Criterion: Run tests with the simulation, making sure to access every area and interaction that triggers a loading screen. Every loading screen should only last 3 seconds or less.

Acceptance Tests: Latency, Storage, Ease of Use

12b Precision or Accuracy Requirements

#P-4 - Weather and Temperature Data

Description: All temperature data displayed in the simulation shall be within $\pm 5^{\circ}\text{F}$ of the average temperature in Chicago for the given month and day. All weather conditions should be representative of the temperature shown.

Rationale: To provide an accurate depiction of homelessness in Chicago, the simulated weather conditions must be realistic to Chicago weather, or else the purpose of the simulation is defeated.

Fit Criterion: All temperature values displayed in the simulation environments must either match the same temperature value from the previous year at the same month and date or be within $\pm 5^{\circ}\text{F}$ of the historical average temperature in Chicago for the given month and date.

Acceptance Tests: Accuracy, Consistency, Informative

#P-5 - Map Distance and Time-to-Travel

Description: All distance values (distance between two places of the map) in the

simulation should be within $\pm 0.5\text{km}$ of the corresponding real-life distance between those same places as derived from Google Maps. All time values (time to travel between two places of the map) in the simulation should be within $\pm 6\text{ min}$ of the corresponding real-life time to travel between those same places as derived from Google Maps.

Rationale: To provide an accurate depiction of homelessness in Chicago, the simulated distance traveled between two given places in-simulation must be realistic to the distance a homeless individual in Chicago would travel to go from and to those same places. The purpose of the simulation is defeated if the simulation does not accurately depict the distances a homeless individual must travel to have their needs met, and in fact, may even downplay the struggles such individuals go through.

Fit Criterion: Any distances between two places indicated in the simulation must be within $\pm 0.5\text{km}$ of the distance Google Maps predicts to get between those same two places in real life.

Acceptance Tests: Accuracy, Consistency, Informative

12c Capacity Requirements

#P-6 - Asset Capacity

Description: During any given loading sequence in the simulation, the simulation should be able to load in a minimum of 500MB worth of in-game assets (UI elements, background, sprites, environment, map, items/props).

Rationale: To provide a proper visual depiction/experience of homelessness, the simulation will make use of many assets that represent the background, environmental features, characters, maps, items/props, and more. If the simulation is unable to load a sufficient number of assets, then the scenes in the simulation will lack necessary details or serve as a poor visual representation of the reality of homelessness.

Fit Criterion: The simulation must be put through a test in which it is to load assets from a folder containing 500MB of asset files. If the simulation is unable to do this within 3 seconds (as laid out in the speed and latency requirements), then it is not sufficient for release.

Acceptance Tests: Storage, System Operatives

13 Dependability Requirements

13a Reliability Requirements

#DP-1 - Crashes

Description: The simulation should not crash more than once per day a user runs the simulation.

Rationale: A program that has a tendency to crash often leaves a user frustrated and unwilling to use the program. If the simulation continually crashes when a user tries to play it, they will not bother playing it anymore, and will not bear witness to the themes and lessons the simulation hopes to convey.

Fit Criterion: The simulation shall be tested over the course of the week, with testers attempting to play multiple sessions throughout each day of that week. If any of the testers report experiencing multiple crashes in a day, then it is likely there is an issue with the simulation and must be resolved promptly.

Acceptance Tests: Maintenance, Ease of Use, System Operatives, Consistency

#DP-2 - Progress Saving

Description: No user progress should be lost in the case of a failure.

Rationale: Making progress in some form of activity, only to lose it all from matters not under one's control, is extremely discouraging and leaves the user with negative emotions towards it. Given the goals of the simulation, such negative emotions would be detrimental to the CCH mission and thus, must be avoided.

Fit Criterion: During testing, the simulation should be set to a state indicating some sort of progress, and then intentionally made to crash. Upon relaunching the simulation, if the progress made prior to the crash is not restored, then this is problematic and must be addressed.

Acceptance Tests: Storage, Ease of Use

13b Availability Requirements

#DP-3 - Simulation Availability

Description: The simulation should be available for use 24 hours per day, 365 days per year. In other words, the user should be able to run and play the simulation any time they wish.

Rationale: The simulation is in the form of an executable that does not rely on any sort of online communication. Therefore, anyone who possesses the executable shall be able to run/play the simulation at any time they wish.

Fit Criterion: If, for some unforeseen reason, the executable for the simulation is unable to be run at any time, this indicates a major problem and must be investigated immediately.

Acceptance Tests: Ease of Use, System Operatives, Availability

13c Robustness or Fault-Tolerance Requirements

#DP-4 - System Resources

Description: Should system resources be running low while running the simulation, the simulation should reduce the number of assets it loads and displays in order to maintain and adhere to the speed and latency requirements specified in section 12a.

Rationale: While preserving the realism of the scenes in the simulation is made possible by the usage of many different assets, another priority is making sure the simulation runs smoothly. If the system the simulation runs on is running low on resources (possibly due to having many other programs open at the same time), rather than slow down, potentially creating an unplayable situation, the developers should accept that some detail should be sacrificed and the simulation should reduce the number of assets it loads in and displays, preserving the smoothness of the experience.

Fit Criterion: Run the simulation on a test machine running many other processes that use up much of the memory and processing power. If the simulation ever drops below 30 frames per second, the developers shall work on further optimizing the simulation.

Acceptance Tests: Storage, Ease of Use, System Operatives, Consistency

13d Safety-Critical Requirements

#DP-5 - System Protection

Description: The simulation should not include any code that creates conditions in which hardware is damaged or its lifespan significantly reduced.

Rationale: The developers must recognize the code of ethics pertaining to their profession and refrain from including nefarious code in the simulation. In addition, it should be made sure that the code does not have any unintended consequences that impact hardware negatively, as this can lead to potential lawsuits and legal trouble.

Fit Criterion: A dedicated test machine will have the simulation run on it. The system resources shall be monitored carefully and vigilantly, making sure the simulation does not cause abnormal spikes in CPU or memory usage (90-100% utilization).

Acceptance Tests: System Operatives, Security, Legal

14 Maintainability and Supportability Requirements

14a Maintenance Requirements

#MS-1 - New Data/Asset Additions

Description: New weather, map data, and assets must be added to the simulation within one working week of when the data and assets are retrieved.

Rationale: Maintaining and updating the simulation regularly makes the process much more manageable compared to attempting to include massive amounts of data/assets at once. It also ensures that the simulation stays up-to-date with the reality of homelessness being experienced by those who are homeless in Chicago.

Fit Criterion: The time in which a set of data and assets shall be logged. A developer shall log when they implement the dataset into the simulation. If a gap larger than a working week between these two logged times is identified at any point during the simulation support period, then it shall be brought to the developers' attention.

Acceptance Tests: Maintenance, Longevity, Accuracy, Storage, Informative

14b Supportability Requirements

#MS-2 - Helpdesk

Description: A live online helpdesk of 5 individuals dedicated to answering inquiries or bug reports should be available from 10:00AM - 10:00PM U.S. Eastern Time, accessible from the CCH website. If the inquiry is beyond the helpdesk member's expertise, the helpdesk member can relay the request/information to the developers.

Rationale: Users who feel they have access to someone who can answer questions and thoughts they have while playing the simulation will be more invested in the themes, messages, and lessons to be learned from the simulation. In addition, it provides an outlet for bugs in the simulation to be brought up to the developers. The helpdesk workers provide a bridge between consumers and developers, and are able to reframe and relay bug reports in a way that is more helpful to the developers.

Fit Criterion: Helpdesk workers shall log their hours, and those hours should read 10:00AM-10:00PM U.S. Eastern Time. Thorough testing shall be done on the helpdesk service, and only when inquiries can be successfully received and bug reports successfully sent should the helpdesk feature be deemed ready to go.

Acceptance Tests: Maintenance, Ease of Use, Accessibility, Consistency, Informative

14c Adaptability Requirements

#MS-3 - Operating System

Description: The simulation is expected to run under Windows 10+.

Rationale: Given the vast popularity of the Windows operating system, especially for games/simulators, it is the ideal operating system for the simulation and will allow for the largest possible user base, which aligns with the client's goals of spreading homelessness awareness to as many individuals as possible. The simulation shall be approved as Windows 10-compliant by the development testing group.

Fit Criterion: The executable shall not fail when launched under the operating systems Windows 10 and Windows 11. The simulation shall be approved as Windows 10-compliant by the development testing group.

Acceptance Tests: Ease of Use, System Operatives, Accessibility

14d Scalability or Extensibility Requirements

#MS-4 - Data Capabilities

Description: The simulation currently is able to load in a minimum of 500MB worth of in-game assets/data. The simulation should be able to load in a minimum of 700MB worth of data within two years of launch without violating other requirements.

Rationale: The issue of homelessness is always evolving. That is, new facts, experiences, and information are constantly being discovered, and thus, increases the potential for new scenes in the simulation. More scenes increases the likelihood of more assets, which may introduce a need for greater capabilities in terms of asset-loading.

Fit Criterion: Regular checks shall be made every three months to ensure that the simulation can load 25MB more data/assets than was possible in the previous check (which after two years, will amount to a 200MB increase).

Acceptance Tests: Storage, System Operatives

14e Longevity Requirements

#MS-5 - Product Maintenance

Description: The developers are expected to update and maintain the simulation for at least 4 years.

Rationale: Spreading awareness about homelessness through the simulation is most effective when the product is maintained long enough for it to gain maturity, have most of its bugs resolved, and stay up-to-date with the reality of homelessness. It also allows for a significant user base to form before maintenance may cease.

Fit Criterion: The developers shall be made responsible to log and complete consistent work on the simulation for the next four years following the release date.

Acceptance Tests: Maintenance, Longevity, Consistency

#MS-6 - Product Lifetime

Description: The simulation itself shall be operational for as long as the platform it runs on (Windows 10+) is supported.

Rationale: Given that the simulation is simply an executable program file, it will be functional for as long as Windows 10+ is maintained/supported by Microsoft. Even when maintenance for the simulation ends, provided the most recent version of the executable is made available on the CCH website, users may still download and launch the simulation.

Fit Criterion: The simulation shall be fully functional on the Windows 10 and Windows 11 operating systems until they are no longer supported (and even then the simulation will likely still run correctly).

Acceptance Tests: Longevity, System Operatives, Availability

15 Security Requirements

15a Access Requirements

#S-1 - Debug mode/dev tools

Description: Only the developers should have access to any tools or systems placed within the simulator related to development.

Rationale: Access to these tools may confuse the user, or cause them to break the application unintentionally or otherwise.

Fit Criterion: Any potential tools placed within the system for developers should be sufficiently hidden from the user. While playing the game, if the user somehow manages to bring up a developer feature or menu, the feature or menu in question needs to be further hidden or removed entirely from the final product (if possible).

Acceptance Tests: Maintenance, Security

#S-2 - Data

Description: The user should not have direct access to any data related files, such as the save data. These files should be hidden away and made illegible to the user.

Rationale: Access to and modification of these files may break the intended functionality of the simulator for the end user, allowing them to do things such as modify values and cheat through the game.

Fit Criterion: Conduct a study on users who identify as hackers in video games and have them try and cheat within the game. If they are able to modify any values leading to unintentional functionality, the files need to be hidden in a better place and made legible only to the application.

Acceptance Tests: Security, System Operatives

15b Integrity Requirements

#S-3 - Saved data integrity

Description: The application shall prevent saved data from being incorrect and corrupted.

Rationale: Corrupted save data would make the user frustrated and likely stop playing through the rest of the simulator as all of their progress has been lost.

Fit Criterion: Run the simulator through various phases that involve time spent playing, items in the inventory, save times and save locations. If any of these result in a save file corruption when saved and reloaded, it is unacceptable.

Acceptance Tests: Maintenance, Storage, Ease of Use, Security

#S-4 - Installation integrity

Description: The application shall prevent files related to its installation from being corrupted.

Rationale: Corrupted installation files will render the application unusable and would require a uninstall and reinstallation. This would frustrate users, and give them an unsatisfactory experience.

Fit Criterion: Run the simulation on various machines and play through the game at various stages. Under no circumstances should the game be unable to be started up after being closed.

Acceptance Tests: Maintenance, Storage, Ease of Use, Security

15c Privacy Requirements

#S-5 - Protection and respect of user privacy

Description: The application shall not store any personally identifiable user data. No data shall be transmitted back to an outside source such as telemetry/analytics data.

Rationale: The application is completely offline and has no use for the collection of personally identifiable user data.

Fit Criterion: While playing through the application, run a test on the incoming and outgoing network traffic of the application. There should not be any. Run through all files saved from the application that resulted from the usage of the application, such as

the save file. There should be no personally identifiable user data within this file.

Acceptance Tests: Confidentiality, Storage, Security

15d Audit Requirements

Not applicable.

15e Immunity Requirements

#S-6 - Offline security

Description: The application shall be fully offline and immune from outside attacks that result from the application communicating outside of the application.

Rationale: The application will be fully isolated from the internet and cannot be used directly as a vector for any potential attack to the user.

Fit Criterion: Perform an audit on the code base and make sure there is no code related to the application communicating to outside parties. For additional safety, inspect the network traffic while using the application. There should be no activity related to the application.

Acceptance Tests: Availability, Security

#S-7 - Local protection

Description: The application shall not be used locally as a vector to execute any malicious code.

Rationale: It may be possible for an external virus or likewise malicious code installed to try and use the application for their attack. The application having code that does not have serious security vulnerabilities will prevent any potential attack.

Fit Criterion: Hire a white hat group of hackers to try and use the application for malicious benefit. If they are able to, its security needs to be improved.

Acceptance Tests: System Operatives, Security, Legal

16 Usability and Humanity Requirements

16a Ease of Use Requirements

#UH-1 - Feedback

Description: Every action performed by the user within the simulation should have a

reaction.

Rationale: The simulation/game is highly interactive and based on user input. Therefore, the user should be able to understand whether they successfully performed an action within the simulation based on visual cues from the system.

Fit Criterion: A test shall be conducted on a group of participants from a wide range of age groups. At least eighty percent of the participants should feel as though any interaction they had with the system was successfully registered by the system.

Acceptance Tests: Ease of Use, System Operatives

#UH-2 - Discoverability

Description: The user should be able to navigate through the interface and find all of the features/options they need to use.

Rationale: The user should not get lost in navigating through the user interface, as it disrupts their work flow as they try to locate certain functionality.

Fit Criterion: A study shall be conducted on a diverse range of participants, ranging from younger individuals to the elderly. They will be told to perform certain basic tasks that involve navigating through the various menus throughout the system. If more than ten percent of the participants take more than a few minutes to complete the tasks due to being stuck trying to navigate through the interface, there is a major issue in regards to discoverability of aspects within the system.

Acceptance Tests: Ease of Use, Accessibility

#UH-3 - Visibility

Description: Visual elements throughout the interface should be easily seen and identifiable by the user.

Rationale: The user should be able to see all of the information presented to them on the screen in order to make sense of the environment they are interacting within. Any visual elements shall be of sufficient size so that the user does not need to move closer to the screen or zoom in to see them.

Fit Criterion: Users in a study shall fill out a survey related to various screens throughout the system and be able to list all of the visual elements on the screen. If more than ten percent of the participants incorrectly identify an item or miss an item, the visibility of said item needs to be improved.

Acceptance Tests: Ease of Use, Accessibility, Consistency

#UH-4 - Mapping

Description: Iconography throughout the system should correlate to its correct

functionality

Rationale: Users should be able to correctly identify what feature a button triggers or the meaning behind any icons displayed to them in order to reduce confusion and increase the usability of the system.

Fit Criterion: Participants in a study shall be given a set of icons, buttons and any other significant visual elements used throughout the simulation. For any specific element, if more than twenty percent of the users incorrectly identify the purpose or functionality behind the icon, it needs to be revised as it maps an incorrect function to said icon.

Acceptance Tests: Ease of Use, Accessibility, Consistency

16b Personalization and Internationalization Requirements

#UH-5 - English(US) language support

Description: The application shall support the English language, specifically the American version of English.

Rationale: The most popular and spoken language in the Chicagoland area [11].

Fit Criterion: Conduct a study with English speaking participants ranging from multiple fluency levels. If more than ten percent of the participants have difficulty with understanding the text within the application, it needs better English language support.

Acceptance Tests: Accessibility

#UH-6 - Spanish language support

Description: The application shall support the Spanish language.

Rationale: The second most popular spoken language in the Chicagoland area and the most popular non English language in the area [11]. Support for more languages will increase the potential user base of the product.

Fit Criterion: Conduct a study with Spanish speaking participants ranging from multiple fluency levels. If more than ten percent of the participants have difficulty with understanding the text within the application, it needs better Spanish language support.

Acceptance Tests: Accessibility

#UH-7 - Mandarin language support

Description: The application shall support the Mandarin language.

Rationale: The second most popular non English language in the Chicagoland area [11]. Support for more languages will increase the potential user base of the product.

Fit Criterion: Conduct a study with Mandarin speaking participants ranging from multiple fluency levels. If more than ten percent of the participants have difficulty with understanding the text within the application, it needs better Mandarin language support.

Acceptance Tests: Accessibility

#UH-8 - Polish language support

Description: The application shall support the Polish language.

Rationale: The third most popular non English language in the Chicagoland area [11]. Support for more languages will increase the potential user base of the product.

Fit Criterion: Conduct a study with Polish speaking participants ranging from multiple fluency levels. If more than ten percent of the participants have difficulty with understanding the text within the application, it needs better Polish language support.

Acceptance Tests: Accessibility

#UH-9 - Arabic support

Description: The application shall support the Arabic language.

Rationale: The fourth most popular non English language in the Chicagoland area [11]. Support for more languages will increase the potential user base of the product.

Fit Criterion: Conduct a study with Arabic speaking participants ranging from multiple fluency levels. If more than ten percent of the participants have difficulty with understanding the text within the application, it needs better Arabic language support.

Acceptance Tests: Accessibility

#UH-10 - Dollar currency support

Description: The application shall use the US dollar for currency type within the simulation.

Rationale: It is the standard currency within the United States, which our users will be based in. The application is not intended for international audiences. Usage of this currency will make the currency system in the game familiar to users.

Fit Criterion: Perform a study relating to the currency system used within the stimulator. If more than ten percent of the participants are unfamiliar with the currency system used within the game, it needs to be adjusted to better align with the system used within the United States.

Acceptance Tests: Accessibility

16c Learning Requirements

#UH-11 - Easy for children and elderly to learn

Description: The application should be easy to learn for everyone of all ages, including children and the elderly.

Rationale: Children and the elderly are on opposite ends of the age spectrum. Children may not have lots of knowledge or real world experience to navigate through software. Whereas elderly individuals may have lost some mental capacity and may have difficulties learning the new software. If both groups have no difficulties learning how to use the software, the average person should also have no difficulty in learning the software.

Fit Criterion: Conduct a study with elderly and children using the software along with any tutorials or manuals that may be present.

Acceptance Tests: Ease of Use, Accessibility

16d Understandability and Politeness Requirements

#UH-12 - Natural symbols

Description: The application shall use symbols associated with functionality that are commonly associated with that functionality in other systems and the real world.

Rationale: This would make the application more familiar with new users, and lower the learning curve as functions would be understood without any newly acquired knowledge.

Fit Criterion: Compile a list of all symbols used throughout the program. If more than twenty percent of the symbols are not easily recognizable by participants in a study, they are not naturally understandable.

Acceptance Tests: Ease of Use, Accessibility, Consistency

#UH-13 - Natural language

Description: The application shall use common forms of speech and non technical terms.

Rationale: This would increase the understandability of words and sentences within the application as no additional background knowledge related to certain words, phrases or meanings would be required by the user to use the application.

Fit Criterion: Compile a list of words or phrases used throughout the simulator and put them into a survey. Have participants select the meaning of each word or phrase. If more

than ten percent of participants are unable to get a certain word or phrase right, it needs to be simplified or adjusted to fit the speech pattern of the users belonging to Chicagoland.

Acceptance Tests: Ease of Use, Accessibility

16e Accessibility Requirements

#UH-14 - Color-blind friendly

Description: Any usage of color within the application should be made with color blind individuals in mind.

Rationale: Some individuals may not be able to see certain colors, leading to a breakdown in any functionality that relies on the usage of color.

Fit Criterion: Determine which colors and/or which combinations of colors to avoid using in the software. Afterwards, perform a study with known color blind or color sensitive individuals and see if they can correctly identify the colors used throughout the software and any meanings associated with the usage of them. If they cannot see or identify the color used, the application uses a problematic set of colors and needs to be modified to accommodate for those individuals.

Acceptance Tests: Accessibility

#UH-15 - Partially-sighted user friendly

Description: The application shall be usable for people who have issues with their eyesight.

Rationale: If visual elements or text is too small within the software, individuals with sight issues will be unable to use the software or have significant difficulty in using the software.

Fit Criterion: Visual elements such as buttons, icons and text shall be used within a survey of users with known eyesight issues. If more than twenty percent of these individuals cannot identify a visual element or make out text from a normal viewing distance of a foot or more, the software is not usable enough for these users and the visual elements need to be modified.

Acceptance Tests: Accessibility

16f User Documentation Requirements

#UH-16 - Installation Manual

Description: A downloadable PDF describing how to install the software on all supported operating systems shall be provided to the user.

Rationale: Some users may not be good in performing basic computer tasks, such as installing new software. The provided PDF will help aid those non tech savvy users in installing the software via step by step instructions.

Fit Criterion: A study shall be conducted with users, such as the elderly or people unfamiliar with computers, that involves them installing the software with the aid of the installation manual. If more than twenty percent of individuals are unable to install the software, provided their computer can install it, the manual needs to be modified as it is not clear enough with its instructions.

Acceptance Tests: Ease of Use, Accessibility

#UH-17 - User Manual

Description: A downloadable PDF describing the purpose of the software and how to use it shall be provided to the user.

Rationale: The user should have the option of learning more about the software and how to use it without first running the software and using a tutorial within the software.

Fit Criterion: A study shall be conducted involving users who are instructed to read the user manual. Any tutorial sections or guides within the software are disabled. The users are then instructed to use the software and perform a task without help within the software itself. If more than twenty percent of the users have trouble, the user manual is not clear enough on how to use the software and needs to be modified.

Acceptance Tests: Ease of Use, Accessibility

16g Training Requirements

#UH-18 - No training required

Description: No training is required for this application as it is not technical or specialized for a certain demographic.

Rationale: The simulator should be easy to use for everyone as it is intended as a casual tool for the CCH to highlight the problem of homelessness and educate users on the issue.

Fit Criterion: Conduct a study involving participants from a diverse pool of age groups and backgrounds. If more than ten percent of the participants have significant issues and need to be guided through how to play the simulator, it is too complicated and requires training to use.

Acceptance Tests: Ease of Use, Accessibility

17 Look and Feel Requirements

17a Appearance Requirements

#LF-1 - Color consistency

Description: Colors and color combinations shall follow those dictated by the client and match their colors used on their website and other materials related to the client.

Rationale: To remain consistent with the overall branding and look and feel of the client that the user of the product would expect to see.

Fit Criterion: Various material related to the CCH shall be gathered. Usage of color shall be compared to the usage of color in the application. If there are significant differences, the wrong type of color(s) were used.

Acceptance Tests: Consistency

#LF-2 - Font consistency

Description: Any text within the application shall match the font(s) used by the CCH used throughout their other materials.

Rationale: To remain consistent with the overall branding and look and feel of the client that the user of the product would expect to see.

Fit Criterion: Various material related to the CCH shall be gathered. Fonts used shall be compared to the usage of fonts in the application. If there are significant differences, the wrong type of fonts were used.

Acceptance Tests: Consistency

17b Style Requirements

#LF-3 - The product shall appear informative/educational

Description: The product shall have a style that appears serious and informative to the user.

Rationale: The goal of the simulator is to educate the user about homelessness in order for them to better sympathize with homeless people and be more likely to donate to the CCH.

Fit Criterion: Perform a study that involves the participants taking a survey about homelessness and ask about how likely they will donate towards solving the problem. After the participants use the product, they fill out the same survey. If at least eighty percent of the participants demonstrate higher education on the issue and an increase in the likelihood of a donation, the product has sufficiently done its job in educating the users.

Acceptance Tests: Consistency, Informative

18 Operational and Environmental Requirements

18a Expected Physical Environment

#OE-1 - CCH Physical Environment

Description: The product shall be operated on-site on the CCH office computers in its own designated section.

Rationale: Having the experience on-site, will attract potential volunteers and can educate them on the experience of homeless individuals.

Fit Criterion: The product shall have the same functionality on-site as it does when downloaded to another user's computer, outside the CCH.

Acceptance Tests: System Operatives, Availability

#OE-2 -Home-Use Environment

Description: The product can be downloaded and used on a user's home computer.

Rationale: The product needs to be widely available in order to adequately accomplish its goal of spreading awareness and educating.

Fit Criterion: The product shall have the same functionality on-site as it does when downloaded to another user's computer, outside the CCH.

Acceptance Tests: Ease of Use, System Operatives, Availability, Accessibility

18b Requirements for Interfacing with Adjacent Systems

#OE-3 - Operating System Requirements

Description: The product shall run on Windows 10+.

Rationale: The product should be as accessible as it can possibly be, which is achieved by supporting the most popular operating system in use.

Fit Criterion: The simulation shall be fully functional on Windows 10+.

Acceptance Tests: Ease of Use, System Operatives, Accessibility

#OE-4 - Processor Requirements

Description: The product shall run on processors equivalent to the Intel Core i5 or newer.

Rationale: The product should maintain accessibility while still providing a robust level of content.

Fit Criterion: The simulation should perform equally at the lowest performance settings on any processor greater or equal to the Intel Core i5.

Acceptance Tests: Ease of Use, System Operatives, Accessibility

18c Productization Requirements

#OE-5 - Installation

Description: The product shall be downloaded from the website as a setup executable which will launch an installation wizard.

Rationale: The installation of the product should be as streamlined as possible in order to be accessed by users who aren't as familiar with installing software.

Fit Criterion: The product can be successfully installed in fewer than 5 steps.

Acceptance Tests: System Operatives, Availability

18d Release Requirements

#OE-6 - Monthly Updates

Description: Following initial release, the project will have monthly updates based on user feedback for one year.

Rationale: The updates are intended to improve the user experience without requiring them to install updates too frequently. After a year, it is expected the simulation should function without bugs, and be used by the CCH for years to come, without the need for maintenance.

Fit Criterion: The budget for continuing to update the simulation should be half of the initial budget due to infrequent updates.

Acceptance Tests: Maintenance, Longevity

#OE-7 - Update Functionality

Description: Each update should only add quality-of-life features or fix existing features, while not causing previous features to fail.

Rationale: Updates are to be made via user input and thus should only IMPROVE the product.

Fit Criterion: Updates should have fewer bugs than the previous update.

Acceptance Tests: Maintenance

19 Cultural and Political Requirements

19a Cultural Requirements

#CP-1 - Consultation with Homeless Individuals

Description: The events of the simulation should be based on stories provided by homeless individuals

Rationale: Ensures that the experience provided by the simulation is accurate.

Fit Criterion: Stories of homeless people are to be collected prior to event programming.

Acceptance Tests: Confidentiality, Accuracy, Informative

#CP-2 - Respect for Dignity

Description: The situations portrayed by the simulation should be contextualized in a way to preserve the dignity and respect of those who had to go through them.

Rationale: Ensures that the experience provided by the simulation is respectful to the homeless.

Fit Criterion: A number of homeless individuals must have some level oversight of the content in the initial release.

Acceptance Tests: Confidentiality, Informative

#CP-3 - Educational Element

Description: The events of the simulation should serve to educate the user of the predicaments that homeless individuals face, preventing them from living a normal life.

Rationale: Ensures that each experience provided by the simulation has a takeaway for the user about homeless people that may change a preconceived notion they had about the issue.

Fit Criterion: The product must be tested by non-homeless individuals who can be surveyed about their thoughts about homelessness before and after using the product.

Acceptance Tests: Accuracy, Informative

19b Political Requirements

#CP-4 - Political Messages

Description: The simulation should not endorse any particular politicians

Rationale: The user experience should be unbiased so that they may come to any political conclusions themselves after playing.

Fit Criterion: The product cannot contain the names of any politicians currently running for office.

Acceptance Tests: Accessibility, Consistency

#CP-5 - Political Funding

Description: The project should not receive funding from politicians currently running.

Rationale: The simulation should be free of any political endorsement.

Fit Criterion: The budget for the simulation cannot include any money donated by currently running politicians

Acceptance Tests: Accessibility, Consistency

20 Legal Requirements

20a Compliance Requirements

#L-1 - Credited for Participation

Description: All individuals who worked on the simulation, including those who had their stories collected, must be credited as participants if they so wish.

Rationale: To properly credit all those who contributed to the success of the project. Project must still adhere to privacy laws.

Fit Criterion: Participants must be asked if they wish for their name to be included in the project.

Acceptance Tests: Consistency, Legal

#L-2 - Story Anonymity

Description: Events in the simulation, while based in reality, must be entirely fictitious.

Rationale: Project must adhere to privacy laws. To protect the identity of those who helped with the project, their names will be included at the end of the simulation, separate from the simulated events their stories may have inspired.

Fit Criterion: All names used in simulated events must be made-up.

Acceptance Tests: Confidentiality, Legal

#L-3 - Copyright and Trademark

Description: Any copyrighted material in the project must have the rights obtained to or will be omitted from the project.

Rationale: To adhere to copyright laws.

Fit Criterion: Legal - Work with a lawyer to ensure no copyright infringement is present.

Acceptance Tests: Legal

20b Standards Requirements

#L-4 - IGDA

Description: The simulation shall comply with IGDA (International Game Developers Association) standards.

Rationale: IGDA lays out standards for report handling, code of ethics, game crediting, management abuse, and event diversity [13]. While not a legal regulation, conforming to these standards are a way of upholding valuable principles in the industry and the reputation of the development group.

Fit Criterion: IGDA certifies that the simulation adheres to its standards.

Acceptance Tests: Legal

21 Requirements Acceptance Tests

21a Requirements – Test Correspondence Summary

Test	Requirements																		
	F - 1	F - 2	F - 3	F - 4	D - 1	D - 2	D - 3	D - 4	D - 5	P - 1	P - 2	P - 3	P - 4	P - 5	P - 6	D P - 1	D P - 2	D P - 3	D P - 4
Confidentiality	X				X														
Latency										X	X	X							
Maintenance				X												X			
Longevity				X															
Accuracy	X			X	X		X	X					X	X					
Storage						X			X			X			X		X		X
Ease of Use		X	X			X			X	X	X	X				X	X	X	X
System Operatives			X	X							X					X		X	X
Availability																		X	
Security																			
Accessibility		X	X																
Consistency				X	X		X	X					X	X		X			X
Informative	X			X	X		X	X					X	X					
Legal																			

Test	Requirements																		
	D P - 5	M S - 1	M S - 2	M S - 3	M S - 4	M S - 5	M S - 6	S - 1	S - 2	S - 3	S - 4	S - 5	S - 6	S - 7	U H - 1	U H - 2	U H - 3	U H - 4	U H - 5
Confidentiality												X							

Latency																		
Maintenance		X	X			X		X		X	X							
Longevity		X				X	X											
Accuracy		X																
Storage		X			X					X	X	X						
Ease of Use			X	X						X	X				X	X	X	X
System Operatives	X			X			X							X	X			
Availability							X						X					
Security	X							X	X	X	X	X	X	X				
Accessibility			X	X												X	X	X
Consistency			X			X											X	X
Informative		X	X															
Legal	X													X				

Test	Requirements																	
	U	U	U	U	U	U	U	U	U	U	U	U	U	L	L	L	O	O
	H	H	H	H	H	H	H	H	H	H	H	H	H	F	F	F	E	E
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6	7	8	9	0	1	2	3	4	5	6	7	8	1	2	3	1	2
Confidentiality																		
Latency																		
Maintenance																		
Longevity																		
Accuracy																		
Storage																		

Ease of Use						X	X	X			X	X	X					X	X
System Operatives																	X	X	X
Availability																	X	X	
Security																			
Accessibility	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X
Consistency							X								X	X	X		
Informative																X			
Legal																			

Test	Requirements																	
	O E - 4	O E - 5	O E - 6	O E - 7	C P - 1	C P - 2	C P - 3	C P - 4	C P - 5	L - 1	L - 2	L - 3	L - 4	-	-	-	-	-
Confidentiality					X	X					X							
Latency																		
Maintenance			X	X														
Longevity			X															
Accuracy					X		X											
Storage																		
Ease of Use	X																	
System Operatives	X	X																
Availability		X																
Security																		
Accessibility	X							X	X									

Consistency								X	X	X									
Informative					X	X	X												
Legal										X	X	X	X						

Table 3 - Requirements - Acceptance Tests Correspondence

21b Acceptance Test Descriptions

Confidentiality: Confidentiality can be tested by ensuring that sensitive information and identities of those who contribute but want to stay anonymous are kept private and secure.

Latency: Latency will be tested by how long it takes for the simulation to respond to user input.

Maintenance: Maintenance will be tested by how often developers are checking in to fix bugs and glitches within the simulation.

Longevity: Longevity can be tested by getting feedback from the users and testers and seeing what can be improved or implemented for monthly updates.

Accuracy: Accuracy will be tested by comparing how similar certain aspects of the simulation are, such as the map, weather and temperature, etc. to the real life aspects that they are based on.

Storage: Storage can be tested by how the information that is gathered during the simulation and whether or not it is properly accessible during the simulation.

Ease of Use: The simulation should be easy to understand and easy to use to anyone who may be using the simulation. The simulation should also provide a good user-experience.

System Operatives: The system that is being used should be able to comfortably run the simulation with proper methods of operation.

Availability: The simulation should be able to be used whenever and wherever the user wishes.

Security: The simulation should have no security risks to the users or the devices that it is running on.

Accessibility: The simulation should be able to be tested and used by all people of age, disability, and knowledge to allow for an experience for all.

Consistency: The simulation should be a cohesive entity and environment that appears the

same every time the simulation is in a loading screen or every time the simulation is started again.

Informative: The simulation should be respectful and informative to the experience of the homeless, without harmful bias or misinformation about homelessness.

Legal: The simulation should adhere to relevant laws and standards.

IV Project Issues

28 Open Issues

Not applicable.

29 Off-the-Shelf Solutions

The system will utilize readily available game engines, programming languages, libraries and toolkits in order to realize the final product.

29a Ready-Made Products

There currently exist available game engines such as Unity and Unreal that can be used in creating the simulation. Both options are readily available for use in creating the final product. It is expected that either of these engines will be used in creating the product and any necessary purchases of licenses will be made in order to legally create and distribute the product.

29b Reusable Components

No specific off-the-shelf libraries or toolkits are required for use in developing the simulator. It is up to the discretion of the developers to decide which libraries and/or toolkits to use in order to aid in the development of the simulator using Unity or Unreal Engine.

29c Products That Can Be Copied

Not applicable. This project will not directly build off of previous projects.

30 New Problems

30a Effects on the Current Environment

CCH workers may have to play a technical support role in setting up the simulator for use in their facilities and administering it to their users. They may also need to answer any questions given by the users related to the simulator and the usage of it.

30b Effects on the Installed Systems

CCH may need to update their hardware systems or add more hardware at their facilities to accommodate for the usage of the simulator on site. Depending on the version installed on existing hardware within CCH, they may need to update their operating system to at least Windows 10 in order for the simulator to run.

30c Potential User Problems

Although the product aims to cover the situation of homelessness with a respectable and sympathetic approach, there may be situations throughout the simulator where individuals may feel uncomfortable with the situation presented to them in the simulation.

30d Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Should the CCH choose to administer the simulator through a desktop computer, any power outages may inhibit the usage of the product. Regarding off-site usage, it is possible that the user can have an unreliable internet connection that can prevent the download of the application.

30e Follow-Up Problems

It is possible that Windows updates may interfere with the usage of the application in that the operating system may decide to install updates during or between play sessions of the simulator. This will interfere with the ability for the user to play through the simulator, although it is out of control of the CCH and the developers of the application.

It is also possible that some software installed on the target hardware, such as graphics drivers, may have an update that requires a reboot of the hardware to successfully install. Should this happen while the user is playing through the simulator, and a reboot occurs, it is out of control of the CCH and the developers of the application.

31 Migration to the New Product

31a Requirements for Migration to the New Product

Not applicable.

31b Data That Has to Be Modified or Translated for the New System

Not applicable.

32 Risks

The development process of the simulator relies heavily on the participation of homeless or former-homeless individuals to provide a first-hand account of what living homeless is like, so that the developers may make the simulation as realistic and accurate as possible. If the project is unable to garner enough interest from homeless people, then while the project may still be carried out, it significantly risks producing a product that fails or inadequately

achieves the goals of the client (CCH), which may be considered a waste of time and resources.

33 Costs

The estimated budget to complete this project is \$250,000.

The opportunity cost of spending the two years to develop the project is the lost chance to spend those two years developing some other project. Given the numerous requests the development team receives on a regular basis, committing to making the simulator could mean losing out on the opportunity to take on a more lucrative endeavor.

In addition, following the release of the simulator, at least some of the development team must commit to maintaining the simulator, meaning the development team will lack resources and time for the next project they take on immediately after the simulator project.

34 Waiting Room

Given the budget constraints of the product, it was decided that the target OS would be Windows 10+, given its vast market share. That being said, if it is found that the budget and other constraints are not being fully utilized (in other words, there is room for extra development), then it may be worth considering development of a MacOS or mobile version of the simulation.

35 Ideas for Solutions

While the simulator could be created from scratch, development efficiency will likely be enhanced through the use of a game engine. Two frontrunners for the game engine of choice are Unity and Unreal Engine.

Ideal programming languages to create the simulator with are C# and C++, given their usage in the Unity and Unreal game engines, respectively.

It is suggested that Microsoft Visual Studio be the IDE of choice.

36 Project Retrospective

To be added at the conclusion of the project.

V Glossary

Donation: Aid provided to an organization or person without the expectation of getting anything back.

Engine: A development environment and/or framework that streamlines game development processes.

Hazard: A term used that refers to a danger or risk.

Homeless: A term used to describe a person lacking reliable access to shelter, thereby forced to live outdoors and “on the streets”.

Hunger: A term used to describe the general feeling of weakness and discomfort associated with the lack of sufficient food intake.

Non-profit: An organization whose purpose is to benefit a community instead of make money.

Prototype: An early version or draft of a product.

Sugarcoat: To make something more attractive than it is in reality.

Simulate: To imitate a feeling or experience

Simulator: Game designed to imitate a real world scenario in order to provide an experience to the user.

Thirst: Describes the feeling of the need to drink something in order to stay hydrated.

UML (Unified Modeling Language): A visual modeling language standard that aids in visualization and design of complex systems.

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