Software Requirements Specification Document for CyberSecurity Escape Room

Amr Khaled, Bavly Hapy, Nour Alaa, Zeina ELKhawas, Rahma Emad Eldin
Supervised by:Dr.Riham Kamal,TA:Eng.Reem Aboushama

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Table 1: Document version history

Version	Date	Reason for Change
1.0	6-Dec 2023	SRS First version's specification are defined
1.1	10-Jan 2024	Problem Statement edited
1.2	7-Mar 2024	System Overview and use case diagram

GitHub: https://github.com/nourjebreel/Escape-Room

Contents

Abstract

No one can deny that a lot of people may have enough knowledge but they lack the way to practice it. Cybersecurity escape room initiative created to offer anyone looking to improve their cybersecurity abilities a captivating and immersive learning environment. In this project, users encounter a variety of difficult circumstances in a virtual environment, each of which represents a real-world cybersecurity risk. In a constrained amount of time, users must solve problems and overcome obstacles by using their knowledge and critical thinking. The project will help to close the gap between theoretical understanding and real-world application by modeling scenarios that closely resemble the intricate workings of the cybersecurity industry.

1 Introduction

1.1 Purpose of this document

This paper will primarily address the topic of an interactive cybersecurity escape game, providing an overview of the features and operation of the game. Additionally, a description of each functional and non-functional need will be included in the document. Furthermore, the paper will include diagrams that explain the project strategy in its entirety as well as the data design. It will also discuss the goals of the game and a few similar systems.

1.2 Scope of this document

This paper aims to give a thorough description of our system's needs, constraints, and goals so that readers will be better able to understand, imagine, and address any possible issues. And Outlining important components for an escape room game includes the target audience, puzzles, and learning objectives that will expand subject-specific expertise across a range of fields. Also, our documentation will explain the functional requirements and the non-functional requirements of our project.

1.3 Business Context

The primary objective of the project is to create a sophisticated interactive cybersecurity game for training and practice. Furthermore, the system aims

to help those who are unaware of how they can use their knowledge by creating an interactive game in an enjoyable and motivational way. The system will also help users live in a realistic environment to improve and increase problem-solving skills.

2 Similar Systems

2.1 Academic

- **Omar El-Gayar and Tania Williams:** mentioned in his paper that he designed a virtual cybersecurity escape room.It describes two artifacts: a concept map and a model of a collaborative cybersecurity virtual escape room.The concept map outlines the relationships of gamification, escape rooms, and learning skills to help future researchers transition content to virtual escape room environment.The model incorporates the cybersecurity-related skills of password security, and binary to create a collaborative virtual experience.The problem that they didn't mention the data-set in their research paper that they are going to use in the game (1).

- **Ruta Pirta-Dreimane and Agne Brilingaite:** mentioned in their paper that they discuss the potential of gamification and important approaches in addressing cybersecurity knowledge gaps. The research aims to explore the impact of merge soft skills, like communication and collaboration, on students' practical task performance. It introduces the cybersecurity game "CyberEscape" developed through the intervention mapping methodology, combining virtualized infrastructure with physical resources to create a hybrid escape room. The study uses a multiple-methods research approach, including questionnaires and small group interviews. Preliminary results from the pilot study indicate a positive impact on students' competence improvement and increased interest in cybersecurity.(2)
  The dataset they use was:

1. Invention map
2. combining virtualized infrastructure with physical resources
3. questionnaires

4. small group interviews

- **Erwan Béguin and Barbara Joannes:** mentioned in their paper that they aim to increase the evolving of the awareness of cybersecurity threats in companies if the employess lack awarness. Traditional ways such as lectures and videos may fall short in preparing individuals for real-life cybersecurity situations. Teachers developed two escape rooms with distinct approaches but a shared goal: raising awareness about computer security; teaching them practical skills to reduce the risk of falling victim to cyber attacks.They didn't mention in the paper what dataset they used in their game(3) .

- **Nelson Pinto Tou and Yoshiyuki Kido:** mentioned in their paper that the problem of cyber attacks must be on the attention spot due to the rapid development if the .It introduces a user-friendly learning tool, a game simulation called Security Defense and Dungeons (SD&D). The game is nor only for familiarize people with the latest cybersecurity equipment and solution but it also provide cybersecurity education and increase awareness of cyber threats.Additionally, the game focuses on training users in effective team communication and human resources practices(4).
  The dataset they use was:

1. Featuring cybersecurity scenarios
2. Chat room with players
3. Evaluation

- **Gabriele costa and Marina Ribaudo:** mentioned in their paper that they hightligths the growing importance of serious gaming in facilitating the learning of complex and technical subjects, with a focus on cybersecurity, known for its perceived difficulty. The challenge of making cybersecurity accessible through serious gaming and presents a specific example, A NERD DOGMA, which is a classical escape room adventure incorporating real-world cybersecurity challenges,The game aims to provide users without security skills with a practical experience of planning and executing security operations(5)

- **Marcus Knüpfer and Tore Bierwirth:** mentioned in their paper that they support cyber security training through the use of cyber ranges and flag events, where participants engage in competitive games modeled after CTF (capture the flag). Consequently, in order to enhance current training programs and step up instruction, they were able to find weaknesses in their training system and provide guidelines for creating new training opportunities. They also improved interactive training, which raises security knowledge in a useful way.(6)

2.2 Business Applications

- **Hack The Box:**: is a well-known online platform designed for cybersecurity professionals. It offers an extensive range of challenges and virtual environments where users can practice and enhance their cybersecurity skills. HTB is often likened to a cybersecurity-themed escape room because it presents users with various scenarios, puzzles, and hacking challenges that must be solved to progress.(7)

- **TryHackMe:** is an interactive learning platform tailored for cybersecurity education. Through virtual rooms containing challenges of varying difficulty, users can explore topics such as penetration testing and web security. This platform accommodates individuals with diverse skill levels, promoting accessibility.(8)

- **OverTheWire:** provides a series of war games, each emphasizing distinct facets of cybersecurity. Challenges span cryptography and network security, featuring progressively intricate exercises. The platform's design facilitates skill development through hands-on and progressively challenging scenarios.(9)

- **PentesterLab:** is a practical platform offering hands-on exercises in web penetration testing. Users gain real-world experience by applying their skills to scenarios designed to enhance proficiency in web security.(10)

3 System Description

3.1 Problem Statement

- One of the main challenges facing our product is that people know a lot about cybersecurity but don't know how to utilize it in practice. The following are the next challenges:

1. Students don't have patience to learn or practicing, and they get easily bored from the theoretical courses.
2. Motivating the user to keep going and play in a pleasurable way. Creating tactics that draw people in and keep them interested throughout the learning process is one way to tackle this difficulty. Making the user experience fun is essential to preserving motivation and engagement.
3. Creating an atmosphere on the playground that closely resembles reality. It is imperative that the virtual playground replicates a realistic setting.
4. Difficulty of learning cybersecurity concepts and can be challenging.
5. Increasing the number of people who use the game by providing interactive easy game that isn't boring.

3.2 System Overview

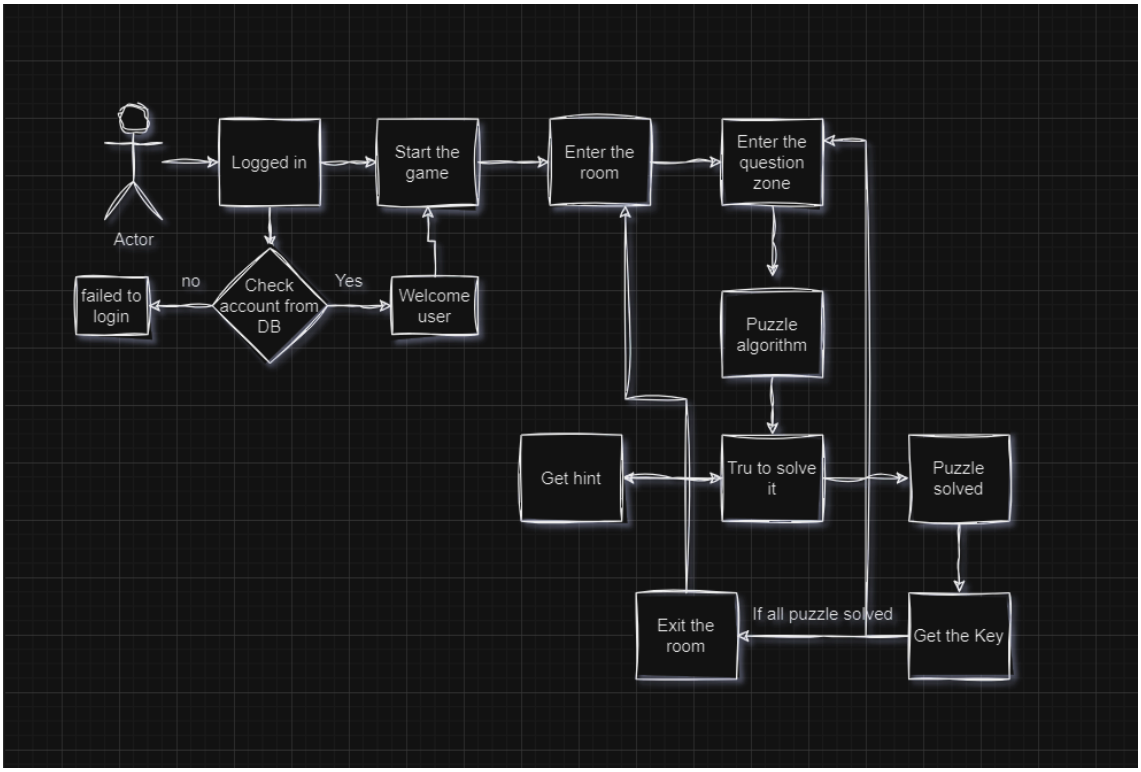

Figure 1: project overview

The above figure represents our project phases as in the following :

- **Unity**:it is a widely used platform game development engine and it provides set of tools for game developers that help them to design or deploy games across various of platforms and we use it for the mobiles platform.(11)

- **Start Game**: the player first opened the game and sign up if he doesn't have an account or log in if he has one and his accounts will be saved in the database and now he can start his journey in our escape room.

- **feedback**: there going to a feedback be after the player pass each room that tell him about his performance within the given time.

- **Hint**: at a specific time during the room there can be a hint that help the player in the challenges he face in the room.
- **Questions**: it can be spread randomly each time the player enter the game according to the difficulty of the room and all the questions are saved in the database.

3.3 System Scope

- The game will be based on unity engine.
- The game will be based on course of "Foundation of cybersecurity".
- The game will contain puzzle and problem solving algorithm in each room.

3.4 System Context

- Control system is responsible for overseeing the overall game, monitoring player progress, triggering events, keeping time, and controlling the state of the game.
- First the player register on game system then starts the game.
- The game system displays the room page and the game system send info about time and progress of player to control system.

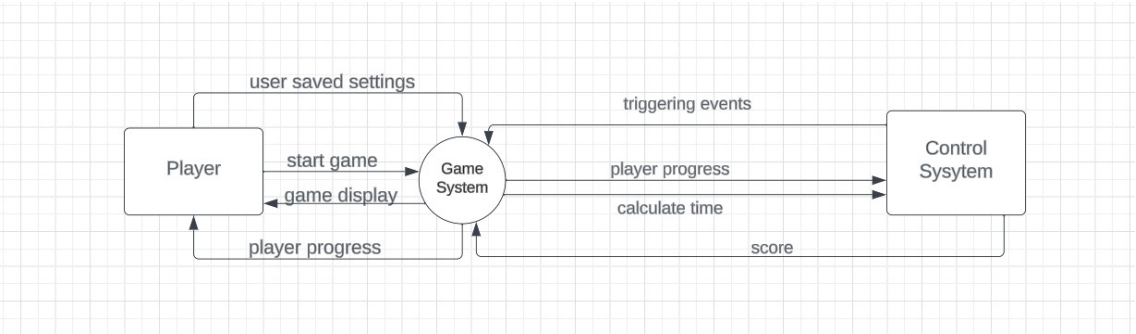

Figure 2: System Context

3.5 Objectives

- Building a realistic environment that simulates typical cybersecurity events and scenarios will improve players ability to think critically and solve problems.
- Our game will be an interactive one with different and enjoyable challenges, including puzzles.
- Introducing techniques frequently employed in the industry to strike a balance between training and enjoyment in order to guarantee a satisfying and unforgettable experience.

3.6 User Characteristics

The players or users who are interacting with the game have these requirements:

- Must have basic knowledge in cybersecurity field.
- The player can be a student, programmer, or anyone who wants to test their knowledge.
- Needs to be able to interact with the gaming system.
- Educators and trainers might suggest the game to their students as an enjoyable and engaging method of practice.

4 Functional Requirements

4.1 System Functions

- **Login:** The player login with his account to continue his game and retrieve his last checkpoint.
- **Start and load game:** the user launches the game that is stored in his device at this point and he is ready to play.
- **Restart game:** the player has the ability to restart the game after a failure to pass any room.

- **Solve Challenges:** there are some serious cybersecurity challenges; they are in different topics in each room.

- **Generate hints:** there can be hints generated after being stopped of progressing in the game by the player to help him to pass the rooms successfully.

- **Certificate:** the player will gain a certificate that he pass "foundation of cybersecurity" course after passing the 3 rooms in the specified time.

- **Quit game:** the player has the ability to quit the game and save it to continue when he play again.

- **Avatar:** A character that the player or the game itself is under control of. It consist of dynamic object modelling or player characters.

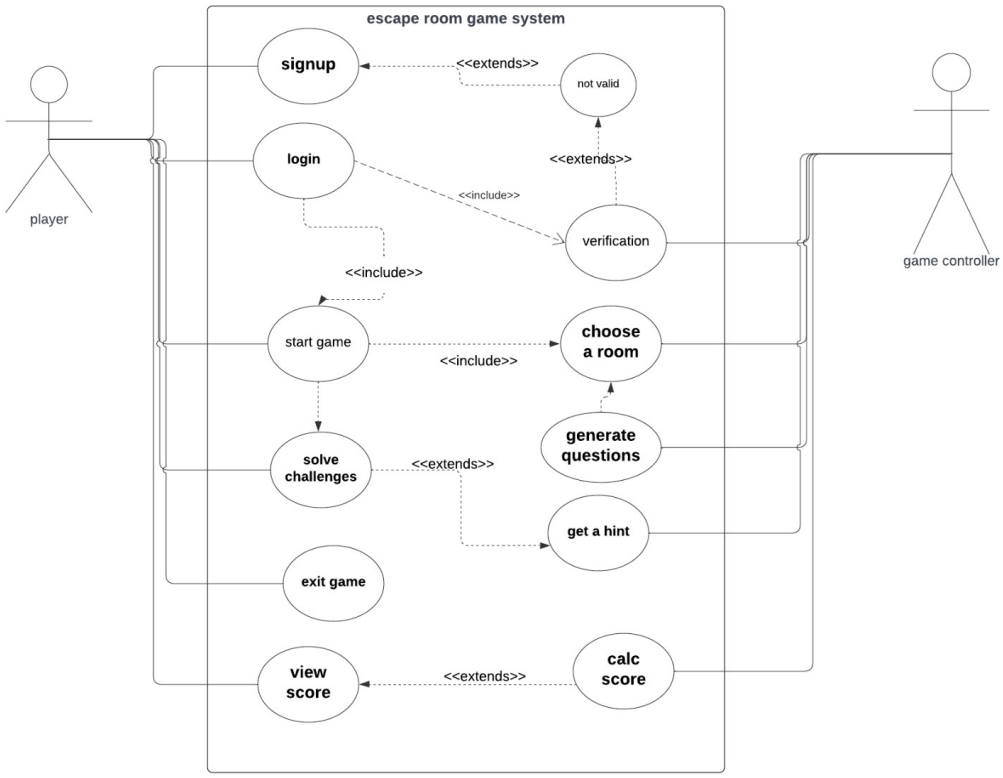

Figure 3: Use Case

4.2 Detailed Functional Specification

- **FR:01** The user shall be able to login to begin his game.
- **FR:02** The user shall start to play the game after login.
- **FR:03**The user shall be able to load his old game.
- **FR:04**The user shall be able to restart his game.
- **FR:05**The user shall be able to quit game .
- **FR:06**The user will face some problem solving algorithm.
- **FR:07**The user will receive hints during the game.
- **FR:08**The user will gain certificate after getting out from the rooms.
- **FR:09**There will be a score for the user.

Name	Login
Code	FR:01
Priority	Essential
Critical	Extremely important
Description	The player login with his account to continue his game
Input	User click on login button in button area
Output	Success or error message
Pre-condition	user is on the home page
Post-condition	Logged in and he is ready to start the game from the main menu
Dependency	on user input
Risk	can't log in

Table 2: Login

Name	Start game
Code	FR:02
Priority	Essential
Critical	Extremely important
Description	The user launches the game that is stored in his device.
Input	User click on play button in button area
Output	Success or error message
Pre-condtion	user is connected to the game and on the main page
Post-condition	game starts
Dependency	on user input
Risk	

Table 3: Start Game

Name	Load game
Code	FR:03
Priority	Essential
Critical	Extremely important
Description	The user can resume his saved progress.
Input	User click on load game button in button area
Output	Success or error message
Pre-condtion	user is connected to the game and on the main page
Post-condition	loaded game starts
Dependency	on user input
Risk	can't start the loaded game

Table 4: Loaded Game

Name	Quit game
Code	FR:05
Priority	High
Critical	important
Description	the player has the ability to quit the game
Input	User save the last process and closes the game
Output	Success or error message
Pre-condtion	options
Post-condition	exit the game
Dependency	on user input
Risk	

Table 5: Quit Game

5 Design Constraints

5.1 Hardware Limitations

- **Graphics API:**
  -Windows: DX10, DX11, and DX12-capable GPUs.
  -macOS: Metal-capable Intel and AMD GPUs.
  -Linux: OpenGL 3.2+ or Vulkan-capable, Nvidia and AMD GPUs.
- **RAM:** minimum 8 GP.
- **Processor:** Any CPU from either AMD or Intel from the newest generation with at least 6 Cores /12 threads

5.2 Standards Compliance

- **Operating System:**
  -Windows: Windows 7 (SP1+), Windows 10 and Windows 11, 64-bit versions only.
  -macOS: Mojave 10.14+ (Intel editor), Big Sur 11.0.
  -Linux: Ubuntu 20.04 and Ubuntu 18.04.
- **Supported languages:** English.
- **It works offline:** no need for internet connection to play.

6 Non-Functional Requirements

6.1 Reliability

The game should specify how much unexpected downtime is acceptable and guarantee that the game is always highly available.

6.2 Availability

Make sure that the game is accessible and works properly on several platforms, including different web browsers without any problems.

6.3 Performance

- The game should immediately respond to various user actions and make sure the system satisfies these expectations.
- The game should manage a scalable user base while taking future user growth into consideration.
- The game should use resources as efficiently as possible to deliver a responsive and fluid gameplay experience.

6.4 Usability

The game should make sure that the user interface of the game is simple to use and offers an enjoyable experience

6.5 Security

Secure player data by utilizing robust encryption. Continually look for and address any security gaps. Ensure that the game can only be accessed by authorized users by using secure login procedures. Limit access to certain areas of the game to manage who can do what. To keep things safe, keep an eye out for any strange activity and act swiftly to stop it. To guarantee that every player has a secure gaming experience, abide by industry standards.

7 Data Design

We are going to build our own dataset in the database. The data set will be in json as key value pairs and it will be saved as a file. The user data will be saved locally on the device by an encrypted file for security of users data.

8 Preliminary Object-Oriented Domain Analysis

This is our class diagram:

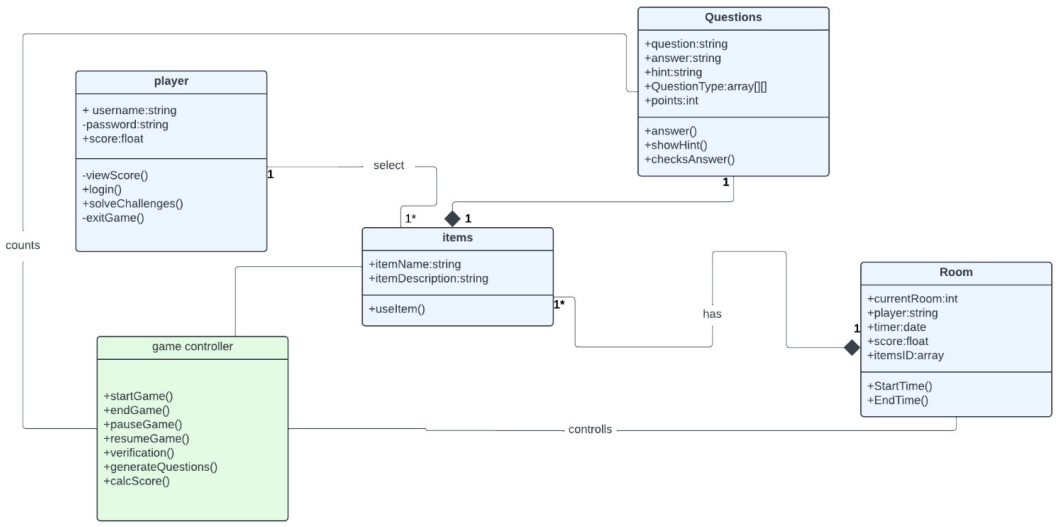

Figure 4: class diagram

9 Operation Scenarios

First the user will sign up and create an avatar if he is new to our game and if he already have one he will login and start the game. Our game will focus on only one scenario that there is an Avatar which the player can move with it through the game.The game involves three rooms and the players must pass through them all in a specific time. The player should

successfully pass the 3 rooms in order to have earn the certificate. Our game is based on "foundation of cybersecurity" course, each room is specified in one chapter such as that the first room are a theoretical questions in the introduction of our course of cybersecuriy and the other 2 rooms are some serious cybersecurity challenges in encryption, decryption and other topics in the course. The main goal is to have an interactive and enjoyable game to practice cybersecurity basic algorithms and to pass the 3 rooms successfully in order to earn the certificate.

10 Project Plan

This is our Project plan:

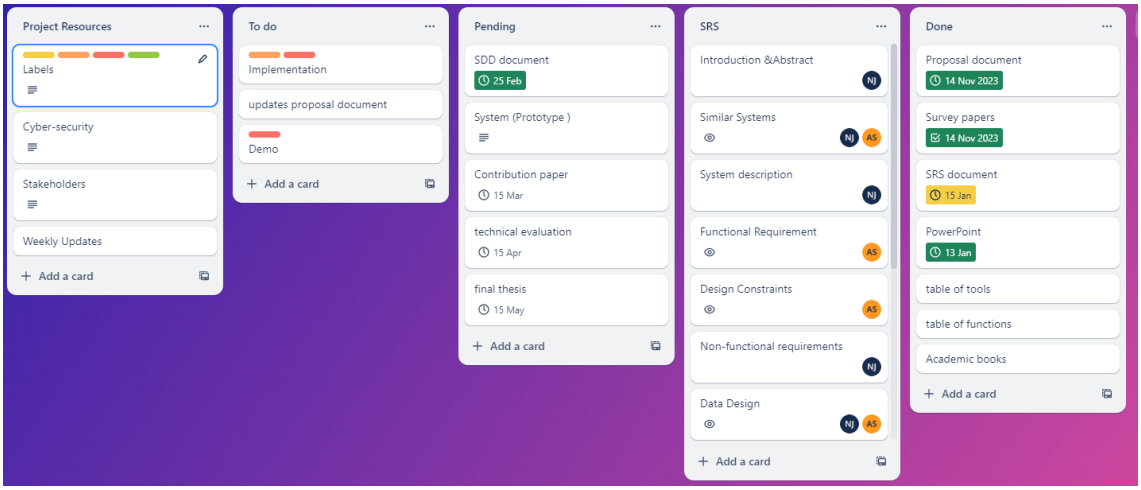

Figure 5: Project Plan

11 Appendices

11.1 Definitions, Acronyms, Abbreviations

- **Encryption:** is the method by which the information is converted into secret code that hides the information's true meaning.
- **Decryption:** the conversion of encrypted data to its the original form.

11.2 Supportive Documents

We made a survey to collect some data that could help us to understand what's the needs of the user and there are the results:

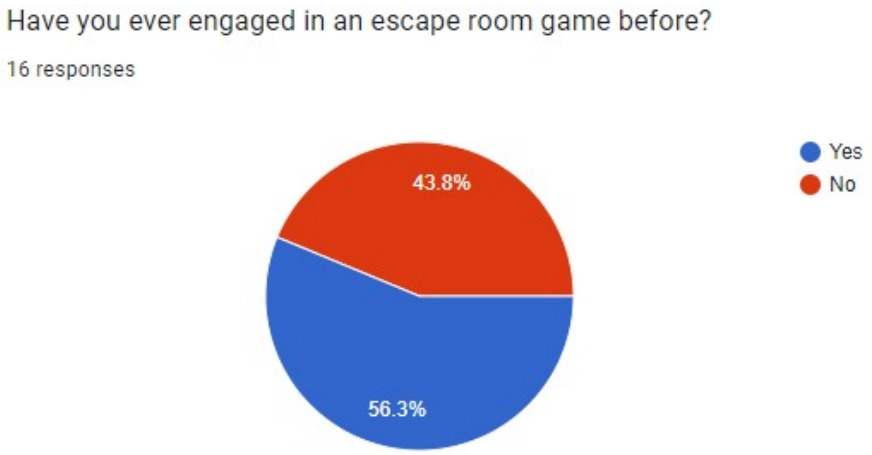

Figure 6: Escape Rooms

Figure 7: Rating

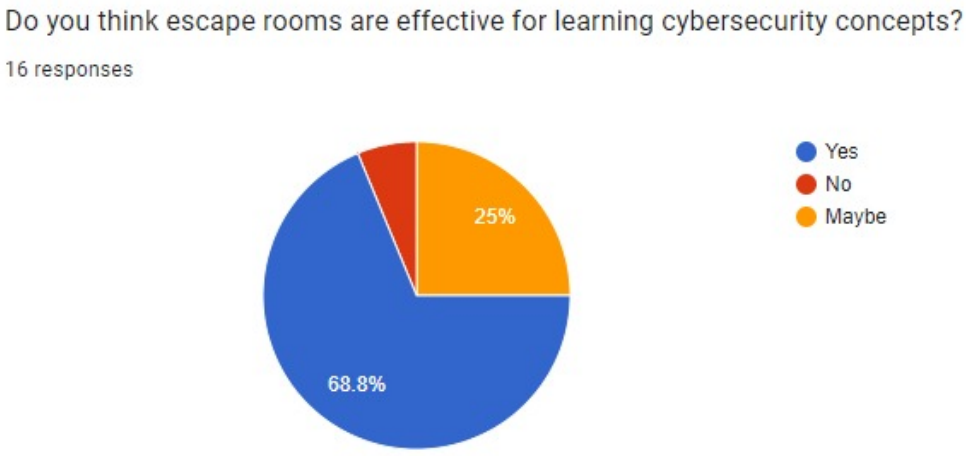

Figure 8: Effective of Escape Rooms

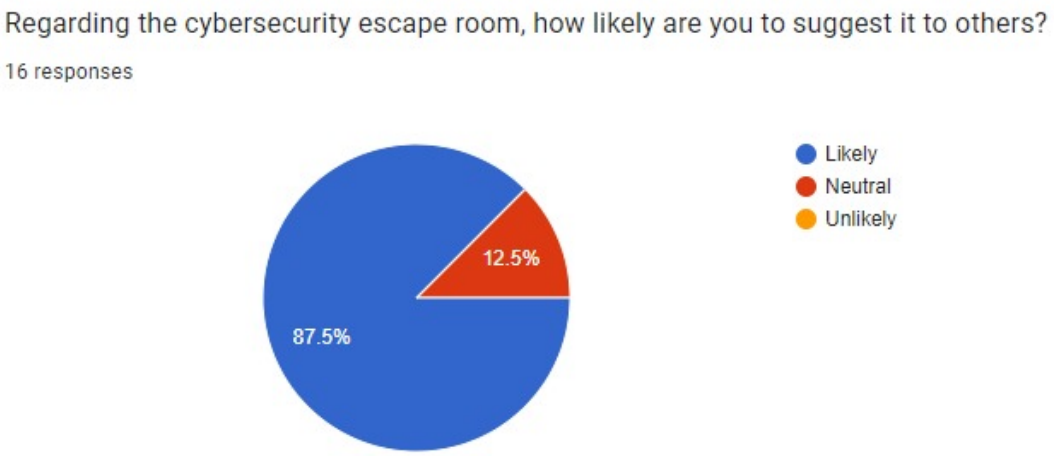

Figure 9: suggestion of Escape rooms

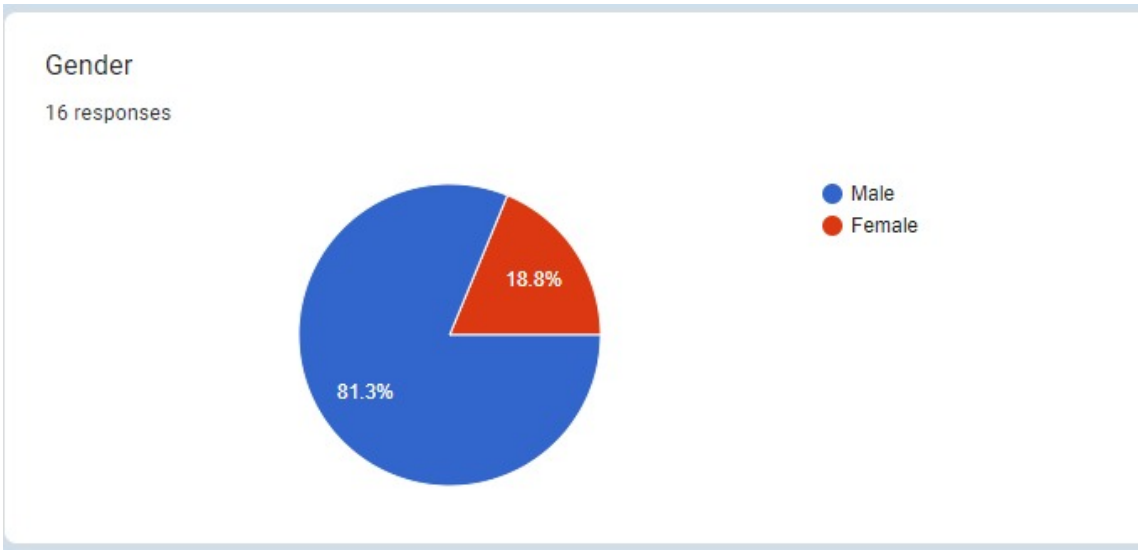

Figure 10: Gender

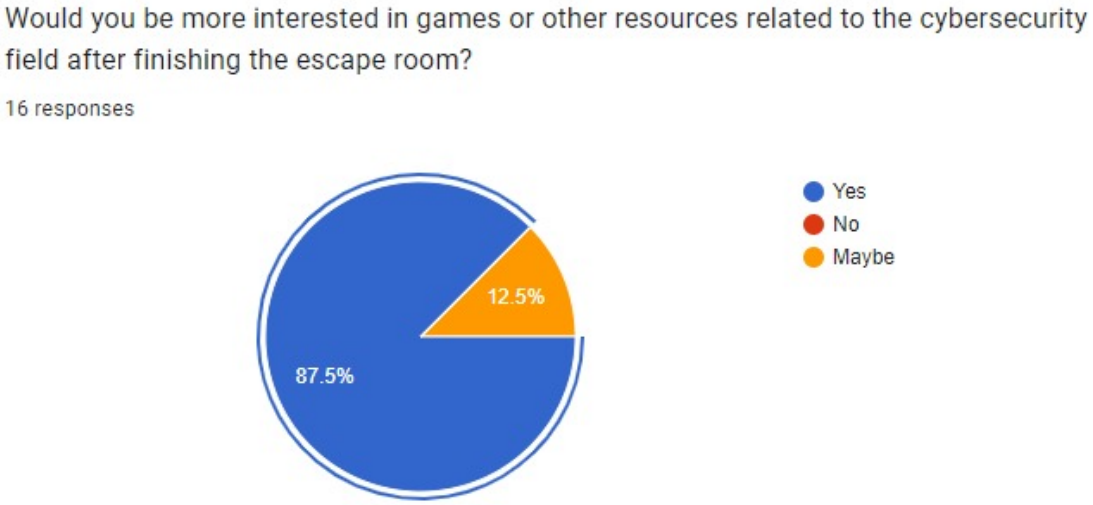

Figure 11: feedback

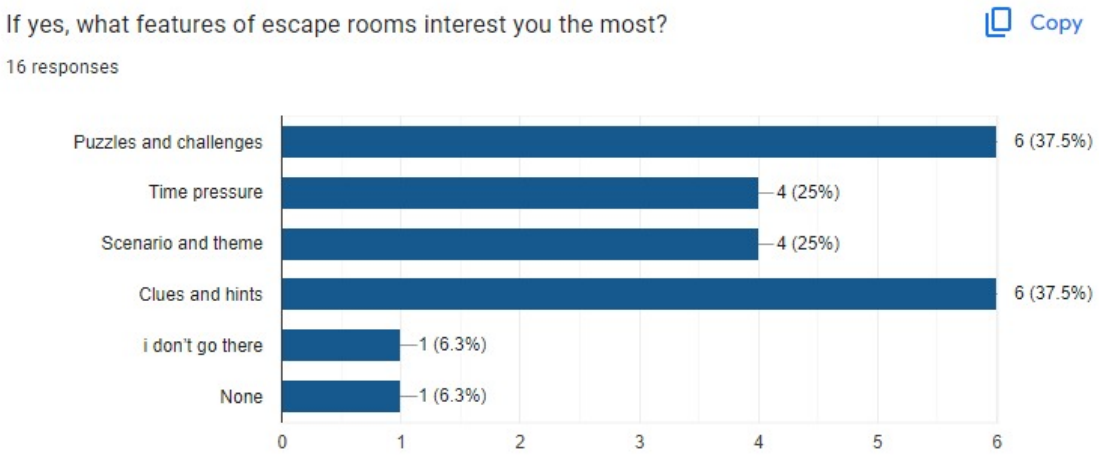

Figure 12: Features

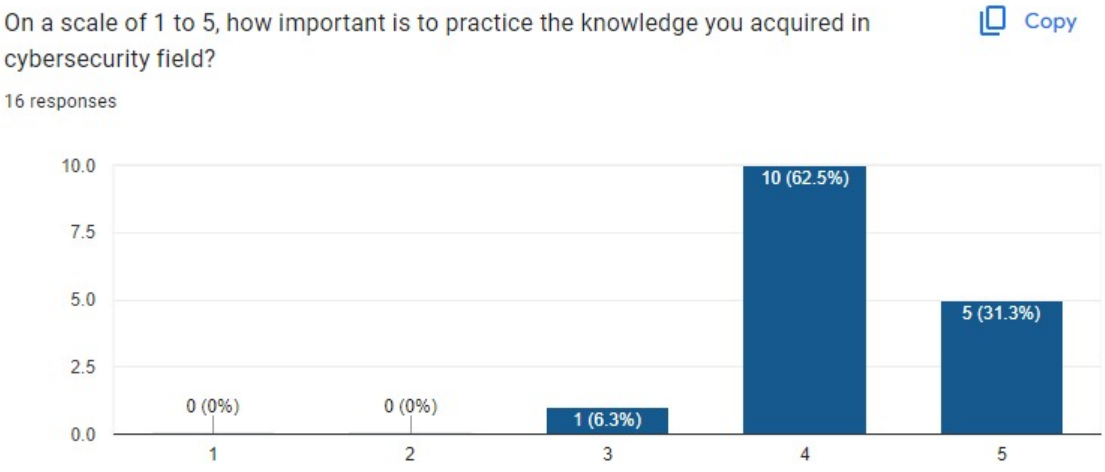

Figure 13: Practicing

12 References

1) Williams, Tania, and Omar El-Gayar. "Design of a Virtual Cybersecurity Escape Room." Faculty Research & Publications, 1 Jan. 2022, scholar.dsu.edu/ccspapers/15. Accessed 15 Nov. 2023.

2)https://www.researchgate.net/publication/$369395380_{G}amification_{b}y_{S}tudents_{A}n_{e}ffective_{a}pproach_{t}o_{c}yber_{s}ecurity_{c}oncept_{l}earning$

3)$Rahman, N.A.A, etal.\backslash TheImportanceofCybersecurityEducationinSchool."InternationalJou$
$//doi.org/10.18178/ijiet.2020.10.5.1393.$

4)$Beguin, Erwan, etal.\backslash Computer-Security-OrientedEscapeRoom."IEEESecurity\&Privacy,$
$//doi.org/10.1109/msec.2019.2912700.Accessed\ 2\ Oct.\ 2022.$

5)$https://www.researchgate.net/publication/339448216_{s}DD_{D}esign_{a}nd_{I}mplementation_{o}f_{C}ybersecurity_{E}ducational_{G}ame_{w}ith_{H}ighly_{E}xtensible_{F}unctionality$

6)$Costa, Gabriele, and Marina Ribaudo. Designing a Serious Game for Cybersecurity Education. 1 J$
$an. 2023, pp. 265–290, https://doi.org/10.1007/978-3-031-33338-5_{1}2. Accessed 6 Jan. 2024.$

7)$\backslash HackingTrainingfortheBest."HacktheBox, www.hackthebox.com/.$

8)$\backslash TryHackMe|CyberSecurityTraining."TryHackMe, tryhackme.com/.$

9)$\backslash OverTheWire: Wargames."Overthewire.org, overthewire.org/wargames/.$

10)$\backslash PentesterLab: LearnWebPenetrationTesting: TheRightWay."Pentesterlab.com, pentester$

11)$\backslash UnityGameEngineGuide: HowtoGetStartedwiththeMostPopularGameEngineoutThere."F$
$game-engine-guide-how-to-get-started-with-the-most-popular-game-engine-out-there/: Accessed 15 Nov. 2023.$