



**COMP3421/COMP9415 Computer Graphics 2024 T3**

**Project Proposal - Deep Dive: Experiment M**

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## **Introduction**

We decided to create an "escape room" game for our project. The definition of escape room is quoted as follows ('Escape Room', 2024):

*An **escape room**, also known as an **escape game**, **puzzle room**, **exit game**, or **riddle room** is a game in which a team of players discover clues, solve puzzles, and accomplish tasks in one or more rooms to accomplish a specific goal in a limited amount of time. The goal is often to escape from the site of the game.*

The background of our game takes place in a biological research institute. All players know at the start is that a serious experimental accident occurred, causing the institute to be abandoned entirely. They later find out that the experimental subjects became extremely dangerous and had begun to kill researchers indiscriminately. As an agent tasked with investigating the situation, the player must explore the various floors of the institute and discover what happened. The overall theme of the game will be horror and mystery. The player needs to control the character to solve a series of puzzles and collect props, with a final battle when facing the boss in the last level.

## **Comparison with Existing Systems**

In this section, we will discuss games similar to the one we want to develop, as well as how we differ from and innovate in similar games. Some of these games are not traditional escape room games, but we think they have unique puzzle design and game atmosphere creation features that are worth discussing. We will describe our views from three parts: Immersive atmosphere creation, puzzle design and combat mechanics.

After researching the current gaming market, we will focus on games from the following series. These games include the *We Were Here* series, the *Resident Evil* series, *It Takes Two*, the *Dark Pictures* series, *Dave the Diver*, *Sekiro™: Shadows Die Twice* and the *Little Nightmares* series.

## **Immersive Atmosphere Creation**

After we studied these games, we found that there are only three methods to make an excellent game: having novel, exciting gameplay, an intriguing story, or a perfect fusion of gameplay and story. As a fusion of gameplay and story, the best embodiment of the perfect balance of escape room games is the immersion of the game. In the games listed above, their game immersion is very strong. Players can even get addicted to playing the game after a period. In these games, players have clear goals and challenges. They will not be confused by the mechanism and gameplay of the game but will only immerse themselves in the story and gameplay of the game. Rather than calling our project a game, we prefer to define it as **a grand performance presented to the player using the game as a medium**.



*Fig. 1 In Resident Evil 7 Biohazard (Left), the game's atmosphere is enhanced through detailed scene design (such as food on the table, weak light sources, etc.), thereby increasing the player's sense of immersion. In The Dark Pictures Anthology: House of Ashes (Right), the special architectural style of the story's background is used to make the player feel as if they are in the scene. (Berich, 2021; Fraser Brown, 2017)*

For the immersion of the game, the player's perspective is also one of the influencing factors. Most shooting, simulation, and adventure games, usually use the first-person perspective, while the third-person perspective is suitable for strategic management, real-time strategy, role-playing and other types of games. After we studied a variety of escape room-type games on Steam, we found that most of the games use the first-person perspective to enhance the player's game immersion. The first-person perspective will make players feel more like they are experiencing the game in real life and feeling the environment around them, and they will take it more seriously in their mentality. At the same time, we also found that a small number of escape room games use the third-person perspective. The third-person perspective lets you see your stand-in clearly and make it easier to operate its behaviour. It is easy to see the overall situation in the process plot and make more correct decisions in the general direction.

After some comparison, we decided to use the third-person perspective in our game. Third-person perspective can reduce the difficulty of the puzzle, allowing players to observe the game environment from more angles. As mentioned above, what we want to do is a wonderful performance with the game as the carrier. Therefore, we don't want players to lose out on the story because they are struggling with the puzzles. We want to enable them to focus on the experience of the story.



*Fig. 2 We Were Here Together (Left) uses a first-person perspective, which can enhance the player's immersion, but the difficulty of the puzzles is greatly increased. Resident Evil 2(Right) uses a third-person perspective, which provides players with a wider field of view, making combat and puzzle solving easier. (Resident Evil 2 on Steam, n.d.; We Were Here Together on Steam, n.d.)*

To make up for the lack of immersion in the third person perspective, we also designed a special operation method, namely the unique body switch in the fourth level. The body switch allows players to observe the

entire story from different perspectives. Different story perspectives can bring different feelings to players, allowing players to understand the entire background story more comprehensively.



*Fig. 3 Resident Evil 2 (Left) allows players to control different characters to explore the same level, allowing players to obtain different story fragments, making the story players get more vivid and complete. Some levels in Dave the Diver (Right) use body switch to allow players to control different characters in the same scene to solve puzzles, which can give players more fun. (DAVE THE DIVER on Steam, n.d.; Resident Evil 2 on Steam, n.d.)*

At the same time, to reduce the difficulty of solving puzzles and allow players to have a more comprehensive understanding of the story and levels, we have also added 2.5D level scenes. 2.5D games are different from 2D games and 3D games. 2.5D allows players to play games from a "God's perspective". The advantage is that it allows players to solve puzzles and understand the story from a global perspective. So, from the perspective of the overall story, 2.5D can also increase the player's sense of immersion.



*Fig. 4 "Little Nightmares II" adopts a 2.5D perspective design, and the protagonist can move and explore in a limited open scene. The complexity of the operation is reduced so that players can shift their attention to the plot and the scene. (Little Nightmares II on Steam, n.d.)*

## Puzzle Design

In our opinion, for games, puzzle elements can be applied to almost all types of games. Puzzles can help games create various immersive atmospheres, directly increase game playability, or bring a better balance to the game rhythm. But in summary, all puzzles themselves are very similar. There are all kinds of strange mechanisms, but in the end, they are all classic types: find the difference, find objects, push boxes, light refraction, Sudoku, various chess and card types, jigsaw puzzles, prop combinations, and so on.

All "puzzles" are themselves good mini-games. In large-scale games, if puzzle elements are added, the entire game can have a fuller and richer feeling, thereby improving its quality and playability. This is the magic of "puzzle" games. No matter what type of subject it is, action, strategy, or even social games, if the "puzzle" tag is added, the game's playability will be greatly improved.

We thought of a good example to illustrate the role of puzzles. If we want to make a cake, we can make a simple cake with flour and eggs, but puzzles are like cream, which can make the whole cake more delicious and tempting.



*Fig. 5 A level in Resident Evil Village (Left) requires players to open the door by lighting the two torches next to the middle torch. Many puzzles in We Were Here Together (Right) require players to control gears on a chessboard so that the various points on the chessboard can be connected through gears.*

(Resident Evil Village on Steam, n.d.; We Were Here Together on Steam, n.d.)

In addition to the above puzzles, there are various puzzles in the games mentioned above. This makes us think about a question: Is it better to have more puzzles?

We believe that the element of "puzzle" can only play a supporting role in the game most of the time. In other words, the main type of each game is "flour", and puzzles can only be used as "cream". Our conclusion is supported by the following factors:

- First, players are always obsessed with various puzzles to varying degrees and enjoy the pleasure of solving puzzles, but if the puzzle is too difficult or too complicated, all they will feel is frustration and anger.
- Second, the iteration of puzzles is a kind of accumulation. The more puzzles are accumulated, the more complex and high-level they will become. Suppose a player has played more than a dozen puzzle games, and the answers to the puzzles in these games are no longer challenging for him, then this player will need more difficult and unknown puzzles to give him the pleasure of solving puzzles. However, if we design very difficult and complex puzzles to satisfy the desire of old players to win, it will not be so friendly to novice players.

Therefore, the puzzles in most excellent game works serve the game itself. The puzzles will not be designed to be too difficult or complicated but will have the characteristics and novelty of the game. This is also a manifestation that distinguishes it from traditional hardcore puzzle games.



*Fig. 6 The maze puzzles in We Were Here Together (Left) are too complex and time-consuming, which can easily make players feel bored and lose patience. Compared with the puzzles in traditional puzzle games, the puzzles in Resident Evil 2 are relatively simple and the principles of puzzle solving are easier to understand. The right picture shows the alignment puzzle in Resident Evil 2. (Resident Evil 2 on Steam, n.d.; We Were Here Together on Steam, n.d.)*

## Combat Mechanics Overview

For escape room games, the main combat mechanisms are divided into two types. One part of the game is to hit the enemy by shooting or using weapons, while the other part is to fight the enemy by using props or solving puzzles. Both methods have their own characteristics. Directly attacking the enemy can give players strong combat feedback, making players feel very addicted. However, indirect attacking the enemy does not have particularly strong game feedback and visual impact. Players are more likely to defeat the enemy through the special mechanism of the game and wisdom.





*Fig. 7 Different combat mechanisms (It Takes Two on Steam, n.d.; Resident Evil 2 on Steam, n.d.; Sekiro™: Shadows Die Twice - GOTY Edition on Steam, n.d.)*

The above three pictures in Fig. 7 show different combat mechanisms. *Sekiro™: Shadows Die Twice* (left) shows the classic combat of ACT games. Players need strong concentration and reaction ability to deal with the enemy's attack and fight back. However, for the escape room theme game, such combat will make players feel very tired and change the nature of the escape room game. *Resident Evil 2* (right) shows that players defeat the enemy by shooting. The enemy also has some "weak points". Attacking the weak points will cause more damage. At the same time, the enemy does not have a clear health bar, which is the finishing touch for the escape room theme game. Because there is no health bar, the player does not know how the battle progresses, which will make the player more nervous and make them more immersed. The battle of *It takes Two* (below) uses a special mechanism. Players need to collect the bombs fired by the Boss to fight back and defeat the Boss. This gameplay is combined with the game environment. Players will feel novel and make the battle more interesting.

## Summary

For our escape room game, we not only need to learn the design of traditional puzzle games, but also learn from other types of games. For example, how to create the immersion and atmosphere of the game, how to balance the puzzle and the development of the plot, how to make the battle more interesting, etc. We will improve our game design based on the characteristics of the above games and their advantages and disadvantages.

## Purpose of the system

### Overall Purpose

Our game is designed to allow players to find a sense of wonder and to experience an interactive escape room/puzzle environment at their own leisure. We plan to create an interesting storyline with heavy

emphasis on stimulating visuals and challenging puzzles to bring a sense of satisfaction to our players. The game will be targeted towards young adults and older, due to the nature of the story and the environment the game takes place in.

### ***Problems with games in the same genre***

#### **Repetitive puzzles**

This issue is addressed by offering 5 different and interconnected levels, each with its own gameplay mechanic and optional story elements. Throughout these 5 different sections, each one will have a different puzzle theme, which the player will navigate. This ensures that players are faced with new and exciting puzzles and keep them interested in our game.

#### **Lack of thematic coherence**

In the afore mentioned 5 levels, each will have hidden story elements that the player can find, creating a thrilling story for the players to discover. Each level will also contain chemical elements, which will link each level and support the narrative that the player must try to escape a lab.

#### **Lack of player engagement**

Our game effectively addresses this issue by incorporating dynamic difficulty and varied gameplay mechanics. The game will introduce new mechanics and diverse puzzles all the way throughout the game to keep players sufficiently engaged, and will challenge the players logic, spatial reasoning and problem-solving skills. This effectively caters to all types of players, and allows them to feel accomplished when they progress.

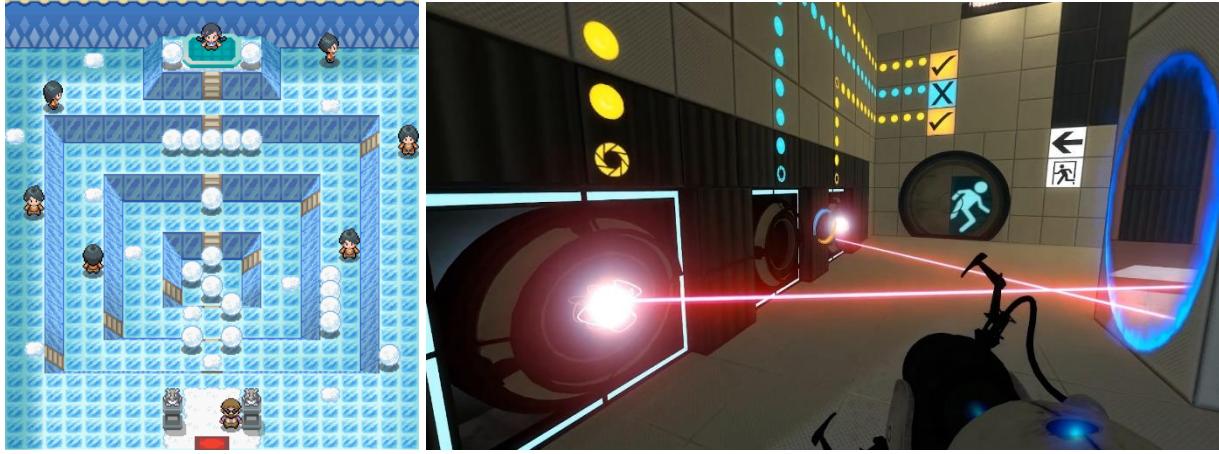
#### **Puzzle difficulty**

Our game addresses this issue by creating dynamic puzzles of all difficulties, which will cater to players of all skill levels. As some levels may be harder, there will be an incorporated hint system, which will become apparent through the scattered research notes that will appear throughout each level.

### ***Modules in our system***

#### **Level 1: Lasers and Mirrors (Ken)**

Taking inspiration from *Pokémon Diamond and Pearl* and the *Portal* series. In *Pokémon Diamond and Pearl*, players navigate an ice floor, sliding across the flooring and stopping on specific tiles, similarly to beams of light and obstacles that stop the light. In sections of the *Portal* series, players manipulate lasers by making them pass through portals to reflect onto a mechanism.



*Fig. 8 Screenshots Pokémon (Left) personally taken. Screenshots of Portal (Right) (Portal 2 - Cool Laser Puzzle [HD] - YouTube, n.d.)*

However, in this module, players will use mirrors to reflect lasers into mechanisms instead. This allows them to obtain objects and unlock new surfaces to put the mirrors on to aid them in completing following puzzles and finally unlock chests, obtaining intel and the keycard to the next level of the building. We also considered having an image or drawing on the wall to explain or give a clue to the player to make the puzzle a bit easier, but this depends on the final complexity of the puzzle.

## Level 2: Code Deciphering (Kairav)

To break away from the more physical interactions of the previous level, this level focuses more on reading documents and cracking codes. We chose not to take inspiration from too many games for this level as we wanted to keep the puzzles as original as possible and avoid accidentally getting influenced by other games. Still, we did take inspiration from *Escape from Mystwood Mansion*, where the puzzles are not based on any mathematical or scientific knowledge but on clues and notes around the room. However, the puzzles in our level are unique from those in these games. For example, we will be developing our own symbol-based language, similar to hieroglyphics, to write the clues with.



*Fig. 9 Screenshots from Escape from Mystwood Mansion (ESCAPE FROM MYSTWOOD MANSION | Full Walkthrough + Secret Area | A Fun New Escape Room Game - YouTube, n.d.)*

This level is split into two rooms. Players must use the notes and documents they find to obtain the codes to access clues and unlock the next room. All these documents aid in making the space look as though people had once inhabited it, especially with details such as the chore chart to assign who fixes the constantly breaking sink. Because our setting is a research institute, it is less obvious that these documents

are meant to guide the player, as they are just notes left behind from the daily routines of the researchers. Also, keeping with our goal to make the puzzles simpler, the messages and clues will guide players more directly through the puzzles to complete the puzzles in the right order while also reducing the complexity of the puzzles and shift focus on to the narrative. To further immerse players in the narrative, the second room is a chemistry lab.

### **Level 3: Shadows and Colours (Molei)**

This floor takes the players back to the familiarity of using lights as part of the puzzles once more. Inspired by *Iris.Fall*, this level allows players to create specific shadow patterns by placing items, and only when the shadows match the given pattern can the player pass through the room. Once again, we will make use of abandoned research notes to inform the player of the goal of this room. Through the shadow puzzles on the wall, players can also get simple story line.



*Fig. 10 Game Screenshots of Iris.Fall (Iris.Fall on Steam, n.d.) & Zenless Zone Zero*

In the next room, players must remember the order in which the colours displayed on the screen appear and press the button indicating the colour, inspired by *Zenless Zone Zero*. The next room, a spotlight will automatically move along a specific path, where players must remember the path, the traps introduce an element of excitement and danger, building up the anticipation for the ultimate “danger” of the enemies in the final floor. At the same time, there will be obvious traces of battle in this level, such as broken furniture, claw marks on the wall, bloodstains, etc., from the researchers' struggles to escape. However, no enemies appear, giving the player a sense of tension. The overall lighting of the room will also be designed to be relatively dim, and only the light in the player's area is relatively bright to highlight the effects of memory games and shadow games.

### **Level 4: Body-switch Maze (Tim)**

“Body switch” capability is chosen as the starting point for level 4. A major inspiration was the mission “Working with Suwan” in *Dave the Diver*. In this mission, you need to switch between the two characters, work together to find a path. However, this mechanic is more of an embellishment than a crucial part of the game, so we wanted to take this deeper.



*Fig. 11 Mission “Working with Suwan” in *Dave the Diver* (Zeawen’s Gaming Channel, 2023)*

Also inspired by *The Legend of Zelda* series developed by Nintendo, this level is a typical traditional Hakoniwa (箱庭) game, also known as Miniature Garden Game. Considering our technical and design capabilities, a maze level where you can freely explore three dimensions with depth and sense of space may be beyond our capabilities. So, a 2D maze map design with 3D modelling but a fixed perspective, like *The Legend of Zelda: Link’s Awakening* (2019 Nintendo Switch Remake) or *The Legend of Zelda: Echoes of Wisdom*, became our final choice.



*Fig. 12 Map of Tail Cave in *The Legend of Zelda: Link’s Awakening* (Tail Cave - Zelda Wiki, 2024)*



*Fig. 13 One room inside Tail Cave, The Legend of Zelda: Link's Awakening (2019 Nintendo Switch Remake), which is an example of 2D map design with 3D modelling but a fixed perspective. (The Legend of Zelda: Link's Awakening Guide - IGN, n.d.)*

Overall, we decided to borrow the idea of Zelda series' traditional dungeon design, also combining something resembling side-scrolling tunnels out of the 2D Zelda series with the form of Working with Suwan, the mission in *Dave the Diver*. Since we decided to leave the combat part to level 5, there will be no fighting or weapons in level 4. Also, given that we need to balance the difficulty and workload of each level, we can't design a level as complex as the dungeon in *The Legend of Zelda: Link's Awakening*. All these reasons lead to a further compression of the complexity of level 4.

### **Level 5: Enemy Level (Anthony)**

This level is the most distinct from the others as it is where the players interact with the enemies. Inspired by *Dungeons of Dreadrock*, we wanted to combine solving puzzles with fighting. However, this game is more about avoiding the enemies rather than attacking, so the mechanics for attacking enemies in this game are more simplistic. We took this further by introducing two weapons and a trap system to defeat the enemies.



*Fig. 14 Screenshot of Dungeons of Dreadrock (Dungeons of Dreadrock on Google Play, n.d.)*

In our system this level is where the rising tension reaches its peak. When players enter the first room on this level, the player receives a warning message, and a countdown timer starts. This creates pressure and urgency on the player to complete the lure and remaining puzzles to escape. This level is also where players finally use the lure components. To find the last component, they use a scanner that is low on battery since it has been abandoned, so the player has limited attempts to determine the correct test tube to solidify the narrative further, the liquid has been frozen to ensure its functionality since the researchers knew they were leaving for good. Later, in the lab, they need to solve a puzzle to turn the flame on and unfreeze the test tube. They find notes of a trap the researchers had devised before they were forced out by the creatures' rising aggression. To up the ante, the final exit door has a ring of fire around it from the enemies lumbering around and knocking things over.

## ***Features of the system***

One of our main focuses for the game is creating a rich narrative element for the player to experience through the game, so we had to put a lot of thought into what the story would be and how the player would interact with it.

## **Narrative**

Our general premise is that the player is an agent that was hired to investigate an abandoned underground biological research institute. The institute is set to be demolished to make way for urban expansion, so our contractor wants to find out why the lab was abandoned as soon as possible. Initially, the only intel they are provided is that the institute was abandoned because of an experiment that got out of hand, and they are tasked with finding out what happened before the lab is set to be destroyed. As they explore the institute, they find various documents left behind by the researchers. They find out that the researchers were trying to enhance human abilities, creating various serums and medicines that would enhance their memory, strength, endurance and more. However, the subjects began reacting to the experiments negatively. At best, they passed away but at worst they mutated into mindless, bloodthirsty creatures. Many researchers lost their lives, but they were able to seal the monsters in the lowest floor of the facility before escaping.

## ***Interactions between the narrative and gameplay***

In each floor, the player can collect various documents either by completing puzzles or exploration of the level. Through gathering intel on each floor, the player can discover the story. For example, the player discovers a note from one of the researchers begging whoever finds the note to kill the monsters before they can escape to the surface, unsure how long the various locking mechanisms they put in place will hold for. This explains why there are puzzles in each room. Additionally, to create a sense of continuity across modules, we introduced a collectable item that players must obtain to complete the game. Players will find a document in the first level that describes a lure the researchers were able to make that will allow someone to direct the monsters to any location. However, to keep the monsters from being lured out of their makeshift prison on the final level of the building, the researchers split the lure into four components and placed one on every floor of the building. In levels 1-4, players will obtain a test tube and in the final level, they will

have to put them together to create the lure. To ensure players do not leave levels without the components, we will include a message prompt indicating they forgot something if they try to leave the level without the test tube. To deepen the mystery, we will include bonus intel on all floors. If players find the bonus intel, they will discover more about the research itself and hints as to why our contractor hired us. Players will find the ID card of one of the janitors who has the same last name as the person who hired us. They will also find a page from his diary, showing how he had been trapped in the building after it had been abandoned, left behind because he was asleep and didn't hear the facility go on lockdown. Finally, we also used the narrative to introduce tension. In the final level, players will get an urgent message from the contractor stating that the planned demolition is taking place sooner than expected, introducing a timer that will determine whether players complete the game successfully or not.

## Game Mechanics

While the narrative is crucial to our game, we still wanted to keep the player's interest and intrigue through the gameplay as well, so there are many varied interactions in each module, allowing the player to experience novel gameplay in each floor. We will reset the level related items or abilities players get after each level. This will also ease the process of trying to link the modules. Even so, we ensured to keep some basic, standard interactions common in all floors since having too many new capabilities may lead to cognitive overload. We want to leave enough time for players to organically discover the interactions for each level.

We will be making use of basic physics simulations such as collision detection with the walls or enemies and gravity for when the player jumps or interacts with an object. Many objects in our scene will be grabbable, such as the intel documents and puzzle items such as a pickaxe, blacklight, and other puzzle items. There will be static objects such as the lights, tables, walls and other elements of the environment that should remain unaffected by player interactions. We will still use stationary lighting in some instances, such as turning laser sources on and off in Level 1. Lighting for the overall environment will remain static, except for a few lights that have blinking animations. This detail gives the impression that the room is in disrepair.

As mentioned, to complete any level, players must collect the lure components. To complete the game, the players must be able to defeat the monsters and escape the building before it explodes. If the player completes the level in time, they succeed in eradicating the zombies and escaping the building before the demolition begins, completing the game. However, if they fail, the facility blows up before the player can escape and the player restarts on the same level.

## *Puzzle Designs*

To vary the gameplay in each module, each module has a different defining concept or interaction that lays the groundwork for all the puzzles in that module.

### **Level 1: Lasers and Mirrors (Ken)**

Players must take mirrors from around the room and place them in mounts on the walls. From these mounts, players can angle the mirrors to reflect the laser to the correct mechanism. By placing objects to block the lasers, players will unlock after solving the previous puzzle and obtain the items after solving the second puzzle. They also must destroy obstacles blocking the rays, such as breakable piles of rubble and crumbling

walls, using a pickaxe obtained from the first puzzle. The decay of the room not only serves as a point of interaction but will solidify the narrative of this institute being abandoned. Players can also interact with the laser source itself, removing this core and placing it in an empty mount to activate it. This level has the first bonus intel, where there is a mirror on the floor near a desk. If a laser is reflected under the desk, the page falls from a mechanism under the desk, and you obtain the intel.

### **Level 2: Code Deciphering (Kairav)**

In the first room, there is a whiteboard with an identification chart and sticky notes with messages written in our symbolic code language. To direct the player to which puzzle to work on first, one of the sticky notes has an arrow pointing to a table, where players must read the code deciphering chart and decode the sticky notes on the whiteboard. The table also has a blacklight, which when shone on the whiteboard reveals that one of the sticky notes has a hidden message written on it. These messages help the player to solve one of the other puzzles in the room and get the code to unlock the door. This is also where players are introduced to the look of the enemies for the first time, as one of the puzzles involves polaroid images and in one image the enemy appears, blurred but distinctly hostile. This begins to build tension in the player. The second room is a chemistry lab, where players will find a paper on one of the lab desks that says to soak the paper in “ChemX.” Players obtain a recipe for this chemical and are guided through the room with various clues to make the chemical, find the lure component and unlock the elevator. To obtain the bonus intel, players will have to climb the ladder propped on the side of the chemical cupboard and find the intel lying on top of it.

### **Level 3: Shadows and Colours (Molei)**

In the first room, there are various props scattered around the room, and the whiteboard will show the pattern that the player needs to project. The player needs to place the props in the right position, rotate, stack or move the props, adjust them to the correct position, and use the fixed light source in the room to project the correct pattern. When the player successfully arranges the props correctly, the signal light on the whiteboard will turn green, otherwise it will remain red. When all the signal lights turn green, the door to the next room will automatically open. After entering the second room, the player will see a large screen. On the screen, different coloured lights will flash in a specific order. The player needs to remember the order in which the lights flash and reproduce these colour sequences by pressing the corresponding colour buttons in the room. The colour sequences may be simple at first, but as the puzzle progresses, the colour sequences will become longer and longer. Until the player completes all the sequences, thus unlocking the door to the next room. In the final room, the player is faced with a grid of tiles. A spotlight in the room briefly illuminates the correct path to the exit, showing a safe route to walk. However, this light disappears after a few seconds, and the player must rely on memory to avoid the traps hidden under the tiles and walk safely to the exit. If the player steps on the wrong tile, the hidden trap will be activated, and the player will be damaged. When the player triggers the trap a certain number of times, the puzzle will reset, and the player will need to start over. When the player successfully completes the correct path, the door to the exit will unlock.

### **Level 4: Body-switch Maze (Tim)**

After solving three levels of puzzle, a maze puzzle with *Zelda* dungeon style gives players a sense of freshness. The relatively larger map than previous levels may help us to arrange props to better explain the game's story or background before the final battle and gives users a break.

To reduce complexity, we designed a more intuitive puzzle, but still maintained a certain level of challenge to ensure the fun and playability of the game. For example, compared to the first dungeon in *The Legend of Zelda: Link's Awakening*, Tail Cave (Fig. 12), which has 16 rooms, we only have 10 rooms, and only 2 large rooms plus 1 small room for pushing boxes and maze puzzle, 1 room for body switch challenge, 4 rooms just for getting props without puzzle. Since this level introduces a few new mechanics, we used some common concepts in other games that players are already widely familiar with, such as pushing boxes, laser alarms, fans, etc., to reduce cognitive load and allow players to get started faster. Additionally, we wanted to provide the players with freedom, but by design. With a smaller level map, through carefully designed routes and props, players have the freedom to explore during the level, but they must follow the main route we designed, due to the requirements of some props, to prevent players from feeling lost or distracted. Also, to reduce the boredom of maze exploration, the concept of Kishōtenketsu (起承転結 / 起承转合) is adopted during the design of the maze. Kishōtenketsu describes the structure of many classic East Asian cultural sphere narratives, which means the progress of introduction, development, twist and conclusion. As shown in the flow chart in Fig. 27, we set the basic gameplay to solve maze puzzles plus box pushing in the beginning of this level, with only the main character. Then, developing it by increasing interactivity by introducing a second character, the drone. Third, twist it by providing freshness by designing dark rooms and the ability of drone lighting. Finally, conclusion: go through the maze, go back to the first room where you start this level, and then the final level.

### **Level 5: Enemy Level (Anthony)**

To create the lure, the player must correctly select the final lure component from an array of 8 test tubes numbered in ascending order. The player has 3 tries to use a scanner that indicates if the correct test tube is a higher or lower number to the one that has been scanned. To do this, the player is given hints through the research notes to use binary search with a vague explanation on how to do so in the form of a clue. Players will also find a freeze ray and shotgun to allow them to make it from the study past the enemies to the lab on this floor. So, once the player finds the correct test tube, they need to go to the lab to find a Bunsen burner, using the freeze ray to slow down the large enemies and the shotgun to kill the smaller enemies. Using their notes, players must assemble a laser to burn through the rope that holds a cage suspended above a section of the floor. The cage dropping down will trap the enemy. Once completed, the player must throw the lure as a projectile into the trap region to lure the enemy. After trapping the enemy, the player must escape. With a fire extinguisher found in the study room players extinguish the fire around the exit and solve the final puzzle to unlock the door.

### **Summary of Interaction Mechanisms**

<b>Modules used in</b>	<b>Interaction mechanisms</b>	<b>Short Description</b>
All	Character movement (Walking/Running/Climbing/Jumping)	Players traverse the map using keyboard controls.
All	Camera Movement	Using the mouse, players tilt the camera to look around the level, simulating how we turn our head in real life. This allows for more interactive,

		immersive gameplay.
All	Accessing/navigating the UI (inventory/game menu/etc.)	Players access various UI screens using the keyboard controls and the mouse to navigate them.
All	Picking up items	Players collect items, categorised in the UI into the general Inventory or the Intel categories
All	Inspecting items	After picking up an item, players turn it around in their hand for closer observation.
All	Reviewing items	Within the Inventory or Intel screens, players review items they have collected by clicking on them and reading the description.
All	Unlocking doors	Players unlock doors by entering a code or using a keycard to progress in the game, whether as part of a puzzle, to enter a different stage of a level or to proceed to the next level.
Level 1	Turning mirrors	Players turn mirrors on wall mounts to reflect the lasers and solve the puzzles.
Level 1 & 4	Destroying objects	Players break objects using items obtained in the level
Level 1	Removing and replacing laser core	Players change which source is activated by placing a laser core into an empty laser mount.
Level 2	Reading documents & notes	Players read documents or notes left on tables using a keyboard button to shift the camera to a top down view of the table, making reading easier.
Level 2	Shining a blacklight	Players use it to reveal

		hidden messages.
Level 2	Turning valves	Players turn the valves on the plumbing system to adjust the direction of the pipes and turn on the water flow.
Level 2	Cleaning beakers	Players clean the beakers to aid in solving the puzzle using the sinks they fixed
Level 2 & 5	Mixing chemicals	Players combine test tubes obtained in puzzles to create various chemical mixtures.
Level 3	Creating patterns from shadows	By placing objects in the correct position and orientation, players create the correct pattern.
Level 3	Pressing buttons	Players press buttons in the right order.
Level 3	Following the path	Players remember the correct path and follow it.
Level 3	Avoiding traps	If players stray from the correct path, they will activate traps.
Level 4	Pushing boxes	Players push boxes out of their path or onto mechanisms to trigger a door to open
Level 4	Switching characters	Player pawn switches to a drone, allowing players to fly around parts of the level as the drone
Level 4	Stepping onto a trigger	Players step onto a button to open the door
Level 4	Fans	As the drone, players will be unable to move past the fans. As the human, players turn off this mechanism
Level 4	Electric Shock Floor	As the human, players will be unable to step onto the floor without taking damage,

		resetting the level. As the drone, players turn off this mechanism
Level 5	Using scanner	Players determine which test tube is the correct final lure component using binary search
Level 5	Using weapons	Players switch between a freeze ray and shotgun to slow down or kill enemies.
Level 5	Using Bunsen burner	Players turn on the Bunsen burner to melt the frozen lure component.
Level 5	Assembling laser	Players take scattered mechanical parts, putting them together in the Builder menu.
Level 5	Throwing the lure	Players throw the lure into the designated trap area.
Level 5	Burning the rope	Players use the laser to burn the rope, dropping the cage on the enemies.
Level 5	Using the fire extinguisher	Players extinguish the fire to escape.

## Visual elements

Creating the aesthetic of an abandoned research institute is both simple and difficult. Due to the time limit of this project, we are limited in the assets we can use as it would be difficult to model every single asset in the game. Though not perfect matches, we were able to find some assets from the Unreal Engine marketplace and Quixel bridge that fit the aesthetic we wished to achieve. Using moody, low lighting scenarios, editing the texture maps on the assets and other design techniques, we will be able to achieve a cohesive overarching aesthetic for our game.

## ***Environmental Design***

The overall look of the game will draw from the aesthetics of the *Resident Evil* and *We were Here* series. The grungy, decrepit buildings, with low, cool-toned lighting will help create the stagnant atmosphere of a place that's been abandoned. This lighting will also help create a sense of tension.



*Fig. 15 Screenshots from We Were Here Together (Right) and Resident Evil 8 (Left). Examples of using moody, cool-toned lighting to create the feeling of an abandoned place. The shades of blue in We Were Here Together radiate a sense of cold abandonment while the greenish-yellow in Resident Evil 8 creates the illusion of a sickly atmosphere.* (RESIDENT EVIL 8 VILLAGE Gameplay Walkthrough FULL GAME (4K 60FPS RTX) No Commentary - YouTube, n.d.; We Were Here Together [PC] Full Gameplay Playthrough (No Commentary) - YouTube, n.d.)

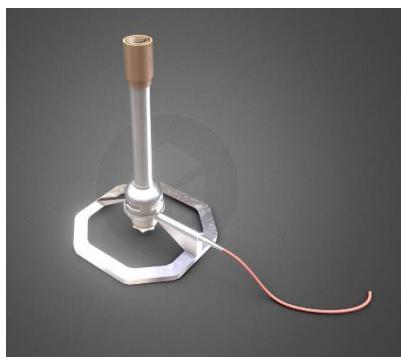


*Fig. 16 Example of a bit too dark lighting scenario (RESIDENT EVIL 8 VILLAGE Gameplay Walkthrough FULL GAME (4K 60FPS RTX) No Commentary - YouTube, n.d.)*

As is evident, different coloured lighting creates a different atmosphere. We will use a range of blue-toned lights on the upper floors, gradually turning them greener as players reach the lower floors and get closer to the enemies. This will increase the tension through the atmospheric change from colder, calmer tones to sicklier, anxiety-inducing tones, also conveying the idea that these enemies are almost corrupting the very air they breathe. However, these lighting scenario examples are a bit too dark and may make reading documents difficult, so we will have to balance aesthetics with the practicality and playability of the game.

The assets will also have to show signs of disrepair, as seen in this screenshot from *Resident Evil 8*. An example of how we will implement this is by using ripped furniture, rusty cabinets and storage chests, and having books, papers and miscellaneous items on the floor to give the place an abandoned feeling.

## Potential Environment Assets



(Bunsen Burner - Download Free 3D Model by Dreamsoft Innovations Private Limited (@dreamsoftin), 2021; Laser Device - Download Free 3D Model by ReImonsen, 2021; Test Tube Rack - Download Free 3D Model by RedAuburn (@redauburn) [F09bcbf], n.d.)



(Chemical Test Tubes - Download Free 3D Model by Alex Krush (@Alex\_Krush), 2024; Fire Extinguisher - Download Free 3D Model by Budørskin (@UDORBUSK) [544c884], n.d.)

## Pipes



## Boxes/Storage Chests



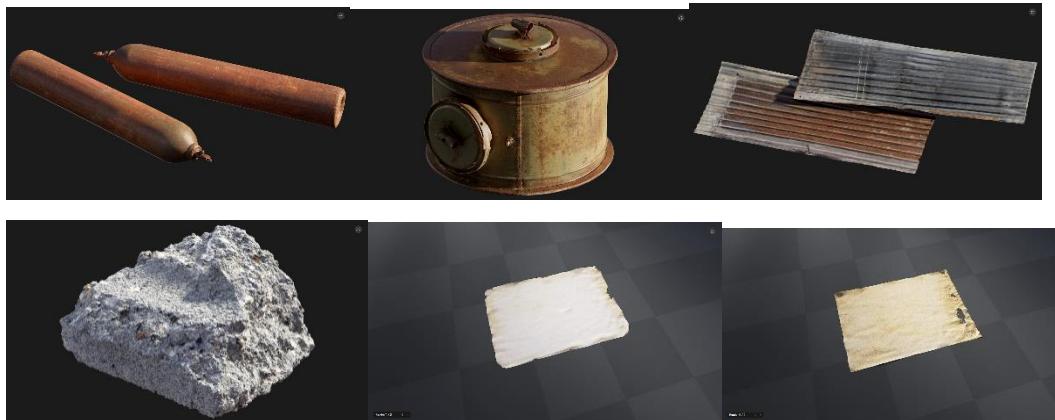
## Electrical Appliances



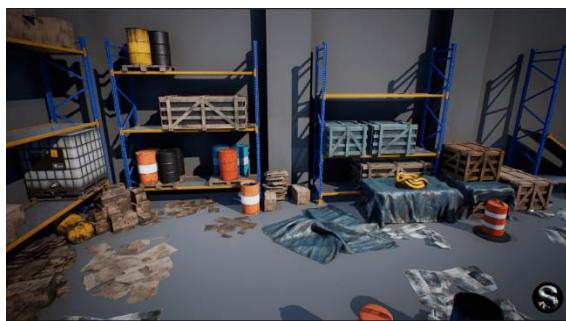
*Doors*



*Clutter*



All above assets from Quixel Bridge (*Quixel Bridge - Manage 3D Content and Export with One Click*, n.d.)



(*Industry Props Pack 6 in Props - UE Marketplace*, n.d.)

## **Character Design**

Though the game has a more serious tone, we felt that using characters dressed a bit more casually would fit the story better. Our main character is not a military or government agent, but a privately hired agent, so we felt these models fit best. Players will be able to choose between these two character models.



*Fig. 17 Assets by Bugrimov Maksim (Adventure Character in Characters - UE Marketplace, n.d.; Adventure Female in Characters - UE Marketplace, n.d.)*

For the drone, we chose to use this asset from Sketchfab:



*Fig. 18 Drone (Drone - Download Free 3D Model by Akiko\_yoshino, 2017)*

## **Creature Design**

Though our options were limited once again, we were able to find character models and creature models that fit the aesthetic of the game. Though the creatures are in a more cartoonish style, using lighting and editing the texture maps once again to give them a more bloodied, gory look will blend them with the environment better.



Fig. 19 Assets by UppercutGames (City of Brass, n.d.)

## ***Technical Depth and Novelty of the System***

### **Novelty**

One of the key aspects of our system compared to existing escape room games is the combination of interactive puzzle-solving elements with dynamic environment and element manipulation and strategic boss battle gameplay. While most escape room games by nature focus primarily on solving static puzzles such as *We Were Here*, our system innovatively merges the puzzle-solving experience with unique environment surrounding interactions and enemy encounters, blending the best of both worlds, puzzles from escape rooms and adventure style such as but not limited to boss battles commonly found in role-playing games. *We Were Here* is also a multiplayer only game however we decided we wanted our players to still enjoy the game solo. This choice enhances the suspense and horror within the game, immersing the player in the feeling of what it truly is like to be alone in an escape room with only oneself to rely on to forge a path to freedom.

Furthermore, in our research, we identified existing systems that incorporate both puzzle-solving and dynamic combat. For example, *Dave the Diver*, an aquatic adventure RPG, includes unique underwater gameplay mechanics involving puzzle-solving. While its 2D pixel art style theme may be considered a design choice, we found the 2D graphics to be a limitation in terms of immersion and a feeling of suspense as it lacks realistic lighting, textured surfaces and overall depth of immersion. Our system differentiates itself by utilising 3D, highly immersive, and realistic graphics developed using Unreal Engine's latest graphics technologies, elevating the visual experience and creating a more engaging, lifelike environment for players to feel immersed in.



Fig. 20 Screenshot of *Dave the Diver* (Essential Tips and Tricks - *Dave the Diver Guide* - IGN, n.d.)

Additionally, we found that most existing escape room games do not include a boss battle at the last level of a game, especially ones where solving puzzles in and using environmental interactions play a direct role in defeating the boss or advancing to the next level. While some RPGs include puzzle aspects, escape room games rarely incorporate the challenge and strategy of defeating a boss as part of the gameplay. Our system introduces this novel mechanic, where players must use their problem-solving skills and freedom to manipulate their surrounding environment to overcome certain challenges not limited to only boss encounters and mini puzzles, adding extra depth to the traditional escape room and role-playing game format.



Fig. 21 Screenshot of *Dungeons of Dreadrock* (Indie Arena Booth, n.d.)

As shown in Fig. 21, *Dungeons of Dreadrock* is another existing system that incorporates escape room elements that utilises the level and its environment as a puzzle by observing the enemies' movements and environment which provide clues as to how to escape the level. The game is also presented in a 2D pixelated top down maze format of the game. One main feature that sets our system apart from *Dungeons of Dreadrock* is the map being confined to a very limited space where the player can see everything going on in the level at once. Instead in our system we offer a more exploratory and mysterious experience, leveraging the nature of a 3D environment. This will also differentiate our game by including many realistic object interactions typical of traditional escape room games.

By combining these elements, we believe we offer a unique and immersive experience that blends strategic combat, environment-based puzzles, and intense boss battles in a way that has not been explored in escape room games before.

## Shortcomings

One particular shortcoming our game is set on improving as mentioned in section 1, is identifying the right balance in puzzle difficulty in order to accommodate players of all skill levels to enjoy the game. If the puzzles are too easy, experienced players may find them boring, while too difficult of a puzzle will only fuel less experienced players with anger and frustration.

To address these concerns:

- Each module features a distinct gameplay mechanic, therefore encouraging different approaches to puzzle solving by presenting unique concepts and interactions that form the basis for completing the puzzles.

- Rather than implementing a game mechanic that provides text-based hints after a set amount of time we plan to offer the player additional clues through sound or subtler image-based clues. This ensures the player receives subtle guidance without feeling like they are relying on any help.
- A mix of action gameplay to balance so the player doesn't get bored of just solving puzzles.

## Technical Depth

One technical aspect commonly found in escape room games is the use of a first-person perspective, as seen in *The Lab*, a VR escape room puzzle game with a similar laboratory theme to ours. Our game utilises a third-person perspective instead, which not only allows the player to see more of the environment, but also emphasises a feeling of loneliness and abandonment when players see their character alone in the environment surrounding them. *The Lab* also has an environment that is very clinical and sterile, which we felt was a bit bland and made the space feel lifeless. In our system the environment works to convey the narrative, with an added sense of abandonment through the myriad objects that act as evidence that the researchers lived in this space. Additionally, our game is structured with distinct levels where the player progresses from levels 1 to 5, making it feel more like a fully developed RPG rather than a simulation of an escape room.



*Fig. 22 Screenshot of The Lab, from (The Lab - Escape Room on Steam, n.d.)*

Therefore, we chose not to implement VR, as it would require a first-person perspective for proper immersion. Instead, we focused on blending escape room mechanics with RPG elements along with a unique story line that persists through each level. Due to this, we opted for a third person view to provide better focus and awareness. This not only allows the player to see how their character interacts with their surroundings but also enhances spatial perception like in a large open world, offering a more comfortable and fluid exploration experience, which we believe is crucial for improved navigation and interaction in escape room games that incorporate RPG elements to it.

## ***System Flow***

### **Overall System Flow**

Our levels are laid out linearly, which means you need to finish one level and then go to another level. If the player dies or fails during a level, you will restart from the beginning of the level or from an autosave point. We have 5 levels in total, numbered from 1 to 5.

### **Gameplay**

Based on our storyline, the main aim is to solve puzzles in different floors and gradually get to the deepest floor (level 5), kill all the monsters and take steps to prevent further entry to this facility. The puzzle will run through levels 1-5, but starting from level 4 there will be enemies, you cannot fight and can only try to escape; in level 5 you can get weapon and attack the enemy.

The player has the following abilities at any time:

- Exploring the space. The player can freely move around.
- Interacting with certain items.
- Collecting items and storing them in the inventory, like documents or access cards.
- Stop the normal flow of play by pausing, exiting, resetting or saving the game via menu.

Fig. 23 shows the overall system flow.

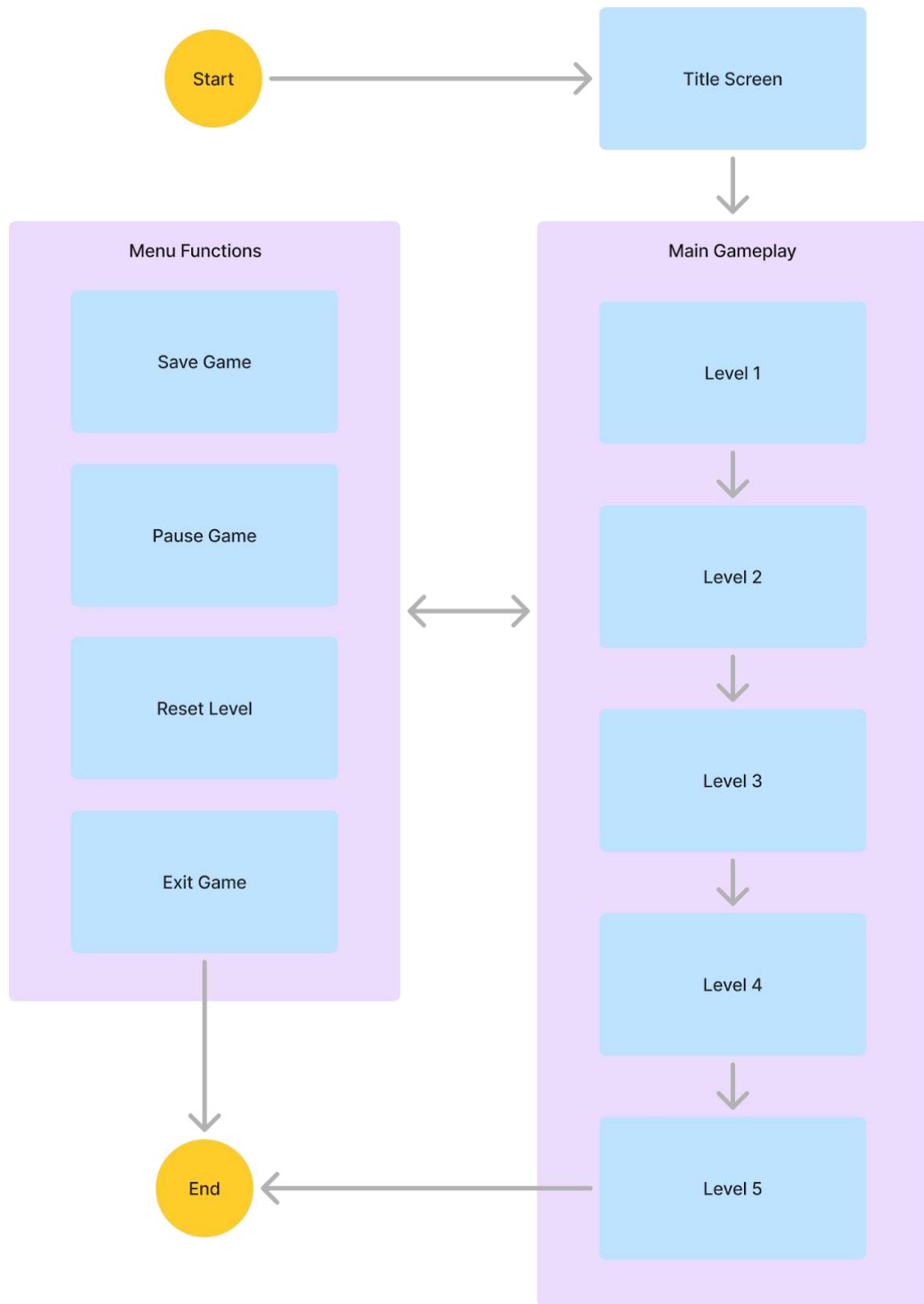


Fig. 23 Overall System Flow

## Level Flow

Please be advised that the following level or puzzle designs are in the initial stage and are for reference only, they may be different from the final deliverable.

Overall objective: go to the next level and defeat the boss in level 5.

### Level 1

As shown in Fig. 24, sequence of events:

1. Find some props
2. Solving the laser puzzle with props
3. Go to next level

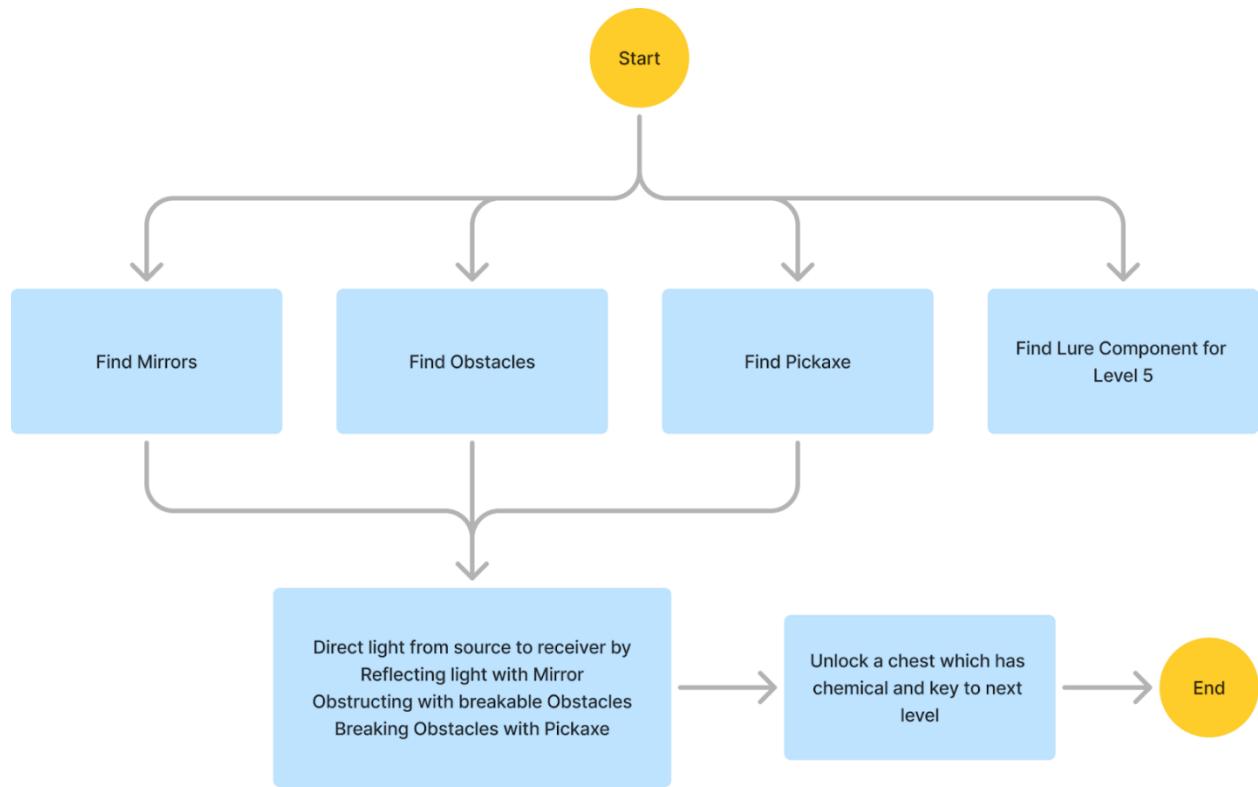


Fig. 24 Flow chart of level 1

## ***Level 2***

As shown in Fig. 25, sequence of events:

1. Enter Room 1, find the clues listed below:
  - i. A whiteboard on the right with identification chart and sticky notes with messages written in code.
  - ii. On the left is a chore chart next to the plumbing system that indicates that the pipes twist out of shape often and someone is assigned to fix it to get the sinks working in the next room.
  - iii. One sticky note points to the table on the right of the whiteboard.
  - iv. Table has chart to break the code of the sticky note messages. Also has a black light.
  - v. Messages written in symbolic code written on sticky notes, tells the player how to get image order by spotting the difference.
  - vi. One message tells how to get the code for the door to the next room
2. Decoding the order of the images & code from the messages on the sticky notes
3. After figuring out the door code, unlock the door and enter Room 2, the chemical mixing lab. Player will find the clues listed below:
  - i. Paper on the lab desk 1 says to soak the paper in ChemX
  - ii. Desk in the corner shows a code cracking sheet for the chemical cupboard and also the recipe for ChemX.
  - iii. Part of the recipe says to clean the beakers, leading the player to go to the sinks, and then for using the sinks, players need to solve the pipes puzzle in Room 1
  - iv. Sinks has a note on the side saying key to the plumbing system is under the plants in Room 1
  - v. Tells player to check the box under the sink for the lure test tube
4. Go back to Room 1, find the table with plants, match the objects to their labels (identification chart written as part of research notes) to get a key for the plumbing system
5. Unlock the plumbing system and solve the pipes puzzle: water flowing in pipes and adjusting the pipes will allow the water to flow
6. Decipher the code to unlock the chemicals cupboard
7. Mixing chemicals to get liquid to soak the paper
8. Reveals the code for the elevator on the note
9. Go to next level

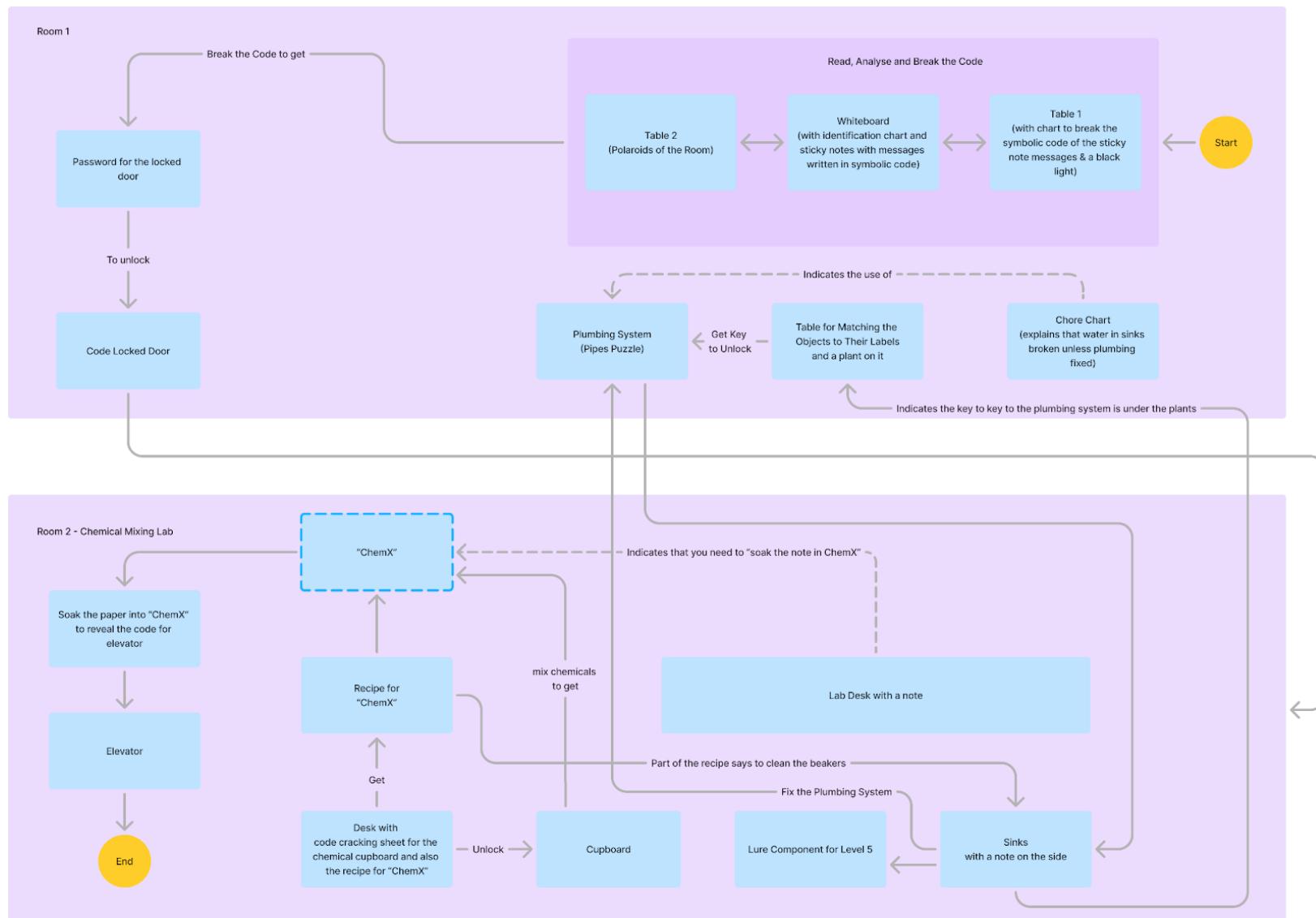


Fig. 25 Flow chart of level 2

## **Level 3**

As shown in Fig. 26, sequence of events:

1. Use objects/the player to create shadow corresponding to the example.
  - a. Clue: 4 example shadows cast on the whiteboard.
2. Press the three buttons in the correct order.
  - a. A display showing colours in different orders.
3. Clue: Walk through the correct path.
  - a. The floor tiles under the correct path will light up in sequence twice.
4. Get lure for Level 5 and go to the next level.

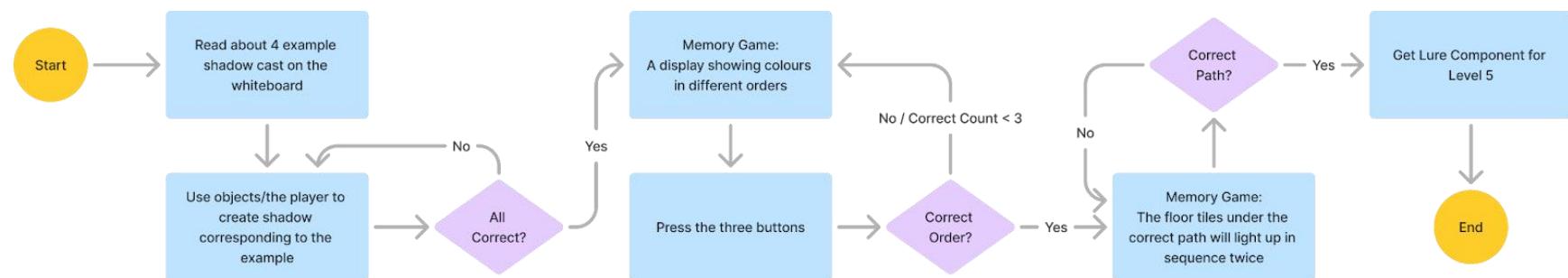


Fig. 26 Flow chart of level 3

## **Level 4**

Corresponding to the map design in Fig. 38, sequence of events is shown in Fig. 27:

1. This level starts in Room 0, elevator room. Since the door on the right is locked, the natural path is to go left, Room 1.
2. In Room 1, solve the box-pushing maze in the lower part, go to the left side of the room, and enter Room 2.
3. In Room 2, get the switchable character, drone.
4. Then return to Room 1
5. Solving the upper part box-pushing maze. Push a box on the once trigger, open the upper-right door. Now the two characters can go to Room 3.
6. In Room 3, switch to drone. Fly to the continuous pressure trigger. Open the door which is left to the main character.
7. Main character goes through the door, solves the lower-left part box-pushing maze in Room 3, steps on the once trigger on the middle-right of Room 3, opens the door to let the drone go to the upper part of Room 3.
8. 2 characters escape from the enemies and go to the upper-left part of the room, then get the flashlight upgrade of the drone.
9. Break the upper-left breakable item, go to the basement, Room 4.
10. Get a key (and maybe some documents) in Room 4, go back to Room 3.
11. Go to the right part of Room 3, unlock the door, Enter Room 5
12. Jump over the 1-grid-gap to get some documents in the middle part of Room 5
13. Push the box on the upper-right corner, go to the basement, Room 6
14. Get a key in Room 6, go back to Room 5
15. In Room 5, Go forward to right, Room 8.
16. Going up, open the locked block, main character to the 2m floor and the drone to the basement.
17. Main character opens the door for drone
18. Drone escapes from winds and stops on the trigger to get a key
19. Main character walks past the Interval Electric Shock Floor and turn off the fan that blows continuously to the right.
20. The drone closes the Electric Shock Floor for main character
21. The drone pauses the laser to let main character pass
22. Go back to the 2m level in Room 3, get the **special key**

23. Jump off the 2m level. Walk through Room 3-5-8.
24. Open the locked door in the lower part of Room 8. Solve the box-pushing maze in darkness. You need to jump over the gap.
25. Open the door which needs the special key, go to Room 9.
26. Get the Lure for the final level.
27. Leave the drone on the continuous pressure trigger. Main character goes back to Room 0, and then next Level.

In step 16, If you open the door of the lower part of Room 8 first instead of in step 24, you can still find a key in the upper-right corner of Room 8. There will be an extra key or a not found key when you finish this level.

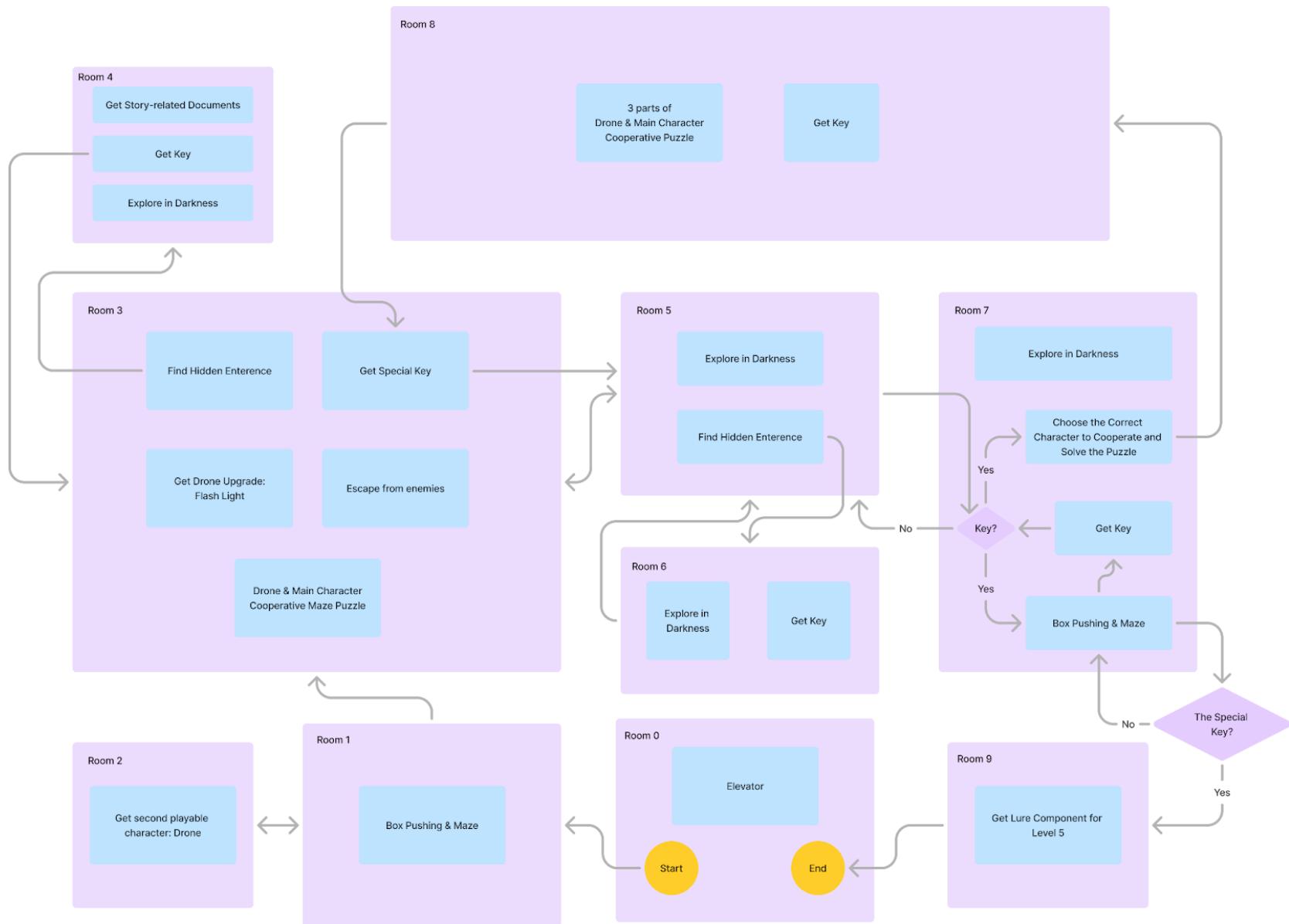


Fig. 27 Flow chart of level 4

## ***Level 5***

As shown in Fig. 28, sequence of events:

1. Starting in the study room, the bomb countdown begins
2. Find gun and bullets
3. Correctly combine different lure components (in the form of chemicals in test tubes) collected from previous levels to create the lure. The player currently holds 4 test tubes from previous levels and must correctly select the final test tube from an array of 8 test tubes (1 correct and 7 incorrect) numbered in ascending order to create the lure. The player has only 3 tries (due to scanner low on battery) to find the correct test tube using a scanner which tells the player higher or lower of the location of the correct test tube.
  - a. Clue: hints on the wall or lab notes to use binary search
4. Once the player finds the correct test tube, the liquid is frozen, so the player needs to find a Bunsen burner and solve a puzzle to turn the flame on to unfreeze the test tube.
5. Once the lure is completed, the player can throw the lure as a projectile into the trap region to lure the enemy.
6. Assembling and utilizing a beam of light / laser to burn through the rope that holds a cage suspended above the lure area, that drops down to trap the enemy.
7. The exit door has a ring of fire around it, use the fire extinguisher found in the study room to extinguish the fire and solve the final puzzle to unlock the door.

If the player completes the level in time, they succeed in eradicating the zombies and escaping the building before it blows up hence completing the game. If the player fails, the self-destruct blows up before the player can escape and the player restarts on the same level.

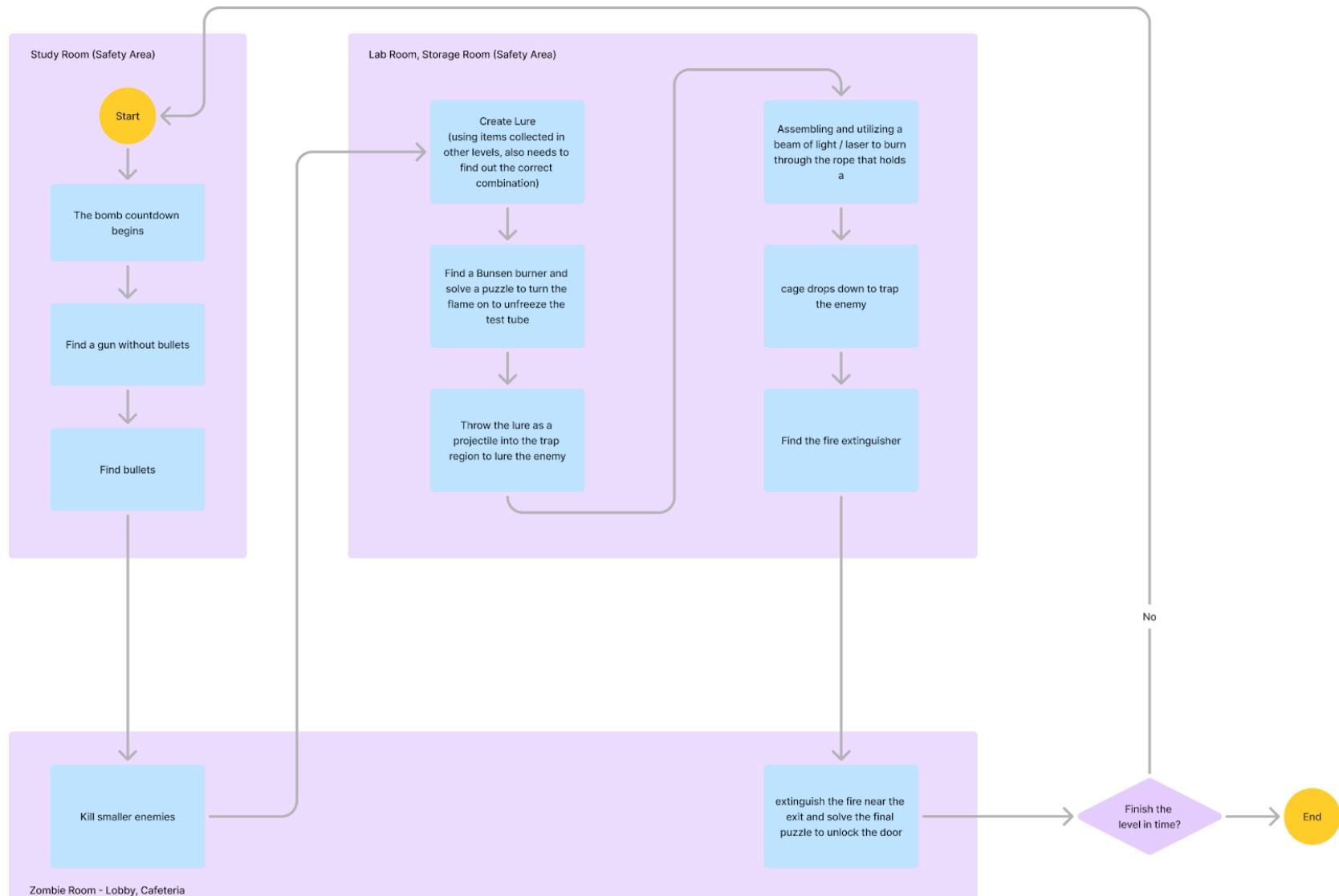


Fig. 28 Flow chart of level 5

## Wireframe / Mock-up of System

### Game UI Design

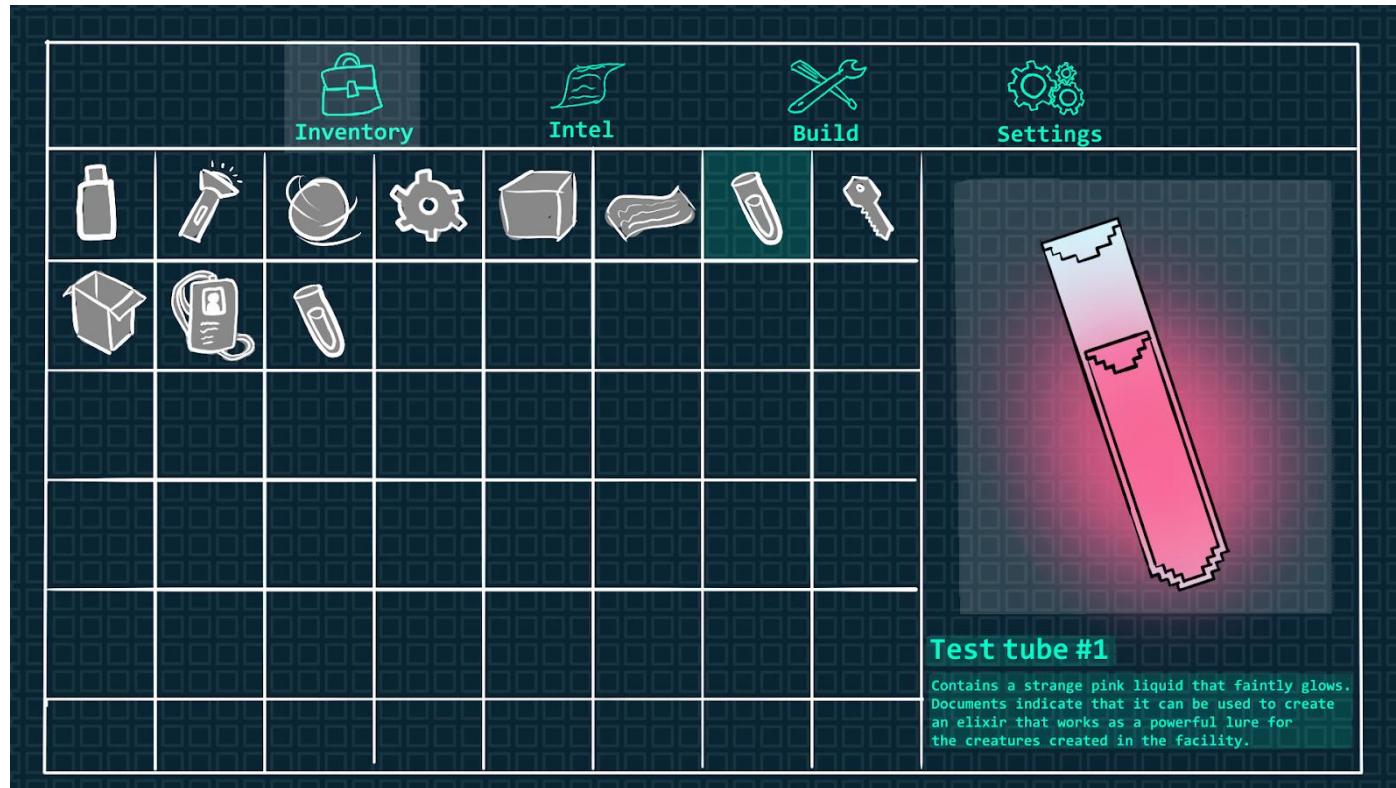


Fig. 29 Inventory

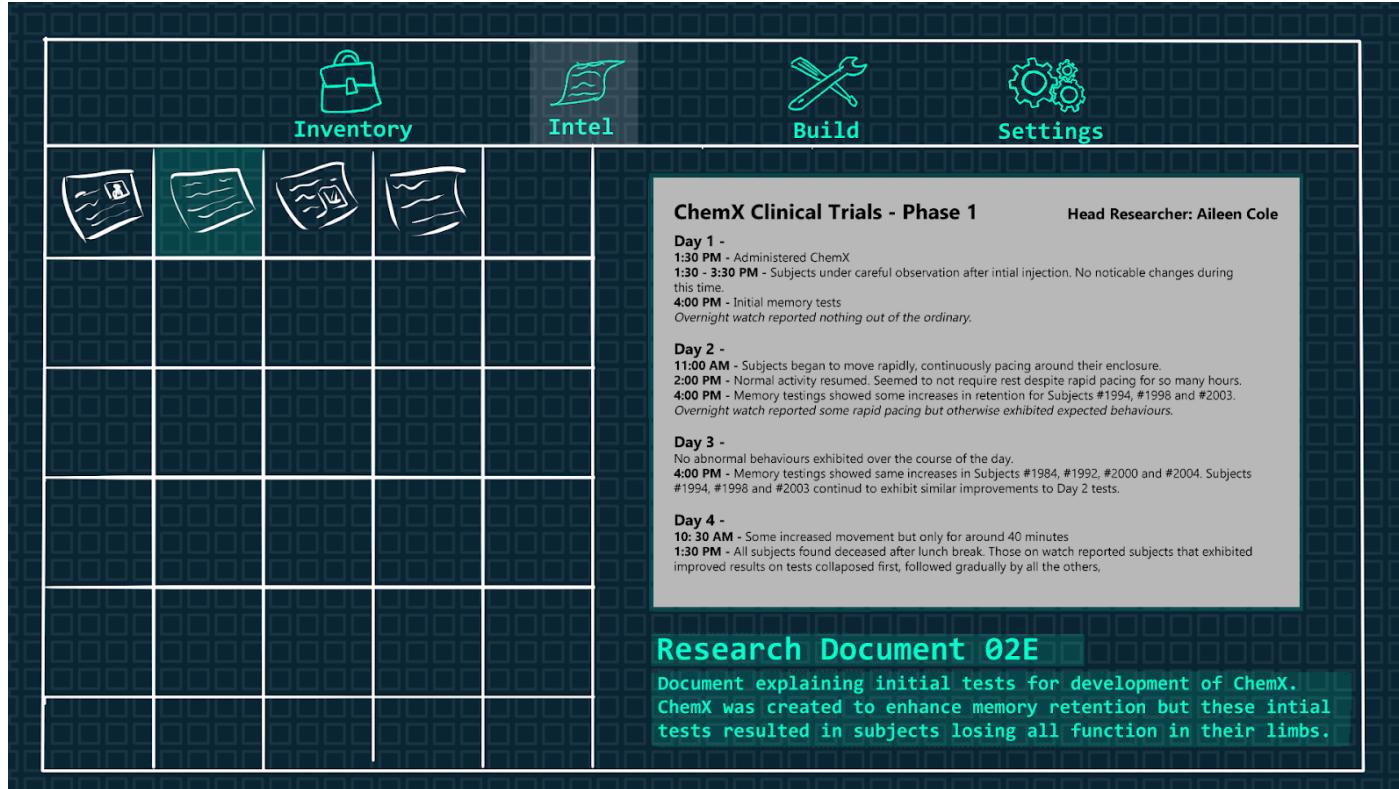


Fig. 30 Intel Viewer

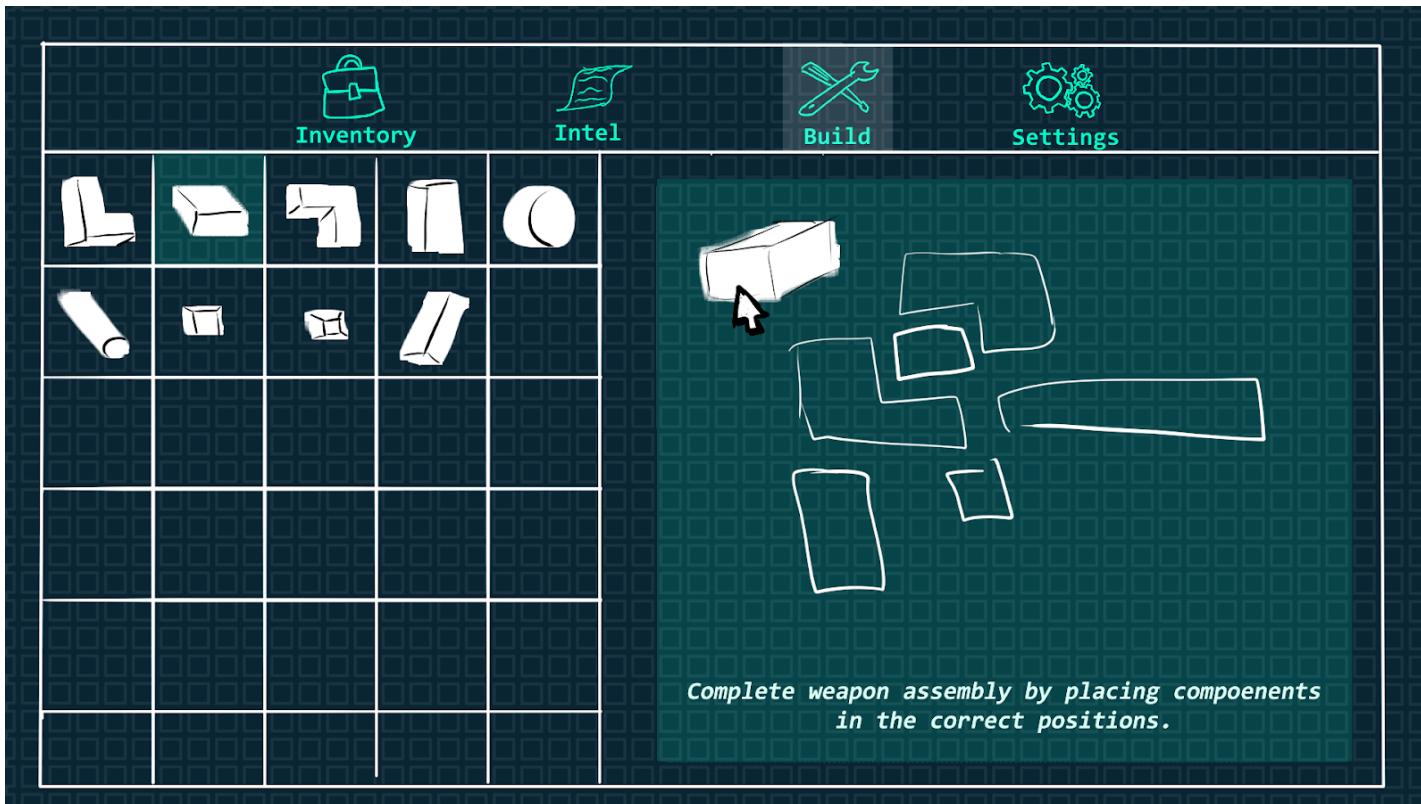


Fig. 31 Builder

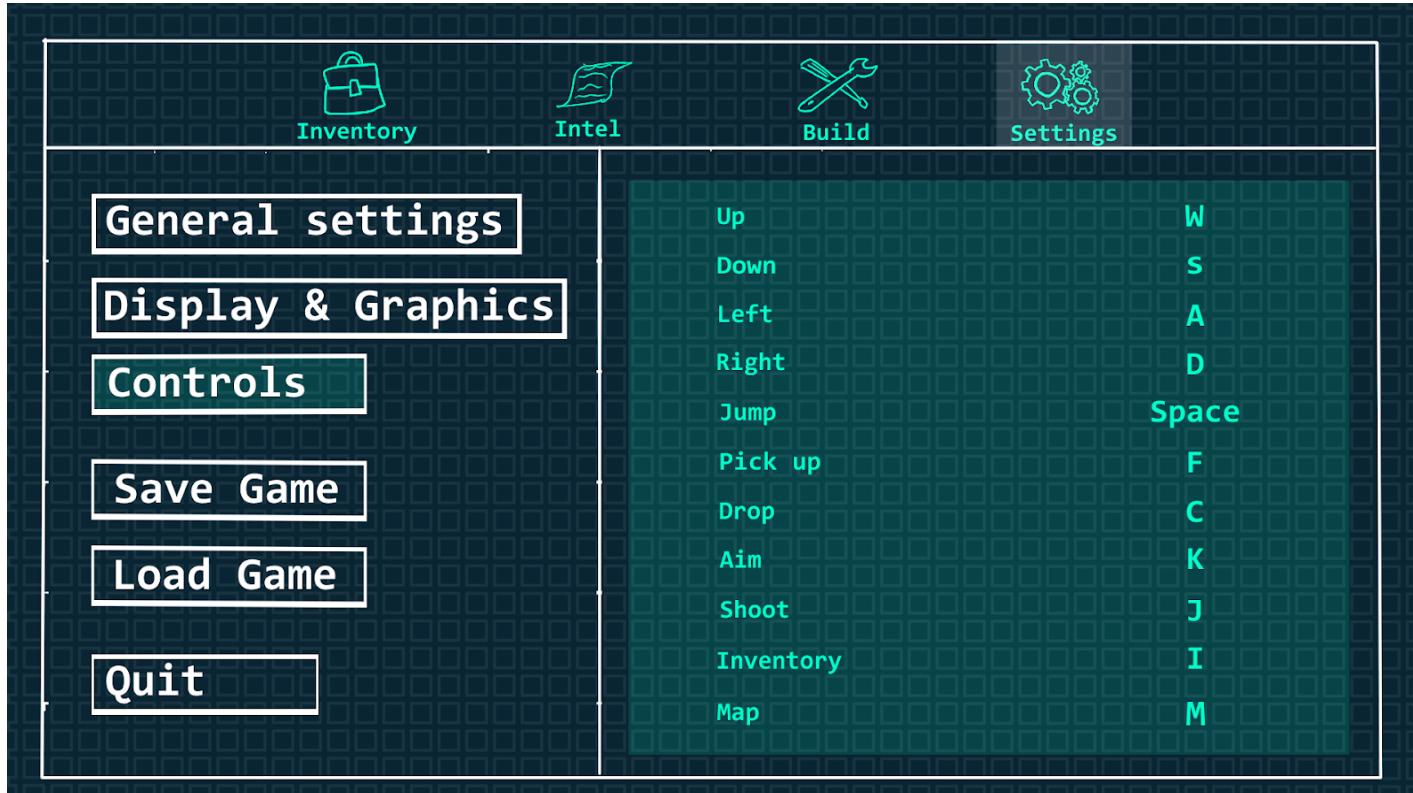
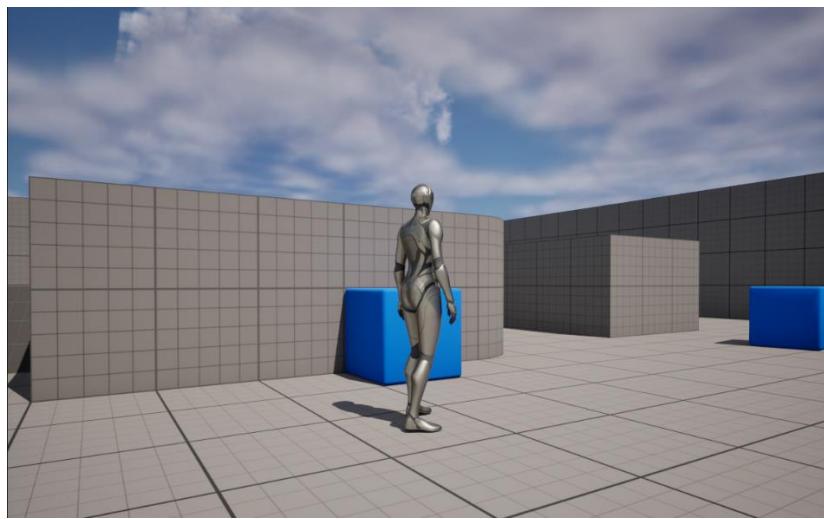
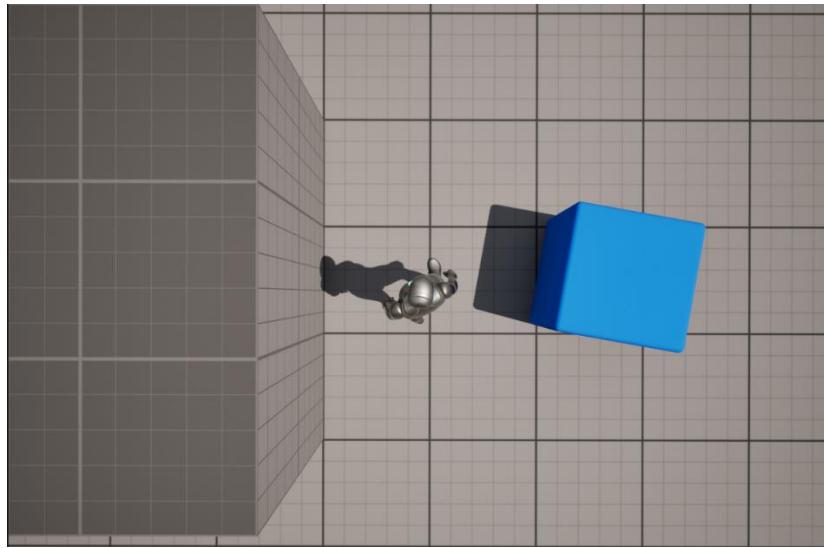


Fig. 32 Settings



*Fig. 33 Playing from third person perspective, in level 1-3 and 5*



*Fig. 34 Playing from top-down perspective, in level 4*

## Level Map Design



Fig. 35 Level 1 Floor Layout (Ken)

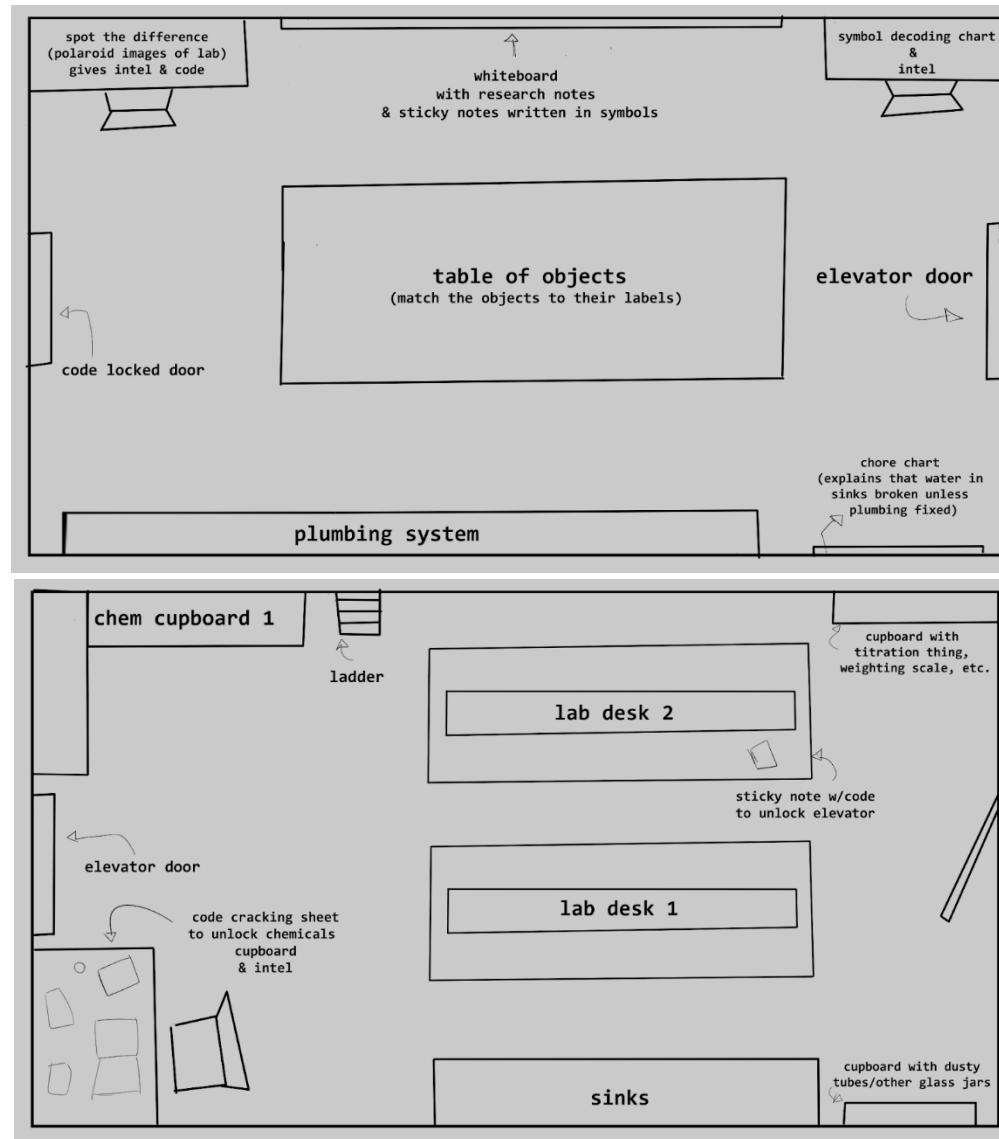


Fig. 36 Level 2 Floor Layout (Kairav)

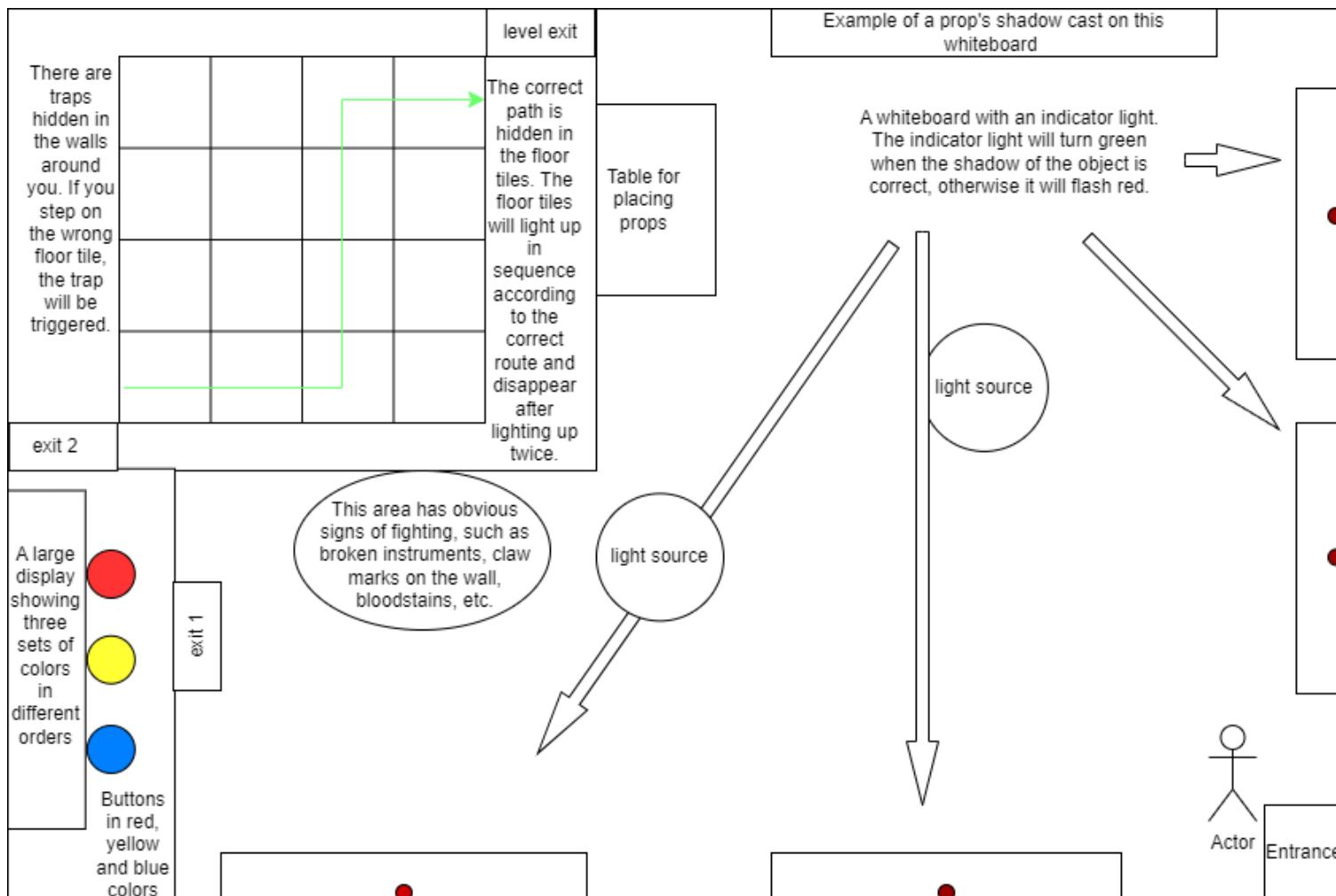


Fig. 37 Level 3 Floor Layout (Molei)



Fig. 38 Level 4 Floor Layout (Tim)

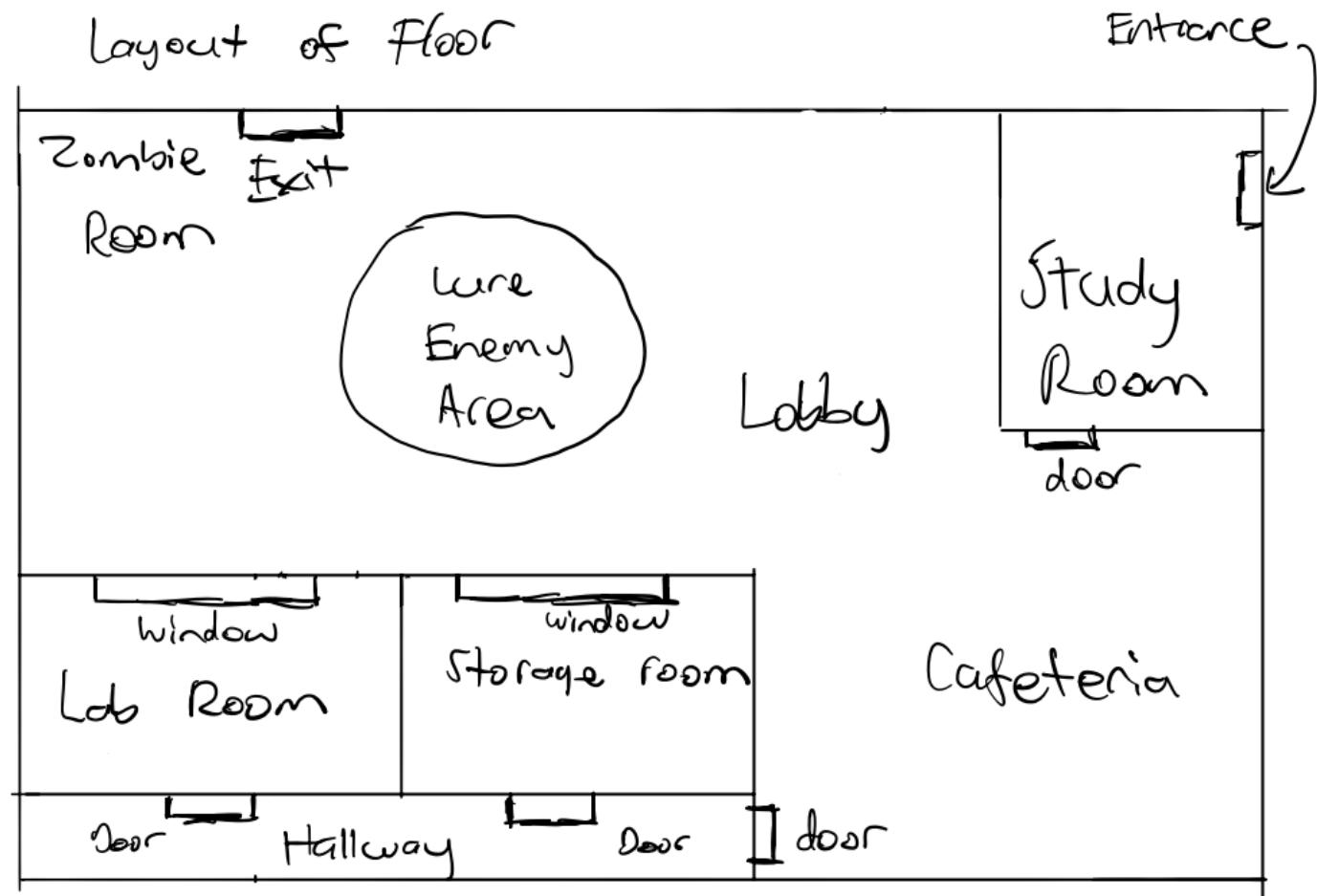


Fig. 39 Level 5: Enemy room (Anthony)

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