Design Connected Experiences

Escape room: “Ghost Signal”

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Abstract

This report details the development of *Ghost Signal*, an interactive escape room experience created as part of the course Design Connected Experiences. The project involved designing an escape-room game with a theme about time lag, in which players assume the roles of a pilot and a flight commander to deliver the package on time despite the complications that will cause them a delay. Together, they must navigate a virtual plane, avoid detection by authorities, and deliver mysterious substances to the correct final destination. The gameplay emphasizes teamwork, communication, and the integration of both physical and digital elements, including sensor technology, color tracking, and real-time data transfer.

The escape room consists of four levels, each introducing new challenges, from basic navigation using color and distance sensors to solving puzzles through Morse code and recalibrating radar frequencies. These levels also incorporate modules created by other student teams, which were seamlessly integrated into the game flow.

This report outlines the concept, design process, technical implementation, DIY instruction on how to make, AI tool usage, and reflections on the final demo. Through the development of Ghost Signal, the team

explored collaborative storytelling, interaction design, and the power of connected experiences in creating immersive gameplay.

Author Keywords

Escape room design; Radar simulation; Puzzle solving; Physical interfaces; Multi-module integration

Introduction

This report presents the design process and the final outcome of our connected escape room challenge for the course Design Connected Experiences. The aim of this project was to design a escape room with your team, where you also made use of other teams' modules that together form a cohesive experience. The team needed to make use of physical and digital modules where players need to solve puzzles through communication and problem-solving under a time constraint.

Our team created the escape room "Ghost Signal", an adventure in which players take on the role of the pilot or the flight commander, where they need to navigate the skies while evading the police. Their mission is to collect substances and determine the correct end destination for delivery and landing the plane. Throughout the experience, players must communicate clearly since they can't see each other and open the final locker that reveals the end destination of the plane.

This report will walk through the concept, the design process, the integration of other modules and the final outcome.

Modules

The trajectory of the escape room changed significantly after presenting challenge 1. It was important to create a clear narrative around the escape room to be able to add other modules and create a holistic experience. Every component had to make sense in regards to the story. Initial concept was just to pick up materials in order to deliver them to the final location. It was decided to make meaning of the materials and turn this into a villain concept where the materials were substances and that the police should not be aware of the plane and the communication between the flight commander and pilot. This unlocked most of the puzzle ideas such as police hacking into the radar system, the plane becoming visible to police once it flies under no flight zones and using morse code to make sure police is not able to hear them. This brought the idea of using the initial 2 modules throughout the whole escape room and adding in the other modules as challenges for every substance collected. Therefore the two modules were used simultaneously.

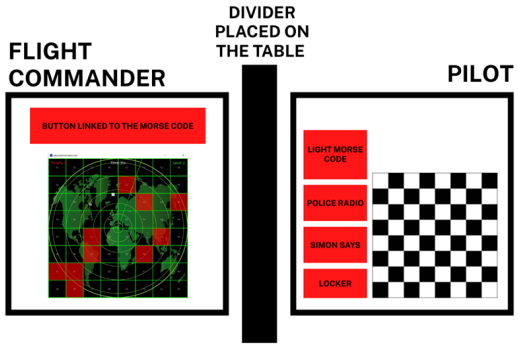

Figure 1 – systematic overview of the escape room

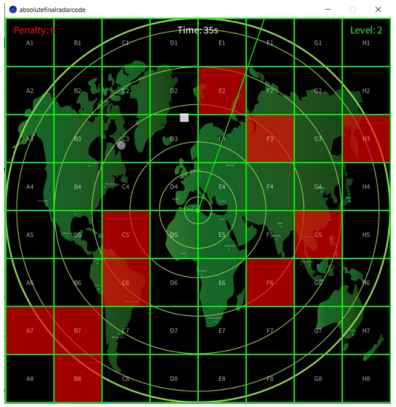

Figure 2-Radar module

Figure 3- flight board module

Level 1 – flight board

The goal of this first level is to understand how the game works and get familiar with the setup, including the board and the radar. Players will be introduced to the two main characters:

- The Flight Commander, who operates a screen showing the real-time location of the plane on a radar *(fig.,2)*, as well as its intended destination.
- The Pilot, who is in charge of flying the plane, uses a physical board made up of eight colored lines, a moveable plane (which can be moved horizontally and vertically), and an ultrasonic sensor *(Fig.,3)*.

The pilot's board is connected to two tools:

- The Colorado Cam, which detects the color lines to determine the X-axis (horizontal) location of the plane.
- The Ultrasonic Sensor, which measures the Y-axis (vertical) distance from the sensor to the plane.

These inputs send real-time updates to the commander, who uses them to track the plane's position on the radar. The core challenge of this level, and of the game overall, is that the pilot and the flight commander cannot see each other's tools. They must rely entirely on communication to navigate correctly and avoid mistakes.

WARNING: Be aware of the No-Flight Zone. If your plane flies over this restricted area, the alarm will go off and the authorities will be alerted to your location.

Level 2 – Simon Says

After first substance is collected and level 1 ends, the players face with their next challenge. Now the radar will freeze and flight commander will see 4 numbers with order 1,2,3,4 and with a screen asking players to press the buttons in correct order *(Fig., 4)*. Pilot has 4 buttons with randomized order and he needs to press them one by one to figure out what number is assigned to which *(Fig., 5)*. The communication with the flight commander is very important for this stage as he will see the number of the pressed buttons. Pilot will need to keep track of the button numbers and memorize them to later press in the correct order. Once the buttons are pressed in correct order, the radar will continue and the next location will be visible where the flight commander needs to guide the pilot to.

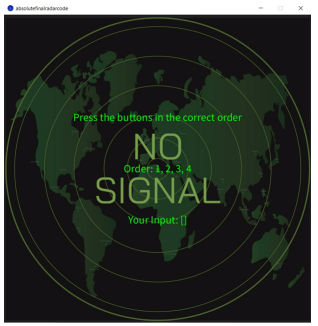

Figure 4- First puzzle (simon says)

Figure 5- Simon says module

Level 3 – Fixing the radar

After the second substance is collected, the radar system will go offline. To restore the radar, the pilot and flight commander must work together to recalibrate the system. This is done by adjusting two potentiometers located on the pilot's side. As the pilot turns the potentiometers, the frequency displayed on the radar screen in front of the flight commander starts to change *(Fig., 6)*. Through clear communication, they must figure out which modules to use and what the correct target frequency is. Once the pilot aligns the potentiometers with the correct frequency, the radar comes back online. With the system restored, the team can move on to collect the next substance and continue their mission.

Level 4 – Morse code and opening locker

The goal of this final level is to unlock the final coordinate, which can be found in the locker. Once the players have found the third coordinate, a text will appear on the screen of the flight commander saying: "You can't talk," along with a code *(Fig., 7)*. Besides seeing the screen with the radar, the flight commander also has a button that can be pressed. When pressed, it activates a light on the side of the pilot. This button is used to communicate numbers through Morse code. The pilot will see the light blinking and needs to understand the message. Once the pilot has received the code, they can use it to open the locker *(Fig., 8)*.

The locker has three potentiometers. The pilot can turn which will active a servo motor and open the locker. Inside the locker, the final coordinate is revealed: D4. This is where the last substance is located and the plane needs to land. The pilot tells this coordinate to the flight commander, who guides the pilot to fly to the correct end location. Once they land the plane, their mission is completed.

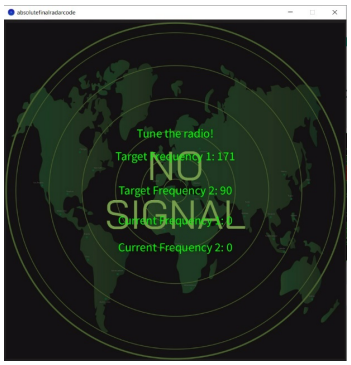

Figure 6- Second puzzle (fixing the radar)

Figure 7- Third puzzle (morse code)

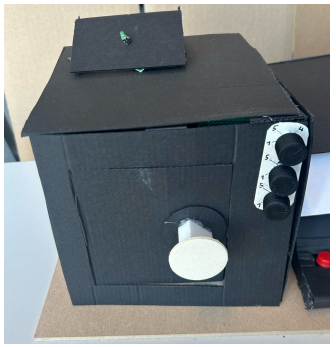

Figure 8- Locker module

System Map

To create a clear overview on how all the modules are connected, a system map was created:

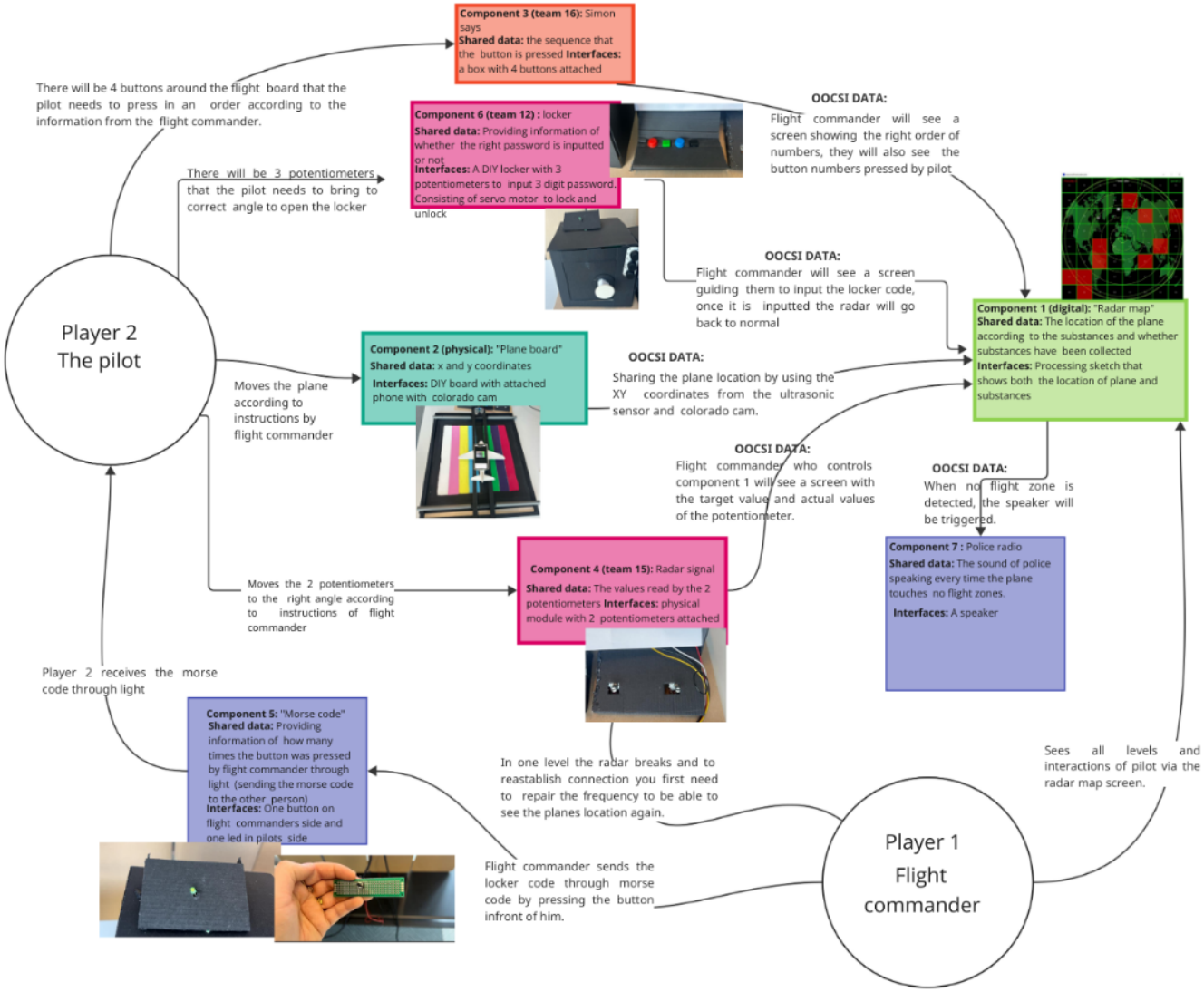

Figure 9- System Diagram

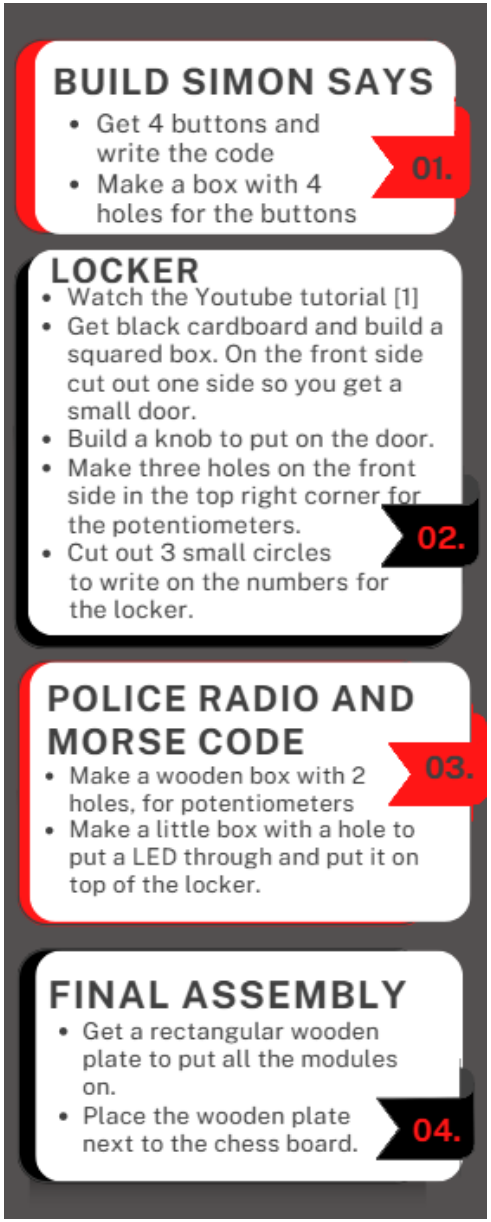

Figure 10- DIY Guide of all added modules

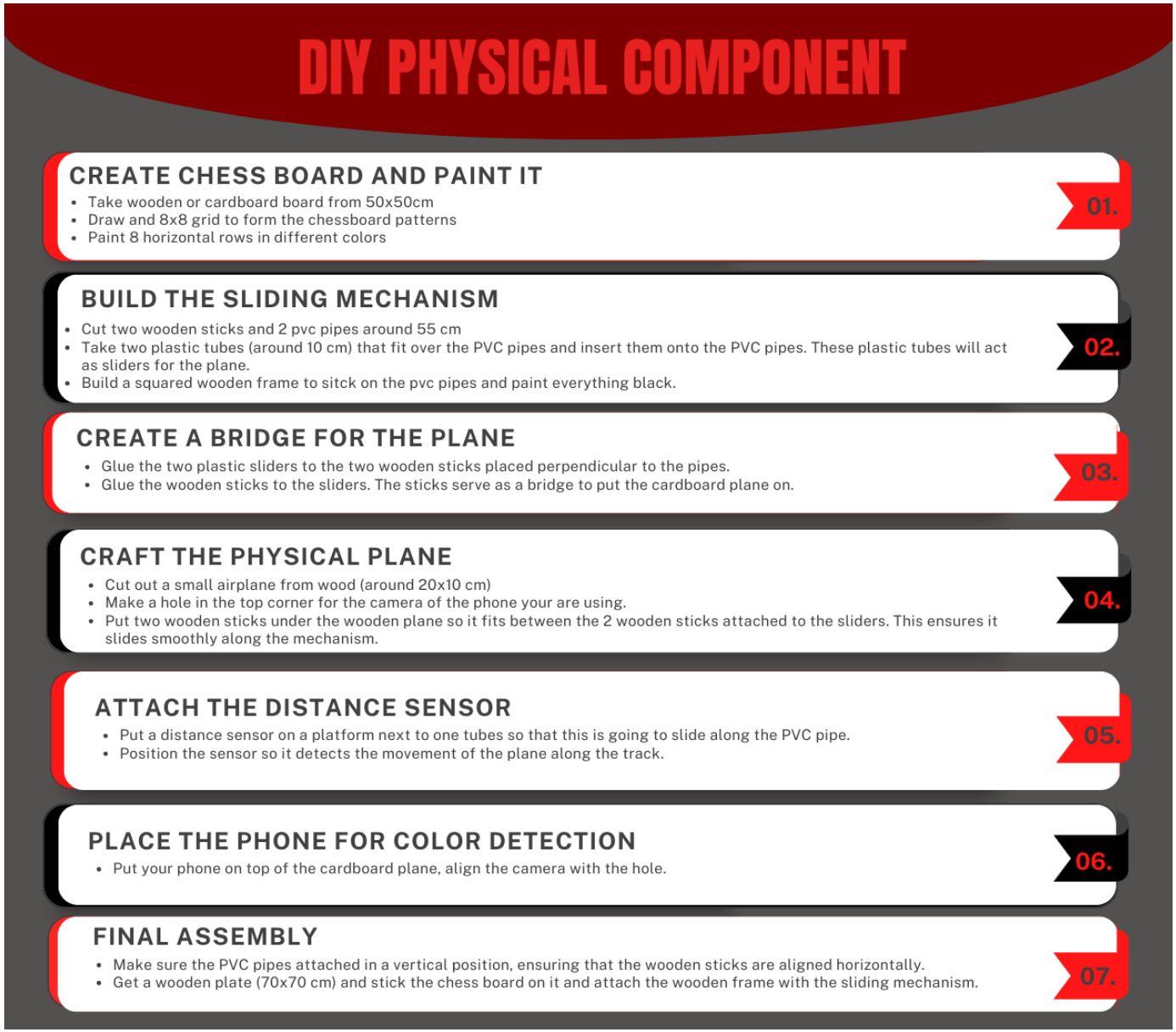

Figure 11- DIY Guide of flight board

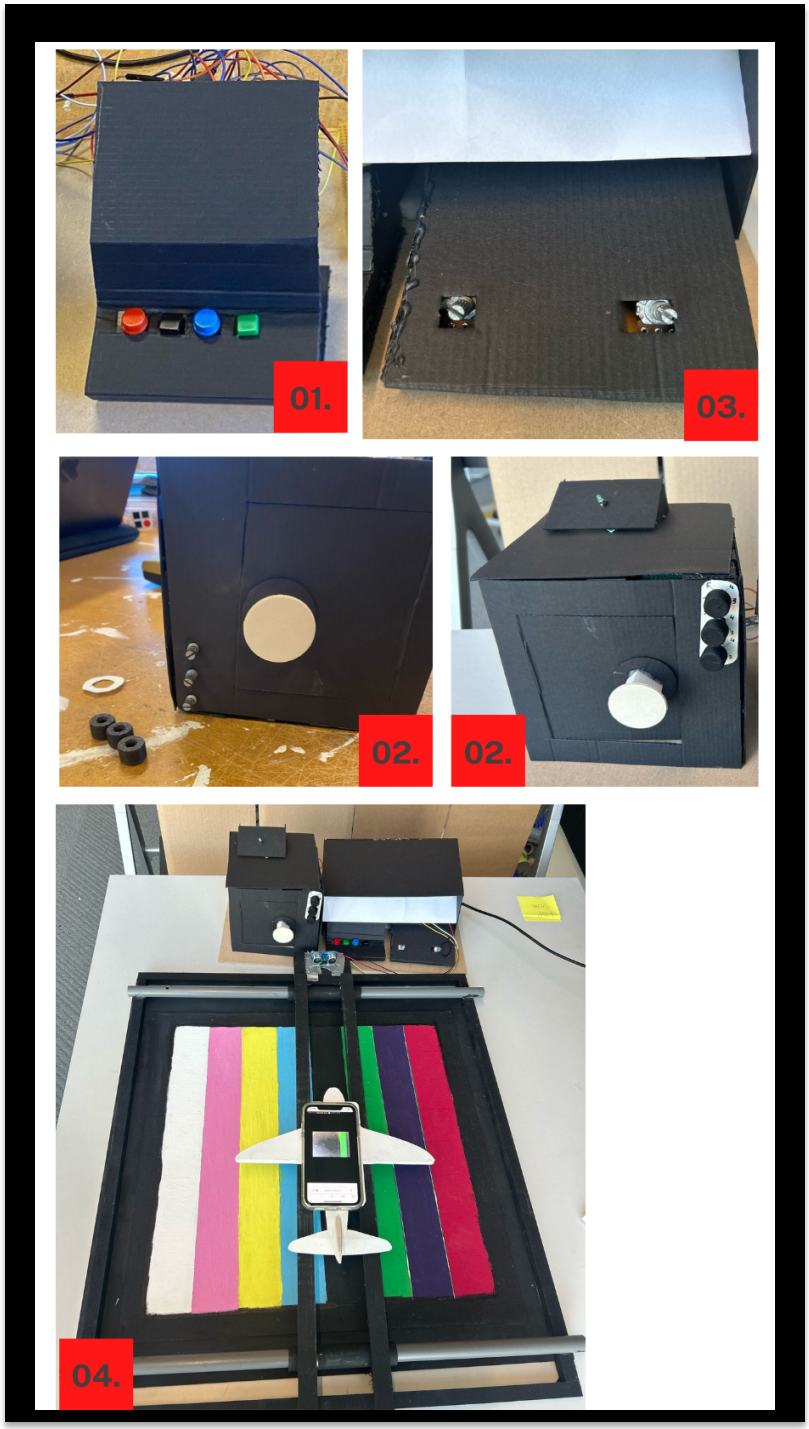

Figure 12- Pictures of added modules

Figure 13- Pictures of flight board module

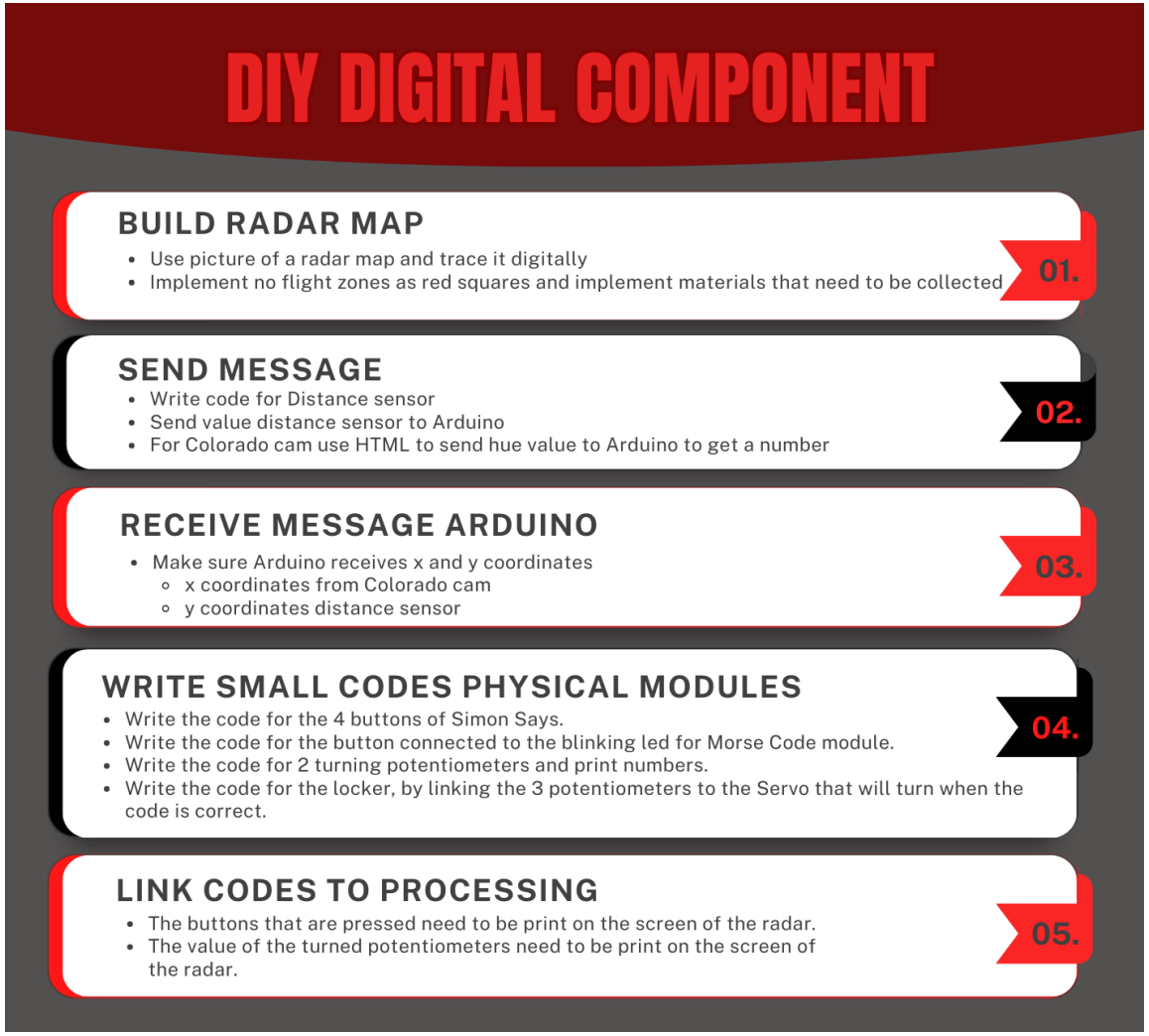

Figure 14- DIY guide of the digital radar component

AI-use in the project

Throughout the project, we had several technical challenges, especially related to coding and the ESP-32 connection. In some cases, the ESP-32 wouldn't connect properly when using specific code files, even though it worked fine with others. To troubleshoot these issues, we used AI tools for support. These tools helped us understand and fix problems we initially couldn't figure out on our own.

The AI was used as a learning tool, allowing us to improve our technical skill and teaching us about the reasoning behind the fixes.

Escape room in action

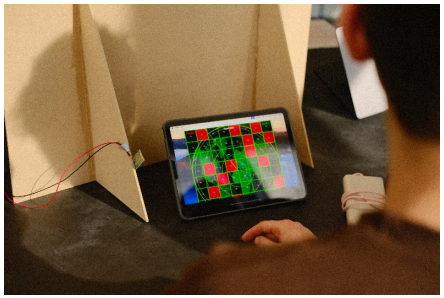

Figure 14- Radar module during demo day (Picture taken by TA's provided by Diede Van Marle)

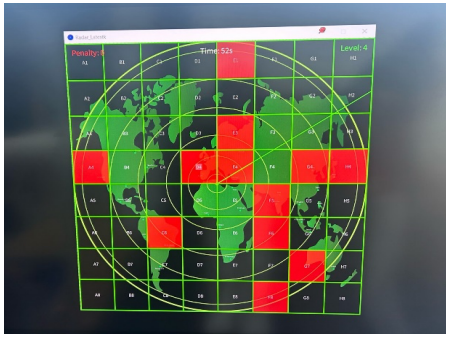

Figure 15- Radar module in action

Figure 16- Flight board module during demo day (Picture taken by TA's provided by Diede Van Marle)

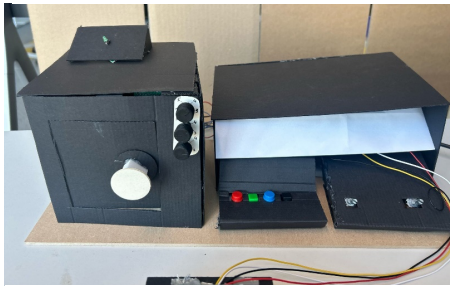

Figure 17- All added modules

Figure 18- Experiencing the escape room

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