R.P.G. - Receipt Printing Game Development Document

Brainstorming Game Ideas

During brainstorming, we had to come up with a lot of different unique ideas, one idea was inspired by dancing video games such as Dance Dance Revolution, where there would be four buttons that the player would press in response to directions on an LCD screen. The controller would mimic the design of an arcade dance game platform, which would allow the player's hand to "dance" on the controller when playing, similar to how someone would play the game normally with their legs.

[Ruaraidh came up with this idea]

Another idea was a werewolf style game where there would be a minimum of four players and one of them would be the werewolf and the others would be given different roles like 'doctor' or 'detective', the werewolf would secretly kill someone every night and the doctor would project someone and the detective would investigate someone. In the realm of this project the idea was that there would be a screen in the middle and it would face one person at a time, once a person would do their turn the screen would rotate to the other players to make their decision, we decided not to go with this idea as it didn't feel as original as some of the others and it did feel al ot like a console.

[Ryan came up with this and wrote it]

Another idea was an RPG-style text adventure game where a thermal receipt printer would narrate the game and display various creatures for encounters, with the receipt being able to be taken as a memento of the adventure once the game was over. We decided to go with the thermal printer RPG idea as the other idea felt too close to a regular video game.

[Stefan came up with the idea for the RPG game, and the rest of the group helped flesh it out to add their ideas to it.]

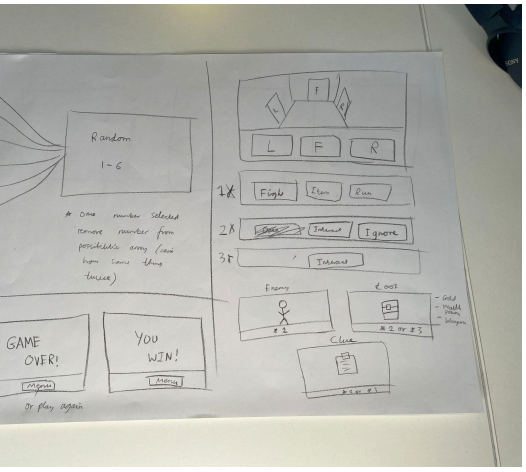
Idea Workshop

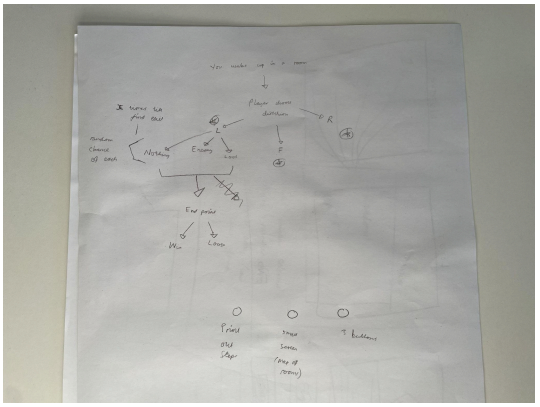
There was a workshop that involved someone coming in and giving many different ideas on how to play-test different game ideas. This process consisted of gathering the main aspects of the project and attempting to build it in simple, fast, and understandable ways. To do that, we got the general MVP and tried to visualise it, starting with using clay. At first we started with a very close to original idea of clay design, with buttons, screen and the printer but we found it didn't leave much to the imagination and nor did it feel like a tangible game, it just felt like a game that can exist on an engine, or arcade machine. So we got to thinking and made a few changes. Firstly, we decided to write down each aspect of the game and the general path the player would follow. So we story boarded with how each room would look and we wrote down a general idea for the story that the rooms may give.
[Ryan attended and wrote this]

After gathering these ideas, we discussed more and tried to think of ways to make the project more tangible and have the users use their imagination more. We then came up with the idea of using an LED ring to signify a compass, which also showed directions you can travel to and may guide you to interactables. This idea greatly improved the idea of the game and gave players so much more

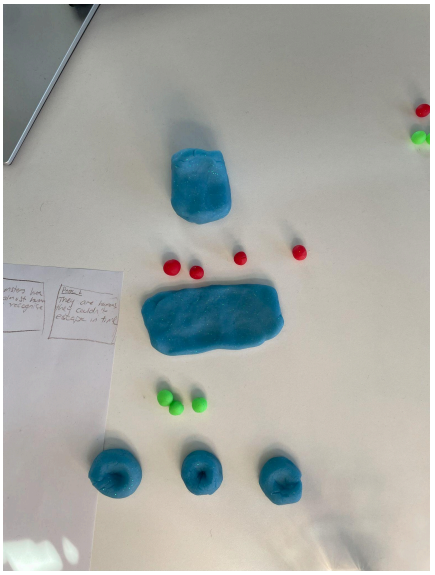
to interact with. We managed to test a lot more of how this may work, and if potentially having multiple LED rings or different LED strips may be better to add, as we needed to give more information. After all of this testing we had a lot of ideas to discuss and finalise as a group, these ideas being - Using an LED ring to signify how close you were to the end of the maze, replacing the LED screen with the LED rings to use less direct visuals, use left over health in an undecided combat system to scale player damage, use three LED rings to show journey, choices and health, using the LED's for journey progress and compass and for the battle mechanic, it was between a rock paper scissors battle system, which was choosing between Rock, paper and scissors and having the in-game enemy randomly pick one too, A block or parry system where you block all damage coming towards you or instead you try and parry every attack, the ones you miss damage you and the ones you hit save yourself and damage the enemy and the last idea was a quick time event which would work perfectly with the LED ring as it allowed for perfect visualisation and a fun challenge.
[Ryan attended and wrote this]

The workshop was extremely beneficial as it offered so much insight into a project that we hadn't entirely opened up. Being able to also try explain it to people who had never heard of it before allowed us to figure out what may be confusing to the actual player as to us it all made sense, this allowed us to create an early version of the project and also allowed us to play it with people who studied different topics than us which gave us opinions from a whole different sphere. It was also important because it got me to test the project in a very fun and positive environment, no one expected a built-up game, and no one expected anything crazy. Everyone was happy to help and took a lot of joy working in that environment, especially since we were working with items like play-dough, which may has a childish view to them but I think that caused a lot of comfort for us as it took away a lot of stress due to it feeling less serious and permanent.
[Ryan attended and got the feedback from everyone here; he wrote it and took the pictures below.]





Thermal Printer Idea



The thermal printer would act as a physical replacement for text-based RPGs. It would print pictures of monsters and describe the player's actions as well as events such as encounters and monsters' behaviour to help paint a picture in the player's mind. When the game ended, there would be additional information printed based on the player's performance, such as how much damage they took or how many attacks they landed.

LED Rings Idea

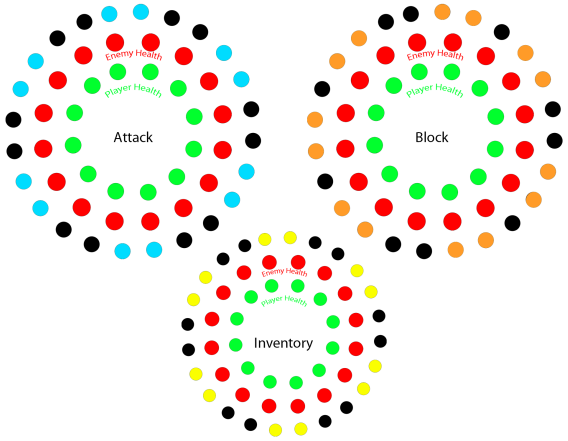
There were various ideas on how to display the player's location, such as having a 8x8 LED grid to act as a map for the player to traverse, but we settled on using multiple LED rings to show the player which direction they could travel in, as well as other rings displaying player and monster health, items etc.

The LED rings were conceived after many different iterations of informing the player of what they can do or must do. The LED rings were split up into 3 different rings, each varying in size. The smallest ring on the inside shows the players health, the middle ring which is slightly larger showing the enemies health and the outer ring showing different potential options for the player depending on the stage.

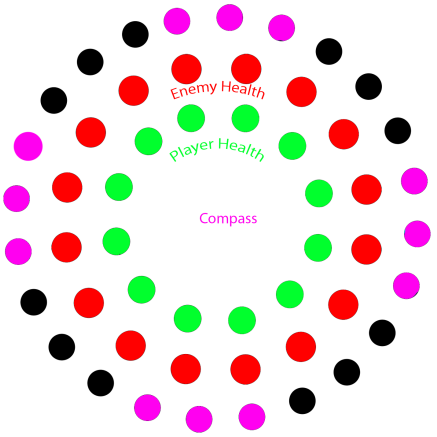
[The base idea for the LED was by Ryan, but was expanded upon by Stefan.]

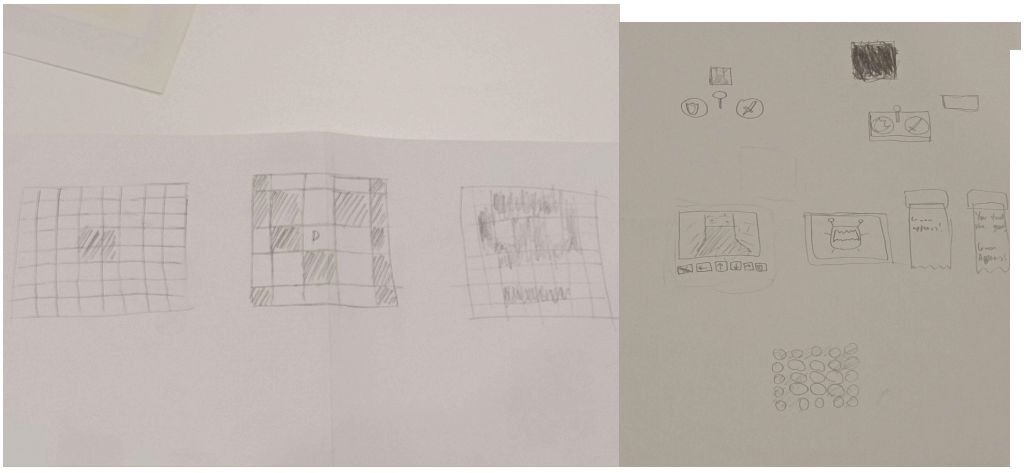
Another function of the LED ring would be the main combat mechanic, where a light will travel across the ring, and the player will need to react quickly to press the attack button when the light reaches a certain area. If the player presses the button at the right time, then they land an attack successfully, otherwise, they miss. The speed of the light and the size of the area would be adjustable depending on the difficulty of the monster encounter. The same kind of function would be used to defend the player against the monster's attacks; this time, they would successfully avoid damage if they pressed the button at the right time. However, we ended up having to simplify this mechanic due to its complexity.

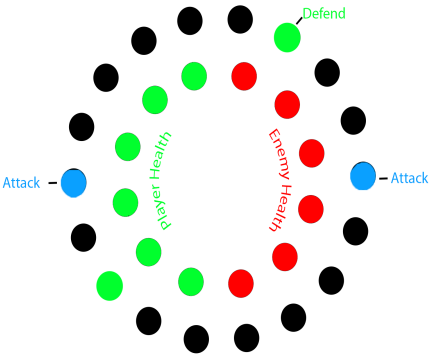
[Idea by Stefan and Ryan - written by Ruaraidh]



[Ryan designed these rings in photoshop]







[Ruaraidh drew these pictures]

Future Ideas

The game has a number of unique monsters that the player can encounter, and thus, they may not encounter every kind of one in their playthrough. We came up with the idea of having a secondary printer that would print out a bestiary page of each monster when they were encountered. This

page could then be torn off and collected to form a bestiary of every monster, encouraging more gameplay to try and get a complete collection.
[Idea and Written by Ruaraidh]

Another idea that would be fun and beneficial to the project to add would be lore snippets into the world, this was tested during the idea workshop but i found that adding lore snippets you can stumble across to gather a better understanding of the world and why you are in it gave the players a push into wanting to explore the maze more as they would want to know why, and how they got there and who put them there.
[Idea and written by Ryan]

An additional idea would be to add designs to the printer paper so it looks more like a scroll so that players feel like it isn't just a boring receipt with their journey on it, it is a scroll written specifically for them. This would do a lot as it would make the player feel more immersed as it builds lore very well for them and it would allow the player to show their scroll off almost as if it was a pokemon card with a story attached. This wouldn't be too difficult to implement but it would require an investment into either paying a company to print these custom made printer papers or trying to hand design each one our own. It wouldn't be impossible nor too difficult but it isn't something that was as important to add immediately.
[Idea and Written by Ryan]

How To Play

The gameplay revolves around the player using the action wheel (the larger outer wheel) as a compass to navigate through a maze, the compass will light up points which signifies that you can go that direction, to choose the directions the player also has 5 buttons, 4 of which involved choosing the direction you want to go and one of them being used for actions like attacking.
The player will choose where they want to go and it will put them in that room, once in the room there is the chance of having an encounter with various monsters which would change your compass into a combat mini-game where you have to press the action on all of the attack points, this will be visualised by the wheel flashing red or green. When it flashes red you have to press the attack button repeatedly to do damage to the monster, however if you repeatedly press the button on the green lights you will take damage instead of the monster, so you have to try be strategic and quick with your reactions during the battles, after you slay the monster you continue to explore the maze, encountering monsters until you finally escape resulting in your win.
[Written by Ryan and Ruaraidh]

Documentation Of Development

Designing monsters for the printer:

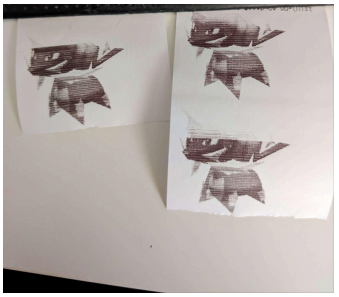
Aseprite was used to design the monsters for the player encounters. To reduce strain on the printer and ensure clear image quality, the sprites for the monsters were made on a 32x32 pixel canvas, which allowed for simpler designs reminiscent of old RPGs. 13 monsters were designed with the idea that each monster would have different behaviour during encounters that would allow for more variety in the mechanics during combat encounters by changing the difficulty depending on the monster. In addition to this, each monster would have

had a unique encounter line printed on the receipt
[Ruaraidh designed and drew all of the sprite designs and wrote this section]

Printer lines:

Flavour text for various sections of the game were written to be
printed on the receipt; however, due to them not being implemented they weren't pushed to the GitHub repository until later on.
[Ruaraidh did all of the flavour text for the receipts and wrote this section]

Printing images



Using the Adafruit thermal library, we managed to print some test images after converting them to the correct format as required by the library
[Stefan did the testing and wrote this section]

Problems and troubleshooting

-Issues with getting the neopixels to display. At one point when switching over to the pi pico 2 for development, we had the pins set up as inputs for buttons and output pins for the neopixel rings so there was a conflict and the neopixel rings were not displaying as intended.

[written and fixed by Stefan]

- The player's position is set wrong after exiting a fight. This could cause the player to end up inside the walls of the area, preventing them from playing the game. To fix that, we made the combat function force the player into mode 0 (navigation mode) to correctly allow the player to interact and move about the map

[written by Stefan and fixed by Joel]

-The player would get locked out during navigation. During the first testing of navigating with buttons, the player could move in every direction correctly for the first room, if that direction was a valid position, but in the second room, the player wouldn't be able to press the same direction as in the previous room. Along with that, the player would get locked out after pressing a direction to go in for the second room. It turns out the program got stuck in a for loop that

-Storage started becoming a big problem when we started implementing the maze and images for the thermal printer, we did countless hours of research into how we can limit our variables, the maze and anything else in the projects file size but what we found seemed unstable, overly complicated and gave us the impression that we may have to remove stuff from our project, we had used these sites to help find answer:

Tillaart, R., n.d. *BitArray*. [online] GitHub. Available at: https://github.com/RobTillaart/BitArray [Accessed 6 May 2025].

Stack Overflow, 2012. *What is bit masking?* [online] Stack Overflow. Available at: https://stackoverflow.com/questions/10493411/what-is-bit-masking [Accessed 6 May 2025].

Arduino Forum, 2018. *Bit packing / union puzzle*. [online] Arduino Forum. Available at: https://forum.arduino.cc/t/bit-packing-union-puzzle/535823 [Accessed 6 May 2025].

Arduino Forum, 2013. *BitBool class - boolean array upto 16000 elements on Uno*. [online] Arduino Forum. Available at: https://forum.arduino.cc/t/bitbool-class-boolean-array-upto-16000-elements-on-uno/125764 [Accessed 6 May 2025].

Arduino Forum, 2013. *More efficient data storage method*. [online] Arduino Forum. Available at: https://forum.arduino.cc/t/more-efficient-data-storage-method/145132 [Accessed 6 May 2025].

Arduino, n.d. *Control Structures - Arrays*. [online] Arduino Documentation. Available at: https://docs.arduino.cc/built-in-examples/control-structures/Arrays/ [Accessed 6 May 2025].

Arduino Forum, 2018. *Bit storing as byte*. [online] Arduino Forum. Available at: https://forum.arduino.cc/t/bit-storing-as-byte/521098/5 [Accessed 6 May 2025].

Tillaart, R., n.d. *BoolArray*. [online] GitHub. Available at: https://github.com/RobTillaart/BoolArray [Accessed 6 May 2025].

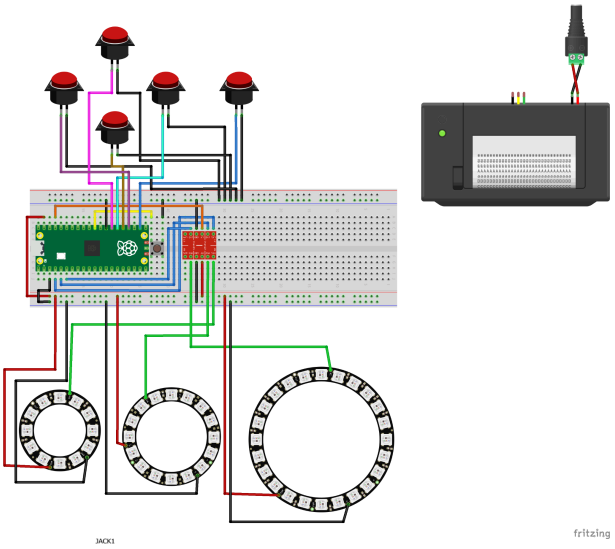
Unfortunately, even after all of this research, we ended up deciding to change from the Arduino Uno to the Raspberry Pi Pico 2, as it was just an overall problem in the end. Not to say that this research was useless, we got invaluable information that we could work with, and for me personally, it taught me so much more about the boards and how we can fully utilise them.

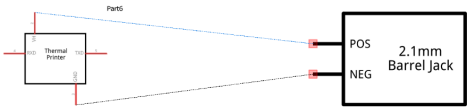
[Written by Ryan, research done by Ryan, Joel, and Stefan]

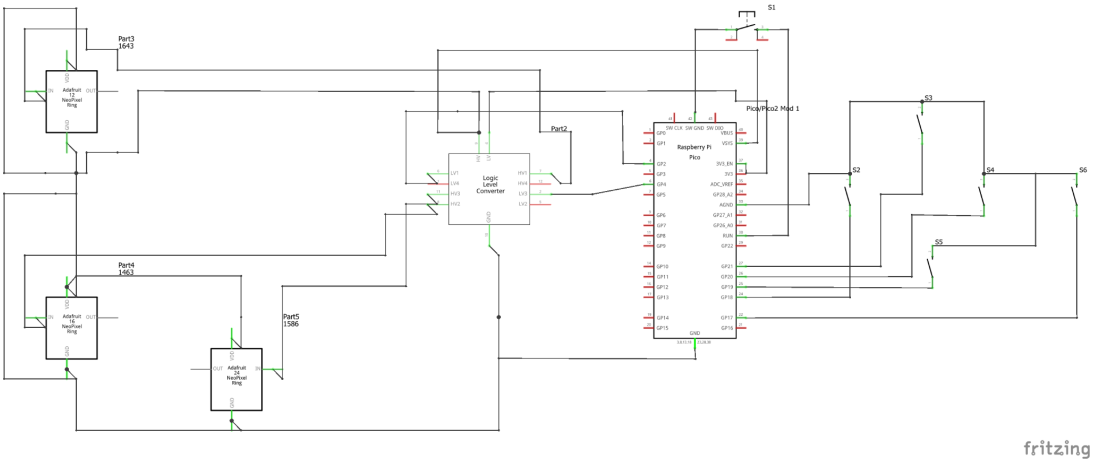
Wiring

Here are the wiring diagrams and schematics, which show how all of the components are wired up. Since we didn't end up getting enough time to implement the thermal printer, it is disconnected in these diagrams.

[Stefan did the wiring diagrams in Fritzing]







Feedback

To help further our development, we had a small group of people test the game and asked their opinions on the game. The testers gave overall positive opinions on the gameplay, as well as suggesting the following additions:

- Gaining a small amount of health after each encounter would make the game less difficult. After adding this feature, testers said it enabled more strategic gameplay
- Reducing the encounter rate to ¼ instead of ⅓ to allow for more exploration without interruption
[Feedback gathered by Stefan, Joel, and Ruaraidh, written by Ruaraidh and implemented by Joel]

Evaluation

Positives

To start, the project has reached a playable state, and the player can win or lose depending on if they meet certain criteria.

The general idea for the project is very unique and offers a lot of fun and interesting developments such as;
The idea of the receipt, which allows players to discuss the gameplay and how well they did, expanding the playtime of the game to more than just one try, allows players to play countless times to attempt to escape faster, kill more enemies or explore all of the maze. This makes the print of their gameplay have a much longer lifespan in their life and creates almost a bond between players.

[Written by Ryan]

The idea of the rings I think is also very unique and it offers a very visual but hands on approach to what could otherwise be a boring button pressing game, the very visual representation of exploration and the way that it is like a compass creates a familiar feeling so that the players don’t feel too out of their depth

[Written by Ryan]

Improvements

The main improvement would be to have the receipt printing implemented, since we didn't get the time to code and test the feature we did not try to half implement it as the game is playable without it.
[Written by Stefan]

A small improvement would be packaging the project more to allow it to be more hands on and traditional like a handheld console, this would allow the users to carry it around more easily but also make the users more comfortable when it comes to using it as it would be similar to others they may have used in the past. An easy fix for this is discussed below in accessibility
[Written by Ryan]

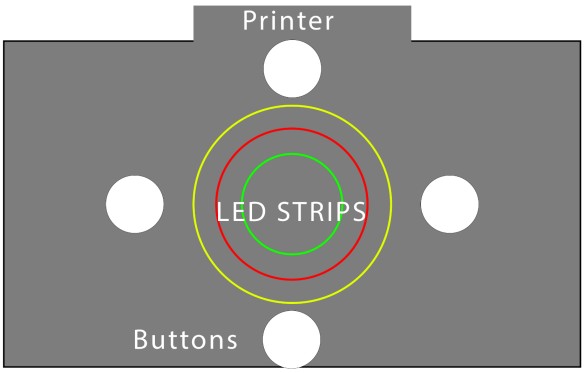
Another improvement would be having sound effects included in the game, as it would improve the experience and interactive feeling when fighting enemies and navigating the maze.
[Written by Ruaraidh]

Accessibility:

One issue with the current design of our tangible game is that it is not very accessible for blind and visually-impaired people due to the game mostly consisting of visual elements, such as lights conveying information, and the narration of the receipt printer. In order for the game to be more user-friendly for blind and visually-impaired people, sound would be a key feature. A text-to-speech program could be used to narrate the information printed by the receipt printer, as well as the user's actions, and the direction they are traveling in. During combat, an audio cue can be used in place of relying on sight while still utilising player reaction time. Furthermore, the player could have a button they could use that can tell them their health, as well as the monster's health, during encounters. For people with colour blindness, we would use a switch to change the colour scheme of the game to colourblindness-friendly colours.

[Written by Ruaraidh]

Another accessibility problem that may arise is that the project is quite a lot to have to carry around; it would have to be set up at home, as it most definitely is not portable and may require setting up, as it is a lot of large pieces. One way around this is to create a casing and maybe have the LED rings placed in the top of a box where the printer is so it can be a lot more portable and it can be potentially portable.
[Ryan wrote this and designed the idea in Top Down view in photoshop]



Top Down View