Software Design Document.

Team: 14, Los Thunder Contribution:

- Salma: completed the introduction, intended core features, game mechanics, game input and multiplayer modes, graphical styles, user interface design as well structuring the document and checking over it. Moreover, I have also added to the feasibility section. I also ensured that the live document was kept up to date by adjusting all relevant parts of the report accordingly.
- Alina: In the software design document, I contributed to discussing the target audience, feasibility and suitability of the game. I also wrote about what kind of experience the user will have while playing.
- Gugundeep: For the design document, I contributed by stating the different risks which could arise to our game in the design stage and the different types of security principles and practices we could use to stop them from occurring. During the final week of the deadline Salma helped me with reading what I had written and giving constructive feedback to what I could do to improve it.

Table of Contents:

1. Introduction

The Magic School game is an educational game where the aim of the game is to reach the finish line first. The map will be filled with obstacles, such as spikes and bots which the players are to avoid tactfully to allow them to reach the questions and finish line before their opponent. Moreover, the education aspect of the game will take form as doors in the game, once a player passes through said door, they will be faced with an English or Maths question, to bypass the door and be able to carry on navigating the rest of the map the player will have to answer the question correctly. Those questions will be a mix of Maths and English, the level of difficulty of those questions is dependent on the level chosen by the players.

2. Target users

Our target users are children aged 11 to 14, i.e., children in key stage three: this is because there are specific aspects of the game which will mostly appeal to children, such as a map based on a magical theme. The map will be planted with obstacles to appeal to target users, this way the game is not too difficult and still challenging at the same time in order to engage the users. The intention of the game is to give the user an educational experience whilst they get to use their imagination to immerse themselves into the game's fantasy world. The user will have the option of what level they would like to play, each level will consist of a mixture of English and Maths questions where the difficulty is reliant on the level chosen, this enables the players to choose the difficulty which appeals to them more and still a choice of different maps. The game involves the user to solve problems in a map based on a magical theme- so it has a mystical feel to it which allows the user to revel in the mysterious and captivating aspects of the game all the while attempting to navigate the map as efficiently as possible. It is a perfect option for users who want to get their competitive spirit up and help them tackle traditional learning with a unique and enjoyable learning experience.

3. Intended core features

The intended core features in our magic school game consists of several aspects, to highlight the goal of the game is to reach the end of the map first, whoever does that out of the two players wins the game. The game is filled with a number of obstacles, such as spikes and floating islands which the player will have to bypass to avoid annihilation. Moreover, in more difficult levels there will be bots in the shape of dragons which will also cause the player's eradication by touching them. Lastly, there will be obstacles in the form of questions to be answered which can be either a Maths or English question, the player must get the answer right to be able to navigate the rest of the map.

Figure 1.

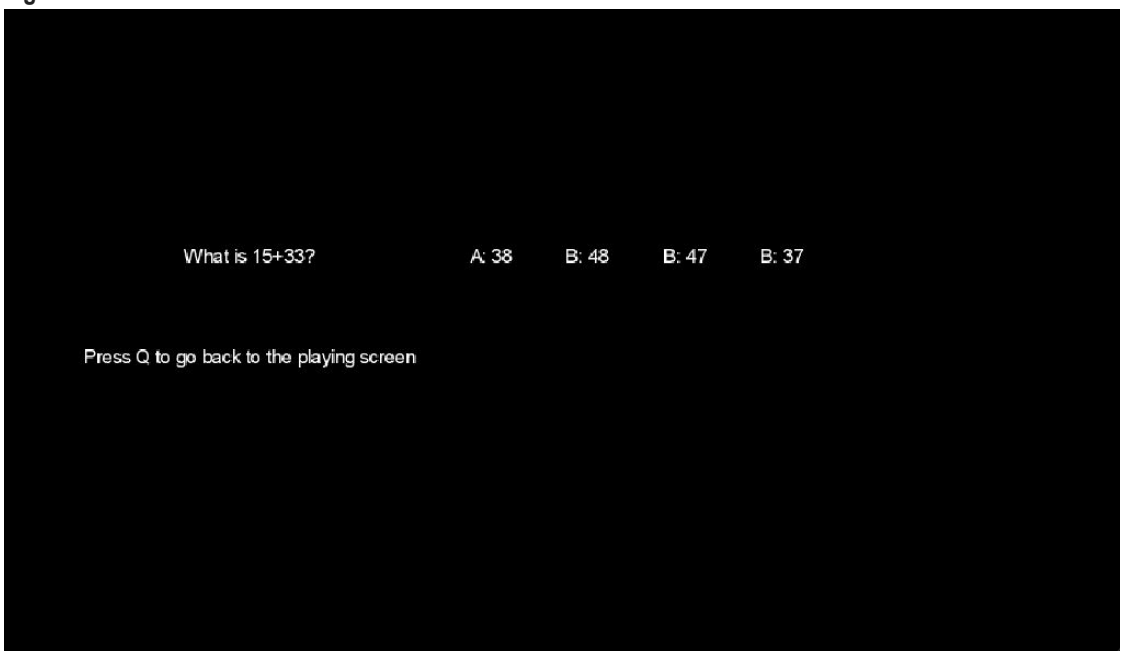

Figure 1. Shows an example of a question which the player may be prompted with when entering through a door.

During the development of the game, it was observed that the most efficient means to structure both the questions and the answers was in a manner that avoided the users requiring to work out anything using pen and paper, as well as having to type their answers as it complicates the game for our target users since it may overwhelm them. Additionally, if the questions were not multiple choice, it may be the case where the user does not have an idea on how to solve the question so they may choose to exit the questions and attempt another one which they already know, which diminished the learning aspect of the game, in contrast, if it multiple choice then they will notice when they get the same question on another occasion of playing what the correct answer is and potentially understand the logic behind it.

In addition to this, power-ups will also be made available in the game, an example of one would be when the player consumes an apple, this will cause the player to be able to jump higher than usual and thus be able to avoid bot or spike obstacles better. In addition to this, to give the players an equal opportunity and to add to the competitiveness sense to the game, once a player reaches the finish line, the second player will be given 20 seconds to also reach the finish line, if they do then they get a number of points, however less than the winner, if they do not then they don't get any points for the round.

The winner will be concluded based on the number of points they accumulated in the games, the player with the highest number of points will be named the winner of the whole gaming session.

4. Game mechanics

As the general idea of the game states, the core features will include the settings which allow the two players to choose the level of difficulty they desire to play. In the settings menu the players can also choose the music and the sound effects volume, the music will be a magic inspired melody, the sound effects will be matching to the activity that the player is carrying out, for instance if the player falls in the water, then there will be a splashing sound effect to resemble that.

To highlight, the levels will reflect the difficulty of both the map, i.e., there will be more obstacles, and the questions will gradually become harder with each level to accommodate the top set, bottom set and the sets in between.

There will be a number of constraints within the game to make certain that the overall game experience is uniform. An instance of this is that if there is one player in the game, the player will not be able to move their character until another player has joined the game; then a countdown will take place where the user can afterwards start the game. Likewise, if a player leaves in the middle of a game, the other player will be removed from the game and sent back to the splash screen to allow them to attempt to start a new game.

Moreover, when one player reaches the finish line, the game will countdown 20 seconds as a means to give the losing player a chance to also collect some points (although less points than the winner of the round), this will add to the suspense of the game and increase the competitiveness between the players. To reiterate, if the losing player reaches the finish line within the countdown, then they will be rewarded an number of points, if not then they will gain no points for the round.

To elevate the suspense of the game a number of power-ups will be implemented, an instance of which would be a power-up that allows the consumers to jump higher than usual, meaning they have better chances of avoiding spikes, bots or traversing through floating islands.

5. Game input and multiplayer modes

The game will be played on a computer device where the two players will be using their directional keys to navigate through the map, and their mouse to select the right answer when faced with a question. The players will be paired with another random player who has selected the same level as them.

6. Graphical styles

The graphical styles that have been chosen for the game will be very simple and consist of 2D graphics, the point of view for the players will be 2D scrolling to allow the players to see only a small section of the map as they traverse the map, this will also allow them to see where the obstacles if they are close enough, but not other obstacles that are further away from them at that point in time. Additionally, 2D scrolling was elected since it preserves the exciting and curious aspect of the game as the players do not know what obstacle they will have to face further down the map, which intensifies the game and provides the target audience with a breath-taking experience seeing as they cannot calculate how to bypass the obstacles beforehand.
Figure 2.

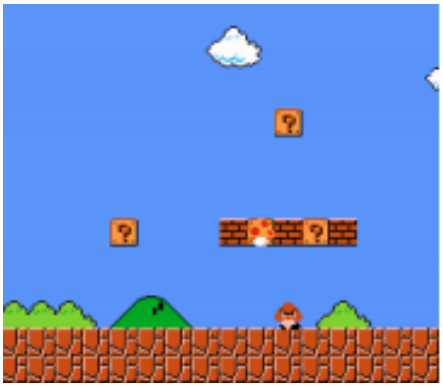

Figure 2. Shows an example of a 2D scrolling game, as illustrated by Nagahiro (2019).

Figure 1 inspired the layout that was implemented in the game, it aided as an example of what the map should resemble, in terms of manoeuvring structure; as well as allude to the mechanisms in terms of the movements for the user (e.g., navigating with the directional keys rather than mouse-guided navigation).

It is worth noting that inspiration was drawn from the iconic Mario Bros, we extracted how the game level were crowded with obstacles and power-ups whilst having the 2D scrolling structure making the game suitable for younger players, reflecting to our target audience and still captivating players from a wide variety of age groups, demonstrating how widely enjoyed the structure of the game was due to its continuous storyline. An essential consideration as to why 2D was chosen over 3D graphics is due to the fact that the key element of the game was the educational side of it, to avoid overwhelming the user with the graphics of the game it was concluded that 2D is captivating yet still enables the players to focus on the aim of the game.

7. User interface design

As the general idea of the game states, the core features will include the settings which allow the two players to choose what level of difficulty they want their game to be, which will be displayed on the splash screen. There will be a total of six different game levels to accommodate players which are top set, bottom set and the sets in between, and to add to the game complexity both question and map wise as they both will become harder each level. To reiterate, in each level the questions will move from the bottom set questions to top set questions gradually, similarly; with each level there will be more obstacles to make navigating the map more challenging and intriguing. This will be placed in the middle of the screen in the focal point as that is the main setting that the user will have to select before starting the game, the other settings (e.g., sound) can be adjusted during the game, unlike the level chosen. Underneath the level options there will be more settings which the players can amend, this will contain the sound and music volume buttons.

Moreover, the splash screen will facilitate the players to choose the music and the sound effects volume (i.e., having them on or off), the music will be a magic inspired melody, the sound effects will be matching to the task that the player completed, for instance if the player is to open a door there will be a unique sound to match the activity being carried out.

There will also be an information (i.e., help) button towards the bottom of the screen which will have the game instructions, in terms of controls, for new players to reference. Finally, there will also be a start button at the very end of the splash screen, it will be placed at the bottom as it will be the last action clicked after the players set their desired game settings.

After the players have selected their game modes and start the game, they will be taken to the map associated with the game mode that they've picked. The UI will then mainly be the map with the exception of the top of the screen where there will be in-game settings such as the sound adjustments, moreover the scores will also appear at the top of the screen as well as the timer if the user has consumed a powerup.

8. Feasibility

8.1. User feasibility

The feasibility of the game is highly reliant on the target audience. We will also aim to make the game simple to understand so the user will not get confused by a ton of instructions or rules. However, because the goal of the game is to challenge the user, we will have different difficulty levels to achieve this. Taking into account our young target audience, we aimed to keep the goal of the game straightforward as well as other elements such as the gameplay in terms of mechanisms, it was decided to make the game only consist of directional keys and mouse-clicks (when answering questions) to make it simple for our target users to play in addition to allowing them to learn the game almost immediately. To elaborate, the questions which are included in the game as the main forms of obstacles to bypass have been tactically structured to enable the players to answer the questions (e.g., maths questions) without the need of using a pen and paper to complete the working out as we recognise that this will affect the game play considering that the player will be required to take their hands off the directional keys etc. It is important to note that although the questions do not require a pen and paper to work out, they still gradually become harder with each level to make certain that the game retains its challenging aspect.

Moreover, the game has a combination of vibrant colours throughout the maps as a means to captivate our target audience, as stated by Xiaodong (2010), “On the vision, children like the bright and vivid colors”, which further justifies the strategic choice of implementing such colours as they will assist in intriguing the audience. Similarly, reflecting to the target audience, 2D scrolling was concluded to be the best structure since it ensures that the aim of the game remains concise and allows the players to easily find the finish line, whilst meeting all (as well as the same) obstacles as their opponent player. To emphasize, if the game did not take the structure of 2D scrolling, the game risks losing the main focus, which is to reach the finish line, as it may lead to players getting lost within the map, or unfair wins due to picking a better route to the finish line.

8.2. Technical feasibility

Furthermore, in terms of technical feasibility, it was concluded that an exact amount of six levels will enable us to encapsulate how the levels gradually become more challenging both in terms of obstacles and questions. Moreover, the number of levels also empowers for showcasing a hint of how the storyline will look different in every other level, i.e., the scenery of the game will change depending on what stage the player has reached. It is important to note that this was decided while considering the time available until the project development came to an end.

By the same token, the game design is feasible as the levels will have identical mechanisms, with the exception of the addition of power-ups in later, more challenging levels. Ultimately, this equips for the game design to become less complicated after completing the first level of the game as it will be a matter of implementing more obstacles and changing the game aesthetic to make certain that the users are invested in the game.

9. Suitability

The game will be suitable for our chosen target audience due to the theme of the game as well as the difficulty of the game- it will have a fantasy feel to it and a low difficulty level which is appropriate for 11- to 14-year-olds. Additionally, the whimsy characters and colourful background is something that will help create the ambience of the game and hence appeal to the target audience. This game will be aimed to challenge the user and make them think fast and smart, which is what makes it suitable for children who want to further their learning in enjoyable ways and improve their problem-solving skills. Moreover, the game will include plenty of thought-provoking questions to provide the education element of the game.

10. Security principles and practices

During the design of the software, there were a number of security principles and practices which were identified, the first one being integrity, which is one of the most crucial security principles we considered during the design stage. Integrity is of high importance as it demonstrates the safety and maintainability of the code created, during the design it is vital to ensure that the code which we are implementing is safe and secure.

We have taken into consideration that software design can change over time and or evolve. To certify that we have fully taken into account the integrity issues during the design we have concluded a method to deploy which will aid in ensuring that issues such as integrity of the software design are not faced. The chosen approach is the “design-first development” method, this is essentially a prototype of the code, in other words, this will help in understanding the root of any problems in a higher level of detail, which could occur during the development of the code. It is important to note that the date is not tampered or used by users who are not supposed to be using it.

Additionally, as good security practice, Heroku was utilized. To elaborate, Heroku allows deploying as well as running applications written in Java, PHP etc. Ultimately, this means that it is not required to make changes to an application in order to run it on Heroku, which provides mechanisms for the game to be played on a live server. The main logic as to why Heroku was utilized in the development was that it defends against threats by implementing security controls at any layer, from physical to device, isolating data and applications, and deploying rapid security updates without requiring user interaction or service disruption.

Moreover, other security risks that were recognised were DDoS attacks, which occurs when multiple computers are used to flood the target IP address, considering that our game is a multiplayer game, it had to be made certain that had to make sure we took this into consideration, there are ways in which a user of the game will be able to find out if they are a victim and there are many solutions to this such as resetting the IP address or requesting a new IP address. There are many ways in which we can stop a DDoS attack, the first way is to organise a DDoS attack response plan, having a response plan ready in case an attack does occur is important, the plan will contain how to maintain the game after the attack occurs and is successful. Another way to prevent a DDoS attack is to perform a network vulnerability assessment. It is important to identify a weakness in your network before a malicious user does, this assessment involves identifying security exposures, so we are better prepared for future cyber-attacks.

11. References

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