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Project Management & Innovation.

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1 Introduction

In today's digital age, the gaming industry has become a thriving and innovative area, reaching audiences worldwide. One project that is in the development is a game based on solving an infinitely generating maze while competing against AI opponents with solvable challenges hidden throughout. This ambitious effort aims to create an immersive and engaging experience that combines the excitement of maze navigation with the thrill of competing against intelligent opponents and uncovering hidden puzzles.

2 Project management and planning

2.1 Project Scope

The proposed solution is to develop an infinitely generating maze game with competing AI opponents and hidden bonus challenges. The game will feature increasingly complicated maze layouts generated through algorithms, AI opponents capable of navigating the maze using pathfinding algorithms like A* or Dijkstra's, and hidden messages or puzzles embedded within the maze for players to discover and decode.

2.2 Required Technologies/Resources

- Game Development Engine – Unity or Unreal Engine
- Programming Languages – C# or C++
- AI/Pathfinding Libraries – A* Pathfinding or Dijkstra's algorithm
- Maze Generation Algorithms – Recursive Backtracker or Prim's Algorithm
- Encryption/Decryption Algorithms for Hidden Messages – Caesar or substitution cipher
- Graphic Design Tools – Adobe Photoshop or Illustrator
- Audio/Music Production Software – GarageBand
- Version Control System – Git
- Project Management Software – Trello or Jira

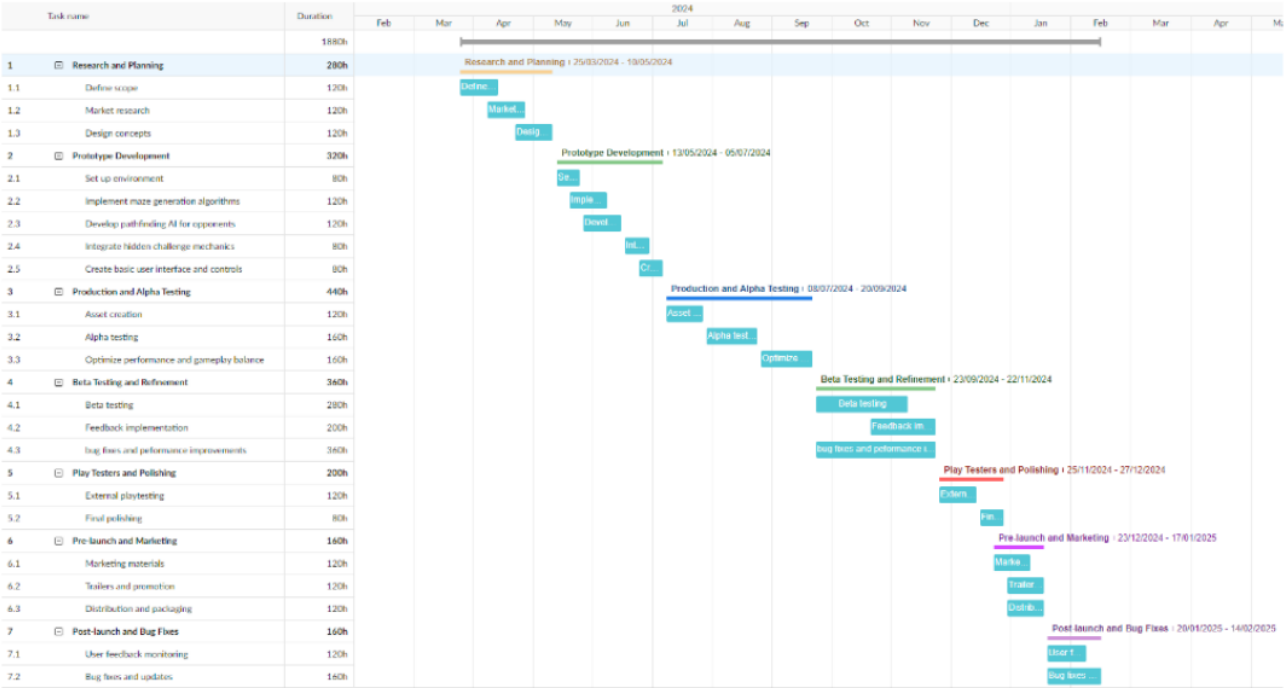
2.3 Project timeline

1. Research and planning – 7 weeks
2. Prototype development – 8 weeks
3. Production and alpha testing – 11 weeks
4. Beta testing and refinement – 9 weeks
5. Play testers and polishing – 5 weeks
6. Pre-launch and marketing – 4 weeks
7. Post launch and, bug and stability fixes – 4 weeks

[1]

2.4 Schedule and Constraints

- The project is estimated to take approximately 12 months.
- The development team consists of 6 members, including programmers, designers, and a project manager.
- The project has a fixed budget of \$100,000.
- The game needs to be compatible with Windows, console, and major mobile platforms.



[2]

2.5 Development Method

The Agile development methodology, specifically Scrum, will be used for this project. Scrum highlights the iterative development approach, frequent feedback loops, and continuous improvement. The project will be divided into sprints, with each sprint aiming on implementing a specific set of features or functionality. Daily stand-up meetings, sprint planning, and retrospectives will be conducted to ensure effective communication, collaboration, and adaptation to changing requirements. [3] [4]

3 Project design

3.1 Requirements specification table

3.1.1 Functional requirements table

Requirement ID	Requirement description	Required / Optional
FR – 01	Maze Generation: Generate a random and intricate maze layout. Should have one starting point and one exit. Should be at least one valid path from the start to the exit.	Required
FR – 02	Maze Generation: Can allow for adjustable maze difficulty.	Optional

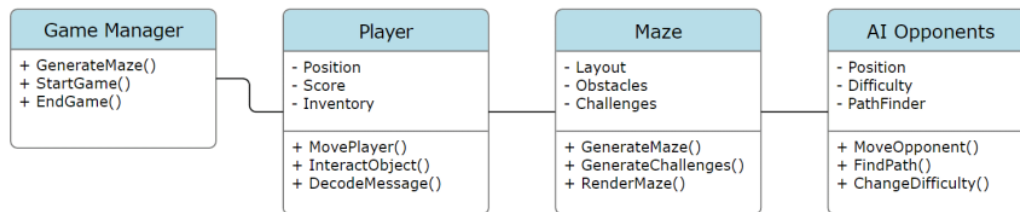
FR – 03	AI Opponents: Will feature AI-controlled opponents that can navigate the maze. The opponents should dynamically adapt their behaviour based on the player's movements and actions.	Required
FR – 04	AI Opponents: The game shall allow for adjustable AI difficulty levels.	Optional
FR – 05	Hidden Challenges: It will embed hidden messages or puzzles within the maze environment. Players should be able to discover and decode the challenges using in-game tools or mechanics.	Required
FR – 06	Player Controls: The game shall provide intuitive controls for players to navigate the maze. Players should be able to interact with objects, activate tools, or use power-ups through dedicated controls or inputs.	Required
FR – 07	User Interface: The game will display a mini-map or a maze overview to help players orient themselves within the maze. The user interface should provide information about the player's status, collected items, and progress. It will include a pause menu, settings menu, and a way to restart or exit the game.	Required

3.1.2 Non-functional requirements table

Requirement ID	Requirement description	Required / Optional
NFR – 01	Performance: The game should maintain a smooth and consistent frame rate, 30/60 for mobile and console with unlocked for PC It will have optimized loading times and efficient memory management.	Required
NFR – 02	Compatibility: The game should be compatible with various platforms, including Windows, macOS, and major mobile operating systems The game needs to support different screen resolutions and aspect ratios.	Required
NFR – 03	Usability: There should be an intuitive and user-friendly interface, with clear instructions and tutorials for new players. The controls and gameplay mechanics should be responsive and easy to learn.	Required
NFR – 04	Replay ability: The game should offer high replay ability by generating unique maze layouts and randomizing hidden challenges for each playthrough.	Required
NFR – 05	Localization: The game will eventually support multiple languages and allow for easy localization of text, audio, and other assets.	Optional

NFR – 06	Security: When the game will eventually add online features or leaderboards, appropriate security measures should be implemented to protect user data and prevent cheating or exploitation.	Optional
NFR – 07	Extensibility: The game's architecture and codebase should be modular and extensible, allowing for easy integration of new features, game modes, future updates, and mod support.	Optional

3.2 UML Diagram



The UML diagram depicts the various classes and their relationships within the game's architecture. The Game Manager class acts as the central controller, managing the Player, Maze, and AI Opponent classes. The Maze class contains the layout, obstacles, and hidden challenges.

4 Innovation

4.1 PEST and SWOT analysis of google

4.1.1 PEST Analysis

4.1.1.1 Political

Google operates globally and must comply with various laws and regulations across different authorities. This includes data privacy laws, antitrust regulations, and content moderation policies. Failure to obey could result in legal punishments and damage to the company's reputation.

4.1.1.2 Economic

Google's revenue is heavily dependent on digital advertising, which can be affected by economic downturns and shifts in consumer behaviour. In addition, the company faces competition from other tech giants, which could impact its market share and profitability.

4.1.1.3 Social

Google's products and services have a significant impact on society, and the company must address concerns related to issues such as online privacy, fake news, and algorithmic bias. Failure to address these concerns could lead to public backlash and regulatory examination.

4.1.1.4 Technological

Google's success relies on its capability to innovate and stay ahead of technological trends. The company must constantly invest in research and development to maintain its

competitive edge, particularly in areas such as artificial intelligence, cloud computing, and quantum computing.

[5] [6]

4.1.2 SWOT Analysis

4.1.2.1 Strengths

- Dominant market share in search and online advertising.
- Innovative products and services.
- Strong brand recognition and customer loyalty.
- Robust cloud computing platform.
- Financial strength and extensive resources for R&D.
- Massive user base and data collection capabilities.

4.1.2.2 Weaknesses

- Dependence on advertising revenue and potential disruptions.
- Concerns over user privacy and data collection practices.
- Highly competitive markets with new entrants and disruptors.
- Regulatory challenges and antitrust inspection.
- Antitrust scrutiny and allegations of anti-competitive practices.

4.1.2.3 Opportunities

- Expanding into emerging markets and developing economies.
- Leveraging AI and machine learning for new products and services.
- Investing in renewable energy and sustainable practices.
- Exploring new revenue streams beyond advertising.
- Acquisition of promising startups and talent.

4.1.2.4 Threats

- Intense competition from tech giants like Apple, Amazon, and Microsoft.
- Potential disruption from new technologies and startups.
- Cybersecurity risks and data breaches.
- Reputational risks and public perception of privacy and ethical practices.
- Acquisition of promising startups and talent.

4.1.2.5 Legal and Ethical Considerations

- Compliance with data privacy regulations and user consent.
- Antitrust scrutiny and potential regulatory actions.
- Content moderation and addressing misinformation and hate speech.
- Ethical AI practices, ensuring fairness and transparency.
- Responsible tax practices and fair competition.

[7] [8]

4.2 Deploying in a large organization

4.2.1 Development

4.2.1.1 Agile Methodology

The project would follow an Agile development approach, such as Scrum, to support iterative development, regular feedback loops, and changing plans.

4.2.1.2 Version Control

A robust version control system like Git would be utilized to manage code changes, collaborate effectively, and preserve a comprehensive code history.

4.2.2 Deployment

4.2.2.1 Distribution services

The game would be deployed on a game service, such as steam, to ensure high availability, and global reach.

4.2.2.2 Containerization

Containerization tools would be employed to package the game and its dependencies into portable, consistent, and easily deployable units. [9]

4.2.3 Maintenance

4.2.3.1 Monitoring and Logging

Comprehensive monitoring and logging solutions, such as Prometheus, Grafana, and Elasticsearch, would be implemented to track performance, identify issues, and aid effective troubleshooting.

4.2.3.2 Automated Testing

Robust automated testing frameworks would be integrated into the development and deployment pipelines to ensure code quality and catch failures early.

4.2.4 Evolution

4.2.4.1 Feature Planning and Road mapping

Collaborative tools would be used for feature planning, road mapping, and tracking project progress, ensuring alignment with business and game objectives and user feedback.

4.2.4.2 Continuous Delivery

Adopting the principles of Continuous Delivery would enable frequent and seamless updates to the game, introducing new features, enhancements, and bug fixes without major disruptions.

4.2.4.3 User Analytics

Integrating user analytics tools would provide valuable insights into player behaviour, preferences, and engagement metrics will help with future development and decisions.

5 Reflection

5.1 New skills

To fully use the opportunities presented in this project, I aim to develop a varied set of new skills across various fields. Here is how I plan to approach each of these skills:

The game will be developed using a programming language that I am not currently familiar with like C or C++. By using this programming language, it will allow me to gain firsthand experience with the language's syntax, data types, and object-oriented programming (OOB) while allowing me to use my pre-existing knowledge.

To implementing an efficient maze generation and pathfinding algorithms for the AI opponents it will require an understanding of algorithms and data structures. I will implement

algorithms like Recursive Backtracker for maze generation and A* or Dijkstra's algorithm for the path finding. Additionally, exploring different data structures like arrays and matrices will help with manipulating and displaying the maze efficiently.

Given the nature of this project, effective project management skills will be essential. I will have to learn and apply project management methodologies like Agile or Scrum to organize tasks. In addition to needing to manage the resources effectively and being able to collaborate with team members. This will involve developing skills in team communication and risk management.

5.2 Contribute to society

This project can contribute to society in that the game can serve as an engaging educational tool. It can encourage critical thinking skills, logical thinking, and spatial awareness among students of all ages. By including hidden messages and puzzles, it can encourage critical thinking, and code-breaking abilities, making learning interactive and enjoyable.

Additionally, navigating different mazes and overcoming challenges can provides cognitive stimulation, allowing individuals to improve their mental ability, and decision-making abilities. This can be particularly valuable for older adults or those recovering from cognitive impairments.

Furthermore, the project can inspire and encourage individuals, especially young people, to pursue careers in STEM fields by highlighting the practical applications of programming, algorithms, artificial intelligence, and game design. It can serve as a learning resource for aspiring game developers, demonstrating various aspects of game development and deployment.

5.3 Challenges and risks

Some of the technical challenges the project could face include performance issues. Generating mazes, running multiple paths finding algorithms and rendering multiple opponents, could lead to bottlenecks, especially on weaker hardware. A way to mitigate the performance impact is to optimize each of the algorithms used.

Another issue is resource constraints. By having a limited team size or budget can reduce the progress during development, this can be solved by carefully planning before development has started. Additionally outsourcing or hiring additional talent can help with budget restraints and prevent falling behind.

An additional area that can pose a risk is the business side of the project. If there is a plan to work on the project for long term and develop it into a full game there will be competition coming from existing or new competitors offering similar games affecting market share and revenue. Mitigations include conducting market research, differentiating the product through innovative features and superior gameplay, and maintaining a strong marketing strategy.

6 Conclusion

The development of this maze-solving game is a testament to the boundless potential of technology and innovation in the gaming industry. By combining intricate maze generation algorithms, intelligent pathfinding opponents, and hidden challenges, this project offers a unique and engaging experience that challenges players' problem-solving skills and strategic thinking.

Beyond its entertainment value, this project has the potential to contribute positively to society by fostering cognitive development, logical reasoning, and critical thinking skills among players of all ages. Additionally, it can inspire and encourage individuals to explore careers in STEM fields, displaying the practical applications of programming, algorithms, and game design.

7 References

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FINAL GRADE

GENERAL COMMENTS

91

/100

Total:		91
1. Engagement with Literature Skills:		
+ Some good use of citations & a formatted reference list. – could be extended to gain additional marks in this category. - Some additional high-quality Professional/academic reference sources could also be included in the reference list, to gain extra marks in this category.	20	16
2. Knowledge and Understanding Skills: 10, 10		
* Project Man. & Planning: + Evidence of knowledge and skills covering project scope inc. proposed solution, required Technologies/resources to be used, a project timeline schedule & Gantt chart documented. Good. + ii: Appropriate concepts, methods, practices and tools to develop, deploy, maintain and evolve the practical element of the project is considered and documented. Good. – Specific user analytics tool could be stated.	20	19
3. Cognitive and Intellectual Skills: 5e		
+ Development methodology and Project scope assessed and clearly documented. – Scope analysis could be enhanced by including timeline key dates. + PEST & SWOT analysis summary	20	17

including some relevant professional legal & ethical considerations have been documented. – some additional professional legal & ethical considerations could be documented. + Project's positive impact on society is clearly described. + Some potential risks identified, and contingencies documented. – Could be documented in a risk analysis table to enhance format, presentation, and readability. + Conclusion. Good.		
4. Practical Application Skills: 10, 10		
* Gantt chart: + Gantt chart is clearly structured, easy to read and well presented. * Project Design: + 2 pieces of design work related to the practical element of the project have been created and documented. Good.	20	20
5. Transferable Skills for Life and Professional Practice: 5, 15		
- No title page. New skills: + Potential to develop new skills clearly documented. Good. Report: Good structure, format and presentation. - Note: excellent idea for final year L6 ET module or Ind. Project.	20	19

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