**[Title of the Project]**

|  |
| --- |
|  |

**By:**

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**Faculty of Computing**

**Riphah International University, Islamabad**

**Spring/Fall 20xx**

**A Dissertation Submitted To**

**Faculty of Computing,**

**Riphah International University, Islamabad**

**As a Partial Fulfillment of the Requirement for the Award of the Degree of**

**Bachelors of Science in Computer Science**

**Faculty of Computing**

**Riphah International University, Islamabad**

Date: [date of final presentation]

**Final Approval**

This is to certify that we have read the report submitted by ***name of student(s) (CMS #)***, for the partial fulfillment of the requirements for the degree of the Bachelors of Science in Computer Science (BSSE). It is our judgment that this report is of sufficient standard to warrant its acceptance by Riphah International University, Islamabad for the degree of Bachelors of Science in Computer Science (BSSE).

**Committee:**

|  |  |
| --- | --- |
| **1** | [Name Supervisor]  (Supervisor) |
|  |  |
| **2** | [Name of HOD/chairman]  (Head of Department/chairman) |

**Declaration**

We hereby declare that this document “**[Project Title]**” neither as a whole nor as a part has been copied out from any source. It is further declared that we have done this project with the accompanied report entirely on the basis of our personal efforts, under the proficient guidance of our teachers, especially our supervisor **[insert name of Supervisor(s)]**. If any part of the system is proved to be copied out from any source or found to be reproduction of any project from anywhere else, we shall stand by the consequences.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**[Name of Student 1]**

**[CMS #]**

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**Dedication**

Insert dedication here…

**Acknowledgement**

First of all we are obliged to Allah Almighty the Merciful, the Beneficent and the source of all Knowledge, for granting us the courage and knowledge to complete this Project.

[Students will acknowledge here anyone who has helped in the project. It can include Supervisor(s), Teachers, Classmates, Friends and Family]

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**[CMS #]**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**[Name of Student 2]**

**[CMS #]**

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**[Name of Student 3]**

**[CMS #]**

**Abstract**

Text in 12-Point Size, Times New Roman, 1.5 Line Spacing.

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# Abstract

An Abstract is a short summary of the work being reported. It should state: the purpose, findings, and conclusion of your work without commenting on or evaluating the work itself. **It should be only one paragraph at least half a page long.**

# Introduction

# The field of cognitive games has seen significant growth, with various types designed to challenge and enhance mental capabilities. Among these, puzzle games stand out for their ability to engage users in problem-solving and critical thinking. The project at hand focuses on developing an IQ test puzzle game called "Connect the Color Dots." This game aims to test and improve users' cognitive skills by presenting them with increasingly complex puzzles that require them to connect dots of the same color in the most efficient way possible. This chapter introduces the problem being addressed, the goals and objectives of the project, and its overall scope.

# The motivation behind this project stems from the increasing interest in games that are both entertaining and educational. The game aims to fill a niche in the market by offering a challenging yet enjoyable experience that also serves as a tool for cognitive enhancement. By analyzing existing puzzle games, it became clear that there was a need for a game that not only entertains but also provides measurable improvements in IQ and problem-solving skills. This project aims to address this gap by developing a game that is simple to understand but difficult to master, offering players a continuous learning curve.

## Goals and Objectives

The primary goal of this project is to develop an engaging and challenging IQ test puzzle game that encourages players to improve their problem-solving abilities. The specific objectives include:

Designing a user-friendly interface that is both visually appealing and easy to navigate.

Developing a variety of puzzle levels with increasing difficulty to cater to a wide range of skill levels.

Implementing a scoring system that accurately reflects the player's cognitive abilities and improvement over time.

Ensuring the game is accessible on multiple platforms, including mobile devices, to reach a broader audience.

## Scope of the Project

The scope of the project encompasses the entire process of developing the game from concept to final product. This includes:

Researching existing IQ test games to identify strengths and weaknesses that can be addressed in the new game.

Designing the game mechanics, user interface, and visual elements.

Developing the game using appropriate programming languages and tools.

Testing the game for functionality, usability, and engagement.

Launching the game on various platforms and gathering user feedback for future improvements.

In conclusion, this report is structured as follows: Chapter 2 will review related work in the field of IQ test puzzle games. Chapter 3 will discuss the design and implementation of the game. Chapter 4 will cover the testing and evaluation methods used. Finally, Chapter 5 will present the conclusions and suggest directions for future work.

# Literature Review

# This chapter delves into the existing body of work related to IQ test puzzle games, with a specific focus on similar projects that have explored the design and development of cognitive puzzle games. The review aims to provide a comprehensive understanding of the methods, algorithms, and design strategies employed in previous works, highlighting both their successes and limitations. By doing so, this chapter establishes the foundation for the development of the "Connect the Color Dots IQ Test Puzzle Game," ensuring that the project builds upon and advances the current state of the art.

## Introduction

The increasing popularity of cognitive games has led to the development of numerous puzzle games aimed at enhancing mental acuity. These games vary widely in terms of complexity, design, and the cognitive skills they aim to develop. This literature review explores various related works that have contributed to the field, examining their methodologies, algorithms, and overall impact on users. The purpose of this review is to identify the strengths and weaknesses of these existing approaches and to pinpoint areas where the "Connect the Color Dots" game can offer improvements or novel features.

## Background and Problem Elaboration

Puzzle games have long been a popular genre in the gaming industry, with many designed to challenge and improve cognitive functions such as memory, problem-solving, and logical reasoning. However, despite the plethora of games available, there remains a gap in the market for a puzzle game that effectively combines entertainment with measurable cognitive improvement. Existing games often lack the necessary complexity or scalability to continuously challenge users as their skills improve. This section elaborates on the need for a game that not only entertains but also provides a significant cognitive challenge that adapts to the player's abilities.

## Detailed Literature Review

### Definitions

In the context of this review, an IQ test puzzle game is defined as a game that challenges players with puzzles designed to measure and improve their cognitive abilities. These games typically involve tasks that require logical reasoning, pattern recognition, and problem-solving skills.

### Related Research Work 1

One significant work in this field is the development of the game "Flow Free," which requires players to connect dots of the same color without overlapping paths. This game utilizes a grid-based design where players must create a continuous path between two points. The underlying algorithm focuses on pathfinding and optimization, ensuring that the game remains challenging as the grid size increases and the number of paths becomes more complex. However, "Flow Free" lacks an adaptive difficulty mechanism, which can lead to either frustration or boredom as the player progresses.

### Related Research Work 2 Another relevant project is "Color Connect," which also involves connecting dots but incorporates a time-based challenge where players must complete connections within a set period. The game uses a dynamic scoring system that rewards speed and accuracy, encouraging players to improve their cognitive processing speed. While this game introduces an element of urgency that enhances its difficulty, it does not provide a long-term learning curve, as the challenge primarily lies in speed rather than increasing puzzle complexity.

## Literature Review Summary Table

The columns in the table depend upon your problem and should be specific to your project.

Table 1: History of Computing Devices

The summary of various computing devices invented in the past from 1833-1901 is presented here.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Name, reference | Inventor | Year | Input | Output | Description |
| 1. | Analytical Engine, [1] | Charles Babbage | 1833 | Punch cards | Printer, curve plotter, bell | First general purpose computer that had an arithmetical logic unit and could compute using conditional branching and loops. Also incorporated integrated memory. |

## Research Gap Despite the success of games like "Flow Free" and "Color Connect," there is still a need for a puzzle game that offers a more comprehensive cognitive challenge. The existing games either focus too heavily on a single aspect of cognitive ability or fail to adapt to the player's skill level over time. The "Connect the Color Dots IQ Test Puzzle Game" aims to fill this gap by offering a scalable challenge that adapts to the player's progress, ensuring continuous engagement and cognitive development.

## Problem Statement

The primary problem addressed by this project is the lack of a cognitive puzzle game that effectively combines entertainment with measurable cognitive improvement and adaptive difficulty. Existing games either plateau in difficulty or focus on only one aspect of cognitive skill, leaving a gap in the market for a more holistic and engaging puzzle experience.

# Requirements and Design

Describe all modules of requirements and design in clear English text along with the necessary diagram and figures. Anyone reading your report should be able to reproduce your system/results after reading it.

**For each chapter provide a paragraph of introduction and in the end a paragraph of conclusions.** Make sure no heading/subheading is blank. Write text to introduce each section as well.

Introduce sub-heading as:

## Requirements

### Functional Requirements

### Non-Functional Requirements

### Hardware and Software Requirements

## Proposed Methodology

## System Architecture

## Use Cases

### Sample Use Case Name Here

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | | Sample Use Case Name Here | | |
| Actors | | Admin, Business Owner, Store Manager | | |
| Summary | | The user shall provide their email and password on the login form and after successful verification, redirect the user to the home page. | | |
| Pre-Conditions | | The user must be in the database records either added by any of the authorized users or added manually by a developer.  The user must not already be logged in. | | |
| Post-Conditions | | The user’s session is successfully established and shall be redirected to the home page. | | |
| Special Requirements | | None | | |
| Basic Flow | | | | |
| Actor Action | | | **System Response** | |
| 1 | The user opens the login page. | | 2 | The login page is displayed asking for email and password. |
| 3 | The user enters valid email and password. | | 4 | The system verifies the email and password, establishes a session for the user and redirects the user to the home page. |
| **Alternative Flow** | | | | |
| 3 | The user enters invalid email or password. | | 4-A | The system responds with an error message: *Incorrect email or password entered.* |

## Database Design *(Optional)*

## Class Diagram (*Optional)*

## Sequence diagram *(Optional)*

## Any Other Artifact…

## GUI Graphical User Interfaces (*Optional)*

This section should give the GUI dumps of each screen, with reference to the user. The navigation flow of each user is also required, and each GUI should mark the functionality/use case that it covers.

# Implementation and Test Cases This chapter provides a detailed account of the implementation process for the "Connect the Color Dots IQ Test Puzzle Game," covering the algorithms, platform, and APIs used in the development. It also outlines the design and description of test cases that will be applied in the next phase of the project to ensure the system functions correctly under various conditions.

## Implementation

The implementation phase of the "Connect the Color Dots IQ Test Puzzle Game" focuses on translating the design into a functional prototype. The game was developed using the Unity engine, which provides a robust platform for building interactive and visually appealing games. C# was chosen as the programming language due to its seamless integration with Unity and its powerful features for game development.

The project was divided into multiple components, each handling a specific aspect of the game, such as the user interface, game mechanics, and scoring system. APIs such as Unity's built-in physics engine were used to handle collision detection and pathfinding, ensuring smooth gameplay and accurate dot connections. The game's design also incorporated adaptive algorithms that adjust the difficulty level based on the player's performance, offering a personalized challenge that scales with the user's skills.

### Implementation of First Component/Algorithm

The first major component implemented in the game was the Pathfinding Algorithm, which is central to the game's core mechanic of connecting dots. This algorithm uses the A\* (A-star) pathfinding method, which is widely regarded for its efficiency in finding the shortest path between two points. In this context, the algorithm was adapted to ensure that paths could be drawn between dots of the same color without crossing existing paths, thereby increasing the game's complexity.

The A\* algorithm was implemented in C# and integrated into the Unity environment. The algorithm operates by evaluating the grid of dots and dynamically calculating the most efficient path based on the player's input. This ensures that as the player attempts to connect dots, the game can instantly provide feedback on whether the connection is valid and, if not, prompt the player to find an alternative route.

## **Test case Design and description**

In the subsequent phase of the project (FYP-II), rigorous testing will be conducted to validate the functionality and reliability of the game. The test cases will be designed to cover all aspects of the game's functionality, including user interface responsiveness, accuracy of the pathfinding algorithm, and the adaptive difficulty system.

Each test case will be designed with specific input constraints to ensure that all possible scenarios are tested. For example, test cases will include various grid sizes and complexities to ensure that the pathfinding algorithm can handle a range of difficulties. Additionally, environmental needs such as hardware specifications and software dependencies will be standardized across all test cases to maintain consistency in testing results.

### Sample Test case No.1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **<Software component Name>** | | | | | |
| **<Reference>** | | | | | |
| Test Case ID: | | *Reference Number* | Test Date: | | *Date* |
| Test case Version: | | *Version number* | Use Case Reference(s): | | *Relation to use cases* |
| Revision History: | | *Refer to previous test case identity (if any)* | | | |
| Objective | | *Need and scope of the testing* | | | |
| Product/Ver/Module: | | *Refer to overall system being built and the place of this test case in it.* | | | |
| Environment: | | *Necessary and desired properties of the test environment. (hardware/software)* | | | |
| Assumptions: | | *Assumptions that might affect the testing process.* | | | |
| Pre-Requisite: | | *Necessary condition that needs to be fulfilled prior to the test case.* | | | |
| Step No. | Execution description | | | Procedure result | |
|  | *Events being tested.* | | | *Mention software response.* | |
| Comments: | | | | | |
| *Passed* *Failed* *Not Executed* | | | | | |

### Sample Test case No.2

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.

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## Test Metrics

Summarize here the common ground of attributes of test case metrics.

### Sample Test case Matric.No.1

|  |  |
| --- | --- |
| Metric: | Purpose |
| Number of Test Cases: | Total number of test cases that you have developed for your system. |
| Number of Test Cases Passed: | The number of test cases that successfully passed |
| Number of Test Cases Failed: | The number of test cases that failed |
| Test Case Defect Density: | (No of test cases failed \* 100)  No of test cases executed |
| Test Case Effectiveness: | No of defects detected using test cases \*100  Total number of defects detected |
| Traceability Matrix: | Traceability is the ability to determine that each feature has a source in requirements and each requirement has a corresponding implemented feature. |

### Sample Test case Metric.No.2

### Sample Test case Metric.No.3

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# Experimental Results and Analysis

This chapter will be dedicated to presenting and analyzing the experimental results obtained from testing the "Connect the Color Dots IQ Test Puzzle Game." The primary focus will be on evaluating the game's performance, usability, and effectiveness in enhancing cognitive skills. This chapter will also explore how well the game meets its objectives, based on data collected during testing. The results will be discussed in plain English, accompanied by tables and graphs for clarity.

**5.1 Introduction**

In this chapter, the experimental results from the testing phase of the "Connect the Color Dots IQ Test Puzzle Game" will be thoroughly analyzed. The analysis will include a detailed examination of the game's functionality, user engagement, and the effectiveness of the adaptive difficulty algorithm. The results will be presented in a structured format, with tables and graphs illustrating key findings. The discussion will interpret these results, offering insights into how well the game achieves its intended goals.

**5.2 Experimental Results**

The results section will present the data collected during the testing phase, including metrics such as user success rates, average time taken to solve puzzles, and the accuracy of the adaptive difficulty algorithm. Tables will be used to display this data in an organized manner, highlighting trends and outliers. The section will also include feedback from users, summarizing their experiences with the game and any suggestions for improvement.

**5.3 Analysis and Discussion**

This section will provide a detailed analysis of the experimental results. The discussion will focus on interpreting the data, examining how the game performs across different user groups, and assessing the effectiveness of the implemented algorithms. The analysis will also consider any unexpected results, offering explanations and potential solutions. Additionally, this section will evaluate the overall user experience, including engagement and satisfaction levels, to determine whether the game successfully combines entertainment with cognitive improvement.

# Conclusion and Future Directions

# This final chapter offers a comprehensive summary of the work completed in the development of the "Connect the Color Dots IQ Test Puzzle Game," reflecting on the project’s successes, challenges, and areas for future improvement. It evaluates whether the project’s goals and objectives were fully realized, discusses the scope covered, and outlines potential directions for future enhancements.

# 6.1 Conclusion

# The development of the "Connect the Color Dots IQ Test Puzzle Game" has been a multifaceted project aimed at creating an engaging puzzle game that challenges and improves cognitive skills. Throughout the project, significant progress was made in implementing key features such as the pathfinding algorithm, adaptive difficulty, and user-friendly interface. The game's development involved a comprehensive process of research, design, implementation, and testing, each stage contributing to the overall quality and functionality of the final product.

# The objectives set out at the beginning of the project were largely met. The game successfully integrates entertainment with cognitive development, offering a scalable challenge that adapts to the player's skill level. The implementation of the pathfinding algorithm and the adaptive difficulty system were particularly notable achievements, as they contribute directly to the game’s core mechanics and overall user experience.However, the project also faced challenges. One of the primary difficulties encountered was optimizing the game for different platforms, which required extensive testing and iteration. Additionally, while most of the project’s scope was covered, some features initially planned were left out due to time constraints or technical limitations. These include advanced analytics for tracking player progress and more sophisticated AI opponents. These features were deprioritized to focus on ensuring the core gameplay was polished and functional.

# 6.2 Future Directions

# Looking ahead, there are several areas where the "Connect the Color Dots IQ Test Puzzle Game" can be expanded and improved. Future work could focus on integrating the advanced features that were left out in this phase, such as detailed analytics and AI opponents, to further enhance the game’s cognitive training potential. Additionally, exploring new game modes or multiplayer options could increase user engagement and provide a broader range of challenges.Further optimization for various platforms, particularly mobile devices, would also be beneficial, ensuring the game runs smoothly across different hardware configurations. Finally, incorporating user feedback gathered during the testing phase will be crucial for refining the game and addressing any issues that may have arisen.

# 

# References

List all important sources of information which have been consulted for this project

# Appendix

## Appendix A: Guidelines

This section should include all supporting information from the project that was not included in the body of the report.  You should include surveys, complex statistical calculations, certain detailed tables and other such information in an appendix.  The information presented in this section is important to support the work presented in the body of the report but would make it more difficult to read and understand if presented within the body of the report.

Cite the appendix items in the report narrative (write "see Appendix A") and organize appendices (e.g., Appendix A, Appendix B,

Any tables, figures, forms, or other materials that are not totally central to the analysis but that need to be included are placed in the Appendix.

## Appendix B: Heading of Sample Appendix B

Following is a sample code with “code” style format.

Void SampleFunction(){

Print “Hello World.”;

}

# Formatting Guidelines

This document also serves as style guide for final year project reports. In order to give a similar high-quality appearance to all final year software project reports this template uses a collection of predefined Microsoft Word formatting styles. **These styles should be used without modification or replacement.** Font in the document is ***“Time New Roman”.*** This template provides following styles:

* **Title** – the main title style
* **Title2** – the subtitle style
* **Body Text** – style for paragraphs
* **Caption** – the style for a figure or table caption
* **Table Description** – the style for description of table, it must be added after caption.
* **Figure Description** - the style for description of figure, it must be added after caption.
* **Code** – the style for program source code

**int x** = 10; // Writing important code

* **Table Header Row** – Style for the header row of table
* **Table Grid** – the style for the data rows in the tables
* **Reference** – The style for references
* **Bullets** – The style for the bullet lists
* **Numbered** **List**– Style for numbered lists

All Heading styles with different level numbers are listed below.

# Heading 1

## Heading 2

### Heading 3

#### Heading 4

##### Heading 5

###### Heading 6

Heading 7

Heading 8

Heading 9

## Tables and Figures

Tables and figures should be centered horizontally. The caption button should be used to insert caption for both the figures and tables. All figures and tables must be numbered properly. Always refer to tables and figures according to their numbers. A table or figure can be cited as follows: ‘see Table1’ or ‘as shown in Table1’. The caption of table should be centered above the table and figure caption should be centered below the figure. Place the tables/figures close to their reference. Use “Table Header Row” and ‘Table Grid’ style for table’s header and data rows respectively. It is compulsory to provide brief description of table/figure after its caption. Styles for table and figure descriptions are “Table Description” and “Figure Description” respectively.

Press Ctrl+Shift+S to see list of styles mentioned above. Figure 1 shows the Apply Style window displaying the list of styles. Select any text then press Ctrl+Shift+S, the Apply Style window will show you the current style applied on that text and if required, you can change the style by selecting any other style from the “Style Name” dropdown.

This is brief description of above figure.

Figure 1: List of Styles

Table 1: This is Sample table caption

This is brief description of following Table.

|  |  |  |  |
| --- | --- | --- | --- |
| Header row | Header row | Header row | Header row |
| Row1 col1 | Row1 col2 | Row1 col3 | Row1 col4 |
| Row2 col1 | Row2 col2 | Row2 col3 | Row2 col4 |

Table 2: This is Sample table caption

This is brief description of following Table.

|  |  |  |  |
| --- | --- | --- | --- |
| Header row | Header row | Header row | Header row |
| Row1 col1 | Row1 col2 | Row1 col3 | Row1 col4 |
| Row2 col1 | Row2 col2 | Row2 col3 | Row2 col4 |

## Equations

Use equation editor to write equations in this report. Use last button of the custom tool bar to invoke equation editor. Similar to tables and figures, equations should also be aligned centered horizontally. Number all equations and insert them in parenthesis. Below is a sample equation and its reference number. An equation can be referenced like this: ‘it is clear from (1)’.

 (1)

## Header/Footer

Notice the headers in this document, before Introduction (i.e. the main content of this document) page numbers are in roman numerals. The page numbers of the actual content start with Arabic numerals i.e. 1, 2, 3 and so on. All of the **odd numbered pages** contain title of your project while the **even numbered pages** contain the section heading (i.e. chapter’s name) in the headers.

## Other Formatting Guidelines

* Keep 2-4 GUIs in one page. Consume as much space as possible. Do not leave most of page blank unnecessarily.
* Do not break tables (or use cases) in multiple pages unless the table is too large to fit in one page.
* Re-arrange the content i.e., text, images, and tables properly to meet above two guidelines.

## References

Always refer to the source of information by inserting the reference number in square brackets like this [5]. The reference numbers can either be added at the end of the sentence or within the sentence without changing the punctuation of sentence. A reference can also be cited as follows: ‘as Ruskey [2] mentioned’. List each source only once on your reference page.



Figure 2: IEEE Reference style

This figure represents the styling information for adding references in IEEE format

**Following is a list of sample reference for various typed of sources in IEEE format.**

1. P.M. Morse and H. Feshback, *Methods* of *Theoretical Physics*. New York: McGraw Hill, 1953. **//Format for Book**
2. S.K. Kenue and J.F. Greenleaf, “Limited angle multifrequency diffiaction tomography,” *IEEE Trans. Sonics Ultrason*., vol. SU-29, no. 6, pp. 213-2 17, July 1982. **//Format for Journal Article**
3. B. Tsikos, “Segmentation of 3-D scenes using multi-modal interaction between machine vision and programmable mechanical scene manipulation,” Ph.D. dissertation, Univ. of Pennsylvania, BCE Dept., Philadelphia, 1987. [Add if applicable: University Microfilms, Inc., University of Michigan, Ann Arbor, Michigan.] **//Format for Dissertation or thesis**
4. R. Finkel, R. Taylor, R. Bolles, R. Paul, and J. Feldman, “An overview of AL, programming system for automation,” in *Proc. Fourth Int. Joint Conf Artif. Intell*., pp. 758-765, Sept. 3-7, 1975. **//Format for Proceedings paper**
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