TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
PULCHOWK CAMPUS

A PROJECT PROPOSAL ON

Tetris: The Classic Puzzle Game

Submitted by:
AASHISH KARKI (078BCT004)
ANUP ARYAL (078BCT015)
APIL CHAUDHARY (078BCT017)

SUBMITTED TO:
DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING
IOE, Pulchowk Campus
Kathmandu Nepal

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We sincerely thank the Department of Electronics and Computer Engineering, Pulchowk Campus, for giving us an opportunity to work on this project to expand our knowledge of Object Oriented Programming and working in a team.

2 ABSTRACT

This report presents the development process, design decisions, and outcomes of our Tetris game project. Tetris, a classic tile-matching puzzle video game, has been a popular choice for both casual gamers and enthusiasts since its inception. This project aimed to create a modern and engaging implementation of Tetris while exploring key aspects of game development, Object-Oriented Principles, graphics rendering, user interaction, and algorithm design.

The project involved designing and implementing the game mechanics, user interface, scoring system, and visual elements of Tetris. Leveraging the capabilities of SFML(Simple and Fast Multimedia Library), we built a playable version of Tetris that captures the essence of the original game while adding visual enhancements and a user-friendly interface.

In this report, we delve into the technical details of our game's architecture and discuss the challenges we encountered during development. We describe our approach to handling user input, managing game state, rendering graphics, and optimizing performance. Additionally, we highlight the design considerations that went into creating an intuitive user experience, including responsive controls and visual feedback.

Throughout the project, we had the opportunity to apply principles learned in our Object Oriented Programming course, gaining hands-on experience in software design, algorithms, and teamwork. We collaborated closely, leveraging each team member's strengths to overcome obstacles and make informed design choices. Our project supervisors, Mr. Daya Sagar Baral and Mr. Rajad Shakya, provided valuable guidance and feedback, ensuring the project's alignment with our learning objectives.

As a result of our efforts, we have successfully developed a functional and enjoyable Tetris game that showcases our technical skills and creativity. This project not only enhanced our understanding of game development but also provided us with a platform to apply theoretical knowledge to a practical context. We hope that our Tetris game brings joy to players. At last, we learned to use SFML library in our C++ projects and learned a lot about GIT and Version Control Systems while working in a team

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3 OBJECTIVES

The objectives of building this game in C++ are listed below:

1. **Use Object-Oriented Programming (OOP):**
    - Create classes for Tetrominoes, game board, and game logic.
    - Organize code for easy maintenance and flexibility.
2. **Explore C++ Features:**
    - Manage game data efficiently using vectors, pairs, maps and other containers in STL.
    - Handle resources smartly to optimize performance.
3. **Graphics with SFML:**
    - Use SFML to draw Tetrominoes, game board, and animations.
    - Respond to player input using SFML's event system.
4. **Reusable Code:**
    - Create header files for sharing code across the game.
5. **Implement Game Mechanics:**
    - Make Tetrominoes rotate, move, and detect collisions.
    - Create a scoring system and difficulty levels.Create a scoring system and difficulty levels.Create a scoring system and difficulty levels.
6. **Add Sound Effects and Music:**
    - Integrate audio using SFML for a better gaming experience.
7. **Test and Debug:**
    - Thoroughly test the game to fix any issues.
    - Use logs and debugging tools for troubleshooting.
8. **Team Collaboration:**
    - Communicate well within the team.
    - Use Git for version control and collaboration.

4 INTRODUCTION

Tetris, an iconic and enduring puzzle game, has captured the hearts of gamers around the world since its inception in 1984. Created by Russian game designer Alexey Pajitnov, Tetris challenges players with a deceptively simple objective: fitting different-shaped blocks, known as tetrominoes, together to form complete lines. Yet, beneath its straightforward premise lies an addictive and exhilarating experience that has stood the test of time.

Gameplay :

Tetrominoes: The game consists of various tetrominoes, each made up of four connected squares arranged in different shapes. The seven tetrominoes are: I, J, L, O, S, T, and Z.

Falling Blocks: Tetrominoes fall from the top of the playing area one at a time. You have the ability to move and rotate the tetrominoes as they descend.

Movement and Rotation: You can move the falling tetrominoes horizontally (left or right) using the arrow keys or buttons. You can also rotate them clockwise or counterclockwise to fit them into available spaces using the up arrow key or designated rotation buttons.

Clearing Lines: The primary goal is to create complete horizontal lines by filling all the spaces within a row. When a line is entirely filled, it clears from the screen, and you earn points.

Scoring: The more lines you clear at once, the higher the points you earn. Clearing multiple lines simultaneously is known as a "Tetris" and yields the highest points.

Leveling Up: As you accumulate points or clear a certain number of lines, you advance to higher levels. With each level, the tetrominoes fall faster, increasing the game's difficulty.

Game Over: The game ends when the stack of falling tetrominoes reaches the top of the playing area. If you can't clear lines fast enough, the stack will reach the top, and the game will be over.

Controls: The controls for Tetris are usually straightforward:

Left Arrow: Move tetromino left
Right Arrow: Move tetromino right
Down Arrow: Accelerate the fall of the tetromino
Up Arrow: Rotate tetromino clockwise or counterclockwise

5 APPLICATIONS

Tetris was originally inspired by a puzzle game called ”pentominoes,” in which different wooden shapes made of five equal squares are assembled in a box. Hence, Tetris is also a puzzle in itself and thus a “mind” game. Although, video games are often dismissed as unsophisticated or the domain of couch potatoes, but many common elements of these simulated worlds can provide tangible benefits in real life. Benefits of Tetris for both children and adults include:

- Healthy Brain Simulation
- Development of Problem Solving Skills
- Stress Relief

Taking these benefits into account, application of Tetris are discussed below:

1. **Problem Solving:** As already mentioned above, Tetris is a puzzle game and thus, is a tool to develop problem solving skills. Placing each block requires a strategy so to get that neat high score everyone craves for. This, in turns develops a habit of searching of the best route for the required outcome.
2. **Quick Decision Making:** Tetris does not only require a gamer to develop a strategy but it also requires them to make a decision to take a certain strategy in a quick manner. There is so little time between the clearing of a line and the falling of the next block that the gamer must choose an optimum decision quickly.
3. **Mental Health:**With something as concerning as mental health, it is only right to search for a remedy to it that boosts morale and mood. Tetris, and video games, in general, are a great tool that can be very helpful.
4. **Learning:**Although video games are portrayed as something that is an obstruction for learning, in truth, the portrayal is anything but far from truth. Tetris can be a great tool for learning as one is required to use their memory, spatial intelligence, problem solving, decision making, etc.
5. **Balancing Time and Priority:**Tetris can be a great teacher if you’re having difficulty prioritizing. To keep up with the game, you must change your priorities very quickly. You can apply this pattern in the real world when you encounter situations that disturb your routine and require you to switch tasks.

6 LITERATURE SURVEY

It all began with a puzzle-loving software engineer named Alexey Pajitnov, who created ”Tetris” in 1984 while working for the Dorodnitsyn Computing Centre of the Soviet Academy of Sciences, a research and development center in Moscow created by the government. Pajitnov was inspired by a puzzle game called ”pentominoes,” in which different wooden shapes made of five equal squares are assembled in a box. Pajitnov imagined the shapes falling from above into a glass, with players controlling the shapes and guiding them into place. Pajitnov adapted the shapes to four squares each and programmed the game in his spare time, dubbing it ”Tetris.” The name combined the Latin word ”tetra” — the numerical prefix ”four,” for the four squares of each puzzle piece — and ”tennis,” Pajitnov’s favorite game. And when he shared the game with his co-workers, they started playing it — and kept playing it and playing it. These early players copied and shared ”Tetris” on floppy disks, and the game quickly spread across Moscow. When Pajitnov sent a copy to a colleague in Hungary, it ended up on display in a software exhibit at the Hungarian Institute of Technology, where it came to the attention of Robert Stein, owner of Andromeda Software Ltd., who was visiting the exhibit from the United Kingdom. ”Tetris” intrigued Stein. He tracked down Pajitnov in Moscow, but ultimately the game’s fate lay in the hands of a new Soviet agency, Elektronorgtechnica (Elorg), created to oversee foreign distribution of Soviet-made software. Elorg licensed the game to Stein, who then licensed it to distributors in the U.S. and the U.K. — Spectrum HoloByte and Mirrorsoft Ltd — The New York Times reported in 1988. According to the Times, ”Tetris” was the first software created in the Soviet Union to be sold in America. In Brown’s book, the unusual story of ”Tetris” is interwoven with an exploration of gaming: why people do it, how it changes them and how it brings people together. Pajitnov himself began this journey simply because he loved games and puzzles and wanted to share them with the world. And in the process, ”Tetris” took on a life of its own.

7 EXISTING SYSTEM

8 METHODOLOGY

This proposed project aims to develop a Tetris game using Object-Oriented Programming principles and the SFML library for graphics. The project will be implemented using the CLion Integrated Development Environment and will utilize CMake for cross-platform build support. Version control and collaborative coding will be facilitated through Git and GitHub.

To ensure a structured and maintainable codebase, we will design the class hierarchy for the game. Different classes will be created to represent game objects such as the game board, tetrominoes, and scoring system. We will employ OOP concepts such as encapsulation, inheritance, and polymorphism to achieve modularity and code reusability. The game logic will be implemented within the classes defined in the previous step. Each class will have private and public member variables and member functions that handle specific aspects of the game, such as moving and rotating tetrominoes, checking for line clears, and updating the score. The SFML library will be utilized for rendering graphics and handling user input.

To facilitate collaboration among team members, we will utilize Git and GitHub for version control. Each team member will have their own branch to work on individual features or bug fixes. Regular commits and pull requests will be used to review and merge code changes. GitHub's issue tracking feature will also be utilized to manage and prioritize tasks. Proper documentation will be maintained to provide an overview of the project structure, class hierarchy, and function specifications. Additionally, a user guide will be created to assist players in understanding the game controls, rules, and scoring system.

This approach will ensure a systematic development process and deliver a high-quality game experience to the users.

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