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A PROJECT REPORT ON

APPLICATION OF OBJECT ORIENTED PROGRAMMING IN BAGHCHAL USING C++

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A PROJECT REPORT TO THE DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING ON OBJECT ORIENTED PROGRAMMING APPLICATION USING C++

DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING
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ABSTRACT

The main aim of this project was to develop game program using an Object Oriented Programming language, C++. For this project, we made a classic two player Bagh-chal game using Simple and Fast Multimedia Library(SFML) for graphical interface.The goal of creating this game is also to learn about game development.

Bagh-chal is a strategic, two-player board game that originated in Nepal. The game is asymmetric in that one player controls four tigers and the other player controls up to twenty goats. The tigers 'hunt' the goats while the goats attempt to block the tigers' movements. This game has variants with a different board, but the rules are the same.

Keywords: Bagh-chal, SFML, OOP, C++

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1. OBJECTIVES

This project does not aim to advance our Game development skills within a matter of days or weeks. Instead, the major objective of this project is to encourage us to implement object oriented approach to think, model and develop basic algorithms into program code. The main objectives of this project can be summed us as:

- To understand Object Oriented Programming paradigm and build a project using it. C++ is preferred over other languages like Python because C++ offers better efficiency and speed and is suitable for almost every platform including embedded systems whereas Python can be used only on certain platforms that support high-level languages.

- To explore the basic attributes of C++ programming language.

- To learn about resource re-usability by building user defined header files.

- To be familiar with software development library designed to provide a simple Application Programming Interface (API) to various multimedia components in computers using SFML library.

- To develop effective and efficient program by optimizing time and space constraints.

- To learn the fundamental concepts about game development.

- To acquire teamwork and communication skills as a result of working as a team.

2. INTRODUCTION

Baghchal is a recreational turn based game played by two players on a 5x5 point grid with one player controlling tiger pieces and the other player controlling goat pieces.

The game Baghchal is asymmetric in that the tiger player controls four tigers and the goat player controls up to twenty goats. In the first phase of the game, four tigers are placed on each corner of the board and the goat player places their goats on any empty point on the grid on their turn. The tiger player can move one of their pieces to a valid point on their turn. A valid point is any point that is empty and either adjacent to the tiger or one step in the direction of an adjacent goat. In the second phase, after all the goats are placed, the goats move the same as tigers,
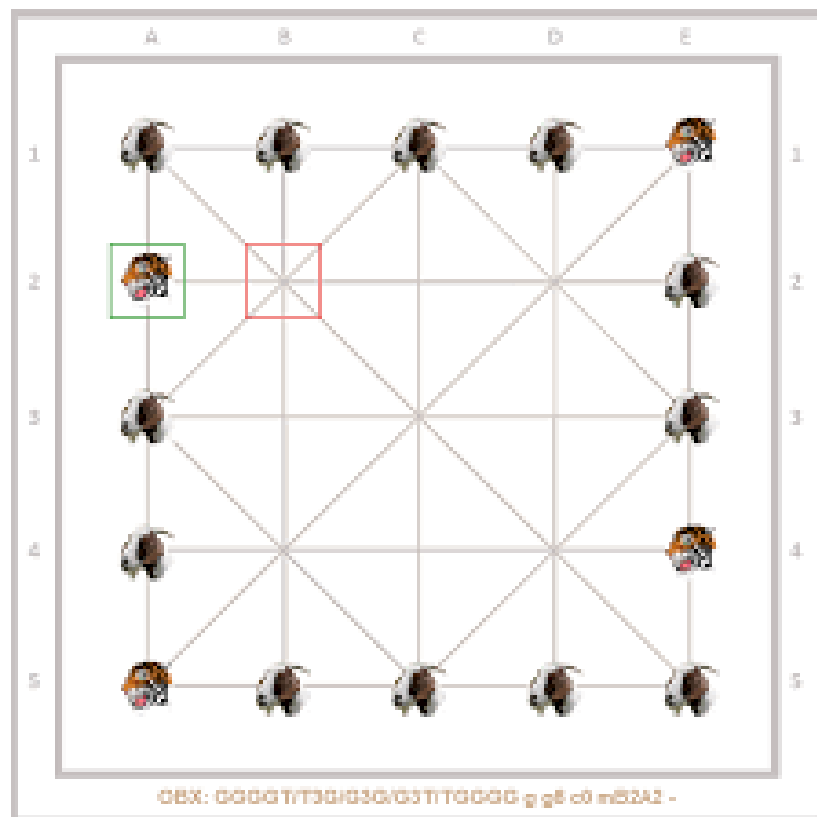
A tiger can 'eat' a goat if it jumps over the goat to an empty tile. The objective of the tiger player is to 'eat' all the goats and that of the goat player is to block all possible moves of the tiger player.

2.1. Background On Object Oriented Programming (C++)

Object-oriented programming (OOP) is a computer programming model that organizes software design around data, or objects, rather than functions and logic. An object can be defined as a data field that has unique attributes and behavior.OOP focuses on the objects that developers want to manipulate rather than the logic required to manipulate them. C++ is a general-purpose programming language that was developed as an enhancement of the C language to include object-oriented paradigm. It is an imperative and a compiled language.

C++ is a middle-level language rendering it the advantage of programming low-level (drivers, kernels) and even higher-level applications (games, GUI, desktop apps etc.). The basic syntax and code structure of both C and C++ are the same.

Applications of C++:

Operating Systems Systems Programming. e.g. Linux-based OS (Ubuntu etc.)

Browsers (Chrome Firefox)

Graphics Game engines(Photoshop, Blender, Unreal-Engine)

Database Engines (MySQL, MongoDB, Redis etc.)

Cloud/Distributed Systems

Simple and Fast Multimedia Library (SFML) is a cross-platform software development library designed to provide a simple application programming interface (API) to various multimedia components in computers. SFML provides a simple interface to the various components of the PC, to ease the development of games and multimedia applications. It is composed of five modules: system, window, graphics, audio and network. With SFML, the application can be compiled and run out of the box on the most common operating systems: Windows, Linux, MacOS and soon Android iOS. SFML has official bindings for the C and .Net languages. And thanks to its active community, it is also available in many other languages such as Java, Ruby, Python, Go, and more.

3. APPLICATION

Baghchal is one of the popular games of South Asian, especially Nepalese people. Most of us have already played this game at least once in our life using stones and lines drawn by the same stones in our childhood, preferably while taking our oxen to graze on pasture lands.

Initially, this project was not designed to be applied and compete in global market. However, with some efforts and modifications, following application area can be covered:

1. The Baghchal game can be played between users in real time when they are playing on the same computer screen.

2. The game serves are stress buster and also contributes in logical thinking and reasoning.

4. LITERATURE REVIEW

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5. EXISTING SYSTEM

The game Baghchal is hardly a novel concept. Baghchal is a game that predates modern computers and technology. Therefore it is no surprise that the game has been adapted to the computer game format numerous times even on commercial levels.

There are many similar applications already made on multiple platforms such as Windows, Android and IOS. As our sole purpose was learning, we have made a simpler versions of these established applications while adding some modifications of our own.

6. METHODOLOGY

To complete our destined project, we are aiming to follow the given methods:

6.1. Initiating and planning

We will be initiating by planning and dividing the work among 3 of our members. We will be familiarizing ourselves with the required library (SFML) along with it we will be refreshing our knowledge on the rules needed for Bagh-Chal.

6.2. Algorithm Design

After getting the required rules and information, we shall be designing the alogrithm and flowchart of the game project. A basic working model algorithm will be designd to further test and validate.

6.3. Software Design

With the basic set of algorithm in our hand, we shall then be writing the code in OOP paradigm. The project will be carried out on C++ as its main skeletal and SFML as its graphics implementation since it is easy to learn and use. As for IDE and compiler we will be using Visual Studio Code and Code-Blocks as our IDE and Ming-W g++ as compiler in Windows operating system and gcc(GNU Compiler Collection) in Linux.

6.4. Testing and debugging

We shall first be developing minimum viable product sample of project for testing and de-bugging. Further testing and debugging will be done to add feature and edit the project code as per our need and capability.

7. IMPLEMENTATION

Baghchal is one of the popular games of South Asian, especially Nepalese people. Most of us have already played this game at least once in our life using stones and lines drawn by the same stones in our childhood, preferably while taking our oxen to graze on pasture lands. Initially, this project was commenced with the idea of application of the Object Oriented approach and paradigm to develop a simple game of Baghchal. Since our objective was not targeted to build a full-fledged game to compete in global applications market but to immerse ourselves into Object Oriented Paradigm, we have learnt and applied various features of OOP such as:

- Objects and Classes: As a basic building block of OOP, it is common to include these concepts in our program. Since game elements can be treated as objects, the classes Bagh and Bakhraa, which in turn are derived from the base class Animal are instantiated into various objects array that act as pieces in the board.

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7.1. System Block Diagram

MENU SCREEN

Start → Render Menu

Menu Screen

A

About

Game Mode

Settings

Render Board and Pieces → Await Input

Render Game window

Game state

GAME SCREEN

User Input

Inheritance from Animal Class

Bagh Object

Bakhra Object

Only allow movements

Attributes and functions

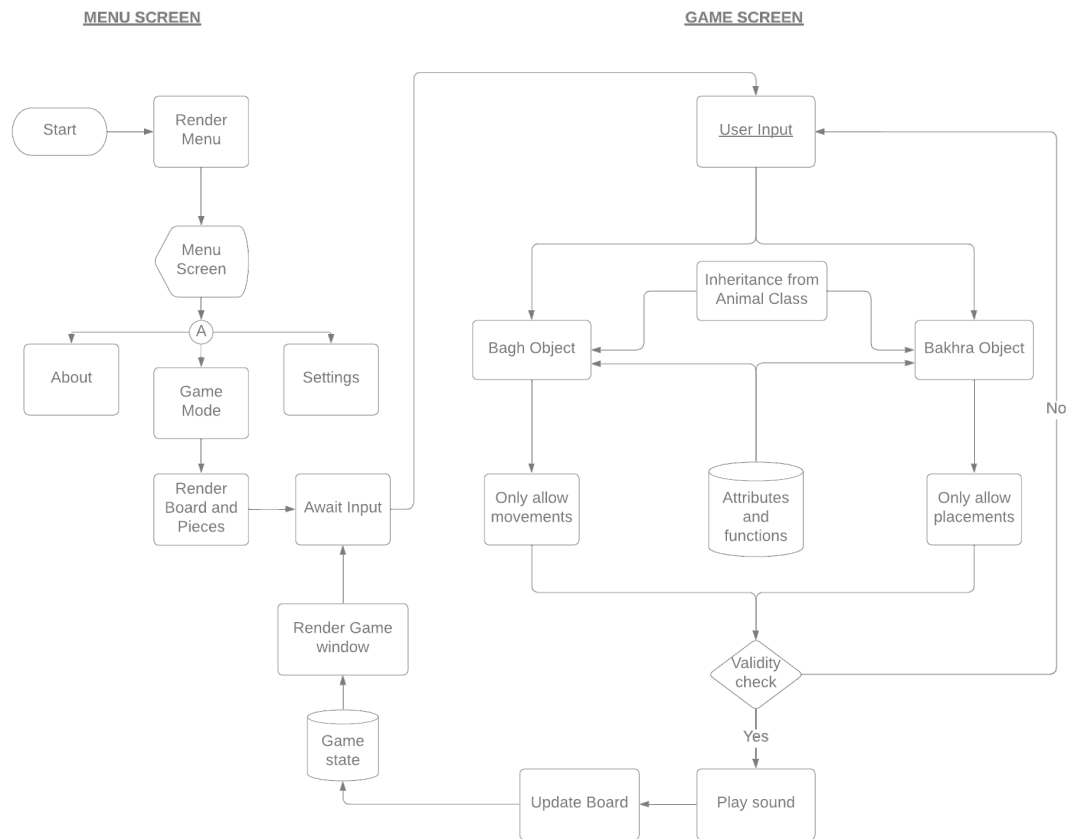Only allow placements

Validity check

No

Yes

Update Board ← Play sound

Figure : Block Diagram

8. RESULTS AND DISCUSSIONS

9. PROBLEMS FACED AND SOLUTIONS

We faced a number of problems over the course of creating a Baghchal game.

9.1. Code partition

While the use of Object Oriented programming helped us in dividing the code into manageable chunks, navigating between certain parts of the code and finding specific lines were slightly tedious due to the sheer volume of the code.

One thing we did to mitigate this problem is utilize the 'commenting' feature of programming languages. Subsections of the code are labeled and clear descriptions are added in order to properly identify a chunk of code or a function. Also, clear and descriptive variable names and function names are used to further improve readability of code.

9.2. Ghost pieces

Due to many simultaneously moving parts in our application, certain features weren't being executed as intended. A particularly annoying instance of this was the updating of the board when the goats were on their moving phase. Certain positions were being prematurely or unnecessarily being updated. This was causing the board to be cluttered with invisible "ghost goats" that were interfering with normal gameplay. This issue was particularly hard to solve as the "ghost goats" didn't appear on the board but were present only internally, thus making them difficult to detect.

The problem was solved by adding additional checks to update the positions of pieces. This prevented the problematic code from being unintentionally executed and hence stopped the production of "ghost goats" and hence stopped undesired effects.

9.3. Unintentional movement

Baghchal consists of a simple but specific moveset for its pieces. However, during testing certain unintentional moves were enabled for the tiger piece that allowed it to move in an 'L' shape across the board.(Similar to the 'Knight' piece in chess)

This issue was solved rather easily by adding additional checks to the movement of the tiger

piece.

10.   LIMITATIONS AND FUTURE ENHANCEMENTS

Due to time limitation, and various examination schedule,we were unable to add some additional features which might enhance our program. There are many more features that can still be added to make the program more attractive, result oriented and useful.Some of the limitation include:

1. No undo move feature.

2. No online multiplayer via networking

3. Only one single style board

4. Lack of proper graphical interface

5. Dynamic screen size to make the program work in multiple screen sizes.

The possible future enhancements are as follows.

1. A multiplayer mode, in which two people from any place can play with each other via networking.

2. An overhaul in the way we store the state of the game with the help of stack to track moves. This would allow for move take backs and will make it so that we don't need to copy the state of the board again and again to make changes.

3. A better AI for single player, using minimax and other techniques.

4. Use of bitboard to represent the board

5. Board variation or newer board design

11. CONCLUSION AND RECOMMENDATIONS

The overall project is based on Object-Oriented programming in C++.This project has been developed using most of the features of OOP.After the completion of program, we have developed some basic knowledge about object oriented programming and Simple Fast Multimedia Library(SFML).

We also learned a great deal about collaboration and team work from the project.We learned to used various industry tools such as Github for version control of our project, LATEX for typesetting documents, Canva for making presentation and Lucidcharts for making flowcharts.

This project was unquestionably a good way of learning and implementing the way for programming practice. This project leads us to the winding up on the programming practice that for developing software a good judgment and proper analysis of the topic is required at first rather than the coding. The coding is not the initial step for emergent of any program, rather a good planning on the basic framework and making decision on the way of implementing the program is the most. After the coding of the program the system may not be as per our requirement but debugging, if any error, and testing and execution of the program is furthermore required. After the completion of the system, its management takes, is another most required obsession that is to be handled with great care. Thus, for developing either a larger of smaller program, proper decision should be made according to the occurrence of the situation.

Thus, after the completion of our project, it taught us a great deal about the development cycle, including planning, analysis, development, testing and debugging. We learned the power of Object Orientated Programming paradigm in making efficient software.

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