Game of Mazes

A brief description

Mazes... We see them all through our lives, from children to... programers. The concept is easy: you have to get from a point, called „starting point“ to another one, called „end point“ through some network of paths... and that‘s all. Even though the task is all clear and easy at first glace, the algorithms required for the computation of the problem are even easier – the well known DFS and BFS. Yay! The current project displays, in a fun and iteractive way, how DFS and BFS work.

How to play

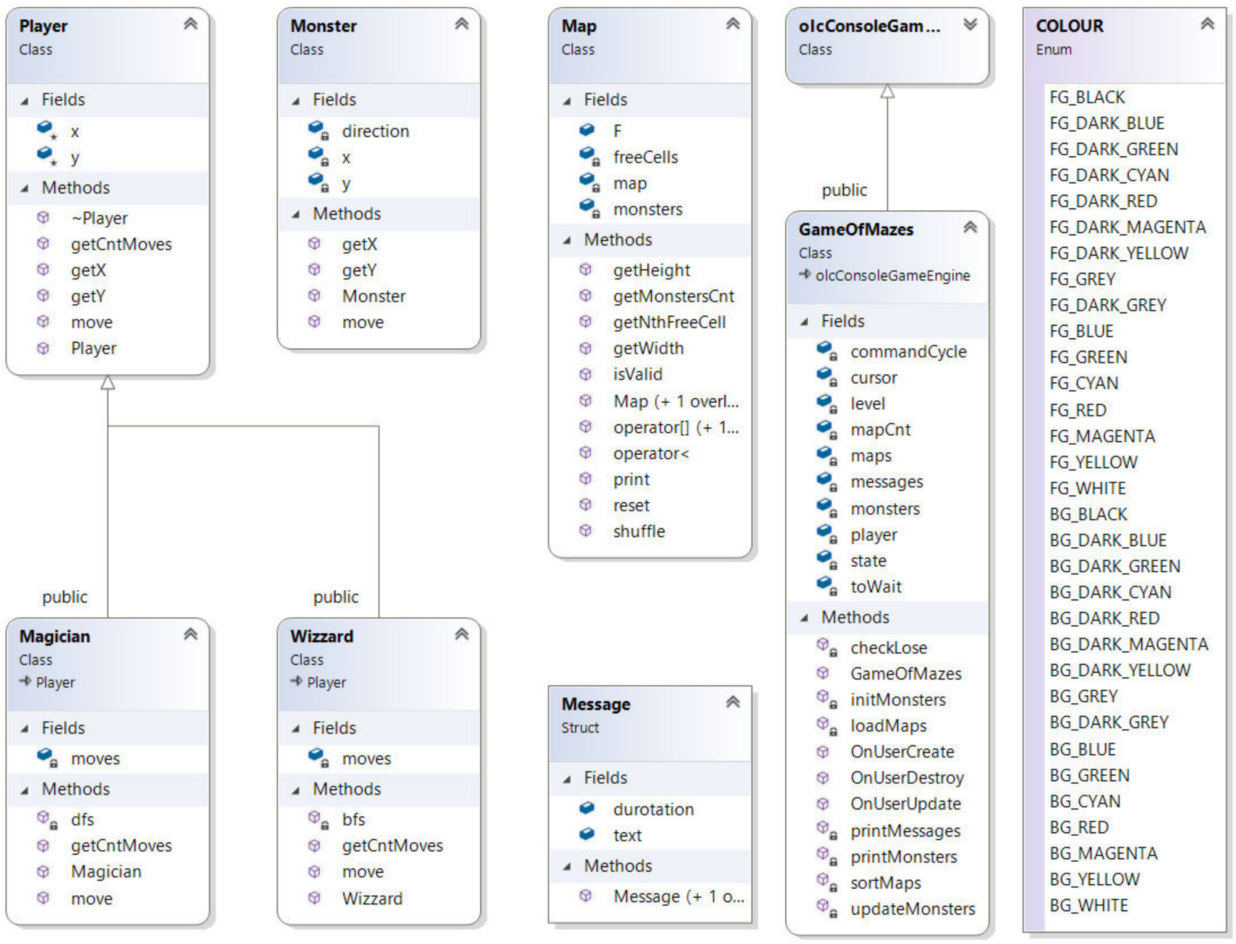
When launched, you are in map configuration mode. You have a cursor: ‘X‘, which can be moved with the keyboard arrows. By clicking the “space“ button, you put/remove walls from the postion, which the cursor is pointing at. When finished with putting the walls, you can choose between the two classes – Magician and Wizard. To start the game with Magician, you have to click ‘M‘ button and ‘W‘ for Wizard.

Once you start the game you are in play/watch mode, where all you can do is watch the player and the monsters all moving though the maze. Each move takes exactly 1 second, which can sometimes be really boring for bigger mazes and therefore by clicking ‘ESC‘ button, you can fast-forward some moves. The level ends either with win, which means that the player proceed to the next level, or with lost, which means that the player starts all over from level 1. Map configuration mode takes place for changes of current map and so on.. The game ends with a win when all levels completed with a win.

Architecture

The architecture of the project is as simple as the task itself.

- We have a pure virtual multithreaded olcConsoleGameEngine class, which is being used for more user-friendly UI.
- We have a self-called GameOfMaze class, which inherits olcConsoleGameEngine and is the core class, connecting all others.
- We have a class Map, which stores the information for a single maze.
- We have a pure virtual Player class, whcih is being inherited by classes Magician and Wizzard - the representatives of the two traversal algorithms.
- We have a class Monster, representing the enemy of the user.



olcConsoleGameEngine

Data members (protected):

```
struct sKeyState
{
	bool bPressed;
	bool bReleased;
	bool bHeld;
} m_keys[256], m_mouse[5];

int m_mousePosX;
int m_mousePosY;
int m_nScreenWidth;
int m_nScreenHeight;
short m_keyOldState[256] = { 0 };
short m_keyNewState[256] = { 0 };
bool m_mouseOldState[5] = { 0 };
bool m_mouseNewState[5] = { 0 };
bool m_bConsoleInFocus = true;

CHAR_INFO *m_bufScreen; //the screen buffer
std::wstring m_sAppName; //the title of the console
HANDLE m_hOriginalConsole; //handle to the standart console
CONSOLE_SCREEN_BUFFER_INFO m_OriginalConsoleInfo; //screen buffer to the standart console
HANDLE m_hConsole; //output handle to the current console
HANDLE m_hConsoleIn; //input handle to the current console
SMALL_RECT m_rectWindow; //struct having left, top, right, bottom
```

Member functions (public):

```
int ConstructConsole(int width, int height, int fontw, int fonth);
virtual void Draw(int x, int y, short c = 0x2588, short col = 0x000F);
void Fill(int x1, int y1, int x2, int y2, short c = 0x2588, short col = 0x000F);
void DrawString(int x, int y, std::wstring c, short col = 0x000F);
int ScreenWidth();
int ScreenHeight();
sKeyState GetKey(int nKeyID);
sKeyState GetMouse(int nMouseButtonID);
int GetMouseX();
int GetMouseY();
void Start(); //creates the game thread: thread(&olcConsoleGameEngine::GameThread, this);

// User MUST OVERRIDE THESE!!
virtual bool OnUserCreate() = 0;
virtual bool OnUserUpdate(float fElapsedTime) = 0;
// Optional for clean up
virtual bool OnUserDestroy();
```

GameOfMazes

Data Members (private):

```
Map maps[1024]; //holds the data of all maps
size_t mapsCnt; //holds the count of the maps
size_t level; //the current level of the player
Player *player; //ptr to the player class (Magician or Wizard)
pair<size_t, size_t> cursor; //cursor for putting walls
string state; //what the main game thread loop should do
string commandCycle; //command for after the infinite cycle
float toWait; //variable, used to track time
list<Message> messages; //interactive list of messages
vector<Monster> monsters; //data for all the monsters of the current map
```

Members Functions (private):

```
void loadMaps(); //loads maps from a file DIR_MAPS
void sortMaps(); //sorts them by level

void initMonsters(size_t level); //sets initial random positions of the monsters
void updateMonsters(); //all monsters move if possible
void printMonsters(); //prints all monsters to the console
bool checkLose() const; //returns true if the player and monster overlap

void cycle(); //"pauses" the main game loop untill a button is pressed
bool play(float fElapsedTime); //the process of "walking" through the maze
void mapManagement(); //the process of putting walls
void printMessages(size_t x, size_t y, float fElapsedTime); //prints the messages and if
needed, deletes them
```

Member Functions (public):

```
virtual bool OnUserCreate() override; //initializes the class
virtual bool OnUserUpdate(float fElapsedTime) override; //main game thread loop
virtual bool OnUserDestroy() override;
```

Map

Data Members (private):

```
vector<vector<char> > map;
vector<pair<size_t, size_t> > freeCells; //a vector, containing all cells of type '.'
size_t monsters; //count of monsters
```

Data Members (public):

```
size_t F; // F = freeCells.size() - monsters – 2
```

Member Functions (public):

```
Map(ifstream &iFile); //loads a map from a file. If failed to import, throws an exception

bool isValid(); //checks if the map is valid (contains only '.' and '#' and a path from
(0, 0) to (m-1, n-1))
void print(olcConsoleGameEngine *cge) const; //prints the map to the console ptr the
modified (with 'X'-es)

void reset(); //undo all 'X' to '.'
void shuffle(); //shuffle freeCells to later place monsters freeCells[0], [1], [2], ...

size_t getHeight() const { return map.size(); }
size_t getWidth() const { return map[0].size(); }
size_t getMonstersCnt() const { return monsters; }
pair<size_t, size_t> getNthFreeCell(size_t n) const { return freeCells[n]; }

bool operator<(const Map &other) const;
vector<char>& operator[](size_t pos);
const vector<char>& operator[](size_t pos) const;

bool operator<(const Map &other) const; //predefined operator<. Returns true if *this is
lower level than other
vector<char>& operator[](size_t pos); //predefined operator[] for non-const
const vector<char>& operator[](size_t pos) const; //predefined operator[] for const
```

Player

Data Members (protected):

```
size_t x;
size_t y;
```

Member Functions (public):

```
virtual ~Player() {} //needed so that x and y destructors are called
virtual pair<size_t, size_t> move() = 0; //virtual func, which when inherited will return
the next move of the player

size_t getX()const { return x; }
size_t getY()const { return y; }
virtual size_t getCntMoves()const = 0;
```

Magician

Data Members (private):

```
queue<pair<size_t, size_t> > moves; //holds the path of the player
```

Member Functions (private):

```
bool dfs(Map &m, size_t x = 0, size_t y = 0); //initializes moves and returns true if
path found
```

Member Functions (public):

```
Magician(const Map &m); //initializes and throws an exception if path not found
virtual pair<size_t, size_t> move() override; //returns the next move of the player +
repositioning
virtual size_t getCntMoves()const override { return moves.size(); }
```

Wizard

Data Members (private):

```
stack<pair<size_t, size_t> > moves; //holds the path of the player
```

Member Functions (private):

```
bool bfs(const Map &m, size_t x = 0, size_t y = 0); //initializes moves and returns true
if path found
```

Member Functions (public):

```
Wizzard(const Map &m); //initializes and throws an exception if path not found
virtual pair<size_t, size_t> move() override; //returns the next move of the player +
repositioning
virtual size_t getCntMoves()const override { return moves.size(); }
```

Monster

Data Members (private):

```
size_t x;
size_t y;
string direction;
```

Member Functions (public):

```
Monster(size_t x, size_t y);
pair<size_t, size_t> move(const Map &map, const vector<Monster> &m); //returns the next
move of the monster + repositioning

size_t getX() const { return x; }
size_t getY() const { return y; }
```

Message

The purpose of this class is only for better user-interface. It contains some simple `wstring` text and some `float` duration. While the duration is higher than 0, the text must be shown somewhere (by the user of the class). When the duration gets lower or equal to 0, the text must be removed from wherever it has been displayed (by the user of the class).

Data Members (public):

```
std::wstring text;
float duration;
```

Member Functions (public):

```
Message(const std::wstring &text, float duration): text(text), duration(duration) {}
Message(const std::string &text, float duration): text(converter.from_bytes(text)),
duration(duration)
```