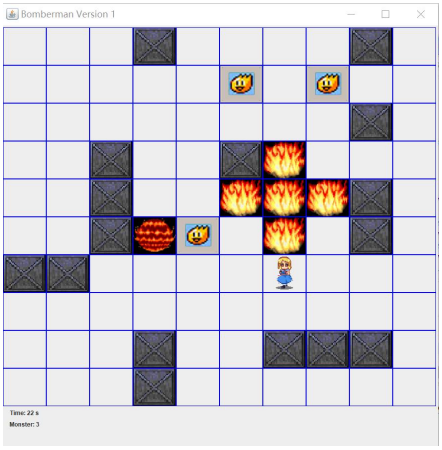

A **bomberman AI game** has been created by myself these days. And the source code as well as this article could be found at my github: https://github.com/XintianCai/MyBomberman

The executable program of this game can be downloaded at: https://github.com/XintianCai/executable-program-bomberman

The current version of my bomberman game displays 2 GUI(playing interface and ending game interface), and implements the basic functions mentioned in this article, including randomly generating roles' initial position, running animation, putting bombs, spraying fire, monster intelligence and collision avoidance.

The Design and Programming of A Creative Bomberman Game

1.1. Introduction

This article firstly shows the design structure of the bomberman AI game, which is followed by the explanation of the detailed programming process. Finally, it introduces the bomberman game programmed by myself in these days.

1.2 Game Design

1.2.1 GUI

The game contains 4 interfaces: start interface, playing interface, game helper interface and ending game interface, to give players a comfortable, fun and creative gaming experience.

In the start interface, players can choose the game level and the role image as well as learning how to play the game. In the playing interface, players control the bomberman to clear all the monsters and avoid being killed by monsters, bombs and fire. This interface also shows the game time and remaining number of monsters. In the game helper interface, players can check the commands of the game. In the ending game interface, the game result is shown, with a button to start a new game and another one to quit the game.

1.2.2 Commands/Objects

Players can control actions of the bomberman by pressing keys on the keyboard(Fig.1). And there are 5 elements in the game, which are shown in figure 2.

Commands	Keys
Move the bomberman in 4 directions	Arrow keys
Put bombs	Space key
Pause the game	Pause/break key
Find the game helper	Shift key
Quit the game	ESC key

Figure 1 Game commands

Objects	Attributes
Walls	Block roads Can be blown up by explosion of bombs
Bombermans	Move; put bombs Can be killed by monsters, explosion of bombs and fire sprayed by monsters
Monsters	Move randomly every 2 seconds; spray fire with a 3-second cool down Can be killed by explosion of bombs
Bombs	Cause the explosion Explosion disappears after 1 second
Fire	Disappears after 2 seconds

Figure 2 Elements in the game

1.2.3 Scene

The game is played in a 10 x 10 scene. And the elements in the scene including walls, a bomberman and monsters are randomly created. What's more, the number and speed of monsters are fully settable. Players can choose different game levels to change these settings.

1.2.4/1.2.5/1.2.6 Game Level/Game Helper/Music

There are 3 game levels: easy level, medium level, and difficult level. The number and speed of monsters increases with difficulty. When players press shift key during the game or click "Help" button at the start interface, the game helper interface will come up, containing the introduction to gameplay. The game has background music. Moreover, explosion, fire, monsters' death and game over can trigger different music.

1.2.7 AI

1/Movement and Path finding

- **Collision Avoidance:** Algorithms need to be designed to avoid monsters hitting together. Also, the bomberman and monsters can't move across the walls or walk out of bounds. Another restriction is that no monster can pass the fire or spray fire to its kind.
- **Speed Control:** The bomberman walks twice as fast as the monster, which is controlled by the time interval of the motion iteration of the monster.

2/Character Behavior

- **The Illusion of Intelligence:** To make monsters more intelligent, an algorithm should be designed to detect the approaching of the bomberman. If the bomberman is closed to a monster, it will spray a fire of 1 gird in one direction randomly.
- **Game Animation:** To make the game more interesting, the image of the bomberman is animated. And the role can turn its body while moving in 4 directions.

1.3 Game Programming

I choose Java as the programming language and Eclipse as the development environment. The project mainly contains 4 packages: component(including object classes such as "Monster" and "Bomb"), listener, main(including GUI and the main class) and image. The following is the implementation process of some functions.

- **GUI:** Each interface is created by a class. The playing board is implemented by a frame with 11 x 10 grid layout(the 11^{th} row is used to show time and monsters' number), and each layout contains a panel (a 10 x 10 matrix of panels in total). An Entity Panel class extends JPanel and overwrite some methods. Each panel is like a grid in the board, with an variable of what type of grid it is. After initializing, the game starts to play.
- **Game Play:** A while loop is used to continuously refresh the frame. By using "System.currentTimeMillis()" method, the time is counted to control monsters' movement, explosion and fire. By resetting the image and grid types of panels and repainting the frame, elements look like that they were continuously moving.
- **Judge Status:** A several methods are wrote to judge if the bomberman is killed or all monsters are dead. Then the while loop is broken and the game jumps to the ending game interface.
- **Monster Intelligence:** Each element has x and y coordinates. By subtracting the coordinates of the monster and the bomberman, the program judges if the bomberman is closed to monsters and randomly generates fire.
- **Role Animation:** The role's image contains 9 different actions. "g.drawImage()" method is used to automatically cut pictures. The panel representing the bomberman changes its image continuously. "Thread.sleep()" method is used to control the image changing speed.
- **Collision Avoidance:** To avoid undesirable movement, algorithms are wrote to compare the coordinates of different elements.
- **Music:** "AudioPlayer" class is used to generate music responding to different events.

1.4 Self-designed Bomberman Game

The Introduction and the way to play it are at the top of the first page of this article.