REPORT

3D Interactive System

Sokoban —— A 3D Game for HCI Final Project

Team Members:

周宇东 1751659

李佳诺 1751188

罗浩 1752547

1 Introduction

1.1 Brief Introduction

Sokoban is a type of puzzle game in which the player pushes boxes around in a warehouse, trying to get them to storage locations.

Despite of its classics and prevalence, the original Sokoban only offers an antique 2D interface, and it appears simple and crude. In order to provide players with a better interactive experience, we decided to make this 3D Sokoban as our final project for HCI.

It is a brand-new Sokoban equipped with more user-friendly 3D interaction including 3D maps (more complicated and interesting), 3D character motion (more vivid) and a series of 3D animation effect (brighter and user-friendly) to enhance user's experience. In addition, we add speech recognition to provide an extra control mode.

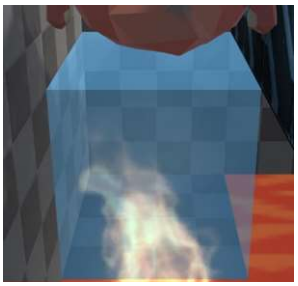
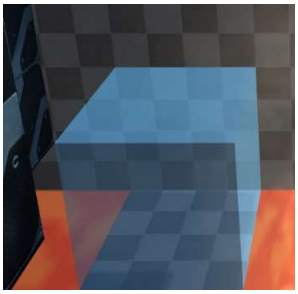
To enable users to play our 3D-Sokoban whenever and wherever possible, we offer two versions which can run on Android and Windows platforms.

1.2 Rules

In the three-dimensional maze composed of square cells which may or may not be filled with rock, the player can move forward, back, left, right, up and down one cell at a step. Upon being pushed, the box will move one cell towards the direction the player is facing. What to remember is that the box will fall freely by gravity if there is nothing beneath it.

You **win**:

All the blue areas are filled with box.

You **lose** in any of the following situations:

1. The box cannot be moved in any other way than by pushing, because if you push it into a corner you can never get it out of the corner again.

2. The character falls into magma.

3. Any one of the boxes falls into magma, by which the box is melted.

1.3 Structures

We develop our game on **Unity**, and our project structure looks like this:

```
3D-Sokoban
├──Assets
│    ├──Effects
│    ├──Map
│    ├──Player
│    ├──Scenes
│    ├──Scripts
│    ├──SpeechRecognition
│    └──UI
├──Packages
└──ProjectSettings
```

1.4 Modules

There are 5 main modules in our game:

- ✧ **Map**
- ✧ **Mini Map**
- ✧ **Character Controller**
- ✧ **Speech Recognition**
- ✧ **GUI**

Map holds everything in our game, **Mini Map** allows game players to watch the whole map from different perspectives, **Character Controller** handles the movement and direction of player, **Speech Recognition** is responsible for understanding speech commands and

converting them into game operations, and **GUI** is supposed to interact with real game player.

2 The Implemented Requirements

2.1 Operations

Windows:

- Keyboard

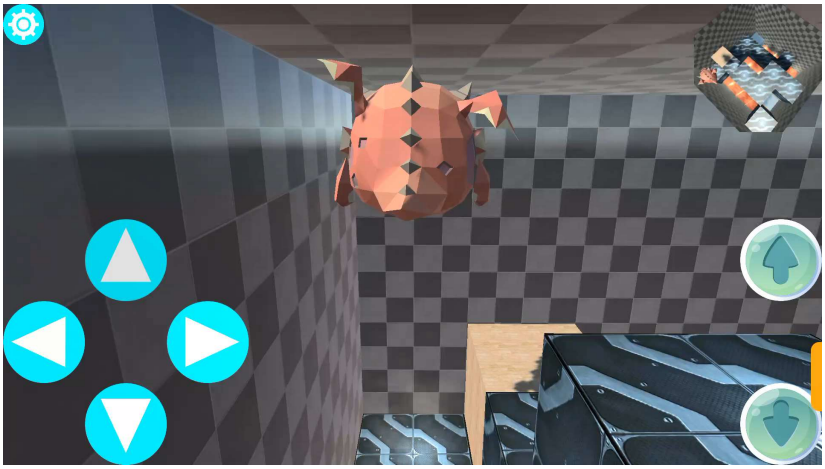
1. “W”: Move forward, if bumped into a box, the box will be pushed toward the direction of the character.
2. “A”: Turn left.
3. “D”: Turn right.
4. “S”: Turn back.
5. “↑”： Move upward.
6. “↓”: Move downward.
7. “Space”: Pause.

8. “Esc”: Exit the game

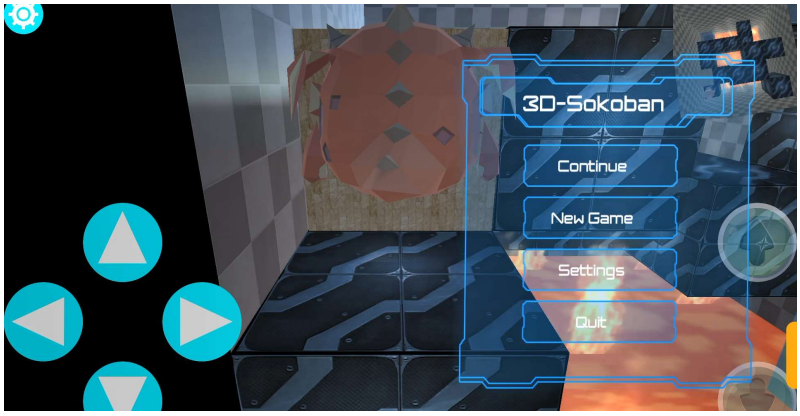
- Mouse

Control the mini map at the top of the page by moving the mouse.

Android:



1.  : Move forward, if bumped into a box, the box will be pushed toward the direction of the character.
2.  : Turn left.
3.  : Turn right.
4.  : Turn back.
5.  : Settings.



6.  : Move downward.

7.  : Move upward.

2.2 Multi-perspective

Main window display in the first-person perspective.

The mini map offers a movable third-person perspective which can be rotated freely by moving mouse.

2.3 Voice commands

You can say:

"*Front/Forward*" to move forward, if bumped into a box, the box will be pushed toward the direction of the character,

"*Left*" to turn left,

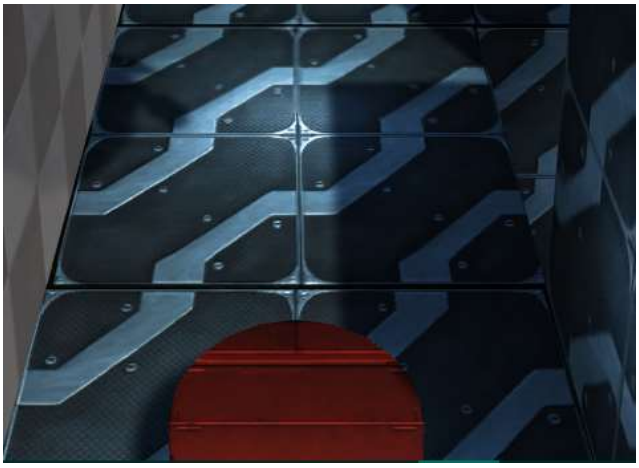
"*Right*" to turn right,

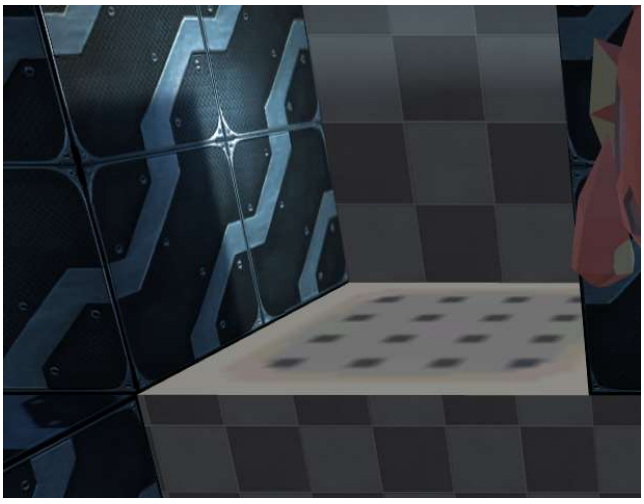
"*Back*" to turn back,

"*Up*" to move upward,

"*Down*" to move downward.

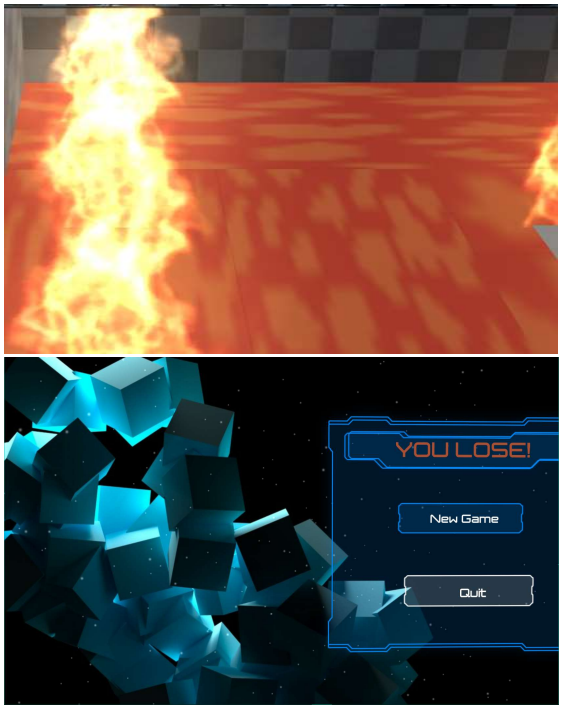
2.4 Mechanism





The door will block you unless the related ***button*** is pressed.

2.5 Traps



The boxes will be burnt by the fire at the bottom of the maze, and the game will end with failure.

2.6 User friendly

The player can pause or continue the game at any time (press space).

2.7 Multi-platform

3D-Sokoban can run perfectly on both ***Windows*** and ***Android***

3 Advantages and Disadvantages

3.1 Advantages

A. Originality: There are no games like this on the market now

B. Interactivity:

1. Our *user interface* is beautiful and refreshing.
2. The *animation effect* is dazzling:
   - The dragon is floating with fanning wings.
   - The fire at the bottom will emit light and heat wave.
   - The button will trigger the event opening the door.
   - Game will give appropriate feedback if necessary.
3. The smooth *speech recognition* makes the interaction more convenient，making you play the game even not pressing any button.

C. Intellectuality: It's not an easy thing to win the game instead you need to watch the global map by rotating the mini map. You also need to pay attention to the traps. Neither can you push box into edges nor the box falls into magma.

3.2 Disadvantages

Due to short of time, we only have one map.

There are some other platforms we don’t support.eg macOS, iOS.

The speech recognition sometimes may not react promptly due to network latency.

4 How to Improve

For the problem of one map, we plan to solve it in the following ways: Firstly, we would design more maps which are fantastic and challenging, stimulating players' desire to explore. Secondly, we will give players more freedom to let them design maps respectively with artifacts provided, and they can upload their maps to share with others, thus increasing user viscosity.

For the problem of platforms, we will certainly provide the support for other main platforms such as: macOS, iOS and so on. And that’s far from enough. We also intend to add VR to our 3D-Sokoban, which will greatly increase the playability and interest of the game.

As for the problem caused by network latency, it is possible to using offline voice packet, which will speed up the recognition.