1 Introduction

To develop a robot, we need to know the environment where the robot will be moving. As this project is to implement a LEGO robot solving a real-life version of a Sokoban game, the environment needs to represent the objects that are found in the game. A Sokoban map consists of some pushable “diamonds” or “boxes”, some fixed walls and goal areas.

2 Physical environment specification

This section represents the map in which the robot will move around.

1. **Surface**
   (a) The surface is white paper with black lines.
   (b) The surface is placed in the horizontal plane on the floor, not on a wall. Only the gravity should be required to keep the robot on the surface.
2. **Grid**
   (a) Every row and column of the sokoban map is represented by a black line in the middle. See figure 1 and 2 for a comparison between the traditional map and the real-life implementation of the same map.
   (b) Every square will be represented by two lines, where the middle of the square represents the two lines orthogonal intersection.
   (c) Every game square is 30x30cm±1cm large.
3. **Diamonds**
   (a) The diamonds is implemented using small cans of tomato puree with a diameter of 54mm and a height of 72mm.
4. **Goals**
   (a) The goal areas are not marked on the map.
5. **Walls**
   (a) The walls are represented by ending the black lines.
6. **Lines**

(a) The lines' color will be black.

(b) The width of the lines is 14mm±2mm.

7. **Start position**

   (a) The start position is given in the map. The direction of the robot is free.

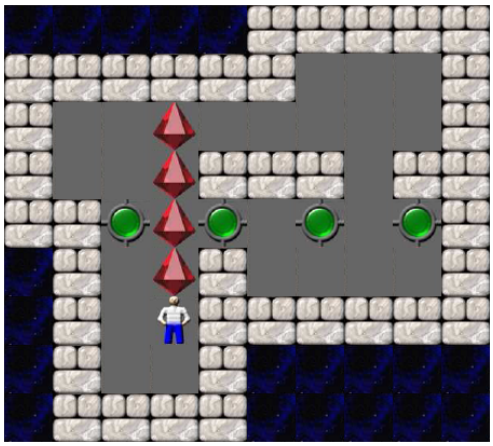

Figure 1: Original Sokoban map

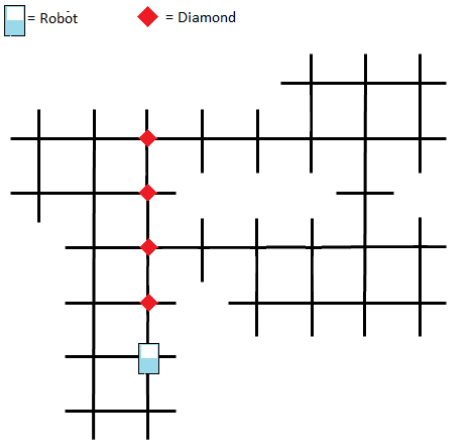

Figure 2: Illustration of real-life map of the same Sokoban map

3 Software environment specification

This section represents the map specification for the solver.

1. **Map specification**

   (a) The map will be given as a file in the *.txt file format.

   (b) The map is represented by a X times Y array of symbols described in "Array representation".

   (c) The map size will given in the first line of the *.txt file in the format XX YY DD.

   - XX represents the width of the array as two characters, ie 10 or 05.

- YY represents the height of the array as two characters, ie 10 or 05.
- DD represents the number of diamonds in the map as two characters, ie 10 or 05.

(d) The rest of the *.txt file represents the map of the sokoban game.

2. **Array representation**

(a) The symbol X represents a wall.

(b) The symbol J represents a diamond.

(c) The symbol G represents a diamond destination / goal.

(d) The symbol . represents a walkable area.

(e) The symbol M represents the sokoban man / the robot.

(f) An empty field represents an area outside the map.

(g) An example of the sokoban map of figure 1 represented as a *.txt file is listed in listing 1.

Listing 1: The map file for the example map

```
1  10  09  04
2          XXXXX
3  XXXXXX...X
4  X..J.....X
5  X..JXXX.XX
6  XXGJG.G.GX
7    X.JX....X
8    X.MXXXXXX
9    X..X
10   XXXX
```