CS 154 Project Report

Names of Group Members:
Bhavesh Dhingra: 160050108
Dhruv Jaglan: 160050106
Sourabh Tote: 160050009

Title of Project:
Elevator Simulation

Description of the Project:
The project idea was to emulate the real-life working of a system of elevators. It made us curious to know which of the lifts was arriving whenever the lift was called by the floor buttons. It intrigued us to know the algorithm behind elevators and apply it to a simulation made by us. So we decided to take up the problem as a project and implement it using an algorithm thought out by us. We also added an automatic simulator that helps in determining optimum number of lifts required for given number of floors.

Design of the Project:
The program consists of following files:

1. declarations.rkt :- It contains the initial conditions required for the simulation, e.g. time taken by lift to travel or stop, number of lifts or floors, etc.

2. classes.rkt :- This is the main file containing the lift class and the classes made for the buttons. The algorithm for the working of the elevator system is also applied in this file. A lot of functions are also defined to implement the main functions.

3. GUI.rkt :- This file contains the complete implementation of the GUI created by us for the elevators and the respective buttons inside the elevator and on the floors. It makes an extensive grid with clickable boxes as buttons for the lifts. It is responsive for left-mouse click events.

4. main.rkt :- This is the implementation file as a combined file. It also builds a new interface to ask the number of lifts and the floors. A manual and an automatic simulation can be started as per the user's choice for the given number of lifts and floors.

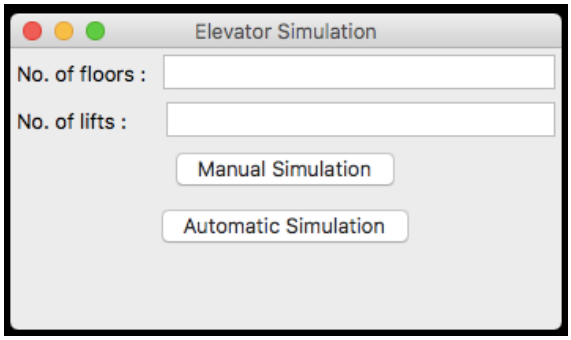
5. automator.rkt :- This is a separate file made for a function to run the simulator automatically and find out the distance travelled by each lift. This will help us to determine the optimum number of lifts required for given number of floors. The automator uses random function for pressing the floor buttons.

Algorithm Outline:

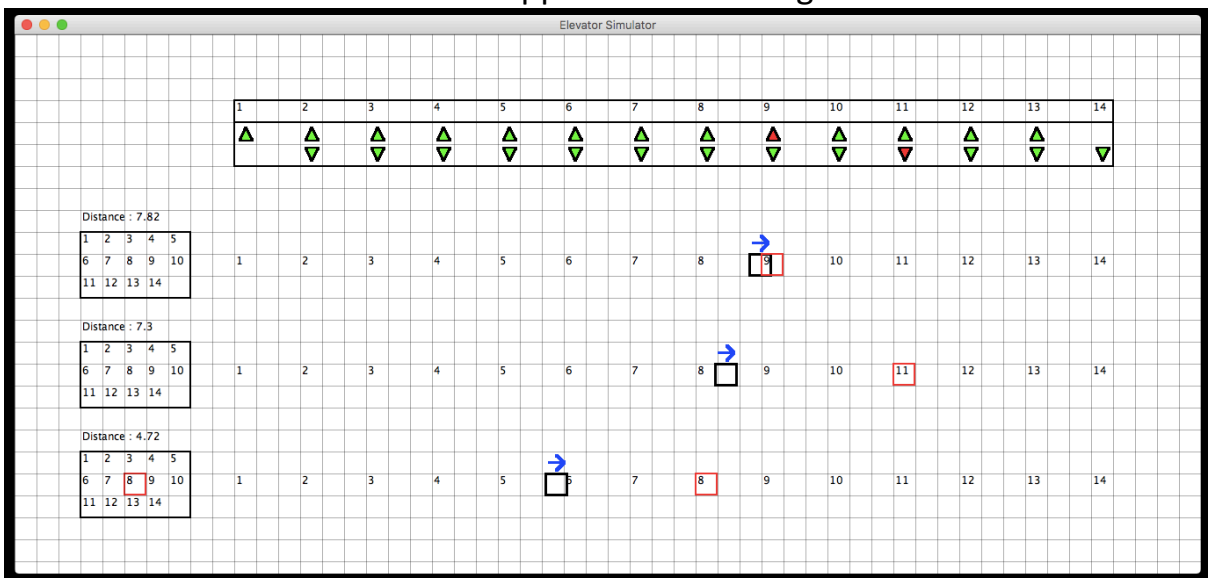
1. Every lift is an instance of lift% class which contains all information about the lift such as the position of the lift, the direction of motion of the lift, the stops the lift is about to make and the buttons in the lift for the people inside the lift to reach their destinations.
2. Whenever a button is pressed from inside of a lift, the respective floor is added to the list of stops for that lift.
3. Whenever a button is pressed on a floor to call the lift, time required by each lift to reach that floor is calculated considering the position and list of stops for a lift. Then the floor is added to list of stops of the lift which takes minimum time.
4. For Automatic Simulation, a function is defined to randomly send calls to lifts and finally calculate distance traveled by each lift in a specific time period.

Sample Input Output:

On running the main.rkt file, a GUI frame appears asking the user number of floors and lifts.



The manual simulation interface appears as following screenshot.



- The black box represents the lift with red boxes as its stops.
- The panel on left of a lift has clickable buttons to represent buttons inside a lift.
- The panel on top has clickable buttons to represent buttons on various floors to call a lift.

The automatic simulation displays a list of distances traveled by lifts in order. Using that data, we can conclude that the lifts that are not moving much as compared to others are not required to serve that building. So we can judge how many lifts are required.

Bugs and Limitations:

1. The size of interface window sometimes is not perfect according to number of lifts and floors. So it is difficult to simulate for high number of lifts and floors.
2. Our simulator shows floors starting from 1 instead of ground.
3. We have not incorporated the feature to keep a lift stopped at a floor as in real life using sensor. So we assume that people use the lifts sensibly.
4. The automatic simulator is not very effective as it is based on random function while in real life some floors like ground are used more than others.