LightBot

LightBot Adaptive Traffic Control System

USER MANUAL

Compiled by MPL Strydom

Contents

1. Introduction

This User Manual will provide all the relevant information needed to start using the LightBot web application. Information can be found regarding the installation, troubleshooting and how to get started. The usage of the system will be explained step-by-step.

2. System Overview

LightBot provides a platform to create and manipulate traffic simulations to demonstrate the effectiveness of implementing a fuzzy logic algorithm for a traffic light intersection.

It currently provides various simulations of a time based traffic controller that showcases the effectiveness/ ineffectiveness in regulating traffic flow at different times of the day.

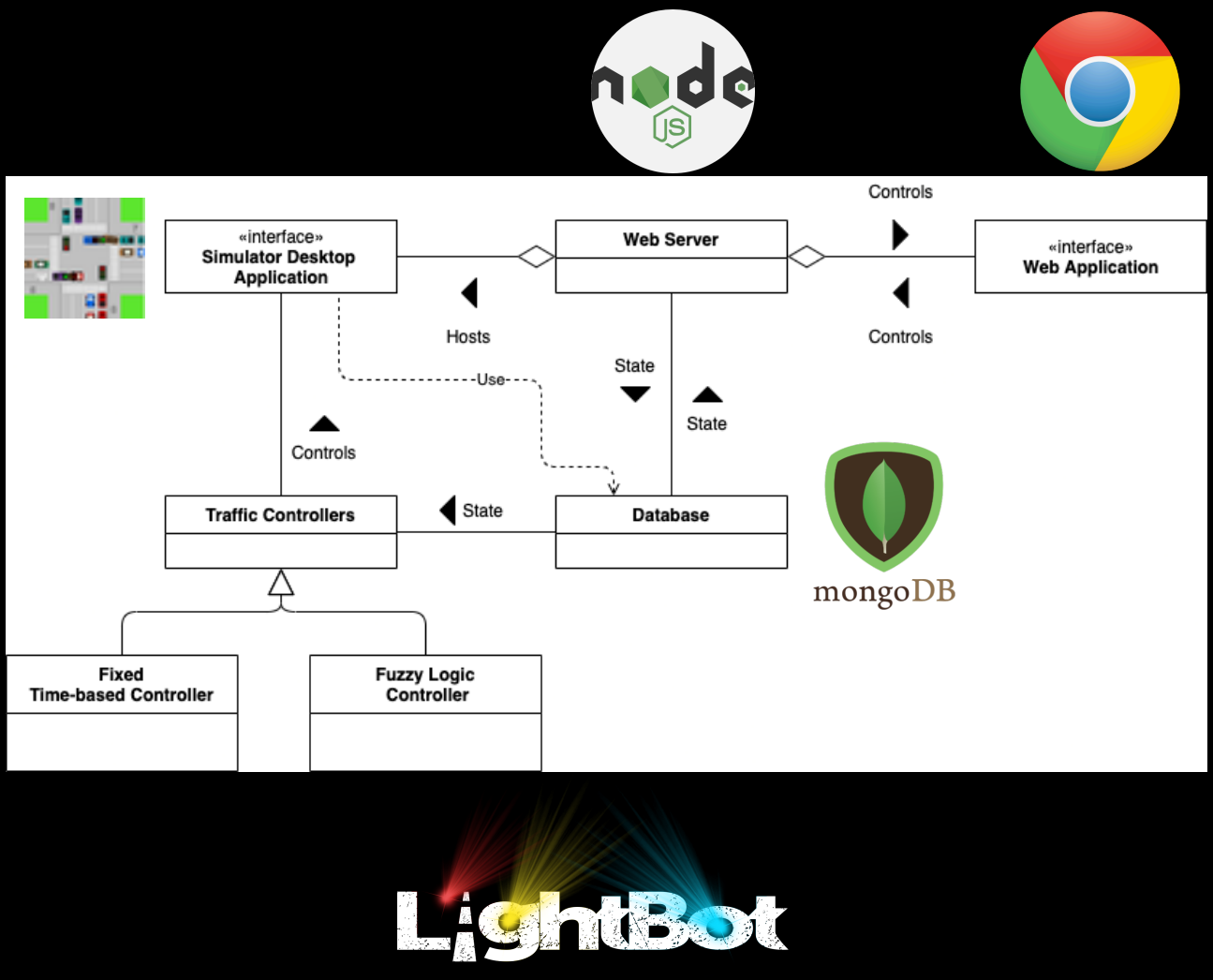


Figure 1: Domain Model of LightBot

3. Installation

The interaction with LightBot and all of the system functionalities are completely web based, therefor the user does not need to install any software other than have access to a modern web browser.

All browsers should be able to run LightBot, however we recommend using Firefox, Chrome or Safari, as LightBot have been tested using these popular browsers.



4. Troubleshooting

If an error occurs while using LightBot, please email me at u04874359@tuks.co.za. On the occasion that LightBot is experiencing technical difficulties, we will inform the users through posting system notifications.

5. Getting Started

5.1 Login Page

When launching the LightBot Web Application in your browser, you will be greeted by the login page, see Figure 2.
Existing users have two options on this page:

- They can login by entering their email and password that they registered with and click on the Login button. They will be redirected to the System Dashboard. For more information about the System Dashboard's Overview page, see section 5.6
- They can reset their password using the Forgot Password link. For more information on the Password Recovery page, see section 5.2

New users must click on the Create Account link to register as a new user. For more information on the Sign Up page, see section 5.

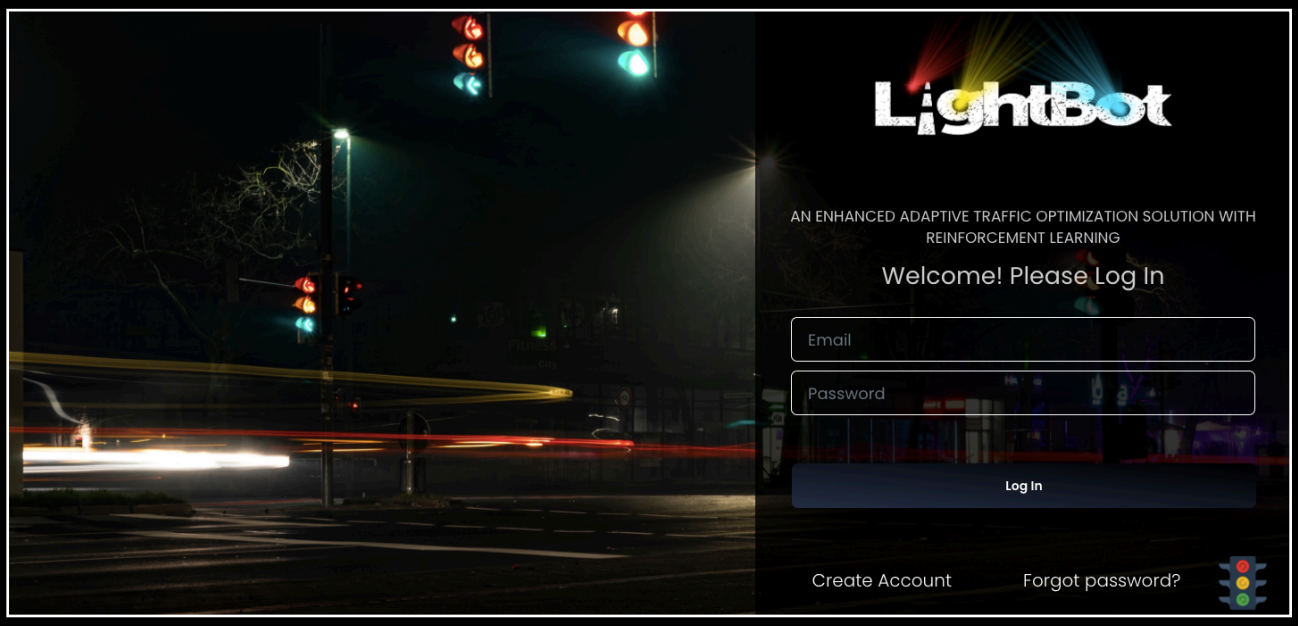


Figure 2: Login Page

5.2 Password Recovery Page

The Password Recovery page, see Figure 3, provides users with 2 options:

- The user can enter their email in the provided text box and click on the Send Password Request button. LightBot will then send the user and email containing password recovery instructions. Please note that this feature is only available to registered users.
- The user can go back to the login page bu clicking on the Back To Login Page link if they do not wish to reset their password.

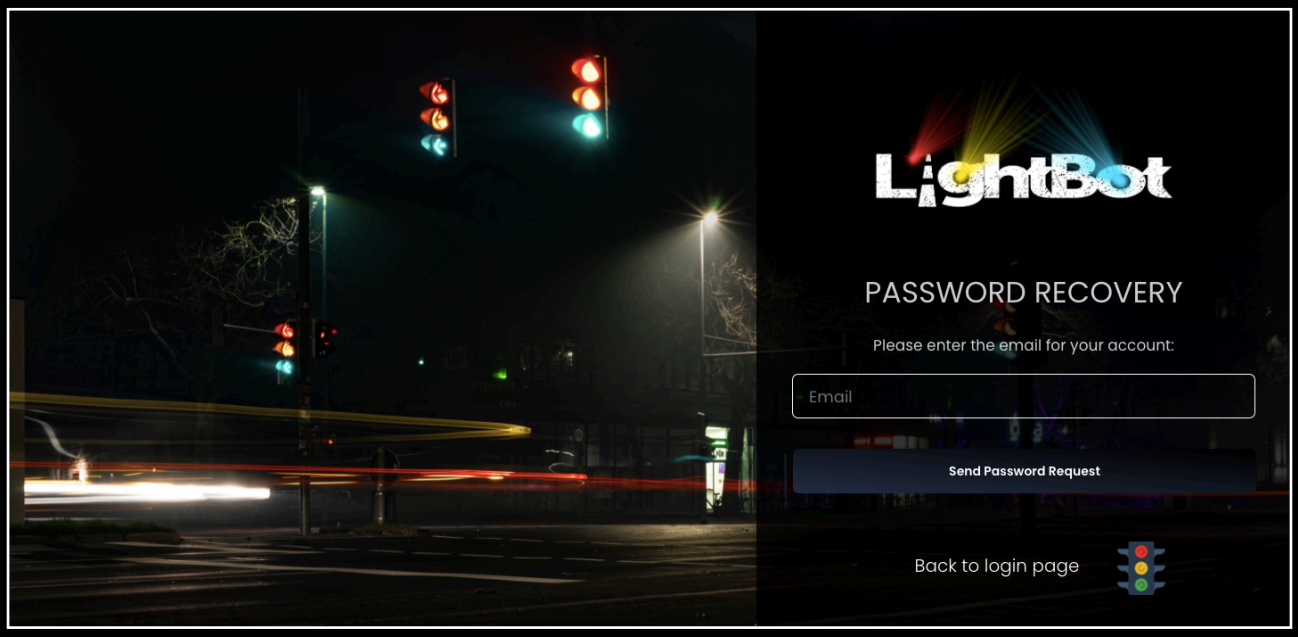


Figure 3: Password Recovery Page

5.3 Sign Up Page

The Sign Up page, see Figure 4, allows new users to register so that they can access the LightBot Dashboard.

- Users have to fill in all 5 of the required fields to be able to register. Then click on the Sign Up button. The user will be redirected back to the Login page, and is expected to log in with the email and password they registered with.
- Users can also go back to the Login page using the Back To Login Page link.

Figure 4: Sign Up Page

5.4 Log Out Menu

Once a user is logged in, all pages will have a user icon that can be found at the top right corner of the screen, which when clicked on provides the user with a log out button, see Figure 5. When this button is clicked, the user will be logged out of the system and redirected to the Login page.

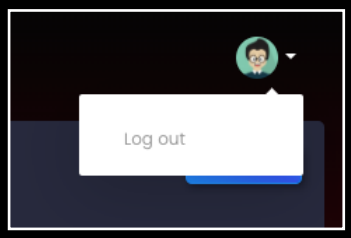


Figure 5: Log out button

5.5 Side Bar

The side bar facilitates navigation on all pages that the user has access to once logged in.

The side bar allows the user to access five different pages on LightBot:

- System Overview page: See section 5.6 for more information.
- Manual Override page: See section 5.7 for more information.
- Simulation page: See section 5.8 for more information.
- Forum page: See section 5.9 for more information.
- User Profile page: See section 5.10 for more information.

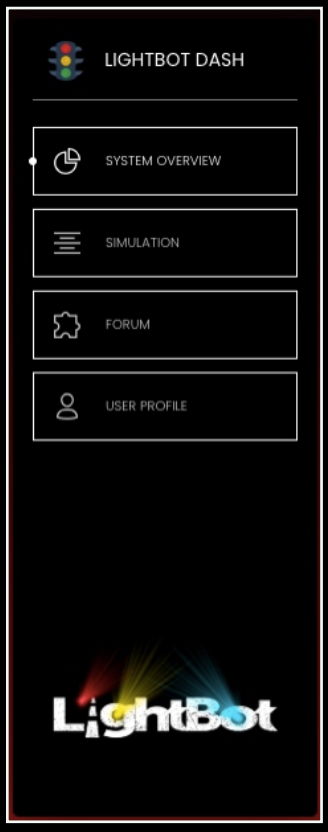


Figure 6: Side Bar for navigation

5.6 System Overview Page

The System Overview page, see Figure 7, is the default page the user is directed to once logged in, as it is the overview of the system dashboard at that current state. On this page, the user can use the side bar to navigate to different pages and views.

Figure 7: System Overview page

5.7 Simulation Page

The Simulation page, see Figure 8, allows the user to download the simulator desktop application. The user can read the provided information that explains how to run the application and what programs need to be installed before they can execute and run the desktop application on their local machines.

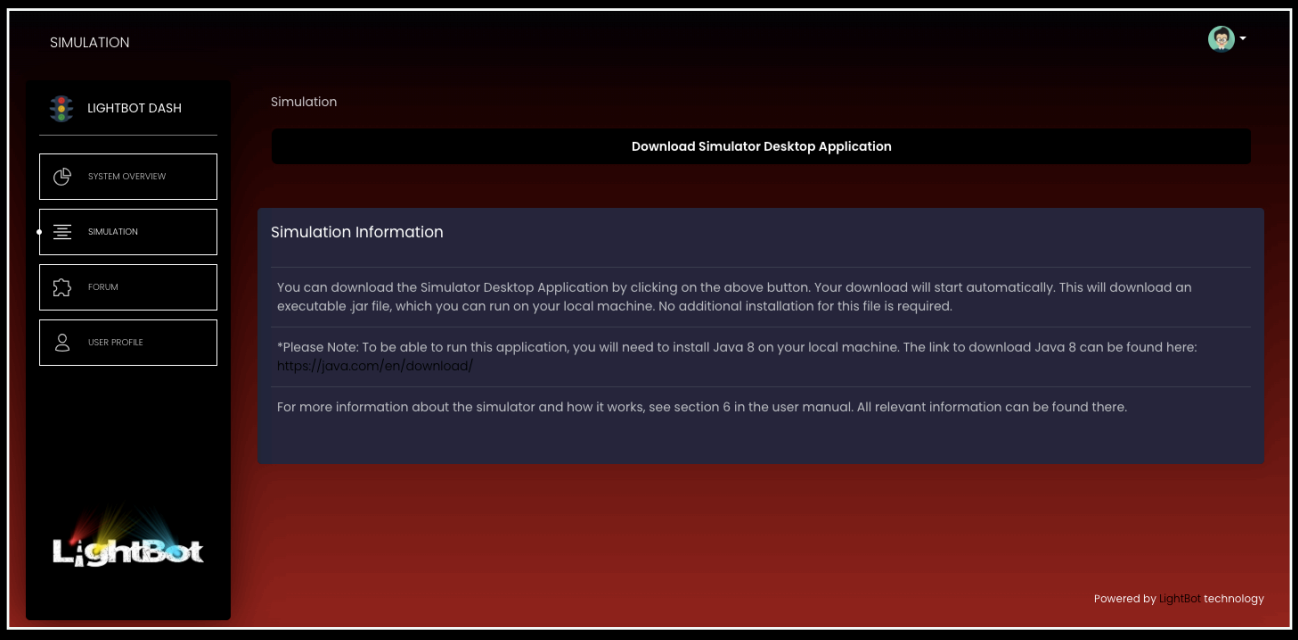


Figure 8: Simulation page

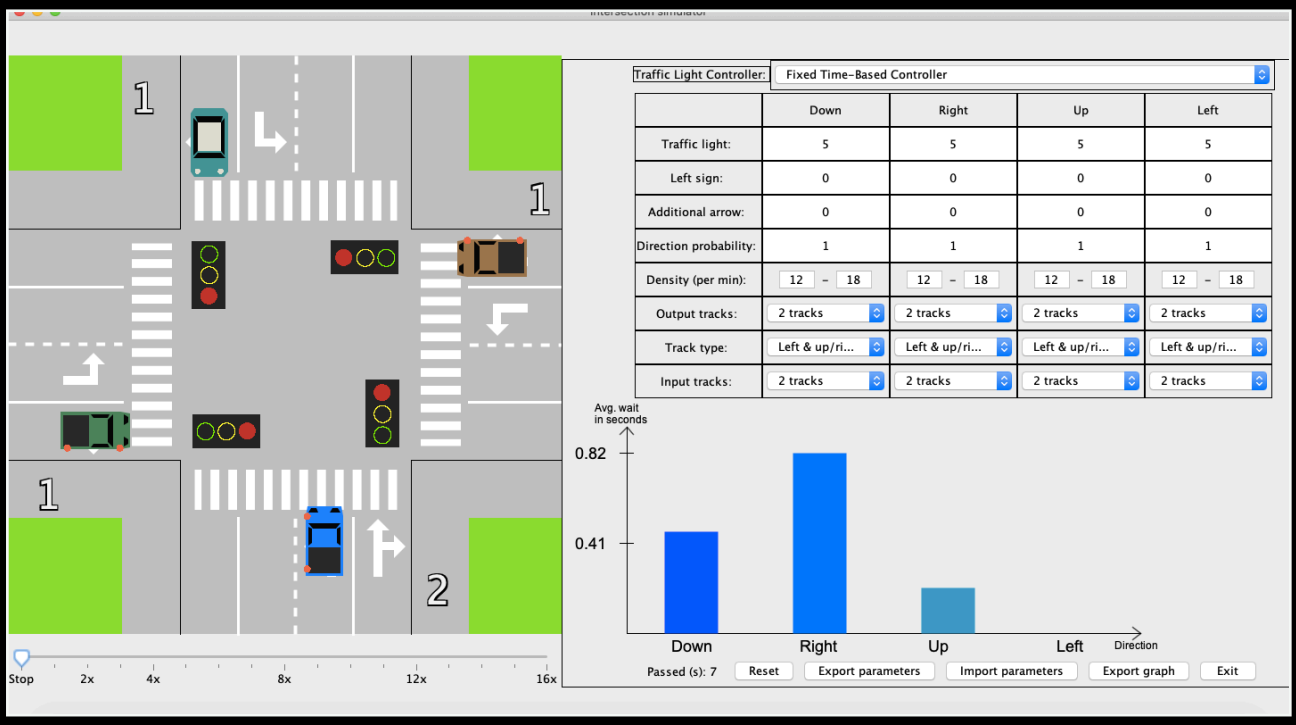


Figure 9: Simulation Interface

Once the user has downloaded the application, and installed all the needed programs, the user can run the desktop application, and the following interface will appear, see Figure 9. Here, the user can run simulations and interact with the simulation by providing personalised results and options. For more information on how the simulator works, see section 6.

5.8 Forum Page

The Forum page, see Figure 10, will allow the users and developers of LightBot to communicate with another. Any announcements will be made on this page.

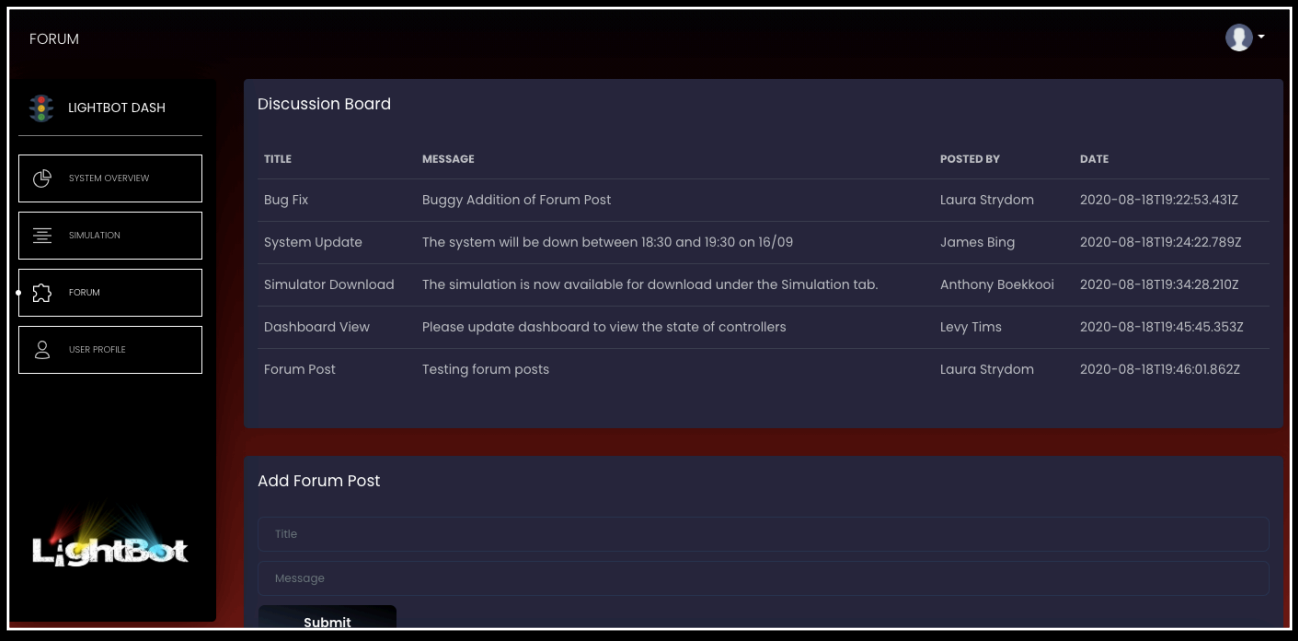
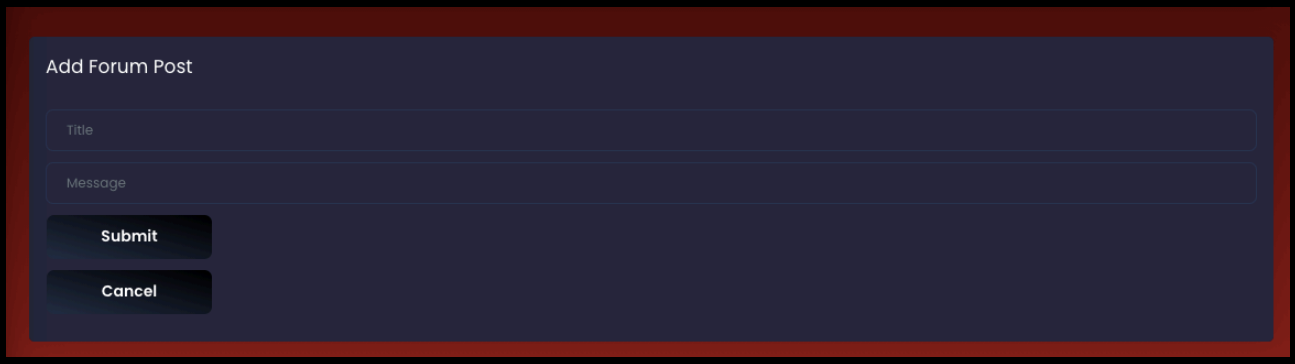


Figure 10: Forum page

Figure 10.1: Add Post



Users can add posts to the forum by entering data and clicking on the "Submit" button at the bottom of the Add Forum Post table. The user can also click on the "Cancel" button to cancel the request and clear all fields, see Figure 10.1.

5.9 User Profile Page

The User Profile page, see Figure 11, will allow the user to view their profile details. They will be able to edit their information and save the edits. The can only edit the name and surname fields, if they wish, as their user role and email can't be changed on the front end.

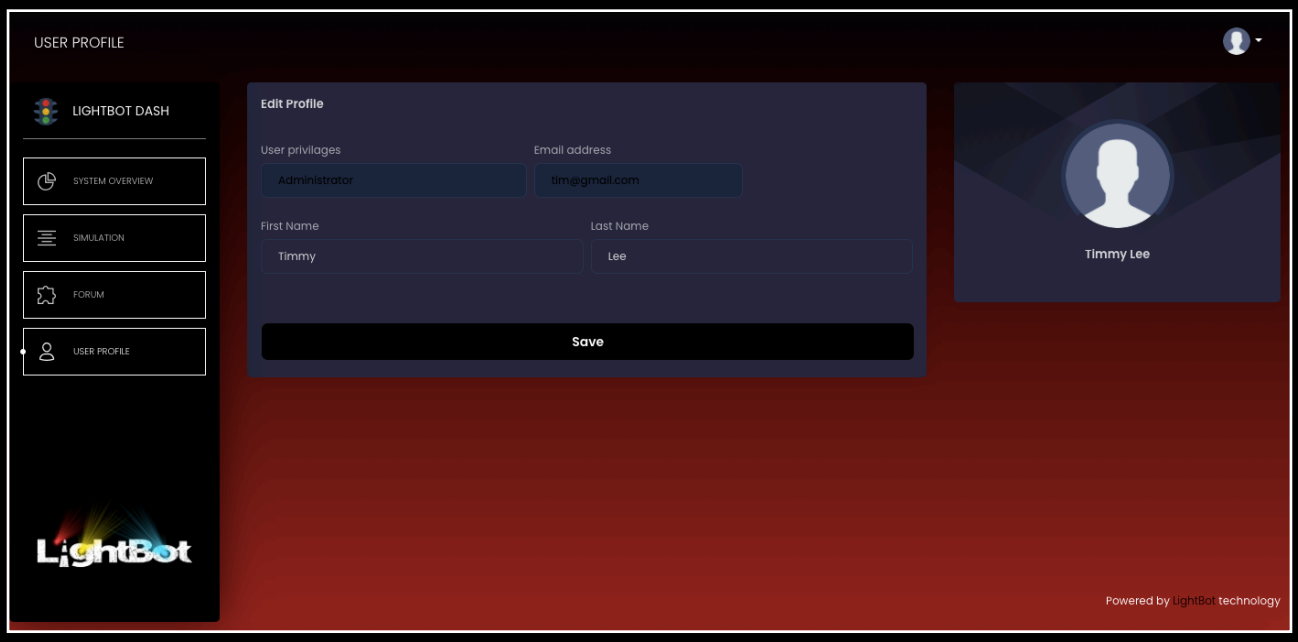


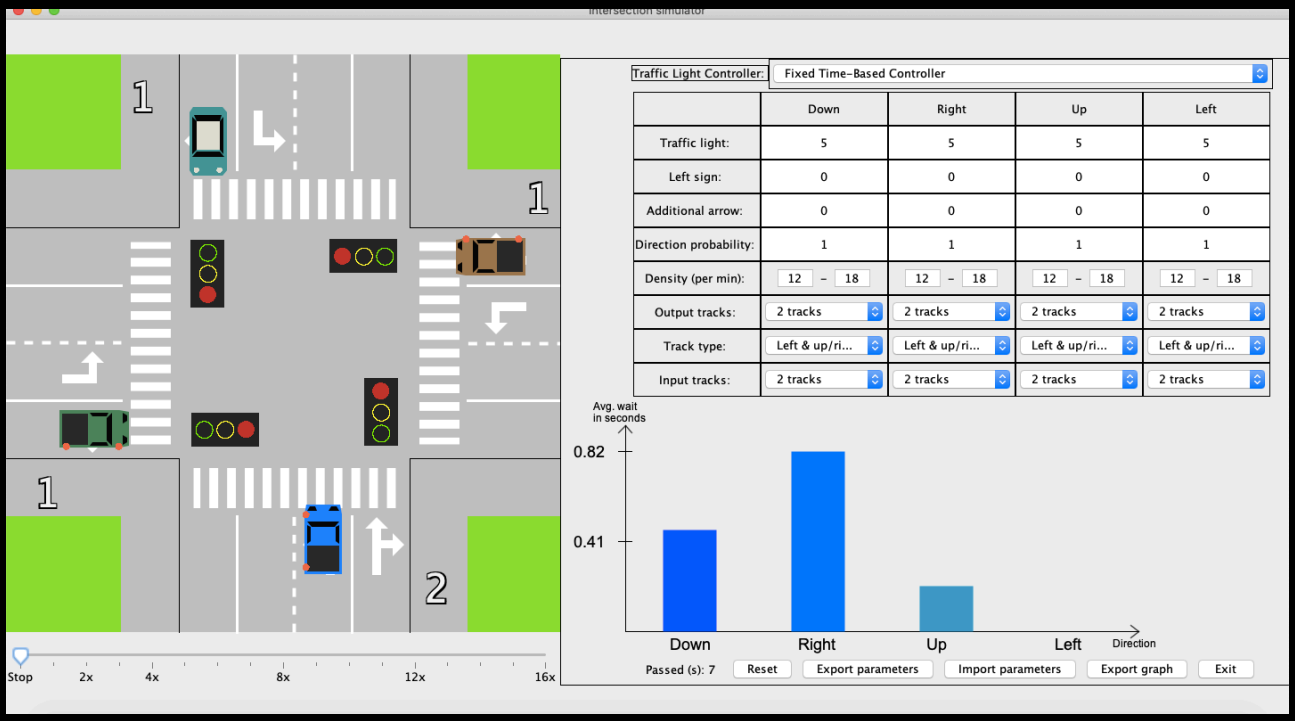
Figure 11: User Profile page

6. Simulation Controls

When a user launches the simulator desktop application, they will be presented with the following interface, see Figure 12.

The simulation will start automatically based on the current parameters available when launching the simulator. The user can stop the simulation by clicking on the Stop button, see Figure 13. The user can also change up the speed of the simulation by clicking on the multiple options for speed-up.

Figure 12: Simulator Interface



This control bar can be found at the bottom left-hand side of the interface, below the intersection display.

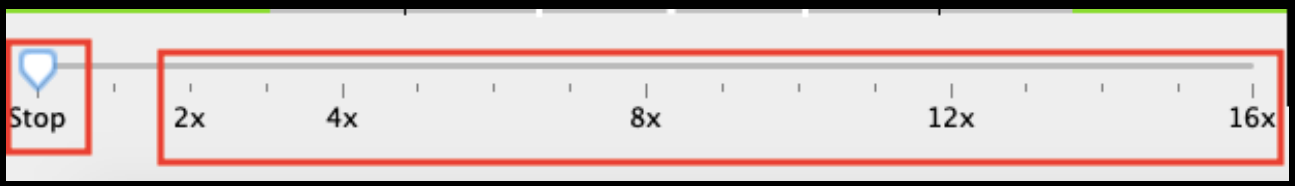


Figure 13: Time Control Bar

The user can alter the parameters of the simulation on the Parameter Control Bar, see Figure 14, which can be found on the right-hand side of the simulator interface.

	Down	Right	Up	Left
Traffic light:	5	5	5	5
Left sign:	0	0	0	0
Additional arrow:	0	0	0	0
Direction probability:	1	1	1	1
Density (per min):	12 - 18	12 - 18	12 - 18	12 - 18
Output tracks:	2 tracks	2 tracks	2 tracks	2 tracks
Track type:	Left & up/ri...	Left & up/ri...	Left & up/ri...	Left & up/ri...
Input tracks:	2 tracks	2 tracks	2 tracks	2 tracks

Figure 14: Parameter Control Bar

The “Down, Right, Up, & Left” options each represent the direction of the lanes, in the 4 directional intersection respectively.

The user has the following options:

- Traffic Light: The length of a green light on a traffic light in seconds
- Left Sign: The length of a green light on a traffic light for turning left in seconds. This can only be added if there are 2 output tracks in that specified direction
- Additional Arrow: The length of an additional arrow for turning right (the last n seconds of a red light)
- Direction Probability: Probability for going in other directions
- Density (per min): The density of the cars, in units, per minute
- Output Tracks: Number of output tracks in the same direction
- Track Type: Type of output tracks (only where there are 2 tracks)
- Input Tracks: Number of input tracks in the same direction

The Statistics Control Bar displayed on the bottom right-hand side of the interface, see Figure 15, displays the relevant information gathered during the current run cycle of a simulation.
Here, the user can see the following information, see Figure 15:

- The average waiting time in seconds for the cars, for each direction in the intersection.
- The time elapsed in seconds for the current run of the simulation.

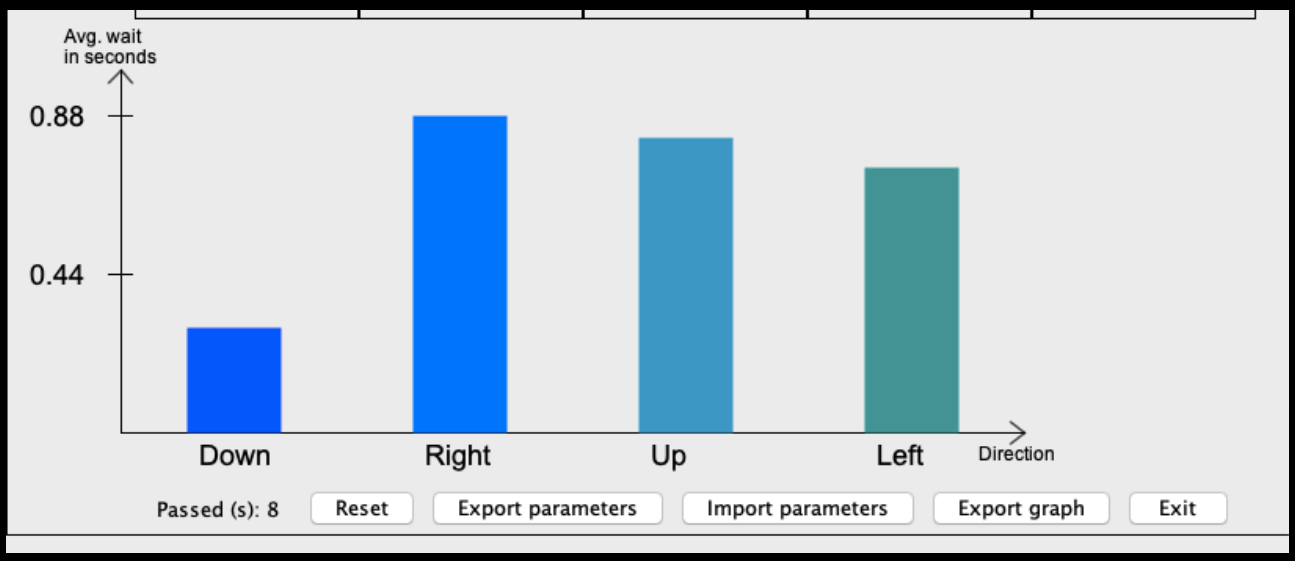
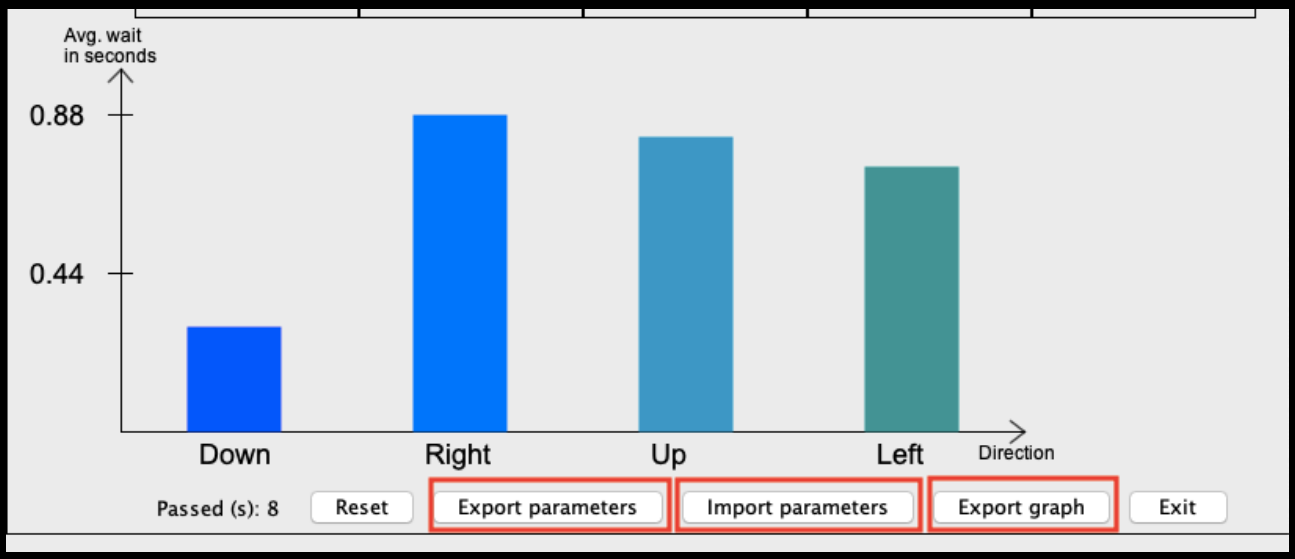


Figure 15: Statistics Control Bar

The user also has the options to export the parameters for the current run of the simulation, import personalised parameters and export the graph with relevant information to the average waiting time in seconds and the time elapsed in seconds, see Figure 16.

Exporting the parameters will result in a window popping up, prompting the user to provide a name for the .txt file and will be saved, upon the click of the Save button, to the specified path upon the users’ machine, see Figure 17.

Figure 16: Statistics Control Bar



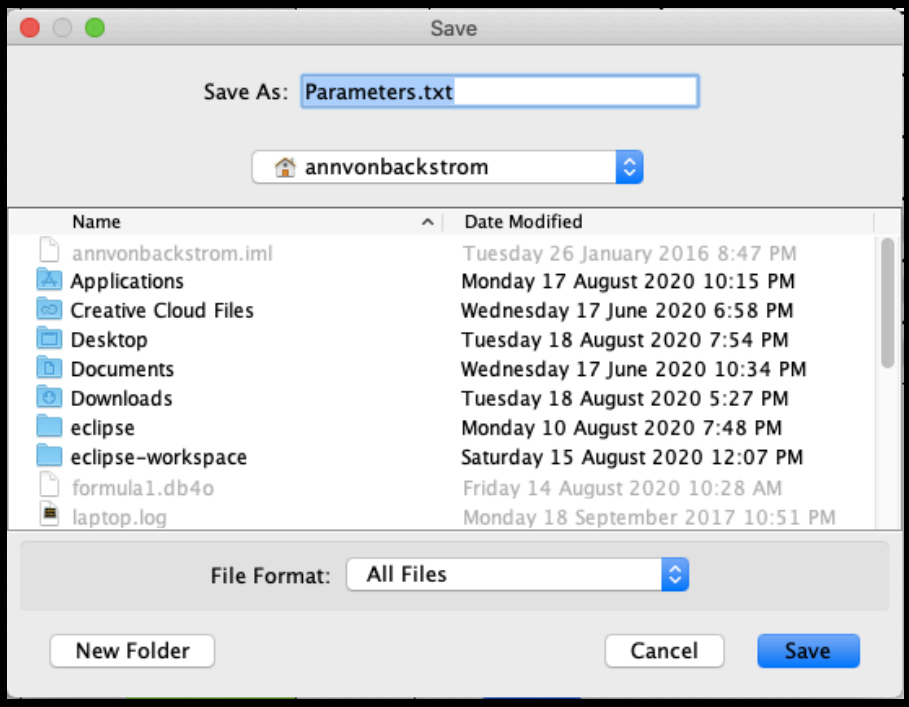


Figure 17: Exporing parameters

Importing personalised parameters will result in a window popping up, prompting the user to choose a .txt file, which will then be uploaded, resulting in the change of the simulator parameters, see Figure 18.

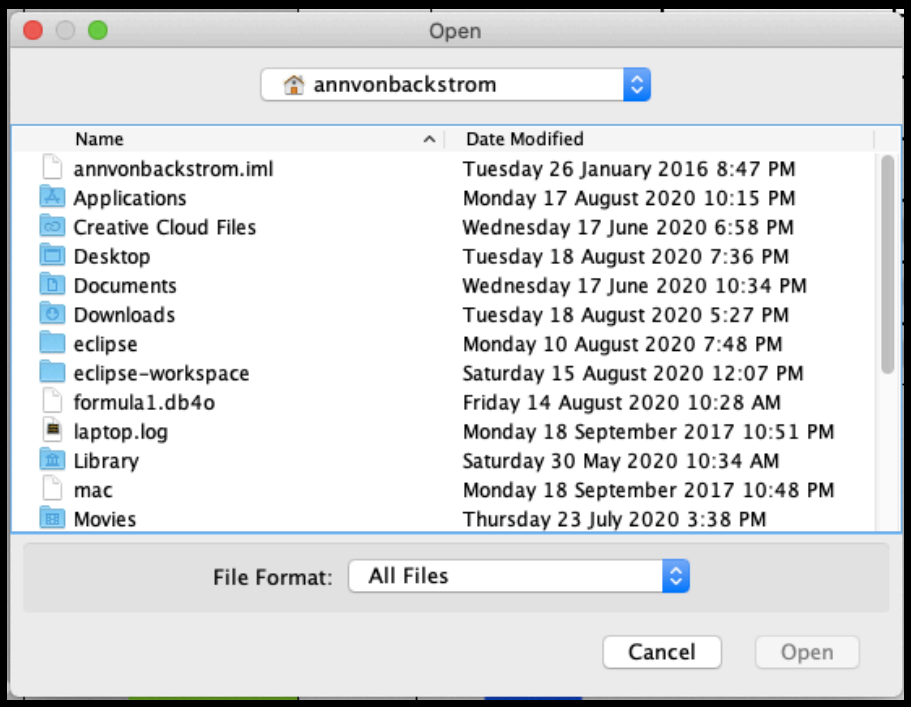


Figure 18: Importing parameters

Exporting the graph will result in a window popping up, prompting the user to provide a name for the .zip file and will be saved, upon the click of the Save button, to the specified path upon the users' machine, see Figure 19.

Inside this .zip file, the user can expect to find a graph.png which is an image of the graph displaying the simulation results, as well as a Simulation_results.txt file where they can find the time elapsed in seconds, and the average waiting time per direction.

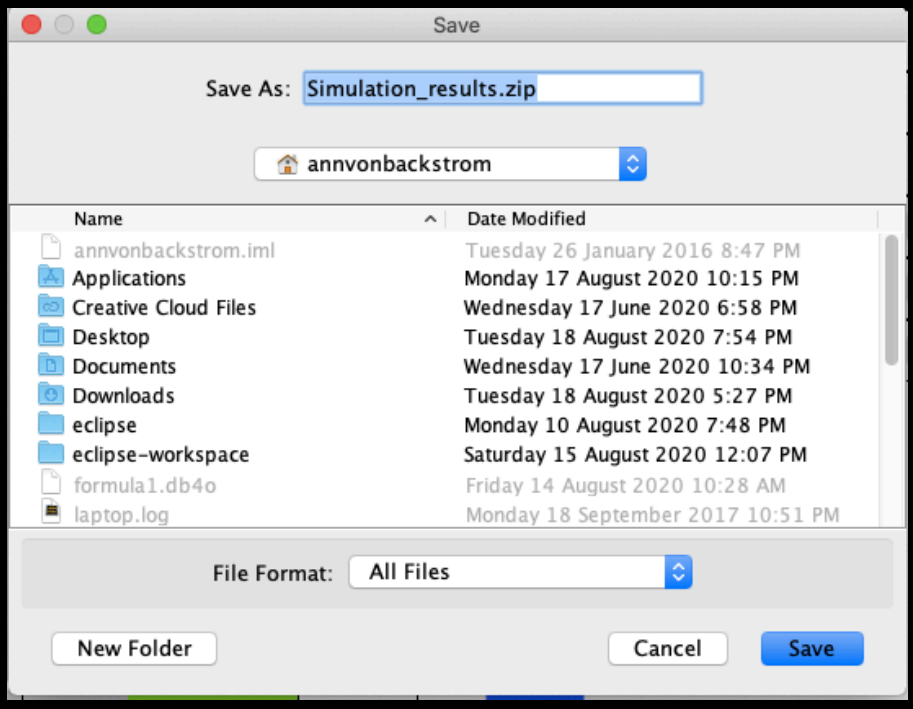


Figure 19: Exporting results

The user also has the ability to reset the simulation, which will stop the simulation and reset the parameters, by clicking on the Reset button. There is also the option for the user to exit the application, by clicking on the Exit button. See Figure 20.

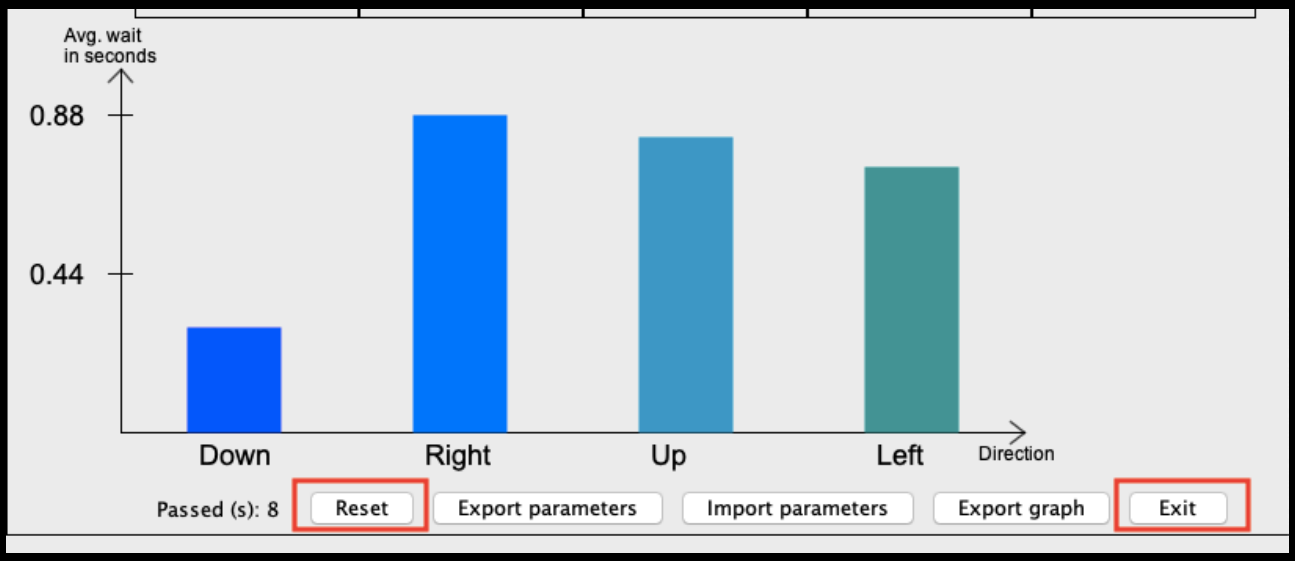


Figure 20: Exiting the simulation

Controller Options:

The user has the option to choose between two controllers that will run the simulation, see Figures 21.

1. The first option is the Fixed Time-Based controller, which gives the user Manual Control over the simulation. As you can see in all the above mentioned figures, the user has the ability to change the parameters and controls of the simulation output. This controller runs on a dial timer that has only one signalised time plan, and it controls the phases at the simulated intersection. The user parameters are then implemented together with this dial timer.

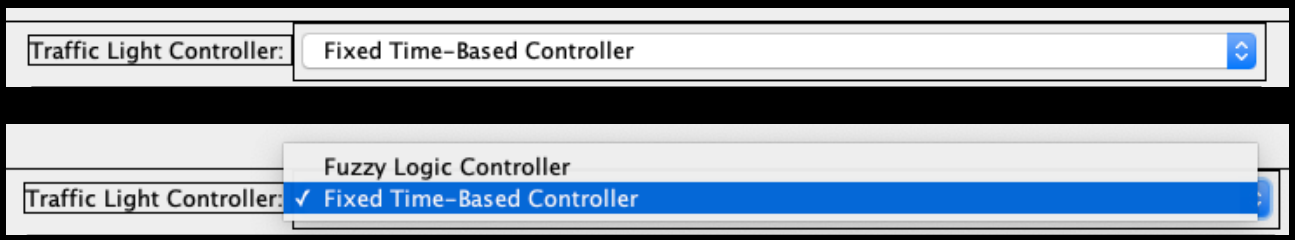


Figure 21: Controller Options

2. The second option is the Fuzzy Logic controller, which automatically runs the simulation based on the parameters of the implemented fuzzy logic algorithm. Choosing this option will remove the parameter panel from the interface, as the user will have no manual control over the simulation. The user can still see the output and export the simulation results. See Figure 22.

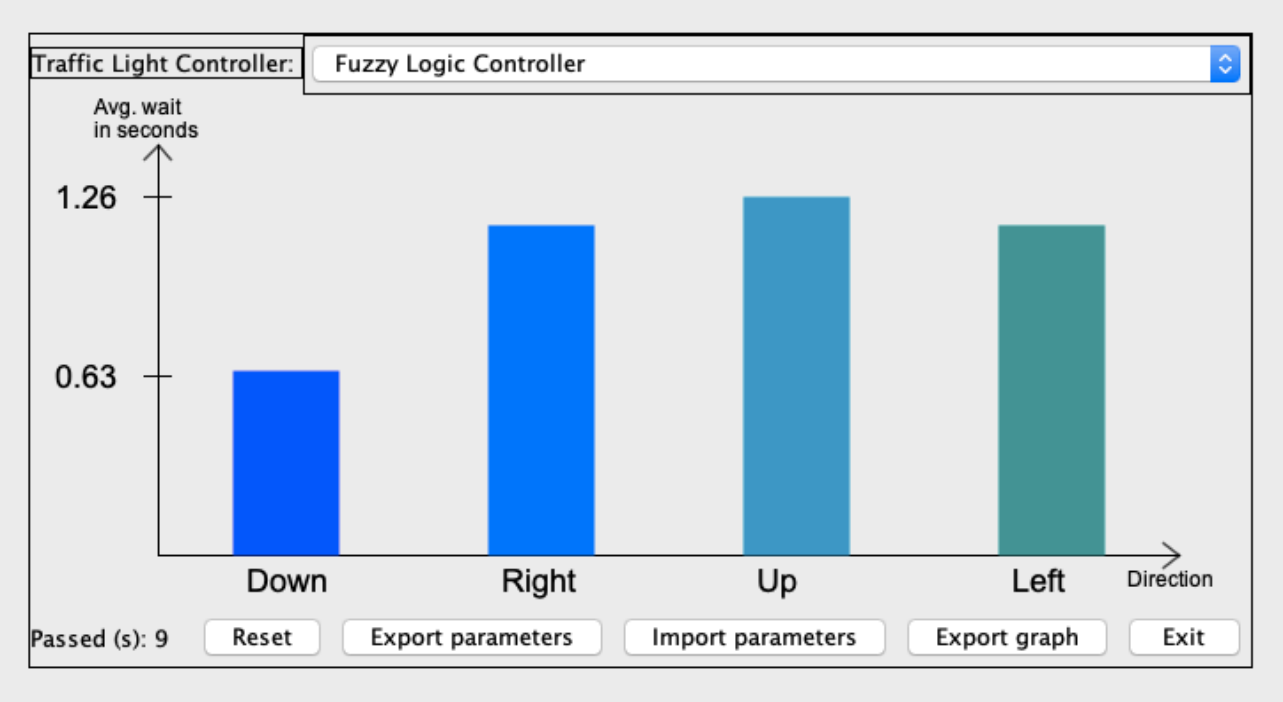


Figure 22: Fuzzy Logic controller chosen