The University of Adelaide
COMP SCI 3006/7015 Software Engineering and Project

Software Design Document (SDD)

for

Road Closure Marking Robot

Version 0.1

Prepared by Group 2

Contents

Change History

Date	Version	Reason for Change
10th Sept	0.1	Initial draft

1 Introduction

1.1 Purpose

1.2 Scope

1.3 References

1.4 Overview

1.5 Constraints

2 System Overview

3 System Architecture and Components Design

3.1 Architectural Description

- Architectural Pattern: Pipe and Filter
- Control Style: Centralised (Manager Model)

3.2 Component Decomposition Description

- Object Oriented Style

3.3 Detailed Components Design Description

3.4 Architectural Alternatives

3.5 Design Rationale

4 Data Design

4.1 Database Description

4.2 Data Structures

5 Design Details

5.1 Class Diagrams

5.2 State Diagrams

5.3 Interaction Diagrams

6 Human Interface Design

6.1 Overview of the User Interface

According to SRS, a GUI is essential on the PC side for the user to implement the following activities:

- The operator can establish communication with the robot by using GUI to manipulate the Bluetooth device.
- The operator is able to manually control and monitor the robot's movement by operating a set of buttons and seeing a map panel.
- The operator has the authority to command the robot to perform the AI mode by clicking buttons on the GUI, and then notice the robot status by receiving a bunch of messages showed on the GUI.
- The operator is able to stop the movement of the robot by using the emergency stop button in the GUI whenever an emergency occurs.
- The operator can control the robot in some perticular extents to ensure the optimised task completion of the robot through the GUI, e.g. monitoring the battery life or adjusting the speed of robot.

The design of the GUI is in accordance with SRS purposing a simulation of the real world to provide visibility of system status to user. The GUI should be consistent and standardised to ensure user control freedom, error provention, safety precaution, and risk handling. To achieve the ease of using for users, the GUI should be flexible, efficient of use, aesthetically friendly, minimalist design, and smooth for control flow.

The development of the GUI follows the process below:

1. Relevant data gathering
   Infer information for GUI from requirements; analyse user habits, contorl flow, and environments; derive from initial strategy and data presentation.
2. Prototypes
   Create prototype based on the results of last phase.
3. Revisions
   Show the prototype to stakeholders (the group and client) for feedbacks and recommendations. If passed move to next stage otherwise design a new prototype or modify the existed prototype.
4. Documentation
   Create User Manual for the GUI.

5. Final review
   Final demonstration for assessment.

6.2 Detailed Design of the User Interface

According to the "User Interface" section of SRS, the GUI should consist of four parts:

1. Command buttons allow the operator to control the movement or change the status of the robot, including:
   (a) forward. Press once and the robot will continue moving forward.
   (b) backward. The same as forward.
   (c) left. Rotate the robot ninty degrees to left.
   (d) right. Rotate the robot ninty degrees to right.
   (e) connect. Establish the connection from PC to robot.
   (f) disconnect. Disconnect the bluetooth connection between PC and robot.
   (g) mark road closure. Command the robot to manually mark road closure.
   (h) start automatic mapping. Enable the AI mode of the robot to automatically explore the map.
   (i) return to base. Make the robot return to the starting position.
   (j) stop. The emergency stop for the robot.
2. Robot information area contains the information in relation to the robot's status, including:
   (a) robot name.
   (b) battery level. Display the current battery level of the robot.
   (c) connection status. Display the status of Bluetooth connection using "on" and "off".
   (d) message. A textfield shows the messages sent by the robot including values of sensors, status of the robot, and warnings.
3. Map area
   A panel in the GUI to diaplay the current map. All objects defined in the DTD will be showed on the map, including roads, road intersections, obstacles, disaster area, closure, and unexplored area. The current location of the robot and traversed path by the robot would also be showed in the map.

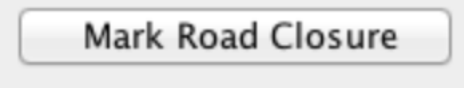
4. List menu.
   A menu that allows the operator to save and reload the map in the form of XML file in the format specified by the DTD by clicking items in the list menu.

The display space for mapping is the major core component of the GUI, and it shall be maximised. All other functions except for the list menu are located at left-hand-side of the display window with a constant width so the display of map can be enlarged for larger screen sized window. The menu list is put on the top left of the window as a button on the top tool bar. The whole menu will emerge after a click on the menu button. Inside the menu list the user will see menu items to deal with the XML file.

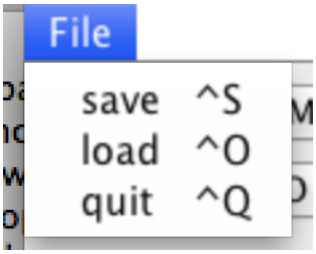
The functions of GUI, which were designed upon the requirements elicitation, are outlined as following:

1. R01 and H02: Manual Control of the robot:

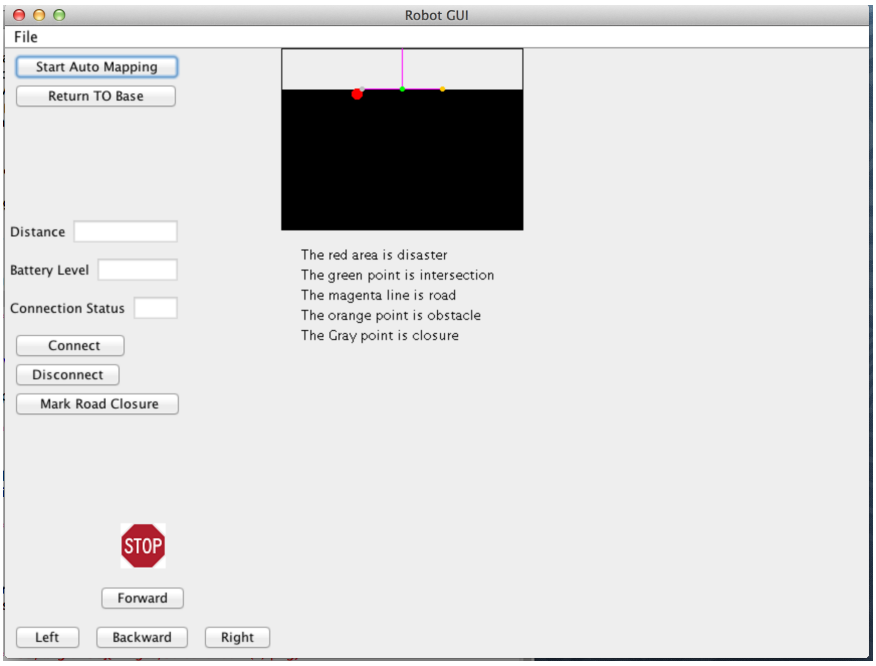
2. R02-03: Map saving and loading:



3. R07: Road closure marking:



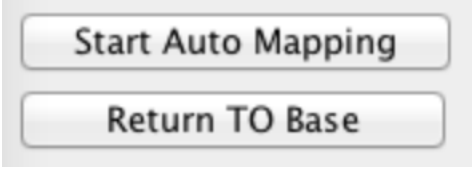
4. H01: The whole GUI:



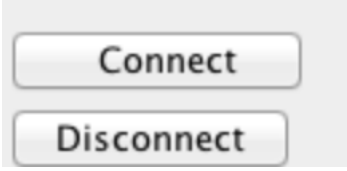
5. H04: Emergency stop:

6. Other attributes stated in other descriptions of SRS:

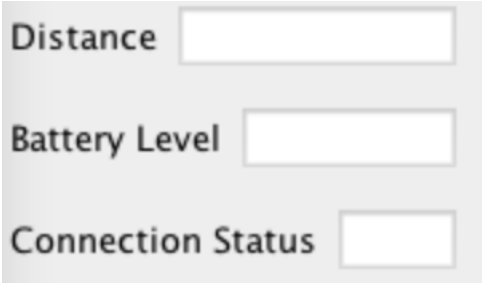
   AI mode:



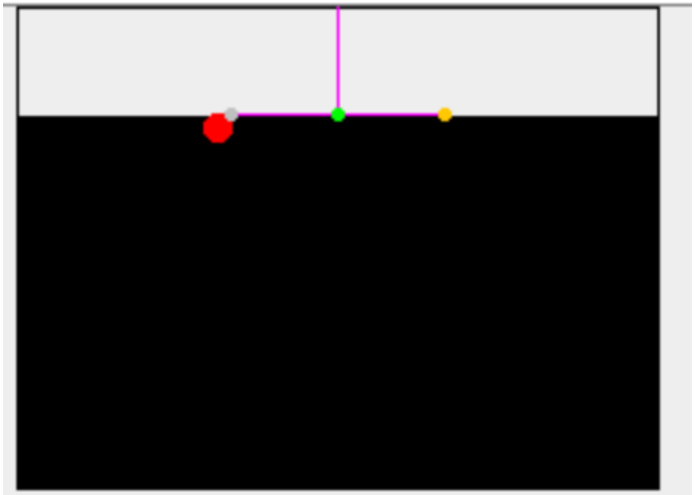
Status:



Connection:



7. The display of the map:



The red area is disaster
The green point is intersection
The magenta line is road
The orange point is obstacle
The Gray point is closure

The functions that have already been defined in SRS but not been implemented yet in the GUI, are outlined as following:

1. M01: Display the taversed path by the robot in map panel.
2. H03: Display the current position of robot in map panel.
3. H06: A textfield on the GUI to show messages such as alert message.
4. SA01: A speed bar on the GUI to adjust the speed of the robot. The speed should be within a safe speed.
5. Other function that was not described in SRS: Zoom feature for the map.

7 Resource Estimates

8 Definitions, Acronymns and Abbreviations