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| Masters | Brunel University Logo  **Software Design**  **Assignment 2 - CS1813 Software Design** | **CS1704 - Group Project**  **Group: B - 47**  **Tutor: Ferdous Hossein**  **Hamza Altaf**  **Student ID: 2440485** |

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# **SOFTWARE REQUIREMENTS SPECIFICATION**

Purpose

The software's purpose is to draw geometric shapes (squares and triangles) based on user input via QR codes. The program controls the Swift Bot’s to provides a visual image on the command line interface along with moving the Swift Bot in the form of shape and calculates information about the drawn shapes.

Functional Requirements

1. Program Start and QR Code Scan

User is prompt to scan the QR code which contain information for Swift bot to process and draw shape (Shape & dimensions).

* QR Code must follow these formats

For square it should follow S-side (S-16).

For triangle it should follow T-side1-side2-side3 (T-16-30-24).

* The QR code can contain multiple shapes separated by a symbol of '&'.

Example: S-16 & T-16-30-24

* A maximum of 5 shapes can be specified in one QR code.

1. Shape Validation and Analysis

After extracting data, it should first recognize the shape S or T.

If squares it need to extract the side length and ensure it is within the valid range. (15-85 cm)

In case triangles extract the three side lengths and verify they satisfy the triangle inequality theorem of **a + b > c, a + c > b, and b + c > a and** Side lengths must be between 15 and 85 cm.

For valid triangles, calculate the angles before drawing by cosine rule (**c^2=a^2+b^2−2abcosC).**

1. Drawing the Shape

* Shape Drawing Process

For square Swift Bot moves forward by the given side length in cm and makes 90° turns four times to complete four sides.

For triangle robot draws each side and makes appropriate turns based on calculated angles by the Cosine rule.

* Drawing Multiple Shapes

If there are multiple shapes, the robot moves 15 cm backwards from its end position of previous shape before drawing the next shape in the QR code.

* Speed and Timing

The Swift Bot wheels move at a low speed to complete drawing in approx. 30 Sec.

The duration for each shape is based on speed calibrated according to the lengths of the side.

* Feedback

Before drawing a shape, the program displays which shape will be drawn on command-line interface (CLI).

When completed, the Swift Bot blinks its undelights in green to indicate successful.

1. User Termination

* User can terminate the program at any time by pressing the ‘X’ button on the Swift Bot.
* When terminated, the program halts all operations and displays a "Program Terminated" message.

1. Successful completion

* After completing a shape, the program prompts the user to:
* Redraw the same shape
* Scan new QR code
* Exit program

1. Summary

* When the ‘X’ button is pressed by the user, the program writes the following information to a text file:
* Names and sizes of all drawn shapes, angles of triangles, and the time taken to draw each shape in the order they were drawn.
* Largest shape (by area) and its size.
* Most frequently drawn shape and its count.
* Average time taken to draw shapes (No of Shape/ Total Time).
* Displays the file path where the log file is saved before termination.

Non-Functional Requirements

1. Performance

* Program responds to QR code scans and shape drawing commands within 10 seconds.
* Shape drawing is completed within a reasonable time (no more than 30 seconds for one shape).

1. Reliability

* System recovers from errors and provides clear feedback to the user.

1. Usability

* Command-line interface is easy to use, with clear outputs and instructions.

1. Scalability

* Program is easily extensible to support more shapes with minimal code changes or by adding user-defined functions.

Error Handling

1. **Input Validation Enhancement**

* **Invalid QR Code**:

Reject QR codes that don’t match the required format or contain unrecognized shapes (S-16 or T-18-12-18).

Example error message: “Error: QR code format is invalid. Please ensure it contains valid format (e.g., S-16 or T-16-30-24).”

* **Out-of-Range Dimensions**:

Inform the user when shape dimensions are out of the accepted range (15–85 cm).

Error message (e.g., “Side lengths must be between 15 and 85 cm. Please try again.”).

* **Invalid Triangle Dimensions**:

If the Triangle Inequality Theorem is not satisfied, provide detailed feedback:

Example: “Error: The lengths T1, T2, and T3 do not satisfy the Triangle Inequality Theorem.”

1. **Shape Drawing Errors**:

* If the bot encounters an issue while drawing.

Example: “Error: Drawing Stopped. Please check Swift Bot and retry.”

1. **QR Code Scanning Errors**:

* Handle where the QR code scanner fails or malfunctions:

Example: “Error: Unable to read QR code”.

Additional Features

1. Movement Status Indicator

* The Swift Bot’s status indicator (e.g., LED light) changes colour based on its state:
* Red when stationary.
* Green during movement.

Purpose: As the program is not able to detect obstacles so with this indication it would decrease the probability of an error due to a physical distribution.

1. Speed Adjustment Option

* Allow the user to manually adjust the speed of the Swift Bot before drawing.
* High Speed
* Low Speed
* Speed

Purpose: Gives user freedom if he found the speed slow, he could increase.

# **ALGORITUM DESIGN**

Main Flowchart

A diagram of a flowchart

AI-generated content may be incorrect.

Processing QR

A screenshot of a computer

AI-generated content may be incorrect.

Shape Check checks whether the shape corresponds to a triangle or square by checking the QR index. If it is a triangle, the name is set to “Triangle.” If it is a square, the name is set to “Square.”

It evaluates the values of the QR code (index T and Sq) that it follows the format (S-16 OR T-12-24-14), and the lengths are in range. Based on the outcome, L1, L2, and L3 are updated. If all conditions are met, Data is set to True.

Draw Square

A screenshot of a computer

AI-generated content may be incorrect.

Draw Triangle

A screenshot of a computer screen

AI-generated content may be incorrect.

Multi Shape

A screenshot of a computer

AI-generated content may be incorrect.

No of Shape checks if the number of shapes to be drawn equals 5. If yes, it prompts the user “max shapes drawn".

QR (Multi) checks whether it is a multi-shape QR by checking the index (Multi = &). If true, the process sets “Shape Left” to “True” and ends the process.

Summary

A screenshot of a phone

AI-generated content may be incorrect.

# **USER INTERFACE**

Start

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Swift Bot Shape Drawing Program

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Welcome to Swift Bot Shape Drawing!

Press 'S' to Start

Press 'X' to Exit the program

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QR Code Scan Prompt

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Scan QR Code

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Please scan the QR code to define the shape(s) for Swift Bot to draw

Square (e.g., S-16 for a square with side 16 cm)

Triangle (e.g., T-16-30-24 for a triangle with sides 16, 30, and 24 cm)

Multiple Shapes (e.g., S-16&T-16-30-24)

======================================================================

Press 'Q' to scan QR code

Press 'X' to Exit

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Shape Completion

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Shape Drawing Complete

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- Redraw the same shape? -

- Press R-

- Scan a new QR code? -

-Press S-

- Exit the program? Press 'X'-

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Terminated

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Program Terminated

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…Logging information...

Shapes drawn:

Shape 1: Square (S-16)

Shape 2: Triangle (T-16-30-24)

The largest shape (by area) is: Square (S-16)

The most frequently drawn shape: Square (S-16)

Average time taken: 30 seconds per shape

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Log saved at: /path/to/log.txt

======================================================================

Error Handling:

Invalid QR format

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Process Stopped

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--Error--

--QR code format is invalid--

--Please ensure it contains valid shape data (e.g., S-16 or T-16-30-24)--

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--Please rescan the QR code--

====================================================================

Out of Range

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Process Stopped

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--Error--

-- Side lengths must be integers between 15 and 85 cm--

-- Please try again--

====================================================================

--Please rescan the QR code--

====================================================================

Bot Drawing Error

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Process Stopped

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--Error--

--Drawing interrupted--

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-- Please check Swift Bot and retry--

Scanning Error

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Process Stopped

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--Error--

--Unable to read QR code--

====================================================================

Please try again

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# **PLANNING**

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| --- | --- |
| **Time** | **Progress** |
| Dec - Week 1 | Had a meeting with group members to discuss the leader & topic disruption. |
| Dec - Week 2 | Confirmed Topics selected by each member and informed our tutor about it |
| Dec - Week 3 | Requirement Analysis – Went through the description & had the first draft of requirements. |
| Jan - Week 1 | EXAM preparation |
| Jan - Week 2 | EXAM preparation |
| Jan - Week 3 | EXAM preparation |
| Jan - Week 4 | Requirements completion and improvisation onto flow charts and started design of user interface. |
| Feb - Week 1 | Received feedback from module leaders and personal Tutor. Tried to restructure the flow chart and user interface according to their feedback. Layout the whole document. |

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