

Table of contents

| | |
|---|-----------|
| 1.0 Introduction | 1 |
| 1.1 Goals and objective | 1 |
| 1.2 Background | 2 |
| 1.3 Report overview | 3 |
| 2.0 System overview | 5 |
| 2.1 System requirement | 5 |
| 2.2 System specification | 5 |
| 2.2.1 Input reading | 5 |
| 2.2.2 Geometry drawing | 5 |
| 2.2.3 Initialize GUI parameters and queues | 6 |
| 2.2.4 Simulate queues | 6 |
| 2.2.5 Statistical recording | 6 |
| 2.3 User inputs | 6 |
| 2.4 Changes in project | 7 |
| 2.4.1 Input change | 7 |
| 2.4.2 Function change | 8 |
| 3.0 System Architecture | 9 |
| 3.1 Functional Decomposition | 9 |
| 3.2 DFD | 9 |
| 3.3 Behavioral Model | 9 |
| 4.0 System Design | 11 |
| 4.1 Function | 11 |
| 4.1.1 Initialize System | 11 |
| 4.1.2 Draw Interface | 11 |
| 4.1.3 Get User Input | 12 |
| 4.1.4 Draw Geometry | 12 |
| 4.1.5 Simulate Queue | 12 |
| 4.1.6 Increase cars | 12 |
| 4.1.7 Assign color code and time for each car | 13 |
| 4.1.8 Decrease cars | 13 |
| 4.1.9 Calculate queue length | 13 |
| 4.1.10 Calculate waiting time | 13 |
| 4.1.11 Store statistics in file | 13 |
| 4.2 Stores | 14 |
| 4.2.1 Traffic Light Sequence | 14 |
| 4.2.2 Car queues | 14 |
| 4.2.3 Arrival Rate | 14 |

| | | |
|------------|---|-----------|
| 4.2.4 | Running time | 14 |
| 4.2.5 | Time interval | 15 |
| 4.2.6 | Number of lanes | 15 |
| 4.2.7 | Average departure time per car | 15 |
| 4.2.8 | Increase status (Queue Length Accumulator) | 15 |
| 4.2.9 | Decrease status (Waiting times accumulator) | 15 |
| 4.2.10 | Max, Min and Average queue length | 16 |
| 4.2.11 | Max, Min and Average waiting time | 16 |
| 5.0 | Implementation | 17 |
| 5.1 | Development platform | 17 |
| 5.1.1 | Header files | 17 |
| 5.2 | Model Algorithms | 18 |
| 5.2.1 | Poisson Distribution Model | 18 |
| 5.2.2 | Normal distribution algorithm | 18 |
| 5.3 | Interface design | 20 |
| 5.4 | Output/input example | 21 |
| 5.4.1 | Input | 21 |
| 5.4.2 | Output | 23 |
| 5.5 | Simulation algorithm | 24 |
| 5.6 | Implementation Issues | 25 |
| 5.5.1 | FLTK classes | 25 |
| 5.5.2 | Drawing the car queues | 25 |
| 5.5.3 | Average Departure time | 25 |
| 6.0 | Testing | 26 |
| 6.1 | Verification | 26 |
| 6.2 | Validation | 26 |
| 6.2.1 | Test case 1 | 27 |
| 6.2.2 | Test case 2 | 27 |
| 6.2.3 | Test case 3 | 27 |
| 6.2.4 | Test case 4 | 28 |
| 6.3 | Test conclusion | 28 |
| 7.0 | Documentation | 29 |
| 7.1 | Interface overview | 30 |
| 7.1.1 | Time counter | 30 |
| 7.1.2 | Time interval | 30 |
| 7.1.3 | Average Arrival Rate | 30 |
| 7.1.4 | Running time | 30 |
| 7.1.5 | Number of lanes | 31 |
| 7.1.6 | Queue vale output | 31 |
| 7.1.7 | Visual environment | 32 |
| 7.1.8 | Control buttons | 32 |
| 7.1.9 | Average Departure time per car | 33 |

| | |
|---|------------|
| 7.2 Operation Overview | 33 |
| 8.0 Project discussion | 34 |
| 8.1 Summary of work | 34 |
| 8.2 Constraints | 35 |
| 8.2.1 Two Lane limit | 35 |
| 8.2.2 Drawn cars limit | 35 |
| 8.2.3 Traffic Light Sequence Manually validated | 35 |
| 8.2.4 Crossroad junction | 35 |
| 8.2.5 One distribution model for each queue | 35 |
| 8.3 Future enhancements: What can be added to achieve perfection | 36 |
| 8.3.1 Different distribution model for each queue | 36 |
| 8.3.2 AI for the traffic sequences | 36 |
| 8.3.3 Different types of traffic junctions with variable lanes | 36 |
| 8.3.4 City-sized traffic simulation | 36 |
| References | 37 |
| Appendix A: Old Requirements | A-1 |
| Appendix B: Old Specifications | A-2 |
| Appendix C: Poisson Algorithmic Code | A-3 |
| Appendix D: Normal Distribution Code | A-4 |
| Appendix E: Program code and Visual C++[®] files | A-5 |