

Team Noble

Software Quality Assurance Report

Project – Electrification of STM bus route 211 from Terminal McDonalds to Lionel-Groulx

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**Date of Issue – April 28th, 2020**

Table of Content

[1. Introduction 2](#_Toc39005745)

[2. Purpose 2](#_Toc39005746)

[3. Review Report of Software Requirement Specifications 3](#_Toc39005747)

[4. Review Report of Software Development Plan 3](#_Toc39005748)

[5. Review Report of Software Design Specification 4](#_Toc39005749)

[6. Review Report of Test Cases 4](#_Toc39005750)

[7. Review Report of Final Product 15](#_Toc39005751)

[8. Conclusion 16](#_Toc39005752)

# Introduction

This document consists of report of Software Quality Assurance activities for electrification of STM bus route 211 from terminus McDonalds to Terminal Lionel-Groulx.

The document is organized in the following sections:

1. Purpose
2. Review Report of Software Requirement Specifications (SRS)
3. Review Report of Software Development Plan
4. Review Report of Software Design Specifications
5. Review Report of Test Cases
6. Review Report of Final Product
7. Conclusion

# Purpose

We have developed the software that will help the STM Team of Montreal to plan the electrification of bus route 211 in their system i.e. from Lionel-Groulx to Sainte-Anne/Terminus McDonals. The software w provides the optimal number of buses and chargers to be obtained in order to electrify the bus route 211. Therefore, in order to develop this software with good quality certain quality assurance planned as describe in software quality assurance plan document so, this document contain the report of activities involved to ensure the quality of developed software.

# Review Report of Software Requirement Specifications

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| --- | --- |
| Details of Review Meeting | |
| Date of Meeting | January 28th 2020 |
| Meeting Organized by | Manager |
| Attendees | Gurpreet Kaur, Daniel, Manager, Fellow classmates |

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| **Review Record** | | | | |
| Name of Activity for which review meeting is planned for. | Date of meeting | Date Approved | Comment | Signature |
| For reviewing the SRS document | 28Th Jan, 2020 |  | 1) There was no option through which user can select the manufacture of chargers.  2) There was no option for users to enter the price for both chargers (slow speed, high speed).  3) Design of charging schedule, bus schedule was missing |  |

# Review Report of Software Development Plan

|  |  |
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| Details of Review Meeting | |
| Date of Meeting | February 3rd 2020 |
| Meeting Organized by | Noble Team (Yu, Gurpreet, Daniel) |
| Attendee | Noble Team, Manager |

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| **Review Record** | | | | |
| Name of Activity for which review meeting is planned for. | Date of meeting | Date Approved | Comment | Signature |
| For reviewing the SDP document | 3rd Feb, 2020 |  | 1) details under product and deliverables needs to be update because final deadline is postponed. |  |

# Review Report of Software Design Specification

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| Details of Review Meeting | |
| Date of Meeting | February 15th 2020, February 30th 2020 |
| Meeting Organized by | Noble Team (Yu, Gurpreet, Daniel) |
| Attendee | Noble Team |

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| **Review Record** | | | | |
| Name of Activity for which review meeting is planned for. | Date of meeting | Date Approved | Comment | Signature |
| For reviewing the preliminary design document | 15th Feb, 2020 |  | 1) Policies for algorithm were missing. |  |
| For reviewing the detail design document | 30th Feb, 2020 |  | 2) Algorithm missed certain criteria like utilization of battery |  |

# Review Report of Test Cases

|  |  |  |
| --- | --- | --- |
| Test case Name | Unit case Bus | |
| Name of state class | Battery | |
| Name of the states | stateOfCharging | |
| Scenario | We create one bus That has a battery with capacity of 300Kwh. Then we do the following methods: | |
| Expected results |  | StateOfCharging |
| Taveling | 260Kwh |
| TravelingEmpty | 220Kwh |
| FastCharging | 227 |
| overNightCharging | 300 |
| Review Commands | For three times it has problems with chargers and travelling empty. then it is solved | |
| Test Case Status | Pass | |

|  |  |
| --- | --- |
| Test case | Integration Test |
| Name of state class |  |
| Name of the states | stateOfCharging |
| Scenario | For integrated Testing we are using the random testing. The way is that we put one simple symmetric schedule in the software and then the we see the results. Because it is symmetric, we can calculate the everything with hand.  This is the schedule for west and east  05,00,00 05,30,00 08,30,00 10,30,00 12,30,00 14,00,00 16,00,00 18,00,00 19,30,00 21,30,00 |
| Expected Results | |
| AT\_SOCkm Charger\_ID Start\_Time\_quickCharg End\_Time\_quickCharge AT\_SOC(ON) Charger\_ID2 Start\_Time\_overnight End\_Time\_overnight BT\_SOC\_trip Trip\_ID Start\_Time\_Trip End\_Time\_Trip Reach  l 294 east05:00:00 05:00:00 06:00:00 east  254km east2OC450kw 06:00:00 06:01:00 261 west08:30:00 08:30:00 09:30:00 west  221km west1OC450kw 09:30:00 09:31:00 229 east10:30:00 10:30:00 11:30:00 east  189km east2OC450kw 11:30:00 11:31:00 196 west12:30:00 12:30:00 13:30:00 west  156km west1OC450kw 13:30:00 13:31:00 164 east14:00:00 14:00:00 15:00:00 east  124km east2OC450kw 15:00:00 15:01:00 131 west16:00:00 16:00:00 17:00:00 west  91km west1OC450kw 17:00:00 17:01:00 99 east18:00:00 18:00:00 19:00:00 east  59km east2OC450kw 19:00:00 19:01:00 66Km east3DC50KW 19:01:00 00:01:00 end of trip  bus ID: 2east05:00:00  AT\_SOCkm Charger\_ID Start\_Time\_quickCharg End\_Time\_quickCharge AT\_SOC(ON) Charger\_ID2 Start\_Time\_overnight End\_Time\_overnight BT\_SOC\_trip Trip\_ID Start\_Time\_Trip End\_Time\_Trip Reach  0km 294 west05:00:00 05:00:00 06:00:00 west  254km west1OC450kw 06:00:00 06:01:00 261 east08:30:00 08:30:00 09:30:00 east  221km east2OC450kw 09:30:00 09:31:00 229 west10:30:00 10:30:00 11:30:00 west  189km west1OC450kw 11:30:00 11:31:00 196 east12:30:00 12:30:00 13:30:00 east  156km east2OC450kw 13:30:00 13:31:00 164 west14:00:00 14:00:00 15:00:00 west  124km west1OC450kw 15:00:00 15:01:00 131 east16:00:00 16:00:00 17:00:00 east  91km east2OC450kw 17:00:00 17:01:00 99 west18:00:00 18:00:00 19:00:00 west  59km west1OC450kw 19:00:00 19:01:00 66Km west4DC50KW 19:01:00 00:01:00 0 null null null  bus ID: 3west05:30:00  AT\_SOCkm Charger\_ID Start\_Time\_quickCharg End\_Time\_quickCharge AT\_SOC(ON) Charger\_ID2 Start\_Time\_overnight End\_Time\_overnight BT\_SOC\_trip Trip\_ID Start\_Time\_Trip End\_Time\_Trip Reach  0km null 294 east05:30:00 05:30:00 06:30:00 east  254km east2OC450kw 06:30:00 06:31:00 261 west19:30:00 19:30:00 20:30:00 west  221km west1OC450kw 20:30:00 20:31:00 229 east21:30:00 21:30:00 22:30:00 east  End of trip  bus ID: 4east05:30:00  AT\_SOCkm Charger\_ID Start\_Time\_quickCharg End\_Time\_quickCharge AT\_SOC(ON) Charger\_ID2 Start\_Time\_overnight End\_Time\_overnight BT\_SOC\_trip Trip\_ID Start\_Time\_Trip End\_Time\_Trip Reach  294 west05:30:00 05:30:00 06:30:00 west  254km west1OC450kw 06:30:00 06:31:00 261 east19:30:00 19:30:00 20:30:00 east  221km east2OC450kw 20:30:00 20:31:00 229 west21:30:00 21:30:00 22:30:00 west | |
| Review Commands | We used this testing as a smoke testing since all information in this are important. So we used this one daily. |
| Test Case status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Normal Usage |
| Use case ID | UC – 1 |
| Description | In this test will check the output of the software when user provides all the necessary inputs as mentioned in precondition. |
| Precondition | User should provide inputs like  manufacture for charger,  price for both slow speed and high-speed charger,  Please input the kind of battery,  Please input the price of bus |
| Expected Result | Software should display number of buses,  number of both types of charger at both terminuses, and total price and generate three files (bus schedule, charging schedule, state of chargers along with bus schedule) |
| Review Comments | Software showed the expected result, it displays number of buses, number of both types of charger at each terminus needs to buy and total price needs to be invested by system. Also generated three files showing the details of charging schedule, bus schedule. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate Allotment of Buses (charger type is ABB and Battery size is small) |
| Use case ID | UC – 2 |
| Description | In this test will validate the allotment of buses by validating the bus schedule file generated by software when battery size is small and charger type is ABB |
| Precondition | User should provide inputs like  manufacture for charger,  price for both slow speed and high-speed charger,  Please input the kind of battery,  Please input the price of bus |
| Expected Result | Bus schedule file should show allotment of 19 buses |
| Expected Result | Verify the file generated for the allotment of buses. After every trip utilization battery gets reduced by 40 and then time between next trip is less than 20 and battery remaining is greater than 90 then, there is no need of charging. If battery remaining is less than 90 and next trip is within 10 minutes, then new bus will get added to the system. And if, waiting time is greater than 20 minutes and battery remaining is greater than 90 then, bus will charge with high speed charger.  And ABB charger charge the battery up to 7 units in 1 minute. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate Allotment of Buses (charger type is ABB and Battery size is big) |
| Use case ID | UC – 3 |
| Description | In this test will validate the allotment of buses by validating the bus schedule file generated by software when battery size is big and charger type is ABB |
| Precondition | User should provide inputs like  manufacture for charger,  price for both slow speed and high-speed charger,  Please input the kind of battery,  Please input the price of bus |
| Expected Result | Bus schedule file should show allotment of 24 buses |
| Review Comments | Verify the file generated for the allotment of buses. After every trip utilization battery gets reduced by 40 and then time between next trip is less than 20 and battery remaining is greater than 90 then, there is no need of charging. If battery remaining is less than 90 and next trip is within 10 minutes, then new bus will get added to the system. And if, waiting time is greater than 20 minutes and battery remaining is greater than 90 then, bus will charge with high speed charger.  And ABB charger charge the battery up to 7 units in 1 minute. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate Allotment of Buses (charger type is HELIOX and Battery size is small) |
| Use case ID | UC - 4 |
| Description | In this test will validate the allotment of buses by validating the bus schedule file generated by software when battery size is small and charger type is HELIOX |
| Precondition | User should provide inputs like  manufacture for charger,  price for both slow speed and high-speed charger,  Please input the kind of battery,  Please input the price of bus |
| Expected Result | Bus schedule file should show allotment of 23 buses |
| Review Comments | Verify the file generated for the allotment of buses. After every trip utilization battery gets reduced by 40 and then time between next trip is less than 20 and battery remaining is greater than 90 then, there is no need of charging. If battery remaining is less than 90 and next trip is within 10 minutes, then new bus will get added to the system. And if, waiting time is greater than 20 minutes and battery remaining is greater than 90 then, bus will charge with high speed charger.  And HELIOX charger charge the battery up to 5 units in 1 minute. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate Allotment of Buses (charger type is HELIOX and Battery size is small) |
| Use case ID | UC - 5 |
| Description | In this test will validate the allotment of buses by validating the bus schedule file generated by software when battery size is small and charger type is HELIOX |
| Precondition | User should provide inputs like  manufacture for charger,  price for both slow speed and high-speed charger,  Please input the kind of battery,  Please input the price of bus |
| Expected Result | Bus schedule file should show allotment of 17 buses |
| Review Comments | Verify the file generated for the allotment of buses. After every trip utilization battery gets reduced by 40 and then time between next trip is less than 20 and battery remaining is greater than 90 then, there is no need of charging. If battery remaining is less than 90 and next trip is within 10 minutes, then new bus will get added to the system. And if, waiting time is greater than 20 minutes and battery remaining is greater than 90 then, bus will charge with high speed charger.  And HELIOX charger charge the battery up to 5 units in 1 minute. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate input format for first input |
| Use case ID | UC - 6 |
| Description | In this test will validate the input format for first input of our software which is “please enter the manufacture of charger (ABB/HELIOX)”. This field should accept only these two values. |
| Precondition | User should provide input either ABB or HELIOX |
| Expected Result | Upon provided the input, which is either ABB or HELIOX only then, software should accept the input else give error message and stop the flow. |
| Review Comments | Software has certain validation applied while taking input from user. Here if user provides any other input (other than ABB/HELIOX). It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate input format for second input |
| Use case ID | UC - 7 |
| Description | In this test will validate the input format for second input of our software which is “please input the price of over-night charger”. This field should accept only numeric values. |
| Precondition | User should provide input only in numerical format |
| Expected Result | Upon provided the input, which is number value only then, software should accept the input else give error message and stop the flow. |
| Review Comment | Software has certain validation applied while taking input from user. Here if user provides any other input (other than number). It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate input format for third input |
| Use case ID | UC - 8 |
| Description | In this test will validate the input format for third input of our software which is “please input the price of fast charger”. This field should accept only numeric values. |
| Precondition | User should provide input only in numerical format |
| Expected Result | Upon provided the input, which is number value only then, software should accept the input else give error message and stop the flow. |
| Review Comment | Software has certain validation applied while taking input from user. Here if user provides any other input (other than number). It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

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| --- | --- |
| Use Case Name | Validate input format for fourth input |
| Use case ID | UC - 9 |
| Description | In this test will validate the input format for fourth input of our software which is “please input the “kind of battery: small(294kwh), big(394kwh)”. This field should accept either small or big. |
| Precondition | User should provide string input which should be either small or big. |
| Expected Result | Upon provided the input, which is either ABB or HELIOX only then, software should accept the input else give error message and stop the flow. |
| Review Comment | Software has certain validation applied while taking input from user. Here if user provides any other input (other than small/big). It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate input format for fifth input |
| Use case ID | UC - 10 |
| Description | In this test will validate the input format for fifth input of our software which is “please input the price of bus”. This field should accept only numeric values. |
| Precondition | User should provide input only in numerical format |
| Expected Result | Upon provided the input, which is number value only then, software should accept the input else give error message and stop the flow. |
| Test Case Status | Software has certain validation applied while taking input from user. Here if user provides any other input (other than number). It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

|  |  |
| --- | --- |
| Use Case Name | Validate input format for second, third and fifth input should not be too large nor zero |
| Use case ID | UC - 11 |
| Description | In this test will validate the input format for second, third and fifth input of our software which is “please input the price of over-night charger, fast charger and price of bus. This field should accept only numeric values that should be neither too long nor zero. |
| Precondition | User should provide input only in numerical format |
| Expected Result | Upon provided the input, which is number value greater than zero, non-negative number, number not too large only then, software should accept the input else give error message and stop the flow. |
| Review Comment | Software has certain validation applied while taking input from user. Here if user provides inputs which will be zero or too large (greater than 50000) or negative number. It will display the message saying that please provide valid input. |
| Test Case Status | Pass |

# Review Report of Final Product

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| Details of Review Meeting | |
| Date of Meeting | April 21st 2020 |
| Meeting Organized by | Manager |
| Attendee | Noble Team (Yu, Gurpreet, Daniel), manager, Fellow classmates |

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| **Review Record** | | | | |
| Name of Activity for which review meeting is planned for. | Date of meeting | Date Approved | Comment | Signature |
| For reviewing the final product | 21st Apr, 2020 |  | 1) Algorithm for software was good.  2) it was console based, display should have GUI |  |

# Conclusion

This document review report of all the work did in the project to create simulation software for electrifying the STM bus route 211 from Lionel-Groulx to McDonalds. All the review comments noted for each document referred to create final documents. For example, there was comment while reviewing the final product that GUI for software display was missing initially software, we developed was console based. So, we update the code and added GUI for displays. Snippet of display was there in requirement specification document. Also, we have used earn value technique for tracking the schedule (details are in software development plan document, already submitted), at first, we spent less time for modelling, and we did not have technical review for the design so we were ahead of schedule. Then in the coding we spent a lot of time for construction and we became behind the schedule. So, we found that if we spent more time on review and designing, our results is going be so much better.

For the future works we can use JavaScript to make it as a Web application. We also can extend this software for the several schedule in same time.