



American International University-Bangladesh (AIUB)

Department of Computer Science

Faculty of Science & Technology (FST)

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Section: B

Software Quality Assurance and Testing

Smart Public Transport Monitoring System

Report submitted

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Software Test Plan

for

<Public Transport Monitoring >

Version 1.0 approved

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<ABC>

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Revision History

Revision	Date	Updated by	Update Comments
0.1	2021.04.29	Saima Zeba Esha	First Draft

1. TEST PLAN IDENTIFIER: TP_SPTMS_01.0

2. REFERENCES

- Software testing model: [Software Testing Models | 6 Types of Software Testing Models | Edureka](#)
- Test Tools: [IBM i Testing, AS/400 \(IBM i, iSeries, Power Systems\) Testing, Jagacy, Selenium with Autolt, Unified Functional Testing \(UFT\) \(srinsofttech.com\)](#)

3. INTRODUCTION

Background to the Problem

- Road safety is one of the major issues in developing countries, 1.24 million annual deaths, 20 to 50 million non- fatal injuries are costing low to middle income countries between 1- 2% of their GDP at about US\$100 billion. Public transports like Buses or Mini buses are highly unregulated in developing countries, which is causing loss of life or injury through accidents. In addition, bad behavior, unfair fare, reckless driving, passenger pickup etc. are common in these countries and almost all the passengers are unsatisfied with the public service. The purpose of this project is to minimize this problem.
- Through numerous research and survey, it is evident that the root cause of this problem is lack of regulation on public transports like buses. Many drivers lack the required skills and documentation to be in charge of public buses, on top of that, this lack of documentation also leads to many harassments for the passengers including severe cases like rape or killing. Buses themselves also lack documentation for fitness and route permit etc. Traffic rules are not obeyed by the bus drivers and this lack of regards for the rules is causing many accidents. Traffic signals like red or green lights are not regulated in most developing countries and also fixed bus stops are not maintained. This leads to buses running over passengers on bus stops and very risky passenger pickups with high speed. Buses also take passengers by stopping the vehicle on the middle of the road, which causes massive traffic jams. Traffic congestion in Dhaka eats up around 5 million working hours' worth Tk 20,000 to Tk 55,000 Crore according to BUET studies. Speeding is also a massive cause of accidents which is responsible for 53 per cent accidents.

Power and Participation Research Centre researched and compiled a report about concerns of road safety in Bangladesh. From the reports we can see that the most amount of deaths occurred by buses (38.01%), and bus stands are the worst accident spot as 40.90% accidents happen in there. BRTA and BUET research shows that 53% accidents happen because of speeding and most heavy vehicles in Dhaka don't have licensed drivers. For more than 80,000 buses in Dhaka, there's only 11000 drivers that are given special certification to drive such public vehicles. Lack of monitoring and regulation is also causing severe crimes like rape or killing on public transports.

Solution to the Problem

- In this project, a probable solution is given to regulate the public transports on developing countries. GPS, IR sensor, GSM network, CPU, Smart Card reader would be used to create a unit device that will be mounted on every bus. This device coupled with the network swarm will validate driver and bus credentials through verifying their documents, detect speeding, violation of traffic lights, regulate bus stops and keep track of the bus's whereabouts through GPS. This will also create a network of all buses for better efficiency, passenger satisfaction and road safety. This solution is particularly appropriate to solve the problem as it targets all the major problems regarding public transport road safety. All the technologies used here are proven technologies and the cost of the solution is relatively lower than other solutions. According to BUET research, 50 to 70% of the losses occurred due to transport regulation can be fixed. So, implementing this solution on roads can save thousands of crores every year.
- The proposed device will hold the information of the bus, including fitness, license, route permit documents. This along with the driver data received from scanning the driver license of the driver, the system can verify if the bus and the driver is eligible to be on the road as a public transport service. This will ensure that driver and bus quality and also it will be easier to track and find responsible persons in case there is any crime committed.

Bus stops will be regulated highly as more than 40% road accidents happen there. Bus doors can only be opened when the bus is on a bus stop, or else a fine and an alert will be sent to the traffic control department automatically. In addition, speeding or traffic signal violation can also be detected and fined through GPS tracking data.

In order to increase passenger satisfaction, the system will also have some features where passengers can check and track buses from their mobile phone, also they can check fare and report any irregularities to the authority.

To make the drivers more service oriented, a driver point system will be introduced. Drivers will lose points by rules violation and negative passenger review, gain points by having clean working hours. High points can avail them of many perks and very low point can lead them lose their permission to drive public transports.
- There is no real software use in this problem area. Some countries are using part of the system in a scatter way, but a fully automated system is not available anywhere. Philippines has introduced GPS tracking system on their public transports, many countries have speed cam etc. However, mostly manual approach is used to regulate public transports which is highly inefficient.

4. REQUIREMENT SPECIFICATION

4.1 System Features

- 1. Connect bus to network

Functional Requirements

1.1 The unit device that will be mounted on every bus coupled with the network swarm will validate driver and bus credentials through verifying their documents, detect speeding, violation of traffic lights, regulate bus stops and keep track of the bus's whereabouts through GPS.

1.2 . This will create a network of all buses and buses to network after verification.

Priority Level: High

Precondition: device needs to hold the information of the bus, including fitness, license, route permit documents.

- 2. Verify driver details

Functional Requirements

2.1 The proposed device will hold the information of the bus, including fitness, license, route permit documents.

2.2 The driver data received from scanning the driver license of the driver, the system can verify if the bus and the driver is eligible to be on the road as a public transport service.

Priority Level: High

Precondition: the bus and the driver have to be eligible to be on the road as a public transport service.

- 3. Detect bus stop, traffic signal and speeding violation

Functional Requirements

3.1 Bus doors can only be opened when the bus is on a bus stop, or else a fine and an alert will be sent to the traffic control department automatically.

3.2 Speeding or traffic signal violation can also be detected and fined through GPS tracking data.

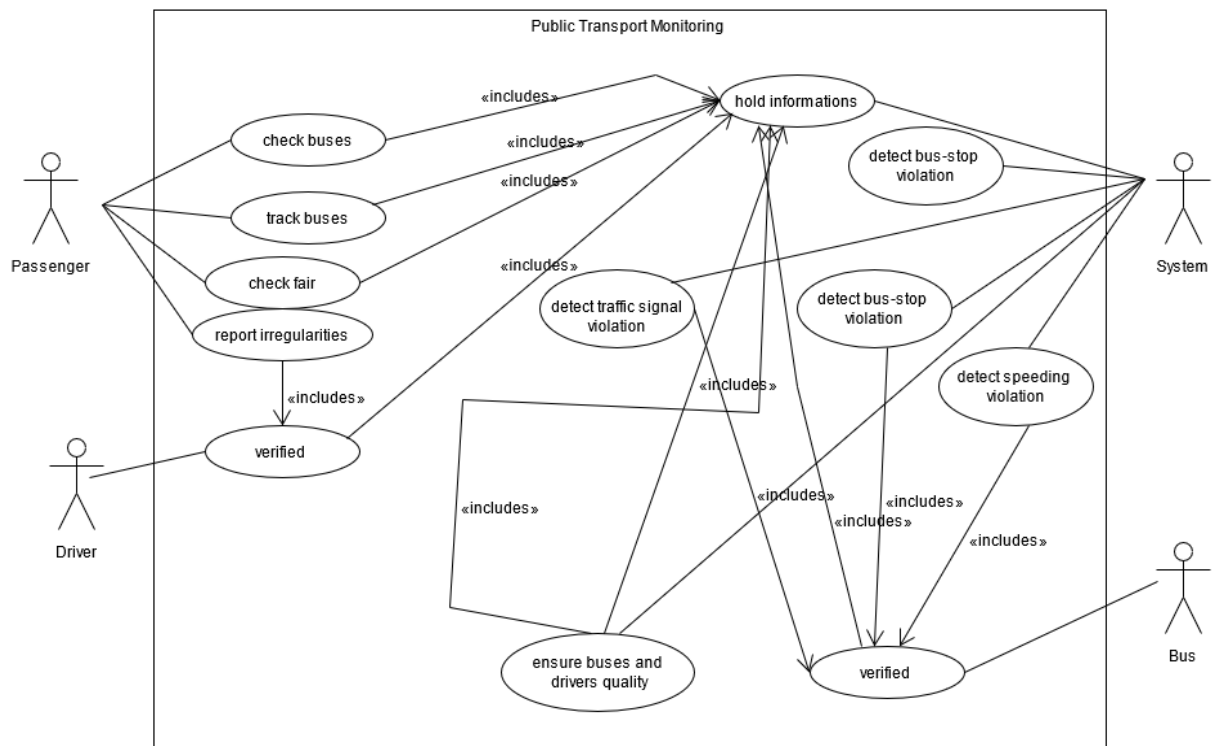
Priority Level: High

Precondition: the bus needed to be connected with GPS.

4.2 System Quality Attributes

- Usability: A user shall be able to check and track buses from their mobile phone, also they can check fare and report any irregularities to the authority. A driver point system will be introduced. Drivers will lose points by rules violation and negative passenger review, gain points by having clean working hours. High points can avail them of many perks and very low point can lead them lose their permission to drive public transports and system will keep track of user usability.
- Outcome: 50 to 70% of the losses occurred due to transport regulation can be fixed.

4.3 System Interface



4.4 Project Requirements

- Total Budget: 7,00,000BDT
- Total Development Time: 2 years
- Team: 1 project manager, 2 UI/UX designer, 3 front end developer, 5 developer, 2 technician and 1 full time tester and hire test team if needed.

5. FEATURES NOT TO BE TESTED

- Connection with the central traffic network
- Passenger interaction with the module
- Hardware related testing (GPS accuracy)
- Performance testing

6. TESTING APPROACH

6.1 Testing Levels

- As the software is used to regulate and fine public transports, the integrity of the system is the most important quality factor. The system has to be proofed against unauthorized tampering and access.
- As the software is a safety critical system, correctness has to be spot on.
- The system has to be reliable to ensure that proper regulation can be implemented every time the bus is on the road
- The system works with different hardware modules and systems like GPS, door sensors, network connection with the centralized system etc. System should be interoperable to work with all the different systems.

6.2 Test Tools

The only test tools to be used are the standard AS/400 provided utilities and commands.

- The AS/400 is easy to use and flexible. Because it is like windows command prompt. And the software is very lightweight. Here we can create our own menu and work with it. That's why it's easy to use and very efficient.

6.3 Meetings

The test team will meet 3 times in month for check. And this will occur on testing part after development. Although our permanent tester will test daily basis.

7. TEST CASES/TEST ITEMS

Project Name: Smart Public Transport Monitoring System		Test Designed by: MAHIA ISLAM		
Test Case ID: FR_001		Test Designed date: 19 January, 2021		
Test Priority (Low, Medium, High): High		Test Executed by: Saima Zeba Esha		
Module Name: Network connection and documents verification		Test Execution date: 29 February, 2021		
Test Title: Connect bus to network and check route permit and fitness papers				
Description: Verify bus details by checking route permit and fitness papers by connecting to central network				
Precondition: Bus has up to date fitness paper and route permit under its registration number				
Dependencies: None				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Press Start Button	Bus registration number: Dhaka Metro Gha 0216-02	Device should connect to central traffic network and verify documents details. Then red light should be turned to yellow light	As expected	Pass
Post Condition: Bus documents are validated with database and red light is turned into yellow light				

Test case-01:

Project Name: Smart Public Transport Monitoring System			Test Designed by: MAHIA ISLAM	
Test Case ID: FR_002			Test Designed date: 9 February, 2021	
Test Priority (Low, Medium, High): High			Test Executed by: Saima Zeba Esha	
Module Name: Verifying Driver Details			Test Execution date: 5 March, 2021	
Test Title: Verify the driver credentials through driving license				
Description: Scan driving license and check if the driver is eligible to drive the bus				
Precondition: Driving license has to have proper credential to be allowed to drive the bus				
Dependency: FR_001				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Scan Driving License	Driving License details	Verify license details with the database, if the driver is eligible then indicator light will be changed from yellow to green	As expected	Pass
Post Condition: Driver verified and the indicator light changed to green				

Test case-02:

Project Name: Smart Public Transport Monitoring System		Test Designed by: MAHIA ISLAM		
Test Case ID: FR_003		Test Designed date: 11 February, 2021		
Test Priority (Low, Medium, High): High		Test Executed by: Saima Zeba Esha		
Module Name: Bus stop violation		Test Execution date: 15 March, 2021		
Test Title: Detect if the bus door is opened outside any bus stops				
Description: Bus stop violation will be detected by plotting bus’s current location data with the bus stop locations from central network				
Precondition: Bus has to be in a location where no bus stop is plotted				
Dependency: FR_002				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Drive to the main road 2. Open bus door	Location: 23.857159, 90.386067 Door state: open	The system will detect bus stop violation and fine the bus according to the law. Also, an alarm beep will be raised to notify the driver.	As expected	Pass
Post Condition: Bus fined and an alarm is raised				

Test case-03:

Project Name: Smart Public Transport Monitoring System		Test Designed by: MAHIA ISLAM		
Test Case ID: FR_004		Test Designed date: 1 March, 2021		
Test Priority (Low, Medium, High): High		Test Executed by: MAHEDI HASSAN		
Module Name: Signal violation		Test Execution date: 1 April, 2021		
Test Title: Detect traffic signal violation				
Description: System will get light information as soon as the bus crosses a signal, if the light is red a fine will be added to the bus				
Precondition: Bus has to cross a location where red light was turned on				
Dependency: FR_002				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Drive the bus through a red light	Location 1: 23.857159, 90.386067 Time 1: 10.15.10 AM Location 2: 23.955462, 90.486565 Time 2: 10.16.20 AM Traffic Light: Red	A fine will be added according to law and an alarm will be raised to notify the driver	As expected	Pass
Post Condition: Bus fined and alarm raised				

Test case-04:

Test case-05:

Project Name: Smart Public Transport Monitoring System		Test Designed by: MAHIA ISLAM		
Test Case ID: FR_005		Test Designed date: 2 March, 2021		
Test Priority (Low, Medium, High): High		Test Executed by: Saima Zeba Esha		
Module Name: Speeding violation		Test Execution date: 5 April, 2021		
Test Title: Detect speeding				
Description: System will get speed limit information if a bus is on a road with a speed limit, if the bus goes over the speed limit a fine will be added to the bus and alarm will be raised until the driver slows down				
Precondition: Driving license has to have proper credential to be allowed to drive the bus				
Dependency: FR_002				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Break speed limit on a road	Location 1: 23.857159, 90.386067 Time 1: 10.15.10 AM Location 2: 23.955462, 90.486565 Time 2: 10.16.20 AM Speed limit: 60mph	After calculating speed by calculating GPS data, speeding will be detected. A fine will be added according to the law and continuous alarm will be raised until the bus slows down	As expected	Pass
Post Condition: Speeding detected, fine added and alarm raised				

Test case-06:

Project Name: Smart Public Transport Monitoring System		Test Designed by: MAHIA ISLAM		
Test Case ID: FR_006		Test Designed date: 3 March, 2021		
Test Priority (Low, Medium, High): High		Test Executed by: MAHEDI HASSAN		
Module Name: Emergency declaration		Test Execution date: 9 April, 2021		
Test Title: Declaring Emergency				
Description: In case of a unavoidable issue, driver can declare emergency, the traffic police will be notified and emergency offloading of passengers will be allowed (Bus stop detection disabled)				
Precondition: Driver has to be on the road				
Dependency: FR_002				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Drive to the road 2. Press Emergency Button 3. Open bus door	Location: 23.857159, 90.386067 Door state: Open	Bus stop violation should be disabled, door can be opened, a signal should be sent to central traffic system for assistance on the road for passengers.	As expected	Pass
Post Condition: Emergency signal was sent; door was allowed to open				

8. ITEM PASS/FAIL CRITERIA

- All test cases to be completed
- 100% of the test cases have to pass successfully without any major error.

9. TEST DELIVERABLES

- Test plan document
- Test cases
- Test design specifications
- Tools and their outputs
- Bug reports and execution logs
- Problem reports and corrective actions
- Test summary report

10. STAFFING AND TRAINING NEEDS

Staffing:

- Testers experienced with embedded safety critical systems
- Traffic law expert representative

Training:

- Training on the system
- Training for the test tools to be used
- Training on government laws regarding traffic rules

11. RESPONSIBILITIES

	TM	PM	Dev Team	Test Team	Client
Acceptance test Documentation & Execution	X	X		X	X
System/Integration test Documentation & Exec.	X		X	X	
Unit test documentation & execution	X		X	X	
System Design Reviews	X	X	X	X	X
Detail Design Reviews	X	X	X	X	
Test procedures and rules	X	X	X	X	
Screen & Report prototype reviews			X	X	X
Change Control and regression testing	X	X	X	X	X

The development team leader will be responsible for the verification and acceptance of all unit test plans and documentation. The project manager/test manager is responsible for all test plans and documentation. The entire project team will participate in the review of the system and detail designs as well as review of any change requests that are generated by the user or as a result of defects discovered during development and testing. The Government agency is also required to participate in the initial high-level system review. The government will provide a person, as required, throughout the project to verify test results and answer questions as they arise. This person will also be responsible for participating in the execution of the acceptance test plan.

12. TESTING SCHEDULE

Task	Members	Estimate effort
Create the test specification	Test Designer	270 person-hour
Perform Test Execution	Tester, Test Manager	200 person-hour
Test Report	Test Team	10 person-hour

Test Delivery	Test Team	20 person-hour
Total		500 person-hour

13. PLANNING RISKS AND CONTINGENCIES

- Safety: As it is a safety critical system with fine system, the margin for error is slim. If the system is not reliable enough, it may not be approved for use by the authority
- Training difficulties about laws: The development team needs to understand the traffic laws well to implement it on the system. Training may not be sufficient and some loop holes can be created
- Complex AI driven functions: The system has to learn from real life data to improve itself, coding a highly efficient learning agent can be very complex.
- Interoperability: The system is dependent on the central network system of all public transport, any problem with that project can lead to the failure of this embedded system project as well.
- Passengers and bus drivers may not find the system user friendly and usability issues can stop a bus from being running.
- Change of laws can be difficult to implement if the law is complex and requires change to the architecture of the entire system.

14. APROVALS

Project Manager- SAIMAZEBA ESHA	Approved
Test Lead- MAHEDI HASSAN	Approved
Development Manager- NAFIS KIBRIA	Approved
Analyst- NUSRAT ZAHAN PROKRITY	Approved
Govt Representative- MAHIA ISLAM	Approved