

Software Requirements Specification For NSTU Bus Tracking System

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1. Introduction

The introduction of the Software Requirements Specification (SRS) provides an overview of the entire SRS with purpose, scope, definitions, acronyms, abbreviations, references and overview of the SRS. The aim of this document is to gather and analyses then give an in-depth insight of the complete **NSTU Bus Tracking System** by defining the problem statement in detail. Nevertheless, it also concentrates on the capabilities required by stakeholders and their needs while defining high-level product features. The detailed requirements of the **NSTU Bus Tracking System** are provided in this document.

1.1 Purpose

The main purpose of this project is to provide the real time location and direction of the bus. Drivers can easily access and implement servicing schedules for the buses, which ensures are roadworthy at all times thus we will ensure a timely maintainable project.

1.2 Project Scope

We want to build a system which will track the current position and direction of the bus and show it to the user who wants to travel by the bus. The driver will share his location that's will show to the user the current position of bus. The system will reduce the waiting time for travelling.

1.3 Glossary

This subsection contains definitions of all the terms, acronyms, and abbreviations used in the document. Terms and concepts from the application domain are defined.

- API – Application Programming Interface
- SRS – Software Requirement Specifications
- UI – User Interface
- SDLC – Software Development Life Cycle
- DBMS – Database Management System

1.4 References

IEEE. IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications. IEEE Computer Society, 1998.

1.5 Overview

Travelling by bus to go for university is the most common thing and also a hassle for students and teachers waiting for the bus. Many times, students and teachers wait for the bus which is not available at that time and it might take a lot of time to reach University. Due to this problem many times they waste their precious time since they do not have the information about the alternative buses and many a times they get late for their exams. Therefore, this project is focusing to provide a solution to this problem by giving the proper and accurate information about the bus to the students and teachers.

We also ensure the necessary security of information and other processes.

2. User Classes and characteristics

There are three types of stakeholders in our “NSTU Bus Tracking System”. Such as:

Driver: Driver share their location which used to provide the user the current location of the bus.

Student: Student can get the current direction and location of the bus when they once logged in to the system.

Teacher: Teacher can get the current direction and location of the bus when they once logged in to the system.

3. Design and implementation constraints

Design and implementation constraints are those that we have used to implement this project make successful. It also describes tool that enables developers and testers to view and interact with the user interface (UI) elements of this application.

3.1 User Interface Technology

3.1.1 Programming Language

We will use Java as programming language to develop our application.

3.1.2 Database Server

We will use Firebase database server to store all of the information of this system. The reason behind to choose the database server are given below:

- Security
- Reporting and Data Mining
- Replication
- Fault tolerance
- Performance diagnostics

4. Requirement Specification

Before a system is designed and implemented, the requirements have to be specified in enough detail to make analysis and design possible. This is a big part of software engineering, especially for larger systems. The complete requirement specification based on the elicitation process is described in this section.

4.1 Functional Requirements

Every system must have some functional requirements. Functional requirement defines a system or its component. It describes the functions a software must perform. A function is nothing but inputs, its behavior, and outputs. It can be a calculation, data manipulation, business process, user interaction, or any other specific functionality which defines what function a system is likely to perform. Functional software requirements help to capture the intended behavior of the system. Now, we are going to mention functional requirements associating with our project.

Table 01: Show bus location in real time

FR-1	Show information to user in real time
Description	When the user request to system the location of the bus then it will show the current location of the bus.
Stakeholders	Student, Teacher, Driver
Priority	High

Table 02: Save real time location records of bus when driver start ride

FR-2	Save real time location records of bus when driver start ride
Description	When driver start ride the real time location records of bus will be stored on database so that later it will be process to ready for students and teachers so that they can see the bus location.
Stakeholders	Driver
Priority	High

Table 03: Allow user to retrieve information from mobile device

FR-3	Allow user to retrieve information from mobile device
Description	User can retrieve information from mobile device when they once logged in to the NSTU Bus Tracking System.
Stakeholders	Student, Teacher
Priority	High

Table 04: Verify the user with institutional email

FR-4	Verify the user with institutional email
Description	When user register to the system, a verification email will send to user institutional email.
Stakeholders	Student, Teacher, Driver
Priority	High

Table 05: Show the currently available bus location in a map

FR-5	Show the currently available bus location in a map
Description	When the user logged in to the system then system will show currently available buses location in the google map.
Stakeholders	Student, Teacher
Priority	High

Table 06: Save real time location of currently logged in users

FR-6	Save real time location of currently logged in users
Description	When user logged in to the system then the system will retrieve the user location using their device location.
Stakeholders	Student, Teacher
Priority	Medium

Table 07: Administrator manage all the user

FR-6	Administrator manage all the user
Description	Administrator will manage all the registered user and bus schedule as required.
Stakeholders	Administrator
Priority	High

Table 08: Emergency contact with administrator

FR-6	Emergency contact with administrator
Description	User can contact with administrator in any emergency situation.
Stakeholders	Driver
Priority	Medium

5.2 Data Requirements

For defining data requirements, we need to build the model. For our application maximum data would be loaded from remote user. And for that purpose, we need to focus on some major points. Such as:

- Types of entity of the system
- Route data locations
- Capacity and resources of the data requirements
- Data source sequence
- Data availability schedules
- Quantity of data
- Availability of data

5.3 Performance Requirements

It is very important to maintain performance of any software system. To ensure performance, we need to maintain some steps. Now, I will explain some perspective by which we are going to enhance the performance of our project.

5.3.1 Speed & Latency Requirements

Speed and latency requirements must be ensured while retrieving data from the bus positioning module.

Table 09: Showing the bus location in a map view must be faster

SLR-1	Showing the bus location in a map view must be faster
Description	When the user request to system the location of the bus then the system will provide the current location within 1 second.
Stakeholders	Student, Teacher
Priority	High

5.3.2 Precision & Accuracy Requirements

Result that is to be shown to the end user is need to be accurate. Because, wrong information might be ruined the whole business process.

Table 10: Showing the bus location in a map view must be accurate

PAR-1	Showing the bus location in a map view must be accurate
Description	When the system will provide the current location of the bus it must have to be accurate.
Stakeholders	Student, Teacher
Priority	High

5.3.3 Capacity Requirements

The developed system by us must be capable to handle user data, provide accurate information, handling database, manage http request etc.

Table 11: The system will handle thousands of data

CR-1	The system will handle thousands of data
Description	The system needs to handle data thousands of data every moment.
Stakeholders	Student, Teacher
Priority	High

5.4 Dependability Requirements

The term dependability is measured based on four dimensions. Such as:

- Availability
- Reliability
- Safety
- Security

If we want to say that our application system is dependable then it must fulfil the four dimensions. But there are other tasks. Like there is no way to make mistakes or our system should have the ability to detect and then remove errors. Besides that, it is also very important to limit the damage which might be caused by system failure.

5.4.1 Reliability & Availability Requirements

Now, we will mention requirements which are related to reliability and availability.

Table 12: The system must be available on time

RAR-1	The system must be available on time
Description	Our system must be available every day on time <ul style="list-style-type: none">• The system must be updated regularly• System must be malware free
Stakeholders	Student, Teacher
Priority	High

5.4.2 Robustness or Fault-Tolerance Requirements

To ensure robustness and fault-tolerance facilities to the end users, it is urgent to ensure 0% crash. Moreover, it must show accurate results.

Table 13: The system handles all user access without system errors

RFT-1	The system handles all user access without system errors
Description	Thousands of users might hit our application system at a time. All their requests must be handled without any fault.
Stakeholders	N/A
Priority	High

5.4.3 Safety-Critical Requirements

There are no safety-critical requirements in our project.

5.5 Maintainability & Supportability Requirements

It is very important to provide after service or support to the end users.

5.5.1 Supportability Requirements

Supportability requirements may have related to some extends. Like:

- Testability
- Extensibility
- Adaptability
- Maintainability
- Compatibility
- Configurability
- Serviceability
- Install ability

Our application meets all of the above requirements related to supportability.

5.5.2 Adaptability Requirements

There are no adaptability requirements in our application system.

5.6 Security Requirements

Making software security as a requirement is very important. Software security requirements should be its functional requirement. Software security enforces security of an application system. Functionality related to software security can either be directly tested or observed. Some security related requirements are given below:

- Signing in with an educational email in a student/teacher module
- Get access according to logged in user
- Signing out as a student/teacher
- Handling encrypted passwords

While accessing to the system, each and every module must provide a central authentication mechanism. There is also a process to prevent entering into the system by ensuring hashed password for the unauthenticated users.

5.6.1 Access Requirements

For accessing to our application system, there remains some authentication and authorization techniques. And every module of our system will provide it. Now we will provide an explanation below.

Table 14: Application provides security mechanism

AR-1	Application provides security mechanism
Description	Every module is designed in such a way that it only gives access to the authorized and authenticated users.
Stakeholders	Student, Teacher, Bus Driver
Priority	High

5.6.2 Integrity Requirements

Integrity requirements refers to a security system which ensures an expectation of data quality. It also ensures that all data of the system would never be exposed to the malicious modification or accidental destruction. For that reason, we will store our user passwords as encrypted format which is impossible to decrypt. It is also called hashed password.

5.6.3 Privacy Requirements

It is very important to ensure privacy of the system users. Privacy requirements enhances to protect stakeholder's privacy. In this way, all data or a partial part of data are going to be disclosed according to system's privacy policy. To ensure privacy, the central database should be protected by the anonymous. Users are permitted to get access to those data which are being associated by them which can be ensured by the user log in system.

5.7 Usability and Human-Interaction Requirements

The main target of developing any system is to make the system user friendly and easy to usable for the end users.

5.7.1 Ease of Use Requirements

Our application is easy to use and also easily understandable.

Table 15: Application must be usable for the end users

EUR-1	Application must be usable for the end users
Description	This app is enough usable to the teacher, student and bus driver by which they can operate this system easily.
Stakeholders	Student, Teacher, Bus Driver
Priority	High

5.7.2 Personalization and Internationalization Requirements

There are not any personalization and internationalization requirements to our system. This maiden version of our application is only be operated by Noakhali Science and Technology University.

5.7.3 Understand ability and Politeness Requirements

It is already said that the application which we are going to develop, is understandable enough. The system provides hints to users whether any error occurred or wrong. By reading those errors users can be able to operate the system easily.

5.7.4 Accessibility Requirements

There are no specific accessibility requirements associated to our system yet.

5.7.5 User Documentation Requirements

Documentation are mainly two types. One is internal documentation which is generally written by the application engineers. It is prepared to make development life cycle easier for the system engineers or system analysts.

Table 16: The system engineer documentation

UDR-1	The system engineer documentation
Description	To develop our application named “NSTU Bus Tracking System”, firstly we have made a system analysis team as well as documentation team.
Stakeholders	System analysts or software developers
Priority	Medium

5.7.6 Training Requirements

Training requirements involved in after service of any application. It is very necessary to properly train up end users to the system so that they would be capable to operate easily. After launching the full package to the market, firstly we provide training to the different end users like bus drivers, students and teachers.

5.8 Look and Feel Requirements

Look and feel requirements mainly refers how the system will look like and how the user interface or graphical user interface of our system will display to the user.

5.8.1 Appearance Requirements

Students and all other user must know which input fields are required and which are not. For that reason, we will use labels for all input fields. Input fields might be text type, radio, checkbox, spinner etc.

Table 15: Labels of mandatory fields must be bold

AR-1	Labels of mandatory fields must be bold
Description	The mandatory field's label must be bold and all input fields must have placeholder to make it easier for the users.
Stakeholders	Teacher, Student, Bus Driver
Priority	Medium

5.9 Operational and Environmental Requirements

Operational and environmental requirement refers to the capabilities, performance measurements, process, measurements of effectiveness, measurements of performance, measures of sustainability, measurements of technical performances etc.

5.9.1 Expected Physical Requirements

There are no expected physical requirements in our system.

5.9.2 Requirements for Interfacing with Adjacent Systems

There are no requirements for interfacing with adjacent system for our project.

5.9.3 Release Requirements

There are no specific release requirements in our system.

5.10 Legal Requirements

Legal requirements normally refer to the terms and conditions or privacy policy of any organizations. The terms and condition of our application is that, no third-party software or person are allowed to engage to use our data for their business purpose.

5.10.1 Compliance Requirements

There are no specific compliance requirements for our system.

5.10.2 Standards Requirements

There are no specific standards requirements for our system.

6. Requirement Engineering Process

Requirement engineering refers to the process of defining, documenting and maintaining requirements in the engineering design process. It is a common role in systems engineering and software engineering.

6.1 Requirement Elicitation Techniques

Requirement elicitation is the process of collecting and refining stakeholder's requirements. It is perhaps the most difficult, most error-prone and most communication intensive software development. It can be successful only through an effective customer-developer partnership. It is needed to know what the users really need.

6.1.1 Perform Document Analysis

Existing documentation can help reveal how systems currently work or what they are supposed to do. Documentation includes any written information about current systems, business processes, requirements specifications, competitor research. Reviewing and analysing the documents can help identify functionality that needs to remain, functionality that isn't used.

6.1.2 Survey/Questionnaire

For Survey/Questionnaire, a set of questions is given to stakeholders to quantify their thoughts. After collecting the responses from stakeholders, data is analyzed to identify the area of interest of stakeholders. Questions should be based on high priority risks. Questions should be direct and unambiguous. Once the survey is ready, notify the participants and remind them to participate.

7. Appendix

7.1 Prioritization Technique

We've prioritized the functional requirements by following Three-level Scale technique.

Three-level Scale:

When a BA categorizes the requirements in any of the ordering or ranking scale, it is subject to the analyst's understanding of the business. Many analysts suggest that this method has some drawbacks and advocate methods that have more than one scale. Covey, Rebecca and Merrill would have never in their wildest dreams have thought that their "The four-quadrant 'Eisenhower Decision Matrix' for importance and urgency", from their self-help book First things First, would become one of the most widely used prioritization techniques in the IT space.

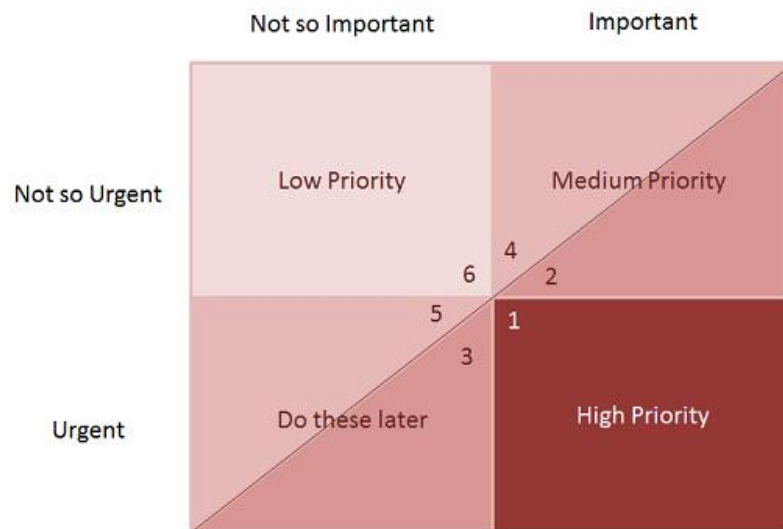


Figure 6.1: Eisenhower Decision Matrix – Lower the number, higher the priority of the section.

With the numbering on the different sections of the diagram, the priority of the sections is implicit. Important items have the highest preference, while urgent items have lower preference.

1. High Priority – These requirements are urgent and important. These are requirements that are generally with respect to compliance or contract that cannot be left out. These requirements need to be implemented in the current release and not implementing the same will have some adverse effect on the business.

2. Medium Priority – These requirements are important but not as urgent. Implement these after you implement the high priority items. If you see closely there is a line that splits this

quadrant into 2 parts. Implement the items that are on the right side of the line first as they are relatively of higher medium priority.

3. Do these later – These items are urgent but do not have a lot of effect on the business. Hence do it after completing the more important medium priority items. Similar to the medium priority items, this quadrant has also been split into two; the items on the right side have a higher priority relatively to the items on the left.

4. Low Priority – These items are neither important nor are they urgent.

The items on the righthand side of the diagonal have higher priority. Start with the bottom-right corner of the high-priority quadrant and work your way up and left.

Prioritization of the requirements of NSTU Bus Tracking System:

FR-1: Show bus location in real time

This priority is high because the system must be able to show information to user in real time.

FR-2: Save real time location records of bus when driver start ride

This priority is high because the system must be able to process the position data received from bus positioning module.

FR-3: Allow user to retrieve information from mobile device

This priority is high because the system must be able to allow user retrieve information from mobile device.

FR-4: Verify the user with institutional email

This priority is high because the system must be able to do mapping with the position data retrieved from bus positioning module.

FR-5: Show the currently available bus location in a map

This priority is high because the system must be able to show the bus position in a map view to user.

FR-6: Save real time location of currently logged in users

This priority is medium because the system must be able to save record of users that what is their location.

SLR-1: Showing the bus position in a map view must be faster

This priority is high because the system must be able to provide the current location within seconds.

PAR-1: Showing the bus position in a map view must be accurate

This priority is high because the bus position in a map view must be accurate.

CR-1: The system will handle thousands of data

This priority is high because the system needs to handle data thousands of data every moment.

RAR-1: The system must be available on time

This priority is high because the system must be available every day on time.

RFT-1: The system handles all user access without system errors

This priority is high because the system must be handled all the user access without any system errors.