TOURGURU : TOUR GUIDE MOBILE APPLICATION FOR TOURISTS

19-018

Software Requirements Specification

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B.Sc. (Hons) Degree in Information Technology

Sri Lanka Institute of Information Technology

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Declaration of the candidate & Supervisor

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text

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The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

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1. Introduction

1.1 Purpose

This document discusses the requirements for smart map interface component of TourGuru system. It gives the overall description of the software system and the solution provided. It also defines requirements for the development of the software system. This document is intended for the users, creators, regulatory bodies and other stakeholders who are involved in developing and deploying the system.

Intended audiences for this SRS are members of research group, project supervisor (Ms. Asanthika Imbulpitiya), project co-supervisor (Mr. Nuwan Kodagoda) and all the parties and individuals interested in this product with good computer literacy.

1.2 Scope

This document covers the requirements for the smart map interface component of the TourGuru system that includes the mobile application and the web application associated with it. It will discuss the features and technologies of each application which will act as the reference to the developers and stakeholders in selecting the best design.

1.3 Definitions, Acronyms, and Abbreviations

Table 1 - Definitions

Term	Definition
TourGuru	Name of the system
Roadtrippers, Toureazy, Tour Buddy, සිංහලංකා AR	Systems that has similar components
NoSQL	Not only SQL (Structured Query Language)
MongoDB	An open-source document database and leading NoSQL database.
NodeJS	JavaScript framework for creating web applications
TourGuru	Name of the proposed mobile application
VB	Visual Basic a IDE
VG	Visual Gaming
NTG	Narrative Tour Guidance

Table 2 - Acronym / Abbreviations

Term	Definition
SRS	Software requirements specification
AR	Augmented reality
API	Application programming interface
GPS	Global Positioning System

OS	Operating system
WIFI	Wireless Fidelity
RAM	Random Access memory
POI	Point Of Interest
MSDLC	Mobile Software Development Life-Cycle

1.4 Overview

TourGuru is a tour guide assistance system that will help increase the touring experience of the user by helping them with some tasks. The route analysis component of the system will alert the user of nearby tourist locations throughout the journey. It will analyse route by collecting route information from many users.

1.4.1 Main Goals

Main objective of the TourGuru mobile application is to help travellers navigate through places of interest without much hassle. It needs to be a simple but very exciting and interactive application. It focuses mainly on being a virtual tour guide by narrating details about the places and answering any questions the user might get during their travels.

1.4.2 Specific Goals

- Guiding a tourist through a route by intelligent routing.
- Providing the user with a voice narration while they are visiting attractions.
- Answering questions related to the tour which are asked by the user.
- Connecting travellers in proximity to each other.
- Updating location information by crowdsourcing.
- Testing the application using various UX evaluation techniques.

1.4.3 Users

The main user group of this system are tourists, tour guides, drivers. This includes regular commuters, or people with driving jobs like taxi, bus, truck drivers.

1.5 Organization of SRS

The rest of the document discusses the research component. The chapter 'Overall Descriptions' describes the overall description of the product which compares the product with other products, functions of the product, user characteristics, constraints, assumptions & dependencies and the order in which the requirements will be implemented. The chapter is 'Specific Objectives' discusses about the requirements of the proposed system. It describes the functional and non-functional requirements. It also discusses the interfaces of the system and the design, system attributes, reliability, availability, security and maintainability aspects of the system.

2. Overall Descriptions

The system of the TourGuru is a tour guidance system for tourits that informs the user of the tourist locations throughout the journey. The system comprises of a mobile and web application. The mobile application is based on the android platform and will collect user satisfaction information throughout the journey and post it to the web application after the journey has ended with the user's consent. The web application will be based on the NodeJS platform to support multiple concurrent requests from many users. The web application will store the information obtained from the mobile application in the database. The database will contain the raw data collected from many users. A service will then process this data to calculate coordinates throughout the journey and the resulting geolocation mapped information is stored in a database. This information would later be given to the users as a guidance when they take journey through the same route. To do this, the mobile application would download the journey data based on the destination that the user has selected and use that to provide speed information based on the user location. The system would also rate the user on how well they use the routes, locations, application. If we mention about this app in brief, when the user directs the phone camera towards a historical place, a 3D picture of that place and a description will be appeared in the user interface[2]. If the user wants to know further details, he/she can go to the Q&A that will be appeared in the navigation bar. There, when the user asked his/her question, the system will provide a relevant answer[3]. The most important feature of TourGuru is that it is capable of understanding the questions asked by the user and providing answers for them. For the common questions that are frequently asked by the users, answers are stored in the database. The process of answering the uncommon questions consists of catching the natural language of the user and separating its important phrases and querying them to get the relevant answers from the online databases or sites like Wikipedia and Google.

Rather than visual assistance for guidance, audio assistance is recommended when unattended interaction with the guide is present. Even if person who need to be guided is driving, walking or any situation it is imperative that they keep their eyes on the road or the path. Even if audio assistance is troublesome when driving. So, very short, correct and narrative content should be spoken for the user to be guided easily.

Nowadays in Sri Lanka there are many tourist attractions that are missed by travelers or misled by tour guides that have their own preference in guidance. So, it is better to get the overall information form most of travelers and local people to identify each tourist attraction for the preference. There are map based solutions that are capable to guide user with the destinations. But most them are not focusing on tourist attractions found through as they guided to the destination.

The component Narrative Tour Guidance of TourGuru system focusses on above mentioned storytelling like tour guidance on nearby attractions. System will use this component to alert user on the oncoming attraction as the user guided to a destination. Travelers will be able to provide their information on nearby important places. If the given information is validated, it will be used on the system. During driving traveler is engaged with the mobile passively but should not be disturbed occasionally so the narrative content should be summarized and then narrated without losing the base of information.

2.1 Product Perspective

There are some tour guide assistance systems that has similarities with TourGuru system.

Table 3 - Product similarities

Features	TourGuru	Roadtrippers	Toureazy	Tour Buddy	සිංහලංකා AR
Intelligent Trip routing (automatic route creation)	✓	✓			
Trip editor (Add or update custom places)	✓	✓			
Categorize locations (monuments places, restaurant etc)	✓	✓			
Map Filters	✓	✓			✓
Shared user activity	✓	✓		✓	
Traffic management	✓			✓	
Narrations or alerts on point of interest	✓		✓		
Waypoint management	✓	✓			✓
Collaborator management	✓	✓			
Distance slider for radius adjusting (proximity alert and activation)	✓	✓			
AR object madling	✓		✓	✓	✓
Identification location (using AR. location means historical places and	✓				

important building).					

2.1.1 System interfaces

Google maps API will be used for location-based information such as displaying user routes in the map. This will require generating a google API key to be used with the application. There will also be integration with google maps android application when the user wants to use it to navigate while using the system. Flutter Framework for building the cross-platform mobile application. Google Cloud Platform for cloud services.(ARcore to enhance user experience by building AR models).SQLite database for mobile app's internal database. NodeJS backend for function invocation. Cloud Speech-to-Text - Google Cloud. Google CloudPlatform or any other compatible cloud platform (Firebase ML Kit etc.) for Deep Learning functions and cloud storage.

2.1.2 User interfaces

Figure 1 : Intelligent route mapping component

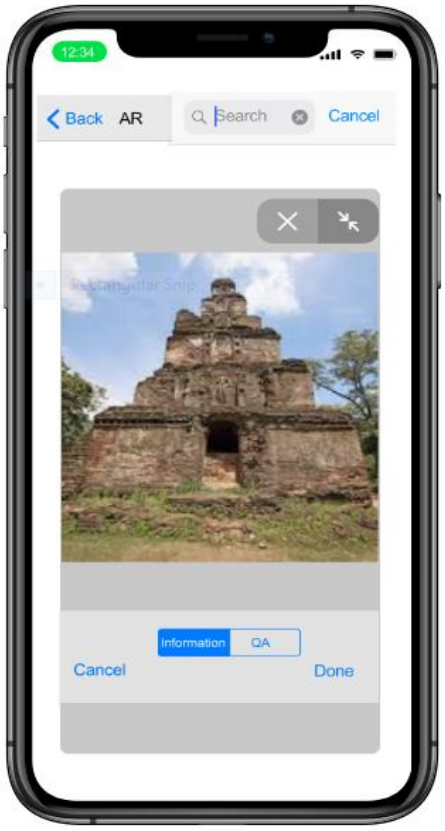

Figure 2 : AR and Q&A component

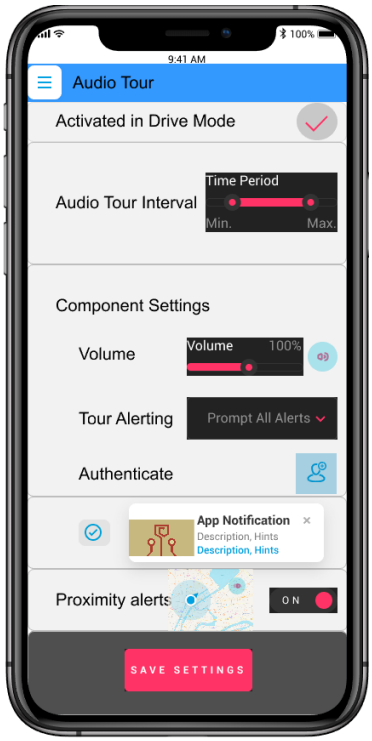

Figure 3 : NTG's Settings

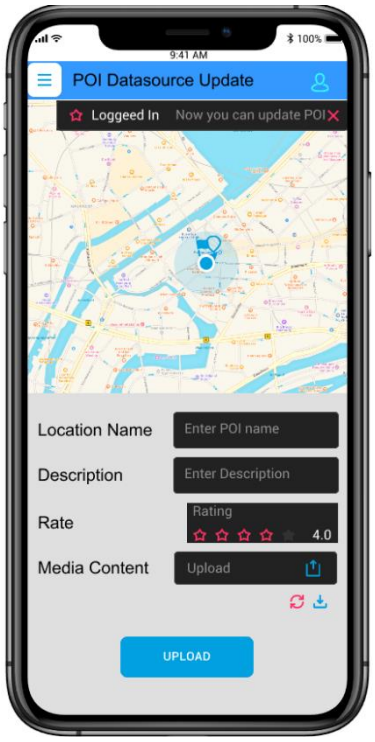

Figure 4 POI update

2.1.3 Hardware interfaces

The application can be used on a GPS enabled android device. It will be used to collect driving information from the user and to provide location-based speed and other alerts. It should be also being capable of internet connectivity, for communication with the server.

2.1.4 Software interfaces

The system will use a NoSQL database such as MongoDB as the database to store information collected from users. It will also use google maps application for navigation purposes.

- Unity 3D.
- 3D Maya- for 3D modelling.
- NLTK
- Cloud Speech-to-Text - Google Cloud.

2.1.5 Communication interfaces

The GPS sensor in the mobile phone will provide location information to the application through OS interfaces and the data modem in the mobile phone will help communication with the API since WIFI access cannot be expected while travelling.

2.1.6 Memory constraints

The application will use at most 1024MB of internal/external storage on the mobile phone and around 2GB of RAM while the application is running.

2.1.7 Site adaption requirements

This system is provided as a SaaS service, that is the system is managed by the service provider, so the user is not required to additional configurations to do this.

2.2 Product functions

2.2.1 High Level Architecture Diagram

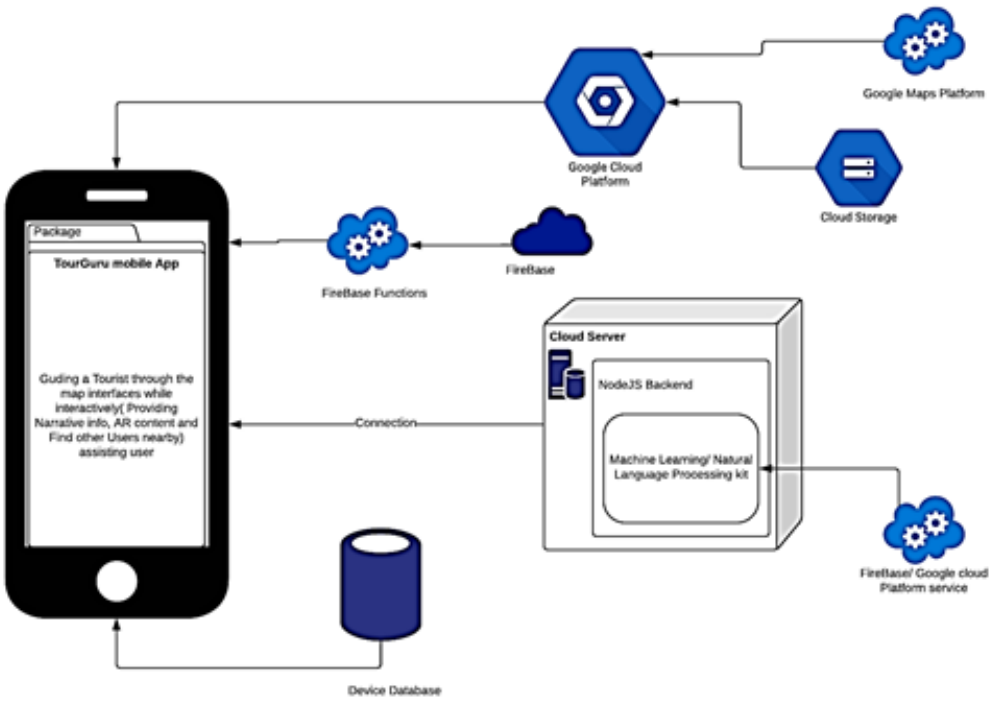

Figure 5 : System Architecture

2.2.2 Use Case Diagram

The requirements for the component are described using a use case diagram followed by the use cases themselves.

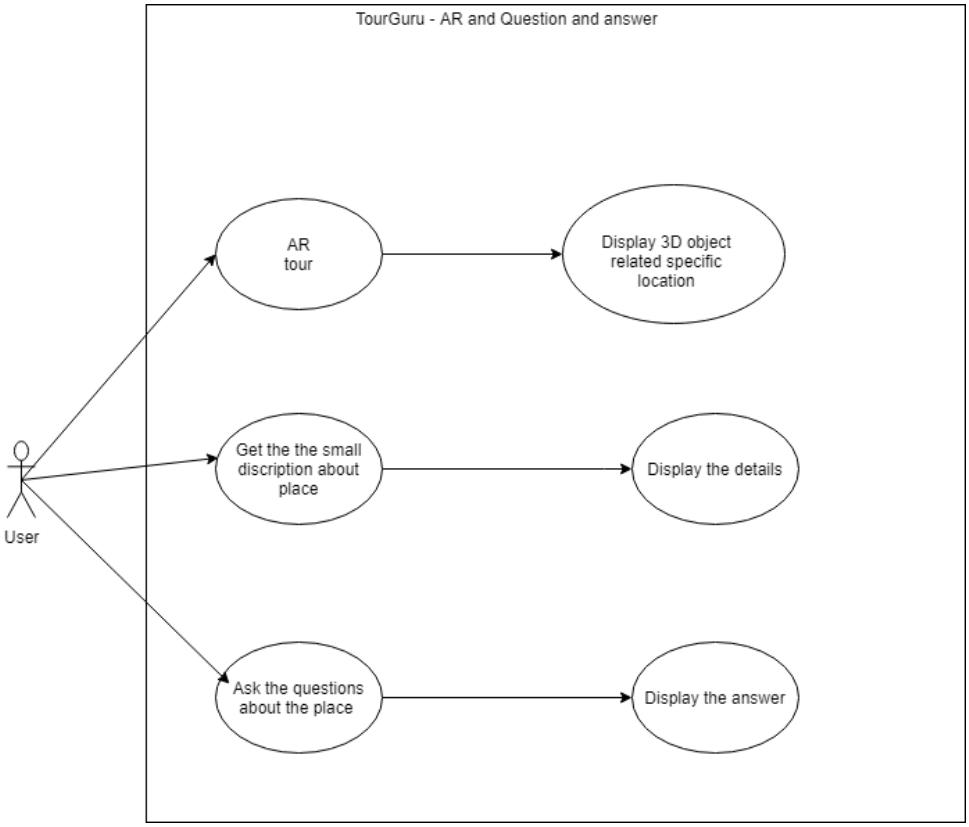

Figure 6 : Use case diagram of question and answer

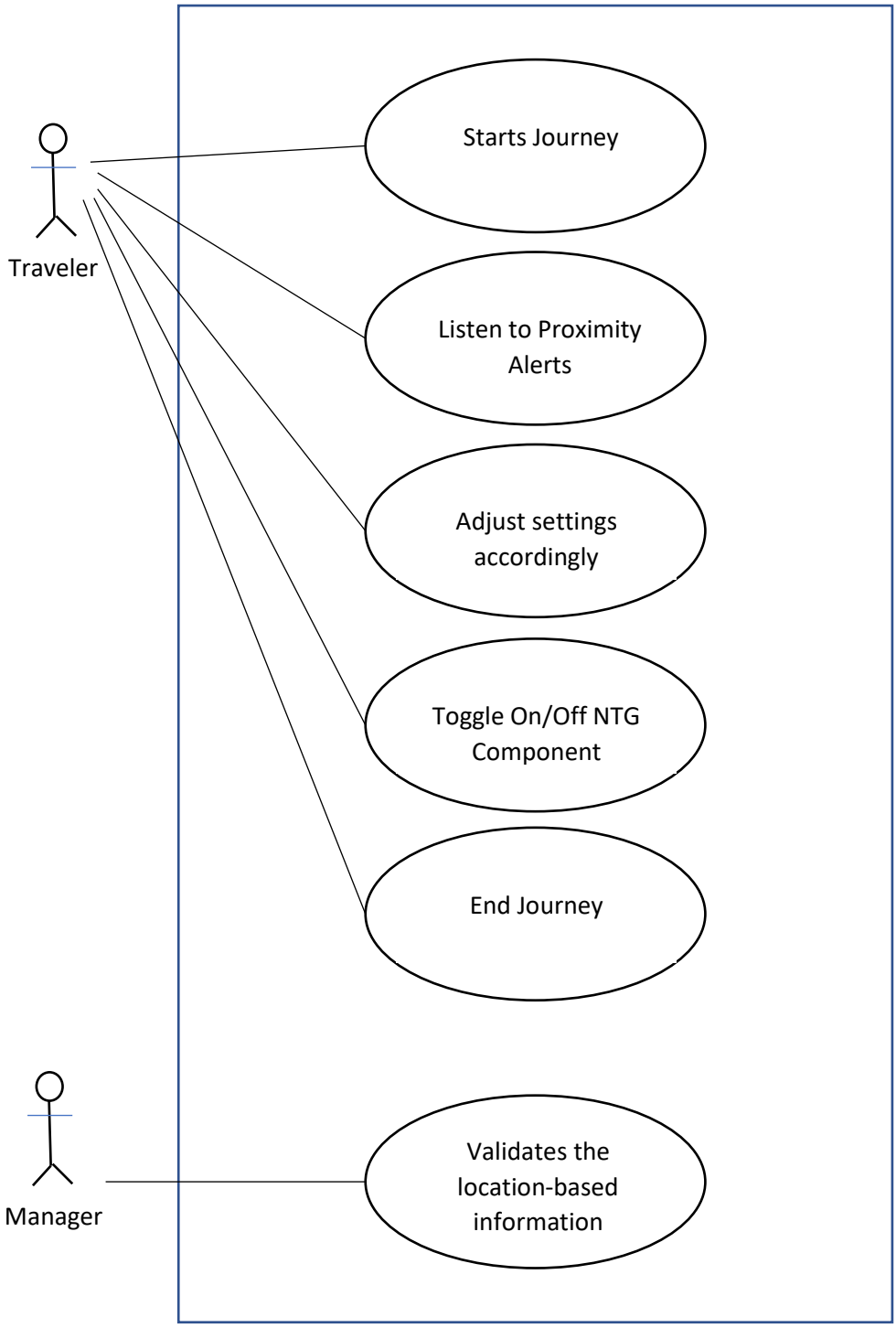

Figure 7 : Narrated tour guidance component use-case diagram

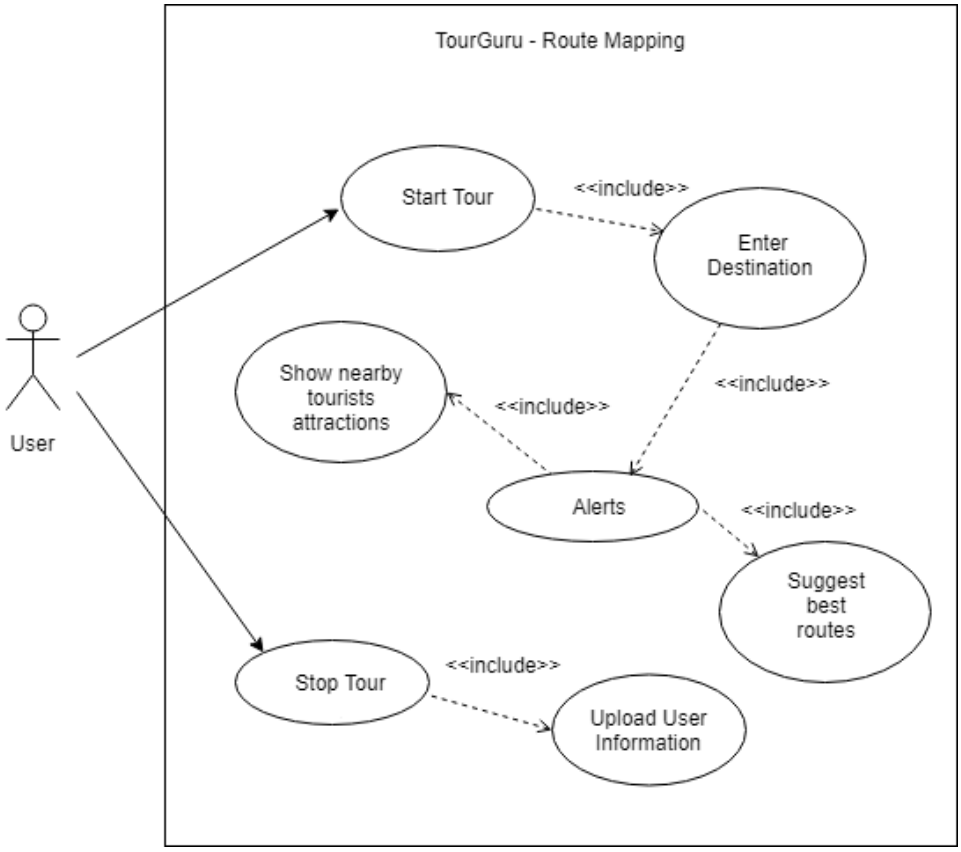

Figure 8 : Route mapping use-case diagram

tourguru System Use Case Diagram

Pasan jayawickrema | May 13, 2019

2.2.3 Use Cases

Table 1 : Use case scenario 01

Use case ID	UC_01	
Use case name	Start tour	
Goal in context	User starts the tour	
Pre-condition	The application started and internet and GPS connectivity are available.	
Post-condition	None	
Primary actor	User	
Secondary actor	None	
Main flow	Step	Action
	1	User starts the tour
	2	User receives alerts in screen.

Table 2 : Use case scenario 02

Use case ID	UC_02	
Use case name	Stop tour	
Goal in context	User starts the tour	
Pre-condition	The application already started, and internet and GPS connectivity are available.	
Post-condition	None	
Primary actor	User	
Secondary actor	None	
Main flow	Step	Action
	1	User stops the tour
	2	Application request confirmation from user.

Table 3 : Use case scenario 03

Use case ID	UC_03	
Use case name	AR Tour	
Goal in context	View 3d model of a monument .	
Pre-condition	User can see an AR model of a monument.	

Post-condition	The application already started, and internet and GPS connectivity are available. Camera permissions should be given.	
Primary actor	User	
Secondary actor	None	
Main flow	Step	Action
	1	User access AR feature.
	2	Application displays the AR model on the camera interface.

Table 4 : Use case scenario 04

Use case ID	UC_04	
Use case name	Ask the question about the place.	
Goal in context	Display the answers.	
Pre-condition	AR 3D model is activated.	
Post-condition	None	
Primary actor	User	
Secondary actor	None	
Main flow	Step	Action
	1	User ask the question about the more information.
	2	Display the answer.

Table 5 : Use-Case scenario 1

Use-Case ID	NTG_UC1
Use Case name	Starts Journey
Goal in context	To get guidance on a tour route
Primary actors	Traveller
Pre-Conditions	i. User mobile is connected to internet ii. Mobile GPS is turned on
Main Flow	1. App gets current GPS coordinates 2. User selects a destination location 3. App shows feasible routes through map interface 4. App requests and processes nearby attractions 5. User starts a journey through a route 6. Proximity alerts will be provided to user
Post-Conditions	Travel and location information will be tracked on occasions

Table 6 : Use-Case scenario 2

Use-Case ID	NTG_UC2
Use-Case name	Adjust settings accordingly
Goal in context	To adjust audio alert, notification settings as preferred
Primary actors	Traveller
Pre-Conditions	i. Notification privacy settings are allowed ii. Location privacy settings are allowed
Main Flow	1. Traveller navigates the app to Audio Tour interface 2. Traveller checks Activated in drive mode 3. Adjusts Audio Alert Interval as preferred 4. Adjusts audio volume 5. Sets Alert Type 6. Toggle In-App Notifications 7. Toggle proximity alerts (NTG component) 8. User selects Save Settings at the end
Extensions	5a. Prompt all alerts option is already selected 5a1. Selects App alerts only option 5a2. Selects Proximity Alerts only 5a.3.Selects Nearby place detail notification only
Post-Conditions	Current preferences will be saved

Table 7 : Use-Case scenario 3

Use-Case ID	NTG_UC3
Use-Case name	Listen to proximity alerts
Goal in context	To alert nearby attractions
Primary actors	Traveller
Pre-Condition	i. Traveller's mobile internet connected ii. Already started journey
Main flow	1. Include :: (Start Journey) 2. Include :: (Adjust settings accordingly) 3. Include :: (Toggle on NTG component) 4. System fetches user’s location-based information 5. System alert the traveller on nearby attraction by selected alert type
Post-Conditions	System tracks location-based information

Table 8 : Use-Case scenario 4

Use-Case ID	NTG_UC4
Use-case name	Toggle on NTG component
Goal in Context	To invoke the NTG component if turned-off
Primary actors	Traveller
Pre-Condition	i. Traveller's mobile connected to internet ii. Already started journey
Main flow	1. Include :: (Start Journey)

	2. Traveller navigates the app to Audio Tour interface 3. Toggle proximity alerts (NTG component) 4. User selects Save Settings
Post-Condition	System saves current settings and starts the NTG component

Table 9 : Use-Case scenario 5

Use-Case ID	NTG_UC5
Use-Case name	Validates the location-based information
Primary actors	App manager/ dedicated team member
Pre-Condition	i. Team member has crowdsourced and validated location-based information ii. App is connected to internet
Main flow	1. Dedicated member authenticates from application 2. Adds location-based information one by one in to system through the UI
Post-Conditions	i. System saves each location-based information ii. System notify success the user on each update

2.3 User characteristics

The users of this system would be regular commuters with a smartphone. This would include people with a wide range of computer skills. However, we presume that the user would be familiar with the usage of an android smartphone.

2.4 Constraints

The development of the mobile application requires that google play services are correctly installed in the devices. A GPS mock location service must be used to emulate the navigation when developing the application. The development requires Android Studio. The minimum requirements to run android studio could be found online.

The application will constantly collect data from users. However, posting this information constantly to the API will consume data and will also exhaust the battery. This information can instead be collected for a journey and sent. In that case, the file size could be large and should be compressed to use less data.

2.5 Assumptions and dependencies

The TourGuru is an application built to use in android smart phones and the user interface is appeared in English language. Therefore all the users are assumed to be convenient in using smartphones and managing English language. Since the phone camera is to be directed to the particular location, it is assumed that quality cameras are consisted in phones. Further in order to have a better service without any interruption, the internet connection is assumed to be always there without any problem and the bandwidth of the internet connection is assumed not be affected to the data transformation.

It is assumed that,

- the android smartphone can consistently update GPS information within a considerable distance and with accuracy and these coordinates are accurate between different journeys.
- integration with the google maps application is possible for navigation purposes.
- the application can refresh itself with changing GPS coordinates with low latency.

2.6 Apportioning of requirements

The primary requirements of the system are the collection of usage data from users and displaying to the user back to the user based on his location / destination. The methodology used in calculating the best routes is yet to be decided. This needs to be included in the initial release of the application. The system for user behaviour is a desirable requirement and does not need to be in the initial release of the software however could be done in subsequent releases.

3. Specific requirements

3.1 External interface requirements

3.1.1 User interfaces

The mobile application will be used by the end users and will contain two UIs for this component. These are described below in detail.

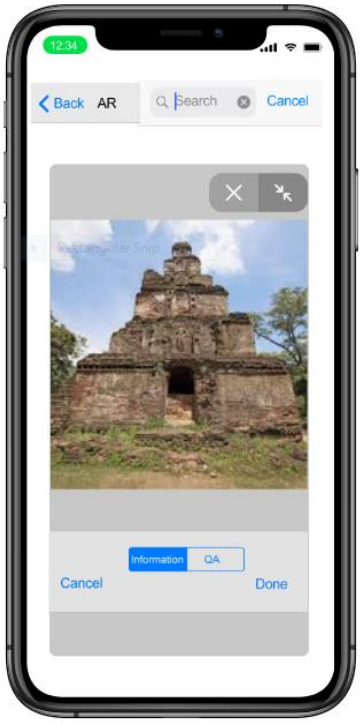

Figure 1 : Intelligent route mapping component

Figure 2 : AR and Q&A component

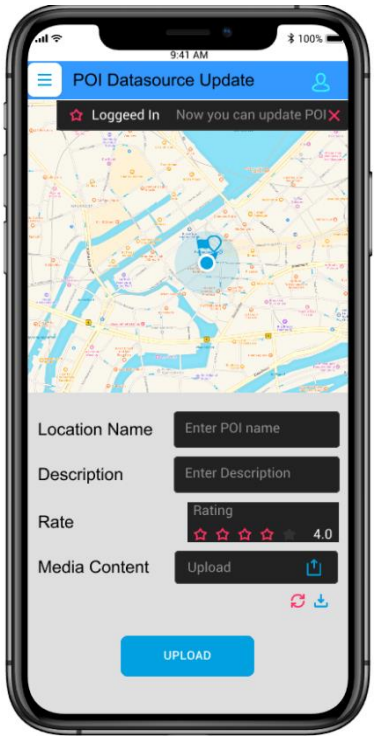

Figure 3 : Narrated Tour Guidance Settings interface

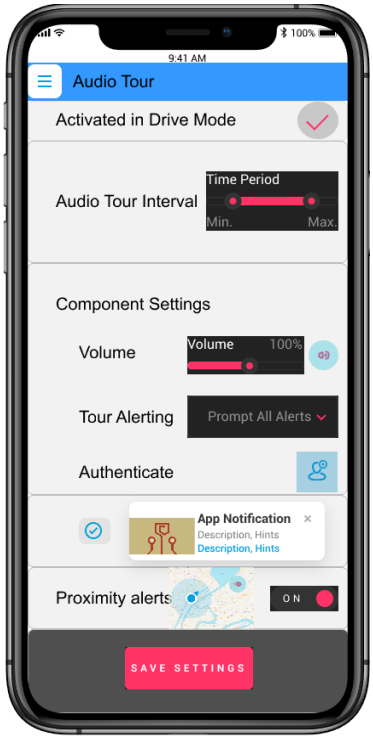

Figure 4 : Narrated Tour Guidance POI data update interface

3.1.1.1 Start tour

This user interface will provide the ability for users to select the destination for the journey and start the journey. It will also indicate in the map, the current location of the user. Once the user selects the start journey, the app will start providing speed related information. This user interface will provide the ability for users to select the destination for the tour and start the journey. It will also indicate in the map, the current location of the user. Once the user selects the start tour, the app will start providing tour related information.

3.1.1.2 Stop tour

When the tour has ended, the user can use the stop button to end the tour and will provided with a screen indicating the attributes of the tour like detailed description about location, nearby locations, time etc.

3.1.1.3 Narrative Tour Guidance Settings page

Figure 3 introduces the NTG component's settings page. Travelling user can define each setting to preferred settings so that the component is usable. Its first option lets the driving traveler to experience most suitable alerting that restricts longer than 10 seconds. Audio tour interval is very important factor to decide the interval between alerts. But the process of this function is adjusting distance radius that identifies nearby attraction and lets the user experience to adjust according to traveling speed. If user travels in a vehicle audio alert interval should be near max margin, else it should be near min margin in the interval slider. User should adjust Component Settings for better experience on receiving alerts and configuring the component. Preferred actions user can make are audio level to listen to alerts, Tour alerting type and Authentication. This authentication is used when a dedicated team member approaches to update external database with validated location-based information. Authentication is a single sing in and form submission for a selected location. This form submission interface is shown on Figure 4. Furthermore the previous settings page has given the user the capability to switch on-off internal app notifications and the component itself.

3.1.2 Hardware interfaces

The mobile application requires an android mobile phone with internet and GPS capabilities to collect location information and post it to the web application. The web application requires a cloud server to run on that is accessible from the mobile application through the internet.

Smart mobile device's sensors, audio output and other device components.

Microphone

In order to enter the user inputs as the question(voice) this component needs an inbuilt microphone in the phone which is working properly as expected.

Camera

The AR model needs to be placed in a real life surface which is viewed through the camera. The camera is required to get this view.

3.1.3 Software interfaces

The mobile application will be built on the android platform. The major functionalities of the system will be based on location. For tracking the current user location, the mobile application will use **FusedLocationProvider** library which provides a battery efficient location API. The app will use SQLite database for temporary storage on the mobile phone especially when we want to bulk collect information and send it to the server and as a backup when offline.

To run this product the mobile platform should be

Android 5.0 or higher version

IOS 10.0 or higher version

API's, plugins, services and other software interfaces may integrate into the product as need for achieving full functionality.

3.1.4 Communication interfaces

The mobile application requires the usage of GPS to fetch location data, but this communication is handled using libraries that hides the underlying communication between the app and the sensor. It also requires internet connectivity through the data modem to access the rest services of the server. This is handled through the underlying OS implementation that hides the complexity from the application.

3.2 Classes/Objects

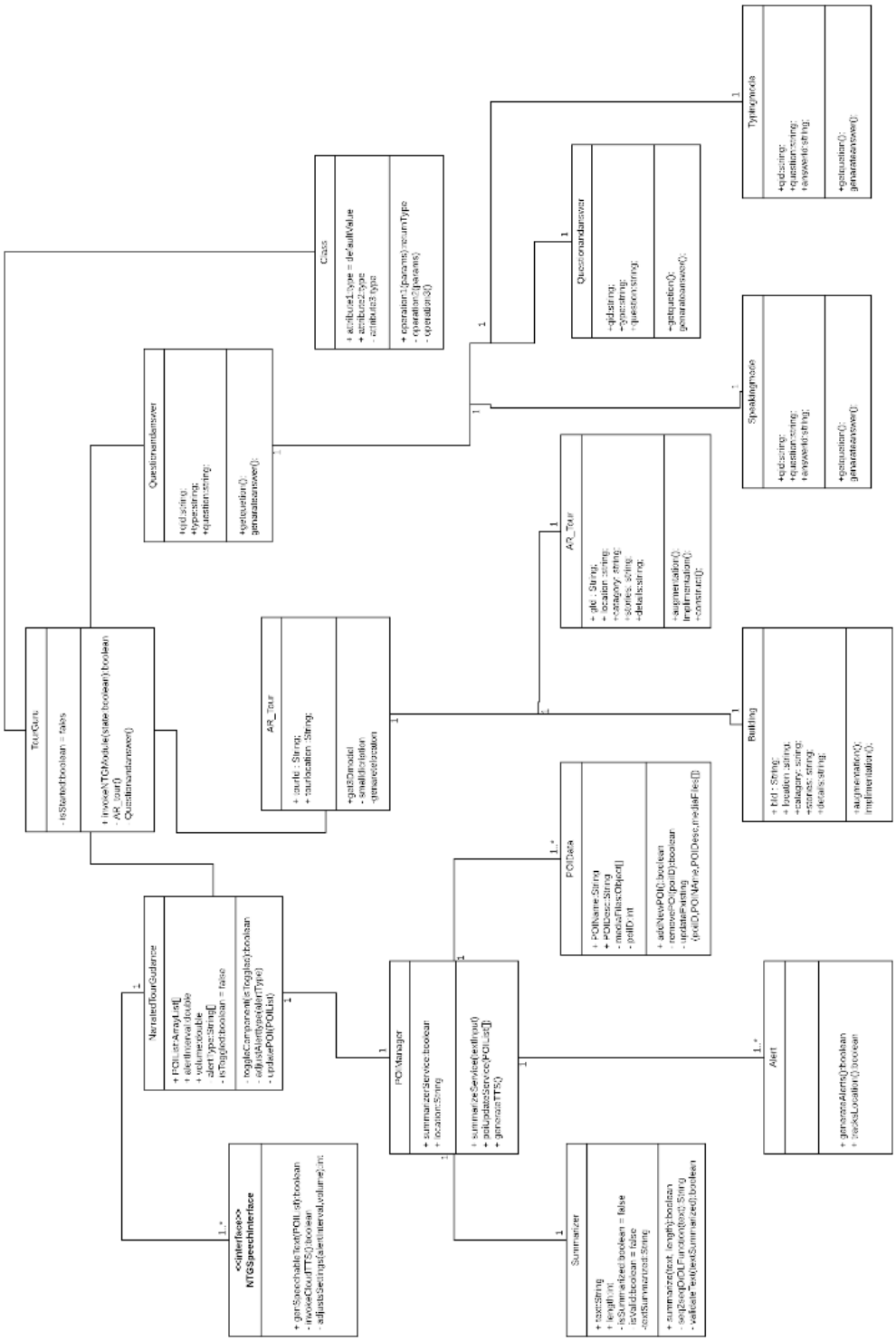

Figure 3- Class Diagram

3.3 Performance requirements

The API will receive concurrent requests from many users with the route information therefore it should be able to handle these concurrent requests and process them without blocking other users. NodeJS is suitable for this as it can serve multiple asynchronous requests.

3.4 Design constraints

The mobile application will use audio alerts to alert the user, therefore it should be running in the background enabling the user to use navigation application while driving. However, it should be also possible to start and stop the journey. This would require integration with navigation applications so that the transition between the use cases would be seamless and the application would not be an overhead to the user.

3.5 Software system attributes

3.5.1 Reliability

The system will not give out speed suggestions until a considerable amount of user data is collected and a reliable prediction could be made. A threshold needs to be set for this to find the most stable and reliable speed predictions.

3.5.2 Availability

The system will have an availability of 95%. Hosting provider AWS promises a 99% availability for the application, but maintenance of the application would be required during the initial stages of the application for purposes like data repairs.

3.5.3 Security

The system deals with location history of users. To protect the privacy of users, this data should be protected. There are layers to secure in the system. The communication between the mobile application and the server should be encrypted to protect sniffing by malicious parties. The mobile application uses a local database therefore it should also be secured from malicious access in case the device is lost.

3.5.4 Maintainability

The system collects large amount of data overtime and needs to be frequently archived when not used. This would require a background service that could automatically archive this data in a backup database after it has been processed.

3.6 Other requirements

The application will use the journey coordinates to find bends and then use the speed information of users to learn a neural network that can later predict speeds at different bends.

4. Supporting information

4.1 Appendices

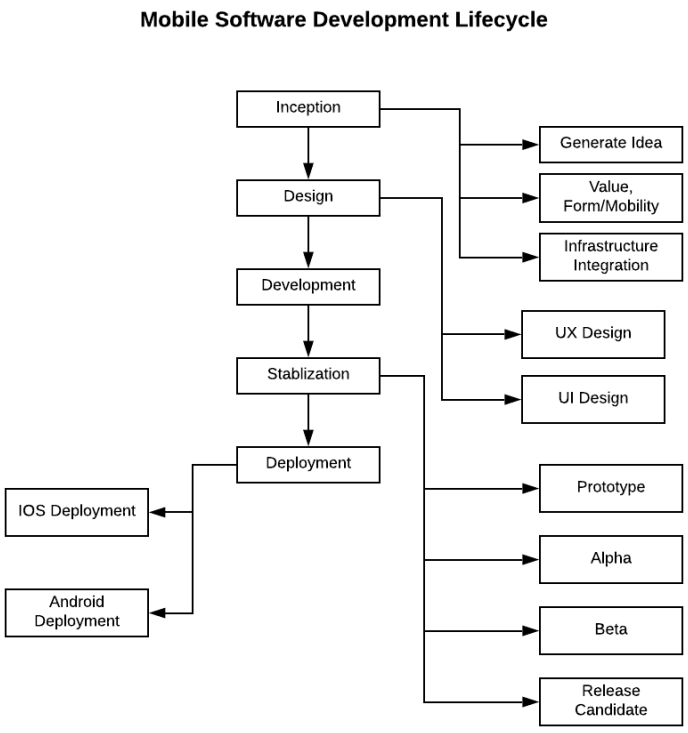

Figure 9 MSDLC in development process

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