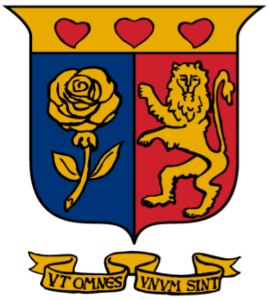

Strathmore

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A Web Based Smart City Tour Application for Tourists Around the Globe

100387

Group A

An Information System Project Proposal submitted to the Faculty of Information Technology in partial fulfilment of the requirements for the award of a Degree in Business Information Technology

Faculty of Information Technology

Strathmore University

Nairobi, Kenya

May 2020

Declaration

I declare that this work has not been previously submitted and approved for the award of a bachelor's degree by this or any other University. To the best of my knowledge and belief, the documentation contains no material previously published or written by another person except where due reference is made in the documentation itself.

Student's signature:

……..…  …….. [*Signature*]

……27-01-2021…….……. [*Date*]

Abstract

The number of people on tours has been increasing around the world, continuing to strengthen and develop the tourism industry. With many cities and attraction sites around the globe, tourists might only have quality information about a few. This creates a challenge of the quality of information, in terms of time and accuracy, that tourists get when they visit new places. The current systems that are used do not facilitate provision of timely and accurate information, for some, to the tourists when on the move. The proposed system plans to solve this challenge by creating a smart application that will be used by tourists around the globe. The application will allow users to fill in their interests while on tours anywhere around the world, then it analyses those interests and create a travelling schedule for the users of the place they are visiting based on what they like. The proposed system will be a web-based application that uses HTML, PHP, CSS, and JavaScript programming technique. Data and information will be stored in a database connected to the system. The MySQL database management system will be used to create, manage, and maintain the database. Google Maps and PHP Mailer APIs will be used to fetch the users' location and send some reminder emails to the user. The system will be developed using the Prototyping System Development method. This method will allow for continuous revision of the system as progress is made in development. This will enable achieving a quality system that meets the user's requirements.

Table of Contents

List of Abbreviations

API Application Programming Interface

CSS Cascading Style Sheets

GDP Gross Domestic Product

GPS Global Positioning System

HTML Hypertext Mark-up Language

ICT Information Communication Technology

IDE Integrated Development Environment

IOS Apple Operating System

PHP Personal Home Page Tools

UML Unified Modelling Language

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Acknowledgements

I owe gratitude to Almighty God for His guidance throughout this proposal by giving me strength and determination while working on this project. I am deeply indebted to my supervisor for his guidance, insights, patience, and ever-present support that ensured successful completion of this documentation.

I highly appreciate my colleagues for constant support. Through interacting with them I have been able to be more creative plus gain the momentum to do this project. I appreciate Strathmore University as well for providing a suitable environment.

Chapter 1: Introduction

1.1 Background

Recently, the consumption structure of the world's population has been steadily improving. Due to this, the number of people out on tours has been increasing around the world (Kaur & Sarin, 2016). Tourism is one of the strongest and largest industry in the global economy world, generating an estimated 11% of the global domestic product (GDP) and employing 200 million people who serve the 700 million tourists worldwide, a figure which is expected to double by this year when things get back to normal (Kaur & Sarin, 2016). With this era of more technological advancements, the number of people using the internet in their daily operations has also been increasing with both the consumers and industries embracing online marketing and businesses (Pratt, Flannery & Perkins, 2019). This has brought about more enriched travel information provided to the tourists on the internet (Chuang, Liu & Lu, 2017). With all these, a problem is still shown that tourists are not able to get travel information timely when on the move (Meng & Xu, 2010). In the tourism industry, most information is obtained mainly through newspapers, magazines, radio, television, and other simple ways that are easily available.

Most of the current systems created only solve the problem for specific cities or places of attraction. These partially solve the problem since not all places are covered around the globe. To completely solve the problem, this project developed a smart city tour application, which fetches the users' location, allow them to enter their interests and the specific places they would like to visit, then it analyses the questionnaire and creates a schedule based on the users' interests.

This project was worth doing since it eliminates the current challenge concerning provision of touring information in the industry, and also reduce on the costs incurred by the tourists when touring since it also gives the shortest routes to the different destinations selected by the tourists, hence minimum fare.

1.2 Problem Statement

One of the main problems that affects the tourism industry is provision of timely information to the tourists on the move (Meng & Xu, 2010). Most of the information used is retrieved from either the newspapers, magazines, radio, television, and other ways that are available easily.

Tourists most of the time fail to fully explore the places where they visit due to the lack of quality information at the needed times. They thus do not get quality services for what they pay for.

1.3 Aim

To address the problem identified in section 1.2, this project developed a smart information system that gives timely information to tourists by providing them with a schedule of time and the places they would like to visit, by analysing the users interests from the questionnaire filled by them. The smart tour system is web based to accommodate its access through any connected computer device.

1.4 Specific Objectives

i. To identify the needs of tourists around the world in relation to the information they get and how they access their places of interest.
ii. To review techniques available to support a smart tour travel application.
iii. To develop a fully working smart travel web-based application that will provide timely information and schedules to tourists.
iv. To test the developed smart travel System using mock case scenarios.

1.5 Justification

This project is important as it will help tourists get timely information about the places they are to visit, giving them an interactive map with the location pinned and at the same time create a schedule for them based on their interests. With this information, tourists around the world are assured of an easy time and quality information when exploring new places to adequately utilize their resources and enjoy their time fully.

1.6 Scope and Limitations

1.6.1 Scope

The aim of this project was to create a web-based smart travel system that will enable tourists get timely information on the move, by it creating a schedule based on the tourists' interest and time. The system enables the user to register and login with their details, then directed to their dashboard where they are required to select their interests and enable their GPS. The user's travel plan is displayed on their dashboard by the system after analysing their interests. The user also gets an interactive map with all the scheduled places pinned on the map making it easier to see the locations.

1.6.2 Limitations

The limitation of this system is that it focuses on a web application, meaning only the users with web enabled devices which are connected to the internet are able to access and use it.

Chapter 2: Literature Review

2.1 Introduction

The aim of this chapter is to review the tourism industry around the globe. The focus being how information is relayed or received by the different players in the industry, the current state and challenges faced by tourists around the globe. Later in the chapter, a technology-based solution is proposed, and the requirements of this new solution discussed.

2.2 Current Systems Used

In more developed countries around the globe, tourism sectors have fully embraced the ever-growing technology and developed some systems like tour guide applications for the various attraction sites in the specific countries. For the still developing countries, the tourism sectors have not embraced use of smart systems to deliver their services. Most of the services and information are relayed through the Tourism ministries or private tour agencies who mostly use the media (Muhoho & Lubbe, 2017). To get hold of these parties, tourists who visit these destinations must visit the websites of the various agents and organize with them to make schedules for their travel. The bookings and schedules with some agents can be done online while for others, the clients are required to physically be present to be considered.

The processes involved in these bookings and scheduling of travel most of the times prove to be hectic for tourists, since they have to dig for information to locate the best agents according to their interests. With the number of cons also rising in the industry, most of the tourists are bound to fall victims of fake agents who steal from them.

For the few countries that have developed applications, they limit the tourists to specific sites or attractions without factoring the different interests of the different tourists. Tourists thus have limited access to information while using those applications and are bound to miss on some activities of interest to them, that might be missing on the applications.

2.2.1 Challenges Faced by the Current Systems

The biggest challenge faced with the current touring systems is lack of timely, relevant information to the tourists in their various destinations or when in move. Some of the information given in the different websites are either outdated or exaggerated for marketing purposes. With this, tourists cannot solely rely on such to make their travelling schedules before or even after landing in their destinations. This creates the problem of them not fully exploring their areas of interest when travelling around the world. In cases where the agencies make schedules for the tourists, they most of the time stick to what they know, prefer or think is best, not considering the different interests of the different tourists.

2.2.2 Correlation between Information Technology and Tourism

Information Communication Technology (ICT) is gradually becoming an integral part of the tourism environment (Tussyadiah, 2017). As technology continues to advance, different industries in the world are slowly embracing it to either improve performance, market their products and services, increase revenue generation and automate processes. Tourism is one of the industries contributing to create a global market through integrating its services to online platforms to reach a wider market. Of late, research is being done to identify the implications of virtual reality technology in tourism marketing. All these are to improve tourists' experiences and increase the revenue received from the industry.

2.3 Related Works

Some of the works related to this include:

2.3.1 Smart Tour Plan, Bangladesh

This is a system that gave ideas about tourist places in Bangladesh so that everyone could get information about the historical places and how they can travel in those places. With this system, a traveller can see the event on our website and choose the place he/she wants to tour, then the guide will help them manoeuvre (Mipu &Arefin, 2018). The advantage of this system is:

a) Tourists can easily manoeuvre from one attraction site to another without the help of a guide and still get memorable quality experience.
b) Tourists can do reservations of nearest hotels of their interests.

The system is however only applicable for Tourists touring Bangladesh historical sites only. Other tourists in other areas around the world with different interests are not catered for in this application.

2.3.2 Use of Media for Tour information, Kenya

Like most countries in Africa, Kenya tourism sector mostly uses the different types of media to construct destination images for both potential and actual tourists. The research done identified television travel documentaries and travel news as the most influential media in the construction of the organic image of Kenya (Muhoho & Lubbe, 2017). Generally, destination image is influenced differently for potential visitors and actual visitors by television, travel guides and newspaper reports. The advantage of this system is:

a) Information reaches a wide local population since most people interact with these media in their daily activities.

The downside of this system is that not all aspects of the destination image are influenced similarly by the different types of media, and not all media information sources have the capacity to influence tourists.

2.4 Gaps in the Existing Works

The main challenge experienced with these available systems is the untimely provision of accurate and relevant travel information of any place at any given time around the world. This is because the available tour guide applications only give some limited information of specific countries or cities that have the applications developed. Since the tourism industries of most countries still do not have such applications, the challenge is still widely experienced around the globe. The main challenge with the use of media is the capacity to influence potential or actual tourists about the various attractions with the information availed. This may be due to various reasons like, bad timing or the media being biased towards some attractions or sites which may lead to them failing to capture all the interests for the different tourists

2.5 A Review of Possible Development Technologies

The software system to solve this challenge can be developed in either the mobile-based technology or the web-based technology. The mobile-based technology is whereby the system is developed to be used only by a specific mobile operating system, mostly android or iOS, that it is developed in. In other words, the system can only be accessed in android phones if it is the operating system it is built on or used in iOS if built on iOS. To cater for the different users, different developments will be required for the different operating systems for the same application. This may prove to be hectic for updates and maintenance as time progresses.

The web-based technology is whereby a system is made such that it is accessible through the internet on a web page. No installations are required, and the system can be accessed by any connected devices, like phones or computers, since no hardware requirements or specifications are required. It is currently the most preferred technology; web applications are more reminiscent of the original mainframe applications, or the later client-server model that were common for early desktop business applications (Bychkov, 2013). The user accesses the application using the web browser (in effect a stand-in for a client), and works with resources available over the internet, including storage and CPU processing power. The developed system implements the web-based technology, such that the system is made accessible to any user around the world without bias of the operating systems.

2.5.1 Requirements for the Developed Web-based System

To access this application, a user only requires a computer device connected to the internet to access the application online. This ensures a wide reach of all the tourists around the world as the number of people using the internet in their daily operations is immensely growing (Pratt, Flannery & Perkins, 2019).

2.6 Conceptual Framework

This is a conceptual diagram showing how the developed system functions. The user registers and logs into the system then he/she is directed to their pages if the credentials are approved. From the user page, the user can start by creating his/her schedule by filling the details asked in a provided questionnaire and submit it back.

The details are then fed to an API that fetches for the local interests of the user and give back a map route summary. After using the summary, the user can also delete the existing travel schedule.

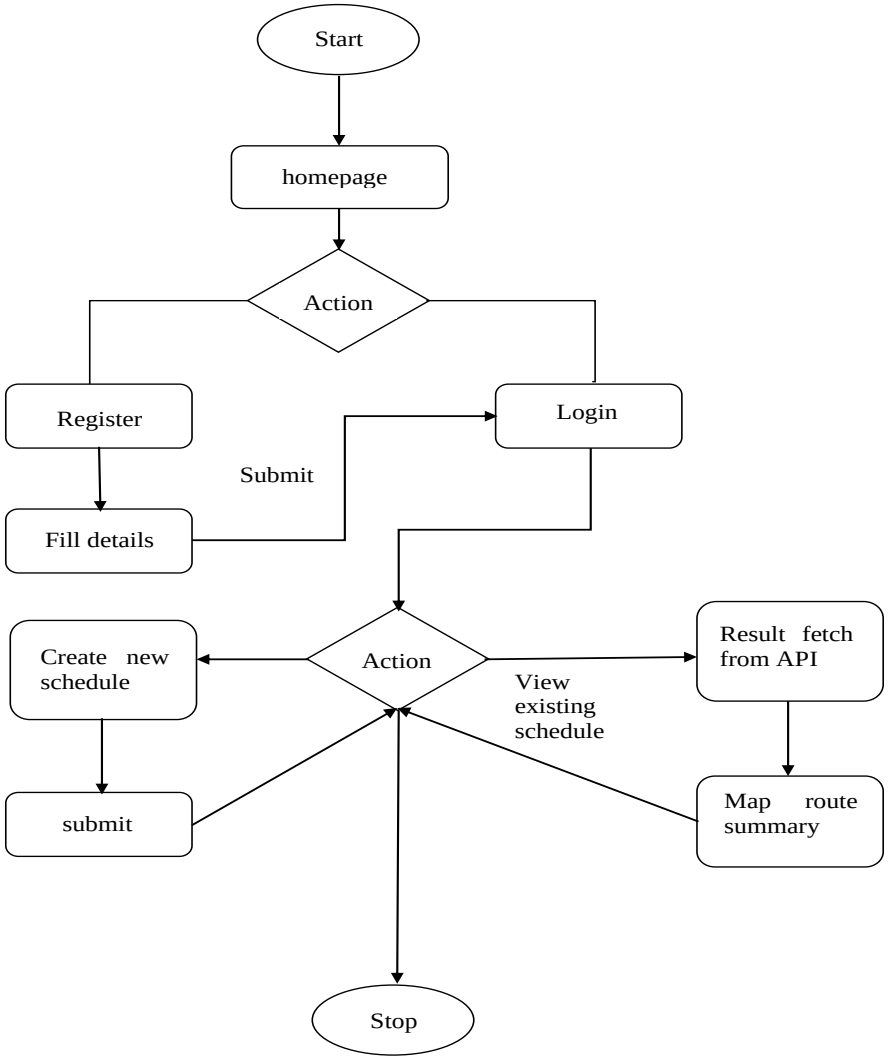

Figure 2-1.1 Conceptual Diagram

Chapter 3: System Development Methodology

3.1 Introduction

System development methodology refers to the structure that is followed in creation of a new system. This structure consists of several processes that will be implemented to ensure that the system is created in the scheduled duration (Maheshwari, 2002). In this case, the Prototyping System Development methodology was used to develop the proposed system. This method allowed for continuous revision of the system, hence ensured that the aim of the system which was to improve the travelling information given to tourists was achieved. This chapter also looks at the functional and non-functional requirements, tools, and techniques required for the development.

3.2 Prototyping System Development Methodology

Prototyping is the approximation of a concept that exhibits essential features of the final product (Avison & Fitzgerald, 2006). It involves iterative development process that enables matching of user's requirements which are then converted into a working system quickly. As progress is made, the system is continually revised to improve quality. Changes to the system can be implemented earlier and development also stopped early if the system is not meeting the desired functionalities. This methodology will enable quick development and delivery of the proposed system.

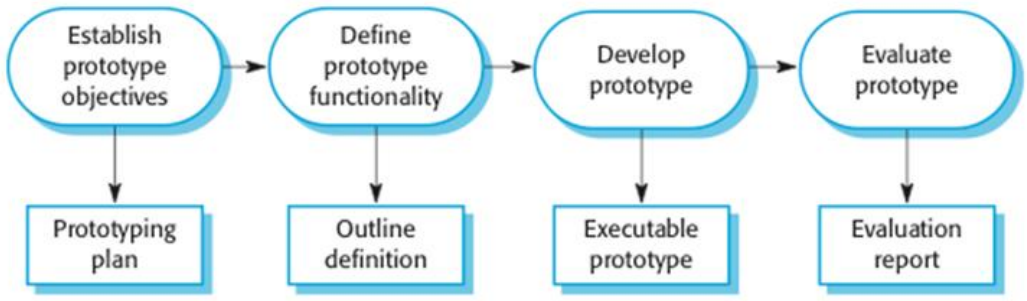

Figure 3-1.1 The Process of Prototype Development

3.2.1 Establishing Prototype Objectives

This process involves coming up with a clear definition of the objectives that the prototype is set to achieve. All the plans to the development of the prototype are made at this point. For the proposed system, the main objective is to avail timely travelling information to tourists. The prototype will thus be developed towards that.

3.2.2 Define Prototype Functionality

This process involves identifying the types of inputs and the expected outputs from the prototype developed. At this point some functionalities like the prototype's response time may be ignored unless the functionalities are relevant to the objective of the prototype. This is mainly to reduce on the costs of developing the prototype and accelerate delivery time.

3.2.3 Develop the Prototype

An executable prototype which satisfies the first two processes is finally developed at this point to give a glance of what is expected. The prototype may only include the various user interfaces of the system's front end.

3.2.4 Evaluate the Prototype

The evaluation process involves training of the users on how the system will be operated using the prototype. After interacting with the prototype, the users give back feedback to the developer. These feedbacks are used to improve the prototype and specification the users require to be met by the actual system.

3.3 System Analysis

Software Requirements analysis involves all tasks and activities that go into determining the needs or the conditions to meet for the development of a new or already existing product that may be required to be changed (Kendall, 2006). The Smart City Tour System was developed using the Object-Oriented Analysis and Design approach. This approach involves use of objects (problem's solutions), that interact with each other to accomplish the project's aim. This approach follows two other approaches, the repetitive and incremental approach, where the repetitive approach focuses on object decomposition that allows for break-down of the problem

into separate and more manageable parts. The system focusing on more than one module, this approach enabled its development in integrations.

3.4 List of Design Diagrams

System design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy the specified requirements. For the developed system, the following diagrams were used to come up with the most effective design:

3.4.1 Use Case Diagram

This is a graphic depiction of the interactions among the elements of a system. The diagram is used to identify, clarify, and organize system requirements. The use case diagram has actors who represent the users and their roles in the system, and the relationship existing among the actors.

3.4.2 Class Diagram

A class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations, and relationships among objects. The classes are arranged in groups that share common characteristics.

3.4.3 Sequence Diagram

This is an interaction diagram that details how operations are carried out. The sequence diagram models high-level interaction between active objects in a system and interaction between object instances within a collaboration that realizes an operation.

3.5 System Development Tools and Techniques

The proposed system was developed using the tools in the table below.

Table 1.1 System Development Tools

Tool	**Use**	**Reasons for use**
Microsoft Word Office 2016	Was used to document the manual.	Easy to use, therefore documenting was quickened.

Star UML	Was used in drawing the analysis and design, also in planning schedule.	Offer the necessary tools that are required to achieve chapter 4 effectively.
MySQL enabled by apache server	Was used to manage the database and providing storage.	Works well with html and php and enables storage of data.
HTML, CSS, PHP, and JavaScript	Were used in the development of the website.	Fundamental tools in web development.
Sublime Text IDE	This is the platform that was used to code on.	It is easier to use and understand code. It also nicely supports the fundamental tools for web development.
Google Maps API	To display the map and all pinned locations.	Covers wide geographical area of places around the world.
PHP Mailer API	To send emails safely and easily via PHP code from a web server.	Will enable sending of schedules to users to their emails.

3.6 Testing Procedure

The developed smart city tour application was validated and verified using the white box testing approach. This approach involves testing of the system's internal coding and infrastructure. The testing mainly focuses on strengthening security, the flow of inputs and outputs through the application, and improving design and usability.

This procedure involves two basic steps, understanding the source code and creating test cases to execute. These form the procedure to follow when testing the system.

This approach will best suit the system since it covers on internal security holes, flow of specific inputs and expected outputs, functionality of conditional loops and broken structured paths in the coding process, all of which are important to the perfect functionality of the system. A fully working system that meets the users' requirements was thus be developed.

3.7 Domain of Execution

The system was developed in the web-based domain. With the number of people using the internet around the globe on the rise (Pratt, Flannery & Perkins, 2019), a web-based system was the best module to use since it allows for a wider reach and use by tourists. Being web-based, the application does not discriminate the different types of operating systems, android, iOS, windows or ubuntu, to be accessed. A tourist only needs a device connected to the internet to access and use the smart application, hence flexibility.

3.8 Proposed Modules and System Architecture

The developed system has the following modules:

3.8.1 Sign in/ Sign up Module

This module contains the pages for sign in and sign up. Here, user is required to enter basic information like name, gender, dob, etc. Once a user creates an account, he/she is redirected to the login page where they enter the registered email and password to login.

3.8.2 Dashboard Module

This module contains a dashboard where user can create, view or erase schedules. To create a schedule, a user is presented with a list to select their interests for further processing. The user is then given a travelling schedule of the places he/she is interested in visiting.

3.8.3 Result Module

In this module, all results are displayed after fetching all locations from user's interests and suggestions given to users to check out the places based on the ratings. One more attracting feature here is that system sends an email to the user's registered email ID with all the details and schedule.

3.8.4 Map view Module

This last module contains the final map view showing all the recommended places with a connected path between them, showing the shortest route saving users cost and time.

Chapter 4: System Analysis and design

4.1 Introduction

This chapter provides a list of the identified system requirements and highlights the approaches that were employed in the process of gathering such requirements. The analysis section focuses on the requirements that the system is expected to meet. The requirements are further divided into the functional and non-functional requirements. These mainly highlight what the system can do and should do.

The design section involves analysis diagrams like the use case and class diagrams, which illustrate more about the system operation and flow.

4.2 Requirements Gathering

This involved the collection and the identification of the different requirements that the system was able to satisfy either functional or non-functional. There are different methods used by researchers to gather and understand the system requirements including analysing existing documents and discovery prototyping which were used in this case.

4.2.1 Analysing Existing Documents

This technique proved to be very useful during this period where minimal contacts with people was highly enforced. Reviewing the current processes and recent documentations helped in understanding the system better and the current situation that the system is in. The analysed documents were from recent related works, where findings and responses from the documents were collected and analysed to identify the gap that was still existing and what was required. On the same documents, the part for future works was also analysed to determine the required advancements that had to be included in this system to fully solve the problem defined.

4.2.2 Discovery Prototyping

This technique involves building of a small-scale representative of the users' requirements to verify or identify new requirements. This technique was used to gather the non-functional requirements of the system like security and performance that meet the user requirements.

4.3 System Requirements

4.3.1 Functional Requirements

Functional requirements refer to the functionality and the services that will be provided by the system for the it to function as intended (Dabbagh & Lee, 2014).

i. Interface Requirements

The landing page shall enable users to register and login to the system.

The homepage shall enable the users of the system to navigate through the menu.

ii. Usability requirements

The users shall be required to fill in a questionnaire for the system to establish their interests and create a travelling schedule based on that.

iii. Security requirements

The users of the system shall be required to have an account to login to the system with their unique passwords. This is to ensure security of records in the system's database from unauthorised people.

iv. Reliability requirements

The system shall be flexible and adequately reliable, in that it would be accessible to any connected device with a browser.

v. Performance requirements

The response time would be minimal to enable fast fetch of users' location and creation of a schedule based on their interests as well as the general operation of the system.

The system shall be adequately scalable to handle workloads since it will be used in various locations around the globe at almost the same time.

vi. Supportability requirements

The system shall be adaptive to changes in user specifications and technology. Maintainability will thus be easy in case of changes.

4.3.2 Non-functional Requirements

Non-functional requirements are those that specifies the criteria that will be used to judge the system (Dabbagh & Lee, 2014).

i. Usability

The system shall be user-friendly to allow easier operation even for the people with limited computer knowledge.

ii. Accuracy

The system shall accurately fetch the users' location and give accurate directions of the places the user selects to visit.

iii. Performance

The system shall be highly responsive and fast enough to ensure all activities carried out by the users are efficiently completed.

4.4 System Architecture

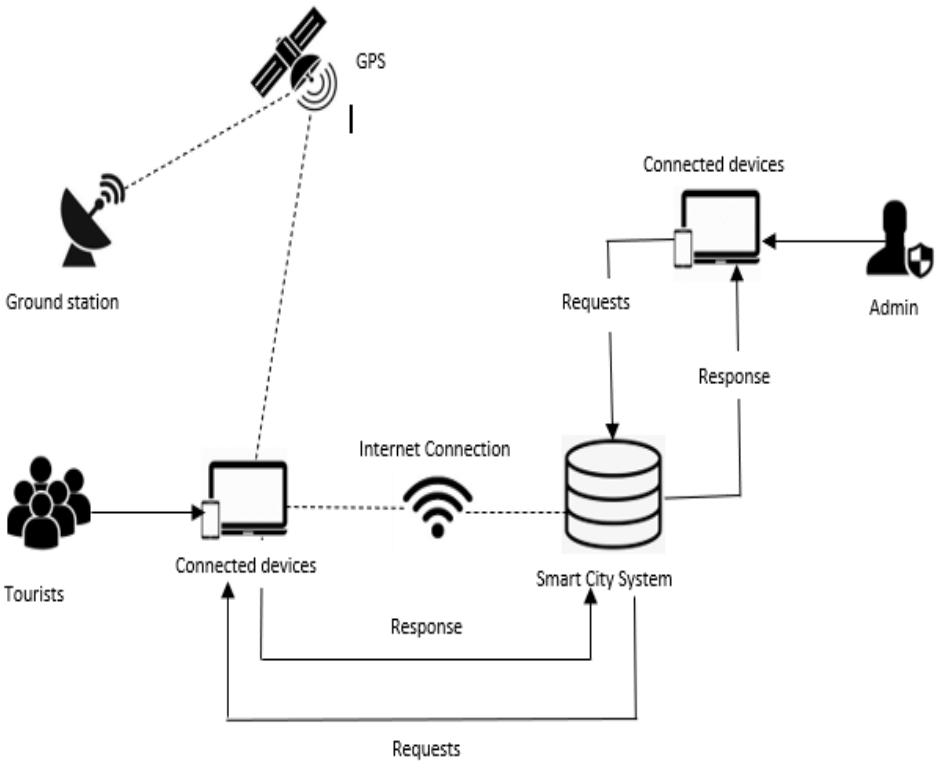

Figure 4-1.1 System Architecture

4.5 System Design

4.5.1 Use Case Diagram

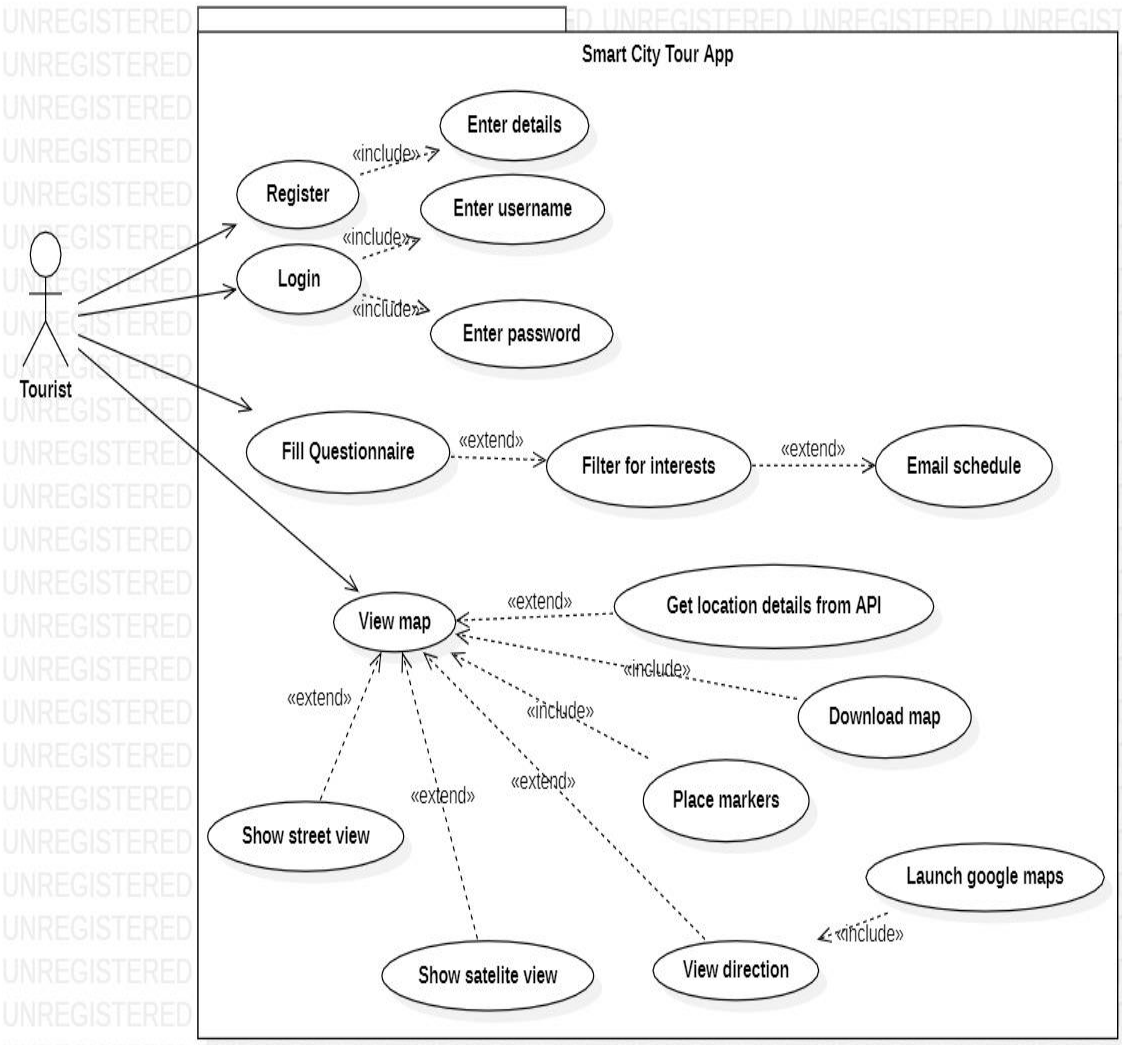

Figure 4-2.1 Use Case Diagram

4.5.2 Class Diagram

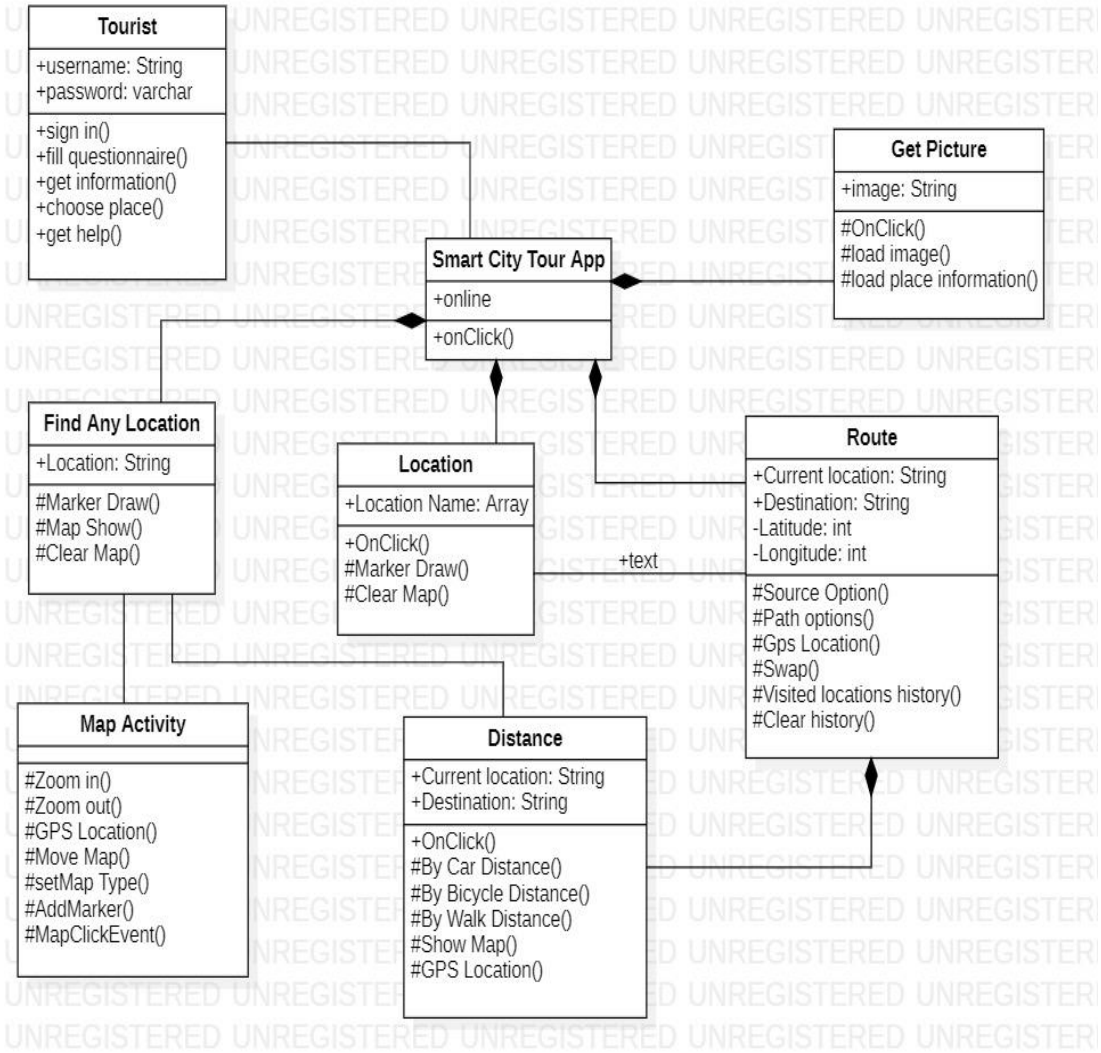

Figure 4-3.1 Class Diagram

4.5.3 Sequence Diagram

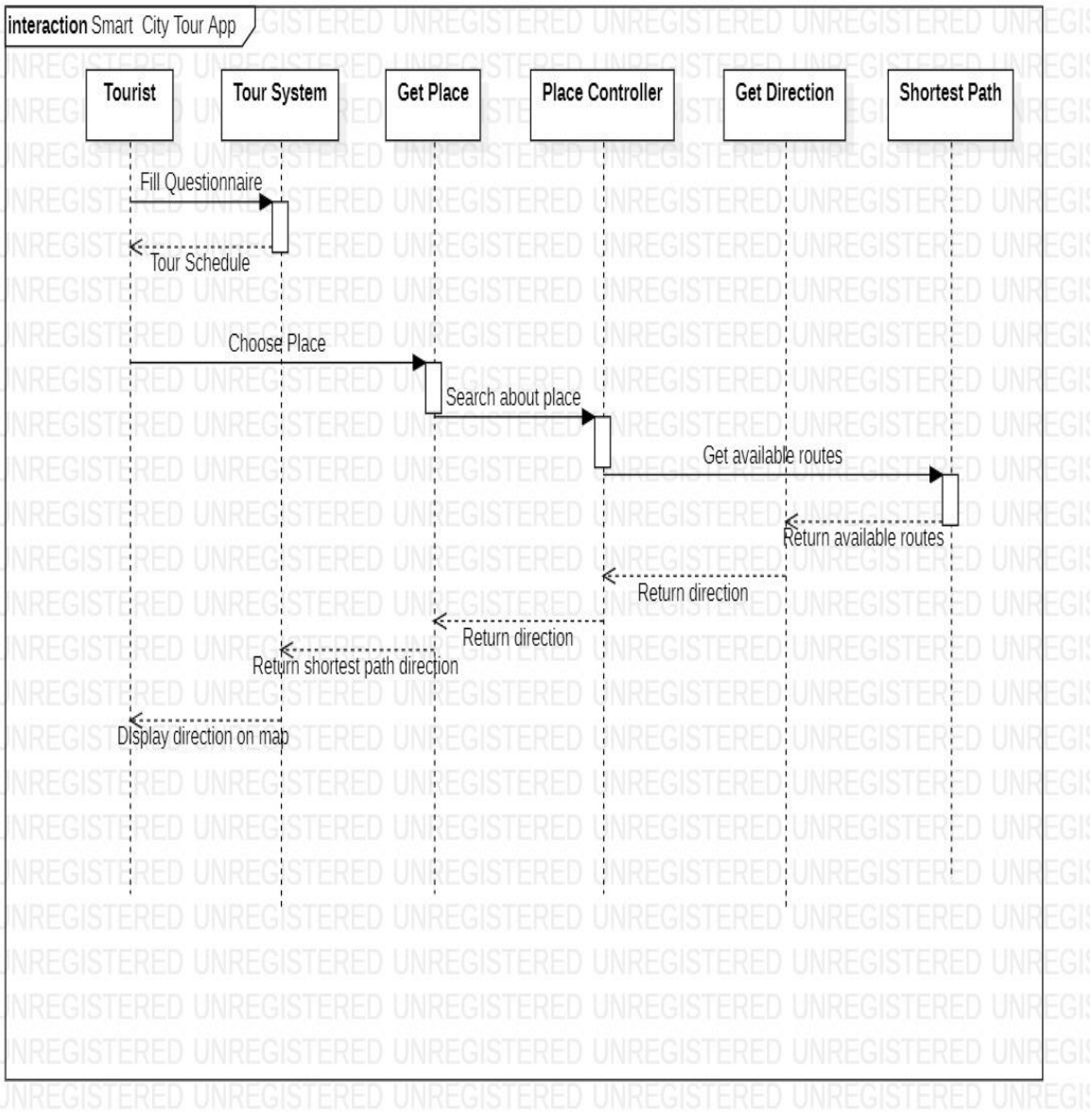

Figure 4-4.1 Sequence Diagram

4.5.4 Entity Relationship Diagram

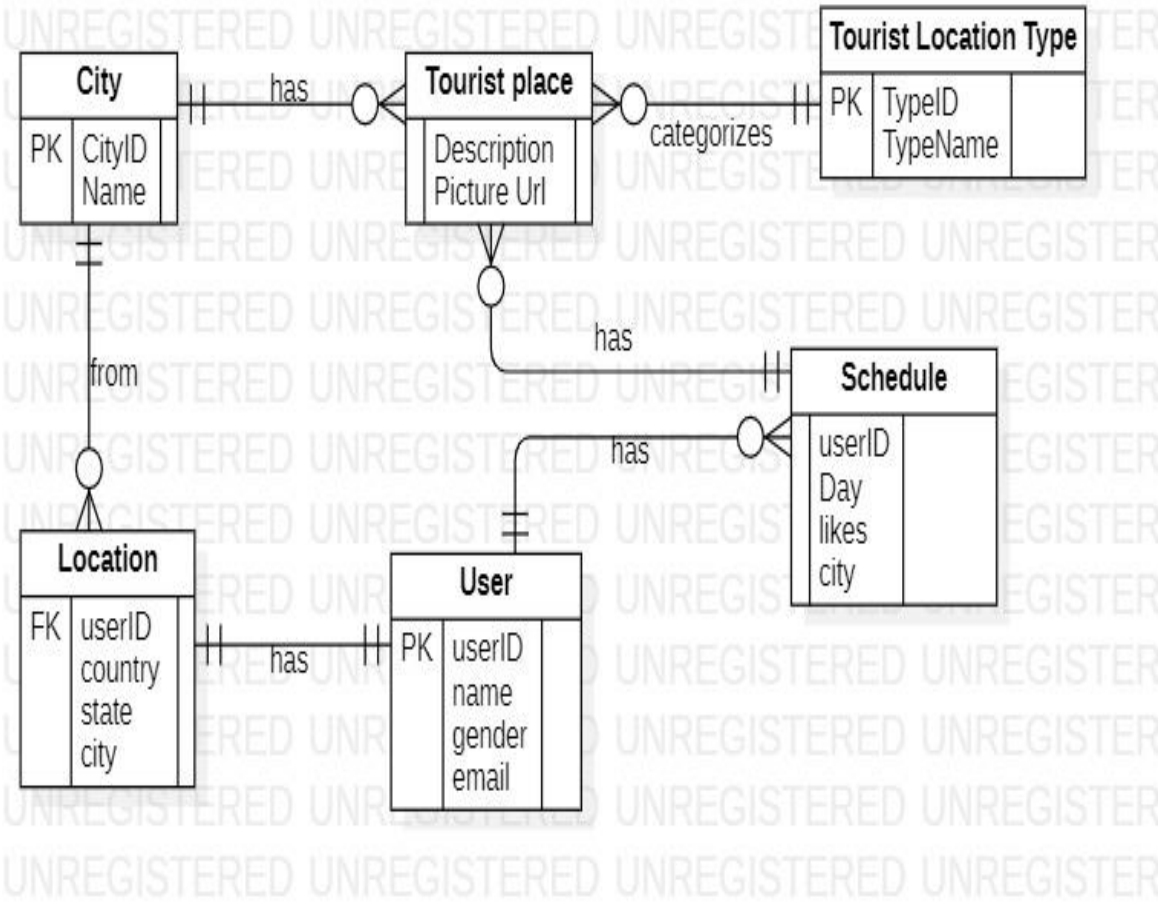

Figure 4-5.1 Entity Relationship Diagram

Chapter 5: System Testing

5.1 Introduction

This chapter seeks to cover more on what the system entails and what is the purpose of various sections of the system. It will also focus on the system testing and where the different sections of the system have truly succeeded or not. The main aim is to detect system failures so that defects can be discovered before the system is fully implemented. The system should be implemented to know if it truly functions as expected and test on whether it can handle a task in whatever manner it is keyed into the system.

5.2 Test Environment

This system has been designed to use a browser to run. The browser tests whether the system's functions are working effectively and checks for any errors in the system. Being web-based, the system does not require any external memories. It however uses resources from the server such as memory to store files that are used to run the system. The system is responsive to the screen resolution of the device being used, so that the view remains user-friendly whether on phone, laptop, or desktop computers. Network availability and accessibility to the internet is mandatory for the access and use of the system.

5.3 Test Cases

This section focused a lot on the system and what it does. It majorly focused on the system testing, detecting system failures, and whether the system functionalities succeeded or not.

Table 2.1 Test Cases Table

Test ID	**Related requirement**	**Inspection check**	**Pre-condition**	**Test data**	**Priority level**
T1	The system should enable registration	Does the system register a new user?	The user must be registering for the first time	Name: Henry Muchiri Gender: Male Email: hmuchiri@strathmore.edu	High

	of a new user			Mobile: 070133489 DOB: 12/03/2000 Password: 09876	
T2	The system should validate login input.	Does the system validate login input?	The user must be already registered in the system	User Email Password	High
T3	Response on entering invalid email and password.	Does the system validate login using invalid details?	The user must have access to the login page of the system	Email: hmuchiri@gmail.com Password: 67890	Medium
T4	The system should enable users select their interests in a particular city.	Can users select their interests from a variety in a city?	An entity should be logged in to the system.	Session data currently available for the logged in entity.	High
T5	The system should filter out the users' interests	Does the system filter out the users' interests and display options?	A user should have selected his places of interests from the questionnaire.	Data for places of interest currently available for the currently logged in user.	High
T6	The system should display a google map of the locations chosen by the user, with their shortest paths from the user's	Does the system display a map of the locations with the shortest routes?	A user should have selected his places of interests from the questionnaire.	Data for the places of interests currently available for the currently logged in user.	High

	current location.				
T7	The system should display the ratings and reviews when the user clicks on the markers on the maps.	Is the system able to display the ratings and reviews when markers on the maps are clicked?	The locations of interest selected by the user should have been displayed on the map.	Data for the places of interests currently available for the currently logged in user.	High
T8	The system should send an email to the user with information about their plan.	Does the system send the users plan through email?	The plan should be saved on the system.	The travel schedule data currently available for the currently logged in user.	Medium
T9	The system should allow a user to move form section to section easily.	Does the system provide easy navigation for the user?	The systems' sections should be interconnected.	User details	High

5.4 Test Results

The tests performed mirrored the following results:

Table 3.1 Test Results Table

Test ID	Expected result	Actual result	Status	Remarks
T1	The system checks if all fields have been filled.	The system gives a warning if one of the required fields is not filled.	PASS	The system warns the user concerning missing fields and does not allow registration to the system without them.
T2	The system checks if all fields have been filled.	The system gives a warning if one of the required fields is not filled.	PASS	The system warns the user concerning missing fields and does not allow access to the system without them.
T3	The system should deny login and output error message.	The system gives a warning error and denies login	PASS	The system warns the user on invalid credentials and denies access.
T4	A user should be able to select his interests in a city from the list provided.	Every user managed to successfully select their interests from the list	PASS	Success selection of places of interest.
T5	The system should filter the places of interest selected by the user.	The selected places of interest were displayed on the page.	PASS	The filter was successful.
T6	The system should display a map with all the places selected by the user.	A map with markers of the places selected by the user was displayed.	PASS	The system successfully displays a google maps with the places selected.

T7	Users can view ratings and reviews of the places on the map	The ratings and reviews were displayed when the user clicked on the markers on the map	PASS	The Foursquare API successfully got the ratings and reviews.
T8	The system should send an email to the user with the schedule.	An email was not sent to the users.	FAIL	The php mailer functionality should be correctly implemented.
T9	Users can navigate easily through the system.	Users can move from one section to another while logged in.	PASS	The system allows a user, once logged in, to view relevant details on different sections of the system.

5.5 Implementation

5.5.1 System Backend

The system's backend entails the logic behind the main functionalities of the Smart City Tour System.

a) Navigation Function

When navigating on a sphere, a heading is the angle of a direction from a fixed reference point, usually true north. Within the Google Maps API, a heading is defined in degrees from true north, where headings are measured clockwise from true north (0 degrees). This heading may be between two locations with the computeHeading () method, passing it from and to LatLng objects. The following example creates two polylines, when you click two points on the map, one geodesic and one "straight" line connecting the two locations and computes the heading for travelling between the two points.

Below is the code snippet:

```
// This example requires the Geometry library. Include the
libraries=geometry
// parameter when you first load the API. For example:
// <script
src="https://maps.googleapis.com/maps/api/js?key=YOUR_API_KEY&libraries
=geometry">

var marker1, marker2;
var poly, geodesicPoly;

function initMap() {
  var map = new google.maps.Map(document.getElementById('map'), {
    zoom: 4,
    center: {lat: 34, lng: -40.605}
  });

  map.controls[google.maps.ControlPosition.TOP_CENTER].push(
      document.getElementById('info'));

  marker1 = new google.maps.Marker({
    map: map,
    draggable: true,
    position: {lat: 40.714, lng: -74.006}
  });

  marker2 = new google.maps.Marker({
    map: map,
    draggable: true,
    position: {lat: 48.857, lng: 2.352}
  });

  var bounds = new google.maps.LatLngBounds(
      marker1.getPosition(), marker2.getPosition());
  map.fitBounds(bounds);

  google.maps.event.addListener(marker1, 'position_changed', update);
  google.maps.event.addListener(marker2, 'position_changed', update);

  poly = new google.maps.Polyline({
    strokeColor: '#FF0000',
    strokeOpacity: 1.0,
    strokeWeight: 3,
    map: map,
  });

  geodesicPoly = new google.maps.Polyline({
    strokeColor: '#CC0099',
    strokeOpacity: 1.0,
    strokeWeight: 3,
    geodesic: true,
    map: map
  });

  update();
}

function update() {
  var path = [marker1.getPosition(), marker2.getPosition()];
  poly.setPath(path);
  geodesicPoly.setPath(path);
  var heading = google.maps.geometry.spherical.computeHeading(path[0],
path[1]);
  document.getElementById('heading').value = heading;
  document.getElementById('origin').value = path[0].toString();
  document.getElementById('destination').value = path[1].toString();
}
```

Figure 5-1.1 Geometry Library

b) PHP Mailer API

PHPMailer is a code library to send emails safely and easily via PHP code from a web server. Sending emails directly by PHP code requires a high-level familiarity to SMTP standard protocol and related issues and vulnerabilities about Email injection for spamming.

```php
<?php
// Import PHPMailer classes into the global namespace
// These must be at the top of your script, not inside a function
use PHPMailer\PHPMailer\PHPMailer;
use PHPMailer\PHPMailer\Exception;

// Load Composer's autoloader
require 'vendor/autoload.php';

// Instantiation and passing `true` enables exceptions
$mail = new PHPMailer(true);

try {
    //Server settings
    $mail->SMTPDebug = 2;                      // Enable verbose debug output
    $mail->isSMTP();                           // Set mailer to use SMTP
    $mail->Host       = 'smtp1.example.com;smtp2.example.com';  // Specify main
and backup SMTP servers
    $mail->SMTPAuth   = true;                  // Enable SMTP authentication
    $mail->Username   = 'user@example.com';                     // SMTP username
    $mail->Password   = 'secret';                               // SMTP password
    $mail->SMTPSecure = 'tls';       // Enable TLS encryption, `ssl` also accepted
    $mail->Port       = 587;                   // TCP port to connect to

    //Recipients
    $mail->setFrom('from@example.com', 'Mailer');
    $mail->addAddress('joe@example.net', 'Joe User');     // Add a recipient
    $mail->addAddress('ellen@example.com');               // Name is optional
    $mail->addReplyTo('info@example.com', 'Information');
    $mail->addCC('cc@example.com');
    $mail->addBCC('bcc@example.com');

    // Attachments
    $mail->addAttachment('/var/tmp/file.tar.gz');         // Add attachments
    $mail->addAttachment('/tmp/image.jpg', 'new.jpg');    // Optional name

    // Content
    $mail->isHTML(true);                                  // Set email format to HTML
    $mail->Subject = 'Here is the subject';
    $mail->Body    = 'This is the HTML message body <b>in bold!</b>';
    $mail->AltBody = 'This is the body in plain text for non-HTML mail clients';

    $mail->send();
    echo 'Message has been sent';
} catch (Exception $e) {
    echo "Message could not be sent. Mailer Error: {$mail->ErrorInfo}";
}
```

Figure 5-2.1 PHP Mailer Code Snippet

c) User Current Location

User's current location is being fetched in real time to know in which city user is. And this is done by the following code:

```
function get_response(callback)
{
const Http = new XMLHttpRequest();
const url =
"https://api.foursquare.com/v2/venues/search?near="+city+"&query="+QUERY+"&client_i
d="+CLIENT_ID+"&client_secret="+CLIENT_SECRET+"&v="+YYYYMMDD;
Http.open("GET", url);
Http.send();
Http.onreadystatechange=(e)=>
{
        outp1 = Http.responseText;
        callback();
}
}
```

Figure 5-3.1 User's Current Location

d) Nearest Place

Here Google Maps API is used to display the map and all the pinned places. To display the directions and shortest route and distance between the places, Google Maps Directions API is used. This also fetches the longitude and latitude of all the places. And to show distance of all the places from user's location, Geometry Library is used. This enables user to know which of recommended places is nearest among them. To show the nearest places, all the places are sorted based on distance using the following code (internally using insertion sort):

```
//calculates distance between two points in km's
        var ct=1;
        var mn=2000000;
        for(var j=1;j<markers.length;j++)
        {
            var p1 = new
google.maps.LatLng(markers[0].coords.lat,markers[0].coords.lng);
            var p2 = new
google.maps.LatLng(markers[j].coords.lat,markers[j].coords.lng);
            distance[ct]=calcDistance(p1, p2);
            if(mn > parseFloat(distance[ct])){
                mn = distance[ct];
            }
```

```
            ct++;
        }
        console.log("min distance="+mn);


        for(var i=1; i < ct; i++){
            var k = parseFloat(distance[i]);
            var lat1 = markers[i].coords.lat;
            var lng1 = markers[i].coords.lng;
            var name_loc = loc_name[i];

            var j = i - 1;

            while(j >= 1 && parseFloat(distance[j]) > k){
                markers[j+1].coords.lat = markers[j].coords.lat;
                markers[j+1].coords.lng = markers[j].coords.lng;
                distance[j+1] = distance[j];
                loc_name[j+1] = loc_name[j];
                j--;
            }


            markers[j+1].coords.lat = lat1;
            markers[j+1].coords.lng = lng1;
            distance[j+1] = k;
            loc_name[j+1] = name_loc;
        }
```

Figure 5-4.1 Nearest Place Code Snippet

5.5.2 System Frontend

The system's frontend entails the snapshot of the graphical user interfaces of the modules that were discussed in section 3.8 of this document.

a) Sign in Page

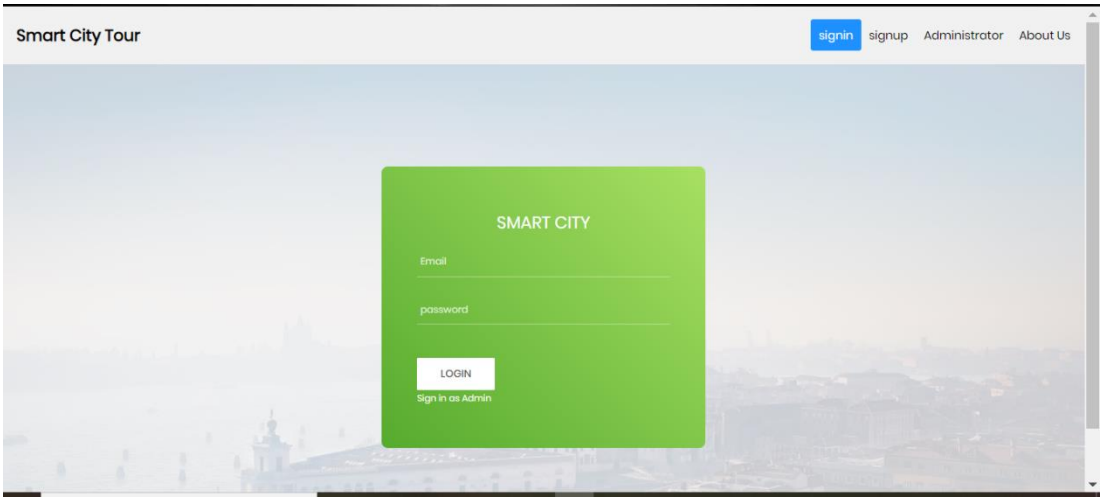

Figure 5-5.1 Sign in Page

b) Sign Up Page

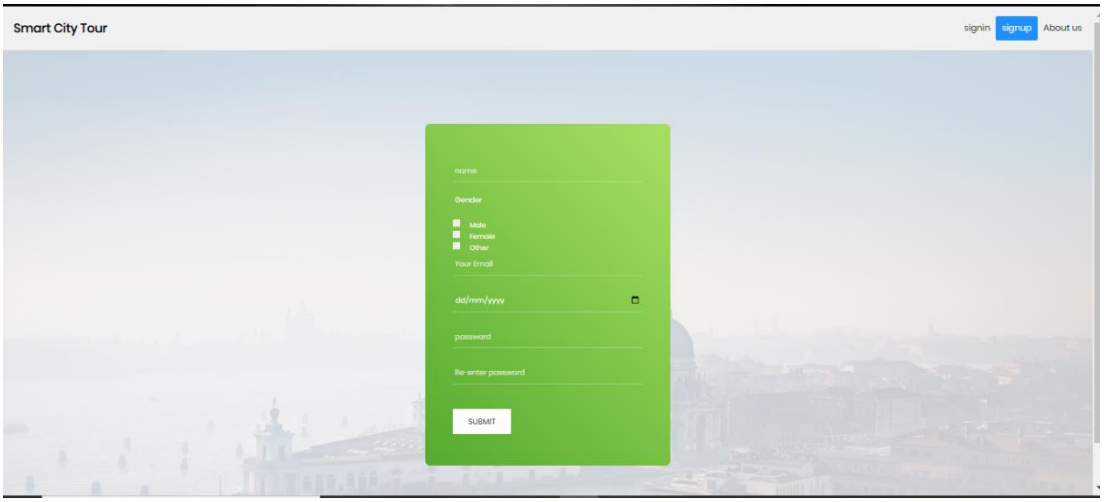

Figure 5-6.1 Sign Up Page

c) Creating a Schedule

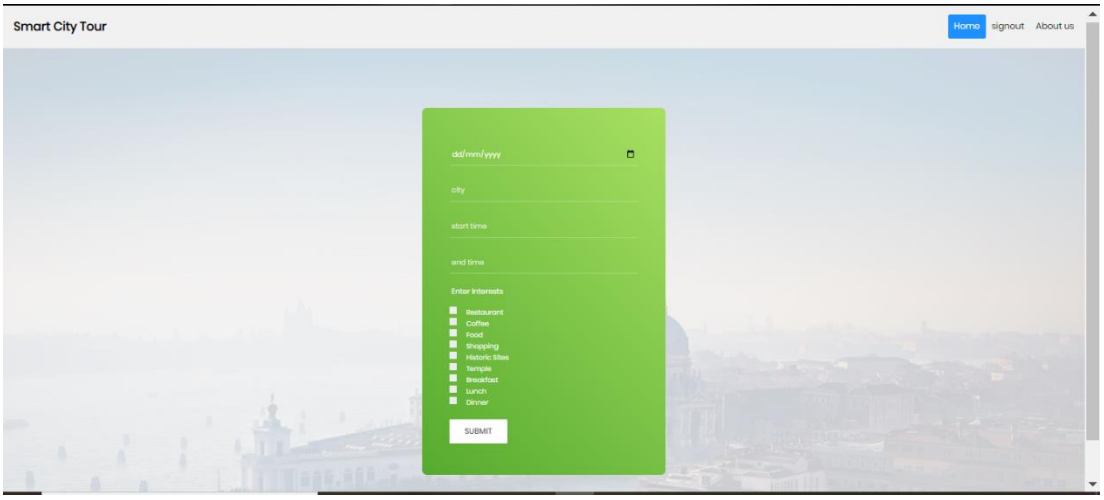

Figure 5-7.1 Creating a Schedule.

d) Dashboard

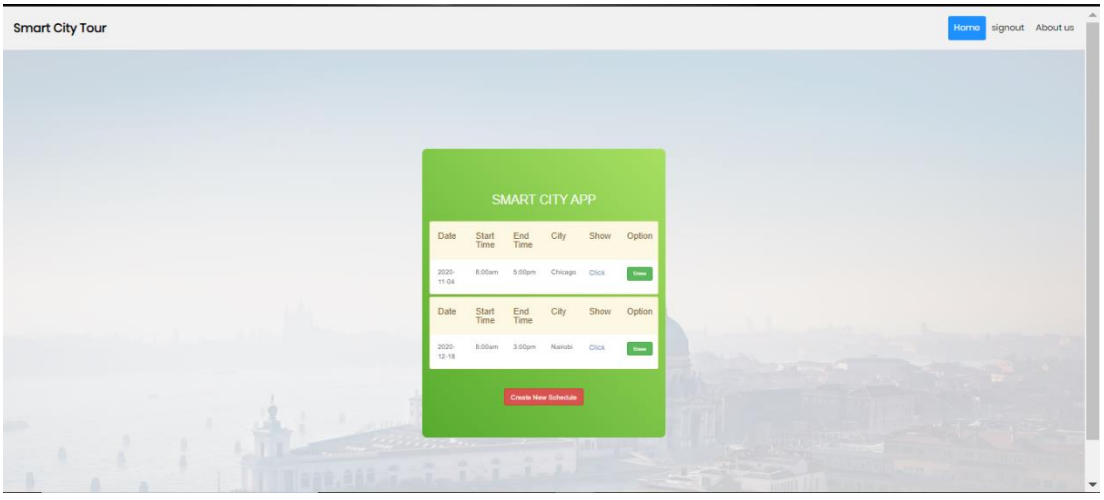

Figure 5-8.1 User Dashboard

e) Map view

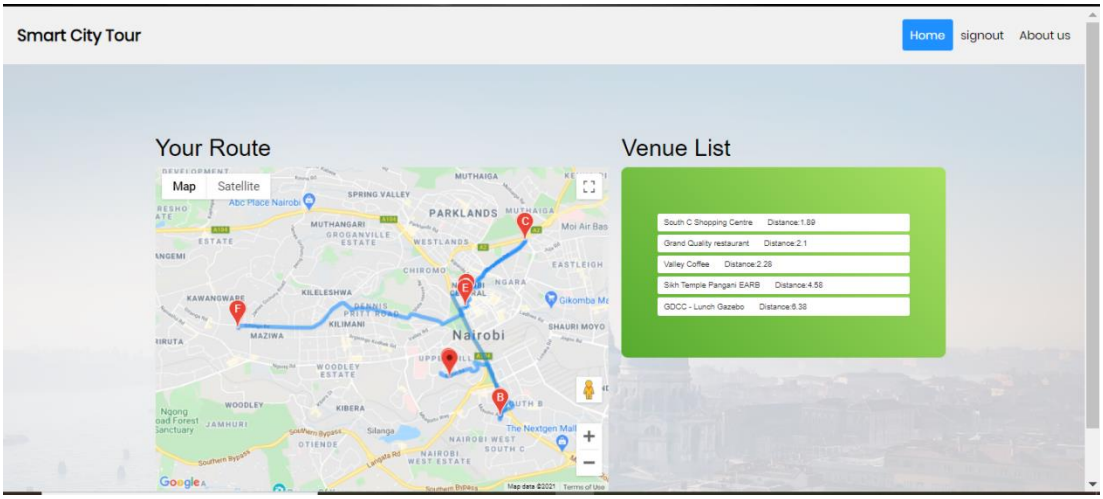

Figure 5-9.1 Map View Showing Connected Paths

Chapter 6: Conclusions, Recommendations and Future Works

6.1 Introduction

This chapter is going to cover on the system and what the system has been able to achieve at the end of its completion. There will also be the coverage on what the system was not able to achieve and make recommendations on future works that can be achieved by similar systems that aim at solving the same problem as Smart City Tour. We will be analyzing the system developed and summarise on the data collected. On the recommendation, this will entail suggestions on other tasks that can be achieved by the system in future or that can also be achieved by similar systems that aim to solve the same problem as the current system. This will help the current and future developers to know of what areas to cover. Conclusion will be on conversing and stating what the system has been able to accomplish as per its completion and will also cover on the termination of the system development. This will also mark the final stage of the system completion by confirming and clarifying that the system development has come to the end of its construction as per the developer's knowledge.

6.2 Conclusions

Smart City Tour was developed majorly to provide timely travelling information to tourists on the move around the globe, which was a concern raised by them as seen in the earlier chapter of this paper. A web-based application was created to enable access by all the tourists using any devices connected to the internet, to facilitate their easier navigation of cities around the globe.

The application works such that a user (tourist) is able to create an account and login using the valid credentials set by them. The users are then requested to fill in the details of their tour in a particular place which entails the time frame and their interests, so that the application can filter and create a schedule only of the places relevant to them. From this point, the application fetches the user's GPS location which is used by the map to show the shortest paths to the different selected areas on a particular schedule. The application allows the users to create more than one schedule for different places or even the same place, and the records are nicely stored and can be easily viewed by the user upon successful login. On the maps, the location pin of the selected areas by

the user reveals the rating of the particular places when the pins are clicked. This was achieved using the Foursquare API, which was also used to filter the places of interests from a list as selected by the users.

For the administrators' panel, which is expected to be majorly for potential investors and owners or managers of the particular places of interests, a graph is provided to show the trends of tourists and their interests in the various cities. This information can be used by them to make sound decisions or investments in particular sectors in anticipation of the on season in particular cities. The graph of different cities and their interests was achieved by using a filter that refreshes using Ajax whenever a new city is selected to be viewed.

The development of this smart information system was carried out using Prototyping System Development Methodology, which was the preferred choice for it favours use of numerous prototypes due its modular nature and accommodative to change. The test results done to the system were positive and therefore gave confidence that the system will work according to its main functionalities. The objectives of the project were all met by the developer.

6.3 Recommendations

For the Smart City Tour system to work, the devices used by the users of the system while accessing the system are required to be connected to the internet and have their location visible or turned on. This is because the GPS technology that is used in the system requires an environment with a stable internet connection for it to be able to track the location of the users and it employs the location feature in smartphones during locating places of interest and displaying the map to those places.

The users will also just be able to view the proper map of places only when they are close to the vicinity or city where they would like to tour. This is because the system takes the users' location in order to show the shortest path. Creation of schedules by the users will however be possible at any place around the globe.

6.4 Future works

Despite this research aiming to solve problems arising while sourcing for accurate and timely tour information while on the move, not all areas have been able to be addressed due to the scope of the project. Therefore, for the future work to enhance the research can entail the development of a smart city system that enables for offline insert or view of details even when the system server goes down. At the moment, the system is single point, which is a great disadvantage when any kind of failure occurs on the server. Also, if possible, future developers can develop a system that is data independent, so that if anything goes wrong with the Foursquare, the system is still able to give reliable and accurate data. Currently, the system is data dependent hence liable to give wrong data if any kind of failure is experienced.

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Appendix A: Timeline of Activities

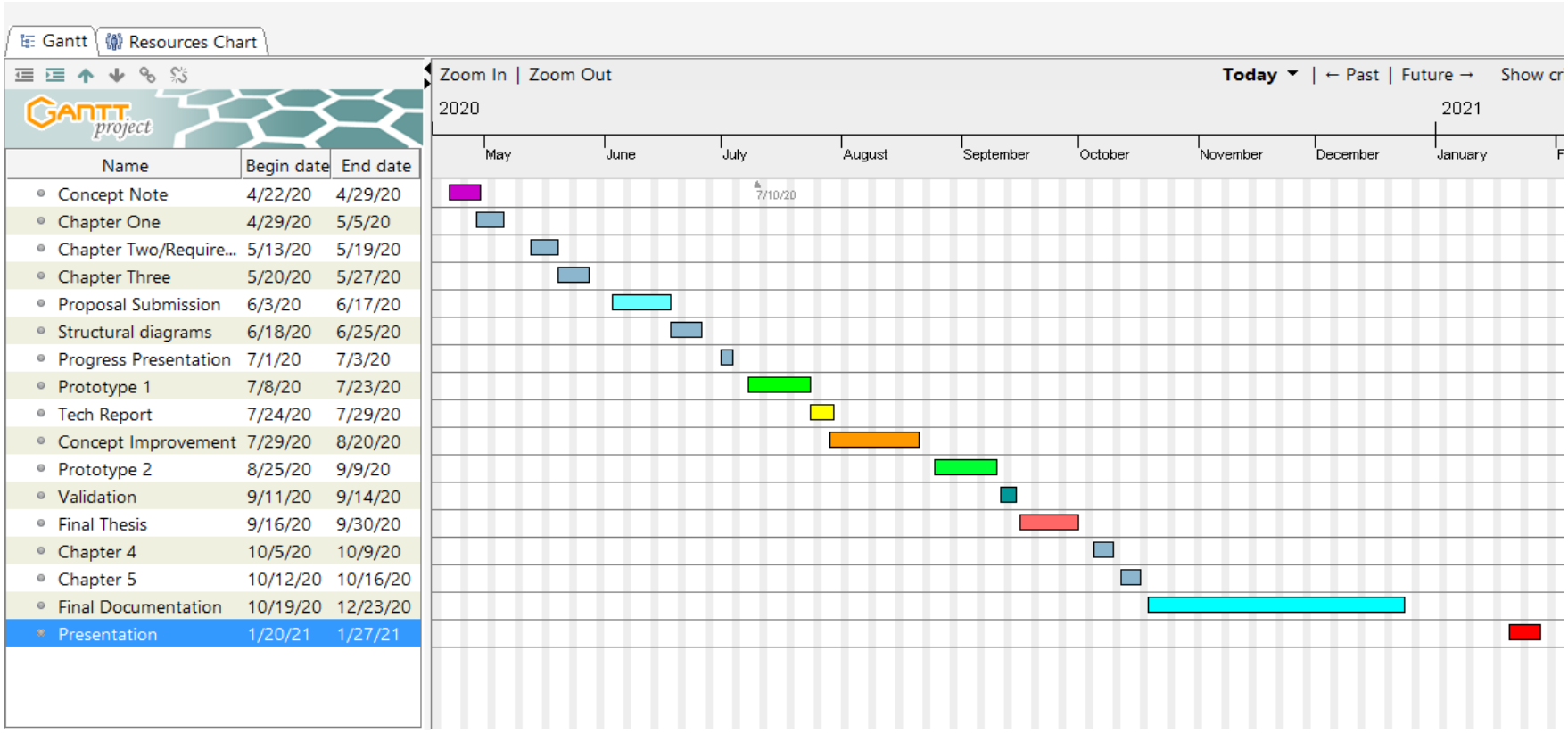

Figure 0-1.1 Gantt Chart

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IS PROJECT 2 DOCUMENTATION ASSESSMENT FORM

Student's Name: ……...…… Student's Number: ……

Project Title: ……

ITEM	Weight	Score	Notes
Title page: Informative, concise and appropriate	**1 pt**		
Table of Contents Present with page numbers corresponding to report	**1 pt**		
Introduction Background Problem Statement (Background, Clear*2, Gap Identified) Objectives (SMART and Linked to Problem Statement)	**(8 pts)** 2 2 4		
Literature Review/Related Work Are relevant literature/work consulted? Is the literature cited properly? Is the literature adequate?	**(6 pts)** 2 2 2		
Approach/ Methodology Is the choice of methodology introduced and supported? Is there a clear, logical and well-planned approach to the project work Is there a clear explanation of the tools and techniques used	**(6 pts)** 2 2 2		
System Analysis and Design Interface Designs Process models(use case) Class models Final Database Schema	**(12 pts)** 3 3 3 3		
Implementation and Testing Is there sufficient evidence of system Testing User guide	**(10 pts)** 4 6		
Conclusions and Recommendations Meaningful recommendations and suggestions for further work?	**(5 pts)** 5		
Report Presentation Is there an abstract that concisely describes the project? Are references provided and formatted correctly? Is there a clear and proper use of language? Effective report structure (divided into chapters and sections) and layout	**(11 pts)** 2 3 3 3		
Total Mark	**60**		

Comments: _____

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Signed_____ Date_____