**CHAPTER III**

**RESEARCH METHODOLOGY**

**Research Environment**

The location of the study is in the Mandaue City. Mandaue City is located on the central-eastern region of Cebu and part of the sixth district of Cebu together with Consolacion and Cordova. The city has 27 barangays and an area of 2, 518 hectares (6, 220 acres). Mandaue City’s road network is composed of a national road which connects the city to its neighboring cities and municipalities, and a national second road which traverses metropolitan area. The total length of the city road network is about 133.68 kilometers, and divided into: National road which has 13.16 kilometers, City road lengths 57.10 kilometers, and Barangay road has 63.42 kilometers. Road density is 5.31 km per square kilometer of land. Land transportation is being catered by Public Utility Jeepneys (PUJ), utility vehicles, mini-buses, multi-cabs, tricycle, and for cargoes, trailers and vans.

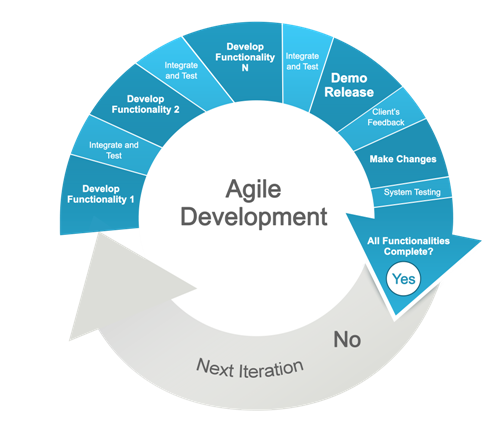
**Software Engineering Methodology**

Figure 2: **Agile Development Life Cycle**

Agile methodology is an alternative to traditional project management; it helps teams respond to unpredictability through incremental, iterative work cadences, known as sprints. Agile methodologies are an alternative to waterfall, or traditional sequential development.

Agile development methodology provides opportunities to assess the direction of a project throughout the development lifecycle. This is achieved through regular cadences of work, known as sprints or iterations, at the end of which teams must present a potentially shippable product increment.

Following are the Agile Manifesto principles

**Individuals and interactions** - in agile development, self-organization and motivation are important, as are interactions like co-location and pair programming.

**Working software** - Demo working software is considered the best means of communication with the customer to understand their requirement, instead of just depending on documentation.

**Customer collaboration** - As the requirements cannot be gathered completely in the beginning of the project due to various factors, continuous customer interaction is very important to get proper product requirements.

**Responding to change** - agile development is focused on quick responses to change and continuous development.

**Planning/ Conception-Initiation Phase**

**Business Model Canvas**

Table 2 shows the Business Model Canvass of the system proposed. This will give idea to an investor about the view of the proposed system and who will be the key partners’ involved that will buy and help the proposed system. The key activities being done by the system, value propositions which presents why the system will be created, how this is involved with customer relationships, key resources which states the resources involved that will be used in developing the system and who are the proponents involved in the study. The customer segments present the place where the proposed system will be implemented. The channels, presents the ways on how to market the business happens while the cost structure presents where the cost of the business occurs.

Table 2

BUSINESS MODEL CANVAS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Partners | Key Activities | Value Proposition | Customer Relationship | Customer Segments |
| -Traffic Management  -CITOM  -Google  -Mandaue City  -Telcom | -Platform Development  -Data Center  Management | -Provide current  Traffic information and alternative routes | -Automated Services | -Commuters  -Private vehicle owners |
| Key Resources  -Network Technology  -Traffic Data  -Internet  -Google Map | Channels  -Mobile network  -Internet connectivity |
| Cost Structure  -Data center costs  -Research and development  -Hardware and Computer Costs | | Revenue Streams  -Free  -Ad Revenues  - Premium usage fees | | |
|

**Program Workflow**

Program workflow shows the workflow shows the process of each system process.

They represent, in a sequential manner, the requisites and/or conditions before the system proceeds to the other process like displaying a page or a prompt.

Display Registration Form

User Fill out Form

No

Yes

Empty fields?

Prompt user to check and fill empty fields

No

Yes

Username exists?

Prompts user to change username

Save Details

Display Login Form

End

Figure 3: **Registration Workflow**

Display Login Form

User inputs username and password

Yes

Prompt user to check and fill empty fields

Empty fields?

Yes

No

Prompt and load registration form

Existing account?

No

Display Home Page

End

Figure 4: **Login Workflow**

Display form for uploading Road disturbance image & video clips

User inputs image/video clips, type of road disturbance, and details on the form

User clicks submit buttom

Yes

Empty fields?

Prompt user to check and fill empty fields

No

Yes

Disapproved by Admin?

Prompt user about the disapproval of the post

No

End

Road disturbance image & video clips successfully posted

End

Figure 5: **Road Disturbance Images and Video Clips Workflow**

View Streets on the Map

Select Streets to add traffic details

Select weight of traffic from the radio buttons

Cancel Selection?

Yes

No

Traffic details on the street saved

Map displays traffic details

End

Figure 6: **Process Traffic Details Workflow**

Display Textbox for origin and destination

Input origin and destination

Yes

Prompt user to check and fill empty fields

Empty textbox?

No

Yes

Origin/Destination not found?

Prompt user of the unavailability of Origin/Destination

No

Display ranked alternative route on the map with fare cost and travel time

End

Figure 7: **View Alternative Routes Workflow**

View listed coordinates

Select origin and destination from the list of coordinates

Yes

Prompt admin to select origin and destination from the list

Destination and Origin not selected?

No

Select the weight of traffic of the route based from the traffic details

Select jeepneys to ride in the route

Yes

Is button submit not clicked?

No

Route has been saved

End

Figure 8: **Add Alternative Routes Workflow**

Display form for adding Destination location

Input Location Name and Coordinates

Prompt user to fill empty fields

Empty textbox?

Submit location name and Coordinates

Destination location saved

End

Figure 9: **Add Destination Location Workflow**

Display Traffic Details Form

Admin Fill out Form

Yes

Empty fields?

Prompt Admin to check and fill empty fields

No

Is confirmed buton not clicked?

Yes

No

Jeepney Information

saved

End

Figure 10: **Process Jeepney Information Workflow**

Table 3

GANTT CHART









LEGEND

|  |  |  |
| --- | --- | --- |
|  |  |  |

Plan, Actual, Delayed

**Functional Decomposition Diagram**

The functional decomposition diagram represents the breakdown of business processes that the proposed system will do. The processes will mainly cover about the functions of users

**ESC: A Mandaue City Travel Route Advisor**

**User**

**Traffic Enforcer**

**Traffic Operation Admin**

Login

Register Traffic Enforcer

Login

Update Traffic Details

Display Road Disturbance Reports

Register

Post Road Disturbance Images and Video Clips

Login

Post Road Disturbance Images and Video Clips

View Ranked Alternative Route

Generate Report

Post Images and Video Clips

Update Destination Location

Update Alternative Route

Figure 11: **Functional Decomposition of ESC: A Mandaue City Travel Route Advisor**

**Analysis-Design Phase**

Analysis design phase consists of design functions and operations which describes in detail the use case diagrams, storyboard, database design, and network design.

**Use Case Diagram**

A use case diagram is a graphic depiction of the interactions among the elements of a system. It used to identify, clarify, and organize system requirements.

ESC: A Mandaue City Travel Route Advisor

User

Traffic Operation Admin

Traffic Enforcer

Figure 12: **Use Case Diagram**

User

<<includes>>

Figure 13: **Process Registration**

Table 4

PROCESS REGISTRATION

|  |  |
| --- | --- |
| Use Case ID | UC-1 |
| Use Case Name | Process Registration. |
| Actors | User. |
| Description | To register user in the system. |
| Trigger | User will click on the registration button. |
| Pre-Conditions | The user will fill in all necessary information needed. |
| Expected Conditions | The user will be finally registered on the database. |
| Normal flow: | User will click the register button.   1. User will input the required data. 2. The User will click the save button. 3. System will send verification through email.   4. User will be successfully registered in the ESC database. |
| Includes | Verify account. |

Traffic Operation Admin

<<includes>>

Figure 14: **Process Register Traffic Enforcer**

Table 5

PROCESS REGISTER TRAFFIC ENFOCER

|  |  |
| --- | --- |
| Use Case ID | UC-2 |
| Use Case Name | Process Register Traffic Enforcer |
| Actors | Traffic Operation Admin. |
| Description | To register Traffic Enforcer in the system. |
| Trigger | Traffic Operation Admin will click on the registration button. |
| Pre-Conditions | The Traffic Operation Admin will fill in all necessary information needed. |
| Expected Conditions | The Traffic Enforcer will be finally registered on the database. |
| Normal flow: | Traffic Enforcer will click the register button.   1. Traffic Operation Admin will input the required data. 2. The Traffic Operation Admin will click the save button. 3. System will send verification through email.   4. Traffic Enforcer will be successfully registered in the ESC database. |
| Includes | Verify account. |

User

<<includes>>

Traffic Operation Admin

Traffic Enforcer

Figure 15: **Process Login**

Table 6

PROCESS LOGIN

|  |  |
| --- | --- |
| Use Case ID | UC-3 |
| Use Case Name | Process Login. |
| Actors | User, Traffic Enforcer, Traffic Operation Admin |
| Description | To login User/TE/TOA in the system. |
| Trigger | User/TE/TOA will click on the login button. |
| Pre-Conditions | The User/TE/TOA will fill in username and password. |
| Expected Conditions | The User/TE/TOA will finally enter the system. |
| Normal flow: | 1. User/TE/TOA will input the username and password. 2. The User/TE/TOA will click the login button. 3. User/TE/TOA successfully logged in. |
| Includes | Verify username and password. |

User

<<includes>>

Figure 16: **View Alternative Route**

Table 7

VIEW ALTERNATIVE ROUTE

|  |  |
| --- | --- |
| Use Case ID | UC-4 |
| Use Case Name | View Alternative Route |
| Actors | User |
| Description | To let User view alternative route. |
| Trigger | User will click on the view alternative button to view ranked alternative route with fare and travel time. |
| Pre-Conditions | The User will fill in its origin and destination. |
| Expected Conditions | The User will finally be successful on viewing the alternative route with fare and travel time. |
| Normal flow: | 1. User will input details necessary viewing alternative route.  2. The User will click the view button.  3. User successfully viewed the alternative route. |
| Includes | View Fare and Travel Time |

Traffic Operation Admin

Figure 17: **Process Traffic Details**

Table 8

PROCESS TRAFFIC DETAILS

|  |  |
| --- | --- |
| Use Case ID | UC-5 |
| Use Case Name | Process Traffic Details. |
| Actors | Traffic Operation Admin |
| Description | To let Traffic Operation Admin add traffic details. |
| Trigger | Traffic Operation Admin will click on the add button. |
| Pre-Conditions | The Traffic Operation Admin will add traffic details. |
| Expected Conditions | The Traffic Operation Admin will be successful on adding traffic details. |
| Normal flow: | 1. Traffic Operation Admin will input details necessary for adding traffic details.  2. Traffic Operation Admin will click the Add button.  3. Traffic Operation Admin successfully added traffic details. |
| Includes | None |

Traffic Enforcer

<<includes>>

User

Traffic Operation Admin

Figure 18: **Process Road Disturbance Images and Video Clips**

Table 9

PROCESS ROAD DISTURBANCE IMAGES AND VIDEO CLIPS

|  |  |
| --- | --- |
| Use Case ID | UC-6 |
| Use Case Name | Process Road Disturbance. |
| Actors | Traffic enforcer, User |
| Description | To let Traffic enforcer and user post road disturbance images or video clips. |
| Trigger | Traffic enforcer/User will click on the post button to post images and video clips. |
| Pre-Conditions | The Traffic enforcer/User will fill in the necessary details with images and video clips. |
| Expected Conditions | The Traffic enforcer/User will finally be successful on posting images and video clips. |
| Normal flow: | 1. Traffic enforcer/User will input details necessary for posting images and video clips.  2. The Traffic enforcer/User will click the post button.  3. Admin will approve the image or video clips.  4. Traffic enforcer/User successfully posted the images or video clips. |
| Includes | Admin Approval |

Traffic Operation Admin

Figure 19: **Process Destination Location**

Table 10

PROCESS DESTINATION LOCATION

|  |  |
| --- | --- |
| Use Case ID | UC-7 |
| Use Case Name | Process Destination Location. |
| Actors | Traffic Operation Admin. |
| Description | To let Traffic Operation Admin add destination location. |
| Trigger | Traffic Operation Admin will click on the add button. |
| Pre-Conditions | The Traffic Operation Admin will add destination location. |
| Expected Conditions | The Traffic Operation Admin Account will be successful on adding destination location. |
| Normal flow: | 1. Traffic Operation Admin will input details necessary for adding destination location.  2. Traffic Operation Admin will click the Add button.  3. Traffic Operation Admin successfully added destination location. |
| Includes | None |

Traffic Operation Admin

Figure 20: **Process Alternative Routes**

Table 11

PROCESS ALTERNATIVE ROUTES

|  |  |
| --- | --- |
| Use Case ID | UC-8 |
| Use Case Name | Process Alternative Routes. |
| Actors | Traffic Operation Admin. |
| Description | To let Traffic Operation Admin to add new alternative routes. |
| Trigger | The Traffic Operation Admin will click on the Add Routes. |
| Pre-Conditions | The Traffic Operation Admin will add new alternative route. |
| Expected Conditions | The Traffic Operation Admin will be successful on adding new alternative route. |
| Normal flow: | 1. Click Add Routes button. 2. Inputs necessary information about the new alternative routes to be added. 3. Click Add button. 4. New alternative routes successfully added. |
| Includes | None |

<<extends>>

Traffic Operation Admin

Figure 21: **Process Jeepney Information**

Table 12

PROCESS JEEPNEY INFORMATION TABLE

|  |  |
| --- | --- |
| Use Case ID | UC-9 |
| Use Case Name | Process Jeepney Information |
| Actors | Traffic Operation Admin. |
| Description | To let Traffic Operation Admin to add jeepney information on the system |
| Trigger | The Traffic Operation Admin will click on the manage jeepney information button |
| Pre-Conditions | The Traffic Operation Admin will input information about a jeepney which include routes |
| Expected Conditions | The Traffic Operation Admin will be successful on adding jeepney information |
| Normal flow: | 1. Click Manage Jeepney Information 2. Input details on the form 3. Jeepney Information successfully added |
| Includes | None |

**Storyboard**

Storyboard helps the user understand exactly how the system will work, much better than an abstract description, and it illustrate the important steps of the user experience.

**ADMIN DASHBOARD**

-Traffic Details

-Road Disturbance Report

-Add Alternative Routes

**LOGIN ADMIN**

(Type username & password)

Username:

Password:

**MENU**

LOGIN

Figure 22: **Storyboard of Admin**

The Admin will type its username and password to access to its dashboard.

(Send image or video clip)

VIDEO CLIP

IMAGE

(Capture road disturbance through image or video clip )

\*Image or Video Clip

CAMERA

**LOGIN TRAFFIC ENFORCER**

(Type username & password)

Username:

Password:

**ROAD DISTURBANCE**

SEND

**SEND BUTTON**

**ROAD DISTURBANCE REPORT**

**TRAFFIC ENFORCER MENU**

Login

Figure 23: **Storyboard of Traffic Enforcer**

The figure shows the process in posting Traffic Images and Video Clips in the newsfeed by the traffic enforcer

(Display image or video clip)

VIDEO CLIP

IMAGE

(Capture traffic status through image or video clip )

\*Image or Video Clip

CAMERA

**LOGIN USER**

(Type username & password)

Username:

Password:

**TRAFFIC POST**

POST

**POST BUTTON**

**Road Disturbance Report**

**USER MENU**

Login

Figure 24: **Storyboard of User**

The figure shows the process in posting Traffic Images and Video Clips in the newsfeed by the user

**Database Design**

Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database.

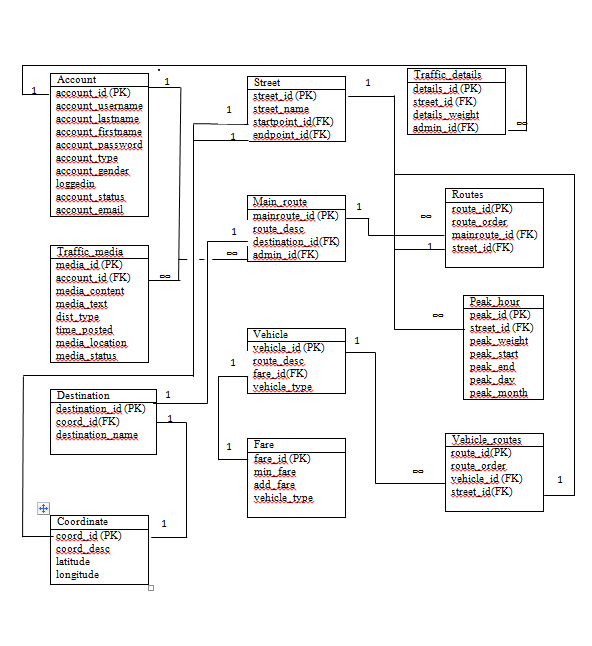


Figure 25: **Database Design**

**Entity-Relationship Diagram**

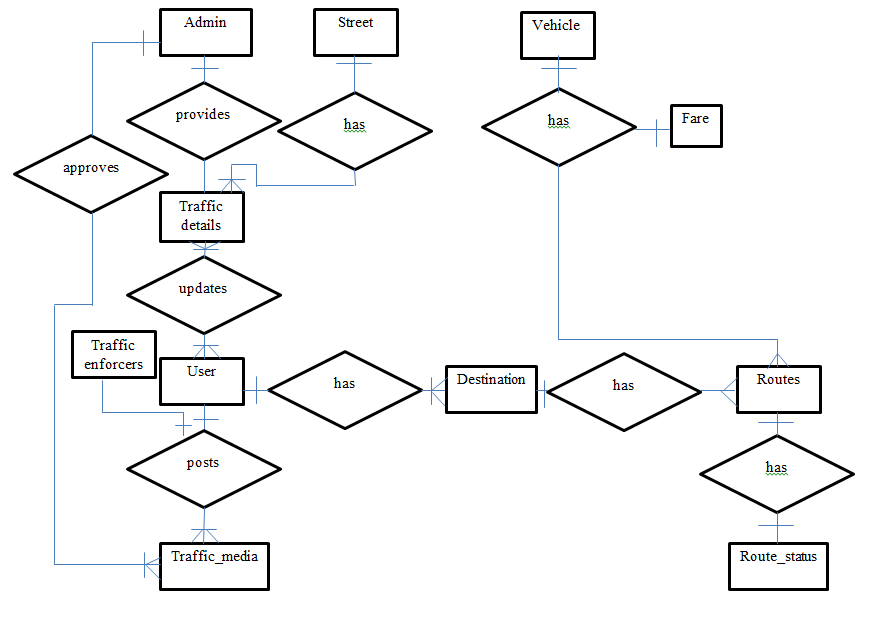
****

Figure 26: **Entity Relationship Diagram**



**Data Dictionary**

A set of information describing the contents, format, and structure of a database and the relationship between its elements, used to control access to and manipulation of the database.

Table 13

ACCOUNT TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| account\_id (PK) | Integer |  | Unique identification of the user | No | Consists of integers which are incremented when new users are registered |
| account\_username | Varchar | 50 | Unique username of the user, admin or enforcer | No |  |
| account\_lastname | Varchar | 50 | Last name of the user, admin or traffic enforcer | No |  |
| account\_firstname | Varchar | 50 | First name of the user, admin or traffic enforcer | No |  |
| account\_password | Varchar | 20 | First name of the user, admin or enforcer | No |  |
| account\_gender | char | 1 | Gender of the user, admin or traffic enforcer | No | Entered as ‘m’ for male and ‘f’ for female |
| account\_type | char | 1 | Account type of the user | No | Entered as ‘u’ normal users, ‘a’ for admin and ‘e’ for traffic enforcers |
| account\_status | char | 1 | The status of the user traffic, enforcer, and admin | No | Entered as ‘1’ if the account is already approved by the admin |
| account\_email | Varchar | 50 | Email address of the user | Yes |  |
| loggedin | char | 1 | Determines if the account has been already logged in | No | Entered as ‘1’ if logged in and ‘0’ if not |

Table 14

COORDINATES TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| coord\_id (PK) | Integer |  | Unique identification of the coordinates | No | Consists of integers which are incremented when new coordinates are added |
| coord\_desc | Varchar | 50 | Description of the coordinates | No |  |
| latitude | Varchar | 50 | Longitude of the coordinate | No | Used for geocoding the location |
| longitude | Varchar | 50 | Latitude of the coordinate | No | Used for geocoding the location |

Table 15

STREET TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| street\_id (PK) | Integer |  | Unique identification of the street | No | Consists of integers which are incremented when new street are added |
| street\_name | Varchar |  | Street name of the street | No |  |
| startpoint\_id(FK) | Integer |  | Foreign key used to reference the coord\_id in coordinates table | No | Used to retrieve coordinates for the starting point of a street |
| endpoint\_id(FK) | Integer |  | Foreign key used to reference the coord\_id in coordinates table | No | Used to retrieve coordinates for the end point of a street |

Table 16

TRAFFIC\_MEDIA TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| media\_id (PK) | Integer |  | Unique identification road disturbance media | No | Consists of integers which are incremented when new road disturbance media is added |
| account\_id (FK) | Integer |  | Primary key used to reference the account\_id of the user or enforcer in the Account table | No | Used for referencing the admin or user who posted the road disturbance media |
| date\_posted | Date |  | Date in which the admin or user posted the status | No |  |
| media\_content | Blob |  | Contains image or video clip of the road disturbance |  |  |
| time\_posted | Timestamp |  | Time when the user or traffic enforcer posted the road disturbance | No |  |
| dist\_type | char | 1 | Type of road disturbance | No | Entered as ‘a’ for accidents, ‘r’ for road closures, and ‘t’ for traffic jam |
| media\_location | Varchar | 100 | Location where the user or traffic enforcer posted the status | No |  |
| media\_status | Char | 1 | Status of the traffic media posted |  | Entered as ‘1’ if approved by the admin and ‘0’ if not |

Table 17

MAIN\_ROUTE TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| mainroute\_id (PK) | Integer |  | Unique identification of the main route | No | Consists of integers which are incremented when new main routes are registered |
| route\_desc | Varchar | 50 | Desciption of the route | No |  |
| destination\_id(FK) | Integer |  | Primary key used to reference the destination\_id in the Destination table | No |  |
| admin\_id(FK) | Integer |  | Primary key used to reference the account\_id of the admin in the Account table | No |  |

Table 18

ROUTE\_TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| route\_id(PK) | Integer |  | Unique identification of the route | No | Consists of integers which are incremented when new routes are registered |
| route\_order | Integer |  | The order of the route according to which comes first in the main route | No |  |
| mainroute\_id (FK) | Integer |  | Primary key used to reference the mainroute\_id in the Main\_route table | No |  |
| street\_id(FK) | Intger |  | Primary key used to reference the street\_id in the street table | No |  |

Table 19

TRAFFIC\_DETAILS TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| details\_id (PK) | Integer |  | Unique identification of the traffic details | No | Consists of integers which are incremented when new traffic details are registered |
| streetd\_id (FK) | Integer |  | Primary key used to reference the street\_id in the street table | No |  |
| details\_weight | Char | 1 | Weight of traffic |  | Entered as ‘l’ for light, ‘m’ for medium and ‘h’ for heavy |
| admin\_id(FK) | Integer |  | Primary key used to reference the account\_id of the admin in the Account table | No |  |

Table 20

PEAK\_HOUR TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| peak\_id (PK) | Integer |  | Unique identification of the peak hour information about a street | No | Consists of integers which are incremented when new peak\_hour is registered |
| street\_id (FK) | Integer |  | Primary key used to reference the street\_id in the Street table | No |  |
| peak\_weight | Char | 1 | Weight of traffic |  | Entered as ‘l’ for light, ‘m’ for medium and ‘h’ for heavy |
| peak\_start | Timestamp |  | Starting time of congestion in a street |  |  |
| peak\_end | Timstamp |  | End time of congestion in a street |  |  |
| peak\_day | Char | 3 | Day of congestion in a street |  |  |
| peak\_month | Char | 1 | Month of congestion in a street |  | Entered as numeric but treated as character. For example January is ‘1’ |

Table 21

DESTINATION TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| destination\_id (PK) | Integer |  | Unique identification of the destination | No | Consists of integers which are incremented when new destinations are registered |
| coord\_id(FK) | Integer |  | Primary key used to reference the coordinates in the Coordinates table | No |  |
| destination\_name | Varchar | 50 | Name of the destination |  |  |

Table 22

VEHICLE TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| vehicle\_id (PK) | Char | 20 | Unique identification of a Vehicle | No |  |
| route\_desc | Integer |  | Primary key used to reference the location\_no in the Location table | No |  |
| fare\_id(FK) | Integer |  | Primary key used to reference the fare\_id in the Fare table |  |  |
| vehicle\_type | Char | 1 | Type of vehicle |  | Entered as ‘t’ for taxi and ‘j’ for jeepney |

Table 23

VEHICLE\_ROUTES TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| route\_id(PK) | Char | 20 | Unique identification of a Vehicle route | No |  |
| route\_order | Integer |  | The order of a route in a vehicle | No |  |
| PUJ\_id (FK) | Char | 20 | Primary key used to reference the vehicle\_id in the vehicle table |  |  |
| street\_id(FK) |  |  | Primary key used to reference the street\_id in the Street table |  |  |

Table 24

FARE TABLE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Column Name | Data Type | Length | Description | Allow Nulls? | Business Constraints |
| fare\_id (PK) | Integer | 20 | Unique identification of the fare | No |  |
| min\_fare | Double |  | Minimum fare in texi or a jeepney | No |  |
| add\_fare | Float |  | Additional fare in texi or a jeepney in the succeeding km | No |  |
| vehicle\_type | Char | 1 | Type of vehicle | No | Entered as ‘t’ for taxi and ‘j’ for jeepney |

**Network Design**

The design of our proposed system has a database where the data are stored, a server that connects to the database, a wireless or LAN/WAN that forward data to the android users which serve as a client.

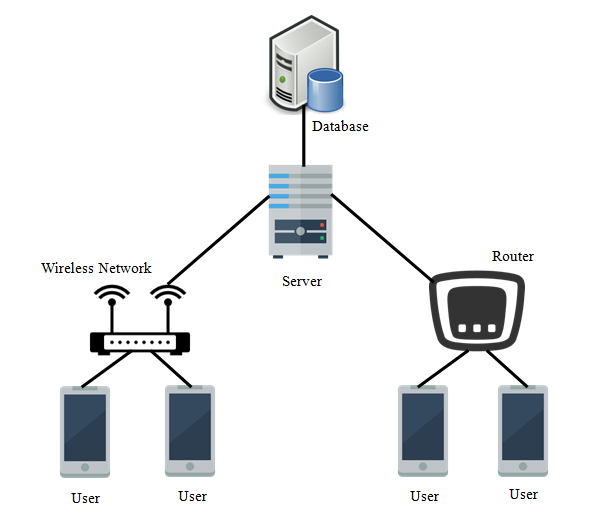
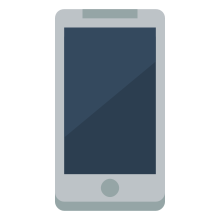
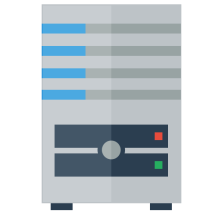


Figure 27: **Network Design**

**Network Model**

WAN or Wide Area Network is being used in this design. Both server and client need internet connection to employ its full functionality.



Fetches Data

Transmit Data

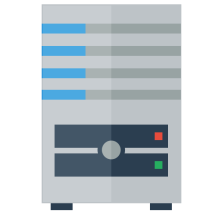
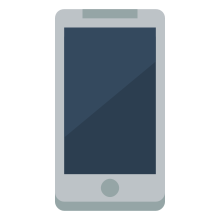
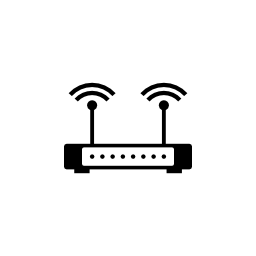
Server

User

Figure 26: **Network Model**

**Network Topology**

A mesh network is a network topology in which each node relays data for the network. All mesh nodes cooperate in the distribution of data in the network. Mesh networks can relay messages using either a flooding technique or a routing technique.



Server

Wireless Network

Mobile Phone

Database

Figure 27: **Network Topology**

**Development/Construction/Build Phase**

Development Phase shows and explains the software specifications, hardware specifications, and program specification of the system.

**Technology Stack Diagram**

A technology stack comprises the layers of components or services that are used to provide a software solution or application.

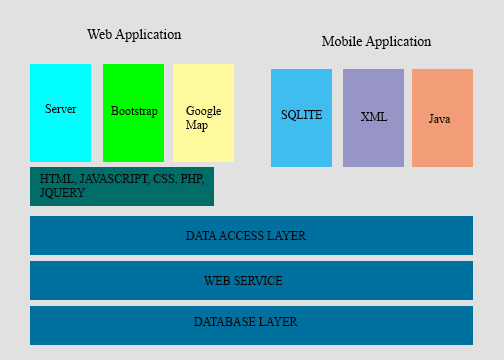


Figure 30: **ESC: A Mandaue City Travel Route Advisor Technology Stack Diagram**

**Hardware and Software Specifications**

This section evaluates the methods of computer communication and discusses how they could be integrated in this project as well as to discuss all about the necessary hardware and software used to employ the system.

**Software Specification**

* The front-end
  + PHP for web
  + Java for android device
* Database support
  + MYSQL
* Graphical User Interface Support
  + Cascading Style Sheet using Bootstrap Framework
* Running in an Operating System such as:
  + Windows 7 (32-bit / 64-bit Operating system)
  + Windows XP - Windows 10

**Hardware Specification**

1. CPU
   * Intel Core i5
2. Motherboard
   * 305U1A model
3. RAM
   * 8GB DDR3
4. Hard disk drive
   * Hitachi HTS545050A7E380 SATA Disk Device 476939 MB
5. Monitor
   * ASUS
6. Keyboard
   * Standard Keyboard
7. Mouse
   * Optical Mouse
8. Mobile phone
   * Any android phones
9. Internet Connection
   * PLDT Home DSL with a speed of 3 MB

**Program Specification**

For the project implementation, the following are the detailed modules that make up the entire proposed system:

* **Functional Requirements**

1. Account Registration
   1. Lastname
   2. Firstname
   3. Gender
   4. Email
   5. Username
   6. Password
2. User Login
   1. Username
   2. Password
3. Input origin and destination
   1. Mandaue City Location
4. Display Alternative Route
   1. Rank routes according to congestion percentage
   2. Fare cost of taxi and jeepney
5. Display Traffic Details
   1. Show map with thickness of congestion
6. Display Road Disturbance
   1. Show type of road disturbance
   2. Show road disturbance image or video clips
7. Update Traffic Details
   1. Traffic details
   2. Location
   3. Date and Time
8. Upload Road Disturbance
   1. Type of Disturbance
   2. Location
   3. Date and Time
   4. Road disturbance image or video clips
9. Update Alternative Routes
   1. Coordinates
   2. Destination
10. Generate Report
    1. Monthly Report on Congested Roads
    2. Monthly Report on Accident Counts
11. Update Jeepney Information
    1. Jeepney no
    2. Route
    3. Min fare

* **Non-Functional Requirements**

1. The system will be sufficiently fast to accommodate various internet connection speeds.
2. The system will run on android devices.
3. The system will be easy to maintain.

**List of Modules**

Table consists of Modules which comprises the whole system which will be divided among the members to ensure the success of the development of the system.

Table 17

LIST OF MODULES

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Programmer | Modules | User | Admin | Traffic Enforcer |
| Aynrand Danielle Sebucao | **Account Verification** |  |  |  |
| Login | \* | \* | \* |
| Logout | \* | \* | \* |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| Bryan Jay Alegres | **Registration** |  |  |  |
| User Registration | \* |  |  |
| Traffic Enforcer Registration |  | \* |  |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| Argie H. Berou & Mark Justin Tumulak | **Manage Road Disturbance Images and Videos** |  |  |  |
| Post Images and Videos | \* |  | \* |
| Update Images and Videos | \* |  | \* |
| Delete Images and Videos | \* |  | \* |
| Approve Images and Videos |  | \* |  |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| Charlie Pogoy & Bryan Alegres | **Destination Location Management** |  |  |  |
| Add Destination Location |  | \* |  |
| Update Destination Location |  | \* |  |
| Delete Destination Location |  | \* |  |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| All Members | **Alternative Route Management** |  |  |  |
| Add Alternative Routes |  | \* |  |
| Update Alternative Routes |  | \* |  |
| Delete Alternative Routes |  | \* |  |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| Argie H. Berou and Mark Justin Tumulak | **Monthly Report Generation** |  |  |  |
| Congested Road Reports |  | \* |  |
| Accident Reports |  | \* |  |
| Number of Users |  | \* |  |
| Aynrand Sebucao | **Manage Jeepney Information** |  |  |  |
| Add Jeepney Information |  | \* |  |
| Update Jeepney Information |  | \* |  |
| Delete Jeepney Information |  | \* |  |
| No. of points(1 point per module per user) | | 1 | 1 | 1 |
| Number of Modules per User (equals total no. of points per user) | | | 1 | 1 |
| Total Number of Modules | | | 7 | 7 |