

EZPAY: AUTOMATED FARE COLLECTION SYSTEM

USER MANUAL



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IMPLEMENTATION OF HAVERSINE, DIJKSTRA'S ALGORITHM, AND
SARIMAX FOR PHILIPPINE TRANSPORT AND
FARE COLLECTION SYSTEM

User Manual

by

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GUIDE FOR DEPLOYING AND USING THE SYSTEM'S MAIN FUNCTION

GETTING STARTED

INTRODUCTION

This manual is designed to guide and provide documentation to users who will use the developed systems of the said study. These said systems are coexisting and aim to help in modernizing the transportation system here in the Philippines. The features, functionalities, and other information are documented here to be accessed by readers, specifically future researchers and developers to help guide them navigate and to better understand this study. The said three systems are the loading system, fare management system, and the automated fare collection mobile application. The loading system is designed to allow the users of the automated fare collection mobile application to top up their accounts. Meanwhile, the automated fare collection system is designed mainly to generate tickets and claim payments via qr code with additional features such as simulating shortest path using dijkstra's algorithm. Lastly, the fare management system is designed for monitoring and managing the loading system for the administrators to use with sales prediction from SARIMAX Algorithm which is integrated to the said system. The develop systems are interconnected using an online server thus it requires an internet connection to operate.

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SYSTEM REQUIREMENTS

Minimum requirements for the loading system and fare management system

<https://ark.intel.com/content/www/us/en/ark/products/96508/intel-pentium-gold-processor-4415u-2m-cache-2-30-ghz.html>

<https://www.cpu-world.com/CPUs/Bulldozer/AMD-A8-Series%20A8-5500.html>

Operating System	Windows 10
CPU	2-core CPU
GPU	Intel HD Graphics, Radeon HD 7560D
Screen Resolution	1080x720
Memory	4 GB
Internet Connection	Yes
Space Allocation	10 GB

The automated fare collection mobile app was developed using this specification

Operating System	Android 11
API Level	30
CPU	x86
Disk Size	500 MB
Memory	2GB
Internet	Yes
Screen Size	1080x2220:440dpi

INSTALLATION

Before using the mobile application and the softwares make sure to visit the links, read the documentations and download the necessary libraries.

For the mobile application:

Mysql-connector-java-8.0.23.jar

<https://dev.mysql.com/downloads/connector/j/?os=26>

Android Volley

<https://google.github.io/volley/>

Advanced-HttpURLConnection

<https://github.com/VishnuSivadasVS/Advanced-HttpURLConnection>

Places API

<https://developers.google.com/maps/documentation/places/web-service>

Hipster4j

<https://www.hipster4j.org>

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The other dependencies or libraries can be found in android studio

```
dependencies {

    implementation 'androidx.appcompat:appcompat:1.3.0'
    implementation 'com.google.android.material:material:1.4.0'
    implementation 'androidx.constraintlayout:constraintlayout:2.0.4'
    implementation fileTree(dir:
'C:\\Users\\User\\AndroidStudioProjects\\MobileApp\\mysql-connector-
java-8.0.23', include: ['*.aar', '*.jar'], exclude: [])
    implementation files('libs\\mysql-connector-java-8.0.23.jar')
    testImplementation 'junit:junit:4.+'
    androidTestImplementation 'androidx.test.ext:junit:1.1.3'
    androidTestImplementation 'androidx.test.espresso:espresso-
core:3.4.0'
    implementation 'com.google.android.material:material:1.0.0'
    implementation 'com.android.volley:volley:1.1.0'
    implementation 'com.github.VishnuSivadasVS:Advanced-
URLConnection:1.2'

    //places
    implementation 'com.google.android.gms:play-services-maps:17.0.1'
    implementation 'com.google.android.libraries.places:places:2.4.0'
    implementation 'com.google.android.gms:play-services-
location:17.0.0'
    implementation 'com.google.android.libraries.places:places:2.4.0'
    implementation 'com.android.support:multidex:1.0.3'

    //hipster
    implementation 'es.usc.citius.hipster:hipster-core:1.0.1'

    //generate qr
    implementation
'androidmads.library.qrgenerator:QRGenerator:1.0.3'
    implementation 'com.journeyapps:zxing-android-embedded:3.4.0'
    //qr reader
    def camerax_version = "1.0.0-beta07"
    implementation "androidx.camera:camera-camera2:$camerax_version"
    implementation "androidx.camera:camera-lifecycle:$camerax_version"
    implementation "androidx.camera:camera-view:1.0.0-alpha14"
    implementation 'com.google.zxing:core:3.3.0'

}
```


For the Top-up System and Fare Management System the following libraries or jar files must be included in the project:

jcalendar-1.4.jar

<http://www.java2s.com/example/jar/j/download-jcalendar14jar-file.html>

rs2xml.jar

<https://sourceforge.net/projects/finalangelsanddemons/files/rs2xml.jar/download>

mysql-connector-java-8.0.23.jar

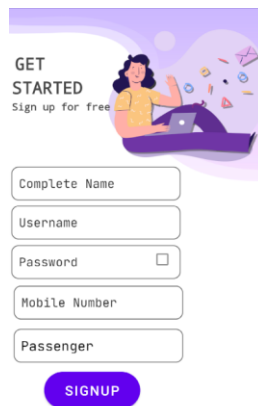
<https://dev.mysql.com/downloads/connector/j/?os=26>

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USAGE

I. Mobile Application

- Account Creation
 - OPEN THE EZPAY APP
 - CLICK THE SIGNUP BUTTON
 - FILLUP THE REQUIRED FIELDS WITH YOUR PERSONAL DETAILS
 - CLICK SIGNUP AND YOU'LL BE REDIRECTED TO THE LOGIN PAGE



GET
STARTED
Sign up for free

Complete Name

Username

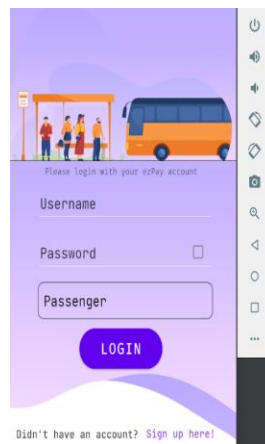
Password ☐

Mobile Number

Passenger

SIGNUP

- ~~HOW TO LOGIN TO THE APP~~
 - OPEN THE EZPAY APP
 - INPUT YOUR USERNAME AND PASSWORD
 - CLICK LOGIN BUTTON



Please login with your ezPay account

Username

Password ☐

Passenger

LOGIN

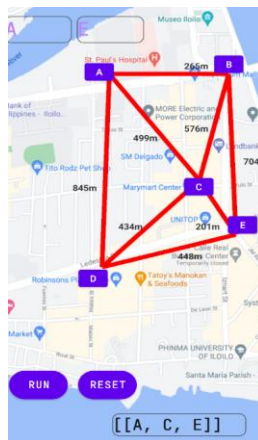
Didn't have an account? Sign up here!

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- HOW TO VIEW YOUR DATA AND TRANSACTIONS AS A PASSENGER
 - LOGIN TO THE APPLICATION
 - SELECT VIEW PROFILE IN THE MENU PAGE

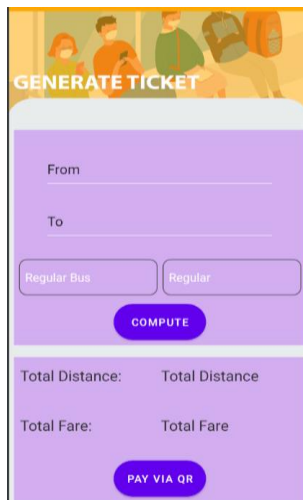


- HOW TO USE THE SIMULATION OF SHORTEST PATH FROM THE MENU
 - HOW TO USE THE SIMULATION OF SHORTEST PATH FROM THE MENU
 - INPUT TWO POINTS FROM THE GRAPHICAL PRESENTATION
 - CLICK RUN



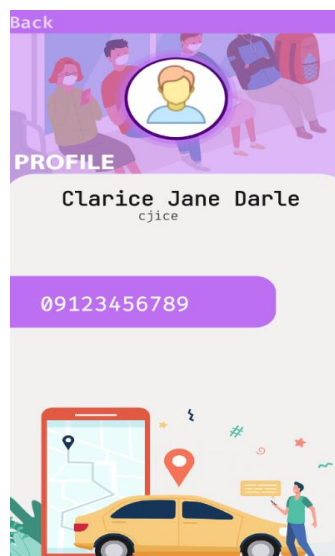
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- HOW TO GENERATE YOUR TICKET
 - SELECT GENERATE QR CODE FROM THE HOMEPAGE
 - FIRST, INPUT YOUR INITIAL LOCATION IN THE TEXTFIELD
 - SECOND, INPUT YOUR DESIRED DESTINATION
 - NEXT, SELECT THE TYPE OF TRANSPORTATION YOU'LL USE
 - THEN SELECT WHAT TYPE OF PASSENGER YOU ARE
 - SELECT COMPUTE BUTTON
 - SELECT PAY VIA QR BUTTON
 - SELECT GENERATE QR CODE BUTTON



The screenshot shows a mobile application interface for generating a ticket. At the top, there is a header with the text "GENERATE TICKET" and an illustration of people on a bus. Below the header, there are two text input fields labeled "From" and "To". Underneath these fields are two buttons: "Regular Bus" and "Regular". A purple button labeled "COMPUTE" is positioned below the "Regular" button. At the bottom of the form, there are four labels: "Total Distance:", "Total Distance", "Total Fare:", and "Total Fare". A purple button labeled "PAY VIA QR" is located at the very bottom of the form.

- HOW TO VIEW YOUR PERSONAL DATA AS A DRIVER
 - LOGIN TO THE APPLICATION
 - SELECT VIEW PROFILE IN THE MENU PAGE



The screenshot shows a mobile application interface for viewing a user's profile. At the top, there is a "Back" button. Below it is a header with the text "PROFILE" and an illustration of people on a bus. Underneath the header, there is a circular profile picture placeholder. Below the profile picture, the name "Clarice Jane Darle" is displayed, followed by the username "cjice". A purple button with the phone number "09123456789" is located below the name. At the bottom of the page, there is an illustration of a yellow car and a person standing next to it.

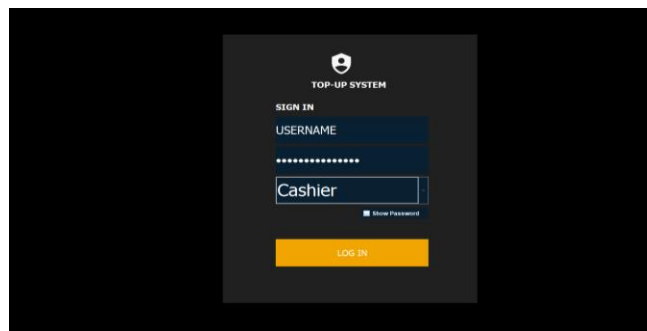
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- HOW TO COLLECT PAYMENT FROM THE PASSENGER
 - SELECT COLLECT PAYMENT
 - SCAN THE QR CODE OF THE PASSENGER
 - CONFIRM THE TICKET



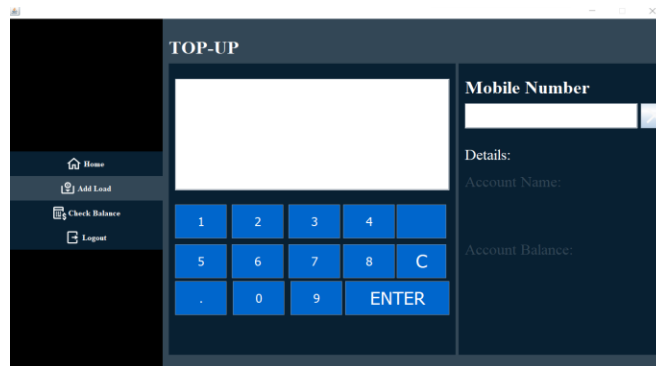
II. Top-up System

- HOW TO LOGIN TO THE APP AS A CASHIER
 - OPEN THE TOP-UP SYSTEM
 - INPUT YOUR USERNAME AND PASSWORD AND YOUR USERTYPE
 - CLICK LOGIN



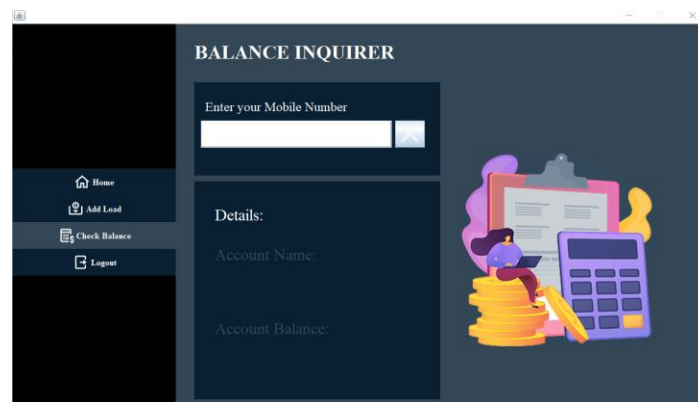
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- HOW TO USE THE TOP-UP OR ADD LOAD FUNCTION(CASHIER)
 - SELECT THE ADD LOAD BUTTON FROM THE DASHBOARD
 - INPUT THE MOBILE NUMBER OF THE PASSENGER
 - INPUT THE TOP-UP AMOUNT
 - CONFIRM THE TOP UP



The screenshot shows the 'TOP-UP' interface. On the left is a dark sidebar with navigation buttons: Home, Add Load, Check Balance, and Logout. The main area has a title 'TOP-UP'. Below the title is a large white input field for the mobile number. To the right of this field is a 'Mobile Number' label and a smaller input field. Below the main input field is a numeric keypad with buttons for digits 1-9, 0, a decimal point, and an 'ENTER' button. To the right of the keypad are labels for 'Details:', 'Account Name:', and 'Account Balance:', each followed by an input field. The interface is dark-themed with blue accents.

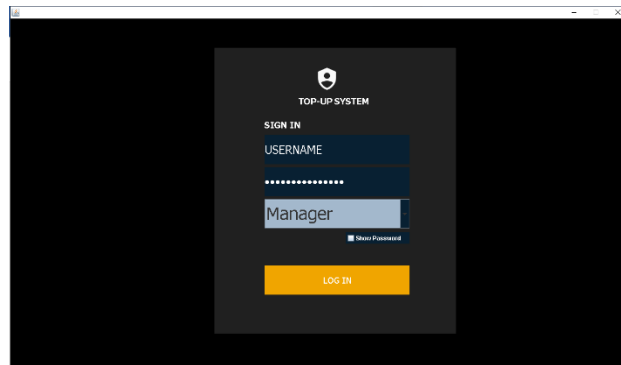
- HOW TO CHECK THE BALANCE OF THE PASSENGER (CASHIER)
 - SELECT THE CHECK BALANCE BUTTON FROM THE DASHBOARD
 - INPUT THE MOBILE NUMBER OF THE PASSENGER
 - PRESS ENTER



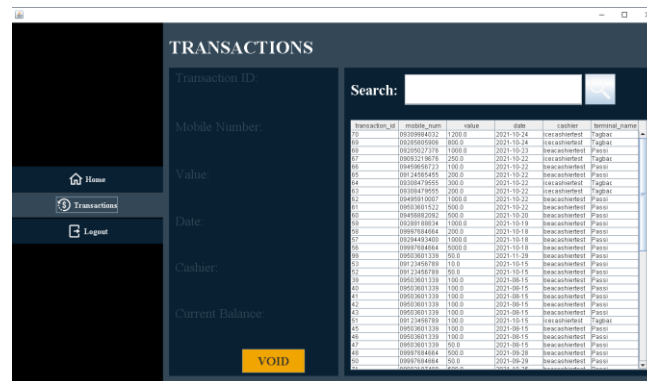
The screenshot shows the 'BALANCE INQUIRER' interface. It has a similar dark sidebar with navigation buttons: Home, Add Load, Check Balance, and Logout. The main area has a title 'BALANCE INQUIRER'. Below the title is a label 'Enter your Mobile Number' above a white input field. To the right of the input field is a 'Details:' label. Below this are labels for 'Account Name:' and 'Account Balance:', each followed by an input field. On the right side of the interface is a colorful illustration of a person sitting on a stack of gold coins, using a calculator and looking at a document.

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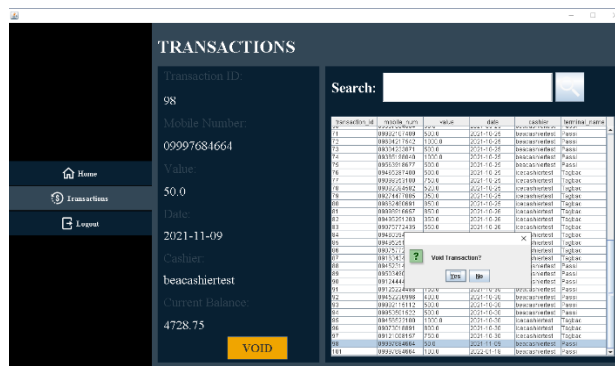
- HOW TO LOGIN TO THE APP AS A MANAGER
 - OPEN THE TOP-UP SYSTEM
 - INPUT YOUR USERNAME AND PASSWORD AND YOUR USERTYPE
 - CLICK LOGIN



- HOW TO VIEW TRANSACTIONS FROM TOP-UP SYSTEM
 - LOGIN TO THE TOP UP SYSTEM
 - SELECT TRANSACTION BUTTON FROM THE DASHBOARD



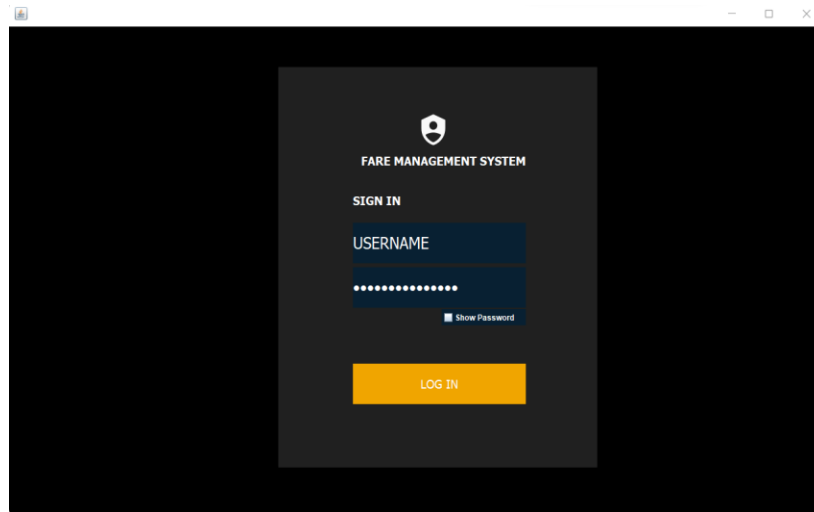
- HOW TO VOID TRANSACTION
 - SELECT A ROW FROM A TABLE
 - CLICK VOID TRANSACTION THEN CONFIRM IT.



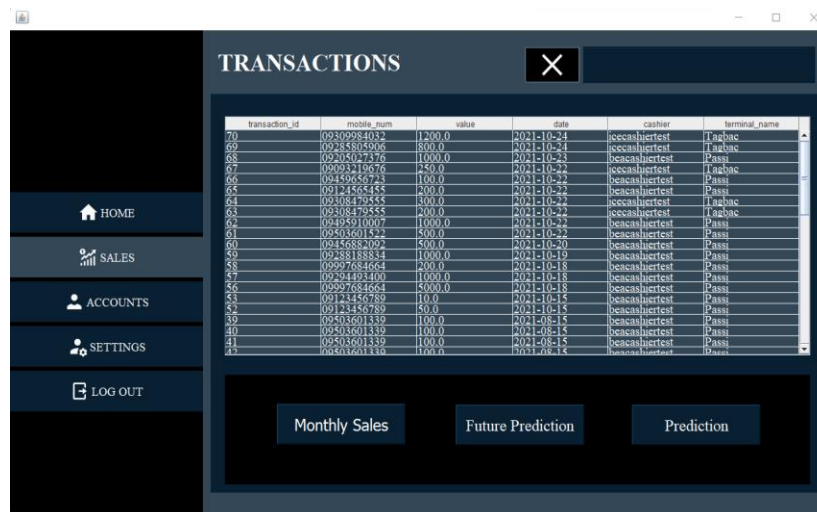
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III. Fare Management System

- HOW TO LOGIN TO THE APP AS AN ADMINISTRATOR
 - OPEN THE FARE MANAGEMENT SYSTEM
 - INPUT YOUR USERNAME AND PASSWORD
 - CLICK LOGIN



- HOW TO VIEW TOTAL SALES GAINED BY THE TOP-UP SYSTEM
 - FROM THE DASHBOARD SELECT SALES IN THE MENU



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- HOW TO VIEW MONTHLY SALES GAINED BY THE TOP-UP SYSTEM
 - FROM THE DASHBOARD SELECT SALES IN THE MENU
 - CLICK MONTHLY SALES

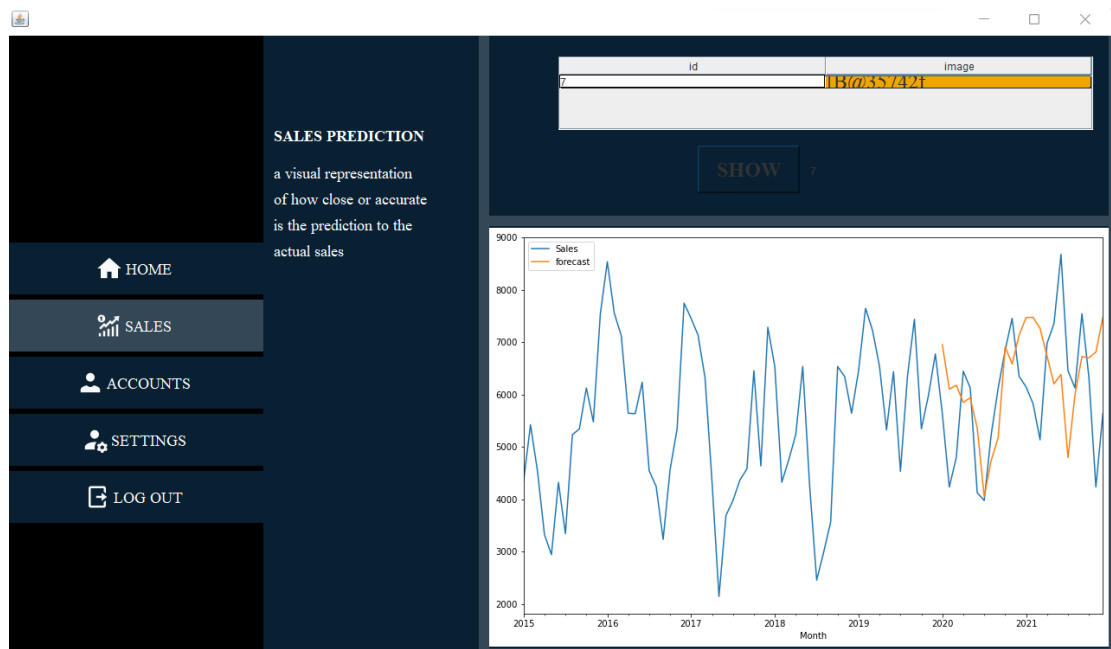
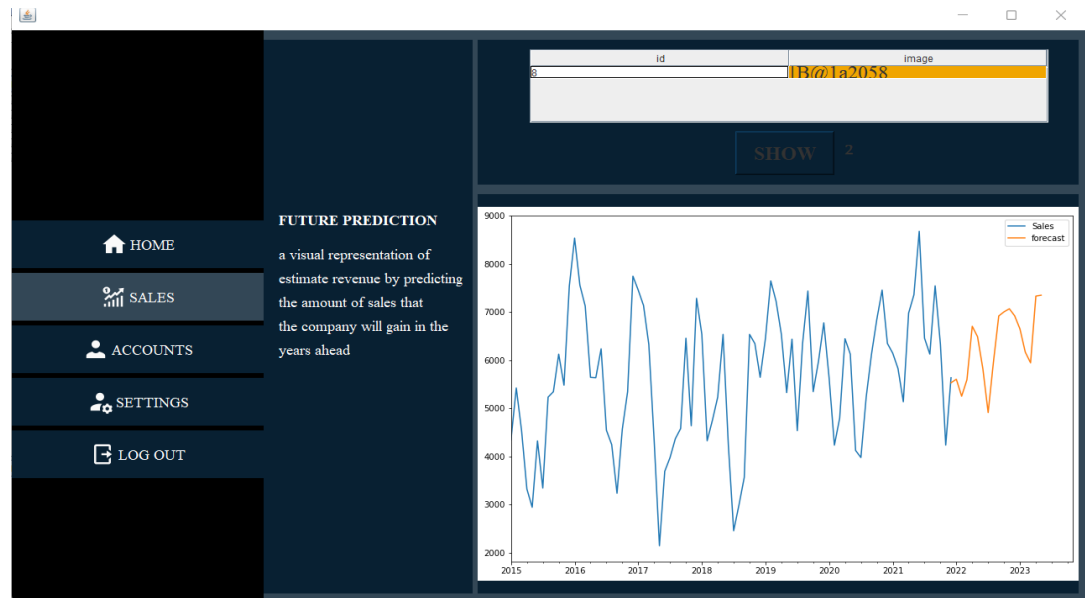
ID	DATE	SALES
1	2014-01-01	4343.0
2	2014-02-01	5421.0
3	2014-03-01	4534.0
4	2014-04-01	2813.0
5	2014-05-01	1333.0
6	2014-06-01	2843.0
7	2014-07-01	4342.0
8	2014-08-01	5331.0
9	2014-09-01	4543.0
10	2014-10-01	5133.0
11	2014-11-01	5478.0
12	2014-12-01	7533.0
13	2015-01-01	8334.0
14	2015-02-01	7553.0
15	2015-03-01	7133.0
16	2015-04-01	5642.0
17	2015-05-01	5834.0
18	2015-06-01	6334.0
19	2015-07-01	4543.0
20	2015-08-01	4344.0
21	2015-09-01	3334.0
22	2015-10-01	1856.0
23	2015-11-01	3145.0
24	2015-12-01	7743.0
25	2016-01-01	7454.0
26	2016-02-01	7134.0
27	2016-03-01	6324.0
28	2016-04-01	4343.0
29	2016-05-01	2144.0
30	2016-06-01	1533.0
31	2016-07-01	3975.0
32	2016-08-01	4367.0
33	2016-09-01	4578.0
34	2016-10-01	2442.0

- HOW TO MANAGE MONTHLY SALES
 - CLICK INSERT TO ADD MONTHLY SALES
 - CLICK UPDATE IF YOU WANT TO UPDATE A SPECIFIC SALES
 - CLICK EXPORT TO EXPORT TABLE AS CSV FILE FOR RECORDING PURPOSES

ID	DATE	SALES
1	2014-01-01	4343.0
2	2014-02-01	5421.0
3	2014-03-01	4534.0
4	2014-04-01	2813.0
5	2014-05-01	1333.0
6	2014-06-01	2843.0
7	2014-07-01	4342.0
8	2014-08-01	5331.0
9	2014-09-01	4543.0
10	2014-10-01	5133.0
11	2014-11-01	5478.0
12	2014-12-01	7533.0
13	2015-01-01	8334.0
14	2015-02-01	7553.0
15	2015-03-01	7133.0
16	2015-04-01	5642.0
17	2015-05-01	5834.0
18	2015-06-01	6334.0
19	2015-07-01	4543.0
20	2015-08-01	4344.0
21	2015-09-01	3334.0
22	2015-10-01	1856.0
23	2015-11-01	3145.0
24	2015-12-01	7743.0
25	2016-01-01	7454.0
26	2016-02-01	7134.0
27	2016-03-01	6324.0
28	2016-04-01	4343.0
29	2016-05-01	2144.0
30	2016-06-01	1533.0
31	2016-07-01	3975.0
32	2016-08-01	4367.0
33	2016-09-01	4578.0
34	2016-10-01	2442.0

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- HOW TO VIEW THE VISUAL REPRESENTATION OF SALES AND FUTURE SALES PREDICTION
 - FROM THE DASHBOARD SELECT SALES IN THE MENU
 - SELECT SALES PREDICTION OR FUTURE SALE PREDICTION
 - SELECT A SPECIFIC COLUMN FROM THE TABLE
 - CLICK SHOW



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- HOW TO MANAGE USER OF TOP- UP SYSTEM
 - FROM THE DASHBOARD SELECT ACCOUNTS
 - FILL UP NECESSARY DETAILS
 - SELECT ADD USER TO ADD NEW USER
 - SELECT A SPECIFIC COLUMN FROM THE TABLE TO REMOVE OR UPDATE A CERTAIN USER

The screenshot shows a web application window titled "TOP-UP ACCOUNTS". On the left is a dark sidebar with navigation links: HOME, SALES, ACCOUNTS (highlighted), SETTINGS, and LOG OUT. The main content area is divided into two sections. The left section, titled "Account Details:", contains form fields for Username, Password, Usertype (a dropdown menu currently showing "Cashier"), and Location (a dropdown menu currently showing "Tagbac"). Below these fields are four buttons: "Add User", "Remove User", "Update User", and "Clear". The right section contains a table with the following data:

user_id	user	password	location	usertype
1	admin1	12345678	Moro O	Admin
2	beacash	123456	Pass	Cashier
3	beacash	123456	Pass	Cashier
4	beacash	123456	Pass	Cashier
5	beacash	123456	Pass	Cashier
6	beacash	123456	Pass	Cashier
7	beacash	123456	Pass	Cashier
8	beacash	123456	Pass	Cashier
9	beacash	123456	Pass	Cashier
10	beacash	123456	Pass	Cashier

- HOW TO MANAGE USER OF FARE MANAGEMENT SYSTEM
 - FROM THE DASHBOARD SELECT SETTINGS IN THE MENU
 - FILL UP NECESSARY DETAILS
 - SELECT ADD ADMINISTRATOR TO ADD NEW ADMIN
 - SELECT A SPECIFIC COLUMN FROM THE TABLE TO REMOVE AN ADMINISTRATOR

The screenshot shows a web application window titled "USER SETTINGS". On the left is a dark sidebar with navigation links: HOME, SALES, ACCOUNTS, SETTINGS (highlighted), and LOG OUT. The main content area is divided into two sections. The left section contains form fields for Username and Password, and three buttons: "Add Administrator", "Remove Administrator", and "Clear". The right section contains a table with the following data:

id	username	password
1	testadmin1	12345678901234567890
2	testadmin2	12345678901234567890
3	admin3	12345678901234567890
4	administrator	12345678901234567890

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TROUBLESHOOTING FOR FIXING POSSIBLE BUGS

Developer Error Code	Type	Description
BillingNotEnabledMapError	Google API Error	You have not enabled billing on your project which is causing this error. You must enable Billing on the Google Cloud Project
ExpiredKeyMapError	Google API Error	The API key included in the script element has expired or is not recognized by the system. You may receive this error after creating a new API if you try to use the key before it is recognized by the system. Wait a few minutes and try again, or you may need to generate a new API key in the Cloud Console.
InvalidKeyMapError	Google API Error	The API key included in the script element that loads the API is not found. Please make sure you are using the correct API key. You can

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		generate a new API key in the Cloud Console.
InvalidKey	Google API Error	The API key included in the script element that loads the API does not look correct. Please make sure you are using the correct API key. You can generate a new API key in the Cloud Console.
CommunicationsLinkFailure	Database Error	The driver has not received any packets from the server. You need to connect to a stable internet connection to connect to the server.
java.security.cert.CertPathValidatorException: Trust anchor for certification path not found.	SSL Certificate Error	In this case, the SSLHandshakeException occurs because you have a CA that isn't trusted by the system. The developers included a function that allows all SSL certificates.

FREQUENTLY ASKED QUESTIONS (FAQ)

Is the Mobile App secure?

Yes! All critical information is encrypted and no personal information is stored on your mobile device. However, mobile devices do offer you the ability to store your login information for apps installed on the device. If you choose to store your login information, any person who has access to your mobile device can access your account.

What features does the Mobile App have?

The mobile app has the ability to generate your ticket if you are a passenger and can also provide a visual representation of the shortest path using the dijkstra algorithm. Also for the driver the mobile app has the ability to collect the payment of the passenger as well as can view the visual representation of shortest path using the dijkstra algorithm.

What is the main use of the system?

The main purpose of this system is to automate the manual fare collection system and to provide an accurate, cashless and efficient mode of transportation.

How Dijkstra Algorithm works?

Dijkstra's Algorithm basically starts at the node that you choose (the source node) and it analyzes the graph to find the shortest path between that node and all the other nodes in the graph. The algorithm keeps track of the currently known shortest distance from each node to the source node and it updates these values if it finds a shorter path. Once the algorithm has found the shortest path between the source node and another node, that node is marked as "visited" and added to the path. The process continues until all the nodes in the graph have been added to the path. This way, we have a path that connects the source node to all other nodes following the shortest path possible to reach each node.

How Haversine Algorithm works?

The haversine formula determines the great-circle distance between two points on a sphere given their longitudes and latitudes. Important in navigation, it is a special case of a more general formula in spherical trigonometry, the law of haversines, that relates the sides and angles of spherical triangles.

Is Haversine Formula accurate?

Consequently, the Haversine formula can result in an error of up to 0.5%. To address this, Thaddeus Vincenty developed a very complicated formula that is accurate up to 0.5mm, making it the ultimate geodesic formula for all serious scientific purposes.

CONTACT DETAILS OF THE DEVELOPMENT TEAM

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