A Project Based Learning – II Report

On

"City transport: RFID-Based Bus Ticketing Systems"

Submitted to the

Savitribai Phule Pune University

In partial fulfillment of

"Artificial Intelligence and Data Science"

By

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Certificate

This is to certify that the project-based learning – II report entitled **"City transport: RFID-Based Bus Ticketing Systems"** being submitted by **Samiksha Dhere : S190312058** is a record of bonafide work carried out by them under the supervision and guidance of **Prof. Priyanka Deshpande** in partial fulfillment of the requirement for SE (Artificial Intelligence and Data Science) 2020 course of Savitribai Phule Pune University, Pune in the academic year 2021 – 2022

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Abstract

Buses are an integral means of public transport in India. In metropolitan cities like Mumbai and Delhi, 10-15 million people travel through public transport buses daily. Today, in the era of Digital India (a campaign launched by the Government of India) and Cashless Economy, public transport needs to adapt the technology advancement. Even though the public transport buses have been providing fairly satisfactory services, there is a need for smart and reliable system. The major problems experienced by the passengers are they sometimes don't have change to give to bus conductors. It also becomes inconvenient for passengers to buy a ticket when the busses are crowded. Few new travellers do not know the busses schedules and names of stops which create confusion while travelling. Thus, to provide an agile and smooth ticketing experience, we have proposed the smart application that will automatically calculate distance travelled by a user, calculate amount required to travel particular distance and will deduct that amount of money from users account and this al process will be done only by scanning RFID cards at entry and exit point. This project mainly focuses on implementing an automatics ticketing system for public transportations such as city busses.

Keywords : RFID card, Busses, Automatic Ticketing System

Chapter 1. Introduction to City transport: RFID-Based Bus Ticketing Systems

1.1 Introduction

In the era of smart and digitalized India, many advances have been made in different fields/ sectors. But many sectors in India are lacking these advances and one such sector/field is public transportations such as city busses. India being a developing country, in the past few years it has made numerous advances in different fields and sectors which made India recognize as a fast-developing nation. But as few people say, it still has a long way to go before gaining the title of a developed nation. And we can achieve this by making small changes and going step by step.

As said earlier, many fields/sectors in India are advancing with speed, but many fields are still lacking this advance. One such field is public transportation such as city busses. In India, 55 to 60% of population uses city busses in metropolitan cities while 40 to 50% of population uses city busses in normal cities. Even after being such high demand of city busses, we still don't have any automatic systems to be implemented for city busses for the convenience of general public. To overcome this problem, we are here with our web application "City transport: RFID-Based Bus Ticketing Systems".

So, basically what is City transport: RFID-Based Bus Ticketing Systems?

As the name suggests, it is related to travelling that is, this application is specially developed for public and public transportations such as city busses. City transport: RFID-Based Bus Ticketing Systems is a hardware-software based web application implemented using RFID (Radio Frequency Identification) technology. This application is specially designed for automatic bus ticketing system for city busses. This system will definitely provide an ease to people using public transportations on daily basis.

Now, how does City transport: RFID-Based Bus Ticketing Systems l work?

First of all, user needs to register in our web application through his/her email id. After registration, he/she will be provided with a smart card with unique id on it. Next, user needs to login in our application and add a particular amount of money in his/her account. Here, the signing process ends. Now, what user needs to do is just carry his/her card while travelling through city busses. At every entry and exit point user just needs to scan through his/her smart card into our system. Rest all work will be done by our web application. Our application will display names of stops where user entered and exited the bus, show total distance travelled by the user, amount required to travel particular distance and will automatically deduct same amount of money from his account after the entry and exit instances are scanned. This application will also show user his/her travel history and will also provide an online receipt after the payment. This application also has a home page where a user can view detailed information of all bus routes and timing throughout the city.

This web application will provide an ease for passengers using public transportations and will add an efficiency for revenue collectors/ bus conductors. It is said that, a country is not recognized as rich where hundreds of people use private cars but where most of public use public transportations. And implementing a smart system for public transportation will attract large amount of people to follow it as it will provide an ease for public and an expression of satisfaction will be seen on their faces.

Start Location	End Location	Distance	Ticket fare
A	B	r	10
A	C	2r	20
A	D	3r	30
A	E	3r	30
B	C	r	10
B	E	2r	20
C	D	r	10

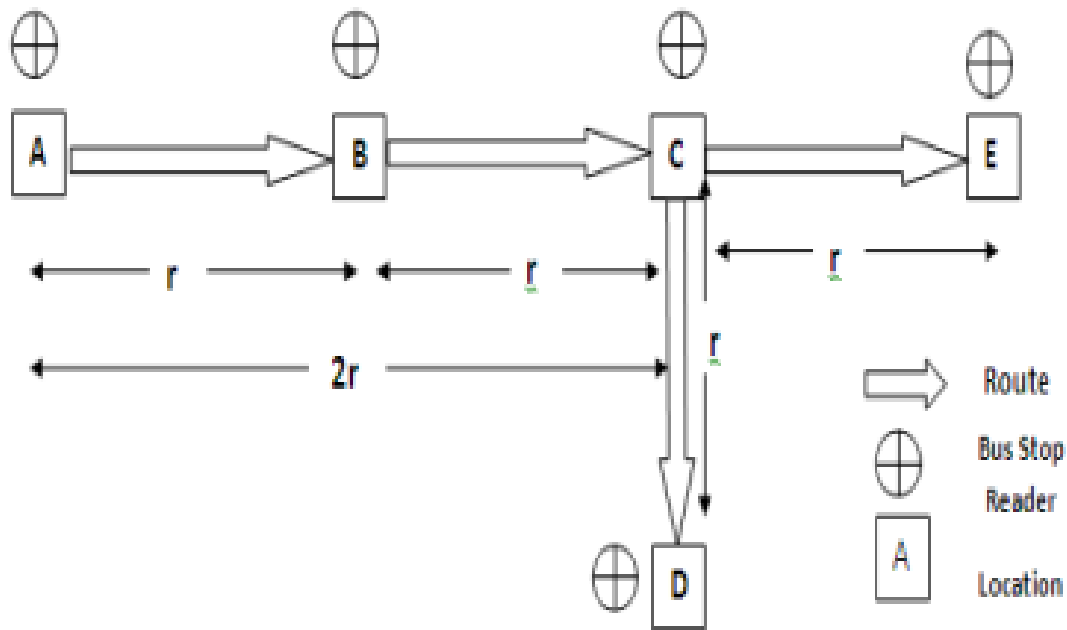Table 1.1 Sample database for entry and exit point, distance and ticket fare collection

Fig 1.1 The distance between different stops in a route

1.2 Problem Definition

City transport: RFID-Based Bus Ticketing System allows a user to use public transportations such as city buses with ease and safety. It provides a user with RFID cards/ smart cards which he/she just needs to scan before entering and while exiting the vehicle. Rest all the work will be done by our web application. This web application will allow a user to create his/her account. After the user scans his card at entry and exit point the application will display names of stops where user entered and exited the bus, show total distance travelled by the user, amount required to travel particular distance and will automatically deduct same amount of money from his account. This application will also show user his/her travel history and will also provide an online receipt after the payment. This system will also provide detailed information about bus routes, stops and timing for particular buses.

1.3 Motivation

Ourselves, being students, we daily need to use public transportations such as city busses to college. Due to frequent use of city busses, we all came across with some inconvenience or problems that many people face daily while travelling through city busses. Firstly, being a metropolitan city, our cities do not have any advanced or automatic system for ticketing of city busses but it is done manually for past several years. Also, public face many problems while using city busses. While researching, we have observed that even being a metropolitan city, it is very inconvenient for people to use public transportations and people face many problems while using them. One such problem is each and every public don't have change to give to the bus conductors while buying a ticket. Other thing is it is way too inconvenient for people to buy a ticket when the busses are too crowed. Also, many new travelers or users don't have much knowledge or idea about at which stop they need to exit the bus. To overcome all these problems, we thought of implementing a system which will help people and provide an ease while travelling through city busses. So, here we are with our web application "City transport: RFID-Based Bus Ticketing Systems".

1.4 Objectives

The main goal behind implementing this system is to provide an Intelligent and public friendly automatic bus ticketing system**.** As we know, people use things or systems which are easy to use (for all group ages), and affordable. So, our main goal behind implementing this system is 100% public satisfaction.

Other objectives behind implementing this project are :

a) **To provide an automatic ticketing system for public transportation**
   For the last decades, public transportations have been using manual system for ticketing and fair collection system. Though this system is practiced till today, but in this era, it is becoming very inconvenient to carry on with such a technique. So, implementing an automatic system for fair collection will solve this problem.

b) **To provide an ease for public using public transportations**
   Total 50% to 60% population of India use public transportations on daily basis. Every person wishes to use these systems with ease and expression of satisfaction. As we know, manual ticket collecting system has lot of disadvantages which results in inconvenience of public using these systems. So, automatic systems will help people to solve these problems and have an expression of satisfaction after implementation of these systems.

c) **To reduce human efforts**
   As the system of bus fare collection is done manually, it is way to exhausting for bus conductors to practice this, as they need to stand from morning till night asking for tickets without thing about whether its summer monsoon or winter. Also, when the busses are crowded its way to inconvenient for these bus conductors to walk through a bus for ticket collecting. Automatic systems will reduce maximum of these human efforts.

2.1 Related work

Sr no.	Name of Research paper	Name of authors
1.	Smart E-Ticketing System for Public Transport Bus	Sanam Kazi, Murtuza Bagasrawala, Farheen Shaikh, Anamta Sayyed
2.	Intelligent Agent based RFID System for On Demand Bus Scheduling and Ticketing	Hamilton, P Suresh
3.	Performance Evaluation of UHF RFID Technologies for Real Time passenger Recognition in Intelligent Public transportation Systems	Oberli, C et al.

Table 2.1 Research paper related to same work

2.2 Introduction to literature survey

Harter, G et al. have observed that GPS technology is being employed for tracking of bus location and scheduling. This has been achieved in some cities in India (e.g.: Ahmadabad) where the government has developed a GPS enabled Bus Rapid Transit System to meet the transportation needs for increasing the security and reliability of the system. BRTS aims to combine the capacity and speed of a metro with the flexibility, lower cost and simplicity of a bus system [4].

Erika Stark et al. stated that, other countries like Canada use refillable smart cards, provide one week passes or offer electronic systems for payment. In the city of Calgary, the users would download an app in their smartphones and create an account which would allow them to purchase a fare that would activate upon boarding a bus. When required to show their ticket, mobile users would simply show the officers a virtual ticket on their smartphone. In Israel, people can purchase a Rav Kav card. A personal Rav Kav card has all the passenger's personal details. Also, tourists can purchase an anonymous Rav Kav card. The Rav Kav can be used to pay for the transportation of several passengers and can be used within a region unless specifically reloaded for the desired routes [5].

Parviz G et al. stated in other research papers, security of the system and its database is another important aspect. Software problems that occur in distributed database systems may involve data management, transaction management, and database recovery [6]. Wang et al. stated that the proposed architecture incorporates the needs of the metropolitan transportation system with persevering the security requirements of the user and enhancing the privacy of commuters. Research was also done on the privacy concerns for collecting the personal information of the user and then aggregating and centralizing of information. User account used in public transportation enables the tracking of the user with data tracking which is stored on the central server [7].

Sanam Kazi et al. stated it is clear that GPS and other technologies are deployed towards the cashless public transportation system. So, with the consideration of these technologies, author have proposed a novel system, in which the GPS enabled device is within the bus and this device would help us to know the bus id and the route information and to each GPS enabled device, id is given for tracking the location and bus-id [1].

2.3 Most common problems in existing systems

Sanam Kazi et al. stated that the transport problems are not common for all the places, but they exist everywhere. Further, transport problems are mainly due to non-availability of alternative modes and inadequate transport services. Even though the public sector transport buses have been providing fairly satisfactory services, there is a feeling that these services are unreliable. Following are some of the most common problems in the existing system faced by the commuters :

a) **Undue waiting time at bus stops :**
The commuters are unaware of the time they have to wait for a bus to arrive. This unnecessary waiting for buses is a waste of time and causes considerable dissatisfaction to the commuters. Moreover, it is clear that more waiting time causes overcrowding. The inefficient time schedules result in unequal intervals between buses which makes commuters wait for an unknown amount of time.

b) **Inadequate time for getting tickets :**
Sometimes, the buses are so crowded and the travel distance is so small that getting a ticket result into chaos. Finding the conductor and getting a ticket in crowded buses is the biggest problem in peak hours.

c) **Non-refund of balance :**
In some cases, it is possible that both the commuter and conductor do not have change. In these cases, the conductor may not refund the balance to the commuter. Moreover, most of the commuters do not co-operate with the conductor by tendering the exact amount of fare. For instance, giving a fifty Rupees currency note for a twelve thirteen Rupee ticket may irritate the conductor, especially when the bus is overcrowded .

d) Excessive waste of paper :

The amount of paper required to generate bus tickets is far too high as almost all the passengers take tickets except those having passes. This results in excessive paper waste which can be stopped by generating e-tickets.

e) Use of cash :

Passengers buy tickets using cash which contradicts the system of cashless economy. There is no other way to buy tickets from the conductor except of cash. This opposes the initiative of the Indian government to go cashless [1].

2.4 Proposed system

Our system is designed to overcome all these problems, as it includes features like

a) Time schedule of pmpml busses :

Our system has a feature in its website which showcases full timetable of city busses thought out the city, so user don't need to wait at bus stops waiting for busses as he/she will priorly know the timing of bus he want to travel through.

b) Online payment system :

Our system uses razor payment system, due to which passenger don't need to carry any amount of change to give to bus conductors while buying tickets. Whereas our system will automatically deduct the amount of money from the user's account.

c) Buying tickets using smart cards :

Through our system user can buy ticket just by scan instances at entry and exit point of bus. This will solve the problem of buying tickets inconveniently from the bus conductor when the bus is overcrowded.

d) Receipt of ticket on web application :

After scanning the smart card at exit point, user will get a receipt of his travel details and if required he can take a print of that receipt. This will reduce the problem of wastage of paper while buying tickets in manual system.
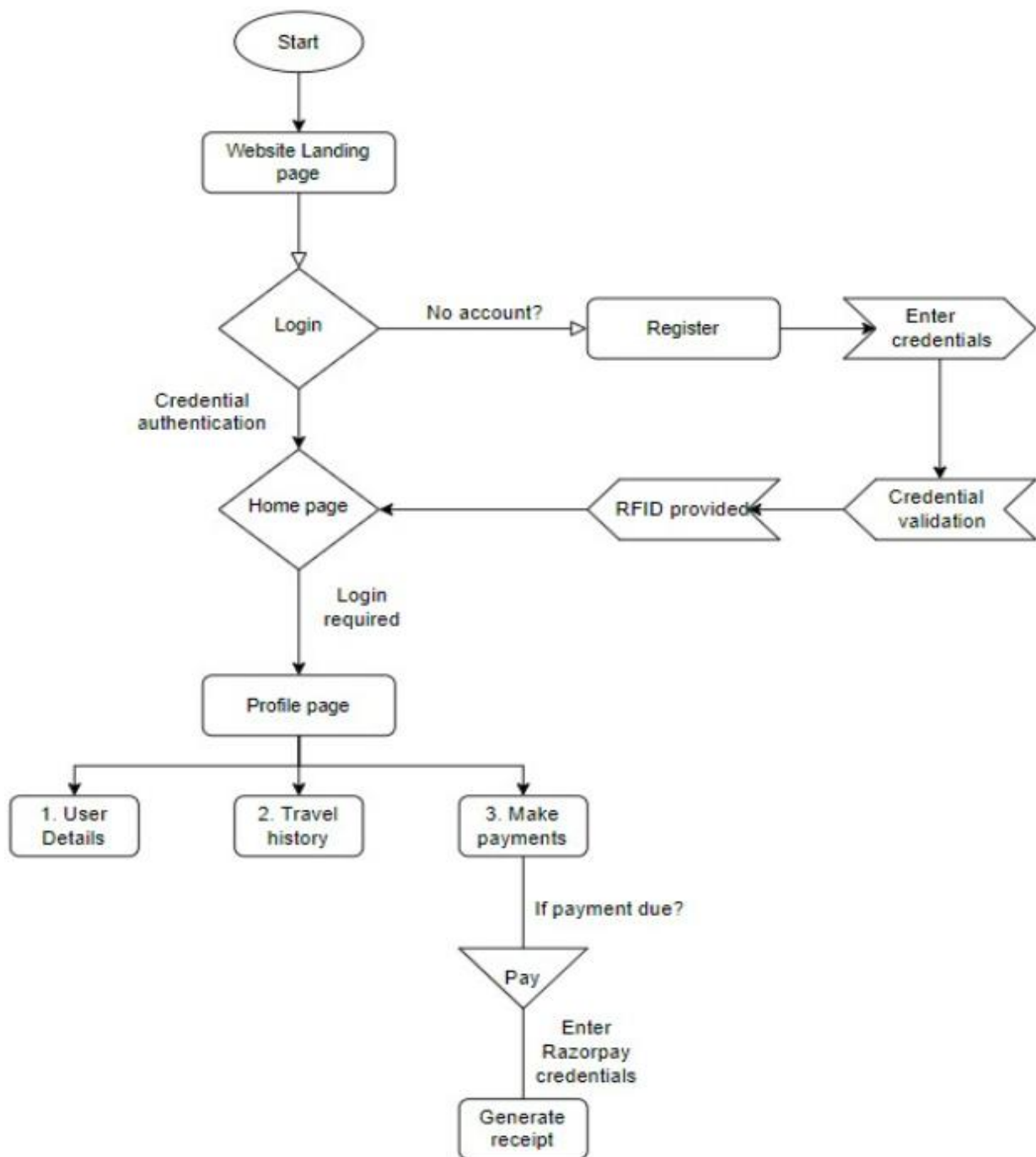
Fig 3.1 Work flow of web application

If the above flow chart is summarized, it says that a user first needs to resister on our website, then he/she needs to login through his/her credentials. After logging in he/she will be directed to the home page, from where he/she can view his profile page. Home page includes general timetable of bus details. From profile page, user can view his details, travel history and make payments.
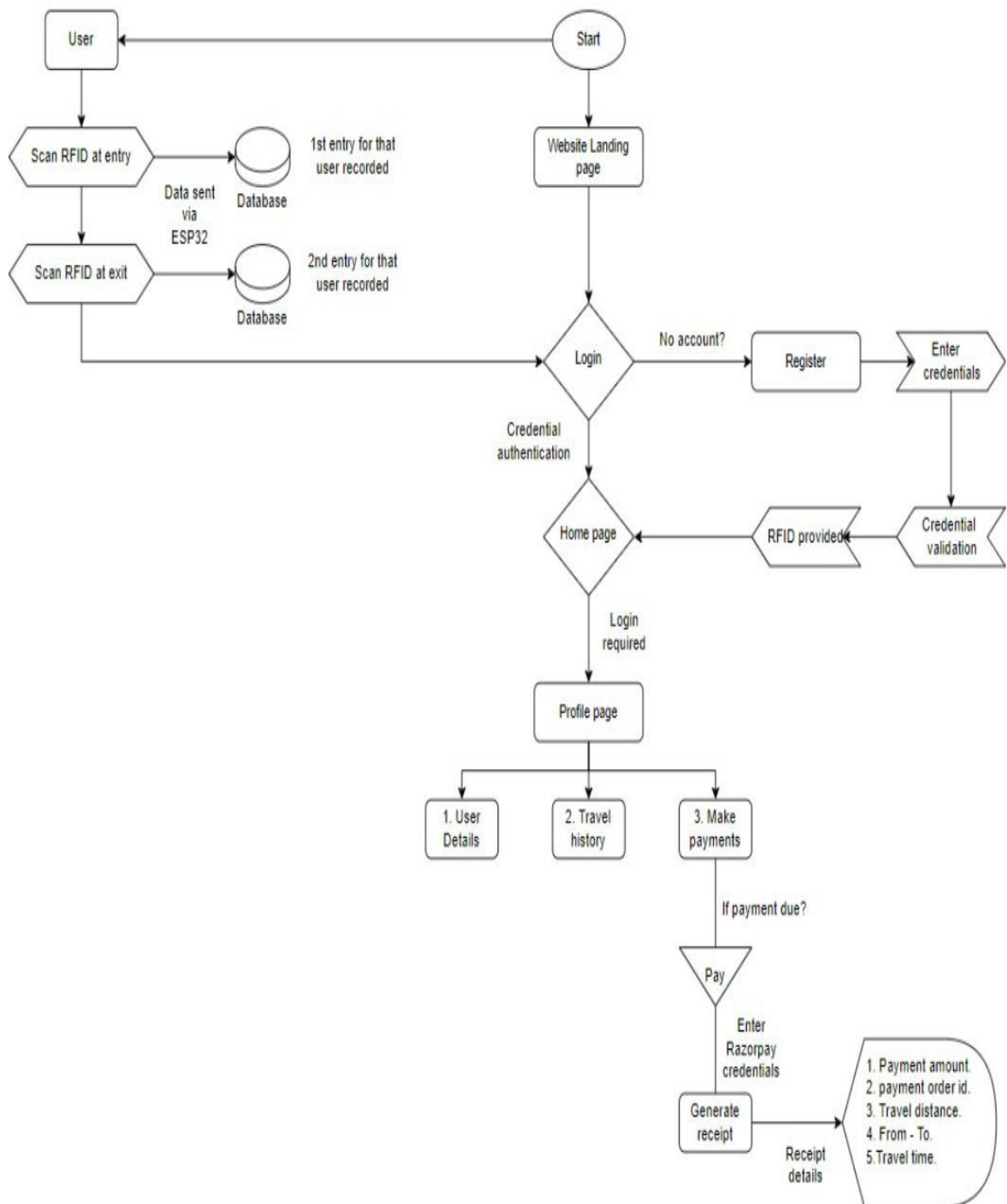
Fig 3.2 Work flow of hardware

If above flow chart is summarized, it says that after registering himself/herself user will be provided with a smart card which he /she needs to scan at entry and exit point. Our RFID reader will record that scan instances and will send data to the web application for further process through ESP 32. After both scan instances are recorded user can login at our website through his/her credentials and make payments.

Different hardware's and software's used while implementing this system are

4.1 Software's used

Our web application is fully designed using HTML, CSS, BOOTSTRAP, JavaScript, Python, and SQL Alchemy.

Sr no.	Software's used	Purpose
1.	HTML 5, CSS 3, BOOTSTRAP 4, JavaScript	Frontend
2.	Python (version 3.9.1)	API
3.	SQL Lite 3, SQL Alchemy (version 1.4.36)	Database

Table 4.1 Software's used

4.2 Hardware's used

Regarding hardware's, we used ESP 32, RFID and LED.

Sr no.	Hardware's used	Purpose
1.	ESP 32	1. Interacting with sensors. 2. Collect scan instances from RFID sensors and transfer that data to web application via Bluetooth
2.	RFID card readers	1. Collect scan instances by a user at every entry and exit point
3.	RFID cards	1. Provided to the user to scan at every entry and exit point while travelling
4.	LED lights (Green and red)	1. Show valid or invalid entry and exit by the user

Table 4.2 Hardware's used

5.1 Conclusion

City transport: RFID-Based Bus Ticketing Systems has helped us to overcome the problem of manual ticket collecting system. The system is fully automated, reliable, transparent and convenient. It is an automatic system which has helped to reduce man power. The cards being reusable, are much more convenient compared to the paper-based ticketing system. We are also able to avoid any unwanted events as all the person carrying RFID tickets are monitored every time they travel. Also, the possibilities of reducing traffic jams, chaos in the bus stoppage that we usually experienced in metropolitan city are reduced

5.2 Future work

Currently, we are working on adding extra features to our system. Few future updates will include

a) **Implementation of real time GPS (Global positioning system)**
   Currently, we have defined all bus stops as stop A, stop B and so on, but in future we are planning to add GPS system to locate the position of passenger and bus.

b) **Developing an Android application**
   Our current system is a web application (website) but in future we will convert it into an android application which a user can download it on his mobile for tome to time use.

c) **Realtime scheduling of busses according to the location of user**
   Implementation of GPS system will help us to add this update, as it will reschedule information of busses according to the location of stop at which user is.

[1] Sanam Kazi, Murtuza Bagasrawala, Farheen Shaikh, and Anamta Sayyed "Smart E-Ticketing system for public transport bus", IEEE International Conference on Smart City and Emerging Technology (ICSCET), 2018.

[2] Hamilton, P and Suresh, S. "Intelligent Agent based RFID System for On Demand Bus Scheduling and Ticketing", International Journal of Future Computer and Communication, Vol.2(5), pp.399-406, 2013.

[3] Oberli, C et al. "Performance Evaluation of UHF RFID Technologies for Real Time passenger Recognition in Intelligent Public transportation Systems", IEEE Transactions on Intelligent Transport Systems, Vol.11(3), pp.748-753 in 2010.

[4] Harter G et al, "Sustainable Urbanization: the role of ict in city development", 2010.

[5] Erika Stark, "City of Calgary gets on board with mobile transit payments", https://www.google.ca/amp/www.cbc.ca/amp/1.4025953), 2010.

[6] Parviz G, Roghieh M, Aytak s, Zoleikha J", A survey of mobile database security threats and solutions for it", 2010.

[7] Wang, J L and Loui, M C, "Privacy and ethical issues in location-based tracking systemrey", 2009.
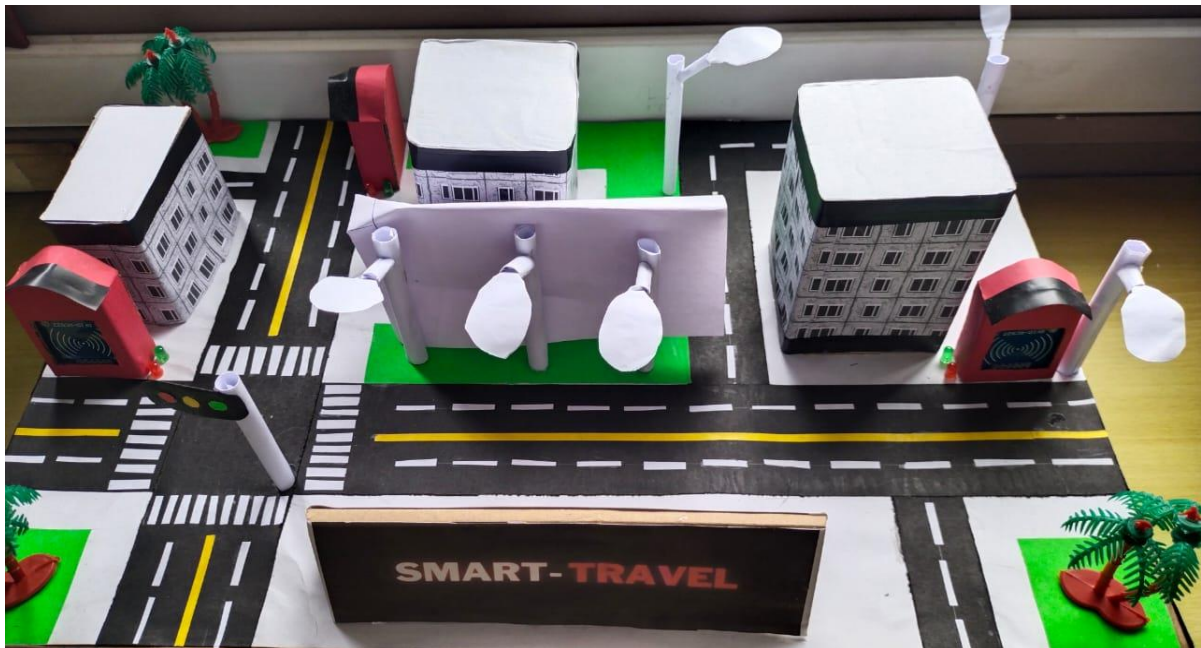
Fig 7.1 Project Model

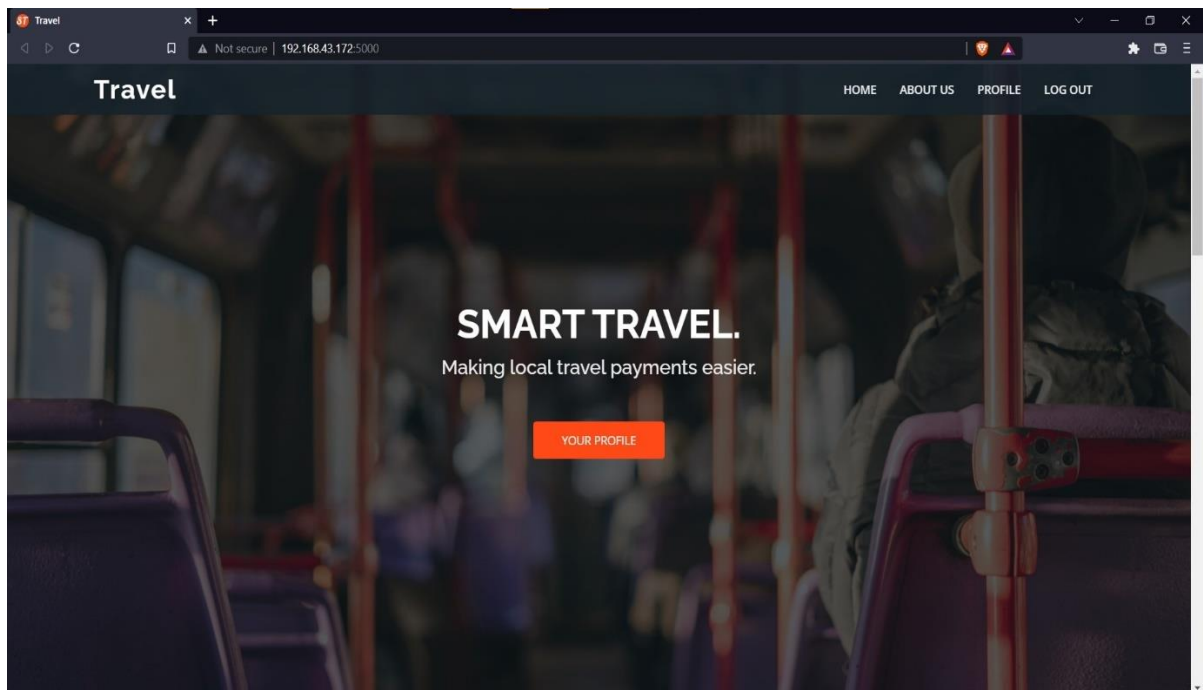Here, Fig 7.1, represents the look of City transport: RFID-Based Bus Ticketing Systems.

Fig 7.2 Home page

Here, Fig 7.2, represents the home page of City transport: RFID-Based Bus Ticketing Systems.

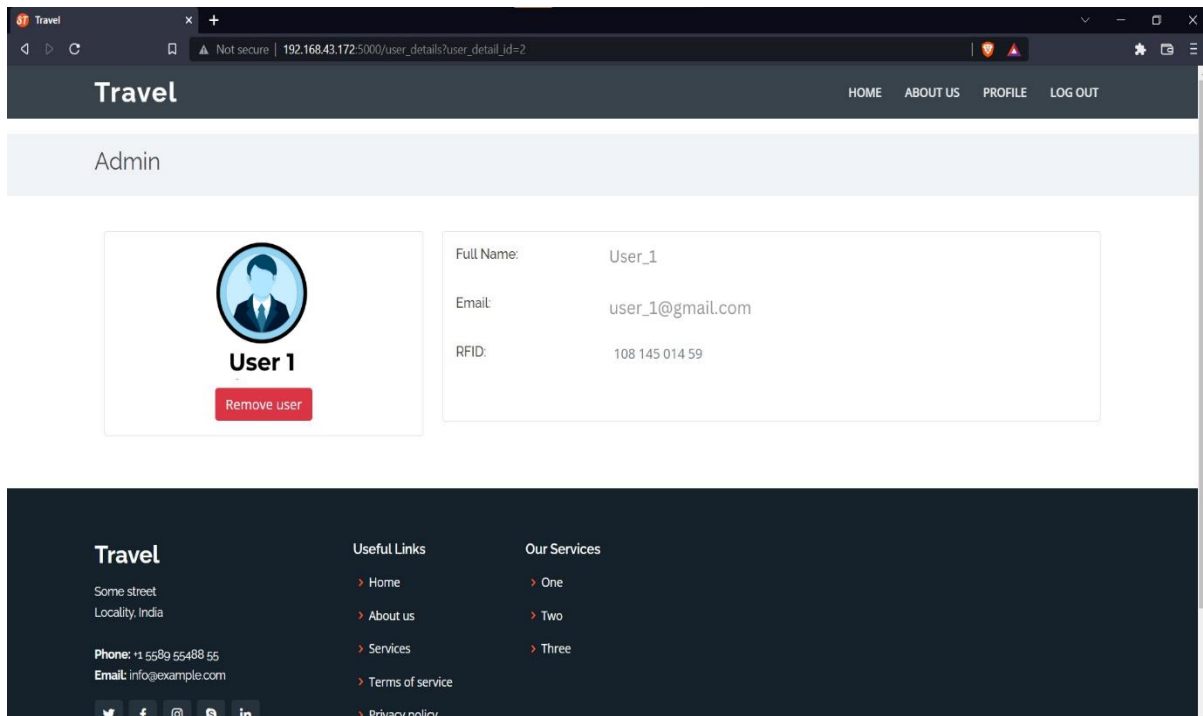Here, user can login into his/her account.

Fig 7.3 Profile Page

Here, Fig 7.3, represents Profile Page of user.

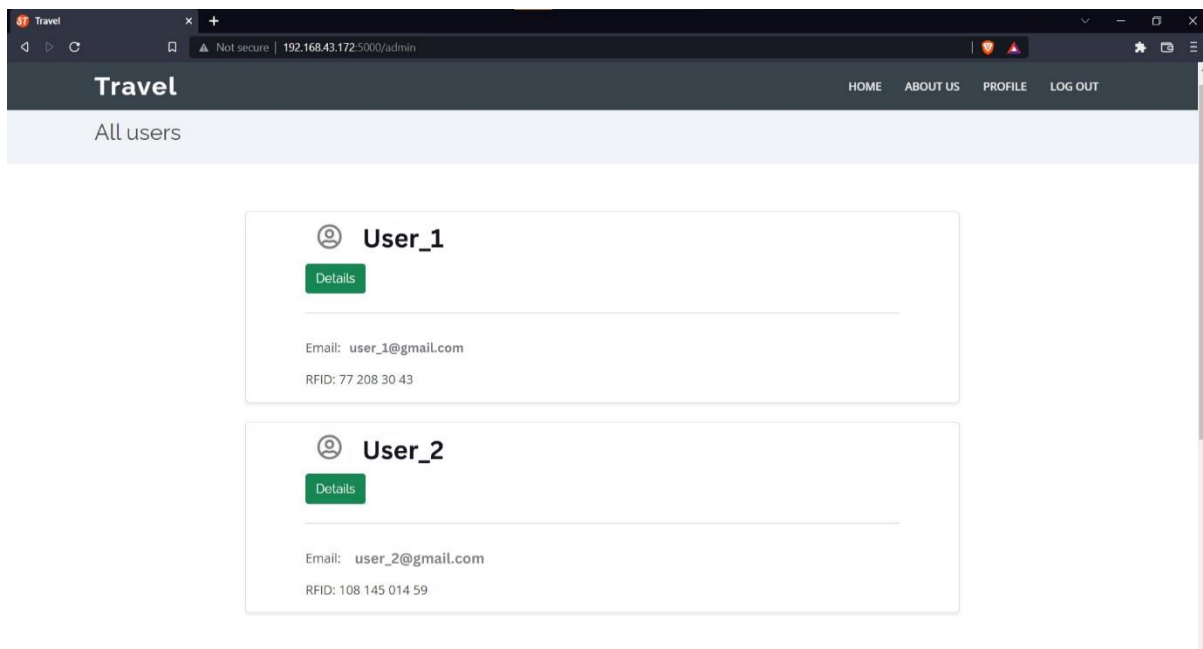Here, user can visit his/her profile and personal information.

Fig 7.4 Payment Page

Here, Fig 7.4, represents payment page.

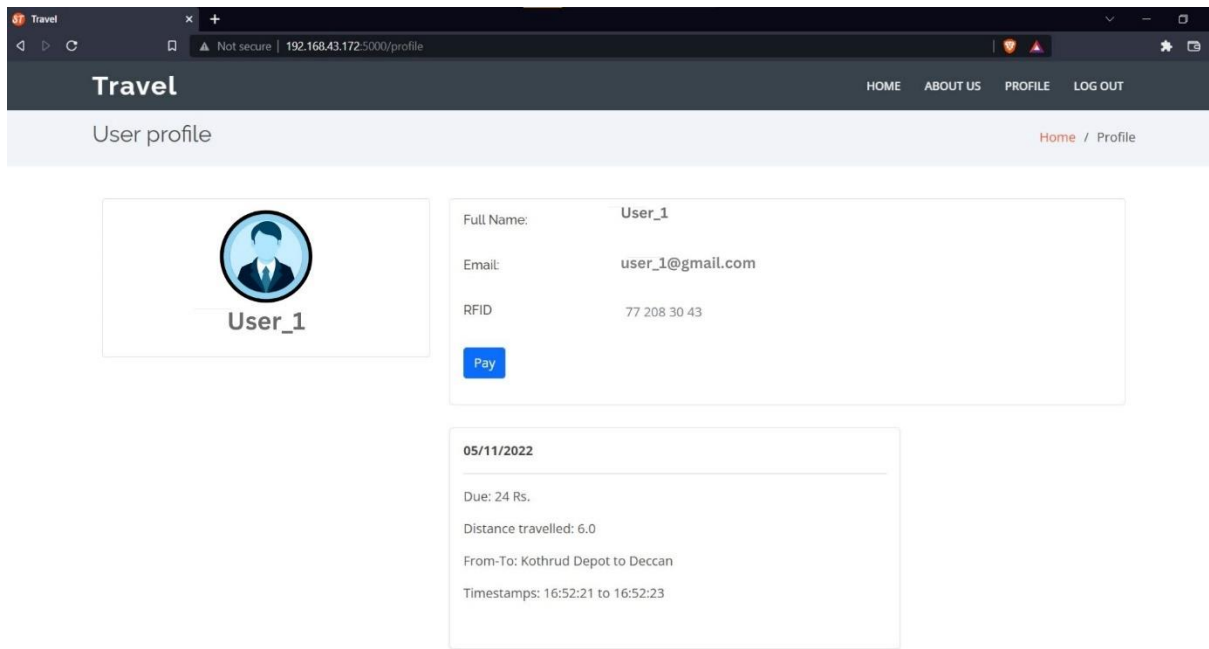Here, user needs to pay his due payments and can download receipts of payment.

Fig 7.5 Payment History Page

Here, Fig 7.5, represents the payment history of the user.

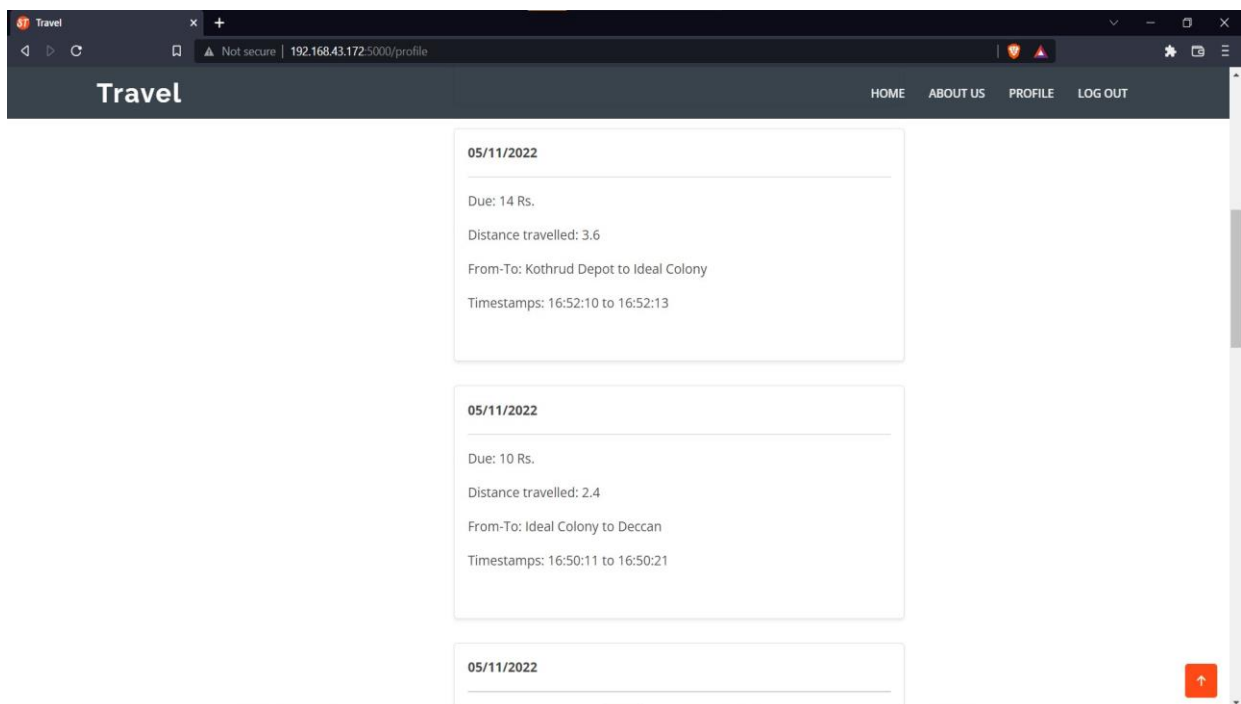Here, user can view his/her payment history, due payment.

Fig 7.6 Travel History Page

Here, Fig 7.6, represents the travel history of the user.

Here, user can view his/her travelling history, travelling location, time stamp and total cost.