STUDENT DECLARATION

This is to certify that I have completed the Summer Project entitled **"EV Charging Hub"** under the guidance of **Mr. Ganesh Yogi** in partial fulfillment of the requirements for the degree of **Bachelor of Information Management** at Faculty of Management, Tribhuvan University. This is my original work and I have not submitted it earlier elsewhere.

Date: 2022/06/9
Signature:
Name: Prabin Manandhar

CERTIFICATE FROM THE SUPERVISOR

This is to certify that the summer project entitled **"EV Charging Hub"** is an academic work done by Prabin Manandhar submitted in the partial fulfillment of the requirements for the degree of Bachelor of Information Management at Faculty of Management, Tribhuvan University under my guidance and supervision. To the best of my knowledge, the information presented by him/her in the summer project report has not been submitted earlier.

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ABSTRACT

Eco Charge Hub system aims to provide a platform which connects an EV (Electric Vehicle)user with its service provider. This system allows the EV users to search service provider according to its destination location and pre booked charging hub on the basis of charginglevel. Service provider require to register along with their location and provide the availabletime which will be stored in the system database. From that information, EV user can findout the available charging station at the given time. EV user can pre-booked charging station.When the EV user booked charging hub then service provider may reject or accept the booking and also update its available time.

Our system is designed in such a way that it makes easier for the EV user to use and interactwith the system. It is the system developed with the objective of making the system reliable,easier and fast. To be precise the main objective of our web application is to make a user-friendly platform that find out the charging hub location easily and make available of charging hub to EV user at right time for travelling its long destination. This system also actsas a source of income for the lender who lends the charging hub. But here the price is highlyflexible as per the rate of unit consumed from the EV vehicles and we have also fixed certainsum of money as a profit amount as per various level of charger. In Nepal the standard voltage is 220 V and the frequency is 50 Hz. So, it is found that level 1 charge is not viablein Nepal as it uses 120 Volt and we will need additional plug adapter or voltage converterfor it which will increase the cost of services. Likewise, our system has gone through bothblack box and white box testing. Our system is hence mediator between an EV user and ahome owner who are ready to provide the services to the desired customer.

ACKNOWLEDGEMENT

It gives us immense pleasure to express our deepest gratitude and sincere thanks to our respected and esteemed guide **Er. Rajan Karmacharya**, Lecturer, Department of Computer Science, for his valuable guidance, encouragement and support. His co-operation in this project are sincerely acknowledged.

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Prabin Manandhar (T.U. Exam Roll No. 9028/18)

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LIST OF ABBREVIATIONS

API – Application Program Interface

BIM - Bachelor of Information Management

DC - Direct Current

ETFC - Electricity Tariff Fixation Commission

EV - Electric Vehicles

NEA – Nepal Electricity Authority

KW - Kilowatt

V - Volt

Chapter 1 Introduction

1.1 Background

Electric Vehicles (EV) are ecofriendly vehicles that use renewable energy source i.e. electricity instead of non-renewable resources such as petrol diesel etc. A non-renewable resource (also called a finite resource) is a resource of economic value that cannot be readily replaced by natural means at a quick enough pace to keep up with consumption. EV are eco-friendly mobile which helps us preserve and conserve finite resource and environment respectively. ECO Charge Hub system will help finding the charging hub forEV. Kathmandu is known for its pollution more than its beauty. Our system will also helpto promote the use of EV's. It will act as a mediator between the service provider and EVusers.

The launch of new EVs in the four-wheeler and two-wheeler segments at NADA Auto Show 2018 held in mid-September and the immense attraction of visitors towards the vehicles are indicative of this fact. Major automobile brands including Hyundai, Kia and Renault showcased their futuristic four-wheelers during the auto show. In just the first threemonths of the current fiscal year 2018/19, the country imported EVs worth Rs 274 millionwhile EVs worth Rs 768 million were imported during the last fiscal year, 2017/18. The data also reveals that the growth of the EVs is accelerating rapidly in the country. Only 10percent excise duty is levied on the import of private EVs and only 1 percent excise duty is levied for import of public EVs. Likewise, only Rs 300 tax is levied on EVs annually while 240 percent tax is levied on standard four-wheeler vehicles. (Duwal, June 06, 2018)

Dealers have been saying that lack of infrastructure—such as well-paved roads andcharging stations across highways—has become a major problem for the growth and expansion of the EV market in Nepal. (prasain, 01/18/2019).

1.2 **Introduction to the organization**

Eco Auto Trading Pvt LTD was founded in 2018 in Kathmandu, Nepal. It set its foot as an Electric Vehicle distributor and EV parts supplier, equipment trading and services company. Over the years, the company has earned a reputation for excellence and professionalism for continuously striving to meet - and even exceed - standards which set the climate for a sustainable business relationship with its clients.

It has a team which is composed of technical skilled and highly dedicated personnel working cohesively to promote value- added solutions with a competitive pricing structure to suit the customer needs. They have set a plan to engage in electrical vehicles installations, testing and commissioning, preventive maintenance, automation, and energy saving solutions.

1.3 Current situation of the organization

At present, the organization has a website with basic information about the location and contact of an organization. It also has a list of Electric vehicles with its proper detailed description. Since it doesn't have the feature that is provided by eco charge hub, people are not convinced to register to the system due to which we are lacking the information about the potential customer. Due to which the company website is lacking proper SEO.

1.4 Issue/ Problem of the report

The major issue with this company is that they are lacking to convince their potential customer to register to their website due to the lack of features which help to facilitate the EV owner. Since there is just a basic information about the company location and contact and the detail of the vehicles, the EV owner who have previously owned the EV are not willing to register but if the company integrate EV charging Hub system, then it allow the

customer to experience the new feature which would help them to find the nearest and desirable location and time to charge the vehicles.

1.4.1 Problem Definition

Electric Vehicles have limited capabilities during long ride and traveling. They have limited mileage of distance coverage with one charge. So, our system is developed to identify the charge hub station near them during long drive. It also helps to preserve finiteresource by promoting renewable resources.

1.5 Objectives of the project

The platform aims to create an online platform where Electric car owner can book for the charging station on the way to their destination. It allows user to register/login into the website so the user can have its own personal account so that they can login and book or modify their service.

- To provide easy and efficient web portal app for EV owner and home owner. • To allow EV owner to choose the available charging station in between their destinations.
- To generate opportunity to make profit by adding a new facility in motels/hotel.

1.6 Methodology

In the application, this project is supposed to handle the online EV charging booking system. There will be various degrees of levels of abstraction based on the nature of end user. This system uses Iterative design model from the System Development Life Cycle which means a new version of the software is produced at the end of each iteration of the model

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1.6.1 Project Framework

A project to run smoothly, on time and produce great result requires a good project framework. Project framework is a combination of processes, tasks, and tools used to transition a project from start to finish. This chapter reveals the proposed method of implementing the project. The important on this is systematic planning and implementation in order to complete system on time.

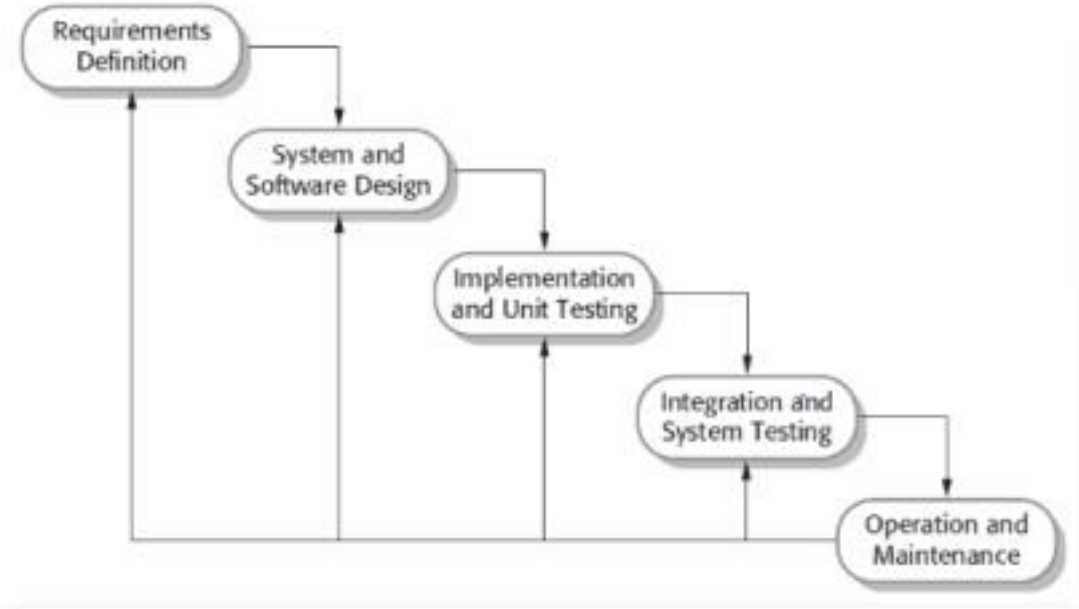

Figure 1: Project Framework for iterative model (Sommerville, 2011)

The project framework includes all the steps mentioned in the iterative model. They are briefly described below:

i. Requirements Definitions:

This section defines all the requirement necessary in the development of the web platform. In this, phase the information is collected from the Internet and other sources of existed charging station .

ii. System and Software Design:

This section is done by making design and plans to be implemented during the development. This phase has included activities like focusing more on end user experience of using the system etc.

iii. Implementation and Unit Testing:

This section is done after each phase of development by implementing and testing each unit of development. In this phase, the coding is tested accordingly after every single feature is added and debugging is done in order to make the system error free. After the successful testing of the system, the project is ready for the implementation.

iv. Integration and System Testing:

This section will include the entire component and their integrated testing.

v. Operation and Maintenance:

Once all prior stages have been completed, it is time for a thorough evaluation of development up to this stage. This allows the entire team, as well as clients or other outside parties, to examine where the project is at, where it needs to be, what can or should change, and so on.

1.6.2 Data and Information

The data and information is the most crucial part of any project. The level of security and availability of data plays an important role in any web based application. For the EV owner to book the ticket it is very necessary to get appropriate data and information about the house/hotel owner. Also for house/hotel owner it is necessary to have information of EV owner.

The data are raw materials which after processing making the use various technology and logic transforms into information. For the collection of information for this platform, various sources were used like:

i. Primary sources

These are the sources from which information is collected through self involvement in these EV distributor companies and charging station company. These are the reliable sources that give accurate information. It involves an artifact, a document, diary, autobiography, a recording, or any other source of information that was created at the time under study.

ii. Secondary sources

Other required information for this project was collected through various other sources such as case studies of previous years, books, websites, journals, newspaper articles, review articles, observations, etc.

1.6.3 Tool used

The tools that are used are listed below:

- Front End:
  - CSS
  - HTML
  - React
  - Bootstrap

- Back End:
  - Node.js

- Database:
  - MySQL

1.7 Feasibility Analysis

A feasibility study is used to determine the viability of an idea, such as ensuring a project is legally and technically feasible as well as economically justifiable. It tells us whether a project is worth the investment in some cases, a project may not be do able. There can be many reasons for this, including requiring too many resources, which not only prevents those resources from performing other tasks but also may cost more than an organization would earn back by taking on a project that isn't profitable.

Feasibility study is a process to check possibilities of system development. It is a method to check various different availability of financial and technical resources. Before startingthe process, various parameters must be checked. There are three different ways feasibilityis tested:

1.7.1 Technical Feasibility

Since this system is technically feasible as the level of knowledge and technical requirement as this is developed using software like Node.js, CSS, React, Html, MySQL, Bootstrap. The system will be self-explanatory and does not need any extra sophisticated training. As the system will be built by concentrating on the Graphical User Interface Concepts, the application will also be handled very easily with a novice User.

1.7.2 Economic feasibility

In Nepal, 1-unit cost around Rs. 12, Per unit electricity tariff has been fixed at Rs 7.80 perunit for rural cottage industries, Rs 9.60 for small industries, Rs 11.20 for trading, Rs 4.30for irrigation, Rs 5.20 for community drinking water, Rs 13 for industries and Rs 14 for entertainment business. (News Team, July 1, 2016).

Level 1 equipment provides charging through a 120 volt (V), Level 2 equipment offers charging through a 240V and Level 3 is also known as a DC charger, charges through 480V (Levels of Charging, 05/18/2019). Level 1 charger is not so viable in the context of Nepalwhere NEA supplies 220 V.

Table 1 Electricity tarrif for household

Electricity Tariff for Households		
Units	**Per Unit Rate**	**Service Charge**
Up to 20 units	Rs. 3	Rs. 30
21 - 30	Rs. 7	Rs. 50
31 – 50	Rs. 8.5	Rs. 75
51 – 150	Rs. 10	Rs. 100
151 - 250	Rs. 11	Rs. 125
251 – 400	Rs. 12	Rs. 150
400+	Rs. 13	Rs. 175

Table 2 Charging rate for the EV users

Level of Charger	Hourly Fixed Rate	Monthly Fee
Level 1	Rs. 50	25%
Level 2	Rs. 100	25%
Level 3	Rs. 150	25%

We won't be adding service charge taken by NEA for the EV Customer. For example, Kiae-Soul which uses 16 kW/180 km for full charge within 5 hours:
For Level 2 charger:

Price = (Hour * Fixed Hourly Rate) + (17 per unit * Unit Consumed)

= (5 * 100) + (17 * 16)

= Rs. 772

Average price per hour = 772/5 = Rs. 154.4

It is advantageous to the user as per the per unit cost than the fuel vehicles.

Table 3 cost comparision

EV Vehicles	Fuel Vehicles
= total price / mileage = 772 / 180	= petrol price per liter/ mileage = 108 /12
=Rs. 4.288 per mileage	=Rs. 9 per mileage

1.7.3 Operational feasibility

This system will fulfill requirement of those who want to pre book for charging their

EV. It saves time, effort and is very cheap to use this system. This system will have easy interface for different model which are easy to understand. It does not require any programming skill to use the system. Users only need to add their personal details and theirrequirement which doesn't require any technical knowledge as only logging and registeringis to be done and make them easily to operate this site. So, the system also passes the test of operational feasibility.

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1.7.4 Schedule Feasibility:

The development process is planned to reach designing phase till the end of the semester, which gives us a windows of roughly six months. Although this may be a tight fit for a perfect, final system, as the Incremental Model is being followed in the SDLC, this is enough time to develop a working first version of the project.

1.8 Risk Analysis

i. Performance risk

The software performance may be hampered due to various factors like unresponsive UI and failure to execute given command(s). One of the factors for these can be a large-sized front end, which can be corrected by making a lightweight UI. Poor internet connection or client-side faults may cause performance malfunctions which are outside the control of the developers.

ii. Safety Risk

Another risk with the system is the safety of the user data. The user data may be lost or corrupted if not for proper management and storage. This can be negotiated by using reliable databases in the back end.

iii. Security Risk

A major risk in the system is the security of user data as well as their personal information. Firstly, the user authentication will have to be very stringent. The communication between UI and database should be secure. The database itself should be secure and measures like hashing and password protection should be used. The user's private information should never be accessible without the express permission of the user in question.

Chapter 2 Task and Activity Performed

2.1 Analysis of tasks, activities, problem, issues

Tasks and activities, i.e. what needs to be done to obtain project objectives have been assessed. Problems of the project are also critically analyzed to find future project improvements and flaws.

2.1.1 System Analysis

Technically, system analysis is a systematic procedure of orderly collection or retrieving the facts and features of the system and its proper interpretation, identifying the possible future problems along with present threats to the system, and finally the decomposition of a system into its several components. System Analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes. The major objectives of systems analysis are to find answers for each business process: What is being done, how is it being done, who is doing it, when is he doing it, why is it being done and how can it be improved? It is more of a thinking process and involves the creative skills of the System Analyst. The result of this process is a logical system design. Systems analysis is an iterative process that continues until a preferred and acceptable solution emerges. The vision of system analysis is to enable the system developer to understand the user requirements and develop an application according to their requirements.

2.1.2 Analysis of tasks and activities performed

The first activity performed was software specification, where the software that is to be produced and the constraints on its operation were defined by customers and developer. The target user was defined and problem statement, objectives were identified.

The next activity was software development, where the software was designed and programmed. It is all about the requirements like the requirement collection and analysis, the use case model of the project and their description, the logical relational database model and the design requirements. All the designs of the project were done.

The software validation was performed, where the software was checked to ensure that it is what the customer requires. Software evolution is the last task, where the software is modified to reflect changing customer and market requirements. The scope for further developments is discussed.

2.1.3 Analysis of the problems and issues

The goal of problem analysis is to gain a better understanding of the problem being solved before developing a solution. The manual system causes numerous problems and it is time consuming inefficient process. Most of the customers face difficulties when their appointments are not properly managed by the salon. It causes customer dissatisfaction. On the other hand, it impacts the goodwill of the business. The owner tends to suffer because the payment details, customer details are not managed properly. Further, there is no proper process for announcing new services. Owner has to allocate prices for services and update them from time to time in papers. They maintain manual documentation for their business activities like making appointments, cancel appointments, managing

customer payments, etc. The social media marketing is a highly valued element of an advertising strategy. The business has not taken the opportunity of it and total profit depends on the consumer recommendations. It was essential to automate the activities managed by the salon to improve service quality and save their time while improving their customers' satisfaction.

2.1.4 Literature Review:

The optimal planning of electric vehicle (EV) charging stations (ECSs) with advanced control algorithms is very important to accelerate the development of EVs, which is a promising solution to reduce carbon emissions of conventional internal combustion engine vehicles (ICEVs). The large and fluctuant load currents of ECSs can bring negative impacts to both EV-related power converters and power distribution systems if the energy flow is not regulated properly. Recent review papers related to EVs found in open literature have mainly focused on the design of power converter-based chargers and power interfaces, analyses of power quality (PQ) issues, the development of wireless charging techniques, etc. There is currently no review paper that focuses on key technologies in various system configurations, optimal energy management and advanced control issues in practical applications. To compensate for this insufficiency and provide timely research directions, this paper reviews 143 previously published papers related to the aforementioned topics in recent literature including 17 EV-related review papers found in Institute of Electrical and Electronics Engineers (IEEE)/Institution of Engineering and Technology (IET) (IEEE/IET) Electronic Library (IEL) and ScienceDirect OnSite (SDOS) databases. In this paper, existing system configurations, related design methods, algorithms and key technologies for ECSs are systematically reviewed. Based on discussions given in the reviewed papers, the most popular ECS configuration is a hybrid system design that integrates renewable energy (RE)-based power generation (REBPG), various energy storage systems (ESSs), and utility grids. It is noteworthy that the addition of an ESS with properly designed control algorithms can simultaneously buffer the fast, fluctuant power demand during charging, smooth the intermittent power generation of REBPG, and increase the overall efficiency and operating flexibility of ECSs. In addition, verifying the significance of the flexibility and possible profits that portable ESSs provide in ECS networks is a potential research theme in ECS fields, in which the potential applications of portable ESSs in the grid-tied ECSs are numerous and could cover a full technical spectrum. (Department of Electrical Engineering, CEECS, National United University, Miaoli 36063, Taiwan)

In the present world, global warming is one of the major problems where air pollution plays a vital role. Different studies showed that the transportation sector is one of the significant role players for air pollution. To reduce air pollution through transportation modes, scientists were working for a long time. Electric vehicles (EV) are important innovations, which is considered one of the best options to fight against air pollution as well as it has less maintenance and operating cost, and low noise emission. However, EV growth is suppressed due to less number of public charging stations, the appropriate position of the charging station, and uncoordinated charging in the charging stations. Charging stations in suitable places and charging time is a significant concern to operate and increase the number of EVs. Different researches reviewed the issues of charging infrastructure like-different technics for charging station placement, optimization techniques, and topologies of fast charging stations but very few did analyze or reviewed different modeling approaches or charging stations optimal localization models. This study has reviewed EV charging station related literature until 2019 and tried to find out the recent trends in charging infrastructure planning of EVs. This study also briefly discusses various mathematical models and algorithms to plan an EV charging station from relevant literature. (**Nashid K. Khadem; Amirreza Nickkar; and Hyeon-Shic Shin**)

While Electric vehicles (EVs) adoption is accelerating in an unprecedented way, lacking EV charging infrastructure hinders the development of the EV market. To compensate for these shortcomings, Mobile Charging Stations (MCS) could play a prominent role to accelerate EV penetration by providing charging services with no restrictions on the location and time of the charging process. This paper disseminates information on other papers and technical reports on MCS in the literature. It also discusses the benefits of MCS, its challenges, and finally introduces the research gaps in this area. (2020 IEEE Transportation Electrification Conference & Expo (ITEC))

Time-varying pricing is seen as an appropriate means for unlocking the potential flexibility from electric vehicle users. This in turn facilitates the future integration of electric vehicles and renewable energy resources into the power grid. The most complex form of time-varying pricing is dynamic pricing. Its application to electric vehicle charging is receiving growing attention and an increasing number of different approaches can be found in the literature. This work aims at providing an overview and a categorization of the existing work in this growing field of research. Furthermore, user studies and the modeling of user preferences via utility functions are discussed.(Honda Research Institute Europe GmbH, 63073 Offenbach/Main, Germany; steffen.limmer@honda-ri.de)

Shifting from a fossil-fueled to an eco-friendly vehicle fleet in cities could pave the way towards a more sustainable future. Electric Vehicles (EVs) should thus be prioritized, so that they could replace conventional vehicles gradually. In this context, an EV-accommodating infrastructure, which ensures the functionality of the entire system, is essential. This study aims to develop a methodological framework to identify suitable locations for the deployment of EV charging points in urban environments. To meet this objective, we acquired a mixed method approach including a systematic literature review, 12 semistructured stakeholder interviews which were thematically analyzed, and an Analytical Hierarchy Process (AHP). The outcome is a spatial model function, which consists of parameters and weights for estimating the suitability of each urban road link that will allow the establishment of EV charging points. Results show that the key location selection factors are: transport hubs, marked or controlled parking spaces, and points of interest. The less significant factor is public services. Therefore, there is a preference, in stakeholder level, for transport features over the land use ones (69% over 31%). Although this research is conducted in Greece, we intend to suggest methods and generate valuable findings that may be valid and generalizable for a more global context.(Sustainable Mobility Unit, School of Rural and Surveying Engineering, Zographou Campus)

2.1.5 Time Schedule & Gantt Chart

Table 4 Time Schedule

Task	Start date	End date	Duration
Project planning	March-03	March-10	1 week
Identification and selection of strategies	March-11	March-18	1 week
Coding	March-19	April-09	3 weeks
Testing and debugging	April-10	April-24	2 weeks
Evaluation and modification	April-25	April-30	1 week
Implementation and review	May-01	May-06	1 week

Gantt chart

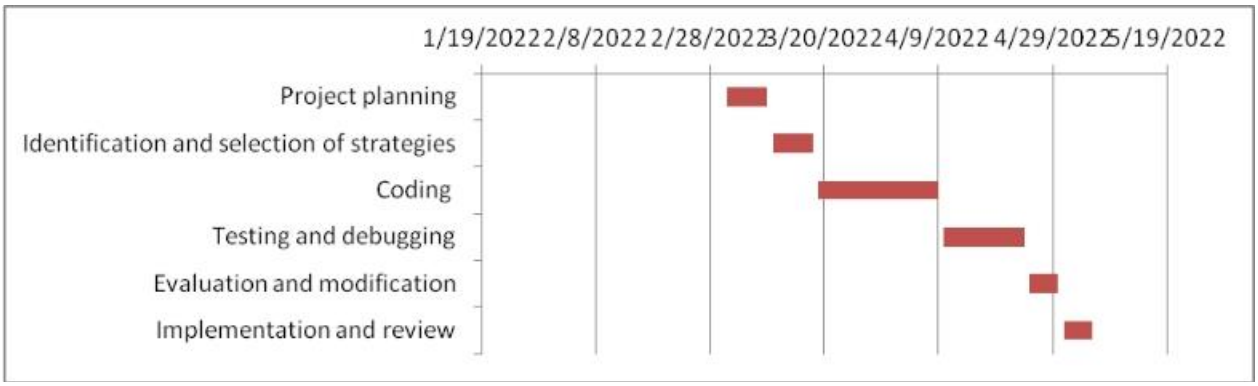

Figure 2: Gantt Chart

2.2 Requirements Definition

This system is developed as a web and android based model and any person with internet access on the system with the correct credentials can access this system. The functional and non-functional requirements of this system can be briefly explained as below:

2.2.1 Functional Requirement

The main purpose of functional requirements within the requirement specification document is to define all the activities or operations that take place in the system. These are derived through interactions with the users of the system.

- Detail of service provider and EV user.
- Change password facility for all user including admin.
- Accurate location tracing for the EVs users.
- Generate notification for the service provider on real time.
- Generate report to analyses the flow of customers on those charging hubs.

2.2.2 Non-Functional Requirement

The non-functional requirements are the requirements that are not directly concerned with specific functions delivered by a system. They actually define the system performances, security, availability, reliability, response time etc. Alternatively, they define constraints on the system such as capabilities of input-output devices and data representations used in system interfaces.

- The system should have interactive and user-friendly user interface.
- The system should be maintainable.
- The system should be extensible and maintainable.
- The performance of the system should be fast and less memory consuming.
- The system shouldn’t have server down problem.
- The system should maintain accurate timestamp.

2.3 Requirement Modeling

A requirement modeling is the combination of test and diagrammatic forms to depict

requirements in a way, this is relatively easy to understand. Requirement modeling can bebest described by use case diagram.

2.3.1 Use Case Diagram

In the given figure, we can see there are three actors all together working in an environment. EV Customer register into the system in order to book the desired location's charger. HomeOwner gets to see the EV Customer's request and accepts if the time and date provided bythe EV Customer are feasible and also s/he can change the availability time in order to provide services.

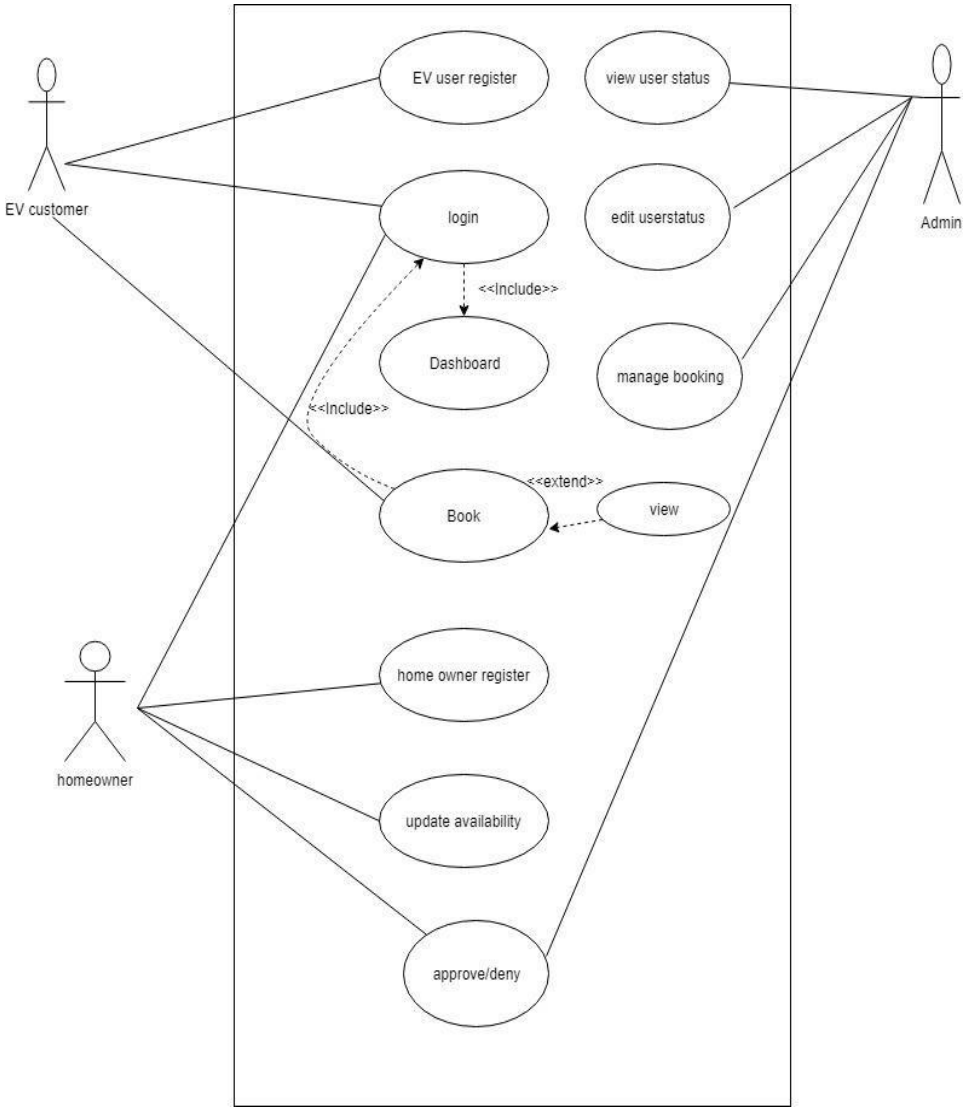

Figure 2: Use Case Diagram

2.3.2 Activity Diagram

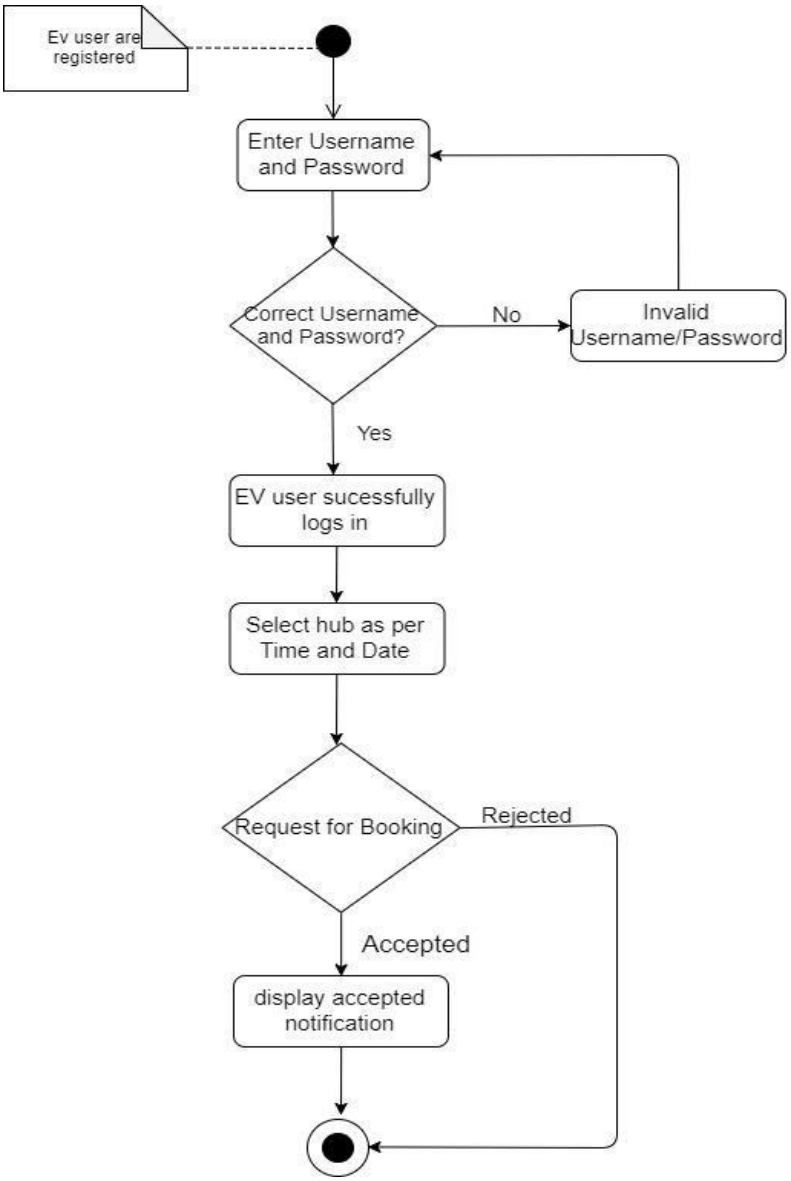

Figure 3 Activity Diagram

In this figure, the activity of the EV Cutomer are shown. Once the user is registered it canselect the desired hub as per the location s/he wants to go and select the time and date to visit to the destination in order to book the charging station on the way. The Home Ownercan either accept or reject the request and the Home Owner can also trade this service if s/he won't be available for providing the charging station.

2.4Architecture of The System

A system architecture is the conceptual model that defines the structure, behavior, and more views of a system. A 3-tier application is an application program that is

organized into three major parts, each of which is distributed to a different place or places in a network. The three parts are:

- Presentation Layer
- Business Layer
- Data Layer

The system architecture of the Eco Charge Hub is in 3-tier architecture model since it includes of three layers first the presentation layer where basic user interfaces have been implemented using Node.js, CSS, React, Html, MySQL, Bootstrap and others.

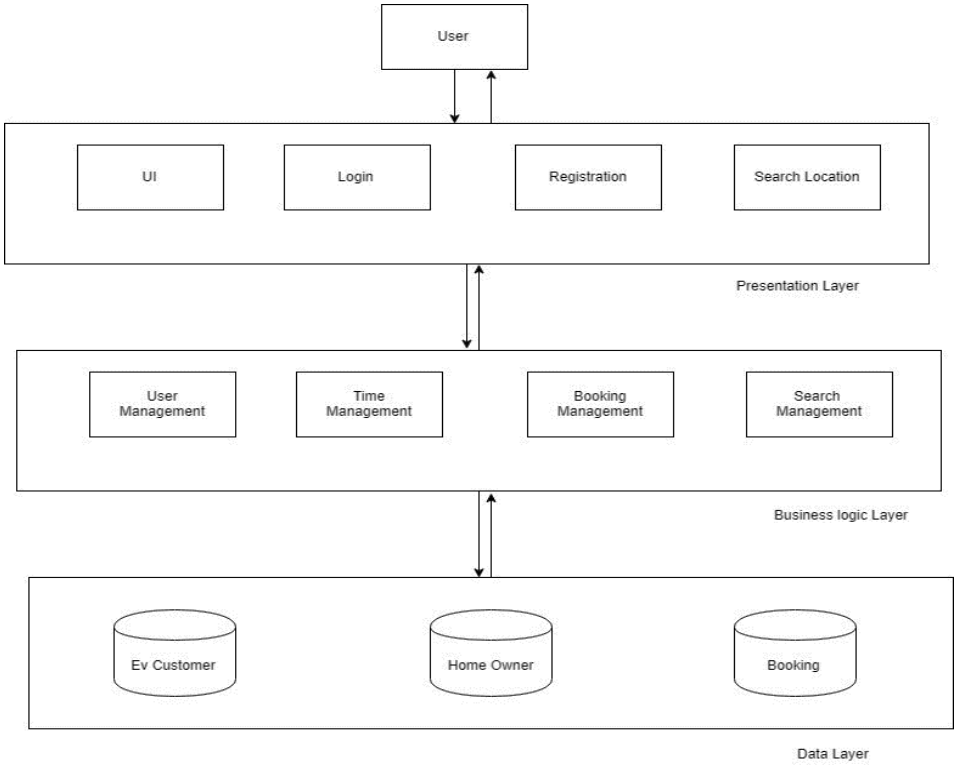

Figure 4 System Architecture

2.4.1 Class Diagram

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 the relationships among objects.

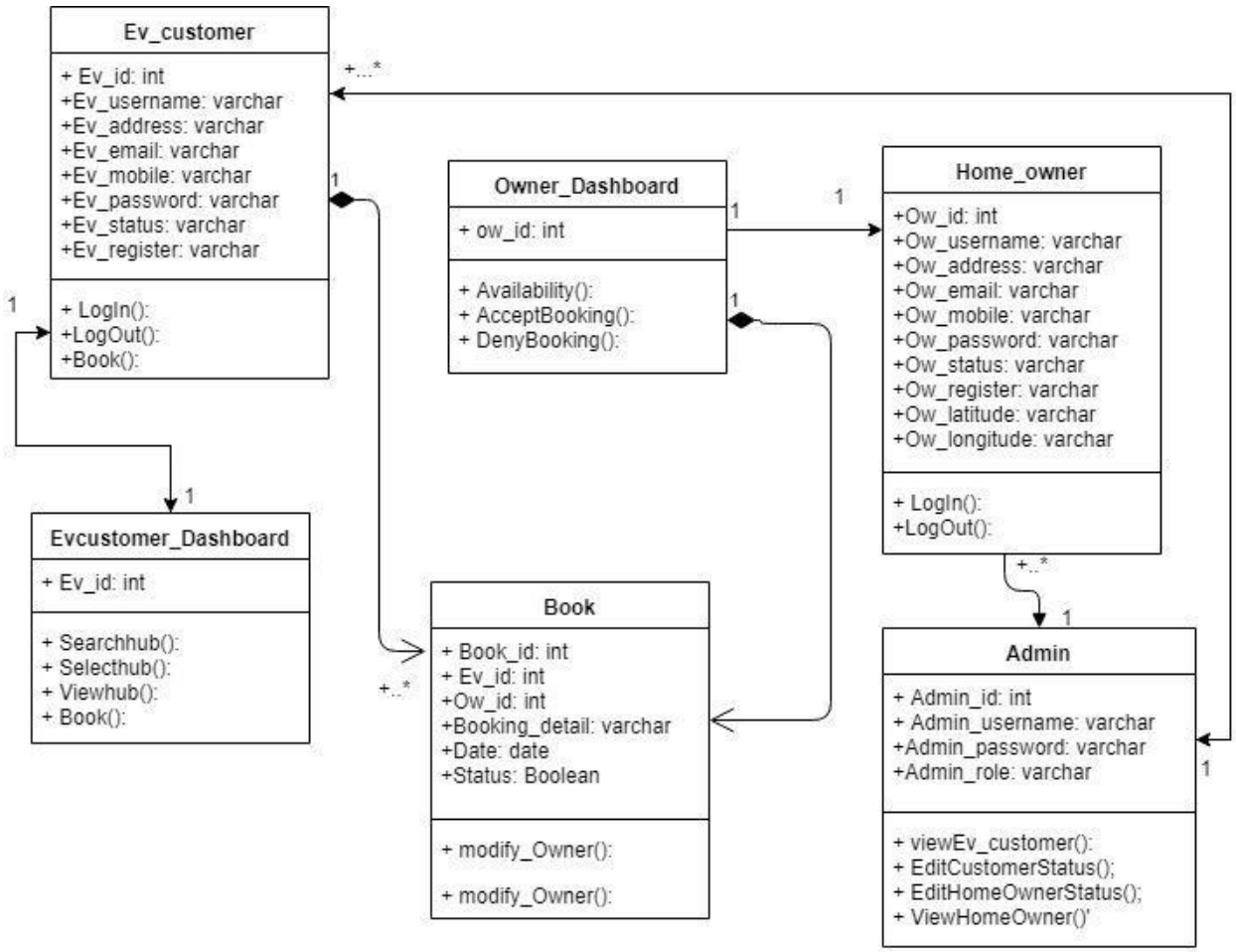

Figure 5 : Class Diagram

In the figure, admin gets to view all the EV customer, who has dashboard which help themin multiple booking of the charging hub in as desired places. The home owner can provideservice to the Ev customer who are in need and helps in booking facility. Without EV customer the class book is worthless.

2.4.2 Sequence Diagram

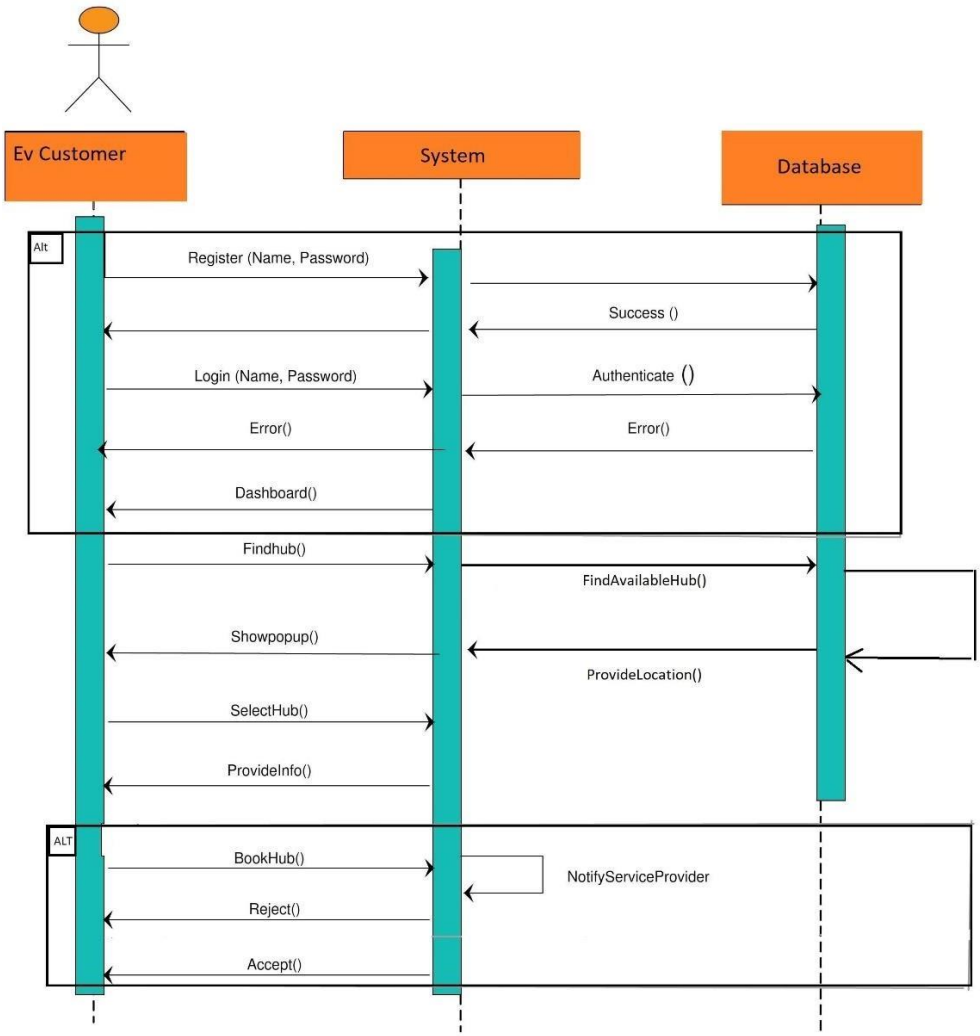

Figure 6 Sequence Diagram

This figure is made by representing the EV Customer who register in our system choose the service provider and notify them. The system helps to locate those service providers who are in the desired location with the help of database.

2.5 Findings

Learning was the major achievement during the entire project. While working in a project we learned lots of things like time constraint, group co-ordination and the dedication that should be given for the project. This project helps us to create a real scenario for working

in the real time environment.
Some of the major Technical achievement during our entire project are:

- Learning and exploration of React (MERN)
- Learning the usages of templates for easy design.
- Learning and exploration of Bootstrap framework.
- Learning and exploration of Apache server.
- Learning and exploration of database (MySQL).
- Learning and exploration of using various design tools such as Illustrator and
- Visual Studio.

Some of the major managerial and vital things we learnt from this project are:

- Know the value of time and discipline.
- Communication gap is always a problem.
- Learnt how to work in group collaborating with the group members.
- Learnt the time management skills.
- Learnt how much effort and dedication is necessary for developing a system.

CHAPTER 3 – DISCUSSIONS AND CONCLUSION

3.1 Discussions

3.1.1 Critical Analysis

This system helps in finding the charging hub for the EV vehicles and is developed as a web-based application model and any person with internet access on the system with the correct credentials can access this system and be both service provider or the service taker. There is no such system available till now in Nepal which provides this kind of services.

• To help Electric Vehicles user travel long distance.
• To generate earning medium for the service providers.
• To conserve the environment and save non- renewable resources.
• To help the EV user locate the charging hub as per their destinations.

This system will fulfill requirement of those who want to pre book for charging their EV. It saves time, effort and is very cheap to use this system. This system will have easy interface for different model which are easy to understand. It does not require any programming skill to use the system. Users only need to add their personal details and their requirement which doesn't require any technical knowledge as only logging and registering is to be done and make them easily to operate this site.

3.1.2 Assumptions

Concerning the implementation environment, we make the following assumptions:

- The user will have internet access.
- Only valid customer information will be recorded when managing.

3.1.3 Limitations

A lot of challenges surfaced during the development of this application. This project still has some weakness that can be addressed in the future. The following are some of the project's limitations and challenges encountered:

- This application requires an internet connection to work.
- Time factor for research to find a method of packing the application successively.

3.2 Conclusion

EV Charging Hub is a platform to connect an EV user with service provider. This web-based application provides information about the location of different Charging Hub. Service provider require to register along with their location and provide the available time which will be stored in the system database.

It is a platform where EV owner can use the space and energy to charge their Electrical cars which can benefit both, EV owner can charge their automobile at their desire location and the home owner can earn some passive income for the services provided.

Moreover, we would want to express our gratitude to our department for providing us with this opportunity to showcase our abilities. In reality, this initiative has given participants a realistic introduction to the real world, allowing them to obtain hands-on experience with information

technology in Nepal. Developing these types of projects enables students to participate in Nepali technology.
We were able to gain real-world information technology experience through this project. This endeavor has inspired us and improved our abilities. This project was a fantastic learning opportunity because it provided us with exposure to a variety of technologies that would be useful in our future careers in information technology. This project has the potential for future upgrades and enhancements.

3.3 Recommendations

This project is recommended for use by any EV (Electric Vehicles) dealer and manufacturing company to boost their sales and help to attract more electric vehicle user. This site help to add value to the customers. The system help the electric vehicle owner to find the appropriate Charging Stations near their destination. And it also helps home owner or any restaurant with parking space to generate passive income by investing small amount of money and also add value to their customer as well which lead to increase in customer flow. There are some limitations during the development of this EV Charging Hub system that will require improvement as stated in previous chapter

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B. C. Clinton and D. C. Steinberg,(2019), "Providing the spark: Impact of financial incentives on battery electric vehicle adoption", *Journal of Environmental Economics and Management*, vol. 98, pp. 102255, http://www.sciencedirect.com/science/article/pii/S0095069618303115.

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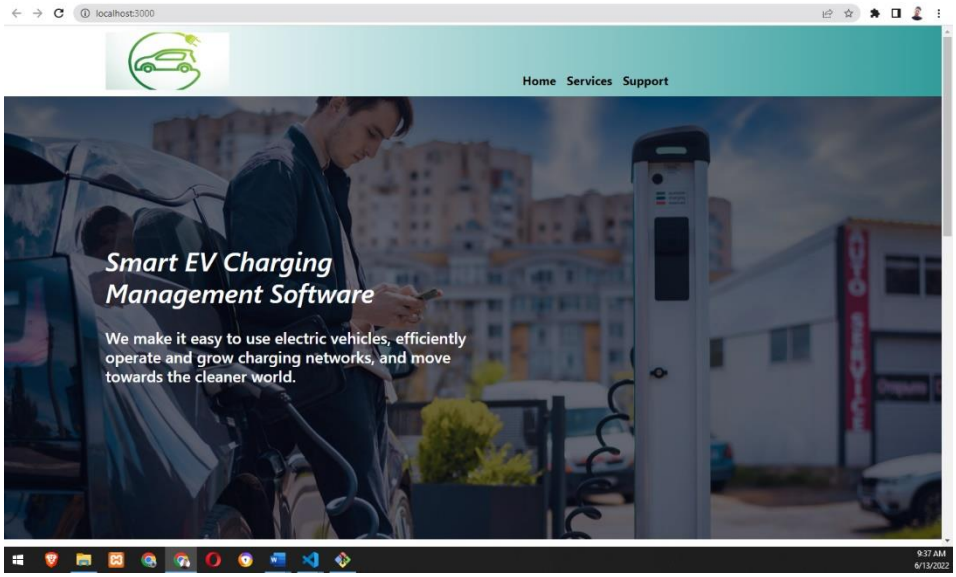
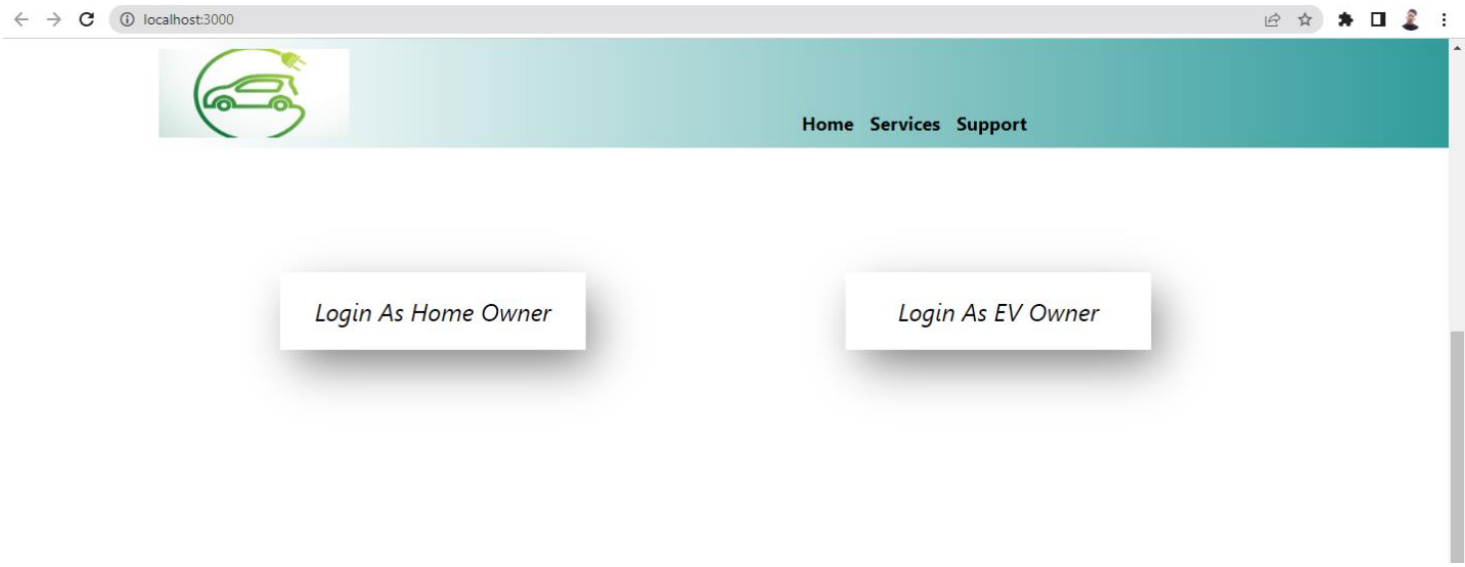
APPENDICES

Screenshots along with coding

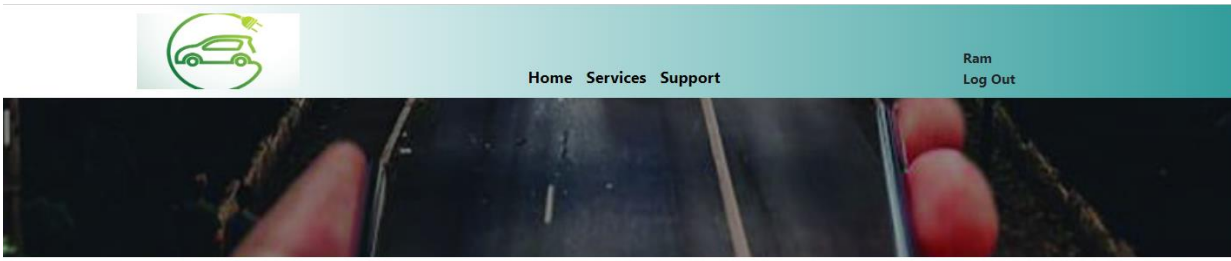


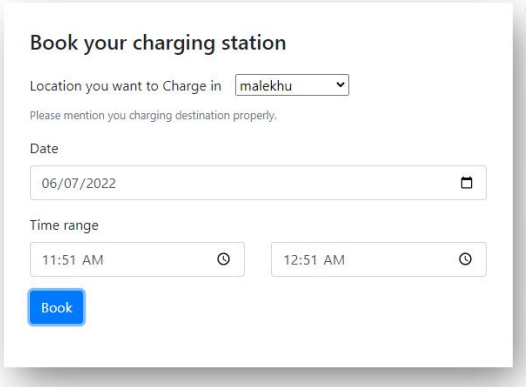

```
function App() {
  const bookingList = useSelector((state) => state.booking.bookingList)
  const HomeOwnerList = useSelector((state) => state.homeOwner)
  const EvOwnerList = useSelector((state) => state.EvOwner)

  const dispatch = useDispatch()
  let title = 'Smart EV Charging Management Software'
  let description = `We make it easy to use electric vehicles,
efficiently operate and
            grow charging networks, and move towards the cleaner world.`

  useEffect(() => {
    console.log('EvOwnerList', EvOwnerList)
    if (bookingList.length === 0) {
      dispatch(updateBookingList(Booking))
    }
    if (HomeOwnerList.HomeOwnerInfo.length == 0) {
      dispatch(updateHomeOwnerList(HomeOwnerInfo))
    }
    if (EvOwnerList.EvOwnerInfo.length == 0) {
      dispatch(updateEvOwnerList(EvOwnerInfo))
```

```
    }
  }, [HomeOwnerList])
  return (
    <div className="main">
      <Header />
      <Banner title={title} description={description}
image={BannerImage} />
      {EvOwnerList.selectedEvOwner || HomeOwnerList.selectedHomeOwner ?
(
        ''
      ) : (
        <LoginBanner />
      )}
      <Service />
      <Footer />
    </div>
  )
}

export default App
```




```
export default function LoginBanner() {
  let navigate = useNavigate()

  return (
    <div className="loginBanner">
      <div className="container login-inner-wrapper">
        <Link className="login-text-field" to="/login/home">
          Login As Home Owner
        </Link>
        <Link className="login-text-field m-3" to="/login/ev">
          Login As EV Owner
        </Link>
      </div>
    </div>
  )
}
```





Your recent booking status

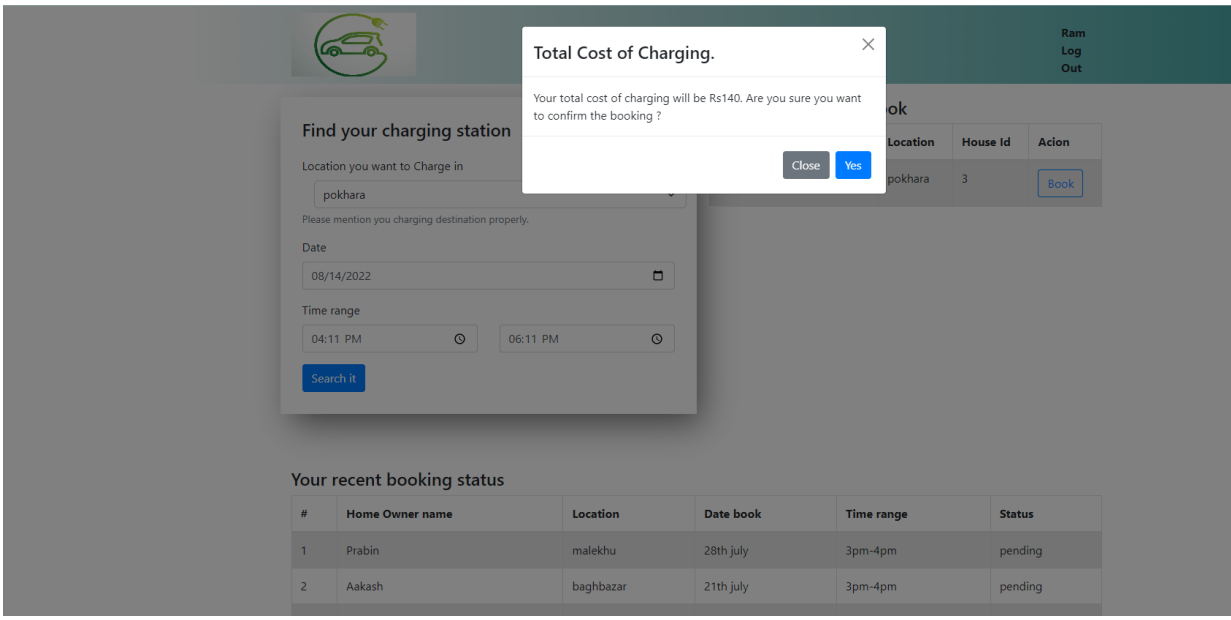
#	Home Owner name	Location	Date book	Time range	Status
1	Prabin	malekhu	28th july	3pm-4pm	pending
2	Aakash	baghbazar	21th july	3pm-4pm	pending
3	Asta	pokhara	2022-06-07	11:51 - 00:51	pending
4	Prabin	malekhu	2022-06-07	11:51 - 00:51	pending

```
export default function HomeDash() {
  let dispatch = useDispatch()
  const bookingList = useSelector((state) =>
state.booking.bookingList)
  const HomeOwnerList = useSelector((state) => state.homeOwner)
  const EvOwnerList = useSelector((state) =>
state.EvOwner.EvOwnerInfo)
  const [showModal, setShowModal] = useState(false)
  const [mybooking, setMyBooking] = useState([])
  const [modalDetail, setModalDetail] = useState('')

  const filterBookingList = () => {
    let mybook = bookingList.filter(
      (item) =>
        item.h_id === HomeOwnerList.selectedHomeOwner.h_id &&
        item.status === 'pending',
    )
    setMyBooking(mybook)
  }

  useEffect(() => {
    filterBookingList()
  }, [bookingList])

  let title = 'E-Hub needs partners like you.'
  let description =
    'Give with E-hub and earn great money as an independent
contractor. Get paid weekly just for helping our community to
promote ev vehicles. Be your own boss and get paid in fares for
servicing in your own schedule.'

  const handleAction = (action, id) => {
```

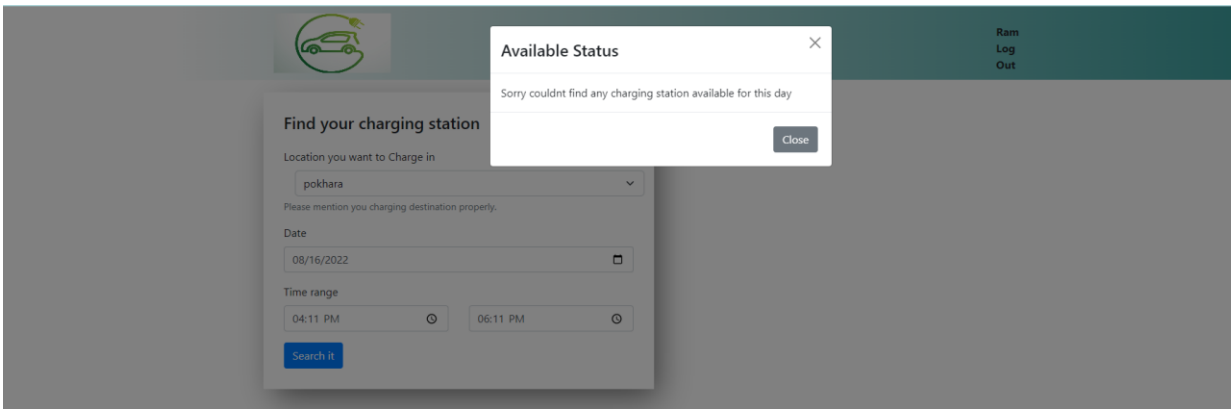
```
      if (action == 'accept') {
        setModalDetail({
          status: 'accept',
          booking_id: id,
          title: 'Accept Booking',
          description: 'Are you sure you want to accept this
booking?',
        })
        setShowModal(true)
      } else {
        setModalDetail({
          booking_id: id,
          status: 'reject',
          title: 'Reject Booking',
          description: 'Are you sure you want to reject this
booking?',
        })
        setShowModal(true)
      }
    }

    const handleSubmit = (action) => {
      let filterdBooking = bookingList.filter((i) => i.b_id ===
action.booking_id)

      let updatedBooking = { ...filterdBooking[0], status:
action.status }
      let newBookingUpdate = [...bookingList]
      bookingList.map((j, index) => {
        if (j.b_id === action.booking_id) {
          newBookingUpdate.splice(index, 1, updatedBooking)
        }
      })
      dispatch(updateBookingList(newBookingUpdate))
      filterBookingList()
      setShowModal(false)
      setModalDetail('')
    }
    return (
      <div>
        <ConfirmationModal
          show={showModal}
          modalDetail={modalDetail}
          handleClose={() => setShowModal(false)}
          handleSubmit={(e) => handleSubmit(e)}
        />
        <Header />
        <Banner image={HomeDashImage} title={title}
description={description} />
        <div className="container mt-4">
          <h2>Recent booking for you</h2>
```

```
          <div className="search-bar-wrapper">
            <input className="search-bar" id="search-bar"
type="text" />
            <button className="search-button">Search</button>
          </div>
          <div className="booking-list-wrapper row">
            {mybooking.length > 0 ? (
              <>
                {mybooking.map((item, index) => {
                  return (
                    <div className="booking-card col-lg-4"
key={index}>
                      <div className="card-inner-wrapper">
                        <div className="row">
                          <div className="col">
                            <div className="cardkey">Booking
Id</div>
                            <div className="cardkey">Ev Owner
Name</div>
                            <div className="cardkey">Ev Owner
location</div>
                            <div className="cardkey">Booking
date</div>
                            <div className="cardkey">Time
allocation</div>
                          </div>
                          <div className="col">
                            <div className="card-
item">{item.b_id}</div>

                            <div className="card-item">
                              {
                                EvOwnerList.filter(
                                  (i) => i.ev_id === item.ev_id,
                                )[0].name
                              }
                            </div>
                            <div className="card-item">
                              {
                                EvOwnerList.filter(
                                  (i) => i.ev_id === item.ev_id,
                                )[0].location
                              }
                            </div>
                            <div className="card-
item">{item.date}</div>
                            <div className="card-
item">{item.time}</div>
                          </div>
                        </div>
                        <div className="row mt-4">
```

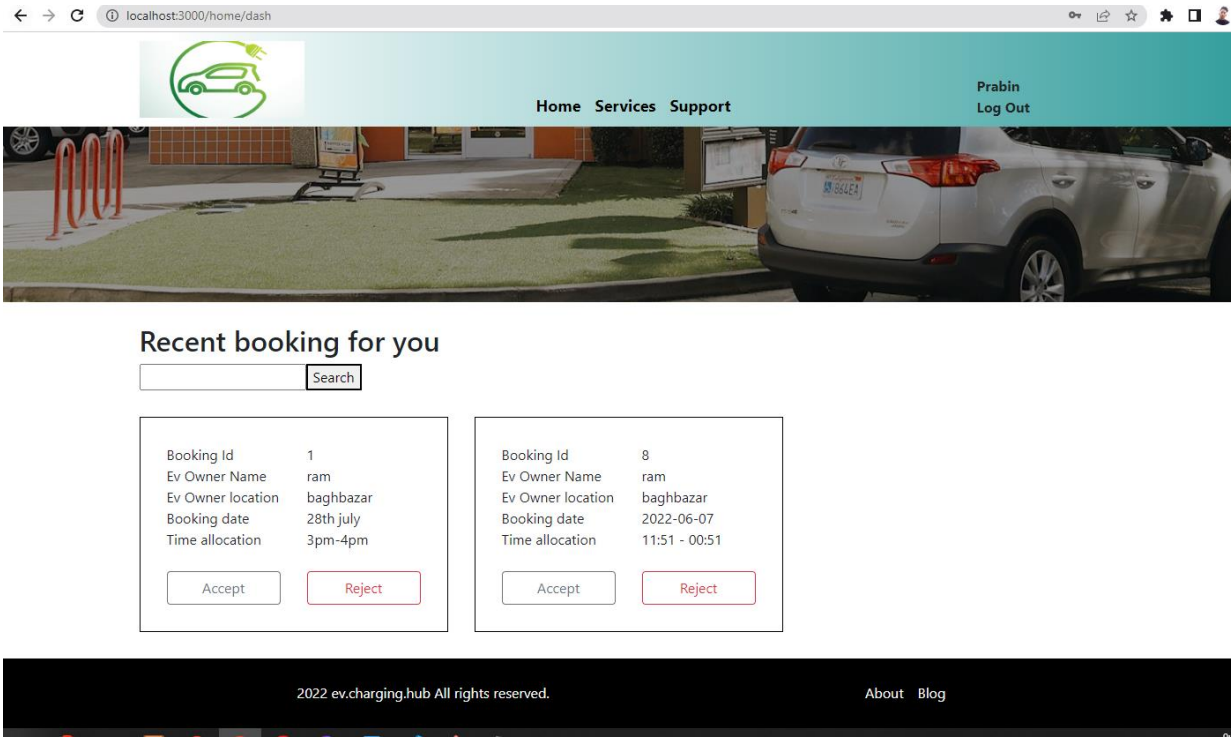
```
                        <div className="col">
                          {' '}
                          <button
                            className=" col btn btn-outline-
secondary"
                            onClick={() => handleAction('accept',
item.b_id)}
                          >
                            Accept
                          </button>
                        </div>
                        <div className="col">
                          {' '}
                          <button
                            className=" col btn btn-outline-
danger"
                            onClick={() => handleAction('reject',
item.b_id)}
                          >
                            Reject
                          </button>
                        </div>
                      </div>
                    </div>
                  </div>
                )
              })}
            </>
          ) : (
            <div className="no-item-show"></div>
          )}
        </div>
      </div>
      <Footer />
    </div>
  )
}
```




```
<ConfirmationModal
  show={showModal}
  modalDetail={modalDetail}
  handleClose={() => setShowModal(false)}
  handleSubmit={() => submitBooking()}
/>
```




```
<ConfirmationModal
  show={showModal}
  modalDetail={modalDetail}
  handleClose={() => setShowModal(false)}
  handleSubmit={() => submitBooking()}
/>
```

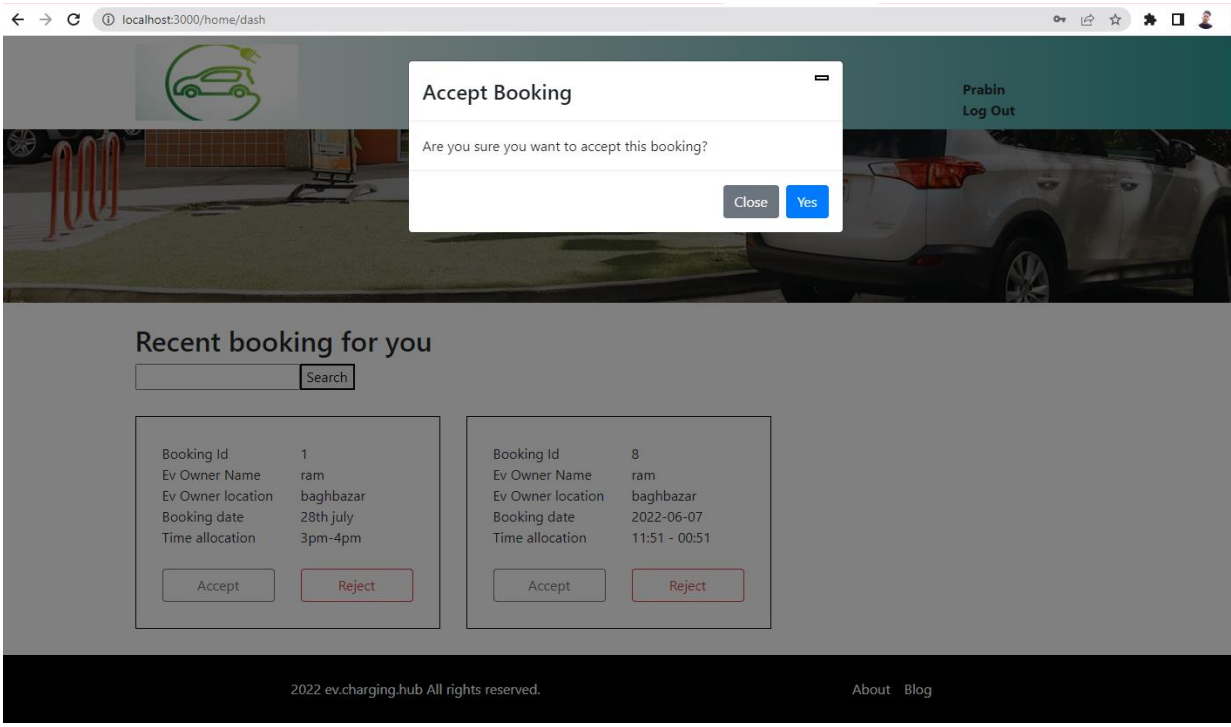



```
export default function EvDash() {
  let dispatch = useDispatch()
  let title = 'Get Your Charging station as per your Destination'
  let description =
    'Keep our planet clean. Dont be mean and go green. We help you to find the charging hub to your appropriate destination'
  const HomeOwnerList = useSelector((state) => state.homeOwner.HomeOwnerInfo)
  const [destinationList, setDestinationList] = useState([])
  const bookingList = useSelector((state) => state.booking.bookingList)
  const EvOwnerList = useSelector((state) => state.EvOwner)
  const [mybooking, setMyBooking] = useState([])
  const [bookingDetail, setBookingDetail] = useState([])

  useEffect(() => {
    let locationList = []
    HomeOwnerList.map((item) => {
      locationList.push(item.location)
    })
    setDestinationList(locationList)
    console.log('item', EvOwnerList)
    let yourbooking = bookingList.filter(
      (item) => item.ev_id === EvOwnerList.selectedEvOwner.ev_id,
    )
    setMyBooking(yourbooking)

    let bookingDetailList = []
    yourbooking.map((item) => {
      bookingDetailList.push({
```

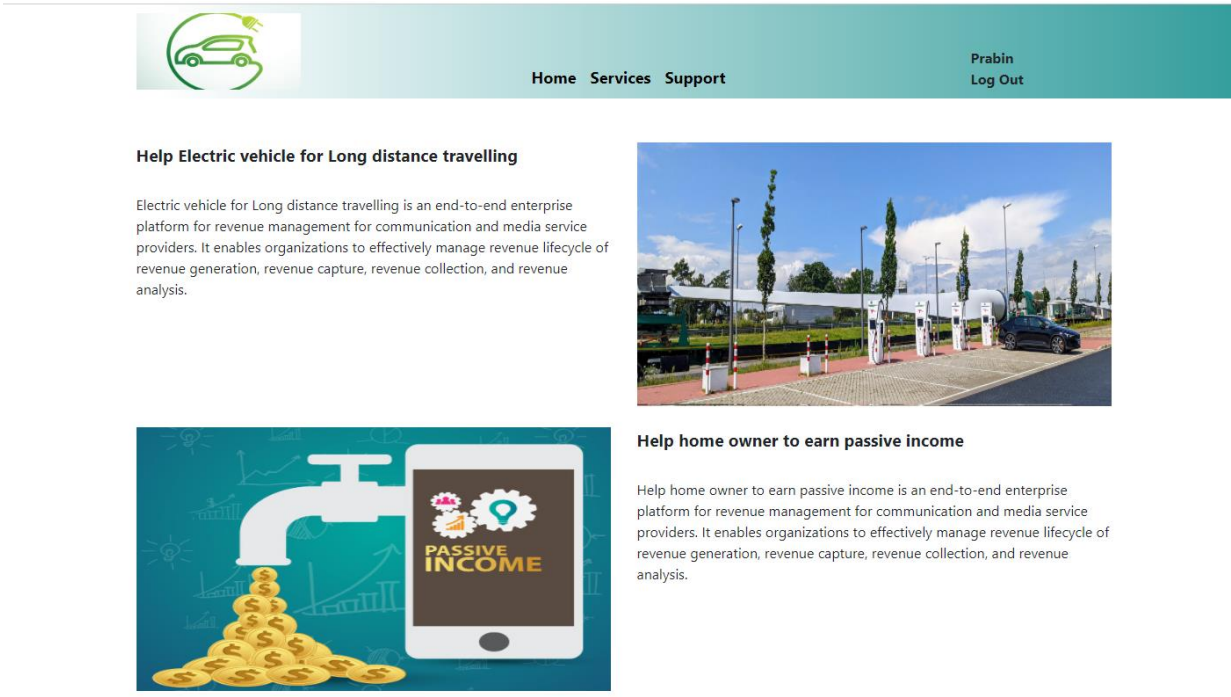
```
          id: item.b_id,
          h_name: HomeOwnerList.filter((h) => h.h_id ===
item.h_id)[0].name,
          h_location: HomeOwnerList.filter((h) => h.h_id ===
item.h_id)[0]
            .location,
          date: item.date,
          time_range: item.time,
          status: item.status,
        })
      })
      setBookingDetail(bookingDetailList)
      console.log('Your booking', bookingDetailList)
    }, [bookingList])

    const handleBooking = (e) => {
      e.preventDefault()
      console.log(document.getElementById('location').value)
      let bookingdata = {
        b_id: bookingList.length + 1,
        ev_id: EvOwnerList.selectedEvOwner.ev_id,
        h_id: HomeOwnerList.filter(
          (h) => h.location ===
document.getElementById('location').value,
        )[0].h_id,
        date: document.getElementById('date').value,
        time: `${document.getElementById('start-time').value} - ${
          document.getElementById('end-time').value
        }`,
        status: 'pending',
      }

      let bookingListCopy = [...bookingList]
      bookingListCopy.push(bookingdata)
      dispatch(updateBookingList(bookingListCopy))
    }

    return (
      <div>
        <Header />
        <Banner image={EvDashImage} title={title}
description={description} />
        <div className="container ">
          <div className="booking-container row">
            <div className="form-wrapper col">
              <h4 className="title">Book your charging station</h4>
              <Form onSubmit={handleBooking}>
                <Form.Group className="mb-3"
controlId="formBasicEmail">
                  <Form.Label>Location you want to Charge
in</Form.Label>
```

```
                  <Form.Select
                    aria-label="Default select example"
                    className="ml-3"
                    id="location"
                  >
                    <option>Select Location</option>
                    {destinationList.map((item, index) => {
                      return (
                        <option value={item} key={index}>
                          {item}
                        </option>
                      )
                    })}
                  </Form.Select>
                  <Form.Text className="text-muted">
                    Please mention you charging destination
properly.
                  </Form.Text>
                </Form.Group>

                <Form.Group className="mb-3"
controlId="formBasicPassword">
                  <Form.Label>Date</Form.Label>
                  <Form.Control type="date" placeholder="Date"
id={'date'} />
                </Form.Group>
                <Form.Group className="mb-3"
controlId="formBasicCheckbox">
                  <Form.Label>Time range</Form.Label>
                  <div className="row">
                    <div className="col">
                      <Form.Control
                        id="start-time"
                        type="time"
                        placeholder="Time"
                      />
                    </div>
                    <div className="col">
                      <Form.Control
                        id="end-time"
                        type="time"
                        placeholder="Time"
                      />
                    </div>
                  </div>
                </Form.Group>
                <Button variant="primary" type="submit">
                  Book
                </Button>
              </Form>
            </div>
```

```
            <div className="recent-booking col">
              <h4>Your recent booking status</h4>
              <div className="table-wrapper">
                <Table striped bordered hover>
                  <thead>
                    <tr>
                      <th>#</th>
                      <th>Home Owner name</th>
                      <th>Location</th>
                      <th>Date book</th>
                      <th>Time range</th>
                      <th>Status</th>
                    </tr>
                  </thead>
                  <tbody>
                    {bookingDetail.map((item, index) => {
                      return (
                        <tr>
                          <td>{index + 1}</td>
                          <td>{item.h_name}</td>
                          <td>{item.h_location}</td>
                          <td>{item.date}</td>
                          <td>{item.time_range}</td>
                          <td>{item.status}</td>
                        </tr>
                      )
                    })}
                  </tbody>
                </Table>
              </div>
            </div>
          </div>
        </div>
      </div>
    )
  }

```




```
export default function ConfirmationModal(props) {
  return (
    <Modal show={props.show} onHide={props.handleClose}>
      <Modal.Header closeButton>
        <Modal.Title>{props.modalDetail.title}</Modal.Title>
      </Modal.Header>
      <Modal.Body>{props.modalDetail.description}</Modal.Body>
      <Modal.Footer>
        <Button variant="secondary" onClick={props.handleClose}>
          Close
        </Button>
        <Button
          variant="primary"
          onClick={() => props.handleSubmit(props.modalDetail)}
        >
          Yes
        </Button>
      </Modal.Footer>
    </Modal>
  )
}
```




```
export default function Service() {
  return (
    <div className="service-wrapper">
      <div className="container">
        <div className="row">
          <div className="col-lg-6">
            <div className="title">
              Help Electric vehicle for Long distance travelling
            </div>
            <div className="description">
              Electric vehicle for Long distance travelling is an
end-to-end
              enterprise platform for revenue management for
communication and
              media service providers. It enables organizations to
effectively
              manage revenue lifecycle of revenue generation,
revenue capture,
              revenue collection, and revenue analysis.
            </div>
          </div>
          <div className="col-lg-6">
            <div className="img-wrapper">
              <img src={Img1} />
            </div>
          </div>
        </div>
        <div className="row mt-4 light-grey">
          <div className="col-lg-6 order-2">
            <div className="title">Help home owner to earn passive
income</div>
```

```
              <div className="description">
                Help home owner to earn passive income is an end-to-
end enterprise
                platform for revenue management for communication
and media
                service providers. It enables organizations to
effectively manage
                revenue lifecycle of revenue generation, revenue
capture, revenue
                collection, and revenue analysis.
              </div>
            </div>
            <div className="col-lg-6 order-1">
              <div className="img-wrapper">
                <img src={Img2} />
              </div>
            </div>
          </div>
        </div>
      </div>
    )
  }

```