



SAPIENZA
UNIVERSITÀ DI ROMA

Master of Science in
PRODUCT and SERVICE DESIGN
a.a. 2020-2022

Final Work

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Yonglin Zhou - Smart Mo: Smart Charging Services Systems For EV a.y. 2020-2022

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Smart Mo: Smart Charging Services

A platform-- Smart Charging Services to EV



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Acknowledgements

While preparing my master's thesis, I received valuable help from many people. Their comments and suggestions have contributed to the completion of the thesis.

First, I should express my deep gratitude to my supervisor--Prof.Ioannis Chatzigiannakis and Prof.Viktor Malakuczi. They gave me excellent guidance and encouragement throughout choosing a research topic, writing the thesis, improving the outline and argumentation, and correcting grammatical errors. They provided insightful comments on each draft and offered me many enlightening ideas that encouraged me to a great extent. With their patient guidance, the thesis was completed.

Secondly, I would like to express my sincere gratitude to all the professors who have helped and taught me in this course. I am especially grateful to Prof. Loredana Di Lucchio, Prof. Angela Giambattista, Prof. Lorenzo Imbesi, Prof. Andrea Vitaletti and Prof.Michele Russo. Their courses have broadened my horizons and stimulated my interest in product and service design.

I also thank all the cited authors whose books and articles have inspired me throughout the process of completing my thesis. As well as my interviewees and interviewed organizations, their patience in accepting my 30-minute interviews has given me significant data to support my design.

CONTENT

ABSTRACT

PART ONE

Desk Research

1 About	3
1.1 Problems	4
1.1.1 Long-distance range anxiety	5
1.1.2 Uneven distribution of compatible charging stations	5
2 Background	6
2.1 Rapid Development Of EV	6
2.2 Consumers' Concerns	7
2.3 Other Problems	7
3 Design Research	8
3.1 Research Field	8
3.2 Case study	9
3.3 Conceptual Map	23
3.4 Conclusion	25

PART TWO

User Research

4 Context	27
4.1 Interview Topic	27
4.2 Interview Type	28
4.3 To Bussiness Interview	23
4.3.1 Car Operators Or Charging Operators	28
4.3.2 Authorities	28
4.3.3 Result	29
4.3.4 City Research	31
4.4 To Customers Interview	33
4.4.1 Drivers Or Consumers	33
4.4.2 Collect And Analyze Interview Data	33
4.5 Persona	36
4.6 Empathy Map	39
4.7 Customer Journey Map	41
4.8 Storyboard Analysis	45
4.9 User Need Summary	47

PART THREE

Design Proposals

5 Ideation	48
5.1 Brainstorming	49
5.2 Design Preliminary Evaluation	50
6 1st Design Proposals	51
6.1 Features	52
6.2 Wireframe	53
6.3 Low-Fi Structure	54
6.4 User Test & Feedback	57
7 Final Design Proposals	59
7.1 Analysis Of Needs And Problems	59
7.2 Functionality	60
7.3 Usability	62
7.4 Morphology	64
7.5 Wireframe	66
8 Design Process	68
8.1 Visual System Design	68
8.2 B2C Design	70
8.2.1 Workflow	71
8.2.2 Design Description	72
8.3 B2B Design	74
8.3.1 Workflow	74
8.3.2 Design Description	75
9 Product Evaluation	76
9.1 Storyboard After	77
9.2 Service Blueprint	79
9.3 Stakeholder Map	81
9.4 Bussiness Model Canvas	83
9.5 Summary	84
Reference	85

ABSTRACT

Governments and car operators have invested heavily in building charging stations. However, electric vehicle owners still suffer from range anxiety and fear of not being able to find a charging station and subsequently running out of power. Range anxiety is the biggest problem in the electric vehicle market because it affects existing electric vehicle drivers and turns away many potential drivers, with more diesel and gasoline vehicles every day.

The Decentralized Charging Solution

Intelligent Routing

Real-time feedback

Smart Mo system provides a solution for all EVs and stakeholders in the EV charging ecosystem, bringing together all types of charging station operators and private charging posts to add their stations to the public charging network. Use more charging stations, provide route planning and feedback to improve the user experience for existing and future EV users, manage to charge stations, and reduce driving range anxiety.

PART ONE

Desk Research

1 About

Inconvenient Charging and long-distance range anxiety, these two points are still the biggest concerns of users of new energy vehicles. Behind the range of anxiety are technical reasons such as battery life, low-temperature performance, charging speed, and non-technical reasons for charging convenience.

Regarding non-technical reasons, one is the messy and inefficient charging process and the scattered charging environment, and the other is the user's psychology and bad charging experience in long-distance driving.^[1]

1.1 Problems

1.1.1 Long-distance range anxiety

Based on the results of an SP survey on the intention to use pure electric vehicles in a large city in China, the current level of technological development and popularity shows that if there is no opportunity to recharge during a work trip. Mileage anxiety causes electric vehicles to be attractive for travel only within 32.7% of the theoretical maximum travel distance with remaining power. The range increases to 83.3% if there is an opportunity to recharge. However, the probability of choosing a purely electric vehicle is inelastic for both indicators of the degree of range anxiety.^[2]



1.1.2 Uneven distribution of compatible charging stations

There are a lot charging stations - there aren't enough compatible charging stations. This is one of the reasons why long-distance anxiety develops.

A fragmented and unplanned charging environment is also causing potential EV drivers to abandon the use of EVs due to the confusing and inefficient charging process.



Anyone who wants to charge their car in Europe must use many different charging point providers, all of which have their customer databases and different payment methods^[3]. It means that car owners must go through the same tedious registration process repeatedly when changing providers. This leads to a situation where users must have multiple data-rich accounts, applications and charge cards, which takes a lot of time and patience

[1] (n.d.). The "charging anxiety" of new energy vehicles, need to be considered from the top design. fortunechina. https://www.fortunechina.com/zhuolan/c/2021-11/26/content_401490.htm

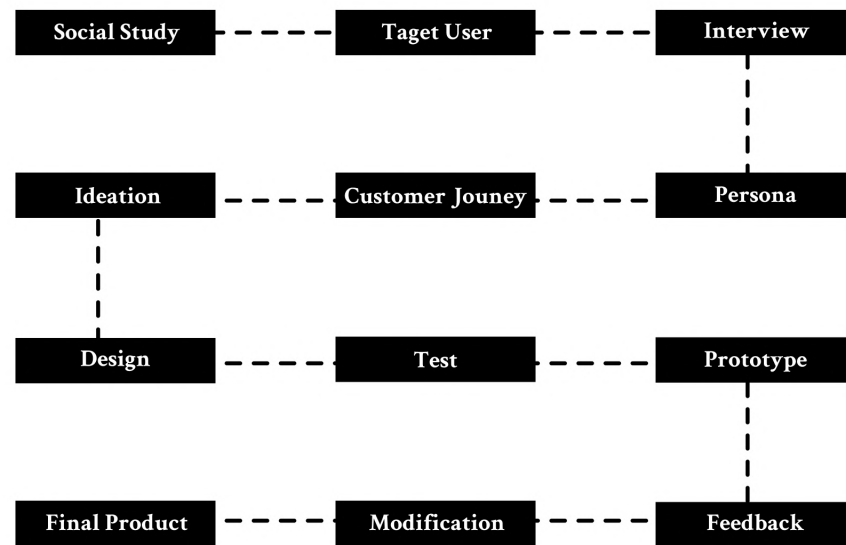
[2] YE, S., & LIU, K. (2017). The effect of mileage anxiety on the willingness to use pure electric vehicles. Journal of Wuhan University of Technology. <https://doi.org/10.3963/j.issn.2095-3844.2017.01.017>.

[3] (n.d.). Myth buster: Electric vehicle range anxiety is real. virta. <https://www.virta.global/blog/myth-buster-electric-vehicles-range-real>

1.2 Design Objectives

The goal of the design of this project is to develop front-end and back-end strategies that would meet the targeted needs most appropriately while maintaining the sustainability and growth of the charging station service. It is to be friendly to the target users and competitive within the peer market, ensuring that the needs of society.

1.3 Design Process



2 Background

2.1 Rapid Development Of EV

By 2030, the EU wants to have 30 million electric vehicles on European roads. In the next 20 years, electric car sales will rise sharply. The EU government is "unprecedented" for a new product that is growing at such a high rate.^[1]

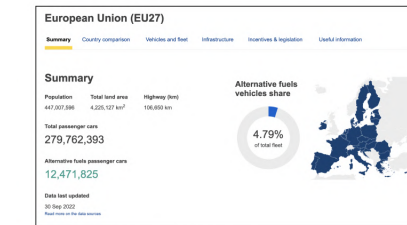
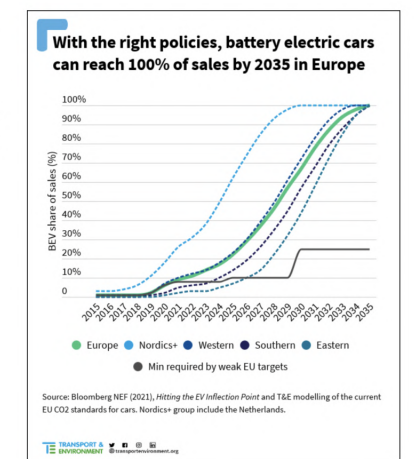
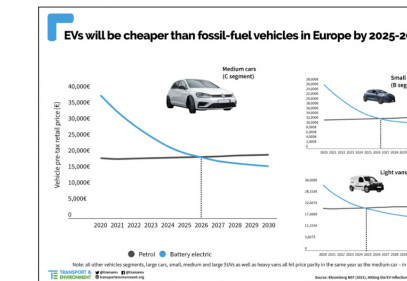


Figure1: European Alternative Fuels Observatory

Parliament adopted the EU Climate Law on 24 June 2021, which makes legally binding a target of reducing emissions by 55% by 2030 and climate neutrality by 2050. It moves the EU closer to its post-2050 objective of harmful emissions and confirms its leadership in the global fight against climate change.^[2]

It should allow the targets to be more easily applied to legislation and should create benefits such as cleaner air, water and soil; reduced energy bill; renovated homes; better public transport and more charging stations for e-cars; less waste; healthier food and better health for current and future generations.



[1](2022). New EU rules for more sustainable and ethical batteries. europarl.europa. <https://www.europarl.europa.eu/news/en/headlines/economy/20220228STO24218/new-eu-rules-for-more-sustainable-and-ethical-batteries>

[2](2022). Green Deal: key to a climate-neutral and sustainable EU. europarl.europa. <https://www.europarl.europa.eu/news/en/headlines/economy/20220228STO24218/new-eu-rules-for-more-sustainable-and-ethical-batteries>

Figure1: European Alternative Fuels Observatory

[3](2022). Here's how EU legislation accelerates the EV revolution. virta. <https://www.virta.global/blog/this-is-how-eu-regulation-accelerates-the-electric-vehicle-revolution>

[4] (n.d.). Infrastructure for charging electric vehicles: more charging stations but uneven deployment makes travel across the EU complicated. European Court of Auditors. <https://op.europa.eu/webpub/eca/special-reports/electrical-recharging-5-2021/en/>

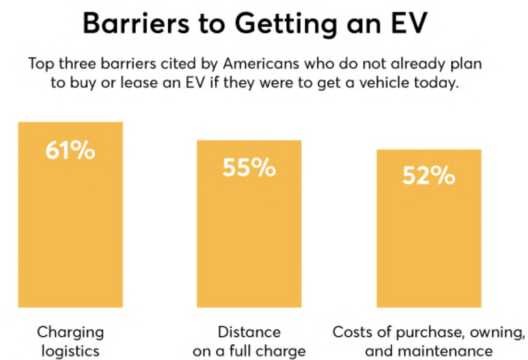
The EU's unique 750 billion euro stimulus package includes 20 billion euros to boost the sales of clean vehicles, and 1 million electric and hydrogen vehicle charging stations will be installed by 2025. In addition, many countries are directing their own national economic recovery investments to the infrastructure of the future: electric vehicle charging.^[3]

The European Commission wants to install 1 million points across the bloc by 2025, a fivefold increase. It is pushing countries to allocate their pandemic recovery funds to such programs. As the European Court of Auditors noted last year, it will take work. "Barriers to electric vehicles crossing the EU remain," the EU regulator said. It is not just that there are too few chargers but that they are clustered in the more prosperous half of the continent. For example, the Netherlands has 47.5 charging stations for every 100 kilometres of a freeway. However, in Poland, a country almost eight times the size, there is only one for every 250 kilometres, according to ACEA. This reflects a sharp divergence in sales. The Netherlands has 275,000 electric and plug-in hybrid vehicles on the road, accounting for more than 3% of the fleet. Meanwhile, Poland has only 28,000 clean cars in a more than 24 million fleet - about 0.1 per cent^[4]

2.2 Consumers' Concerns

A new national survey by U.S. research firm Consumer Reports found: About 6 in 10 Americans who were not already committed to purchasing an EV say concerned about where and when they would be able to charge it (61 per cent). In particular, concerns for charging logistics are most significant among white and English-speaking Asian Americans, at 67 per cent for each group.

Erasing barriers: Charging logistics (61 per cent) is the top barrier to getting an EV, followed by the number of miles the vehicle can go before needing a charge (55 per cent) and the costs involved with buying and maintaining an EV (52 per cent).^[1]



Source: CR nationally representative survey of 8,027 U.S. adults conducted Jan. 27 to Feb. 18, 2022.

2.3 Other Problems

In the rapid development of the new energy vehicle market, the construction of charging piles is also in full swing. On the one hand, electric car sales are growing, and the current public charging piles will only be able to meet the needs of a few users in the future. On the other hand, consumers' "mileage anxiety" about electric cars is also one of the main factors affecting car purchases. Therefore, it is imperative to speed up the construction of charging piles.^[2]

The European Union and many European countries have also made accelerating the construction of public charging piles one of the priorities of this round of vehicle market stimulation policies. Nevertheless, the charging infrastructure in most European countries is still very backward and unevenly distributed: about 70% of public charging posts in the EU are concentrated in the three central member states - Germany, France and the Netherlands, while some other EU member states do not even have one public charging post per 100 kilometres.

In China, there are also such problems. Each charging facility operator has launched and continuously improved charging apps to provide navigation services for electric vehicle users. It made efforts to develop in the direction of interconnection and interoperability, so the difficulty of finding piles has been gradually solved. In some areas, charging piles are idle for a long time, and in others, there are no piles for charging.^[3]



[1](2022). More Americans Would Buy an Electric Vehicle, and Some Consumers Would Use Low-Carbon Fuels, Survey Shows. consumerreports. <https://www.consumerreports.org/hybrids-evs/interest-in-electric-vehicles-and-low-carbon-fuels-survey-a8457332578/>

[2] (n.d.). European Charging Station Construction. sohu. https://www.sohu.com/a/496457341_121119176

[3](n.d.). Sorting out 9 major problems in China's charging and switching infrastructure industry. ofweek. https://libattery.ofweek.com/2022-03/ART-36016-8420-30552408_2.html

3 Design Research

The current market product research is a combination of social research reports and literature on charging stations, consumer research reports and issues reflected by the current state of society.

The product research type is from two perspectives: the product of the actual user scenario and the virtual product for product and market research. The purpose is to explore the basic situation of the current market products and the service logic, target users, and market situation. Meanwhile, define criteria to help analyze the positioning of products in the market and the development of each product to lay the foundation for future design.

3.1 Research Field

Three stakeholders are involved in this issue, the government or the planning department, the charging station operators and the drivers.

Product design and product market research will be conducted to analyze the design of products related to these three stakeholders. The purpose of the analysis: is to explore the relationship between current products and social issues, the relationship between users, and the current problems of charging stations.



Government



Drivers



Operators

The definition of acceptance criteria focuses on deeply understanding the users, what they need, what they value, their capabilities, and their limitations. It also considers the business goals and objectives of the group managing the project.

General Criteria

- **Usable:** Site must be easy to use
- **Desirable:** Image, identity, brand, and other design elements are used to evoke emotion and appreciation
- **User involvement:** User involvement is denned as a subjective psychological state reflecting the importance and personal relevance of a system to the user.

Focus Criteria

- **Useful:** Content should be original and fulfill a need
- **Inclusive design:** Inclusive design provides multiple design points for people with different preferences, acceptance styles and ability levels^[1]
- **Process Simplification:** The complete process for users to achieve a certain goal in different scenarios, find the node that can determine the user's intention in each node of the process, skip unnecessary processes, or merge the necessary processes^[2]

[1]Garrett, J. J. (Director). (2000). The Elements of User Experience [Film].

[2] (n.d.). Usability 101: Introduction to Usability. nngroup. <https://www.nngroup.com/articles/usability-101-introduction-to-usability/>

[3](n.d.). Difficult to find piles? ofweek. https://libattery.ofweek.com/2022-03/ART-36016-8420-30552408_2.html

3.2 Case study

Designs related to the construction of urban charging stations

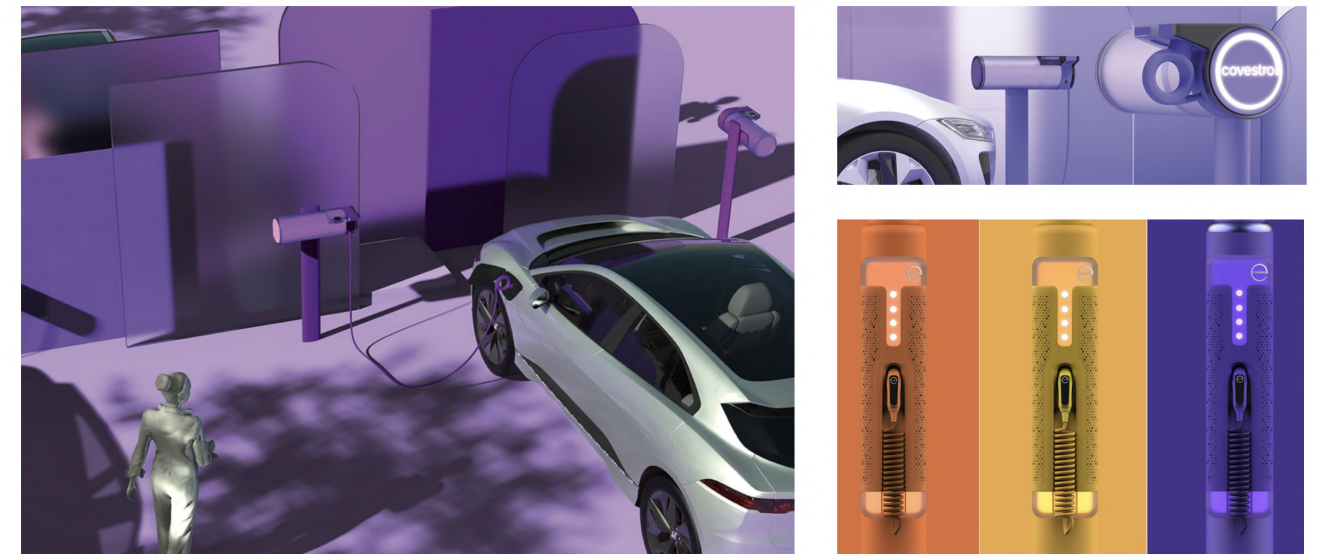
Design to increase user experience

Design related to innovation and operation of charging station construction

Criteria for selecting case studies

1. Innovative entrepreneurial projects or new projects
2. Accessible to users, each cell phone or products that they may come into contact with in their daily life
3. occupy a large share of the market
4. Have a significant impact on society
5. Project must already exist in the market or a project that has practiced in the market

01 Collaboration sparks innovation in future EV charging stations



Location :

Umea, Sweden

Year :

2020

Producer :

Umea Institute of Design

Keywords :

Protection and weather resistance
Integrated functions
Global knowledge

Target :

Public use, supermarkets and stores

General Criteria

Usable



Desirable



User involvement



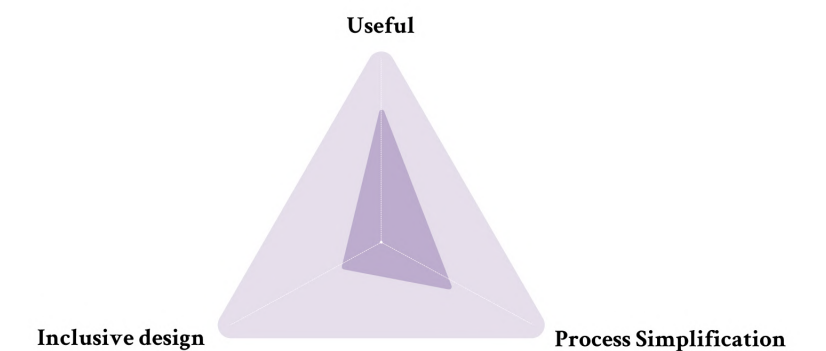
Introduce :

The e-mobility surge calls for sustainable and affordable solutions. It's driving innovation in electric vehicle (EV) applications by working alongside established designers and partnering with next-generation talent to imagine EV charging stations of the future.

A selection of potential electric vehicle charging station designs, created by students from the Umeå Institute of Design.

- Stylish aesthetics and design freedom Allows designers to create different shapes, colors and surfaces while incorporating light integration
- Protection and weather resistance Offers flame retardance and resistance to impacts, UV rays and chemicals
- Integrated functions Enables connectivity, smart control via mobile phone, smart energy management and more
- Global knowledge Covestro possesses know-how of country-specific regulations and offers value-added technical services

Focus Criteria



02 Eco-Bonus program



Location :

Italy

Year :

2019

Producer :

Italy government

Keywords :

Government Subsidies
EV charging point installation

Target :

Those who are willing to buy electric cars;
People who own an electric car

General Criteria

Usable



Desirable



User involvement



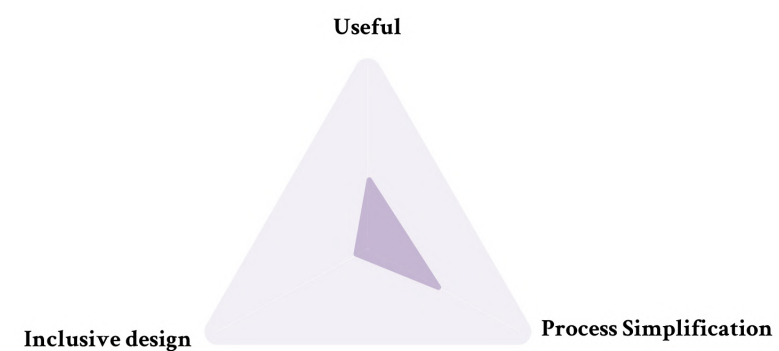
Introduce :

In 2019, Italy launched the [Eco-Bonus program](#) to provide subsidies for electric and hybrid vehicles, as well as electric vehicle charging infrastructure. In 2021, The automotive fund for the purchase of low-emission vehicles was refinanced with [€350 million](#).

The Eco-Bonus program aims to cut net emissions to zero by 2050 and mandates that electric vehicles should replace ICE vehicles by 2035 at the latest.

- A [refund](#) of 110 percent (up to €2,000) of the total costs of purchasing and installing electric vehicle charging stations (up to 220 kW) in privately used parking spaces (individual or shared)
 - The EV charging point installation must be part of wider energy efficiency renovations which will increase the energy efficiency of the building by at least 2 classes
- A [refund](#) of up to 50 percent (up to €2000) of the total costs of purchasing and installing electric vehicle charging stations up to 220 kW in privately used parking spaces (individual or shared).

Focus Criteria



03 Collaboration sparks innovation in future EV charging stations



Location :

Xi'an China

Year :

2020

Producer :

Bsdon

Keywords :

Photovoltaic energy
Storage integration
Energy Storage System

Target :

Areas of energy instability

General Criteria

Usable



Desirable



User involvement

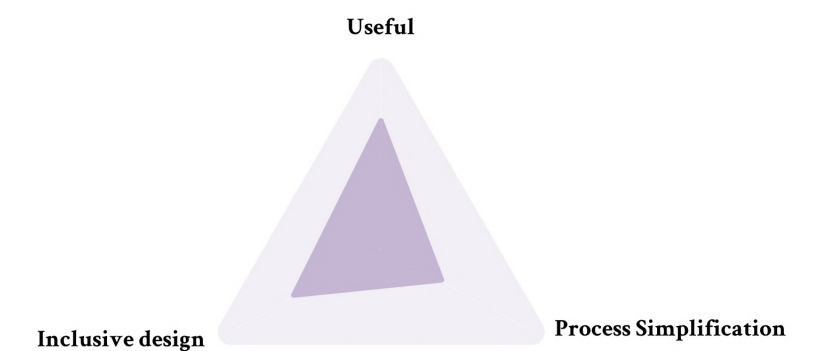


Introduce :

The late planning of the charging station can consider using a PV storage integrated charging station; the current national attitude is very supportive of new energy power generation, and there is no problem with grid access, so adding a PV power generation system with an energy storage system and charging system, forming the micro-grid system of charging station, on the one hand, can balance the new electricity load of charging station, thus not constituting new demand for grid power supply capacity, and less investment required for grid capacity increase. On the other hand, it can also reduce the operating cost of charging stations. If enough PV power is generated, it can also supply power to the grid and increase revenue.

Rooftop photovoltaic can be used to generate electricity, and the electricity will be used to supply electric vehicle charging equipment, self-generated, and the surplus power will be put online; considering the instability of the photovoltaic system and the irregularity of the charging equipment, a particular energy storage system will be configured for the temporary storage of electricity.

Focus Criteria



04 EN+ Logistics vehicle charging station charging solution



Location :

Guangzhou China

Year :

2018

Producer :

Guangzhou government

Keywords :

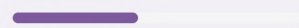
4G
Logistics vehicles

Target :

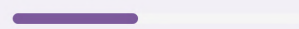
Logistics vehicles

General Criteria

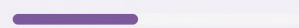
Usable



Desirable



User involvement



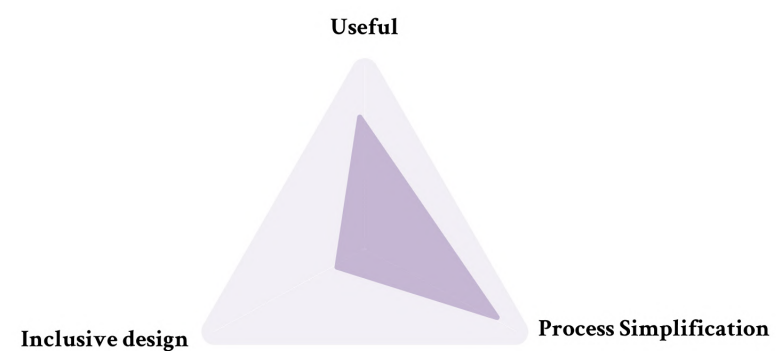
Introduce :

EN+ is suitable for dedicated centralized small charging stations

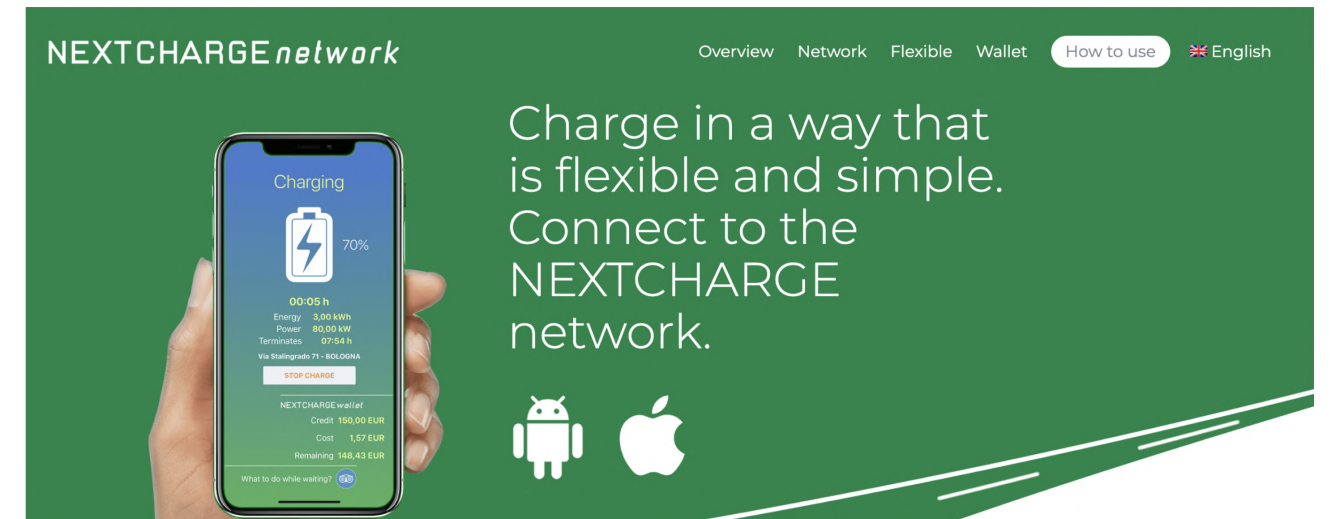
Solve the charging problems of cabs, logistics vehicles and commuter vehicles

The solution can be equipped with EN+-body DC charging piles, three-phase AC piles, single-phase AC piles and other charging products; among them, DC piles are used for fast replenishment during the day and AC slow charging is used for charging in the evening. Combined with the charging operation and management platform, it supports Ethernet, 4G, CAN and other communication methods, facilitating centralized control of the charging pile operation and management platform, meeting the needs of charging station operation and management, and facilitating end-users to grasp charging information in time.

Focus Criteria



05 NEXTCHARGE



Location :

Italy

Year :

2019

Producer :

Go Electric Stations S.r.l.

Keywords :

Information gateway
Management

Target :

Public use, supermarkets and stores

General Criteria

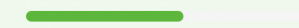
Usable



Desirable



User involvement



Introduce :

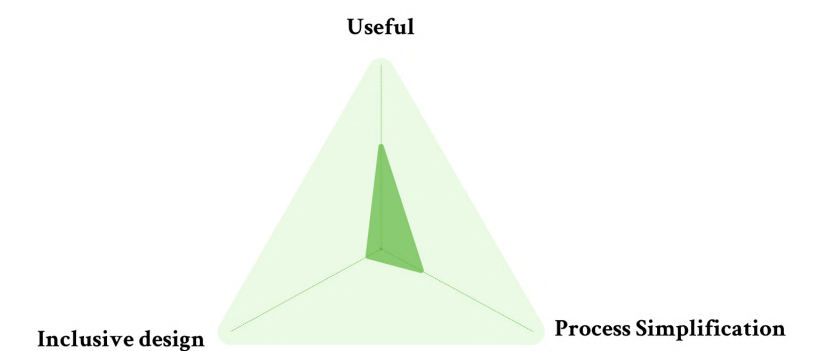
Technological development in recent years, especially within the power cell research, has made the deployment of electric cars with performance and autonomy possible and comparable to that of internal combustion cars.

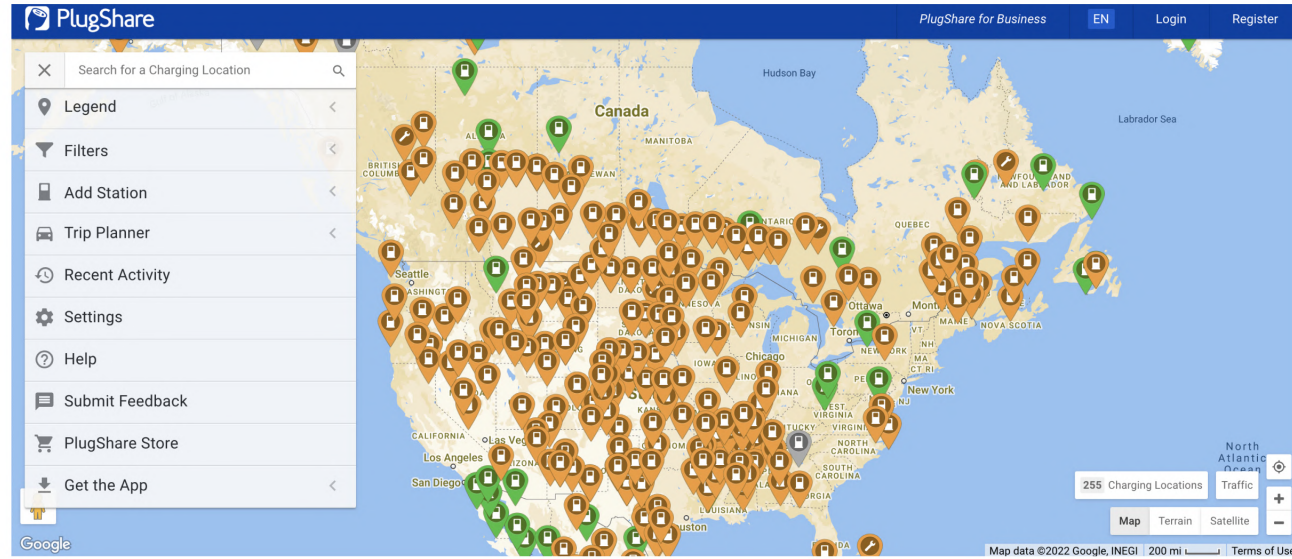
Nextcharge confident that this technology will be the inevitable future of the automotive market. The resistance from users who fear the inconvenience and lack of a capillary distribution of charging stations will fall and that the incentives for purchases will become increasingly available by the state administrations.

- an information gateway, designed to define the mapping of all the electric charging stations;
- a mobile application where users can add new stations, photos and comments;
- a management system that allows station owners to comfortably control their installations, no matter where they may stay.

Knowing the location of a charging station, whether it is available at any given time, easily booking a charge, or organizing a long distance journey with stops and providing appropriate autonomy to charging needs are the services that our site will provide to You.

Focus Criteria





Location :

Greater Los Angeles Area, West Coast, Western US

Year :

2010

Producer :

Recargo, Inc

Keywords :

Sharing tips
Comments

Target :

1. People living in North America, Europe
2. People who need to drive to travel
3. Users who need to view comments

General Criteria

Usable



Desirable



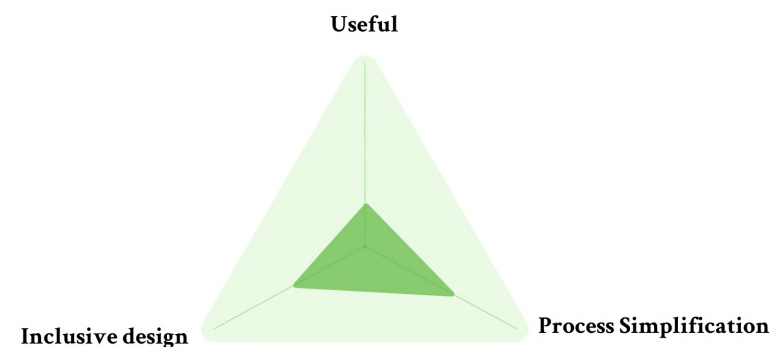
User involvement



Introduce :

PlugShare is a free EV driver's app for [iOS](#), [Android](#), and [web](#), allowing users to find charging stations, leave reviews, and connect with other plug-in vehicle owners. It has the most accurate and complete public charging map worldwide, with stations from every major network in North America, Europe, and throughout much of the globe. PlugShare is also home to the largest community of EV drivers in the world. Every day, drivers add more station locations, constantly making the app more comprehensive, powerful and accurate. From within the app, users check-in when they charge, sharing tips, comments, and photos of their charging experiences. Thousands of drivers also list their personal home charging stations for public use on PlugShare, helping to fill the gaps in the charging infrastructure. These drivers have complete control over the times and terms of their station's availability, how other members can contact them, and what personal information is displayed.

Focus Criteria



Location :

Austin, Texas, U.S.

Year :

2014

Producer :

Tesla, Inc.

Keywords :

Tesla,
Fast,
Short time

Target :

1. Tesla car owners
2. Other car owners with Tesla charging devices
3. People who care more about service
4. People who need to save time

General Criteria

Usable



Desirable



User involvement



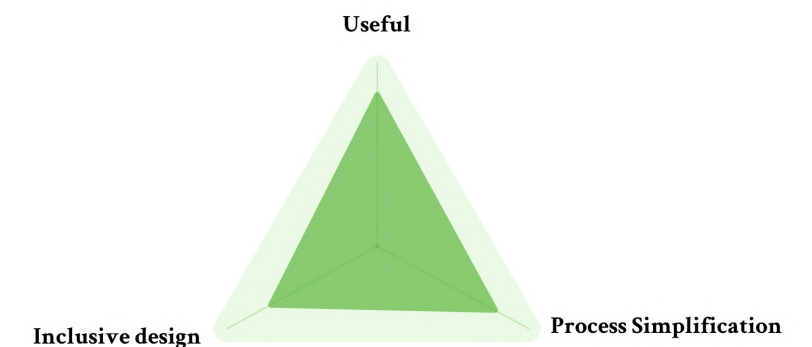
Introduce :

The Supercharger network allows you to stay charged on the go. Plug in at a convenient location, grab a cup of coffee or a quick bite to eat, and get back on the road. With 35,000+ global Superchargers, the network gives you the freedom to travel.

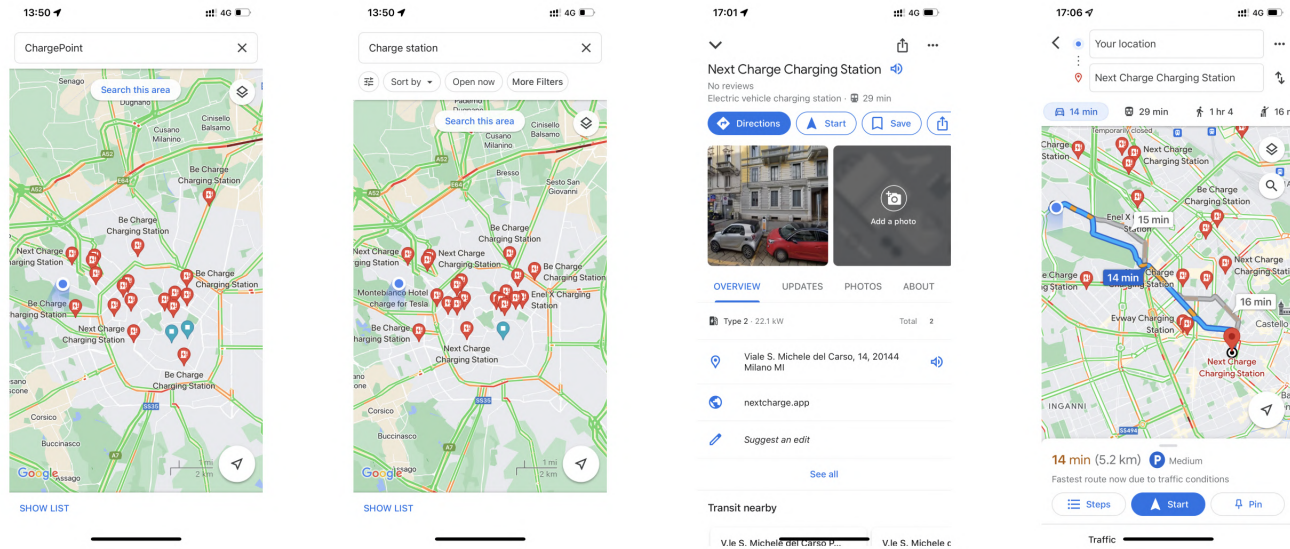
With 35,000+ Superchargers, Tesla owns and operates the largest global, fast charging network in the world. Located on major routes near convenient amenities, Superchargers keep you charged when you're away from home. Simply plug in, charge and go.

Superchargers can add up to 200 miles of range in just 15 minutes. Since charging above 80 percent is rarely necessary, stops are typically short and convenient. With a broad network of fast charging, automatic battery preconditioning and the exceptional range of every Tesla car, you'll spend even more time on the road.

Focus Criteria



08 Google map



Location :

US

Year :

February 8, 2005

Producer :

Google

Keywords :

Collaboratively expand
Update the service'

Target :

1. Users who are on the road and cannot switch APPs
2. Users who are planning a quick route
3. Users who need to charge urgently

General Criteria

Usable



Desirable



User involvement

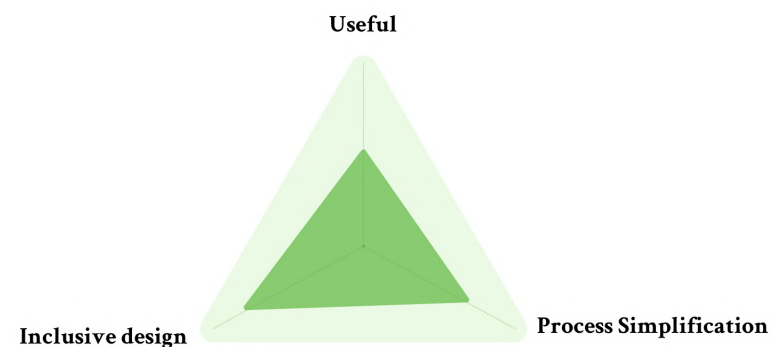


Introduce :

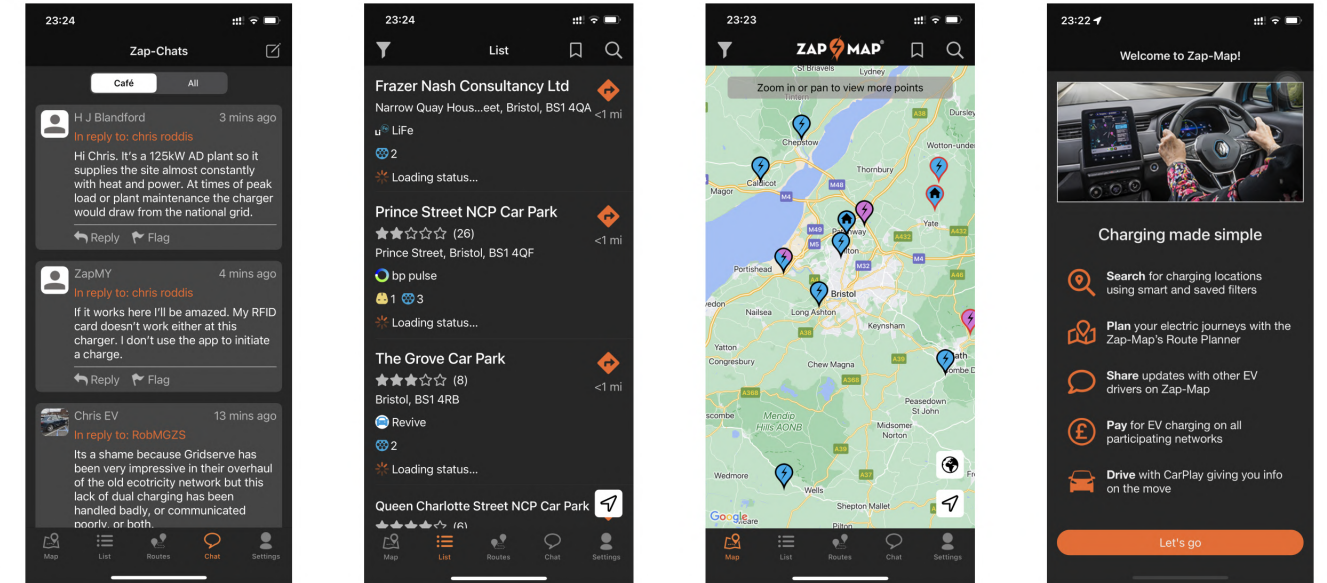
Google Maps is a Web-based service that provides detailed information about geographical regions and sites around the world. In addition to conventional road maps, Google Maps offers aerial and satellite views of many places. In some cities, Google Maps offers EV charging point location.

Google Maps' satellite view is a "top-down" or bird's-eye view; most of the high-resolution imagery of cities is aerial photography taken from aircraft flying at 800 to 1,500 feet (240 to 460 m), while most other imagery is from satellites. Much of the available satellite imagery is no more than three years old and is updated on a regular basis, according to a 2011 report. Google Maps previously used a variant of the Mercator projection, and therefore could not accurately show areas around the poles. In August 2018, the desktop version of Google Maps was updated to show a 3D globe. It is still possible to switch back to the 2D map in the settings.

Focus Criteria



09 ZAP-MAP



Location :

UK

Year :

2014

Producer :

NEXT GREEN CAR LTD

Keywords :

Community
Zero carbon mobility

Target :

1. People living in the UK
2. EV drivers need the latest statistics, as well as news, info and tools
3. Users who need to plan longer journeys

General Criteria

Usable



Desirable



User involvement



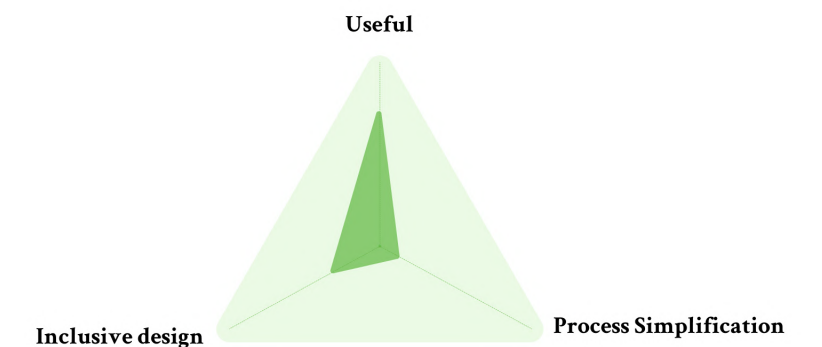
Introduce :

UK's leading app and digital platform for EV drivers to search for charge points, plan longer journeys, pay on participating networks and share updates with other EV drivers. The engaged Zap-Map community add daily status and info updates to charging points, and can make their home and work charge point available to other EV drivers as part of the peer-to-peer Zap-Home and Zap-Work network.

With 95%+ of public charge points mapped and around 70% of charge points showing live availability status, Zap-Map provides EV drivers with peace of mind and the confidence to drive any length of journey in their EV. A purpose-led company, Zap-Map's mission is to accelerate the shift to electric vehicles and help the drive towards zero carbon mobility.

Zap-Map attracts more than 250,000 UK users per month from a rapidly growing fleet of over 590,000 battery-electric EVs (SMMT: October 2022). As the go-to data source for the industry, check Zap-Map for the latest [statistics](#), as well as [news](#), [info](#) and [tools](#) for current and prospective EV drivers.

Focus Criteria



10 Audi charging hub



Location :

US

Year :

2018

Producer :

AUDI AG.

Keywords :

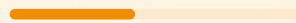
First-Class Waiting
Highway Service

Target :

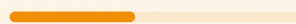
Touch, structure, architecture,
heritage

General Criteria

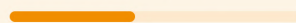
Usable



Desirable



User involvement

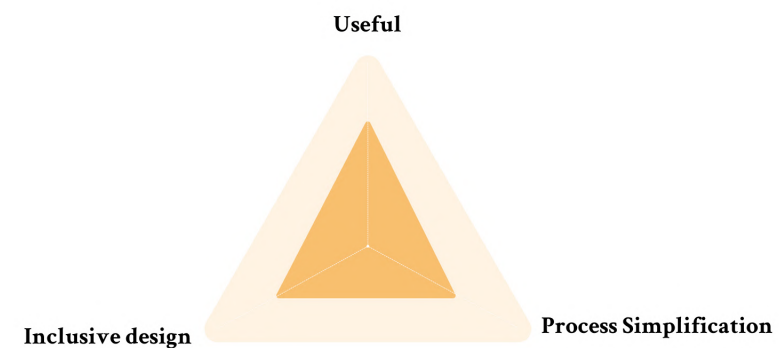


Introduce :

The inability of the expansion of charging base stations to keep pace with the growth of electric vehicles has become a new daily dilemma for urbanites. Finding an empty charging point in the city has become a daily challenge. And the high-powered fast-charging facilities often found in highway service areas are almost nowhere to be found in cities.

It is for this reason that Audi wants to inject some fresh blood into the urban electric vehicle charging solution by establishing the Audi Charging Center. Ralph Hollmig, project leader for the Audi Charging Center, said, "The aim of the Audi Charging Center is to provide a viable solution to the problem of urban charging by enabling Audi customers to reserve charging posts in advance to meet peak charging demands through a reservation function." After all, in today's cities, the likelihood of finding just the right vacant charging post is pathetically low. In the future, Audi customers will be able to book charging in advance, according to their own schedules, without having to wait for a charging post that is only occasionally available. Of course, this is only one aspect of our new concept. The other aspect is: "We want to offer our customers a first-class waiting experience during the charging of their vehicles. With us, customers can spend their waiting time for charging in a much higher quality." Hollmig had this to say

Focus Criteria



11 CATL-Passenger Vehicles Solutions

Ultra-long Driving Range

Continuous innovation in the energy density of single cells, battery pack design and energy system storage efficiency ensure ultra-long mileage.



Location :

China

Year :

2011

Producer :

Contemporary Amperex Technology Co.

Keywords :

Generation +
EV batteries
Electrification +

Target :

Tesla, Nio etc.
EV companies

General Criteria

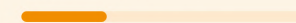
Usable



Desirable



User involvement



Introduce :

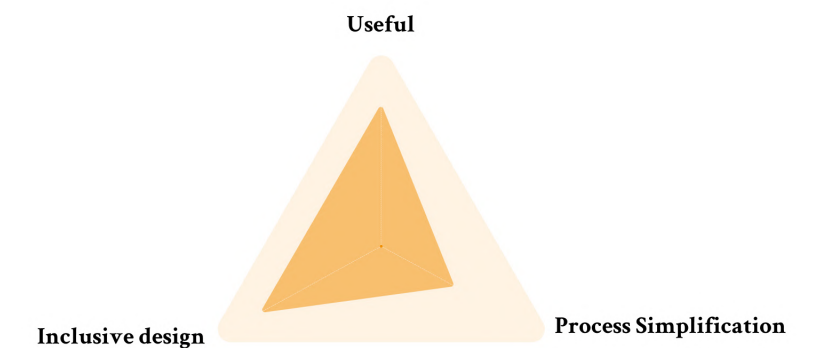
With rapid iterative material innovation, simplified product design and a constantly improved manufacturing process, CATL has made significant breakthroughs in system energy density and ultra-long range to facilitate driving experience.

Continuous innovation in the energy density of single cells, battery pack design and energy system storage efficiency ensure ultra-long mileage.

From the fast and furious feeling of maximum acceleration to beating the extreme weather challenges of cold or heat, CATL makes you enjoy the pleasure of driving by supporting strong power.

Through a futuristic tech combination in software and hardware, and the material mechanism of self and external maintenance, CATL batteries achieve more cycles, longer life and better long-term performance.

Focus Criteria



12 NIO Power



Location :

China

Year :

2018

Producer :

Nio power

Keywords :

Touch, structure, architecture, heritage

Target :

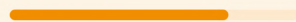
1. Nio car owners
2. Other car owners with Nio charging devices
3. People who care more about service
4. People who need to save time

General Criteria

Usable



Desirable



User involvement



Introduce :

NIO Power is a mobile internet-based charging solution with an extensive network of charging facilities and a "rechargeable, exchangeable and upgradeable" energy service system based on Azure Cloud technology, providing vehicle owners with a full range of charging services.

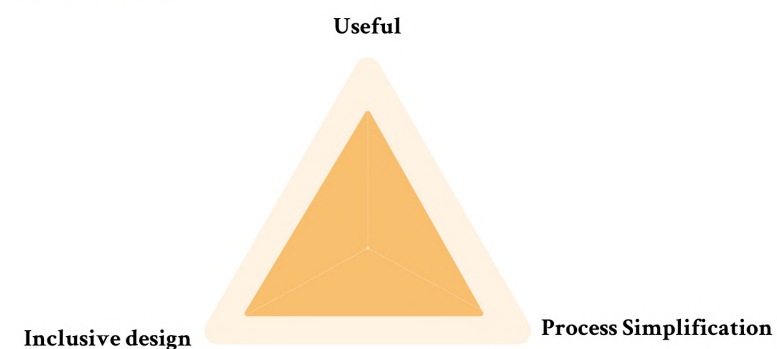
The combination of switching stations, charging piles and charging vehicles becomes a tight charging system.

Switching Station: With more than 1400 patents, it is a special charging experience for Azera customers, and it takes only one song to set off with a full charge. Each power change performs a three-electricity self-test to ensure the entire vehicle and battery are always in optimal condition.

Charging Pile: With a powerful performance of up to 180kW and 250A, it can provide fast, intelligent and reliable charging service for all new energy vehicles in public scenarios. It supports plug-and-charge and code charging, and the operation and payment process is faster.

Charging Car: A new flexible charging method developed by Azure, like a super charger that can rush to the user to provide charging service. one click on the app to place an order, the charging car comes to you, completely say goodbye to charging waiting and free up your time!

Focus Criteria



13 ZipCharge



Location :

UK

Year :

2021

Producer :

ZipCharge

Keywords :

Mobile Charging Portable

Target :

1. People who need to save time

General Criteria

Usable



Desirable



User involvement



Introduce :

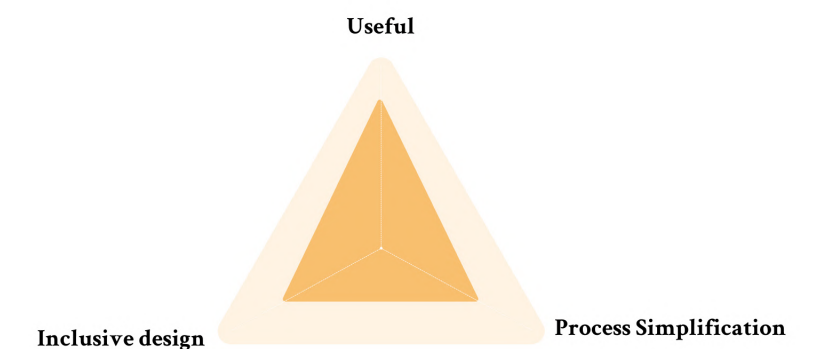
A pioneer in portable energy and electric vehicle (EV) charging, ZipCharge, has announced that more than 10,000 people have registered to pre-order a Go portable EV power bank, when they go on sale in 2023.

Launched at COP26 in November 2021, ZipCharge has developed Go from a concept to B Sample prototype, ready for real-world trials and is on track to enter production and deliver the first units to customers in quarter two of 2023. Since launching, pre-order registrations have come in from 88 countries and every continent across the globe.

Indeed, pre-order registrations have come in from every major market for electric vehicles around the world including the US, UK, Canada, Germany, France, The Netherlands, Italy and Sweden. Orders have been received from every country of the EU, as well as from established Asian markets including China, Singapore, Hong Kong, Japan, India, Taiwan, Korea, Thailand, along with the Middle East and African nations including South Africa, Kenya, Guinea and Nigeria.

ZipCharge is developing the Go based upon the same rigorous engineering approach as major car manufacturers. It is building several iterations of prototypes from validation through to pre-production, all of which will undergo an extensive testing regime.

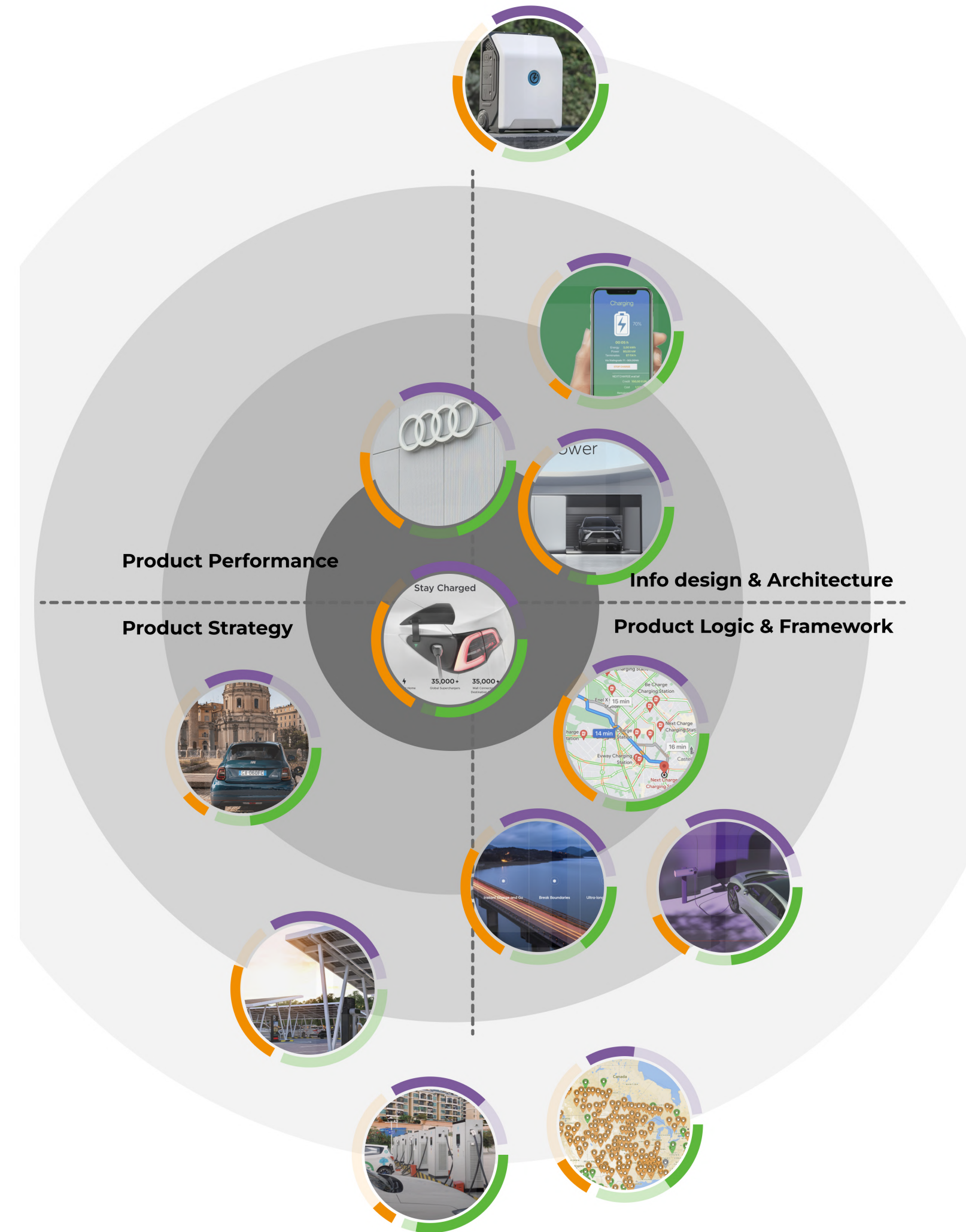
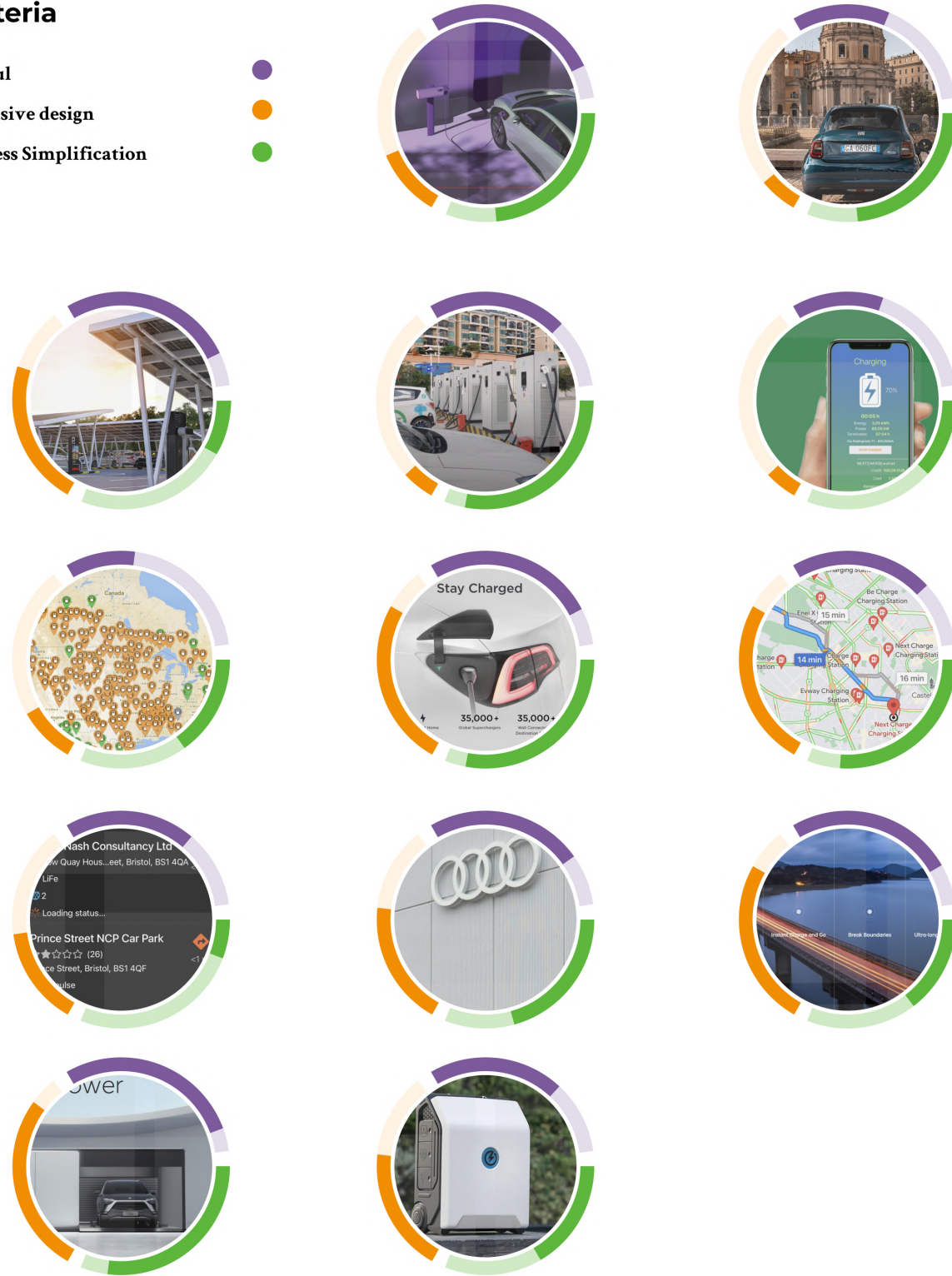
Focus Criteria



3.3 Conceptual Map

Criteria

- Useful ●
- Inclusive design ●
- Process Simplification ●



3.4 Conclusion

From the analysis of the product market, whether from the perspective of the government or the operator, there are many products for charging station planning and user scenarios, and there are various products for different scenarios. However, users still have many concerns about electric vehicles.

Visual design

The visual design of some large operators and the definitive treatment of interface elements are very well. In contrast, the visual design of some small and medium-sized enterprises could be more transparent and more beautiful. Most of the products are more focused on functionality.

Info design

Design the presentation of information to facilitate understanding. Most products have design information misunderstood by consumers, which increases the cost of comprehension for users. In addition, the presentation is minimal and inflexible.

Interaction design Info Architecture

The structure of the information of most products is very clear. The presentation and logic of the functions are obvious

Functional Specifications

Detailed descriptions of functionality the site must include in order to meet user needs. Most of the product's features are intended to reduce user range anxiety by addressing issues that arise in social research. For the widespread uneven construction of charging stations in cities, the products on the market do not address this issue well

Strategy

Most projects are very clear about product definition and strategy. This is the foundation of the product user experience.^[1]

PART TWO

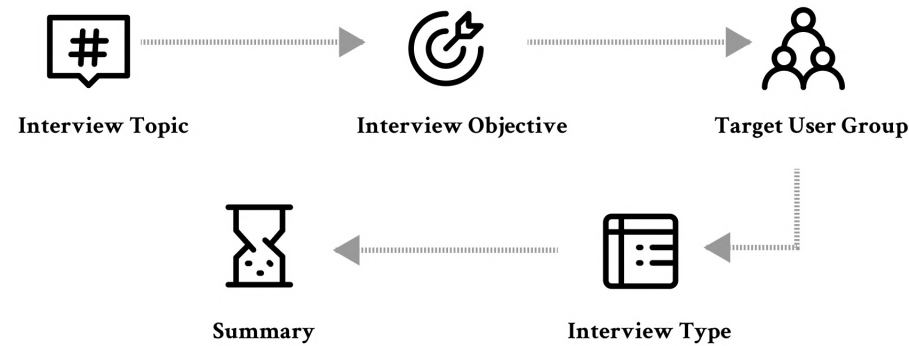
User Research

[1]Garrett, J. J. (Director). (2000). The Elements of User Experience [Film].

4 Context

The current market for charging station service products is a rapidly developing one, and the charging station service itself has become a key factor in the use of electric vehicles by users.

The interviews will be conducted with three types of users, drivers (real users), operators and charging station planning departments.



4.1 Interview Topic

There is a confusing pattern in the electric vehicle charging industry. How can charging station services improve product dissemination and find new growth points by relying on government incentives to ensure a comfortable charging experience and more effectively solve the problems of range anxiety and charging station construction planning.

The optimization and problems of charging service and charging equipment, as well as the pain points of users when using charging service

Key interviewees: Electric vehicle drivers and users who want to buy electric vehicles

Secondary interviewees: charging station planning departments and operators

4.2 Interview Type

Type: Face-to-face or remote communication

Quantity:

20-30 drivers or consumers

1-3 Car operators or charging operators

1-2 Station Planning Authorities

Interviews

to find out the optimization and problems of charging service and charging equipment, as well as the pain points of users when using charging service

4.3 To Business Interview

4.3.1 Car Operators Or Charging Operators

BASIC QUESTIONS

Q1: How many series of electric vehicles does your company have?

Q2: Which supplier is your company's electric vehicle battery ?

Q3: Do you have a collaborative R&D relationship with this supplier or is it a buyer-seller relationship?

Q4: What percentage of the battery capacity is below unusable?

Q5: How do you provide the charging service?

Q6: Do you have an after-sales service for batteries and charging?

Q7: Can you explain the after-sales service? (in terms of company operations)

Q8: Which of these processes do you find or do you understand to be more difficult? Why?

Q9: Do you have any measures in place to deal with this problem?

HOT ISSUES

Q10: Can you describe the process in general terms?

Q11: Are there any problems with it?

Q12: There are many charging operators, do you have a policy on after-sales service for these operators?

Q13: Do you have a policy on battery and charging?

Q13-1: If so, how are they handled?

Q13-2: If not, how do you think the batteries will be disposed of? What would be the impact?

4.3.2 Authorities

Open discussion

The main point is to understand how city governments and related organizations are currently planning the construction of charging stations.

What is the relationship between these governments and the operators and users?

There are also those problems that are not identified or predicted in advance.

4.3.3 Result

Charging Operators

Interviewee infomation

Name: Mr. Ding
 Occupation: Charging Equipment Company Administrator (State-Owned Enterprises)
 Age: 40 years old
 Status: Married with one son
 Location: Guangzhou, China

Hobby

1. In his off time he likes to go fishing
2. Going on holiday with his family
3. Prefers a quiet environment

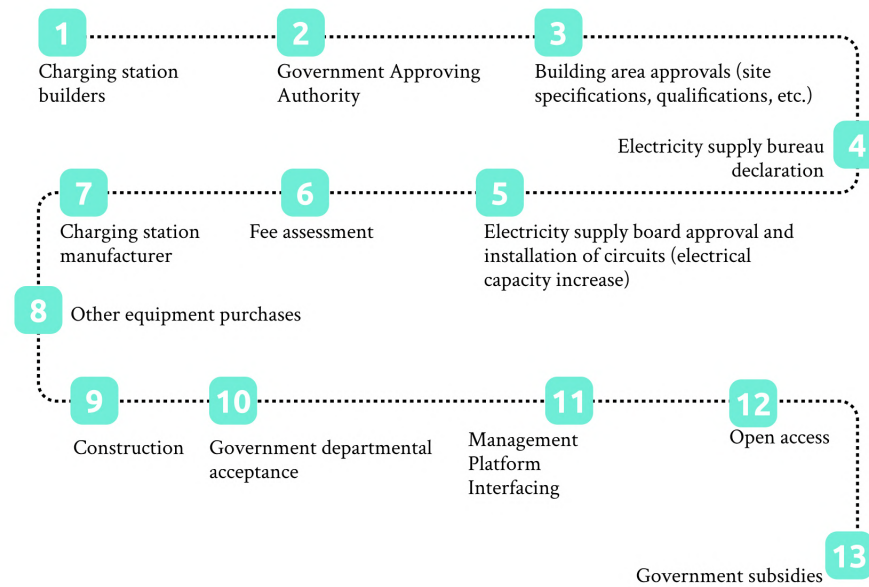
Basic information

Companies specifically permitted by the government - to install charging stations on a large scale in cities and to cater for urban public transport and urban construction vehicles, as well as for charging private cars

From 2016, all car charging stations in China are unified for all electric vehicles - and are unified under the national charging gateway system.

Building a charging station

12 steps of process



Charging station costs

One charging post: 60-70k for the charging post body
 Construction and circuit costs 60-70k
 Maintenance costs 60-70k
 Total cost around 210k

Charging station profitability

Government subsidy + service charge + difference in electricity tariff

Authorities

Type of charging station

Interviewee infomation

Name: Mrs. Yang
 Occupation: Guangzhou Public Transport Group Co.,Ltd.-- Manager
 Age: 42 years old
 Status: Married
 Location: Guangzhou, China

Hobby

1. Like to travel
2. Play with her kids
3. Likes to shop

A. automotive companies

Reasons for the construction of charging stations

1. Additional services for cars
2. Increasing the social valuation of the company
3. Enhancement of brand image, marketing tools

B. Government-approved charging station construction companies

Reasons for the construction of charging stations

1. Required by the government
2. Required by city construction
3. Serving urban transport mainly, urban transformation

Conflicting

1. Charging stations built for the sake of building, unevenly distributed, not taking into account the actual usage of the area
2. Low coverage in small cities, high coverage in large cities
3. Low coverage of highways and high coverage of urban roads
4. Uneven quality of charging stations (some operators will buy poor quality charging posts in order to reduce prices)
5. Confusing management

Future development of charging stations

1. The installation layout will form a network, starting from the two points of people's travel, the dotted line
2. Intelligence and integration will increase
3. Data transparency and system management



Milan city centre (City life)

16 April afternoon

- Some drivers drove up and had to move away because there was no space
- A phenomenon: a driver was waiting for a charge at the charging station. It did not have enough battery capacity to allow him to find another charging station, and he had to wait. I accompanied him to wait for an hour, and the vehicle at the charging station was still not taken by the driver

Planning Problems

1. Uneven distribution
Inconsistent plans by commercial vehicle companies and government, resulting in uneven distribution
2. Confusing management
3. Low coverage in small cities, high coverage in large cities



Milan city centre (Only 15min walk from city life)

- No electric vehicles charging at all
- Waited for half an hour before a SMART came in to charge

Summary

1. There are many charging stations in the city centre, and people can reach a large charging station within almost 15 minutes of walking distance.
2. Even if they are very close, the traffic volume is entirely different

4.4 To Customers Interview

4.4.1 Drivers Or Consumers

BASIC QUESTIONS

Q1: Which electric vehicle do you own?
 Q1-1: How many years have you been driving an electric car?
 Q1-2: Do you have any other vehicles in your household apart from electric vehicles?

Q2: Could you please tell us why you chose an electric car?
 Q2-1: During your time driving an electric car, do you think there are any advantages of electric cars?
 Q2-2: Do you think there are any disadvantages of electric vehicles?

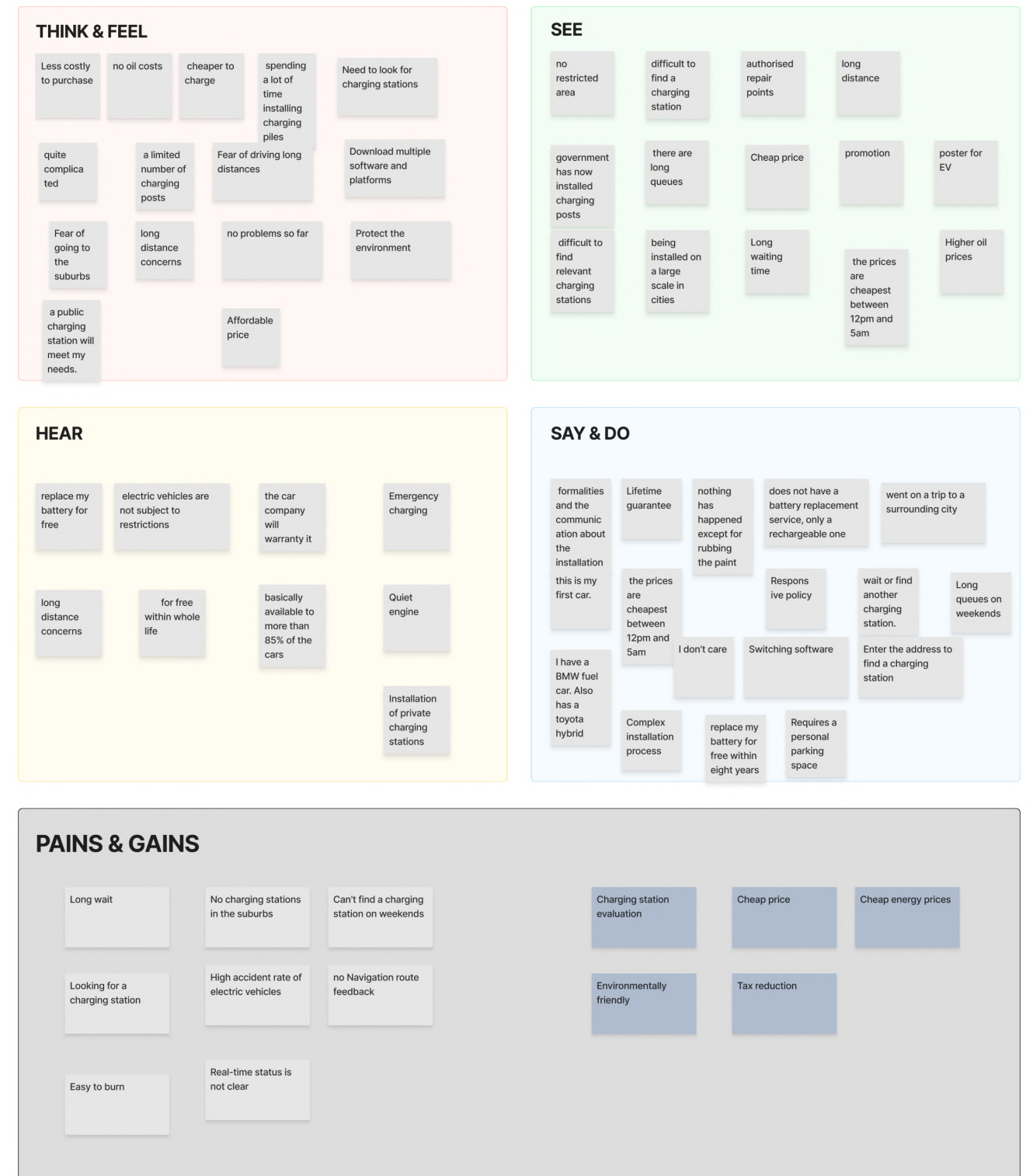
HOT ISSUES

Q4: What concerns did you have before you purchased your EV?
 Q5: Did you understand some of the relevant charging policies before you bought your electric vehicle?
 Q6: Did you take any solutions to these concerns?
 Q7: The biggest hotspot for electric vehicles at the moment is power exchange and charging, what is the brand you have chosen?
 Q8: What is the power exchange policy? Features and drawbacks
 What charging services are available? Features and drawbacks
 Q9: Do you check the battery life of your electric vehicle when you use it?
 Q10: After roughly how many years do you need to replace the battery with a new one?
 Q11: Are you aware of the relevant policies?
 Q12: What problems have you encountered during your use of an electric vehicle?
 Q13: What are some solutions to these problems?

4.4.2 Result

Fifteen drivers and EV users participated in the interview. After collecting the data, the data were categorised according to "think & feel", "see", "hear", and "say & do". The four dimensions of "think & feel", "see", "hear", and "say & do" were used to record their thoughts and to understand their pain points and desired needs during the interviews. Below is the data analysis chart of the driver and user interviews.

User Data Analysis



Drivers Or Consumers Interviews' Conclusion

A total of 15 interview data were collected

Basic information

The time of owning an electric cars are about 1 - 4 years and the cars are relatively new

Reasons to choose electric vehicles

1. Electricity is cheaper than fuel
2. Taxes on electric cars are low
3. No travel restrictions for electric cars
4. Electric cars can meet the needs of urban commuting
5. The car company will give a permanent warranty or semi-permanent warranty on the battery

Problems with the use of electric vehicles

1. Long queues for charging at tourist attractions (70%)
2. Some car owners taking up charging spaces (75%)
3. Highway concerns, even waiting up to 3 hours to charge (80%)
4. When they buy an electric car, they do not know anything about batteries, but they are proactive in finding out about the services available at charging stations. (80%)
5. No feedback with a route and charging station(65%)

4.5 Persona

“I need to plan a comfortable journey for my family , I want to be served efficiently”

Basic description

- He is a recently primary school teacher who is happy to have more time to spend with his families
- His favourite thing to do with his families is travelling with car at the weekend.
- He is afraid to drive far way. He worries that he won't be able to find a car charging station and the power is not enough
- Especially on the motorway. It is not easy for him to find a charging station. Charging on the motorway is also a very time-consuming affair

Needs

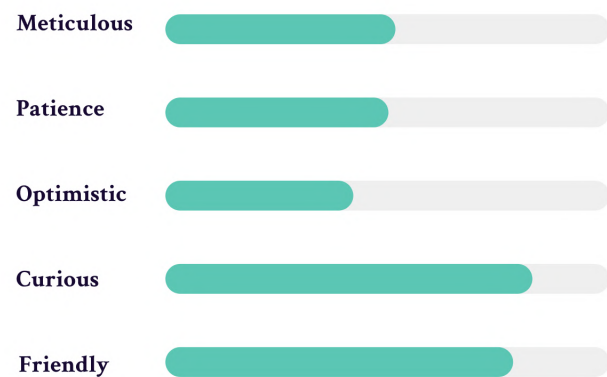
- Needs help for planning routes and charging stations
- A forum or community for owners to exchange and rate charging stations
- Private charging stations can be reserved

Problems

- Planning the route of the charging stations along the way gave him a hard time
- The uneven distribution of charging stations on the motorway deters him from going to certain places

Wishes

- It can plan the journey
- He needs to know more quickly how each route differs
- He can get information about charging stations



Andrea Geta
Office Administrator
 38 years old
 Amsterdam, Netherlands

“I wish there is a channel for easy check the status of charging station”

Basic description

- She is a commuter and needs to travel to the city centre for work and to drive to other places to deliver information.
- She wants to share some good route for people to travel
- She often uses navigation software to get to the charging station, but when she arrives, the charging station is already occupied.
- While driving her electric car, she takes the time to calculate the amount of battery left and the distance to travel, although she can use the navigation software to select a charging station in time. She finds it very dangerous when driving.

Problems

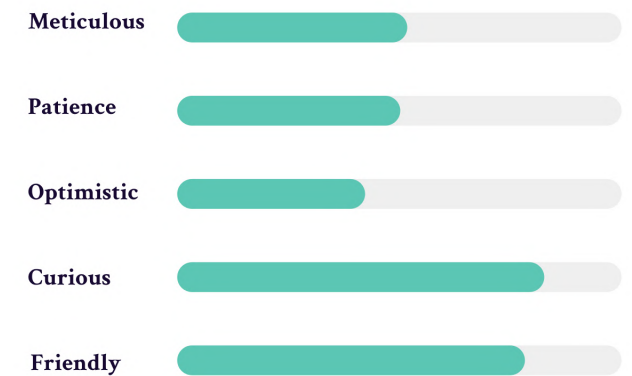
- Some car owners continue to occupy parking spaces after a full charge
- There is no place to charge after arriving at the charging station
- No way of knowing how long to wait

Wishes

- She wanted to be able to get the review with car owners, especially those who are charging.
- She would like to switch charging stations in advance

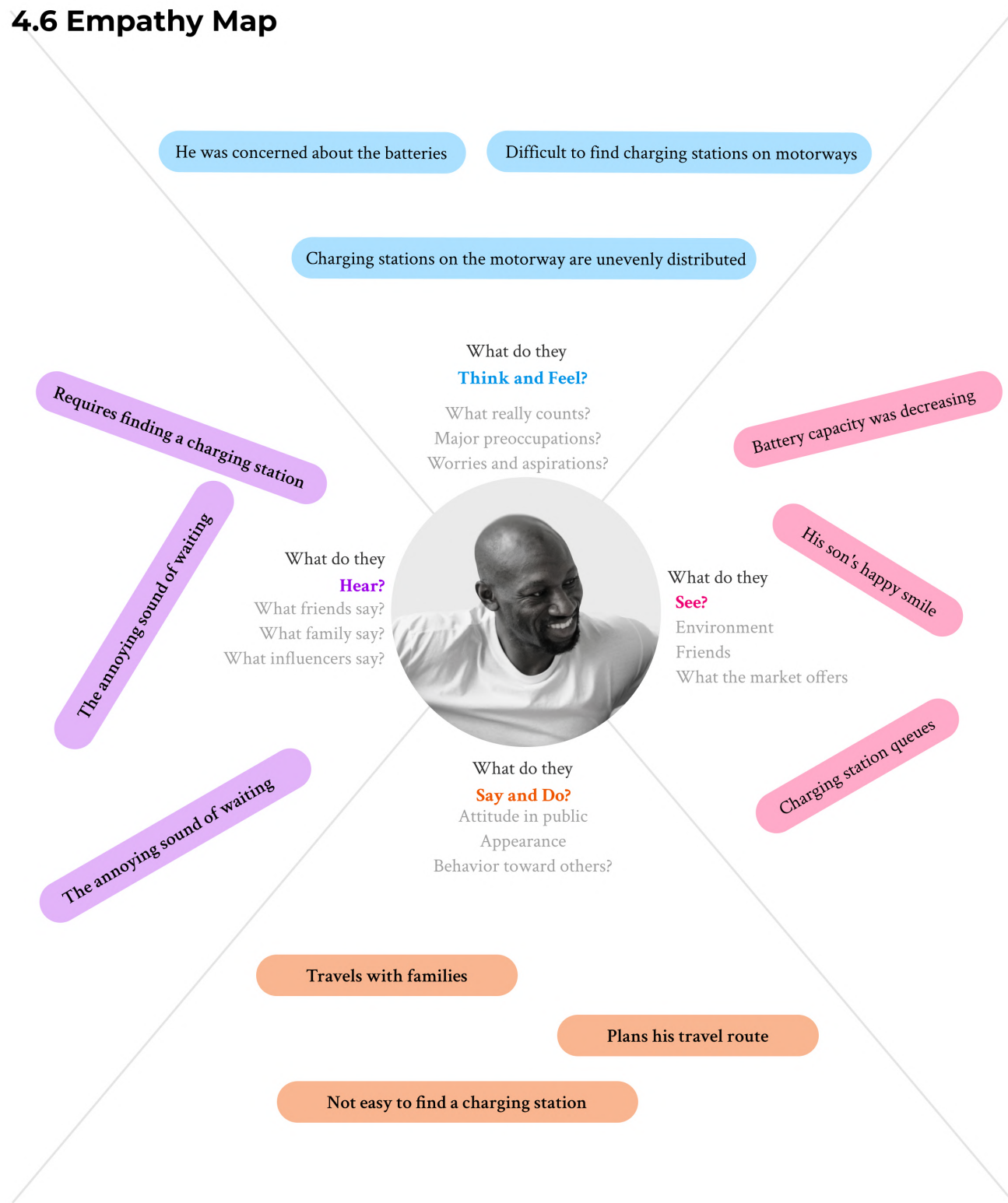
Needs

- Needs to know the waiting time
- Needs a channel to be able to get the feedback of the route
- Needs to be kept informed of the status of charging stations



Karle Feng
HR Officer
 27 years old
 Berlin, Germany

4.6 Empathy Map

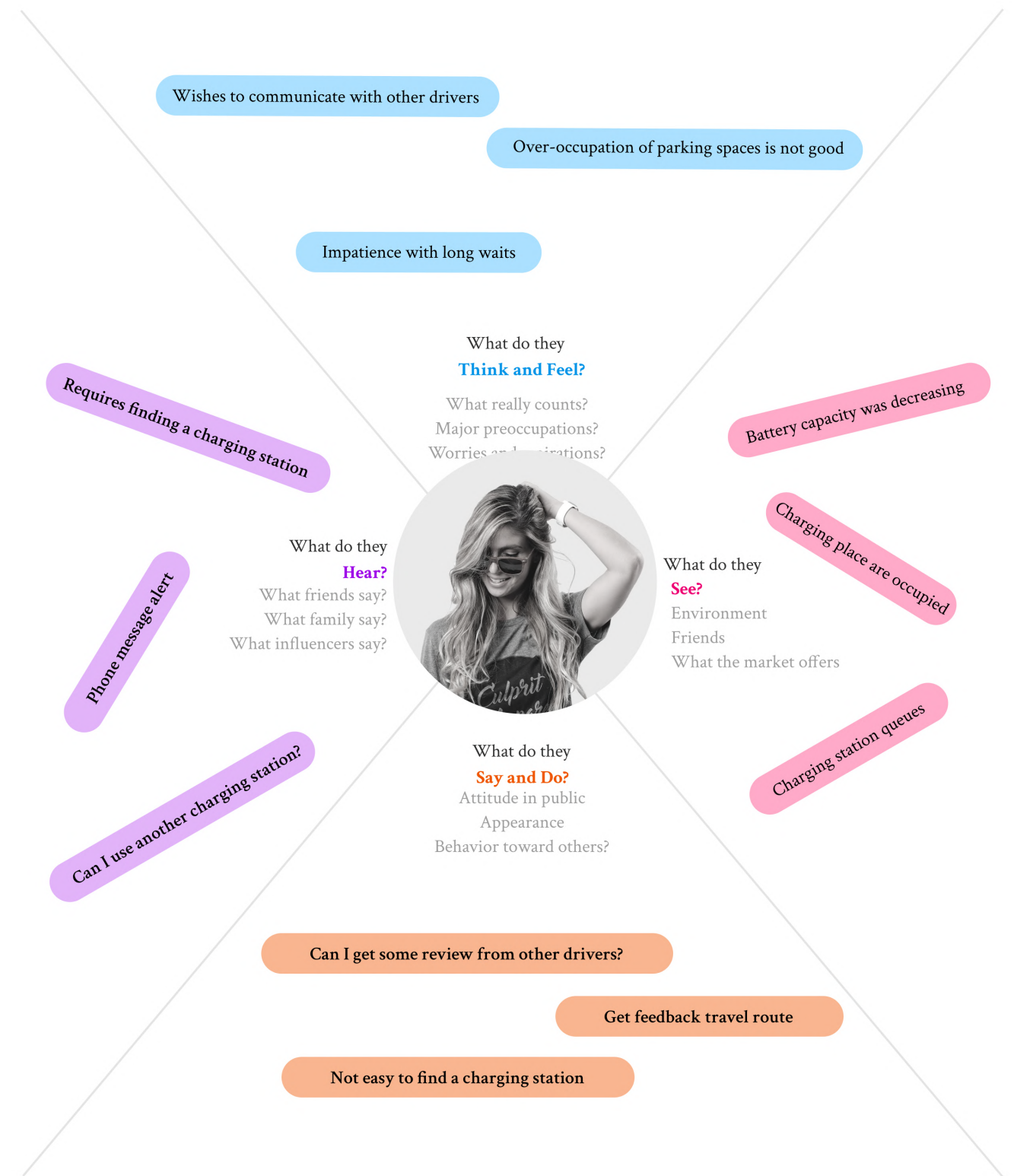


Pains
Fears, frustrations, obstacles...

- Go somewhere far away
- Car without electricity
- Can't find a charging station

Gains
Want/needs, measures of success, achievements

- Route planning for charging stations
- Get information on the nearest charging stations
- Charging alerts and automatic route planning



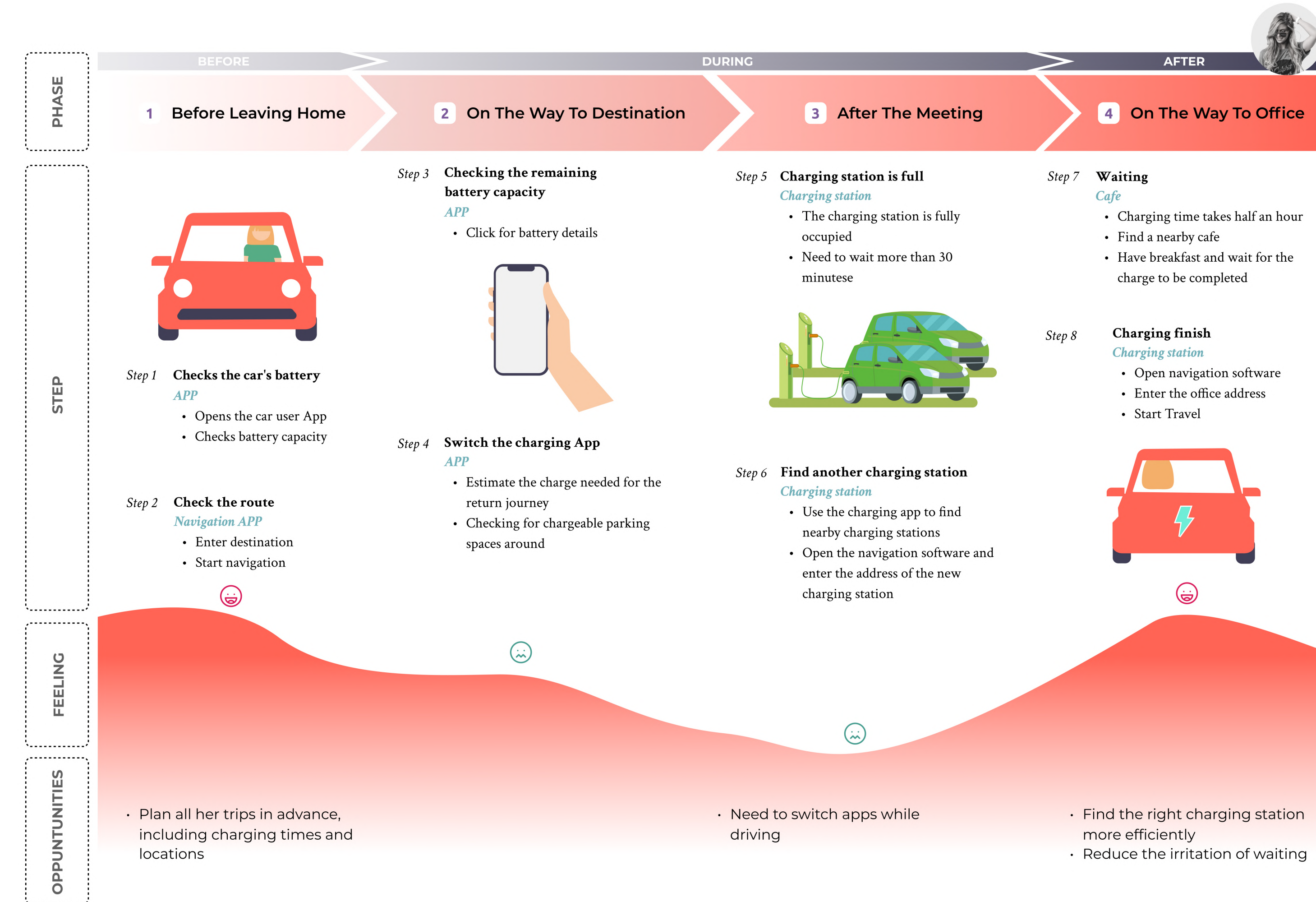
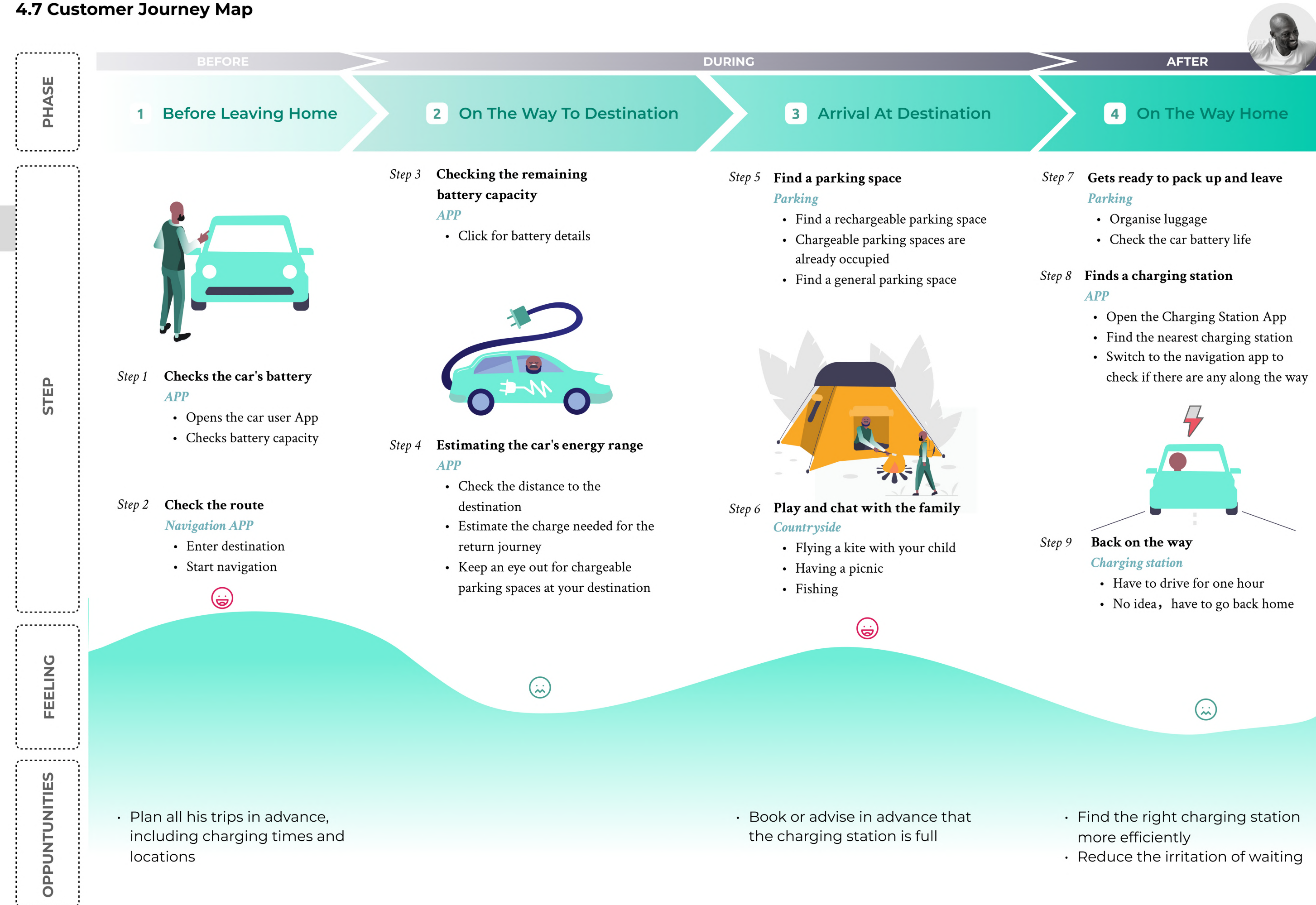
Pains
Fears, frustrations, obstacles...

- Not getting timely feedback
- Car without electricity
- Charging stations are occupied

Gains
Want/needs, measures of success, achievements

- Route feedback for charging stations
- Community for charging stations
- Charging alerts and automatic route planning

4.7 Customer Journey Map



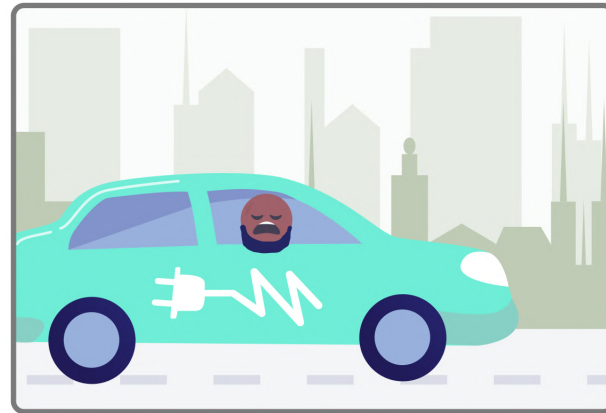
4.8 Storyboard (Before)



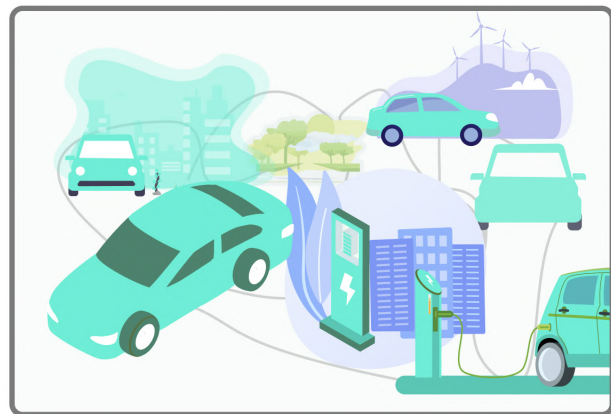
Andrea Geta
Office Administrator
38 years old
Amsterdam, Netherlands



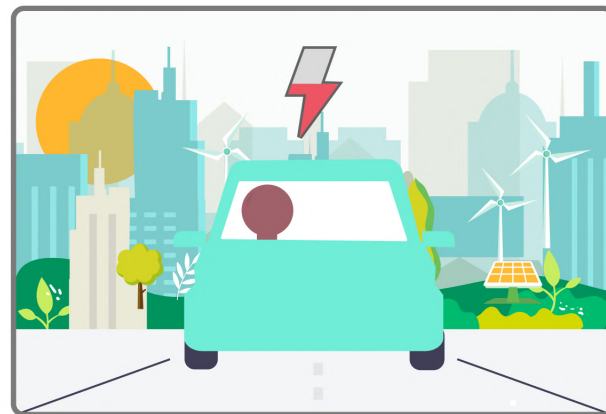
1. He likes to travel to the countryside by car



2. Since there are no charging stations in the suburbs and rural areas, he needs to constantly calculate the battery usage on the road.



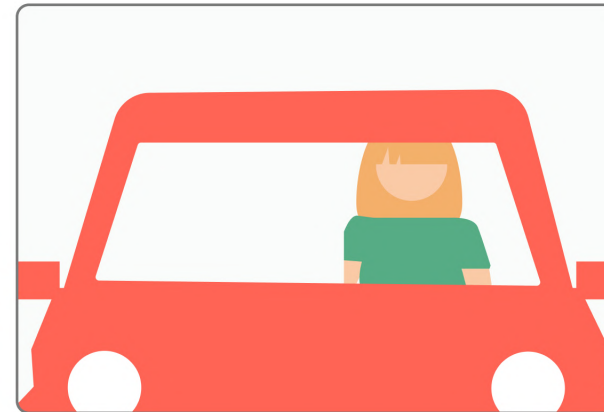
3. He drives and looks for charging stations while driving



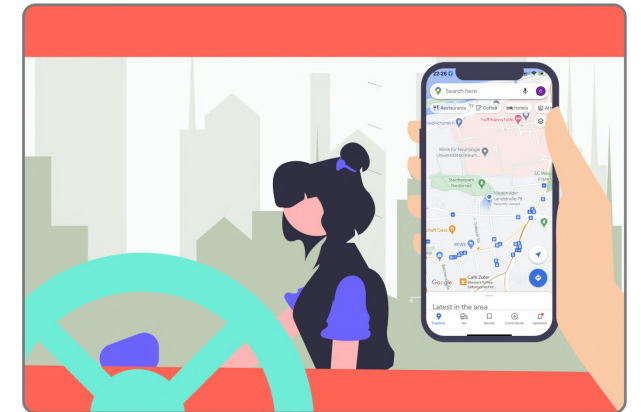
4. He is unhappy that finding a charging station takes too much time and ruins his travel mood



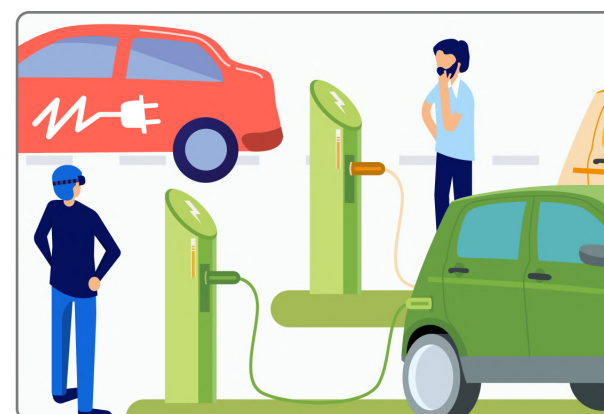
Karle Feng
HR Officer
27 years old
Berlin, Germany



1. She regularly drives as a means of transportation for commuting



2. When she drives, she needs to switch to different apps, which is dangerous



3. When she arrives, the charging station is already occupied by people



4. She doesn't know which route is better, and it's hard to choose

4.9 User Need Summary

Problems with the use of electric vehicles

1. Switch APP to check the route and charging station
2. Long queues for charging stations
3. No place to charge after arriving at the charging station
4. Uneven distribution of charging stations
5. Unable to check the strengths and weaknesses of the route

User needs

1. Needs planning routes and charging stations
2. Needs to be kept informed of the status of charging stations
3. Private charging stations can be also charged
4. a channel to be able to get the feedback of the route

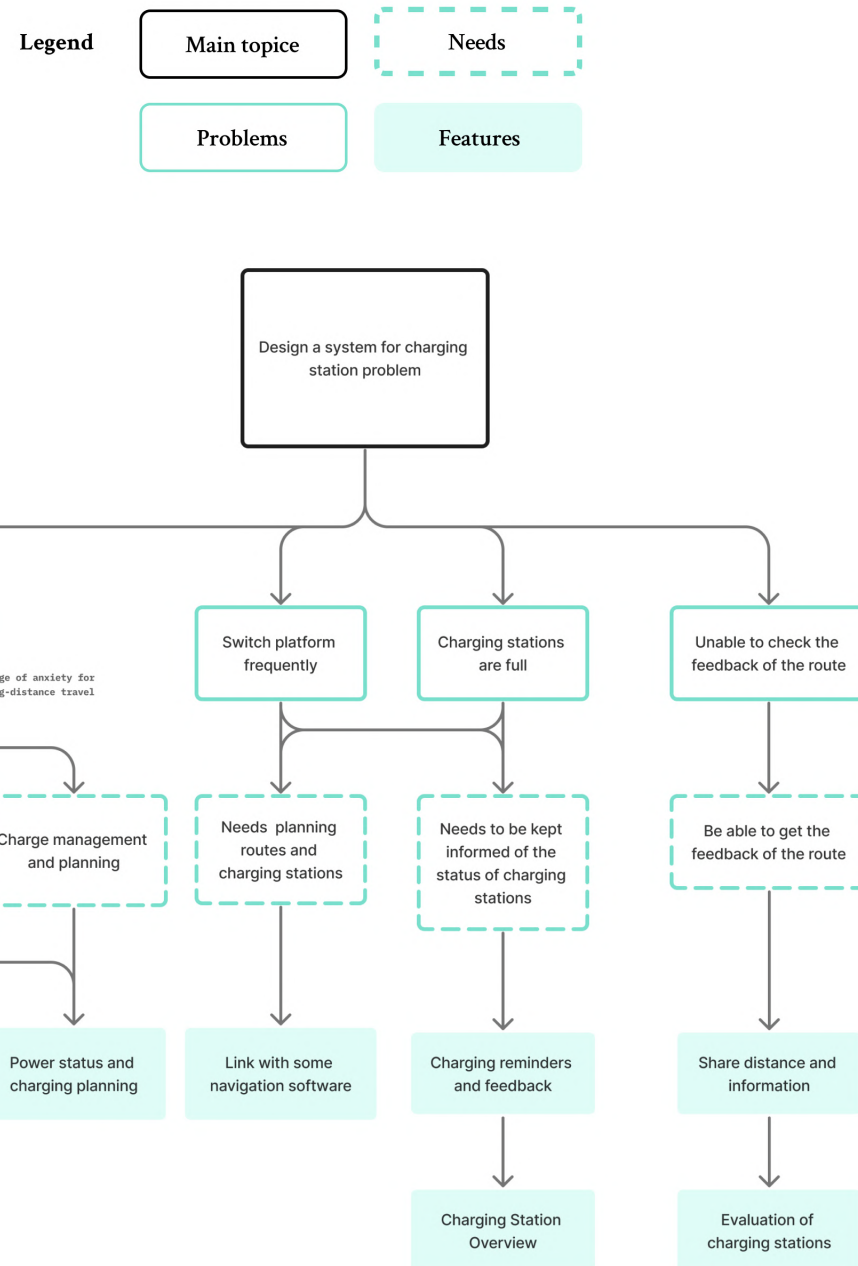
PART THREE

Design Proposals

5 Ideation

5.1 Brainstorming

Brainstorming product features and appearance based on the user requirements mentioned in section 4.9 to solve user problems and meet user needs.



After brainstorming, the following user needs were defined and implemented according to the interview data and the priority of user needs analysis.

1. Charging management and planning
2. Planning routes and charging
3. Keep informing the status of charging stations
4. Be able to get feedback of the routes

5.2 Design Preliminary Evaluation

The preliminary design assessment will be conducted in the following areas. Based on the preliminary assessment results, it will be determined whether a design study needs to be initiated.

a: Analyze the project's future to decide whether the study should be continued in depth.

b: Initial assessment and identification of key user pain points and core issues in the project to determine if they need to be addressed

c: Preliminary assessment of supporting studies that must be conducted to address the core issues of the project and determine whether the necessary technical, experimental and human conditions are available to support them.



1. The need to design the project: the user's problems and needs have existed for a long time-- a range of anxiety for long-distance travel, which is and many of the same products on the market seem unable to solve the user's problems completely.

2. Project construction period: the design period is about two months

3. Procedures required for the project: functionality, usability, form analysis, framework diagram, lo-fi prototype, user testing and user feedback, information framework and flow chart, final product presentation, prototype presentation, service blueprint, stakeholder analysis, and business canvas

4. Whether the project features and objectives can be achieved: Yes. The current technology can achieve this.

5. Whether the economic and social benefits of the project can be guaranteed: Stakeholder analysis and business canvas analysis are required

What is Smart Mo?

A platform-- Smart Charging Services to EV

Currently, the central charging platform for the city in the service is perfect, but for the highway or long-distance travel platform is relatively less; however, the current user problems, mainly in driving in the **range of anxiety for long-distance travel**.

Smart Mo is a combination of three phrases. "Charging Planning", "Building Communities", and "Construction Management". The first is to manage charging, battery replacement and charging long-distance route planning based on the individual vehicle configuration, timer, location, battery SOC (state of charge), plug-in status and departure time.

Secondly, it is a user community, which provides a platform for car owners to share information and reduce each other to reduce range anxiety.

Thirdly, charging station management. Based on the user's behaviour collection and analysis, we can provide reasonable suggestions for building charging stations and reducing the uneven distribution of charging stations.

WEB & App



Merge charging station

Different suppliers will be stored in the cloud for easy sharing and editing



Route Planning

Drivers can know when they need to charge and for how long.



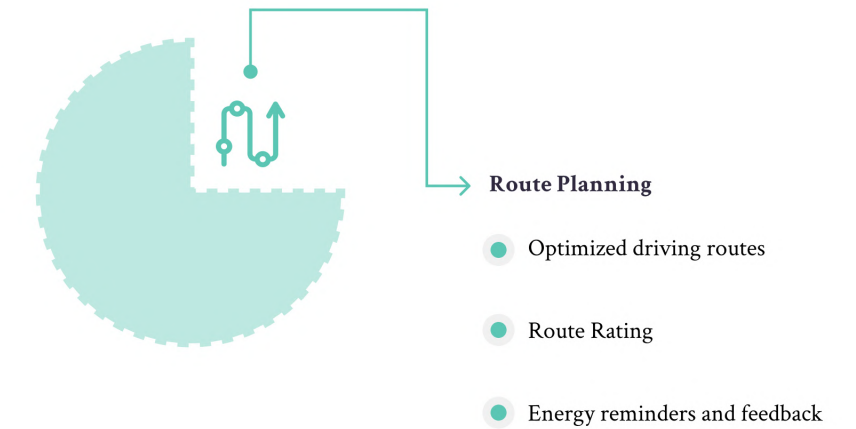
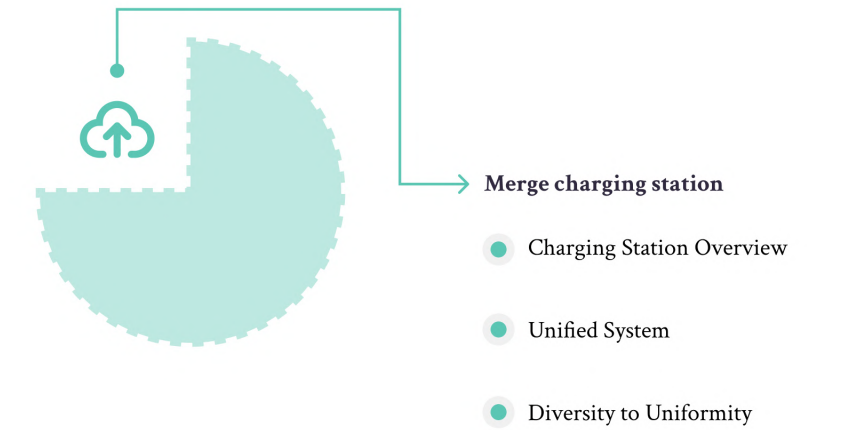
Community Influence

Creating a community and provide contact information between owners



Power status

Timely power status of the car

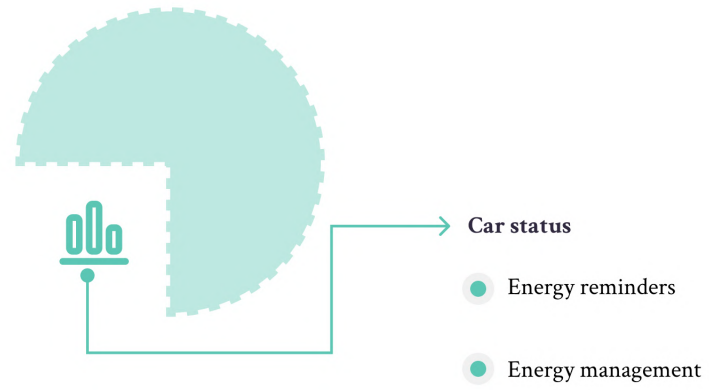


Optimized driving routes: Route selection for users based on their car and road conditions

Route rating : Users can review and give feedback on the routes and user experience provided to them by the platform. The platform can update the route data based on relevant feedback.

Energy reminders and feedback : Users can review and give feedback on the routes and user experience provided to them by the platform. The platform can update the route data based on relevant feedback.





6.2 Wireframe

Merge charging station

Route Planning

Community Influence

Power status

6.3 Low- Fi Structure

User APP

Welcome

Heading

Glad to see you!

Account created!

SIGN UP

LOG IN

Community



Route planning

Homepage

Car status

Profile

HMI UI System


LOG IN

Homepage

Route planning

6.4 User Test & Feedback

User test with five people. An interactive prototype was created to record and collect their behaviour and suggestions. Simulated real user scenarios to identify current product problems and make improvements to improve user experience.

 Mr.Zhang
Office Administrator
48 Years Old

1. It seems to be able to connect to all charging systems **without additional registration**, so will my **personal information be provided to all** charging stations by this app?
2. Is this app **a collection of all the branded** charging stations in the world? I have a lot of apps now, and the **combination of those apps can meet almost 90%** of the charging stations

 Mr. Wang
Packaging Company
Manager
35 Years Old


1. My **car's dashboard would have shown real-time power consumption**, what is the difference between it and my car's display?
2. I think the **route review and feedback**, as well as the **community sharing function is good**, it will really improve the accuracy of the charging route.
3. I can get reviews about charging routes through the community, which can **help me choose a route**.

 Mrs. Li
Designer
29 Years Old

1. **I don't trust those small operators**, can I delete?
2. Will charging stations in remote areas be covered using this app?
3. I have tried to use **personal charging stations** in rural areas where I could not find regular charging stations.

 Mrs. Lee
HR
32 Years Old

1. What if I get **disconnected from Google maps** in the middle?
2. How do I choose the best route when I select the navigation route?
3. Do I have to go back to the "community" search and note it down? (HMI)

 Mr. Diaz
IT Developer
26 Years Old

1. If I **barely see so much text** while driving. (HMI)
2. Does red mean the charging station is occupied or broken? Is navigation still an option or offered to me to choose from?



Route review and feedbacks

Community sharing function is good

Personal Information Release

Unable to choose a favorite charging station



Multiple App Downloads

Don't trust small suppliers

The car dashboard can already show the car status

NEW

Really make charging stations compatible

Can individual charging stations join the sharing system?

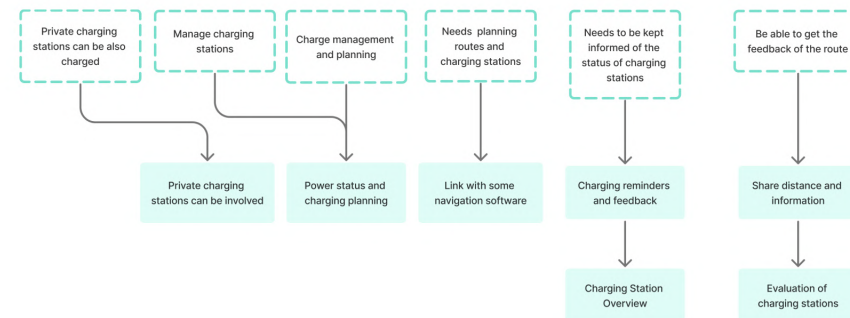
7 Final Design Proposals

7.1 Analysis Of Needs And Problems

As a result of feedback from user testing, problems with the product gradually emerged. After summarizing the issues, the initial case study and interview questions need to be continued to be analyzed and combined with the issues found in the user profile. Re-read the original findings and interview transcripts and make minor changes to the application's functionality.

For details : chapter 4.3, chapter 4.4, chapter 4.9 and 5.1 Brainstorming

Brainstorming



In conclusion,

1. **Cooperater with charging station operators** and show their charging stations in SmartMo.

2. **Create security protocols.** Protect the user and the charging station operator from security issues.

The original research question:

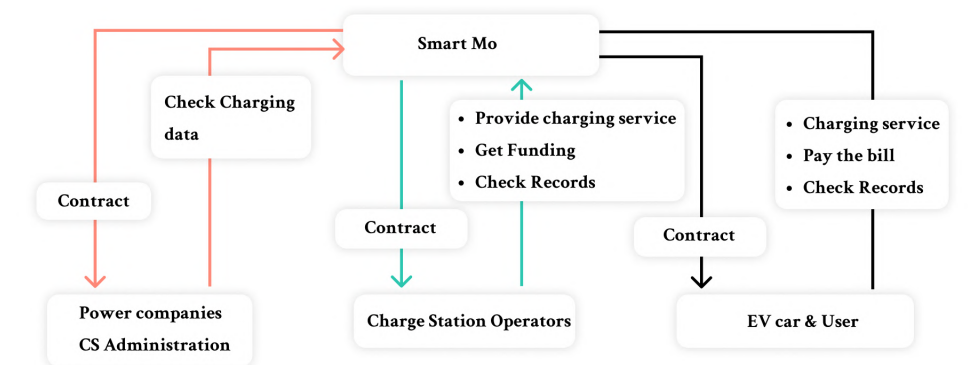
Government issues: **uneven distribution of charging stations, closed information**

Users: **range anxiety**

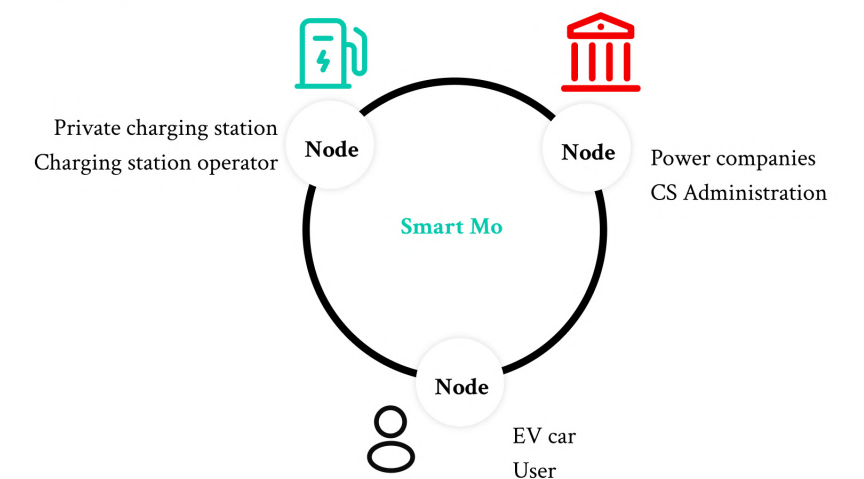
One of the reasons for range anxiety is the uneven distribution of charging stations

7.2 Functionality

Merge system



Relationship



Purpose

1. Peer-to-peer transactions--Contracts that can be executed without an intermediary
2. Each EV car, user, and charging station is assigned a Self-Sovereign Identity, a digital identity that exists on the system and gives the owner, whether a person or a machine, complete control over their identity and data.
3. The SSI allows the EV and the charging station to identify themselves to each other securely.
4. Next, the car proves that it has an active payment method and enough funds to pay for energy. These funds are then frozen.
5. Once authentication is completed, the charging station authorizes the car to begin charging.
6. The frozen funds are transferred to the Charging station operator based on the amount of energy used.

Route planning

Optimized driving routes

Route selection for users based on their car and road conditions

The EV routing features of the API extend the routing service with electric vehicle-specific options. Routing responses can contain details of the vehicle's energy consumption on the route. Route calculations can also add charging stations to the route to ensure that destination can be reached without running out of energy while still optimizing the result for overall travel and charging time.

For code samples, see these tutorials:

- Calculate consumption per section
- The display state of charge on the route
- Calculate consumption without capped speed
- Calculate consumption with capped speed
- Calculate a route with charging along the way^[1]

Energy reminders and feedback

Users can review and give feedback on the routes and user experience provided to them by the platform.



Software Development Kits (SDKs) provided

Shared information: device parameters and system information (device model, system version), network information (IP address, network type, network standard), application feature information

Community system

Community system

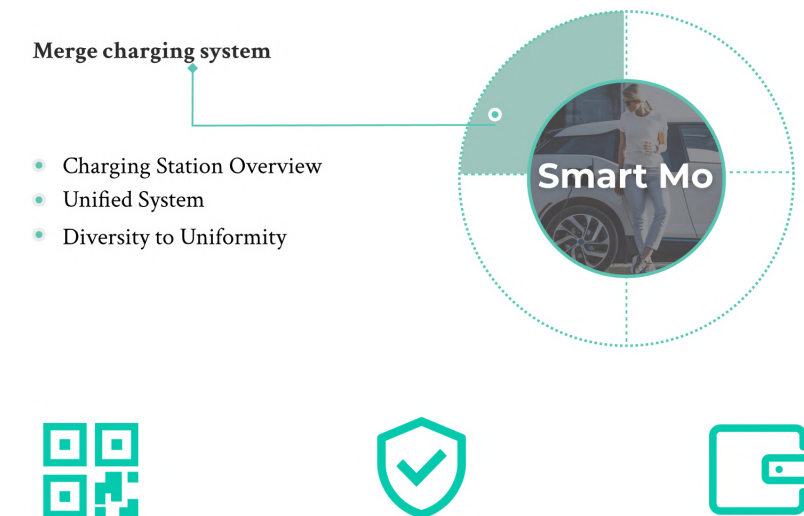
Statistical analysis:

This function is combined with the user evaluation function to calculate the total evaluation. It includes two items: statistical results and query results. In the statistical results, the user evaluates the routes provided by the system and can derive the teacher's total evaluation. In the query results, the user can browse the results of the evaluated route and have a preliminary understanding of the route.

[1] https://developer.here.com/documentation/routing-api/dev_guide/topics/use-cases/ev-routing.html

7.3 Usability

Merge system



Thanks to these decentralized management charging station solutions, the application creates a shared trading environment for charging stations. Users can charge any charging station (public and private) without additional registration simply by scanning the QR code of the charging station or creating a link with it. There is no need to worry about security issues such as information leakage.

In addition, Significant management and security risks are associated with Public Key Infrastructure. The government or the administration can obtain information on charging stations through blockchain to plan the construction of compatible charging stations and the electricity consumption plan.

From these two perspectives, it can **solve the problem of user range anxiety.**

GOVERNMENT

1. Through this solution they are informed about the operation of the charging stations and the electricity consumption,
2. Set the terms and conditions to plan and limit the construction of charging stations.

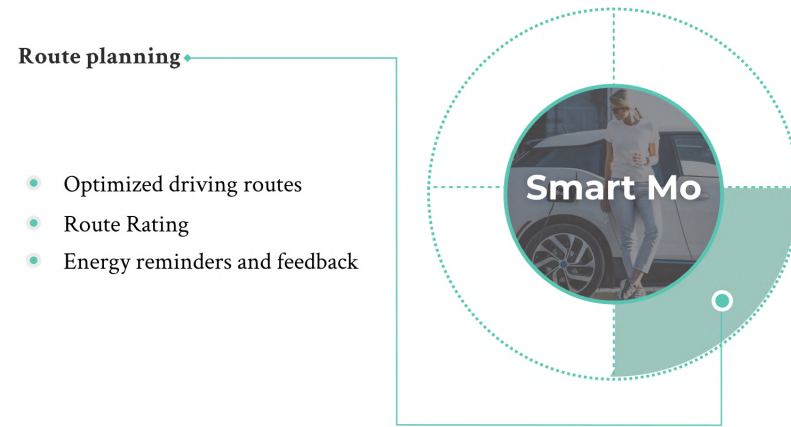
CHARGING STATION OPERATORS

1. Share charging stations in this system. Allow car drivers of all brands and countries to use the charging stations. This will reduce conflicts between brands and brands, and countries.
2. Allow access to usage and transaction records to plan the layout of their charging stations;
3. Allow the sharing of individual charging stations, which will provide more compatible charging station facilities in areas where public charging stations have not yet been built.

USER

1. Public, branded and personal charging stations can be used for charging services.
2. There is no need to register for multiple apps.
3. Regardless of which charging station is used, charging funds will be adjusted and frozen based on the amount of charging, and the operator will not receive the funds until after charging is complete.

Route planning



Route rating :Users can review and give feedback on the routes and user experience provided to them by the platform. The platform can update the route data based on relevant feedback.

Provide rating system & show rating



Share:

Share routes and tips to other users

Rate:

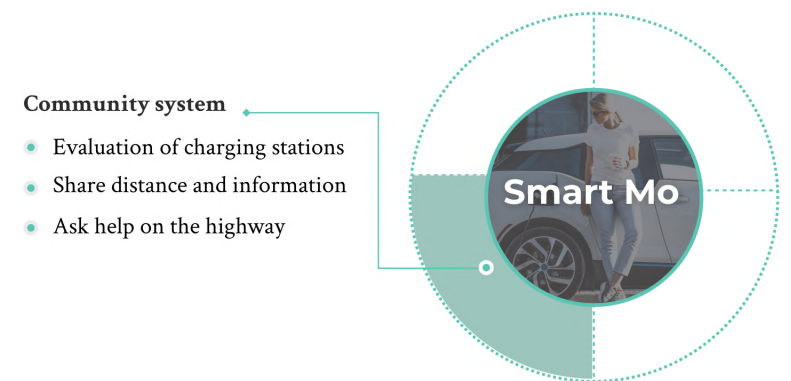
Rate the routes provided by the system

Feedback:

Users search for routes and can visually see the related ratings



Community system

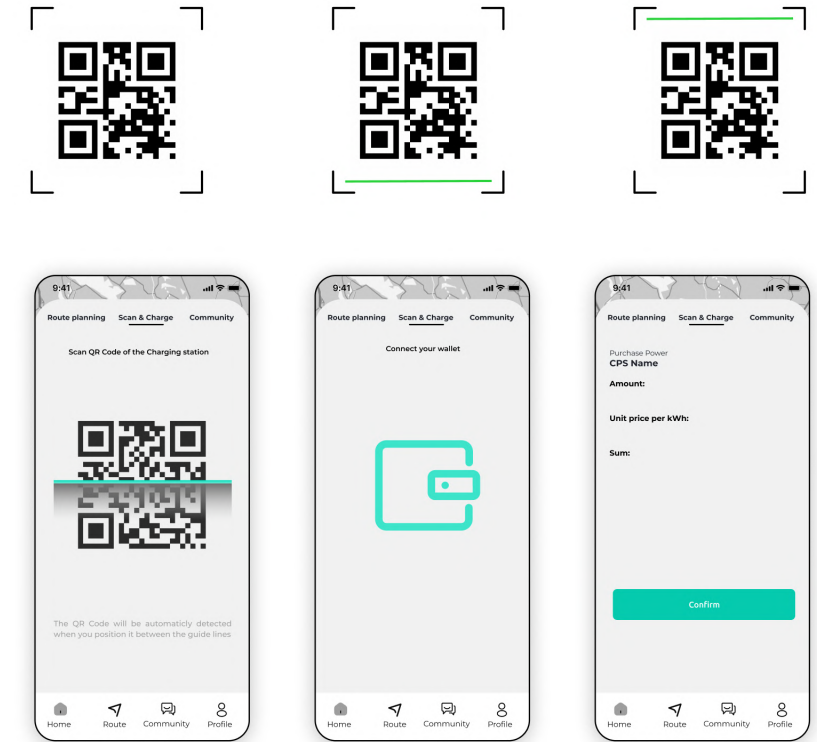


To share the experience and evaluate the routes provided by the system. The main functions include accurate charging station information, real-time feedback power, planning power and travel information. It is also one of the most critical components of this system.

7.4 Morphology

Merge system

With the above solution, users can scan the code or connect to each compatible charging station for charging services.

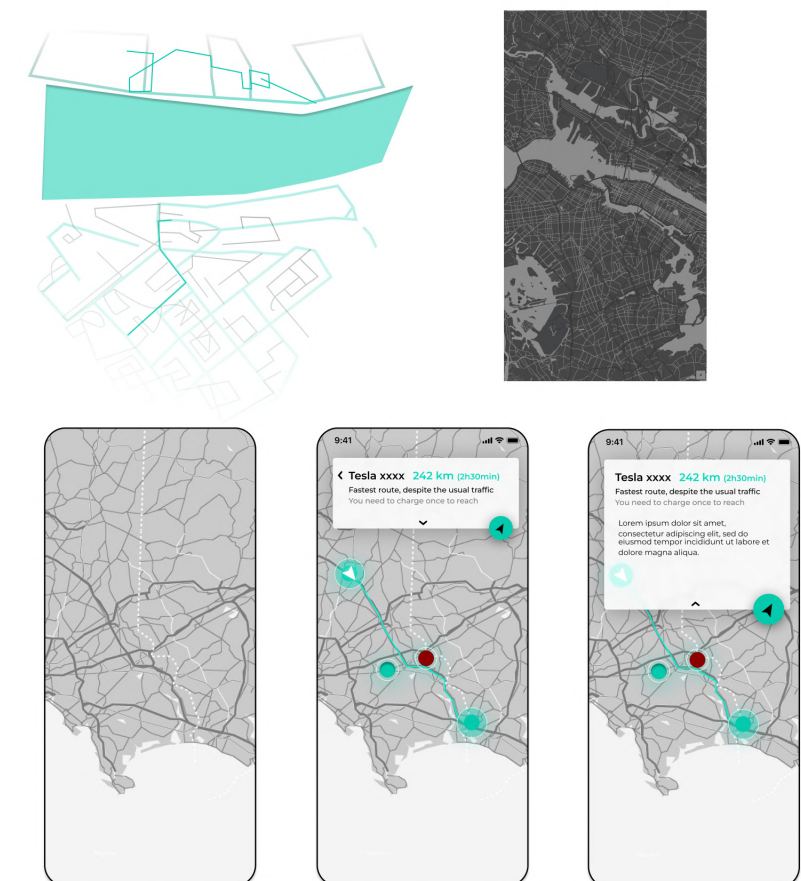


Route planning

Purpose of use: login to SmartMo

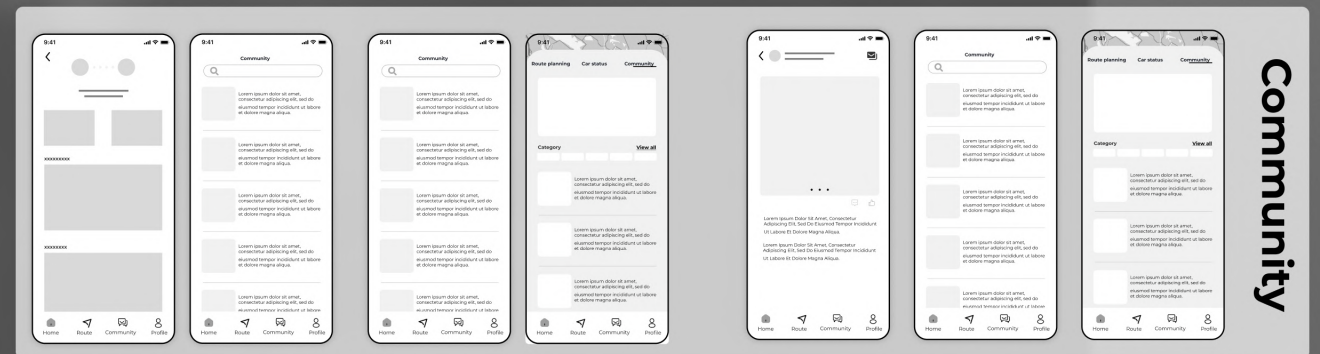
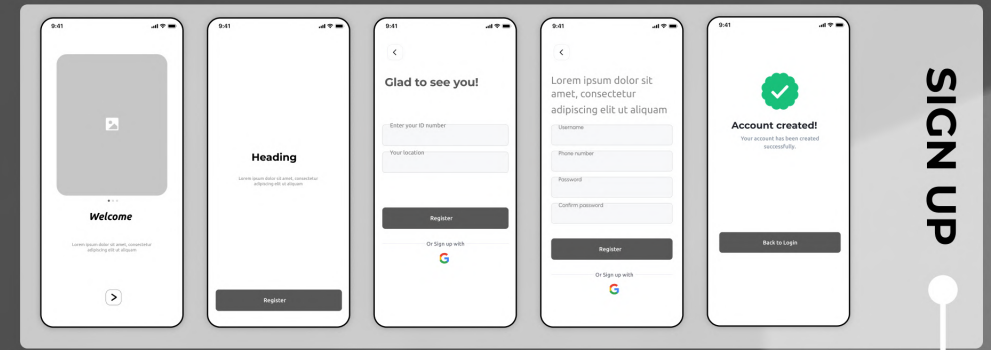
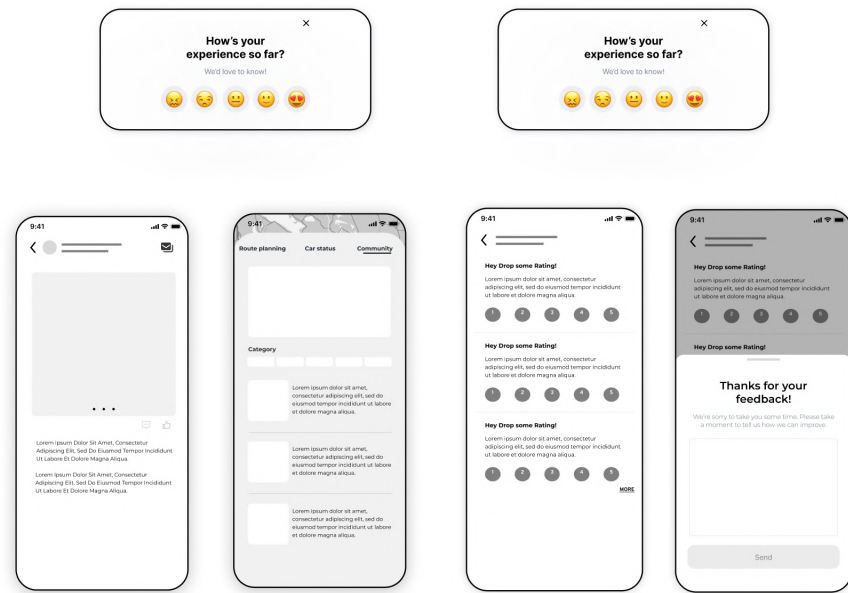
Usage scenario: One-click login when users use their cell phone numbers

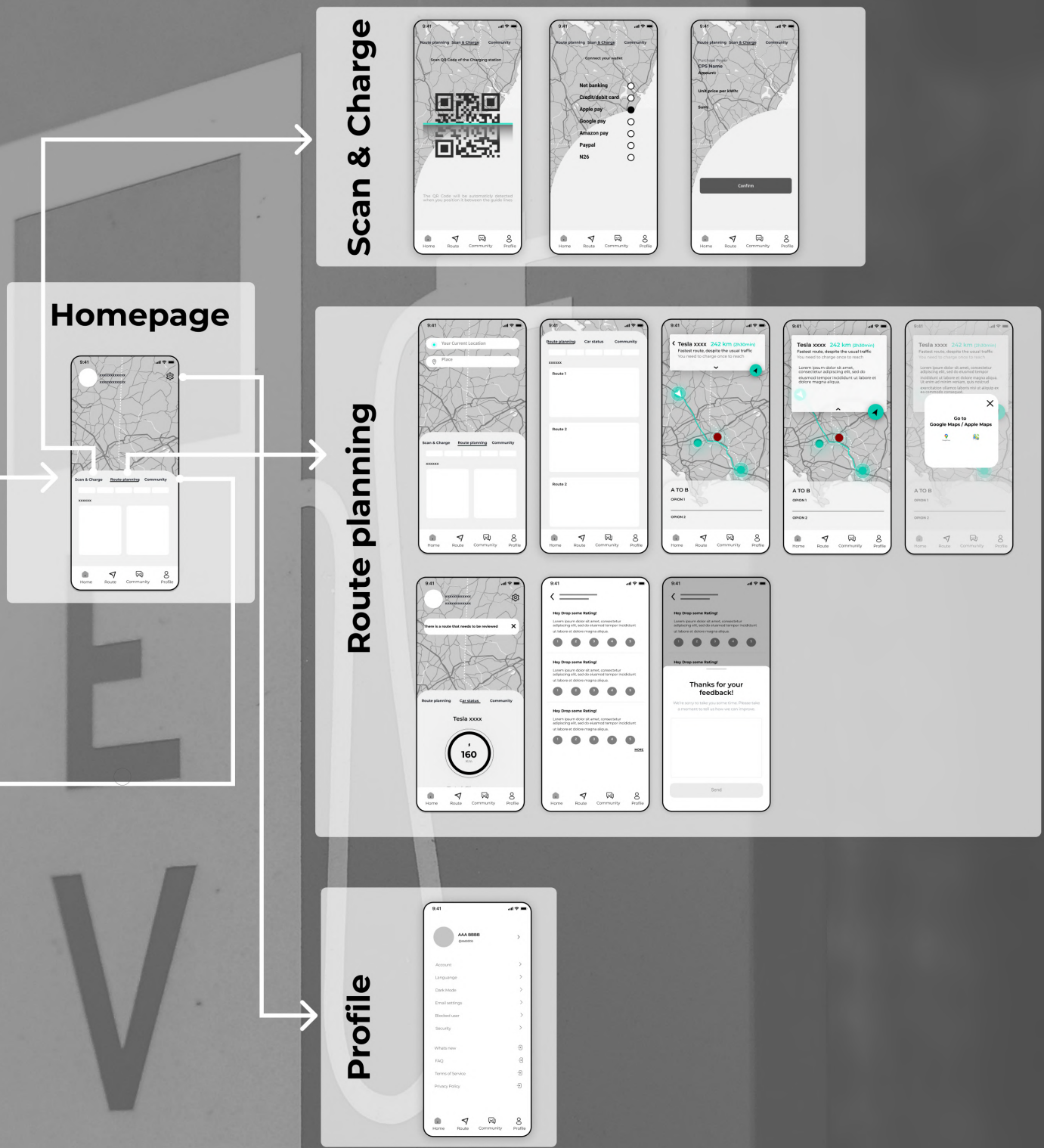
Sharing method: SDK collection



7.5 Wireframe

Community system





8 Design Process

8.1 Visual System Design

Typography

Montserrat

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 abcdefghijklmnopqrstuvwxyz
 1234567890

Aa Aa Aa Aa
 Regular Medium Semi-Bold Bold

Headlines

H1 **Almost before...**
size: 28

H2 **Almost before...**
size: 24

H3 **Almost before...**
size: 20

Texts

subtitle1/button **Almost before ...**
size: 16

body1 **Almost before ...**
size: 14

LOGO



Brand Color

Primary
--color-primary

- hover --color-primary-hover
- active --color-primary-active
- disabled --color-primary-disabled

Bg
--color-bg-0

- 1 --color-bg-1
- 2 --color-bg-2
- 3 --color-bg-3
- 4 --color-bg-4

Primary-light
--color-primary-light-default

- hover --color-primary-light-hover
- active --color-primary-light-active

Tertiary-light
--color-tertiary-light-default

- hover --color-tertiary-light-hover
- active --color-tertiary-light-active

Text

- 1 --color-text-1
- 2 --color-text-2
- 3 --color-text-3

Bg

- bg-1 rgb(255, 255, 255)
- bg-6 rgb(213, 213, 213)
- bg-7 rgb(170, 170, 170)
- bg-8 rgb(128, 128, 128)
- bg-9 rgb(85, 85, 85)

Black

- black rgb(0, 0, 0)

Brand

- brand-0 rgb(245, 253, 251)
- brand-1 rgb(225, 251, 245)
- brand-2 rgb(195, 248, 236)
- brand-3 rgb(166, 244, 227)
- brand-4 rgb(138, 241, 220)
- brand-5 rgb(111, 237, 214)
- brand-6 rgb(91, 198, 180)
- brand-7 rgb(71, 158, 145)
- brand-8 rgb(52, 119, 110)

Red

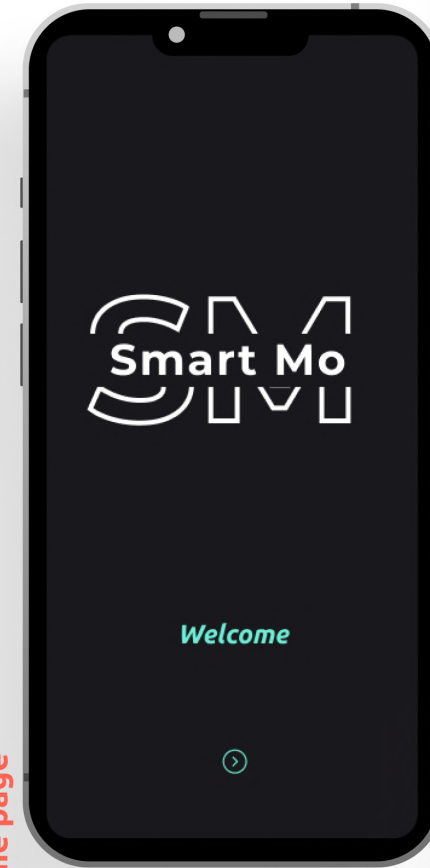
- red-0 rgb(255, 246, 243)
- red-1 rgb(255, 229, 221)
- red-2 rgb(255, 200, 187)
- red-3 rgb(255, 169, 153)
- red-4 rgb(255, 136, 119)
- red-5 rgb(255, 100, 85)
- red-6 rgb(219, 75, 67)

8.2 B2C Design

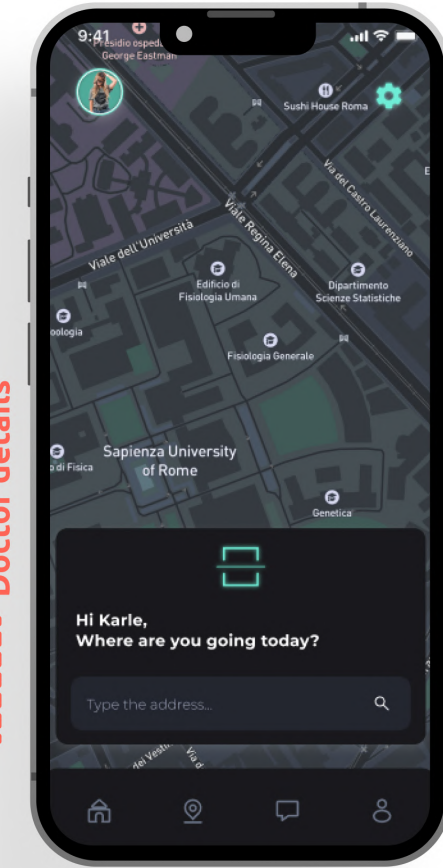


Medical platform for the elderly

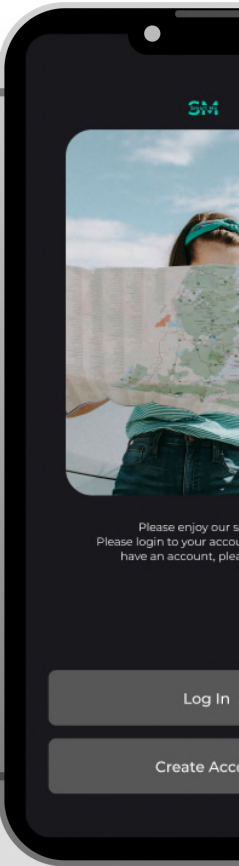
Smart Mo system provides a solution for all EVs and stakeholders in the EV charging ecosystem, bringing together all types of charging station operators and private charging posts to add their stations to the public charging network.



----- Welcome page



----- Doctor details



----- Introduction



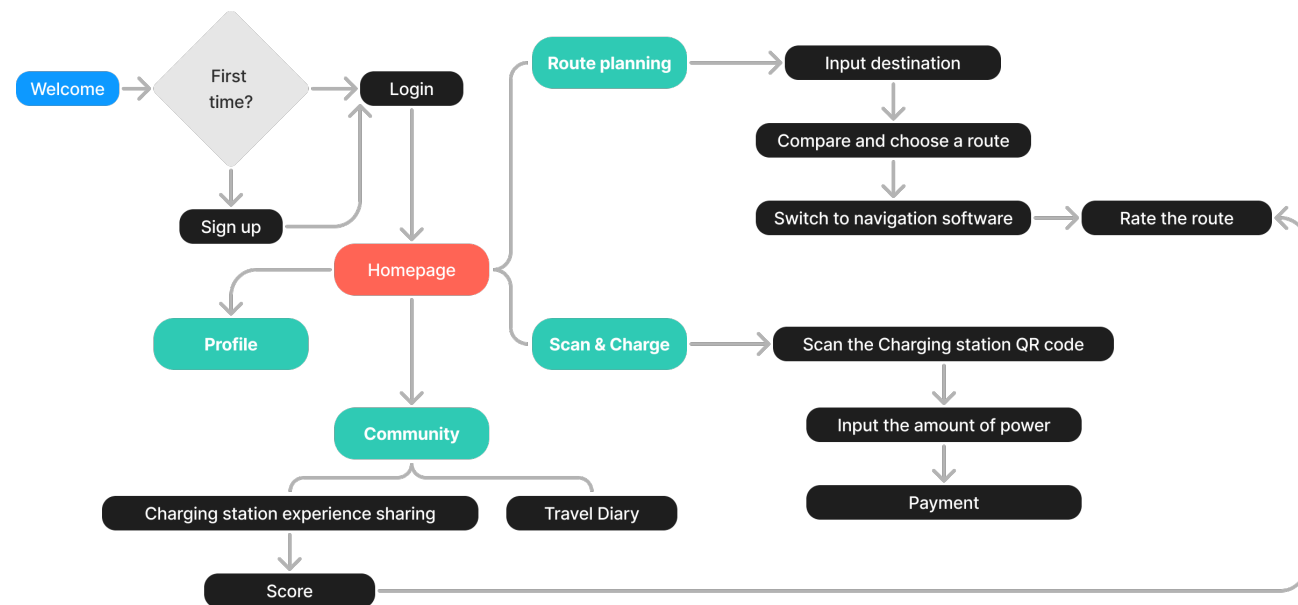
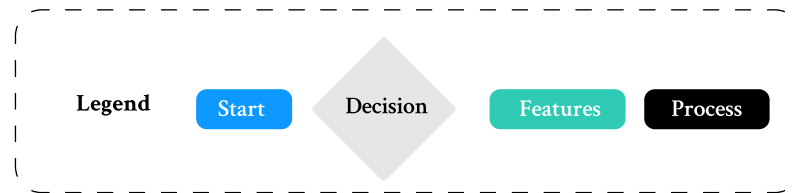
----- HMI System

8.2.1 Workflow

There are many different pathways a user can take when interacting with a product. A user flow is a visual representation, either written out or made digitally, of the many avenues that can be taken when using an app or website.

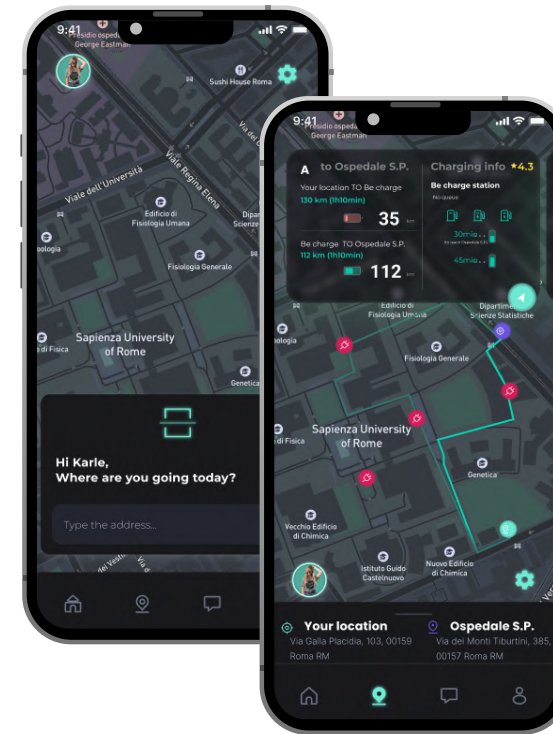
The flowchart begins with the consumer's entry point on the product, like an onboarding screen or homepage, and ends with the final action or outcome, like purchasing a product or signing up for an account.

Depicting this process allows designers to evaluate and optimize the user experience and therefore increase client conversion rates.^[1]



[1](n.d.). what are User Flows in User Experience (UX) Design? careerfoundry. <https://careerfoundry.com/en/blog/ux-design/what-are-user-flows/>

8.2.2 Design Description



Route planning

- Input destination.
- The system will display the best route with the correct battery level
- Based on the rating, select the route.
- Click on the route, and a prompt window will appear to select Google Maps for navigation.
- The route information will be delivered to Google Map.

Rating system (community)

- Read the diaries and experiences shared by other users
- Read reviews and experiences of the route
- Increase communication and exchange between users



Merge system

- Since the merge system, users can scan the QR code of any charging station to pay and charge.
- The user can see the power more visually by charging according to the percentage of power.



8.3 B2B Design

8.3.1 Workflow

According to the data from the interview with the government staff, people's range anxiety or concerns about purchasing electric vehicles are caused by poor planning of charging station construction and opaque information.

Through B2C design, we can obtain the usage data and situation of operators and users, and B2B design can use this data to analyze the charging station service in the city and better manage the construction of charging stations in the city.



Route planning

- Keeps the route navigation and route selection functions for UMI only

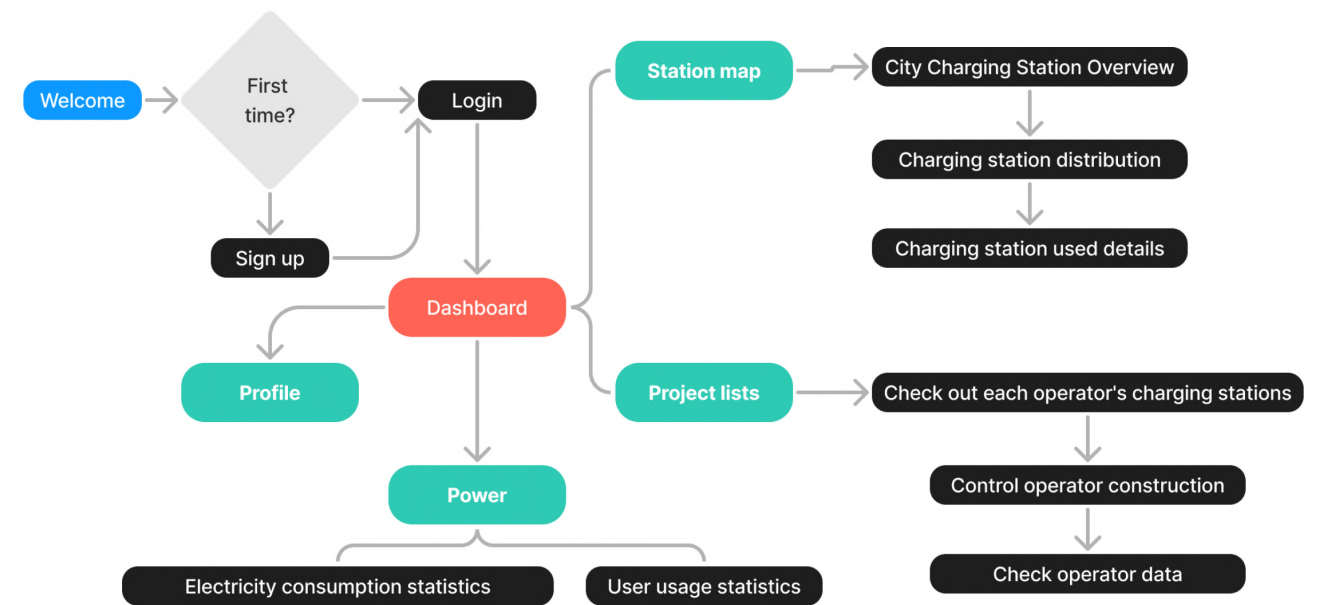
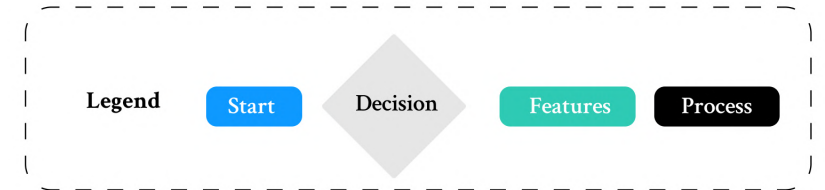
Route planning

- Check the rating and information of the route, and choose the suitable route



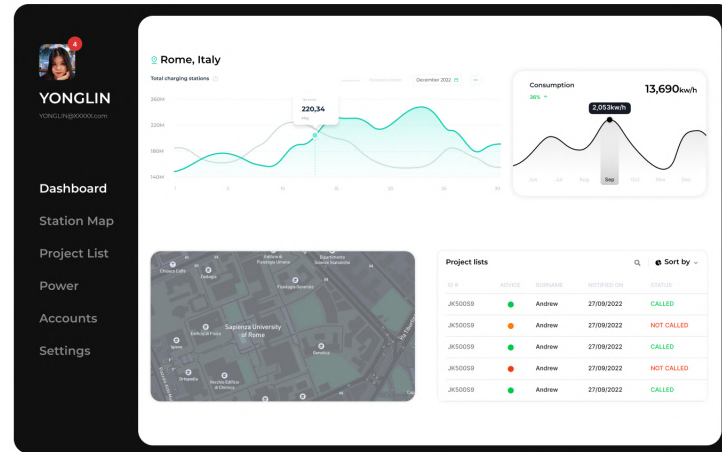
Real-time feedback

- The driver can receive the following feedback through the carplay port:
 - Distance to charging station
 - Charging station usage



8.3.2 Design Description

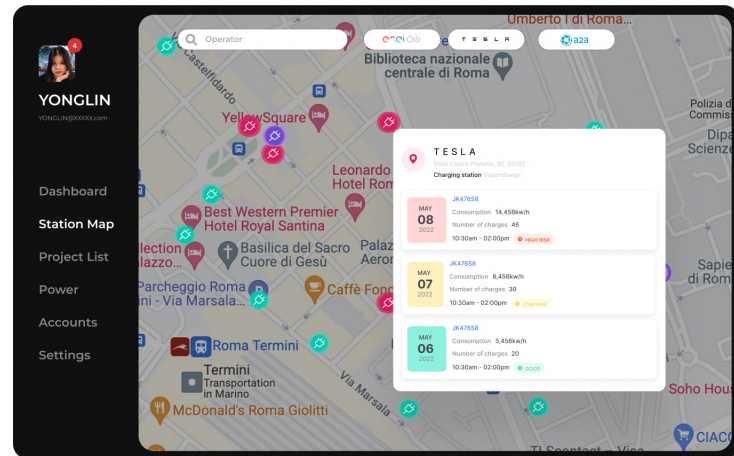
Homepage



Station map

Government and related staff can check the distribution of charging stations throughout the city

Information and records on the usage of each charging station

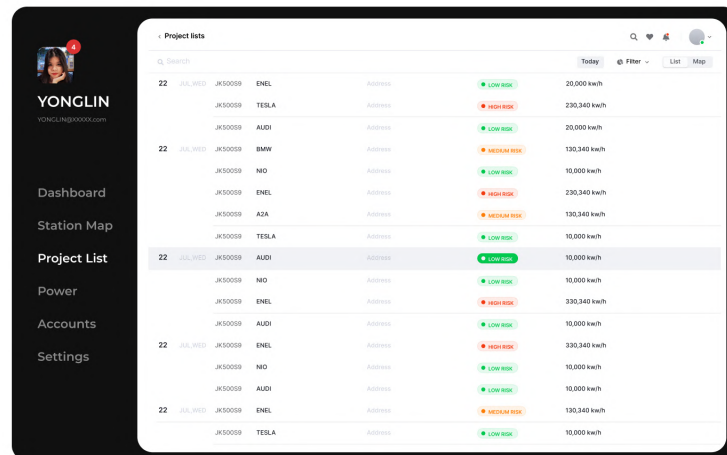


Project lists

Government and related staff can check the construction of charging stations throughout the city, as well as the profile of the charging stations

Review and management of charging station construction

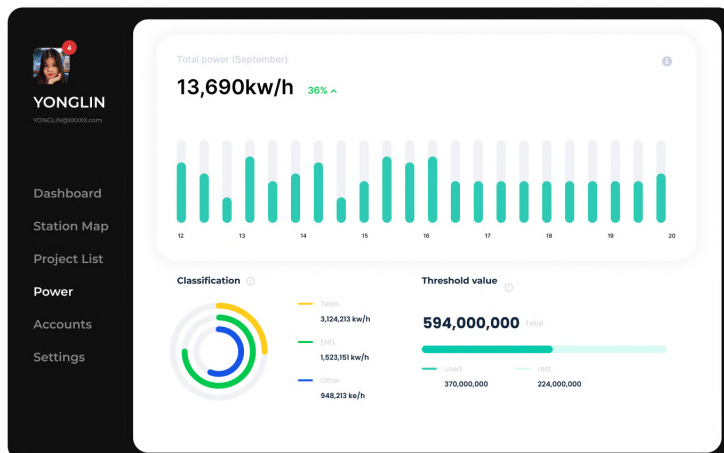
*Each charging station has a unique number "JK500X9"



Power

Government and related staff can check the power consumption of the charging stations.

Manage electricity consumption and set up electricity consumption plans



9 Product Evaluation

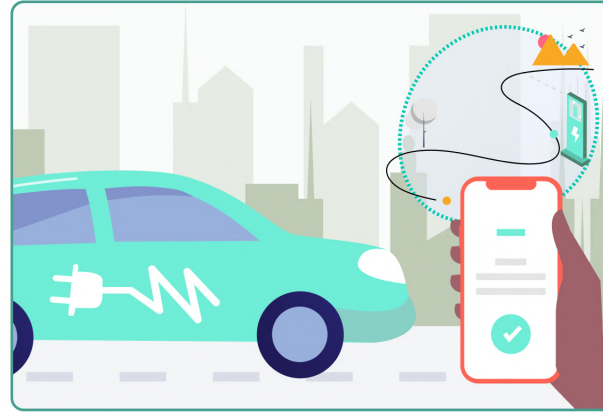
9.1 Storyboard After



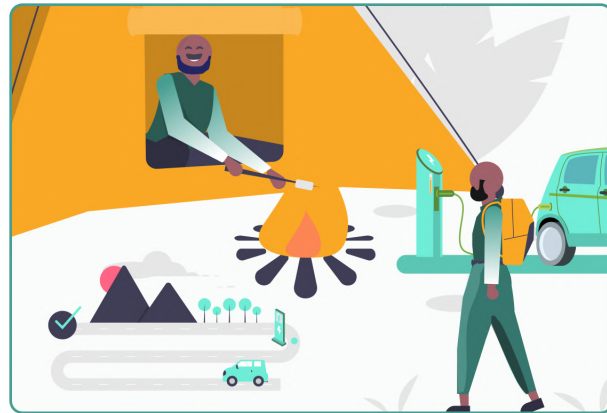
Andrea Geta
Office Administrator
38 years old
Amsterdam, Netherlands



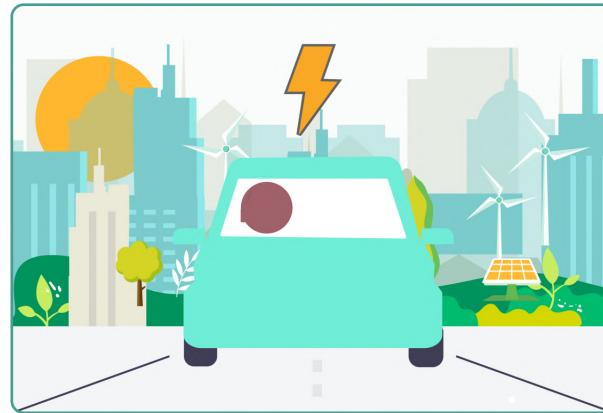
1. He is going on a weekend trip by car



2. In the suburbs, he can check which charging stations, including private charging stations, are available on the app and pay for them



3. Plan and calculate the route and battery usage in advance, and enjoy the trip



4. For the charging problem, he does not have any worries on the way home, because the power is sufficient



Karle Feng
HR Officer
27 years old
Berlin, Germany



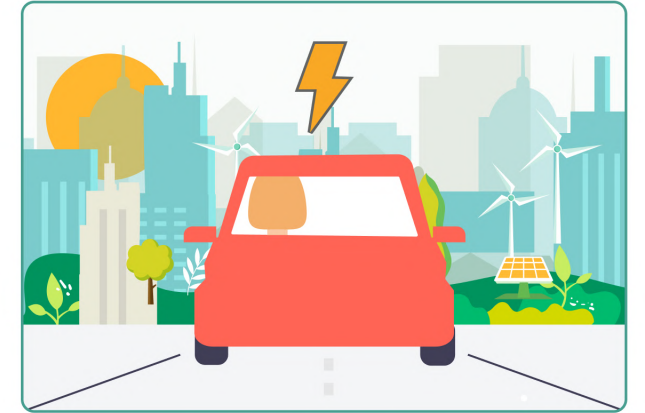
1. As she usually does, she commutes by car



2. When she drives, she navigates through the car app. The app provides her with regular battery feedback

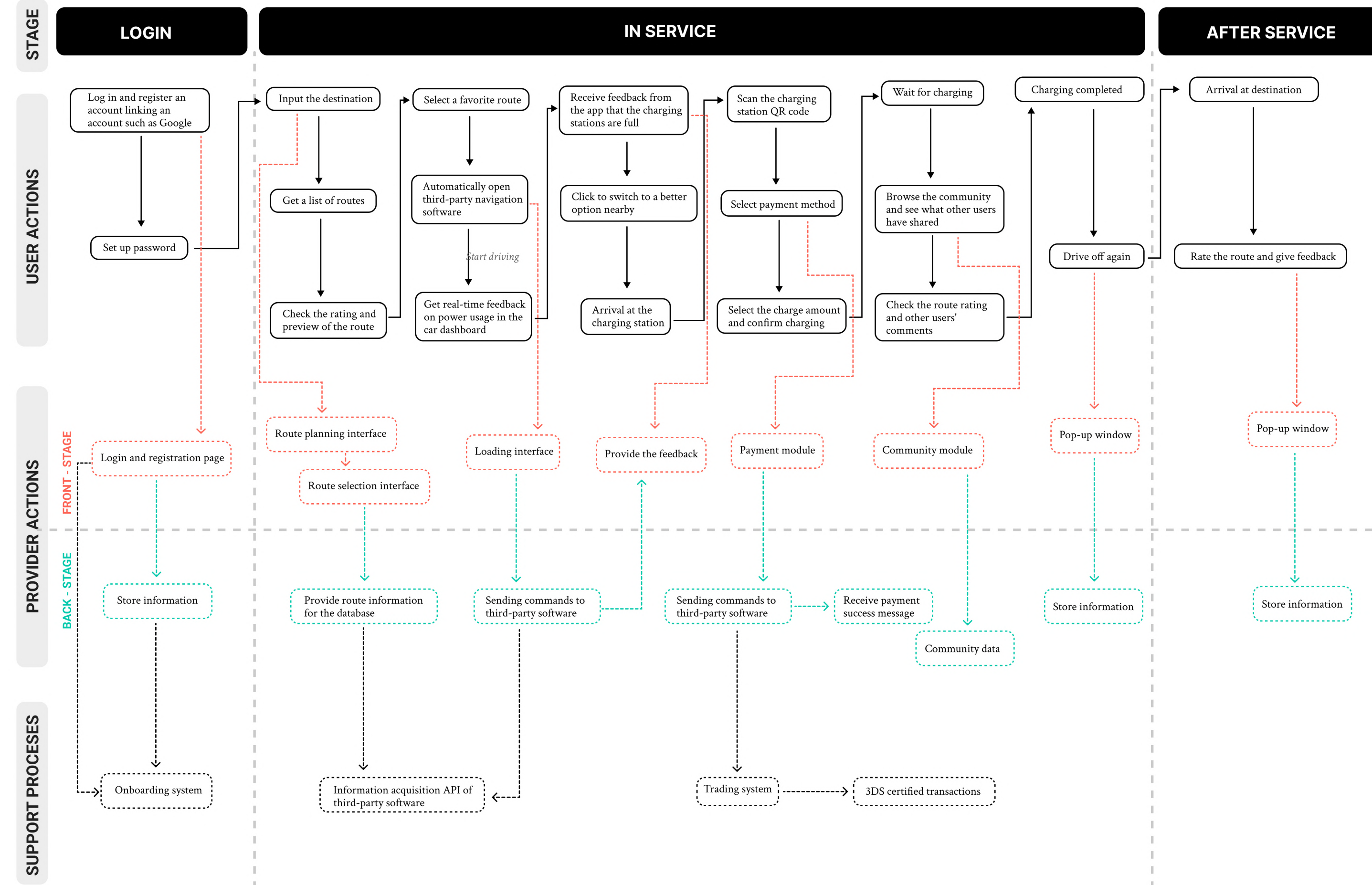


3. Follow the system's directions to find the charging location, she browses the community while charging

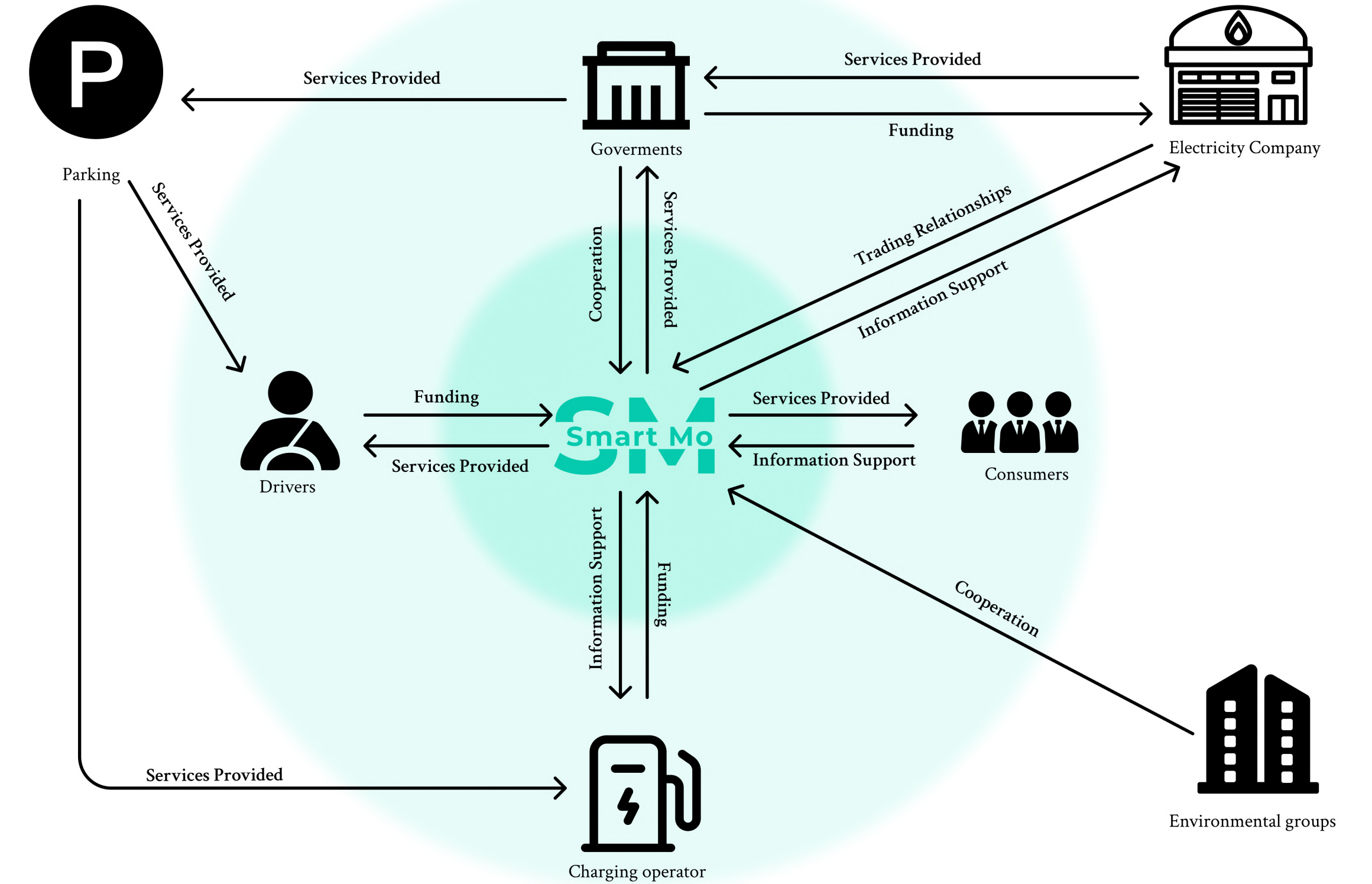


4. Enter her destination, she checks the route rating and chooses the best route to drive away

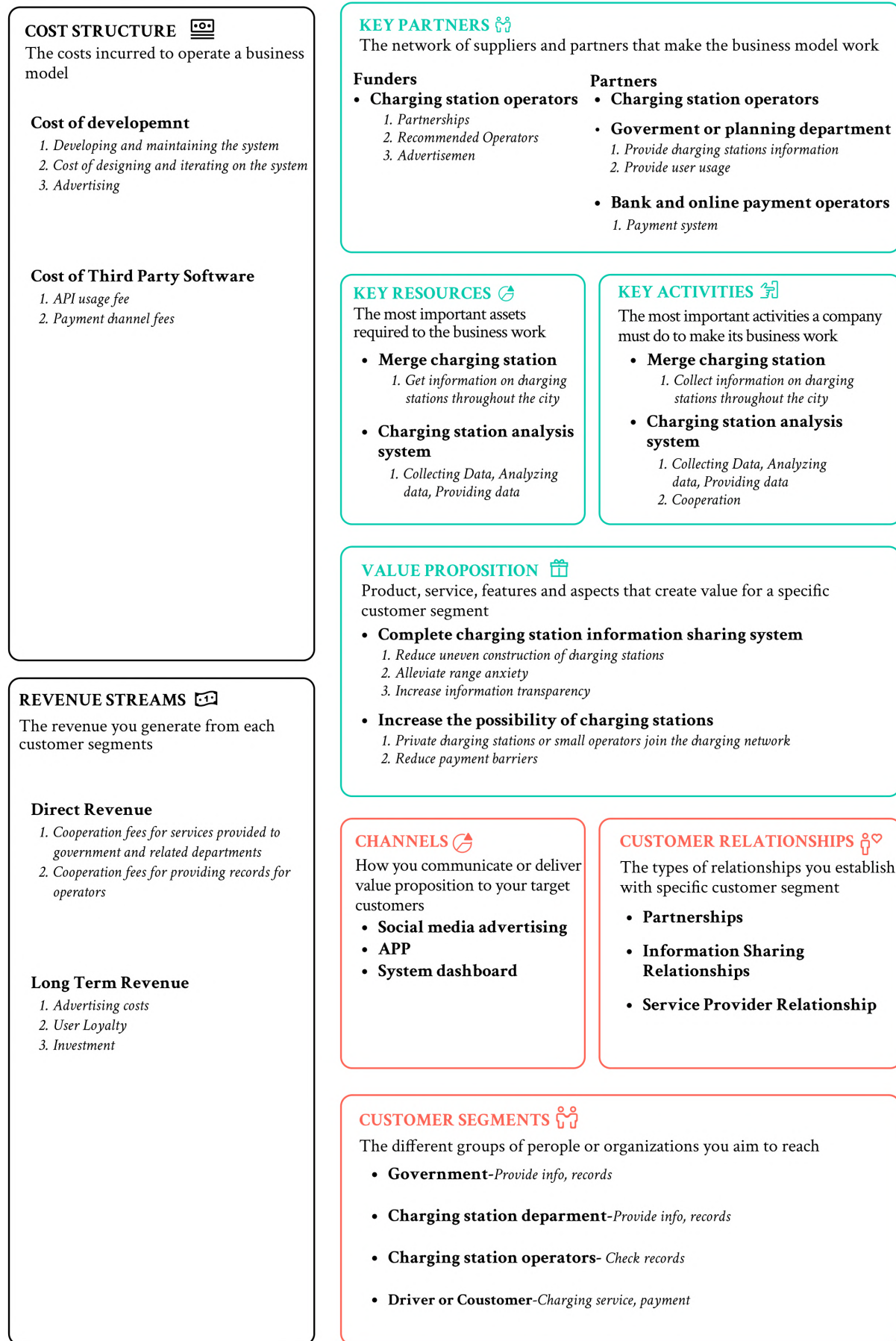
9.2 Service Blueprint



9.3 Stakeholder Map



9.4 Business Model Canvas



9.5 Summary

Economic

- Reduced costs for reducing unnecessary charging stations
- Provide a more efficient and systematic charging station service
- Users are able to benefit from the service

Society

- Reduces the problem of uneven reduction of charging stations
- Increase the participation and management of small operators and private charging stations
- Transparency of information, increasing user trust
- Satisfy the requirements of the EU environmental policy

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Garrett, J. J. (Director). (2000). The Elements of User Experience [Film].



SAPIENZA
UNIVERSITÀ DI ROMA

Master of Science in
PRODUCT AND SERVICE DESIGN
a.y. 2020-2022

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