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Project Coordinator: Jacqueline Floch, SINTEF

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Supporting Smart Electric Mobility in Cities
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GreenCharge Project Deliverable: D2.14

Intermodal On-street Car Sharing Stations in New Housing Development

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About GreenCharge

GreenCharge takes us a few important steps closer to achieving one of the dreams of modern cities: a zero-emission transport system based on electric vehicles running on green energy, with traffic jams and parking problems becoming things of the past. The project promotes:

Power to the people!	The GreenCharge dream can only be achieved if people feel confident that they can access charging infrastructure as and when they need it. So GreenCharge is developing a smart charging system that lets people book charging in advance, so that they can easily access the power they need.
The delicate balance of power	If lots of people try to charge their vehicles around the same time (e.g., on returning home from work), public electricity suppliers may struggle to cope with the peaks in demand. Therefore, we are developing software for automatic energy management in local areas to balance the demand with available supplies. This balancing act combines public supplies and locally produced reusable energy, using local storage as a buffer and staggering the times at which vehicles get charged.
Getting the financial incentives right	Electric motors may make the wheels go round, but money makes the world go round. That's why we are devising and testing business models that encourage use of electric vehicles and sharing of energy resources, allowing all those involved to cooperate in an economically viable way.
Showing how it works in practice	GreenCharge is testing all of these innovations in practical trials in Barcelona, Bremen and Oslo. Together, these trials cover a wide variety of factors: *vehicle type* (scooters, cars, buses), *ownership model* (private, shared individual use, public transport), *charging locations* (private residences, workplaces, public spaces, transport hubs), energy *management* (using solar power, load balancing at one charging station or within a neighbourhood, battery swapping), and *charging support* (booking, priority charging).

To help cities and municipalities make the transition to zero emission/sustainable mobility, the project is producing three main sets of results: (1) *innovative business models*; (2) *technological support;* and (3) *guidelines* for cost efficient and successful deployment and operation of charging infrastructure for Electric Vehicles (EVs).

The *innovative business models* are inspired by ideas from the sharing economy, meaning they will show how to use and share the excess capacity of private renewable energy sources (RES), private charging facilities and the batteries of parked EVs in ways that benefit all involved, financially and otherwise.

The *technological support* will coordinate the power demand of charging with other local demand and local RES, leveraging load flexibility and storage capacity of local stationary batteries and parked EVs. It will also provide user friendly charge planning, booking and billing services for EV users. This will reduce the need for grid investments, address range/charge anxiety and enable sharing of already existing charging facilities for EV fleets.

The guidelines will integrate the experience from the trials and simulations and provide advice on localisation of charging points, grid investment reductions, and policy and public communication measures for accelerating uptake of electromobility.

For more information

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Executive Summary

This deliverable is intended to give the reader insides into the e-Carsharing business demonstrated in BREMEN DEMO 2 (BRE.D2). Car-Sharing as such is not in the overall focus of the GreenCharge project, but as the project is trying to overcome hurdles in the use of electric vehicles, e-Car-Sharing became an interesting use case. Especially charging related issues often appear in close connection to operational questions, making the setup, operation and scaling of a e-Car-Sharing business much more complex than a comparable business using ICE Cars. The Bremen demonstrator was able to show that the Bremen law for the provision of parking spaces in new construction projects can help to promote e-car sharing. Cooperation between housing associations and e-car sharing providers makes it possible to efficiently overcome the hurdles of set-up by the provision of parking space and charging infrastructure.

The System firstly rolled out in the first half of the GreenCharge Project was revised and adjusted based on the experiences gained during the operational phase in order to provide a better user experience and to deal with issues caused by the COVID-19 pandemic. Despite this improvement, the use of the vehicles was restrained.

To increase the utilization of both the charging infrastructure and the shared cars, two potential extensions of the demonstrator have been tested for their feasibility:

- Extension of Fleet management system with Charge Point Operations System

The first goal of this extension is to show how sharing charge points between the shared EV fleet and private users could enhance the reliability of recharging options in the neighborhood on the one hand and produce an additional positive business outcome on the other hand.

- Extension of Fleet management system with Mobility as a Service Platform

The second goal is to extend the fleet management with a connection to a local Mobility as a Service Provider to show how an intermodal service can help to promote the use of shared EVs.

As a result, however, the implementation of the outlined extensions met with serious obstacles and therefore were not implemented. The sharing of charging points requires a complex connection of third-party solutions whose interfaces are only partially standardized. Even if vendors could be convinced to open up their systems, it is highly unlikely that the investment would have a positive impact on the bottom line, given the business data collected. Furthermore, since charging points are seldom available due to the low use of the sharing vehicles, there are also problems on the operational side.

A much more positive balance can be drawn from the connection of MaaS platforms. The implemented prototype shows that the developed fleet management system fulfils the basic requirements for the connection. A full demonstration during the project was not possible since no suitable MaaS provider was active in Bremen, but still the prototyped connection serves as a prove of concept and can by used for future service extensions.

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

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List of Abbreviations

Table 1 List of abbreviations

Abbreviation	Explanation
CS	Charging Station
CPO	Charge Point Operator
EV	Electric Vehicle
eMaaS	Electric Mobility as a Service
MaaS	Mobility as a Service
SoC	State of Charge
UC	Use Case

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1 About this Deliverable

1.1 Why would I want to read this deliverable?

The BRE2 demonstrator focuses on e-Car-Sharing in residential neighbourhoods. It is part of the Bremen pilot. This deliverable presents the car-sharing concept implementation as well as the results of different evaluations of user needs and user experience used for the development of an intermodal e-Car-Sharing solution.

1.2 Intended readership/users

This deliverable focuses mainly on readers with (technical) knowledge on the design and implementation of e-Mobility and / or (e)car-sharing solutions.

The GreenCharge project partners involved in design, development or deployment of the pilots can find additional information about the final state of the Bremen Pilot.

Due to the deliverable's scope, it may also be interesting to external stakeholders planning to deploy e-Mobility solutions (mainly in Germany). Decision-makers responsible for the e-Mobility landscape could find improvement possibilities based on lessons learned. Housing companies get insights into cooperation conditions of e-Mobility solutions provided to residents.

1.3 Other project deliverables that may be of interest

The following deliverables are providing additional information about the pilot execution with respect to different fields of interest:

- General Pilot planning, implementation and set up:
  - D2.10 *Implementation Plan for Bremen pilot*
  - D2.11 *Pilot Component Preparation for Full-Scale Pilot (Bremen)*
  - D2.12 *Full-Scale Pilot Implementation for Car Sharing*
  - D2.13 *Technical Monitoring Report and Feedbacks (Bremen)*

- Business model:
  - D3.3 *Revised Version of Business Models*
  - D3.4 *Final Business Model Designs*

- Car-Sharing in Sustainable Urban Mobility Planning:
  - D7.2 *Recommendations and Guidelines for Integrating E-Mobility into SUMPs*

1.4 Other projects and initiatives

ZET AT took part in the eMaas-Project from 01/2018 to 06/2020. The overall goal of this EU funded project was to advance adaption of electric mobility in Europe. Therefore, eMaaS combined innovative technology and new business models to create the conditions for large scale adaptions of electric vehicles.

The integration of various forms of transport services into a single mobility service accessible on demand is the key of the MaaS concept. However electric mobility poses special challenges. The eMaas Project explored this challenge and implemented the so called TOMP-API (Transport Operator Mobility-as-a-service Provider - API) standard for the integration of shared EV fleets into a MaaS Platform.

Through the new car sharing system, developed during the GreenCharge Project, it is now possible to transfer all relevant data (e.g. live State of Charge) to the MaaS platform using the new TOMP-API standard.

Read more on: https://emaas.ui.city/

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

2 Overview Pilot Bremen Demonstrator 2 e-Car-Sharing

2.1 Status after Project Phase I

As described in *D2.12 Full-Scale Pilot Implementation for Car Sharing* the demonstrated system consists of different hardware and software parts. Electric Cars and the needed charging infrastructure are used for public car sharing. During the project the former used in-vehicle system has been replaced by a new system. Also a new fleet management software connected to a new user interface (Car-Sharing App) has been developed, implemented and tested.

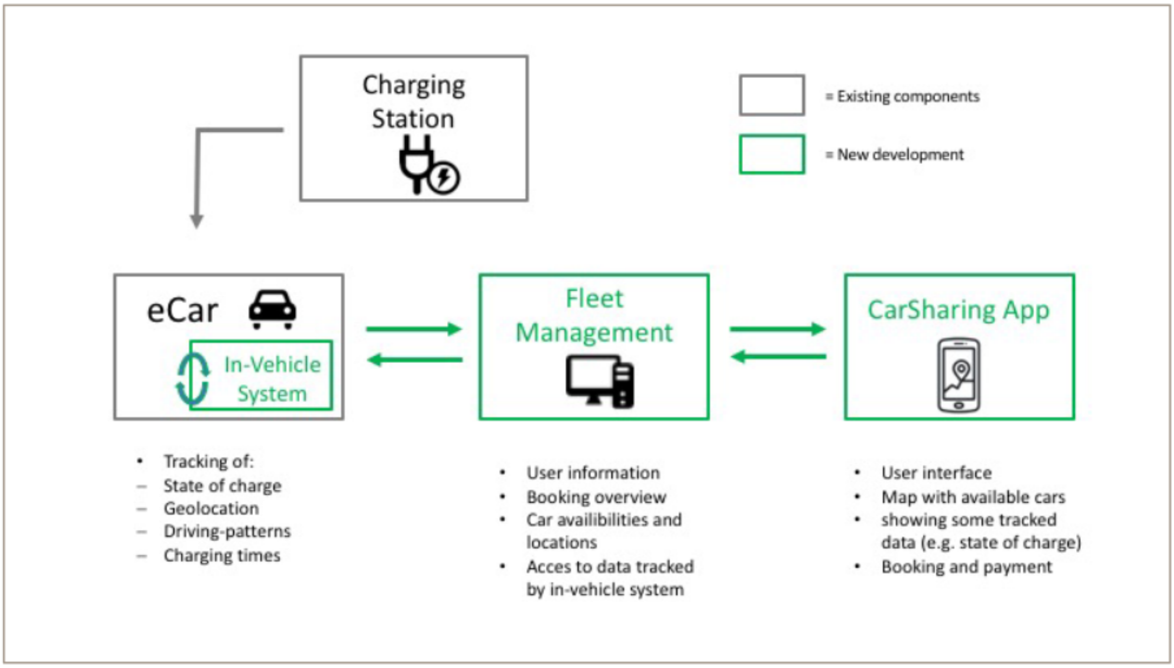

Figure 1 Overall architecture BRE.D1 - Project Phase I

2.2 Components implemented

The following table illustrates the components implemented in the first project phase within the Bremen demonstrator 2 and describes how these components relate to the GreenCharge Reference Architecture (D4.2).

Table 2 Components installed BRE.D2 *(see source: D2.12 Full-Scale Pilot Implementation)*

GC Reference Architecture Service	Component name	Description	Demo site	Type	Partner
Mobility as a Service	CS-Frontend (ZET APP)	The ZET App provides EV access as well as information about public transport to the customer	BRE.D2	SW	ZET

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Fleet management	Fleet management system	This Backend system provides EV status information to the fleet manager	BRE.D2	SW	ZET
EV In-vehicle system	OTA Key Box	Vehicle system plugged to the EV OBD2. It allows the communication between EV and other s/w components	BRE.D2	HW	ZET
EVSE	Wall boxes	5 wall boxes enabling charging for Car-Sharing EVs at local housing blocks	BRE.D2	HW	ZET

2.3 E-Car-Sharing in new housing development KSS54 - URBAN LIVING AT THE EUROPAHAFEN

In early 2020 a local housing cooperative finished the construction project *KSS54* - URBAN LIVING AT THE EUROPAHAFEN. The 6-storey building has 58 residential and 2 commercial units in Bremen's Überseestadt.

Figure 2 KSS54 Car-Sharing Station Europahafen

ZET started its e-car-sharing service in cooperation with the local housing cooperative to demonstrate the new developed e-carsharing system. The basis of this cooperation is a law from 2013 which made it possible to compensate parking spaces with mobility management in new buildings. One of the major parts to implement a low car- and low carbon mobility management as a housing company can be to provide a charging infrastructure together with an e-car-sharing offer. Especially for inner-city, housing car parking spaces are very expensive – underground parking spaces easily cost 10-15% of the whole building.
Another way to compensate obligatory parking spaces is to pay a compensation amount for each parking lot you cannot offer. This amount differs from district to district between 1500€ - 11800€ for each parking lot (§7 1-2 StellplOG Bremen).

The alternative to compensate these costs by smart mobility managing is highly welcome by housing associations. This opportunity is highly beneficial for cities, too, as less vehicles but more efficiently used vehicles take part in the overall traffic. That's why this system is included in the Bremen Sustainable Urban Mobility Plan (SUMP) e.g. in more detail presented in Deliverable D7.2 "*Recommendations and Guidelines for Integrating E-Mobility into SUMPs*".

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3 Demonstrator iteration II

3.1 CS-Frontend ZET Car-Sharing App (s/w)

One of the main tasks of project phase II was to translate user feedback into user experiences adoptions. The Car-Sharing Frontend (CS-Frontend) had been consistently updated to guarantee an easy booking journey for the user. Figure 3 gives an example of the adaptions done in the second demonstrator iteration. The App provided much more functionally and information on one page to give the user a better overview of the selected vehicle. Start and end date of a potential booking can be entered directly without the need of switching the screen. Also more details about the car itself can be displayed in a pop-up window. The shown picture gives the user a better impression of the vehicle before going deeper into the booking process.

In addition to the appearance of the app, the functionality has also been significantly expanded. Many processes that were previously handled by the fleet manager in direct customer contact had to be revised, also for reasons of infection control during the COVID-19 pandemic. Customers can now make essential changes to their account directly in the app. This also includes the regular validation process of the driver's license.

Day-to-day business has also shown that the wide variety of end devices in particular has repeatedly led to unforeseen functional failures during the registration process. Accordingly, this process was fundamentally revised to ensure stability.

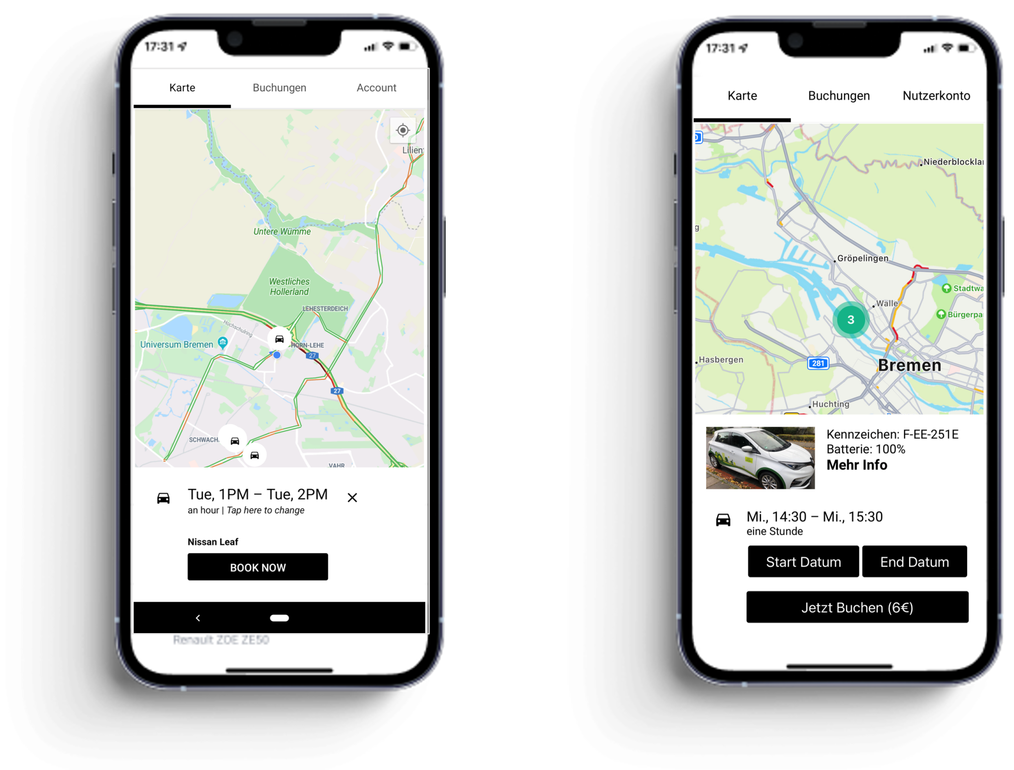

Figure 3 Usability update based on customer feedback *(Source: ZET. Share App)*

The operation of the demonstrator consistently delivers the need for adaptions. The following table describes the update history of the CS-Frontend.

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Table 3 Release history ZET Car-Sharing App

Release No.	Build No.	Update description
2.0	34	• Redesign of vehicle booking field • Grouping of vehicles in close positions e.g. at Stations • Improvement of location detection
2.1	36	• Forgot password option on log in page • Automatic one time password (OTP) generation • Automatic e-mail notification update including new OTP service
2.1.1	37	• Improved stability of registration process
2.1.2	38	• Updated driver's license validations prosses • Possibility to re-upload and edit license
2.1.3	39	• Possibility to edit personal data e.g. connected e-mail address, invoice address and phone number
2.1.4	40	• Update of invoice overview • Minor bug fixes

3.2 EV fleet and In-Vehicle system (h/w)

During the first "lockdown" in Germany in May 2020, we took advantage of the generally low demand for mobility to upgrade our fleet from Renault ZOE ZE 40 to the new model Renault ZOE ZE 50. Basically, the upgrade was for contractual reasons, but it was also beneficial from the customer's perspective. The new model has a larger battery and better overall equipment. Furthermore, greater interest from customers was to be expected, as we made it possible to use a new car at a fair price, which enjoys great popularity in Germany.
The plug-and-play technology of our in-vehicle system was particularly beneficial for this fleet upgrade. The installation of 4 vehicles on site could be done without a mechanic and in less than one hour. The deliverable *D2.12 Full-Scale Pilot Implementation for Car-Sharing* describes the in-vehicle system and the installation in more detail.

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

Figure 4 Vehicle Change – Upgrade Renault Zoe ZE.40 to ZE.50 *(Source: Dennis Look)*

The following table presents a comparison between the Renault ZOE ZE 40 and the new Model Renault ZOE ZE 50. the following data are particularly important for Car-Sharing:

Table 4 Technical data fleet upgrade

Technical Data	Renault ZOE ZE 40	Renault ZOE ZE 50
Battery Capacity (kwh)	41,0	52
Max. Charge Power AC (kW)	22	45
Max. Charge Power DC (kW)	22	46

Next to the change of the vehicles we also acquired a new business possibility. We extended the cooperation with the local housing association and established a new marketing cooperation contract. We are using the surface of the shared vehicles to present logos of the housing association. By that we gained two benefits: firstly a financial benefit and secondly we created a higher visibility of our cars and services in the local neighborhood. Also the housing cooperative became an additional first point of contact for residents which are interested in using the service. Find more information about the business model in Deliverable D3.4 *Final Business Model Designs.*

Figure 5 Vehicle branding *(Source: Dennis Look)*

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

3.3 Data Collection

The data collection strategy, which was implemented in the first half of the project, aimed to collect data only via the used in-vehicle system. After multiple iterations and provided test data sets, we came to the conclusion that the original planned process is not sufficient for the purpose of evaluation aspired by the project. Therefore, we extended the way of data collection by adding data logged by the charge point.

Via a technical interface, provided by the charge point manufacturer, it was possible to download logged data from a charge point internal storage on a monthly base. By combining charge point data and in-vehicle system data the required research data set could be composed. The Deliverable *D2.13 Technical Monitoring Report and Feedbacks* describes the collected data in more detail.

Table 5 Implementation of data collection process

Testing	Date	Description	Status
Access Service Installer	14.01.2021	To access the service installer provided by the charge point manufacturer, the manufacturer have to create credentials. Test: Download and log in to service installer	success
Access Charging Point log	24.02.2021	To access the log of the charge point, the charge point and the service installer have to be connected. Test: Request charge point log	success
Request first usable data set	26.03.2021	As the internal storage of the charge point is limited, the log have to be cleared after each request. The fist usable results therefore had been collected on month after the first access. Test: Request charge point log	success

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4 Demonstrator extensions

4.1 Prototyped extended architecture for Project Phase II

The microservice based architecture makes the new developed system environment flexible enough to be scaled and extended seamlessly. Project Phase II evaluated different extensions of the demonstrator to incorporate 3rd party services.

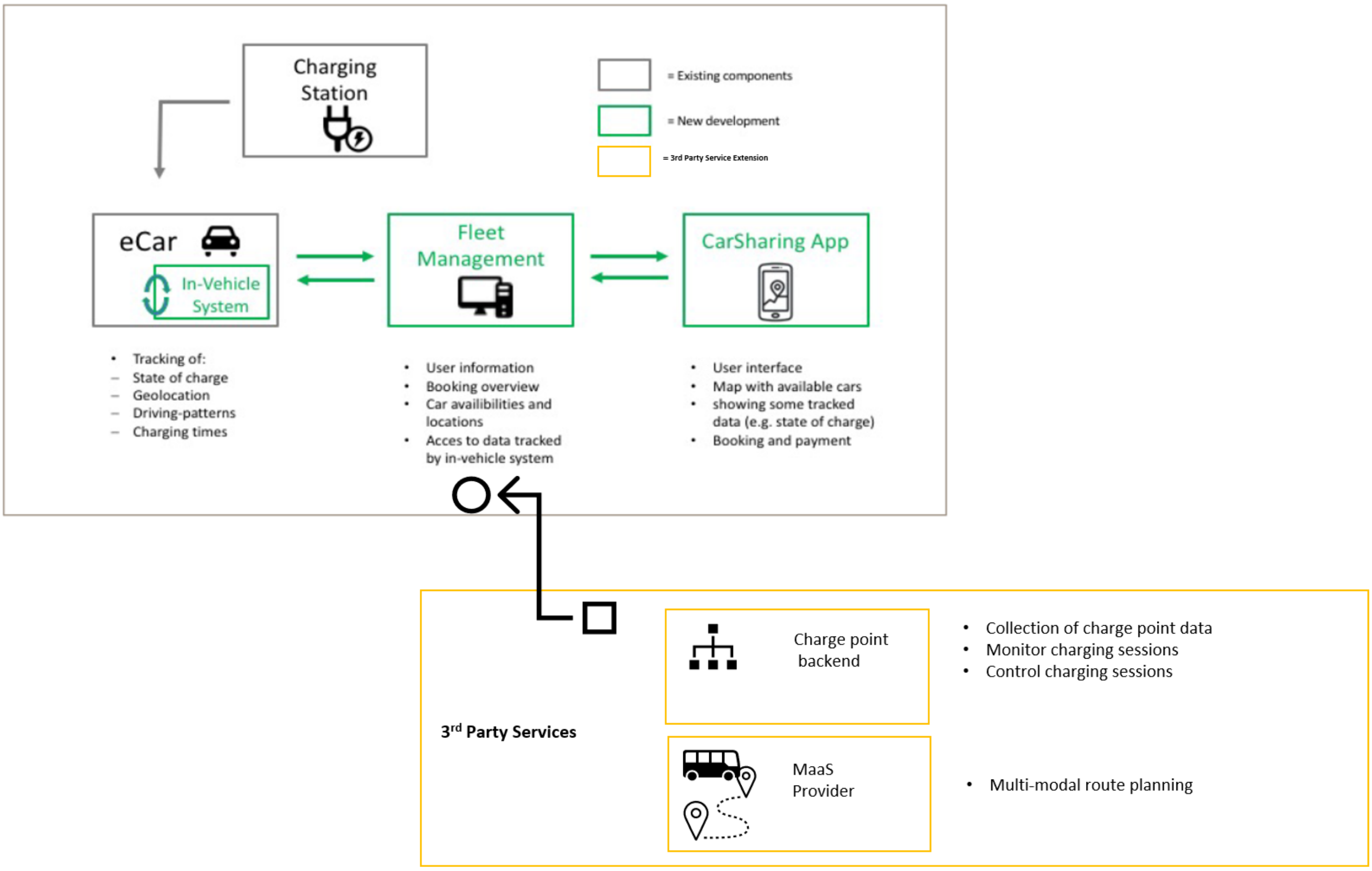

Figure 6 Overall architecture BRE.D2 - Project Phase II

Two main extensions of the demonstrator were made in the second project half:

- 1) Connection between Fleet management system and Charge Point Backend Provider

The goal of this extension is to explore how a fleet management platform for e-vehicles can be combined with charging station booking in a user-friendly way in order to a) enhance the reliability of recharging options and b) optimize the charging process with respect to cost and use of green energy *(see DOA Annex I, p.:13)*.
To fulfil this task, the existing system needed to communicate with a 3rd party provided backend system and exchange relevant live information. The fleet management system had to become the control unit and needed to be able to overrule the authentication process generally controlled by the charge point backend.

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The overarching goal with regard to the special requirements of e-car sharing was to be able to compensate for the increased investment costs by sharing charging points.

- 2) Connection between fleet management system and MaaS Provider

Second goal of the extension was to investigate how intermodal EV-Car-Sharing can be promoted. Intermodal carsharing from our point of view needs a technical integration of different mobility offers like public transport and micro-mobility. To promote and establish this kind of sharing it was necessary to connect the fleet management system with a Mobility as a Service (MaaS) Platform..

Again, the overarching goal with regard to the special requirements of e-car sharing was to be able to compensate for the increased investment costs and to build a sustainable business model. The GreenCharge Architecture presented in D4.2 *Final Architecture Design and Interoperability Specification* sketches how to technically set up such service extensions:

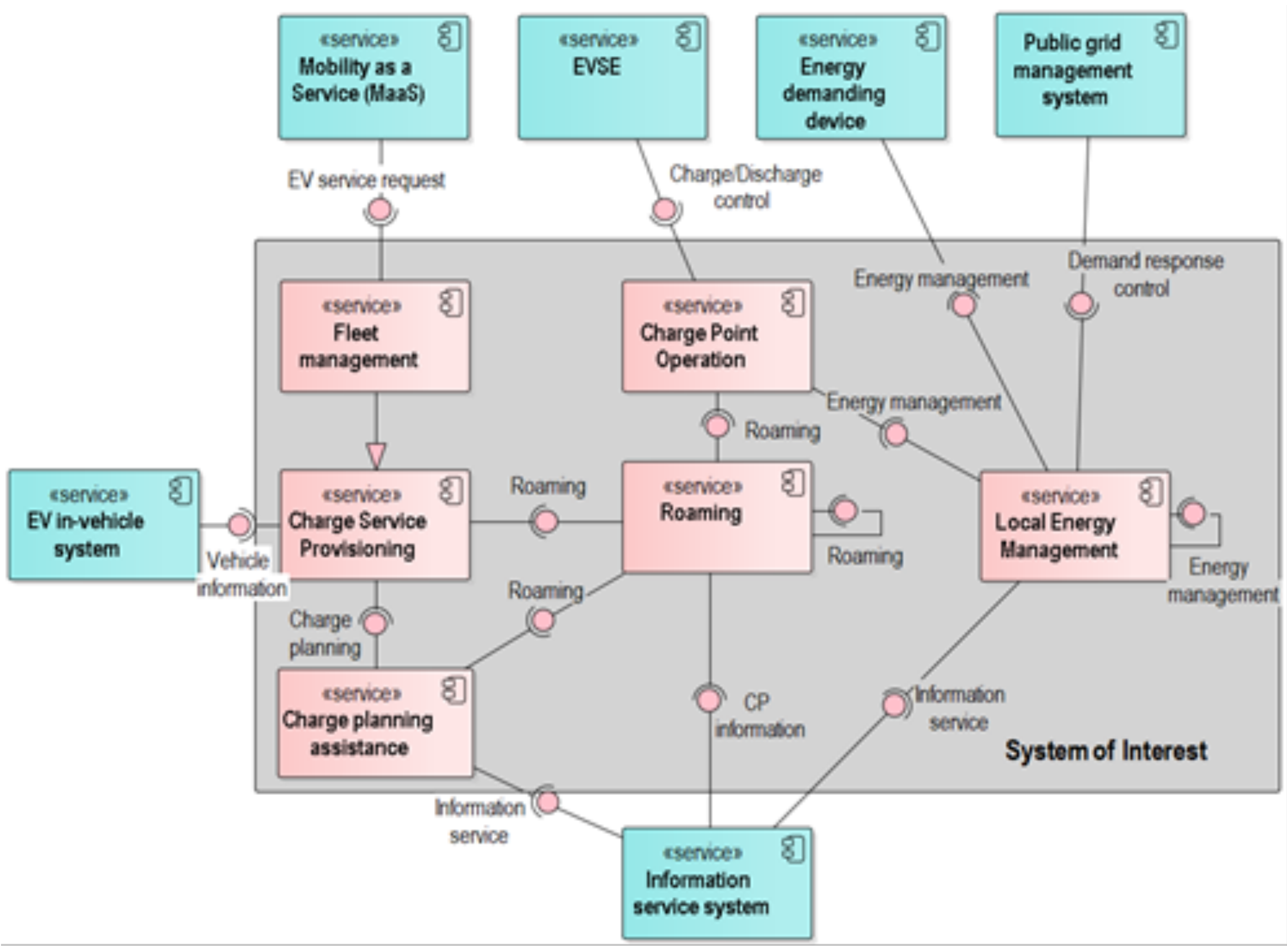

Figure 7 D4.2 Final Architecture Design.

4.2 Components involved

The following table illustrates the components implemented in the second project phase within the Bremen demonstrator 2 and describes how these components refer to the GreenCharge Architecture.

Table 6 Overview components involved

Service	Component name	Description	Type	Partner
Mobility as a Service	CS-Frontend (ZET APP)	The ZET App provides EV access as well as information about public transport to the customer.	SW	ZET
Fleet management	Fleet management system	This Backend system provides EV status information to the fleet manager.	SW	ZET
EV In-vehicle system	OTA Key Box	Vehicle system plugged to the EV OBD2. It allows the communication between EV and other s/w components.	HW	ZET
EV charging	Wall boxes	5 wall boxes enabling charging for Car-Sharing EVs at local housing blocks	HW	ZET
Mobility as a Service	MaaS API	Connection between MaaS Provider and fleet operator system	SW	3rd Party
Mobility as a Service	MaaS Endpoint	Technical access point for API requests in fleet management system	SW	ZET
Charge Station Operation	CPO Backend	Charge point operation backend system to monitor and control charging sessions and enable additional services	SW	3rd Party
Charge Service Provisioning	CPO Backend	Charge point operation backend system to control CP access	SW	3rd Party
Charge Service Provisioning	Fleet management system	Booking calendar for charging facilities coordinating with shared and private charging	SW	ZET
Roaming	eRoaming connection	Connection to an eRoaming Platform e.g. Hubejct	SW	Hubject
Charge Service Provisioning	Electro Mobility Provider (EMP)	Interface for private users to book a charge point, start/stop a session and pay for it	SW	3rd Party

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4.3 Fleet management system combined with Charge Point Operations System

4.3.1 Chare Point Operations System requirements (s/w)

To be successfully used in the described extended architecture the 3rd party Charge Point Operations system had to fulfill certain requirement:

- Including the Open Charge Point Protocol (OCPP) version 1.6 or higher
- Including eRoming extension based on the Open intercharge Protocol (OICP)
- Provide smart charge endpoint for 3rd party charge management systems (no standard)
- General charge point compatibility
- Meets the German calibration law standard

4.3.2 Fleet management system requirements (s/w)

To be successfully used in the described extended architecture the 3rd party fleet management system had to fulfil certain requirement:

- Booking calendar for charging facilities coordinating fleet and public charging
- Provide API for user authentication management (no standard)
- Provide API for charge point get requests (e.g. to get charge point status)

4.3.3 Charge Point requirements (s/w + h/w)

To be successfully used in the described extended architecture the 3rd party charge point had to fulfil certain requirement:

- GSM connection via SIM card
- Including the Open Charge Point Protocol (OCPP) version 1.6 or
- Meets the German calibration law standard
- Public accessible

4.3.4 Full- Test of demonstrator extension

Due to the low interoperability readiness level of the technical systems currently available in the involved sectors, it was not possible to implement this demonstrator extension. The complexity and effort needed to implement full-fledged demonstrators was beyond what could be achieved within the budget of this project.

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Also, with respect to the lessons learned from the business model evaluation and the actual operation of the demonstrator, the use case appeared not suitable for a more costly fleet operation system.

Nevertheless, all required technologies have been demonstrated in the Project. The systems used in the Oslo demonstrator which have been developed by ZET can be implemented in a more suitable technical environment. As part of the exploitation of our Key Exploitable Results (KER) the technical systems from Oslo and Bremen will be merged and offered to lager fleets were a positive return on investment can be achieved.

Deliverable D2.15 "*Final Report for Bremen Pilot Lessons Learned and Guidelines*" will elaborate more on the lessons learned during the set up phase of this demonstrator extension.

4.4 Fleet management system combined with Mobility as a Service Platform

4.4.1 Mobility as a Service Provider (s/w)

Mobility as a Service is a relatively new concept of integrating different mobility service providers into one combined platform offer. The idea is mainly supported by different technologically developments of the past years like e.g., the constant internet access of mobile phones.

Mobility as a Service is an ever-growing trend in European cities. Numerous providers are entering the market with intermodal offerings. For example, Jelbi in Berlin, IMOVE in Manchester, UbiGo in Gothenburg, Whim in Helsinki and many others have emerged and continue to expand their services[1]. Unfortunately none of those providers operates in the City of Bremen.

Prior to the launch of the GreenCharge Project, Bremen's public transport operator announced its intention to make its "Fahrplaner" app more multimodal. In fact, the BSAG introduced a new feature in its journey planner app at the end of 2021. In the latest version, the route entered can now be optimized for the user's own bicycle, car, cab or car-sharing vehicle in conjunction with public transport.

Unfortunately, this development was too late to be taken into account in the GreenCharge project.

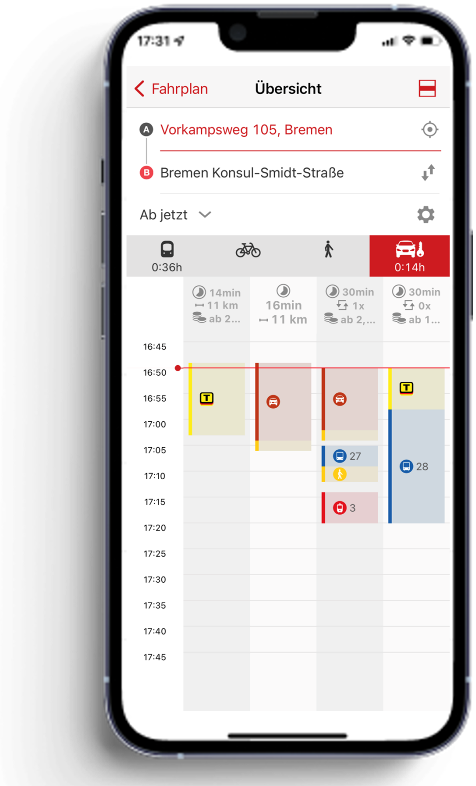

Figure 8 Screenshot "Fahrplaner"-App operated by the bsag

Nevertheless, the development shows how important concepts for a sustainable decarbonization of traffic are. That's why ZET Austria took part int the so called eMaaS Project. During the project ZET Austria and the consortium partners extended the idea of MaaS:

[1] Source: D7.2 Recommendations and Guidelines for Integrating Electric Mobility into SUMPs

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

"electric Mobility as a Service (eMaaS) refers to the integration of multiple forms of (electric) transportation modes – including public transport – and shared electric mobility services (e.g. e-car sharing, e-bike sharing, e-scooter sharing, e-bus, e-taxi) into a single mobility service that allows travelers to plan and go from A to B (and/or from B to C and/or vice versa) in an eco-friendly and seamless way. The service is offered through a single customer-centered interface and it also involves the prearrangement of electric mobility technologies and infrastructure (e.g. charging stations, energy contracts)[2]"

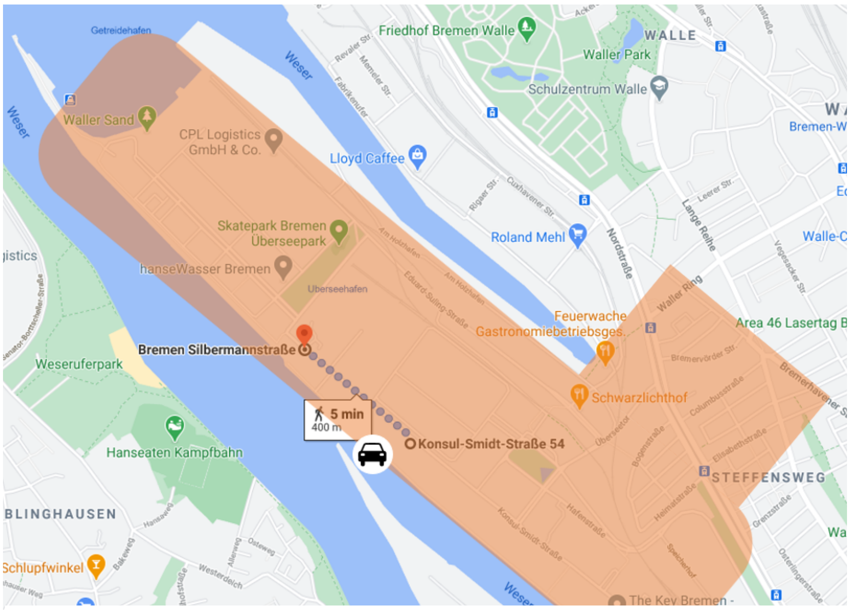

Figure 9 Sketch extended catchment area KSS54

A consistent implementation of the concept including a further integration of micro-mobility providers can, in our view, contribute massively to reduce local emissions in neighborhoods but also to facilitate the shift from private individual transport to shared mobility and thus reduce traffic problems. For example, the catchment area around a car-sharing station can be tripled with the integration of e-Scooters, creating an alternative to private car ownership for many more residents.

4.4.2 Fleet management (s/w)

To demonstrate the connection of the Car-Sharing fleet to a MaaS platform, an API endpoint must be set up in the fleet management system. The API endpoint is subject to the requirements of the respective third-party service provider, even if the requirements are likely to overlap considerably in terms of content. For a complete connection, the following processes must be enabled via the API endpoint:

- Get operator information (e.g. systems, stations, operating hours)
- Get planning data (e.g. model, geo position, SoC, range, booking status)
- Get support information
- Post a booking (Location, start time, end time, user detail)
- Trip execution (e.g. giving the user access to the shared car)
- Payment (exchange of payment information)

[2] Reyes García, J.R.; Lenz, G.; Haveman, S.P.; Bonnema, G.M. (2020), State of the Art of Mobility as a Service (MaaS) Ecosystems and Architectures—An Overview of, and a Definition, Ecosystem and System Architecture for Electric Mobility as a Service (eMaaS). World Electr. Veh. J. 2020, 11, 7.https://doi. org/10. 3390/wevj11010007

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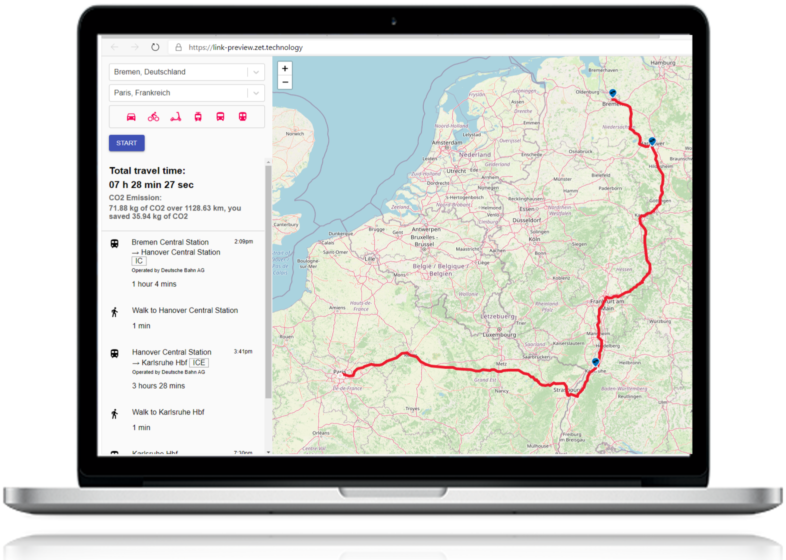
4.4.3 Full-test of demonstrator extension

The depth of integration can, due to the complexity, vary from provider to provider. A deep integration including booking, payment and trip execution is rarely performed, even if the first mobility providers established appropriate processes (e.g. VOI).



Since no suitable MaaS provider was available in Bremen at the time of the project, the connection to a multi modal route planning tool was demonstrated.

The multimodal route planning prototype ZET.Link was developed by ZET Austria as part of the eMaaS project. It uses free accessible API interfaces to different mobility services to optimize route options. The optimization takes different mobility options like Car-Sharing, Bike-Sharing, e-Scooter and public transport into account to provide the fastest possible option. Also it shows the user the estimated CO2 emission of the trip compared to the same trip using an internal combustion engine car only.

Figure 10 ZET.Link MaaS Prototype developed in eMaas Project

Table 7 Overview set up MaaS extension

	Testing	Date	Description	Status
	Operator information test	24.02.2021	To provide an optimized route ZET.Link needs general information about the transport Operator e.g. stations, operating hours Test: Establish API connection to fleet management endpoint. Get HTTP status code 200 OK	success
	planning data test	24.02.2021	To provide an optimized route ZET.Link needs general information about the mode of transport e.g. model, geo position, est. range Test: Establish API connection to fleet management endpoint. Get HTTP status code 200 OK	success
	Support information test	24.02.2021	To provide an optimized route ZET.Link needs general information about support possibilities. Test: Establish API connection to fleet management endpoint. Get HTTP status code 200 OK	success

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5 Conclusion and further work

The implementation described in this document is the result of the second iteration of the integrated prototype. During the first phase of operating the pilot we have identified different changes or improvements for the final iteration:

- The new developed e-Car-Sharing App was iterated multiple times in order to further improve the usability. Mainly feedback form costumers, costumer support and fleet management had been considered for interface changes.
- The interruption of service caused by COVID-19 had been used to upgrade the used vehicles in order to attract more users. In addition, a marketing cooperation with the housing association had been set up with the goal to create a new contact point to residents and to improve the business case.
- To collect data which is better suited to generate value for the project, the processes of data collection have been adjusted. Instead of using vehicle data only, the demonstrator delivers charge point data to contribute to the project evaluation. Also, the collection of charging data provided a better inside into charging related cost for both, the business model evaluation and the fleet operation.
- To contribute to the goal of providing more reliable charging options to the neighborhood, we designed a potential solution to share the charge points used for our service. The demonstration of this solution was not possible due to lack of cooperation in the sector, low standardization and other operational issues.
- To demonstrate the new intermodal car sharing station in a low car and low carbon new housing development, we connected the shared EVs in the local neighborhood to a MaaS - Prototype developed by ZET Austria in the so called eMaaS – Project. Due to the delayed launch of a service announced by an important local 3rd Party provider, further connections could not be realized.

In the following deliverable D2.15 *Final Report for Bremen Pilot Lessons Learned and Guidelines* we will present our lessons learned during the set up and operation of the Pilot in more detail.

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