



# D2.3: CLICK software prototype integration report and demonstrator

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## Abstract

The aim of USER-CHI work package 2 is to design, specify, implement and test a decision support system for the planning of charging infrastructure called “Charging Infrastructure Location and Holistic Planning Kit (CLICK)”. CLICK is an easy to use question-and-answer online tool for the top-down location planning of charging infrastructure. Its purpose is to optimise location planning for new charging infrastructure in cities and TEN-T corridors.

Up to and including Task 2.2, CLICK was specified in terms of functionality, algorithms and interfaces and appearance. D2.2 has set the base for the development of CLICK in T2.3.

Within Task 2.3, CLICK was developed an integrated. The current deliverable D2.3 “CLICK software prototype integration report and demonstrator” summarizes the work carried out in T2.3 and documents the implementation and integration of CLICK.

## Keywords

CLICK, Holistic Planning, Charging Location Planning, Decision Support System, Specification, Architecture

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# 1 Introduction

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## 1.1 Purpose of the Document

USER-CHI's product 1, the Charging Location and Holistic Planning Kit (CLICK), is an easy to use question-and-answer online tool for top-down location planning of charging infrastructure. Its purpose is to optimise the location planning of new charging infrastructure in cities, matching the users' needs, preferences and habits, with the existing charging technologies and typologies available in the market. CLICK analyses inputs and estimates the optimum charging infrastructure to be deployed in the city.

Furthermore, CLICK can be fed with actual utilisation data of charging infrastructure within the cities and planning areas. This enables a post-planning process of monitoring of the utilisation and thereby enable the demand-oriented expansion of the charging infrastructure network taking actual usage into account.

Within T2.3 the demonstrator of CLICK was developed based upon the results of the previous tasks T1.1, T1.3, T2.1 (CLICK High Level Requirements and Targets) and T2.2 (CLICK specification).

With the present deliverable D2.3 "CLICK software prototype integration report and demonstrator", the results of the work carried out in Task 2.3 of the USER-CHI project are documented.

## 1.2 Scope of the Document

Based on previously executed tasks, within T2.3 the functionalities and outlines of CLICK were developed and a CLICK demonstrator was published.

Therefore, based on the specification of CLICK in terms of functionality, algorithms and interfaces of Task 2.2, the actual implementation and integration took place during T2.3.

Due to global external circumstances, parts of the work within WP2 needed to be adapted, resulting in an extended timeline. First, task 2.3 was extended to allow for the compensation of previous delays. Secondly, the delivery data of D2.3 was set to one month before the end of the task in order to be part of the second reporting period of USER-CHI. The currently presented version of D2.3 therefore contains the main outcomes of T2.3. While the connected Task is ongoing, minor changes and additions to the CLICK demonstrator may occur.

## 1.3 Structure of the Document

The present document consists of three major parts:

- Chapter 2 “CLICK Software Prototype” references to the actual software demonstrator.
- Chapter 3 presents the implemented functionalities of CLICK, as specified in T2.2,
- Chapter 4 shows the integration report and outlines the actual integration of CLICK.
- Chapter 5 summarizes the findings and draws the outlook.

## 1.4 Connection to other Tasks

Task 2.3 builds upon Task 2.2, the CLICK specification.

Within Task 2.3, based on the specified functionalities, frontends, backend, algorithms and interfaces, CLICK software prototype was developed.

Within the upcoming Task 2.4, CLICK will be demonstrated among users using the prototype.



## 2 CLICK Software Prototype

Within Task 2.3 of the USER-CHI project, the software platform CLICK ("Charging Infrastructure Location Concept Development Kit") was developed as a prototype and integrated.

The current version of CLICK can be found via the internet at the URL:

[www.click-platform.eu](http://www.click-platform.eu)



Figure 1 CLICK HOME

## 3 Functionalities of CLICK (Process view)

The functionalities of CLICK were specified within D2.2 “CLICK specification”. Therein, the flow of events was specified for the execution of a location concept development process in a high-level view (Figure 2) and in detailed process views (cf. D2.2).

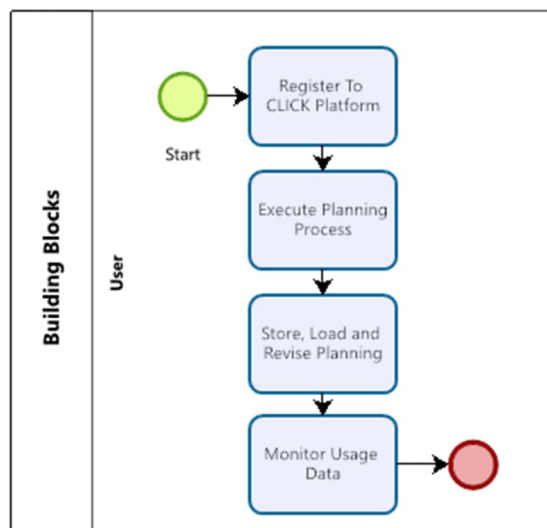


Figure 2 High-Level User Process View

This flow of events is implemented in the CLICK prototype as shown below:

### 3.1 Registration

By opening the click platform via <http://click-platform.eu> using a web browser the user is forwarded to the home section which is accessible for the public. Besides this, there is a personal area called profiles, where the cities can be planned and managed. To do so the users need to register.

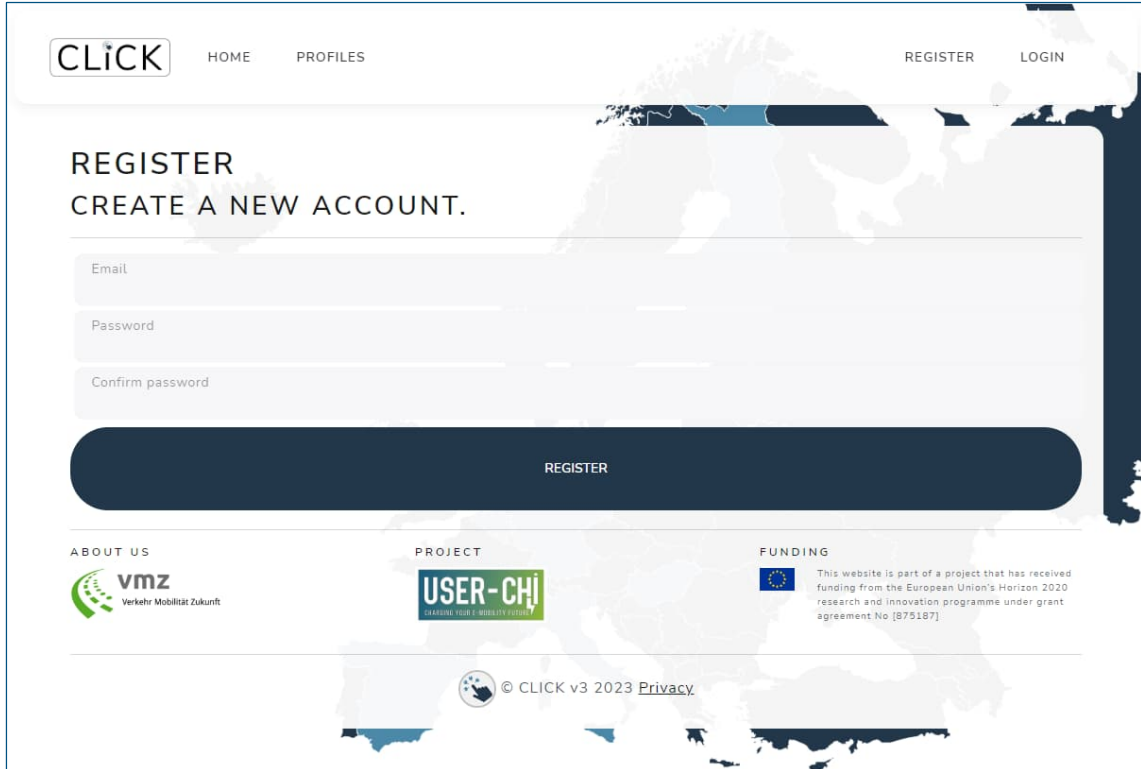
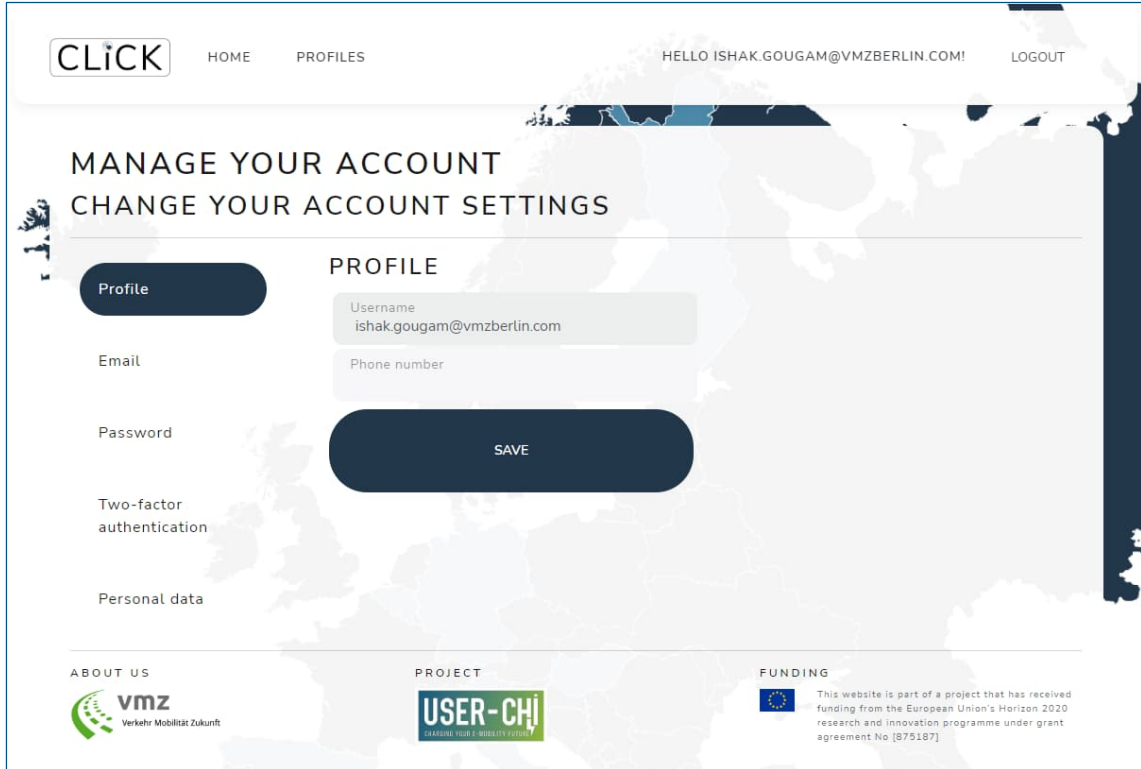


Figure 3 REGISTER

In the top right corner, a link to the “register” functionality can be found. From there user can start the registration by entering an e-mail address, defining a new password and double-checking it (Figure 3). Following data minimization principles, these are the necessary information to complete a registration. After clicking on register, an e-mail with a confirmation link will be sent and by following this link, the process is completed successfully.


Registered users can log in by clicking on the intended button in the top right corner. Therefore it is necessary to enter the credentials (email and password). On top of that the click tool contains a forgot-password functionality to define a new one in case of loss. It is also possible to resend the configuration email from the registration.



**CLICK** HOME PROFILES HELLO ISHAK.GOUGAM@VMZBERLIN.COM! LOGOUT

## MANAGE YOUR ACCOUNT

### CHANGE YOUR ACCOUNT SETTINGS



Profile

Email

Password

Two-factor authentication

Personal data


#### PROFILE

Username  
ishak.gougam@vmzberlin.com


Phone number

**SAVE**


ABOUT US



PROJECT



FUNDING

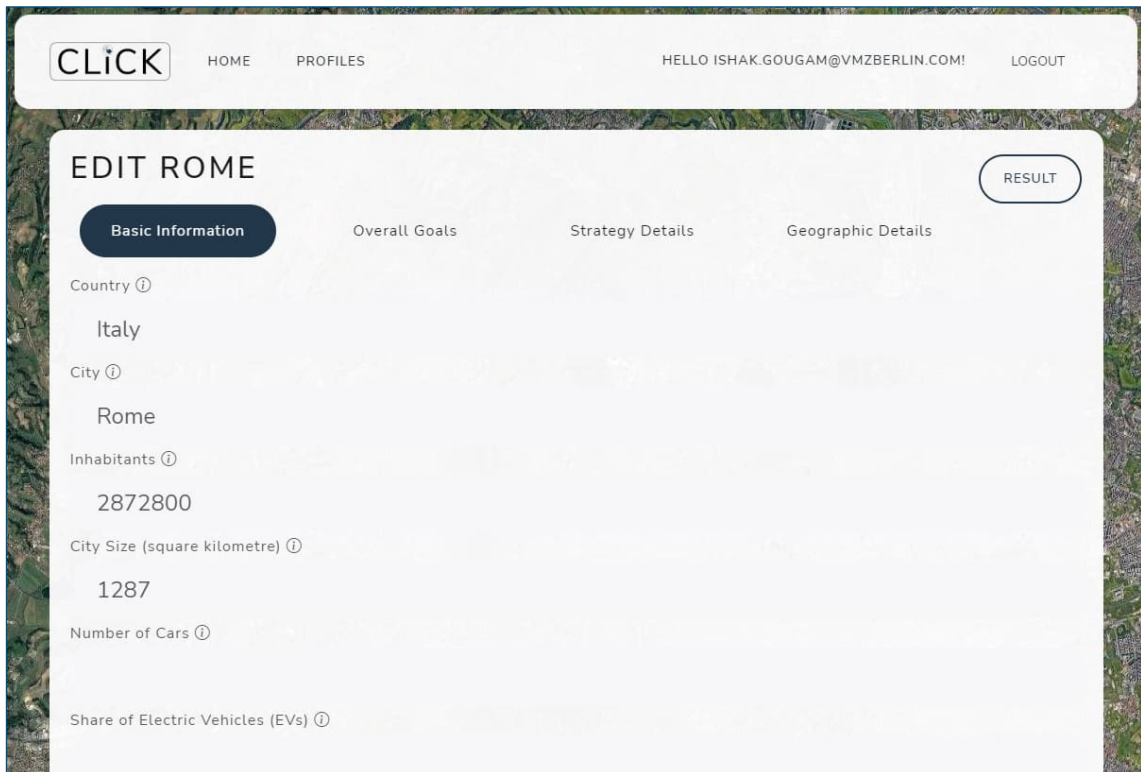


This website is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [875187].

Figure 4 ACCOUNT MANAGEMENT

Logged-in users can now access their account settings by clicking on their shown email address in the top right corner. This section provides the possibility to enter optional profile information as for example a phone number (Figure 4). In addition, the e-mail address and the password can be changed. The last sub-section PERSONAL DATA allows the user to delete the account with all the associated data.

## 3.2 Execution of Planning Process



The screenshot displays the 'CLICK' web application interface. At the top, there is a navigation bar with the 'CLICK' logo, 'HOME', and 'PROFILES' links. On the right, it shows the user's email 'HELLO ISHAK.GOUGAM@VMZBERLIN.COM!' and a 'LOGOUT' button. The main content area is titled 'EDIT ROME' and features four tabs: 'Basic Information' (selected), 'Overall Goals', 'Strategy Details', and 'Geographic Details'. A 'RESULT' button is located in the top right corner of the form area. The 'Basic Information' tab contains several input fields with pre-filled or suggested values: 'Country' is 'Italy', 'City' is 'Rome', 'Inhabitants' is '2872800', 'City Size (square kilometre)' is '1287', 'Number of Cars' is empty, and 'Share of Electric Vehicles (EVs)' is empty. Each field has a small information icon (i) next to it.

Figure 5 EDIT - Basic Information

The planning process starts by adding a new city in the PROFILES area. The click tool asks the users for a city name and by entering this city name a background process is started which tries to find some basic information automatically in *Wikidata* (location coordinates, country, inhabitants, city size). After finishing the search process the users will be forwarded to the edit page. Here the section – BASIC INFORMATION opens and the user can check the *Wikidata* results. Furthermore, the user has the opportunity to readjust the data (Figure 5). Also, there are some more fields like number of cars and share of e-vehicles. After submitting the basic data users can go over to the next step: the OVERALL GOALS (Figure 6).

**CLICK** HOME PROFILES HELLO ISHAK.GOUGAM@VMZBERLIN.COM! LOGOUT

## EDIT ROME

Basic Information **Overall Goals** Strategy Details Geographic Details

RESULT

Please select your overall poles goal for the planning process:

Poles ⓘ

1335

SUBMIT

Get a recommendation depending on your basic informations:

PROVIDE A BASIC COVERAGE

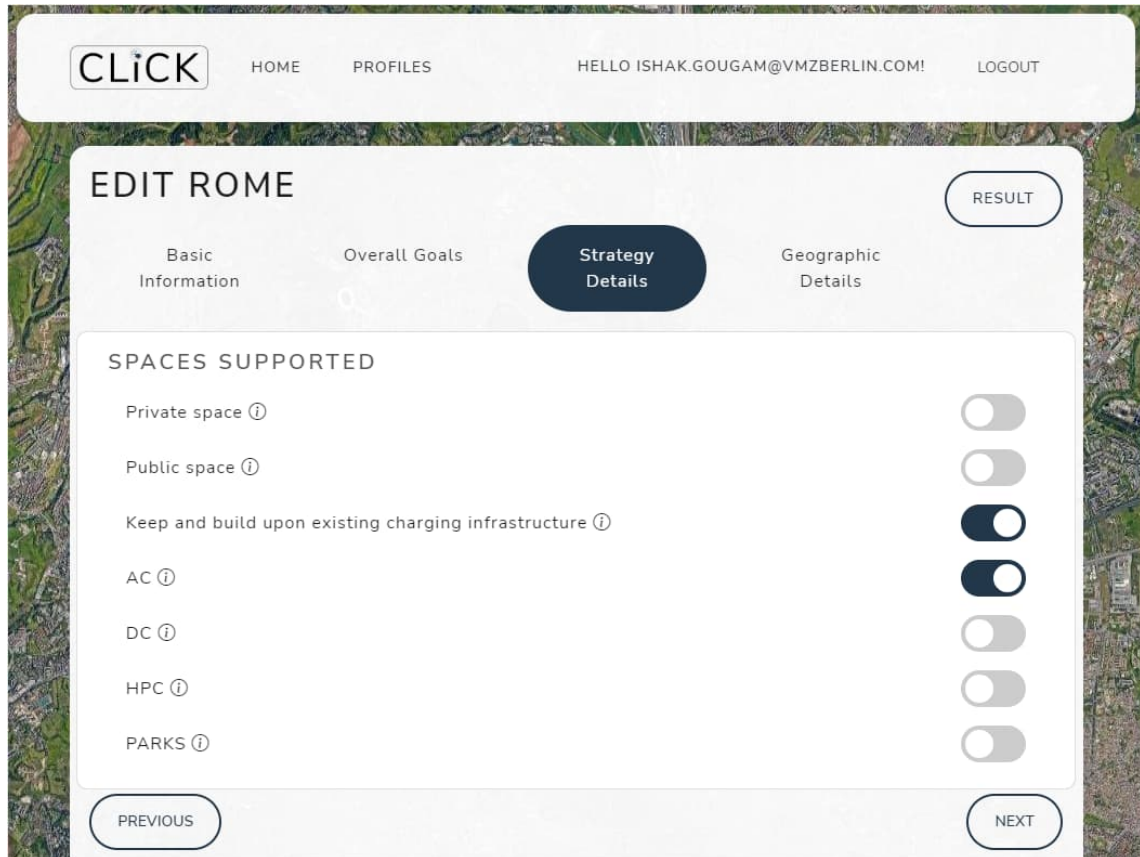
ASSIST THE MOBILITY TRANSFORMATION

**BECOME A LIGHTHOUSE FOR ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)**

PREVIOUS NEXT

Figure 6 EDIT - Overall Goals

Here they have to define a number of charging poles they want to distribute. If the users are not sure which number fits to their needs, the click tool can provide a recommendation with tree intensity levels. This calculation based on the basic data inputs from the step before.



The screenshot displays the 'EDIT ROME' interface within the CLICK application. The top navigation bar includes the 'CLICK' logo, 'HOME', 'PROFILES', a user greeting 'HELLO ISHAK.GOUGAM@VMZBERLIN.COM!', and a 'LOGOUT' button. The main content area is titled 'EDIT ROME' and features four tabs: 'Basic Information', 'Overall Goals', 'Strategy Details' (which is the active tab), and 'Geographic Details'. A 'RESULT' button is located in the top right corner of the main content area. Below the tabs, the 'Strategy Details' section is titled 'SPACES SUPPORTED' and lists seven categories with corresponding toggle switches:

- Private space ⓘ (toggle off)
- Public space ⓘ (toggle off)
- Keep and build upon existing charging infrastructure ⓘ (toggle on)
- AC ⓘ (toggle on)
- DC ⓘ (toggle off)
- HPC ⓘ (toggle off)
- PARKS ⓘ (toggle off)

At the bottom of the main content area, there are 'PREVIOUS' and 'NEXT' buttons.

Figure 7 EDIT- Strategy Details

The third edit step is the STRATEGY DETAILS (Figure 7) section. There is space for enabling or disabling a variety of strategy features as technics. In the last section of the edit page – the GEOGRAPHIC DETAILS provides the options to insert geo-reference data (Figure 8). In this section modules for different data types are listed. The users can choose between upload own data files (GeoJSON, CSV), create a new file or for some types they can try to fetch some data from *OpenStreetMap* by the click-tool. After an insertion users have the options to edit, re-download it or to delete the file.



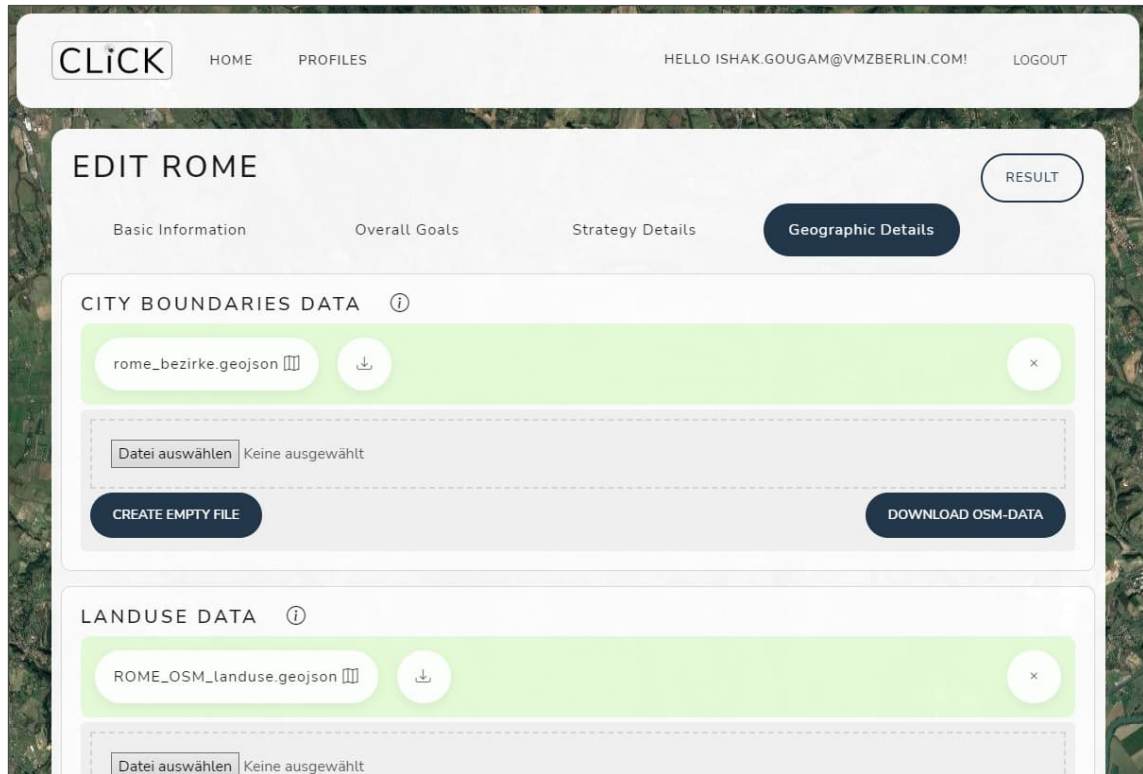


Figure 8 EDIT- Geographic Details

The files can be edited by clicking on them. Afterward the file opens in a map view, the so called DRAW (Figure 9). Here, users can add different shapes as polygons, lines or points to the file. There is also the option to modify the properties of each shape. Already existing shapes can be edited by clicking on it. After finishing the work, the users can back up their changes with a save button in the top right corner.



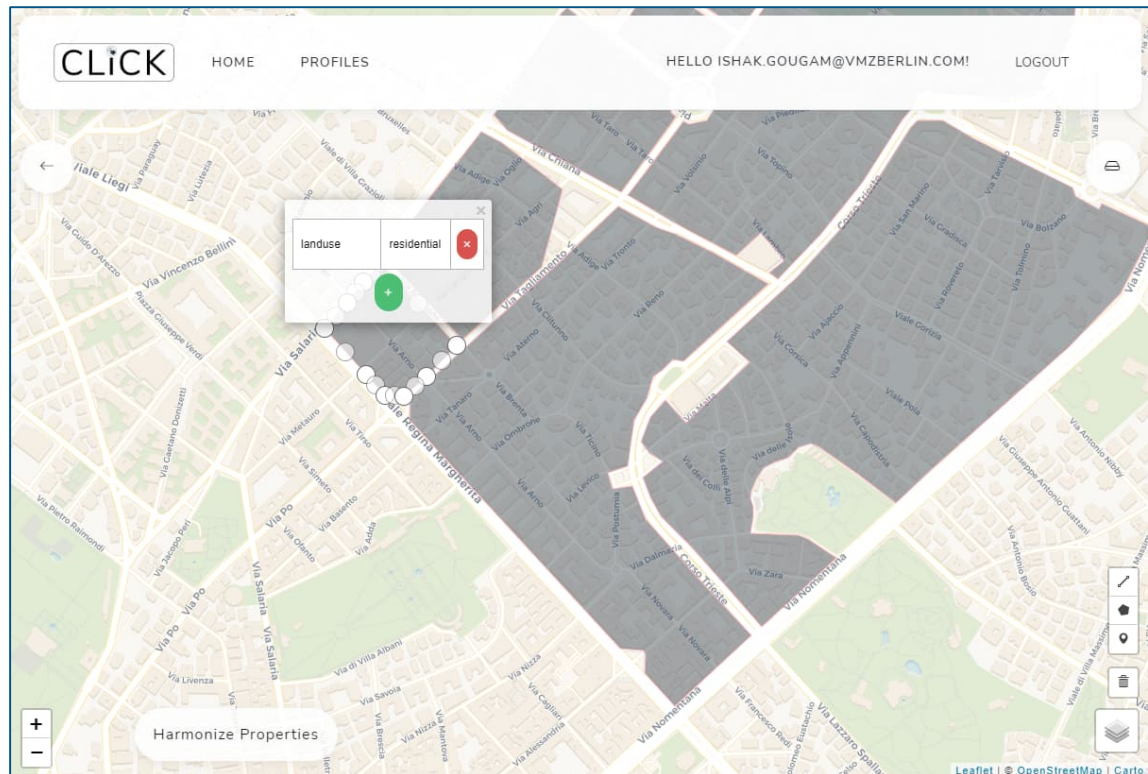


Figure 9 DRAW - Edit a file

The so-called harmonizer, accessible via the 'Harmonize Properties'-button, can help the users to bring system foreign files in a compatible format.

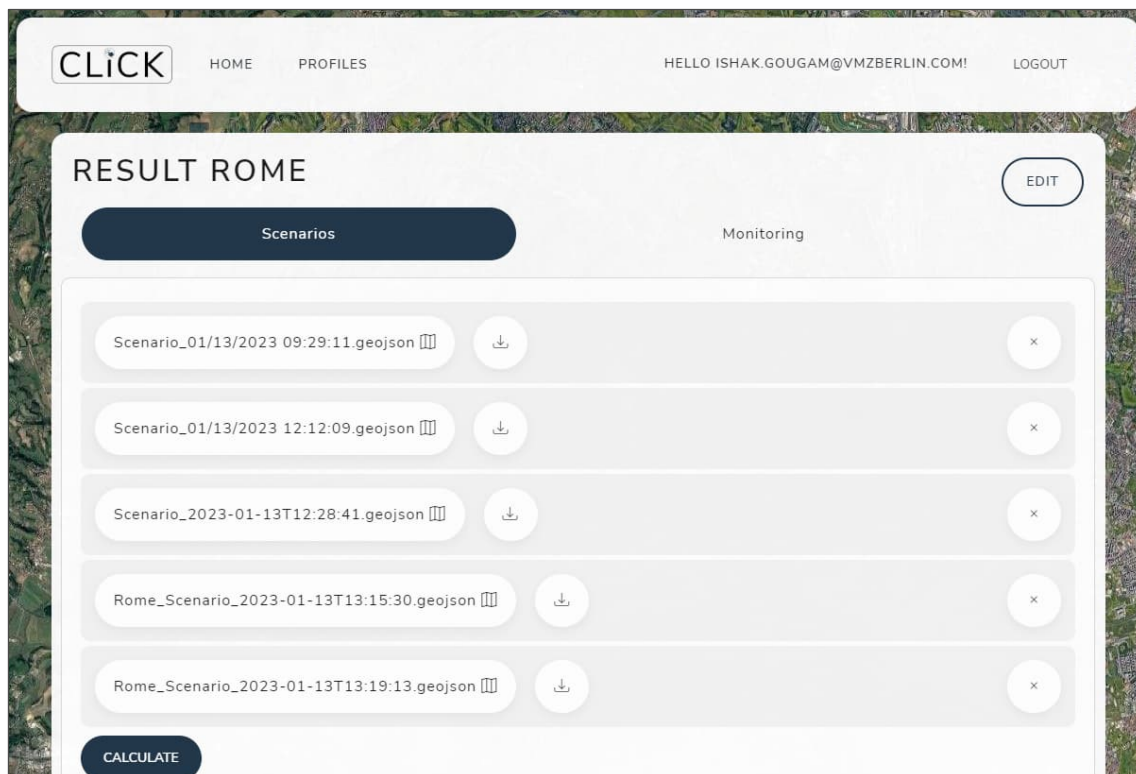


Figure 10 RESULT - Scenarios

After successfully filling the edit page, users can go over to the result page (Figure 10). This page has two subsections - the SCENARIO section and a MONITORING section. In the SCENARIO section a planning calculation can be initialized. Also, there can previous results be reviewed in a map (Figure 11), downloaded as GeoJSON or deleted. In the MAPVIEW a general recommendation of number of poles for each district were shown.

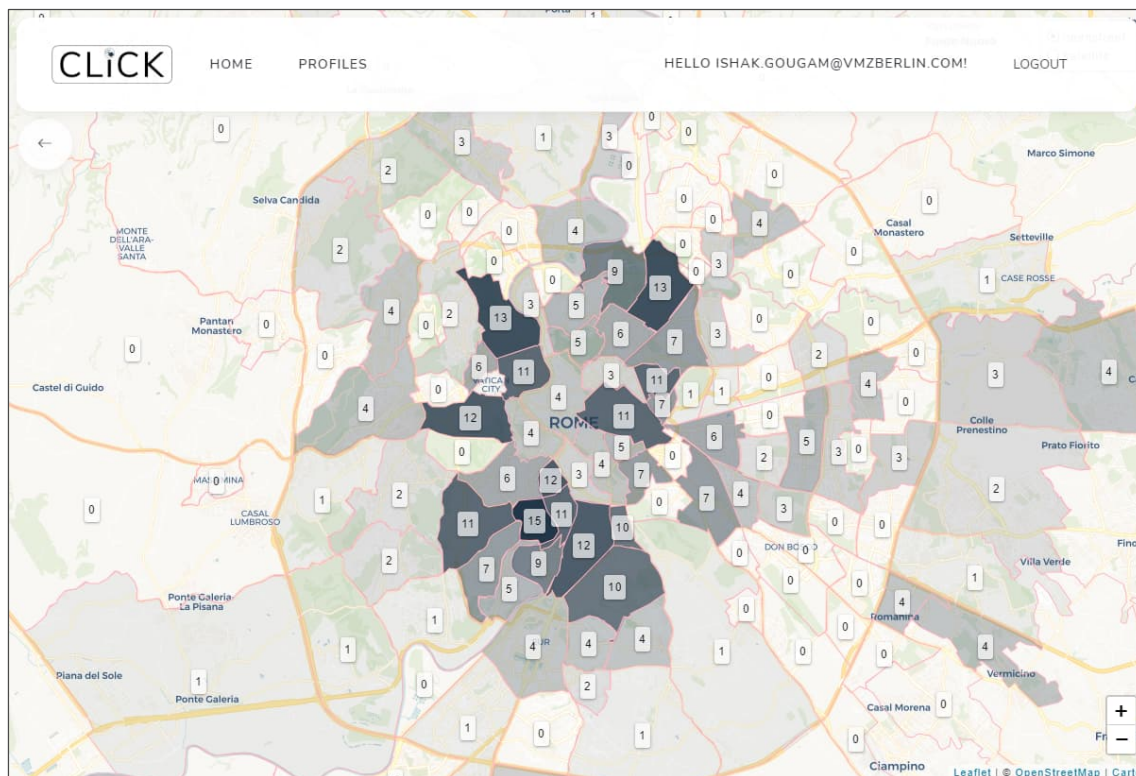


Figure 11 MAPVIEW of a scenario

### 3.3 Storage, Loading and Revision of Plannings

In the personal PROFILES area of the click tool, the already planned cities are listed (Figure 12). The users can access the edit page of each city for revising their plannings. They also can reach the result page to calculate a new distribution and review scenarios. At the PROFILES page, it is also possible to delete a whole project.

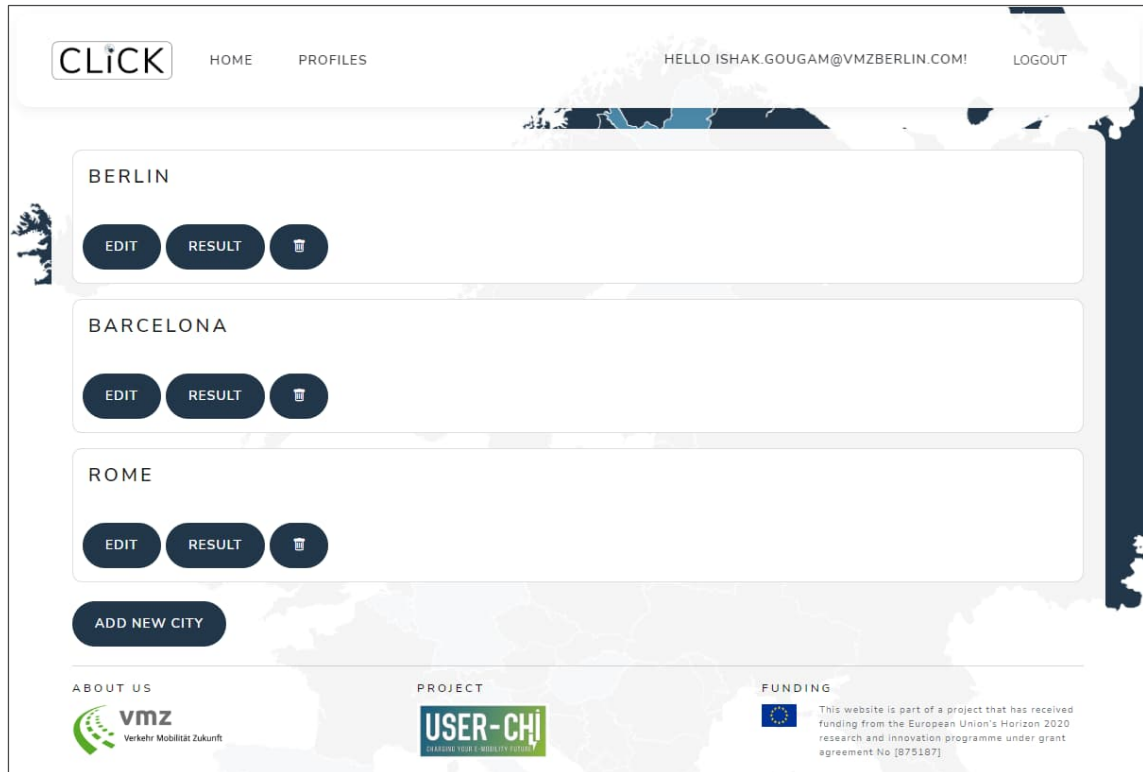


Figure 12 PROFILES

## 3.4 Monitoring of Usage Data

In the RESULT section there is also a topic, called MONITORING. From there, the users can access a map (Figure 13 MONITORINGFigure 13), where the usage of poles can be visualized. An interface to a backend of ETRA ensures live data.

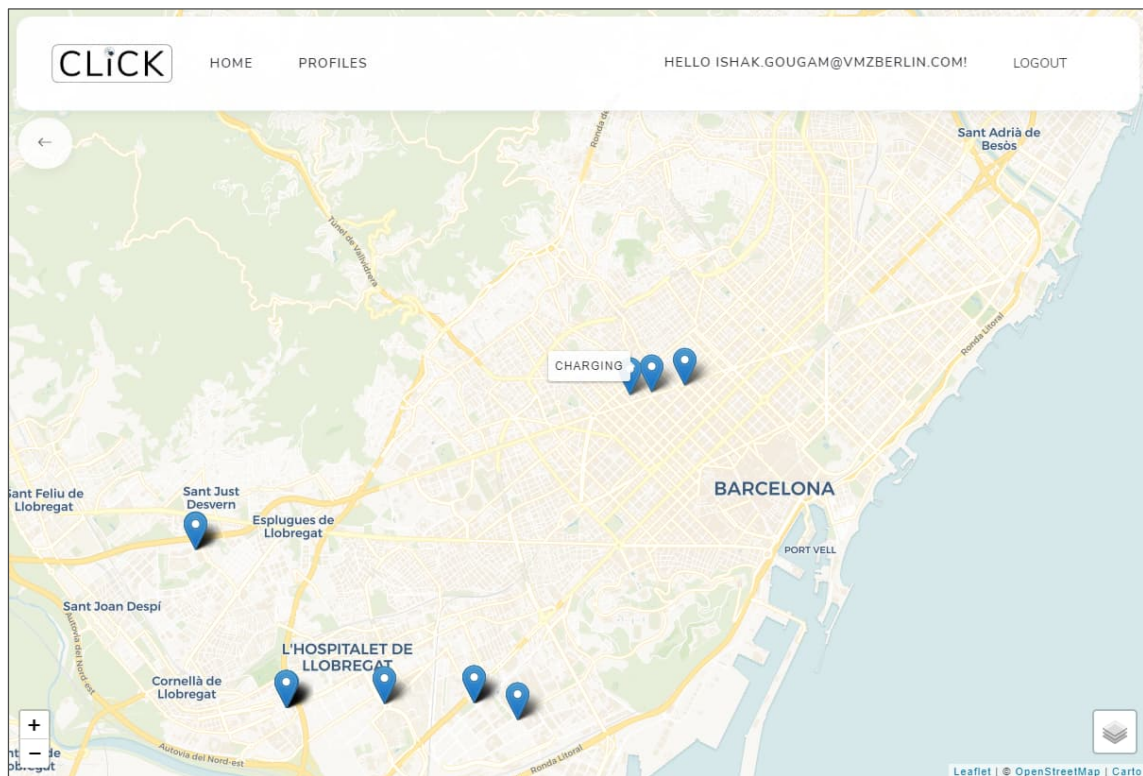


Figure 13 MONITORING



## 4 Integration Report

The following Figure 14 depicts the logical view of CLICK as outlined in D2.2. It shows the main building blocks with interfaces to planning and monitoring data on the left side, backend controllers in the centre and user-interfaces (views) on the right side.

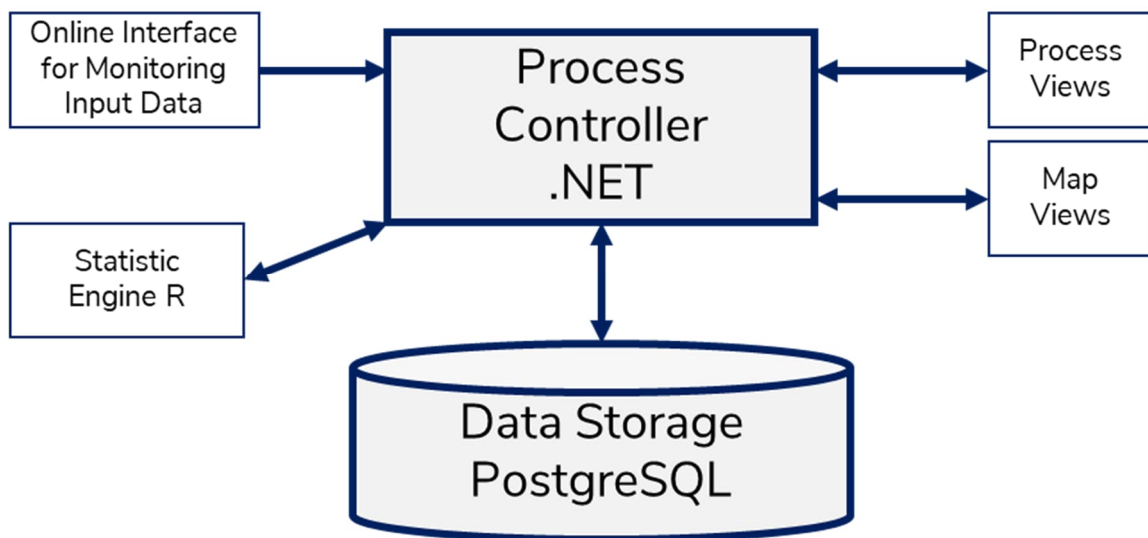


Figure 14 Logical View of CLICK

The CLICK software prototype was developed according to that logical view.

Data transfers use standard interfaces and protocols such as HTTP (hypertext transfer protocol) and JSON/REST (JavaScript Object Notation / Representational State Transfer). For planning data input, interfaces to existing online web services (such as wikidata.org and overpass for OSM) and manual data provision (such as upload of GeoJSON-files or CSV-files) are used and provided.

CLICK offers a basic monitoring functionality for charging infrastructure. Usage data of existing charging points are integrated to online interfaces (application programming interface – API) from ETRA. CLICK implements an interface to INCAR to receive actual usage data and is prepared to integrate interfaces to other existing platforms (e. g. Hubject) in the future.

The user of CLICK, e. g. a city planner, is guided through the multistep planning process as outlined in chapter 3. This process is handled by a process controller. A statistical engine (R statistics) derives charging demand and recommendations for charging infrastructure extension based on the input data provided. This engine is controlled by a statistics controller, the actual calculation of CLICK by a calculation controller.

The main interaction between CLICK and the user takes place via a web interface with forms and links. The map interface is implemented by standard solutions and tools: (e. g., leaflet based on OpenStreetMap).

CLICK results are made available to the user via the web interface. The result files can be exported as a GeoJSON file. A provision of the results in file format for export (e. g. CSV, XLSX) is considered.

The following Figure 15 shows the high-level physical view of the CLICK system as outlined in D2.2. The CLICK environment itself consists of a backend part and a frontend part.

The backend contains the algorithms, processes that provide the actual functionality. The backend is developed in a Microsoft .NET Environment. Furthermore, a storage system was established in order to handle and store data used for the planning (e. g. form inputs, preferences and files). As storage system, a PostgreSQL Database is used.

The frontend part of CLICK consists of a web frontend that is reachable via a common internet browser ([www.click-platform.eu](http://www.click-platform.eu)). The frontend contains functionalities to guide the user through the planning process, to show results on map views and to visualize monitoring data. The frontend is developed as an ASP.NET application.

The CLICK backend supports the storage of results and inputs. The user can save the planning process status and results at specific stages of the process. A reprocessing of calculations is thereby made possible.

The statistical calculations are executed by an R statistics environment.

The controller modules and the database are containerized for Docker and are hosted in a web farm. This leads to an easy-to-scale system.

External to the system are third parties providing data for planning and monitoring services of CLICK. Therefore, interfaces for the acquisition of (online or offline) planning data (e.g. shape files) as well as usage data of charging infrastructure of third parties are to be designed.

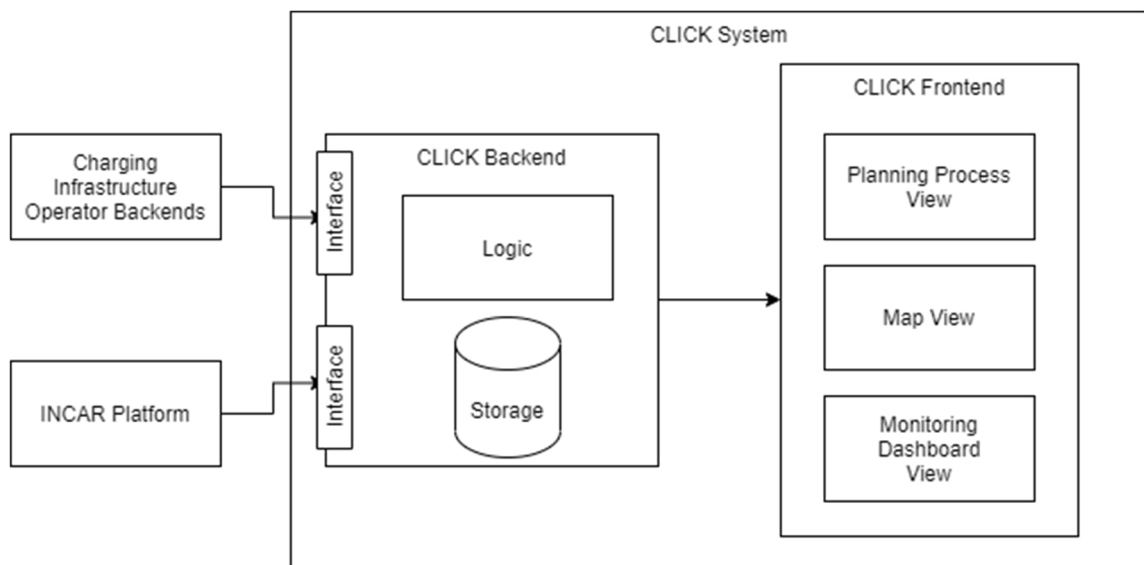


Figure 15 High-Level Physical View

## 5 Conclusions and Outlook

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Task 2.3 of the USER-CHI project was the development task for the CLICK frontend and backend. Its goal was to develop product 1 of the USER-CHI project, called "CLICK". The "Charging Infrastructure Location and Holistic Planning Kit" is a decision support system that assists urban planners and other users in the planning process of charging infrastructure.

The current deliverable D2.3, "CLICK implementation and integration report and demonstrator" summarizes the work done within Task 2.3 "Development of CLICK frontend and backend". Based on the results of Task 2.2, documented in D2.2 – the CLICK specification – the actual development and integration was carried out.

Building up on D2.2, the structured specification using the "4+1 View Model of Architecture", the requirements and goals were executed. The planning process designed within D2.2 is implemented in the CLICK backend, the frontends and components were designed based on the first outlines within D2.2. Finally, the underlying system and architecture was implemented to host all CLICK functionalities.

As a result, with the work carried out within Task 2.3, the CLICK demonstrator was set up including its components and functionalities. It is available and useable via internet connection for testing in the upcoming demonstration Task 2.4.



# Acronyms

Acronym	Meaning
AC	Alternating Current
API	Application Programming Interface
BPMN	Business Process Modelling Notation
CLICK	Charging infrastructure Location and Holistic Planning Kit
CPO	Charging Point Operator
CSV	Comma-separated values
D	Deliverable
DC	Direct Current
DSS	Decision Support System
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FAQ	Frequently Asked Questions
GDPR	General Data Protection Regulation
GUI	Graphical User Interface
HPC	High Power Charging
HTTP	Hypertext Transfer Protocol
ICT	Information and Communication Technology
INCAR	Interoperability, Charging and Parking Platform (product of USER-CHI)
JSON	JavaScript Object Notation
M2M	Machine to Machine (-Communication)
NPE	Nationale Plattform Elektromobilität
OS	Operating System
POI	Point of Interest
REST	Representational State Transfer
T	Task
TEN-T	Trans-European Transport Network
UML	Unified Modeling Language
USER-CHI	Project Title: innovative solution for USER centric CHarging Infrastructure
VMZ	VMZ Berlin Betreiber-gesellschaft mbH (project partner)