DELIVERABLE REPORT
D6.3.2
"POI Navigation Service"

collaborative project

MASELTOV
Mobile Assistance for Social Inclusion and Empowerment of Immigrants with Persuasive Learning Technologies and Social Network Services

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CONTENT

1. EXECUTIVE SUMMARY

This deliverable represents the final status of the navigation and POI (points of interest) based search service. Whereas deliverable D6.3.1 covered the problem specification and the technical as well as the interaction concept, this document will present the actual status of these two services.

The details of the implementation phase will be described in the first chapters. Thereby, the individual services and the implemented features will be explained in detail.

MASELTOV will support navigation with an innovative navigation module, combining the journey planner application in combination with augmented reality service that displays the routing directly into the smartphones's life view. This service will enable the immigrant to orientate and navigate in the new city. On the other hand, the POI search module will enable the user to find the most relevant POIs, from hospital until administration offices, and therefore also minimize the barriers for the integration process. Additionally, the interlinkage with other MApp services will be discussed. The interlinkage represents an important aspect of the overall MApp experience and leads to huge benefit for the immigrants. Combining common or standard functionalities of the services with innovative functionalities and interlinkages with other modules, MApp represents a state-of-the art context aware service providing the benefit of motivating the users to combine the support of different system components according to the requirements of a current situation.

The second part of the document deals with the technical specification and the technical details of the services. Since the POI search and navigation service are strongly linked with each other, the system design represents an important part of the technical specification.

The implementation phase for these services is seen to be finalized in the described configuration. In the next step the services will be evaluated within the scope of the final field trials within WP9.

2. INTRODUCTION

This deliverable describes the work carried out in the scope of task *6.3 "POI Navigation Service"* of work package WP6 *"MOBILE ASSISTANCE & INFORMATION SERVICES"*.
The result of this task is a documentation of the MASELTOV services called "Navigation" and "Places of Interest". Both services will be developed for the cities Vienna and London where extensive field trials will be implemented.

Assistance for successful mobility is a major need of immigrants and thus a key MASELTOV service. This task investigates and develops towards an intuitive user interface for navigation assistance and personalised location based information access. State-of-the-art technologies including augmented reality will enable a most intuitive quality of navigation. Based on the interlinkages with other services MApp goes beyond the standard functionalities and improves the overall experience of MApp.

The next figure identifies these two services within the MApp dashboard.

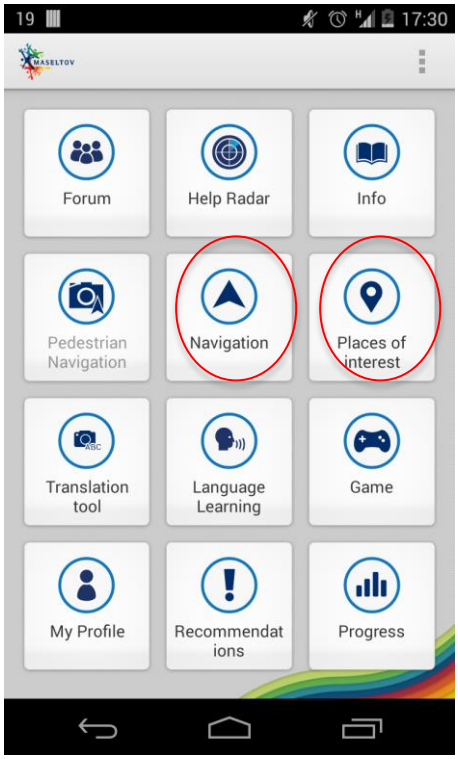


Figure 1: MApp dashboard.

The functionalities of the mentioned services will be described in detail in the next Sections.

3. NAVIGATION SERVICE

3.1 OVERVIEW

Mobility is one of the key issues in barrier free existence with equal rights to local citizens. Mobility in the initially foreign urban environment provides many barriers to overcome, however, mobility is a human right that immigrants need to enjoy as local citizens do. If the immigrants are not able to navigate in the new city then the risk for social exclusion is high. Most intuitive navigation is crucial for immigrants since they have to organise their orientation within an initially completely unknown environment.

MASELTOV will support navigation with a mobile augmented reality service that displays the routing directly into the smartphones's life view. The navigation service of Mapp consists of two parts: journey planning & augmented reality navigation. The goal of this service is to develop an intuitive user interface for navigation assistance, combining the benefits of multimodal route planning and augmented reality navigation in one service and therefore allowing the immigrants to navigate easily through their new city. The interlinkage with other MApp services provides additional benefits that enhance the functionalities of the common navigation service.

The service will be available for two 'trial' cities: Vienna and London. The service is therefore available in Turkish, Spanish, English and German.

3.2 ACTUAL STATUS OF THE NAVIGATION SERVICE

Based on the results from the first trials and evaluation the screenflow was optimized. The idea behind this update was to provide a more simplified interface. Based on the updated it is now possible to find the optimal route with fewer steps in comparison to the previous versions of the navigations service. Figure 2 represents the adapted screenflow of the navigation service.

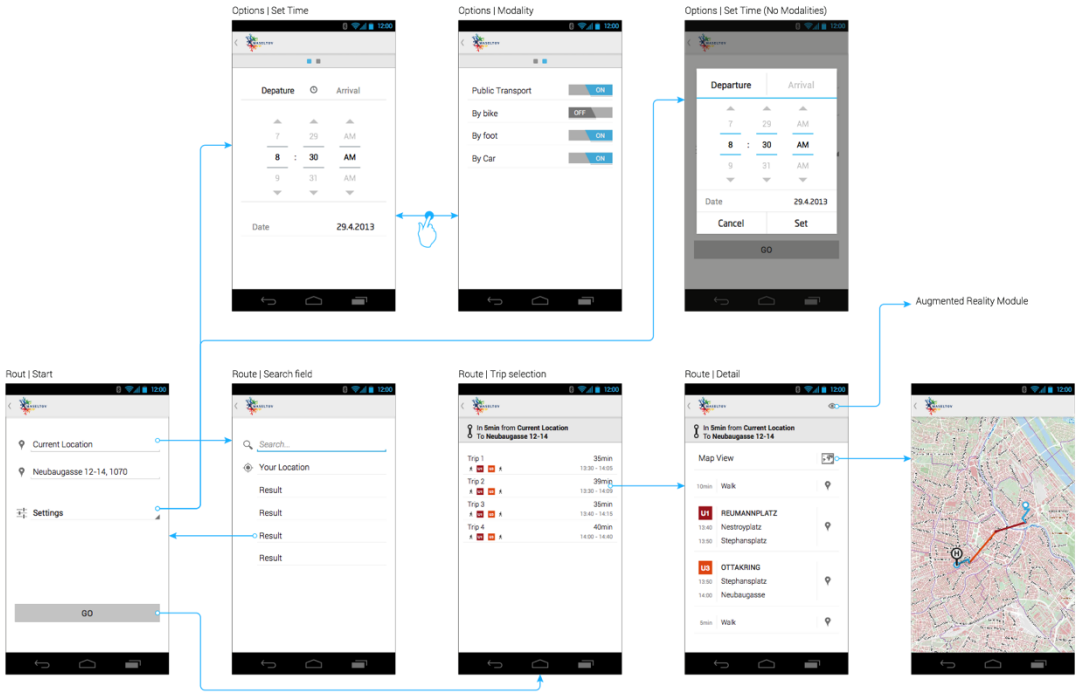
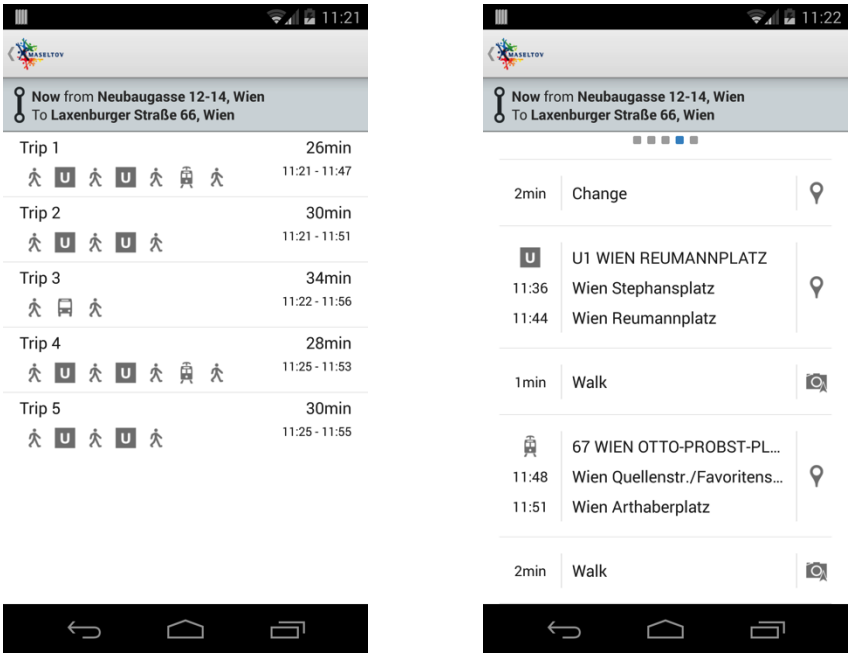


Figure 2. MApp journey planner screenflow – final concept.

Following features were implemented within the navigation service:

- Search/selection of start and destination point (addresses, POIs)
- Route settings (date, time, modalities – public transport, bike, foot, car)
- Route results overview
    - To maintain continuity for the user, a summary of the chosen settings from the first screen is displayed.
    - Afterwards, the user sees the list of all possible routes. Thereby, the most important criteria – route duration and start/end time as well as the used modalities – are shown to the user. These criteria are essential when it comes to route choice.
    - Once the user chooses a route he gets the next level of complexity: a full list of the tasks ahead to complete that route including all relevant information for each route segment (modalities, the start/destination time as well as the duration, map view). The map view is available for the whole route as well as the individual segments. This way the user is never overwhelmed with the information presented but can access all the details needed to reach his destination.

In Figure 3 and 4, we depict the screenshots of the final navigation service (Vienna/London).



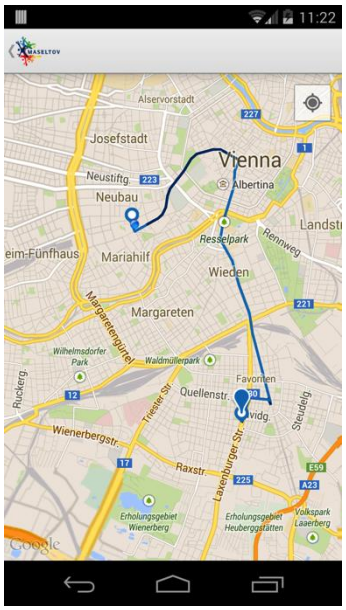


Figure 3. Screenshots from the MApp Journey planner service (Vienna).

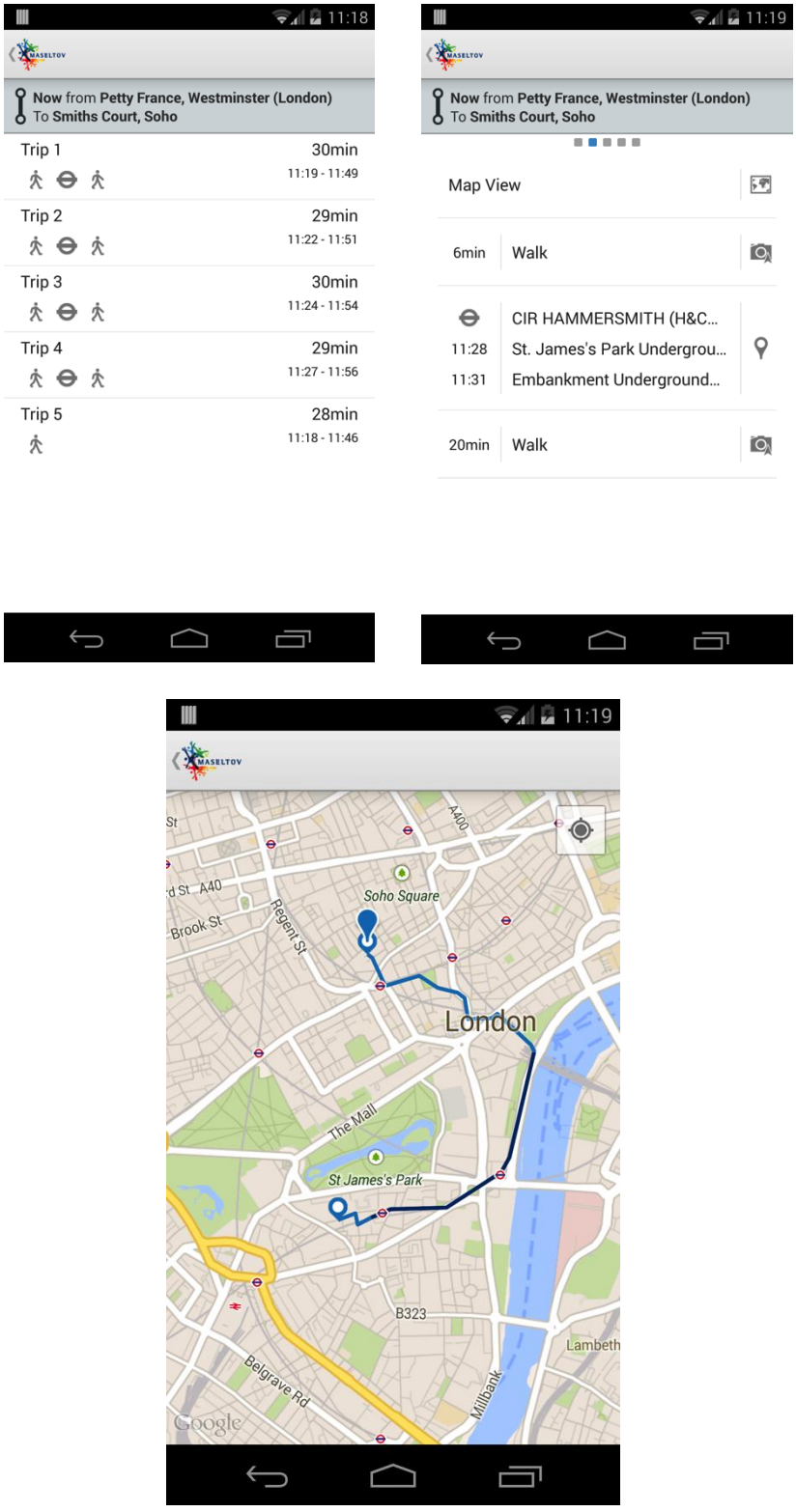


Figure 4. Screenshots from the MApp Journey planner service (London).

3.3 LINKAGE WITH OTHER SERVICES AND EVENTS

The interlinkages between navigation service and other MApp services will be explained in detail as well as the events.

Augmented Reality Navigation

The users have the possibility to use the AR component for walk segments of the route and receive turn-by-turn instructions. In order to establish the interlinkage, start and destination point (GPS coordinates) will be forwarded to the AR module. After the segment is finished, the user comes back to the journey planner application.

The next two figures show the interface of the augmented reality navigation module.

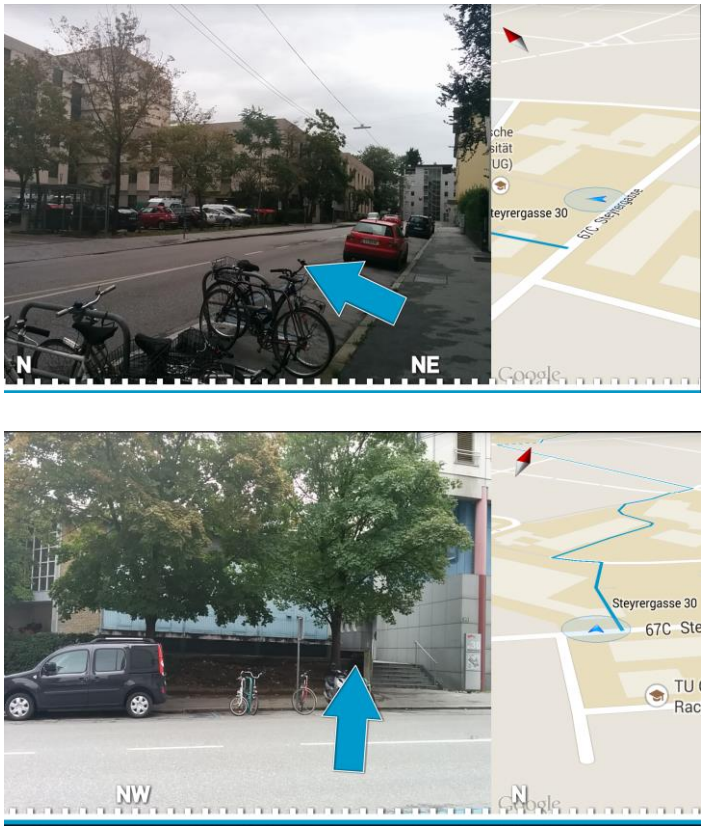


Figure 5: Screenshots from the MApp augmented reality navigation service.

Points of Interest Search

An individual POI can be used as start/destination point within the Points of Interest module. The coordinates of the specific POI will be forwarded to the navigation component and entered within start/destination field and can be used for the route request. Details of this feature will be explained in chapter 4.2.

User profile - Coins

For every route request the user gets a coin. This will be forwarded to the API of the user profile, which is responsible for collection of the coins of every MApp modules.

User profile - Events

Navigation service delivers the following events to the user profile:

- Usage events – Values of pairs (key,value), ("duration", <duration>)
- Interesting things – Values of pairs (key,value) for start/destination point ({"pointAs":"start/end","title":"<title>","latlng":"<latitude>:<longitude>:WGS84:","type":"<type>"})

3.4 ADVANTAGES OF THE SERVICE

Within this chapter the benefits of the MApp navigation service in comparison to regular navigation service (e.g.: Google Maps) will be explicitly highlighted. Following add-ons are a part of MApp navigations service:

- From the architectural perspective MApp navigation service is based on a unique data format (described in chapter 5.2). This enables an easy extension of the service in any other city and is therefore independent from the routing provider itself.
- The combination of the journey planner with the augmented reality turn-by-turn navigation provides a huge benefit for the user.
- Based on the interlinkage between MApp navigation and POI search service the set of functionalities is enhancing. On one hand the user have the possibility to search and browse for POIs and on the other hand to use the specific POI as start/destination point within the navigation service.
- Interlinkage with MApp user profile service enables an additional advantage, expanding the overall user experience and and spectrum of functionalities.

4. POI SEARCH SERVICE

4.1 OVERVIEW

The goal of the POI search service is to provide the user a tool that enables the user to search easily over different POI categories. Additionally, the user has the possibility to see all POIs in the surrounding.
In consultation with the NGO's the most important POI categories for the immigrants were defined. It was important to cover all topics that are relevant for the immigrants and include them in one service. The following categories and POIs were included in the service:

- Health care
  - Hospital
  - Pharmacy
  - Doctor
  - Clinic
  - Dentist
  - Health
- Shops
  - Supermarket
  - Post office
- Administrative
  - Local government office
  - Police
- Transport
  - Subway station
  - Train station
  - Bus station
  - Railway station
- Other
  - Mosque
  - Church
  - School
  - University

The service will be available for two trial cities: Vienna, London and Madrid. The service is therefore available in Turkish, Spanish, English and German.

Based on the combination of the POI search service and the location-based function with the innovative navigation service, a state-of-the-art mobility service is established.

4.2 ACTUAL STATUS OF THE SERVICE

During the specification phase the screenflow for this service was finalized. Figure 6 represents the final screenflow for POI search service.

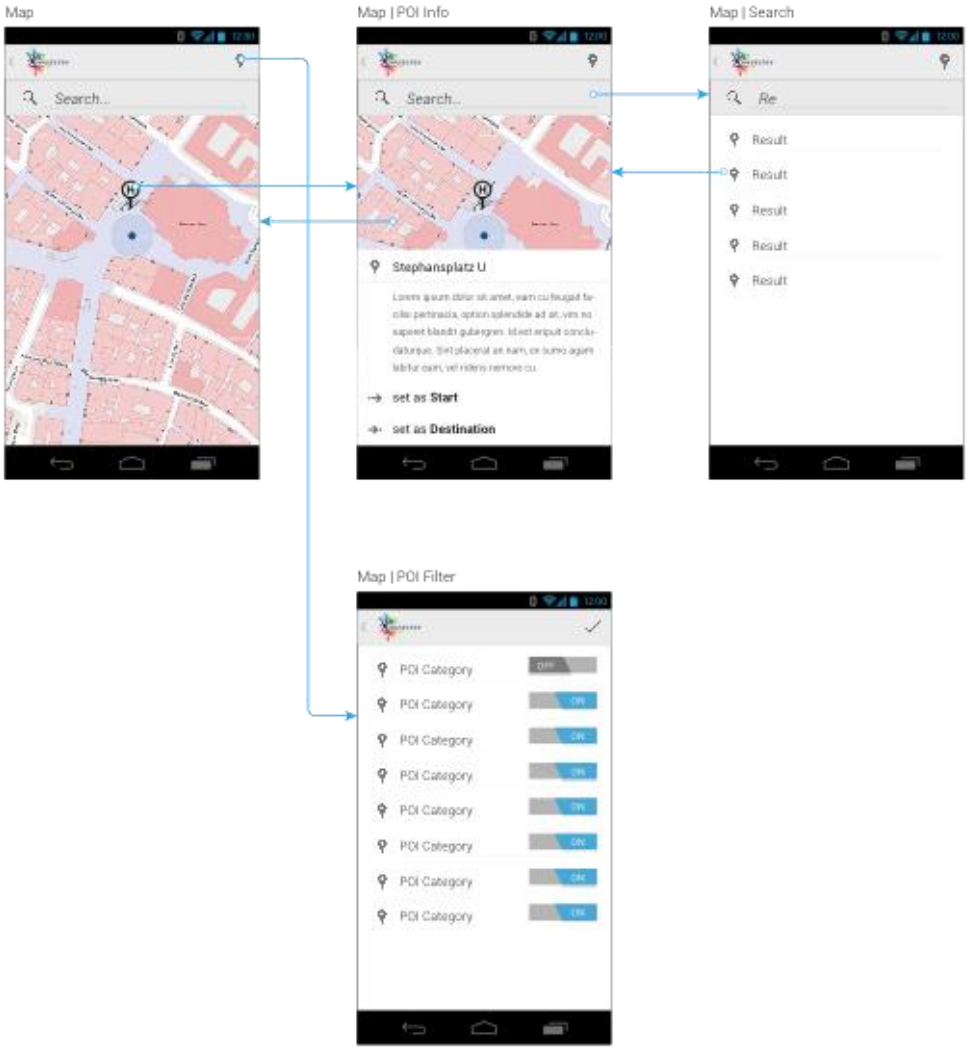


Figure 6: MApp POI search screenflow – final concept.

Following features were implemented within the POI search service:

- Localization of the current position
- Selection of POIs in the surrounding. The user can browse the map freely and explore the POIs shown on the map. This provides the user with an opportunity to familiarize themselves with the map or the environment they are in.
- Searching o specific POIs. To make this process easier for the user, the application suggests auto-completion results for the input text.
- Provision of the meta information to the selected POI. The aim here is to give easy access to basic information without forcing any action onto the user.
- Filter possibility and selection of relevant categories for the map. By utilizing the category setting, the user can customize what type of POIs will be shown on the map before beginning a search.
- POI can be used as start/destination point and the navigation module will be triggered.

Figure 7 represents the screenshots of the finalised POI search service.

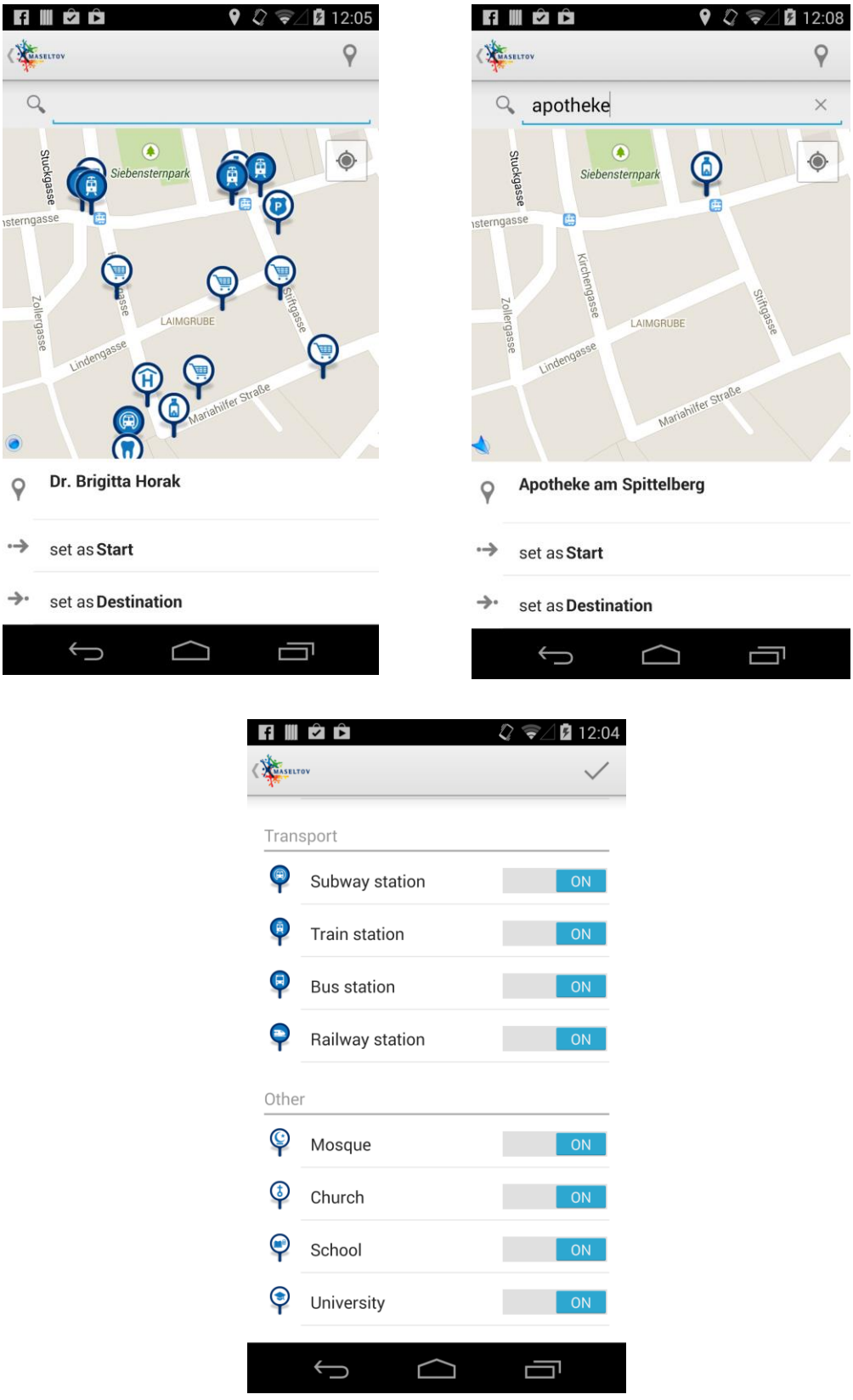


Figure 7. Screenshots from the MApp POI search service.

4.3 LINKAGE TO OTHER SERVICES

Navigation service

An individual POI can be used as start/destination point within the Points of Interest module. The coordinates (GPS points) of the specific POI will be forwarded to the navigation component and entered within start/destination field and can be used for the route request.

Info service

Within the info module the MApp admin can add a POI/address to the relevant article. Additionally, this POI can be then shown in the POI search service in a map view. Afterwards, the POI can be used as start/destination point like the other POIs.

User profile - Coins

In every case when a POI is used as start/destination point a coin will be added. This will be forwarded to the API of the user profile, which is responsible for collection of the coins of every MApp modules.

User profile - Events

POI search service delivers the following events to the user profile:

- Usage events – Values of pairs (key,value), ("duration", <duration>)
- Interesting things – Values of pairs (key,value) for search keywords ("keyword",<String>)
- Recommendation – the user receives recommendation of POIs based on the previous behaviour or context related

4.4 ADVANTAGES OF THE SERVICE

Within this chapter the benefits of the MApp navigation service in comparison to regular POI search will be explicitly highlighted. Following add-ons are a part of MApp POI search service:

- Based on the interlinkage between MApp POI search and navigation service the set of functionalities is enhancing. On one hand the user have the possibility to search and browse for POIs and on the other hand to use the specific POI as start/destination point within the navigation service.
- The interlinkage between MAPP info and POI search service represent a unique implementation. If an address is used within info module, this will be then shown as a POI within POI search service.
- Interlinkage with MApp user profile service enables an additional advantage, expanding the overall user experience and spectrum of functionalities.

5. TECHNICAL SPECIFICATION

This section deals with the technical specification of the POI Navigation service. As mentioned in the previous chapters, the navigation and POI search service are from the technical perspective closely linked with each other.

5.1 SYSTEM DESIGN

Figure 8 depicts an overview of the structural design of the service.

The client with the corresponding services is presented in the left side of the diagram. The route as well as the POI server component with the corresponding API's is represented in the middle of the diagram. The servers are again connected on one hand to the routing providers of Vienna & London as well as the corresponding POI databases.

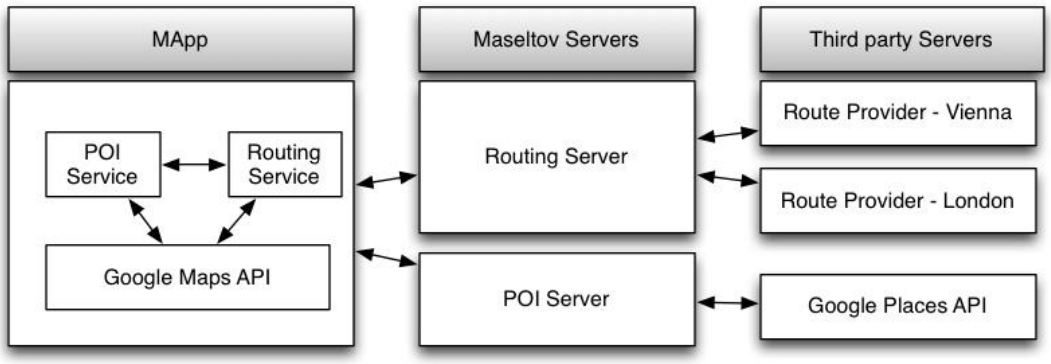


Figure 8: Structural design of POI Navigation Service.

There are three main components within MApp (client side) that realize these two services, the *Google Maps API*, which provide that map and the map functionalities for MApp, the *POI Service* lets the user search for POI as well as retrieving a list of POIs surrounding the user, and the *Routing Service* allows the user to request for routes from A to B.

On the server side, two servers exist in order to fulfil the requirements of the services. On one hand the *POI Server* that provides MApp with list of POIs in around the current location of MApp. Secondly, there exists the *Routing Service* that provides the user with routing results and information.

In order to develop these two services, third party services were necessary since the *Routing Server* as well as the *POI Server* depends on external data providers. Thereby the *Google Places API* us used by the *POI Server* to retrieve the POIs list. In case of the *Routing Server* two different routing engines for the routes in London and Vienna were used.

5.2 TECHNICAL DETAILS IN RESPECT TO THE NAVIGATION SERVICE

In both cities the routing provider or respectively the routing engine from Mentz Datenverarbeitung GmbH (http://www.mentzdv.de), the so-called EFA server, is used within MApp.

EFA is an intermodal information system that enables users to plan journeys with all modes of transport, including public transport (by bus, rail, tram or underground), footpaths, cycle routes and even cars.

A journey can begin or end at a stop, a locality, an address, a point of interest, a postcode or a specific map coordinate[1].

In the project consortium there is no partner that provide a routing service for Vienna. Therefore, the first step was to contact a provider in order to enable to get an access for a routing engine in Vienna. Fluidtime made an agreement with ITS Vienna Region to use their routing engine for the MASELTOV project until the end of 2014.

The public transport operator in London (TfL - Transport for London) offers an open API for the routing engine. In case of London only public transport will be used as modality for routing.
The specification of the service in London is available here: http://www.tfl.gov.uk/assets/downloads/businessandpartners/journey-planner-api-documentation.pdf.pdf

5.2.1 BRIEF DESCRIPTION OF FUNCTIONALITIES

The main function of navigation service is to enable the user in finding the way from A (start) to B (destination). The user can choose the start and destination points by typing the desired address. Having entered some text in the text filed provided by the user interface (UI) of the routing service, the search process starts and the entered text is sent to the routing server, the routing server responds with a list of found results. The list could contain addresses, public transport stops and stations, or POIs. For the start the user can select her current location as well. After having selected the start and destination of the trip, the user can start the routing process. The result is then displayed to the user as a list of possible routes for different transport modalities. The user can select a route and view the details of the route and display it polyline on the map.

5.2.2 TECHNICAL SOLUTION

The user can search for the *start* and *destination* of her trip, after having entered the address or a keyword for searching the locations; MApp sends a search location request to the *routing service*, the server responds with a list of the found locations. Table 1 lists the parameters of the search location request.

Table 1: Parameters for search location.

Parameter Name	Data Type	Description
searchstring	String	Free text for the search process

[1] http://www.mentzdv.de/englisch/products/efa/basic-funtions/public-internet-journey-planner/

city	String	The city where the user is using MApp

The route request could be processed after setting the *start* and *destination* of the route. Table 2 lists the parameters that MApp sends to the routing server.

Table 2: Parameters for search location.

Parameter Name	Data Type	Description
from	String	A string that represents the *Start*
to	String	A string that represents the *Destination*
year	Integer	
month	Integer	
day	Integer	
hour	Integer	
minute	Integer	
mode	String	A string that represents the transportation modalities

The server responds to the route request with one or more possible routes. The data model of the route a generic data model for representing routes. This generic data model enabled using different routing services at routing server side. However for MApp, the route has only one data model regardless of the specific data model of the routing engine. Table 3 displays a part of the data model of the route represented in JSON.

Table 3: JSON representation of the route.


```
{
  "id": 1411390594475138,
  "request":
  {
    "sessionId": "EF3529F56FCC3976CA05CC1CE6186C86",
    "requestId": 1
  },
  "locationFrom":
  {
    "type": "Feature",
    "geometry":
    {
      "type": "Point",
      "coordinates":
      [
        16.34956,
        48.19927
      ]
    },
    "properties":
    {
      "name": "",
      "title": "Neubaugasse 12-14",
      "municipality": "Wien",
      "municipalityId": "49000000",
      "type": "address"
    }
  },
  "locationTo":
  {
    "type": "Feature",
```

```
      "geometry":
      {
         "type": "Point",
         "coordinates":
         [
            16.28798,
            48.08508
         ]
      },
      "properties":
      {
         "name": "",
         "title": "Achsenaugasse 16a",
         "municipality": "Mödling",
         "municipalityId": "43017017",
         "type": "address"
      }
   },
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   [
      {
         "id": 7,
         "modality": "bike",
         "description": "normal",
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         "distanceMeter": 20982,
         "timePlanned":
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            "start": "2014-08-20T14:20:00.0+0200",
            "end": "2014-08-20T15:42:00.0+0200"
         },
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         [
            {
               "id": 1,
               "durationMinutes": 82,
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               "speedMeterPerMinute": 255,
               "type": "bike",
               "locationFrom":
               {
                  "type": "Feature",
                  "geometry":
                  {
                     "type": "Point",
                     "coordinates":
                     [
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                        48.19927
                     ]
                  },
                  "properties":
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                     "name": "Wien, Neubaugasse 12-14",
                     "title": "Wien, Neubaugasse 12-14",
                     "municipality": "Wien",
                     "municipalityId": "49000000",
                     "type": "address"
```

```
        }
    },
    "locationTo":
    {
        "type": "Feature",
        "geometry":
        {
            "type": "Point",
            "coordinates":
            [
                16.28798,
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        "type": "bike",
        "name": "bike",
        "towards": "",
        "attributes":
        {
        }
    },
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        "geometry":
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            "coordinates":
            [
                [
                    16.34956,
                    48.19927
                ],
```


5.3 TECHNICAL DETAILS IN RESPECT TO THE POI SEARCH SERVICE

In this chapter the technical solution and specification for the POI search service will be described in detail.

After a comprehensive data analyse it was decided to use the Google Search API in order to get the relevant POIs. The Google Places API offers a comprehensive dataset and is continuously improved and enhanced.

Figure 9 represents all categories that are available (https://developers.google.com/places/documentation/supported_types).

accounting	embassy	moving_company
airport	establishment	museum
amusement_park	finance	night_club
aquarium	fire_station	painter
art_gallery	florist	park
atm	food	parking
bakery	funeral_home	pet_store
bank	furniture_store	pharmacy
bar	gas_station	physiotherapist
beauty_salon	general_contractor	place_of_worship
bicycle_store	grocery_or_supermarket	plumber
book_store	gym	police
bowling_alley	hair_care	post_office
bus_station	hardware_store	real_estate_agency
cafe	health	restaurant
campground	hindu_temple	roofing_contractor
car_dealer	home_goods_store	rv_park
car_rental	hospital	school
car_repair	insurance_agency	shoe_store
car_wash	jewelry_store	shopping_mall
casino	laundry	spa
cemetery	lawyer	stadium
church	library	storage
city_hall	liquor_store	store
clothing_store	local_government_office	subway_station
convenience_store	locksmith	synagogue
courthouse	lodging	taxi_stand
dentist	meal_delivery	train_station
department_store	meal_takeaway	travel_agency
doctor	mosque	university
electrician	movie_rental	veterinary_care
electronics_store	movie_theater	zoo

Figure 9: Google Places categories.

The categories that were considered within the implementation of the MApp POI search service can be seen in chapter 4.1.

5.3.1 BRIEF DESCRIPTION OF FUNCTIONALITIES

The main function of the service is to show on the map the current location of the user as well as the POIs in the surrounding. The user can select a POI from the map by tapping on the pin representing that POI. As a consequence, more details about the selected POI are viewed in addition to providing a possibility for using the selected POI as a start or destination for the navigation service. Additionally, a search function is also provided, where the user can type a search keyword. The user can choose which categories of POIs she would like to have by activating or deactivating the categories in the settings.

5.3.2 TECHNICAL SOLUTION

When the user starts the POI search service, the current location of the user is sent to the server as a couple of GPS coordinates. Additional parameters as listed in Table 4 are also provided to the POI Server in order to optimize the results. The server responds with a list of retrieved POIs which are then displayed on the map. Types of POIs are distinguished using different icons that have been designed for each category.

Table 4: parameters for the POI server.

Parameter Name	Data Type	Description
longitude	double	longitude of the current location of the user.
latitude	double	latitude of the current location of the user.
radius	integer	radius in meter within which the list of POIs should retrieved.
maximumResult	integer	The maximum number of retrieved POI.
categoryList	String List	A list of POIs categories the use are interested in.
searchKeyword	String	a keyword to be used for searching and retrieving POIs.

The POI search service within MApp has its own data model to represent the POI. This internal data model ease using different POI Servers. In MASELTOV project, the *Google Places API* is used as the main POIs provider. The output of the API is mapped to the internal data model of MApp. Table 5 shows the JSON representation of the internal data model within MApp.

Table 5: JSON represantation of POI search service.

```
{
            "type": "Feature",
            "geometry":
            {
                "type": "Point",
                "coordinates":
                [
                    -0.25057,
                    51.5281
                ]
            },
            "properties":
            {
                "name": "1000011721",
                "title": "Old Oak Cafe",
                "municipality": "London",
                "municipalityId": "31117124",
                "type": "poi"
            }
        }
```

Within the POI search service, the user can select a POI as a start or destination for the route. Therefore the routing service will be triggered. Since MApp has its own internal data model, exchanging data objects between POI search service and navigation service is a straightforward task. POI search service has to send the selected POI to the navigation service and inform it whether the POI is a start or destination of the trip. The following code snippet shows how MApp implements the interaction between POI search service and navigation service.

Table 6: interaction POI search service and navigation serivce.

```
Intent intent = new Intent("com.fluidtime.Route");
intent.putExtra("CITY", userCity);
JsonFeature feature = new JsonFeature();
JsonProperties prop = new JsonProperties();
prop.setTitle(selectedMarker.getTitle());
prop.setMunicipality("");
prop.setType("POI");
feature.setProperties(prop);
JsonGeometry geo = new JsonGeometry();
ArrayList<Double> featureList = new ArrayList<Double>();
featureList.add(selectedMarker.getPosition().longitude);
featureList.add(selectedMarker.getPosition().latitude);
geo.setCoordinates(featureList);
feature.setGeometry(geo);
if (v.getId() == R.id.ft maseltov poi marker start lay) {
intent.putExtra(RouteMainActivity.FROM, feature);
} else {
intent.putExtra(RouteMainActivity.TO, feature);
}
startActivity(intent);
finish();
```

6. SUMMARY AND OUTLOOK

This deliverable describe the work carried out in the WP6 MOBILE ASSISTANCE & INFORMATION SERVICES, Task 6.3 POI Navigation Service.

The mobility aspect is one of the crucial factors for the immigration. Additionally, it represents the key issues in barrier free existence with equal rights to local citizens. Mobility in the initially foreign urban environment provides many barriers to overcome, however, mobility is a human right that immigrants need to enjoy as local citizens do.

The deliverable is structured in two important topics. The first chapters the functional description of the navigation and POI search services will be explained in detail as well as the current status of these services. Therefore, the final screenflow and functional description will be provided in addition to screenshots of the services. Additionally, interlinkages with other MApp components and the overall benefits will be explained. The second part of the document deals the technical aspect of the implementation. Thereby, the system design as well as the technical concept of the services will be elucidated.

During the implementation phase the server and client implementation was finalized. Thereby the routing providers of Vienna/London are connected as well as the POI server. In parallel, the client development was finalized, covering as well the interlinkages with other MApp components.

The final status of services will be will be evaluated within WP9 and the corresponding final field trial. The results of the trial will be collected and prioritized and considered for the improvement of the services.