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DELIVERABLE

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D3.8 – i-Locate Documentation Manuals

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Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

1 List of references

Number	Full reference
1	<i>i-locate deliverable D3.7 – i-locate Toolkit v.2.0.</i> Available online from: http://www.i-locate.eu/public-deliverables/
2	<i>i-locate deliverable D3.1 – i-locate Toolkit v.1.0.</i> Available online from: http://www.i-locate.eu/public-deliverables/

2 Table of Acronyms

Acronym	Description
API	Application Programming Interface
App	Application
DoW	Description of Work
LBS	Location Based Services
WP	Work Package



3 Executive Abstract

This deliverable acts as documentation manual for v.2.0 of the i-locate toolkit [1]. It collects the documentation related to the single components and their implementation. It is designed to be used by technical supporting partners for usage with the pilot sites, as well as for Web entrepreneurs, innovators and high-tech SMEs who want to leverage the i-locate toolkit for developing and deploying LBSs.

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5 Introduction

5.1 Scope

According to the DoW, D.3.8 covers "Documentation manuals and screencasts illustrating how to deploy, configure and run the toolkit". This deliverable acts therefore as documentation manual for v.2.0 of the i-locate toolkit, shipped as D3.7 [1]. The toolkit is composed of a number of components, coherently integrated according to a high-level architecture able to fulfil the requirements derived on the basis of the i-locate pilot partner needs.

5.2 Objectives and Usage

The report is meant to document the different components of the i-locate toolkit in terms of their implementation. The functionality of the various components is described in D3.7 [1] and concisely reported here for the sake of completeness and readability.

Target users of the material contained in the deliverable are technical personnel interested in contributing to the development of the i-locate toolkit and/or using it for building value-added location-based services.

The documentation is technical in nature. It is highly recommended to interested parties to first take the i-locate toolkit training module¹, which includes a general introduction to the toolkit as well as specific training modules for the single components.

The document at hand serves as a directory of the documentation of the single modules. The latter ones are maintained as live documents on the Web; the deliverable includes therefore a collection of URLs pointing to the various relevant material.

It is nonetheless worth remarking that, in order for a third party to deploy the complete i-locate toolkit, it is not required to dive deep into the documentation. The latter one is rather meant to be used in case modifications to the toolkit, e.g., integration of legacy software or ad hoc personalisation to meet specific needs, are to be carried out.

5.3 Organization of the Document

The deliverable is organized as follows. The toolkit deployment model is briefly presented in Section 6. Section 7 presents documentation for the various components of the toolkit. Section 8 concludes the document.

¹ <http://www.i-locate.eu/training/i-locate-toolkit/>

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6 Toolkit Deployment Model

Initially the i-locate toolkit was designed to follow a single-tenant deployment model, as described in [2]. During the second year of project activities, however, most pilot partners expressed interest in the usage of a centralized, cloud-based, multi-tenant deployment of the toolkit. While this option was note a priori excluded in the initial release [2], it was not the central focus. A number of modifications to the design of components was carried out to accommodate such an option, which now represents the de facto standard for pilots to access i-locate toolkit functionality [1].

A detailed description of the i-locate cloud-based deployment can be found in Section 8 of [1]. Accordingly, the focus of the deliverable at hand is on the documentation of the single components of the toolkit.

The documentation of each component includes also guidelines for the deployment. In most cases a script for automating the configuration and deployment has been provided by the partner in charge.

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7 Toolkit Components: Documentation

All toolkit components are released under an Apache v.2 project. A gitlab repository hosts all the latest stable version of the components' implementation. The repository can be accessed through the official project Web portal or directly at: <https://gitlab.com/groups/ilocate>

The core documentation of the various i-locate toolkit components is hosted on the aforementioned online repository, where it is kept updated to reflect changes in the code base. This document is essentially meant to act as a glossary, providing -rather than the documentation itself- links to the various repositories where documentation (and the corresponding) source code can be found. This choice was made to ensure that the document is linked always to the online repositories where the most updated documentation can be found, rather than editing a new version of the deliverable every time a modification to the documentation or code will occur. The latter is something that the consortium expects to be occurring on a continuous basis during the pilot phase as feedback from the partner is collected and improvements to existing features are proposed.

The online gitlab repository is organized as follows. The source code and documentation of each component is maintained as a separate project. The i-locate project coordinator handles the permissions for the repository.

As highlighted in the introduction, the documentation itself is rather low-level and is meant to be used by software developers working on integration and/or forks of the i-locate toolkit code base. We therefore strongly recommend interested parties to first read [1] to get a high-level overview of the structure and functionality of the toolkit. An introductory description of all components is also shipped as part of the i-locate training toolkit, accessible at <http://www.i-locate.eu/training/i-locate-toolkit/>

7.1 Proxy

The goal of the proxy component is to provide location information relative to i-locate entity(ies), specified by a given unique ID. The key functionality provided by this module is to return the position of a given object; this is offered in both push and pull mode. The proxy acts as collection point for all indoor localisation subsystems present in a given i-locate deployment, in the sense that all data about the position of entities tracked is sent to the proxy. The proxy is also used by, e.g., mobile apps, to fetch an estimate of the current position based on environmental data (e.g., Wi-Fi networks seen, data from associated tags, QR code readings, beacons etc.).

In terms of actual implementation, the proxy component has been developed in PHP using the well-known Yii framework², which makes it easy for third parties to add new technologies. At the time of writing the following positioning technologies are supported:

- Quuppa
- eeRTLS
- Wi-Fi (through outdoor localisation component plus Combain APIs; through UH PI radar technology)
- GPS
- EGNOS (through external receiver)

² <http://www.yiiframework.com/>



- QR codes
- Beacons

7.1.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-proxy>.

7.1.2 Documentation URL

Documentation is available in markdown format and can be accessed at:

<https://gitlab.com/ilocate/ilocate-middleware-proxy/wikis/home>

7.1.3 Cloud deployment URL

The proxy is deployed at:

- <https://cloud.i-locate.eu/proxyapi/> (redirect)
- <https://cloud.i-locate.eu/ilocproxy/api/www/>

7.1.4 Additional Notes

Not applicable.

7.2 Configuration

The configuration module is used for holding configuration parameters of the specific localisation subsystems integrated (e.g., battery level of tags, RSSI etc.). Given the knowledge of the deployed indoor localisation system one can request parameters of specific devices of each localisation system (e.g. Wi-Fi, Quuppa, eeRTLS).

The configuration module is implemented as Java application with an integrated grizzly Web server. The Proxy or other i-locate entities can access the configuration data via a REST interface, data being formatted as JSON nodes.

The configuration module at the moment includes bindings for Quuppa and eeRTLS. It is an optional module and has to be deployed on a per-pilot basis, within a local area network with direct connectivity to the indoor localisation subsystem gateway.

7.2.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-configuration>.

7.2.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-configuration/blob/master/doc/document>.

7.2.3 Cloud deployment URL

Not applicable.

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7.2.4 Additional Notes

Not applicable.

7.3 OGC Spatial

The OGC Spatial component has the goal to provide and allow third party client applications to access i-locate data according to OGC standards.

In terms of supported OGC standards, currently the OGC Spatial support WMS (Web Map Service) and WFS (Web Feature Service) services. Furthermore, the OGC Spatial component includes a geocoding service that is used, in the i-locate context, by the app to allow users to search for a given address and to obtain the corresponding (lat, lon) coordinates for issuing requests to the routing engine.

The current OGC Spatial implementation is based on the Geoserver open source engine.

7.3.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-ogc-spatial>.

7.3.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-ogc-spatial/tree/master/doc>.

7.3.3 Cloud deployment URL

<http://cloud.i-locate.eu:8080/geoserver/ows>.

The geocoding service (covering both indoor and outdoor spaces) is available at:

http://cloud.i-locate.eu/geocoder/geocodeFull/PILOT_ID/QUERY.

7.3.4 Additional Notes

Not applicable.

7.4 Location Analytics

The location analytics component provides analytics of geographical information related to i-locate entities. In particular, the focus is on indoor environments, for which no off-the-shelf solution was available. The location analytics component is meant to provide means to identify issues based on entity-level and aggregated position and movement patterns. Open APIs and a wrapper covering data ingestion, based on Apache Kafka is shipped as part of the toolkit. It provides subscription capabilities via MQTT client, scalability and persistence. The proxy connects to the commercial ThinkIN indoor data analytics service developed by U-Hopper and commercialised by its third party ThinkInside srl, which includes advanced means for scalable KPI/metrics computation and a visualisation dashboard.

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7.4.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-location-analytics>.

7.4.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-location-analytics/wikis/home>.

Official documentation for Apache Kafka can be accessed at: <http://kafka.apache.org/documentation.html>.

7.4.3 Cloud deployment URL

Not applicable.

7.4.4 Additional Notes

Not applicable.

7.5 Geofencing

The geofencing component has the goal to provide a real time solution to deliver notifications and provide information regarding the location changes of objects inside configurable areas. By having a specific identified object (whose identifier comes from the proxy component) the geofencing engine receives location updates constantly and, if a specific area is configured (i.e. a room) for the object, will notify subscribed clients about the entrance/exit of the object inside/outside of the area.

The current implementation of the geofencing component is based on proprietary Trilogis technology. The communication protocol used for receiving and notifying events is based on MQTT. Interfaces are described in D3.7 [1].

7.5.1 Repository URL

Not applicable.

7.5.2 Documentation URL

Not applicable.

7.5.3 Cloud deployment URL

Not applicable (the geofencing component is deployed on a per-pilot basis due to scalability reasons).

7.5.4 Additional Notes

The geofence engine used in the i-locate pilots is a proprietary solution of Trilogis. The Interfaces and endpoints are open and described in [1].

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7.6 Routing

The routing service shipped with the i-locate toolkit works for both indoor and outdoor routing. The routing service supports multimodal routing from door-to-door in a seamless way across outdoor and indoor environments. It allows the navigation between multiple floors by incorporating stairs, elevators, open spaces, etc., and generates turn-by-turn navigation guidance which is specific for indoor routing.

The integrated routing service uses Open Trip Planner (OTP³), an open source platform for outdoor multi-modal routing, for outdoor routing and extends the OTP to support also indoor routing. It supports multiple IndoorGML graphs for the indoor part, OpenStreetMap data for outdoor and GTFS format for public transportation schedule.

7.6.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-routing>.

7.6.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate.middleware.routing.example>.

7.6.3 Cloud deployment URL

http://cloud.i-locate.eu/routing/{PILOT_ID}

7.6.4 Additional Notes

Not applicable.

7.7 Spatial Solver

7.7.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-spatial-solver>.

7.7.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-spatial-solver/tree/master/doc>

7.7.3 Cloud deployment URL

<https://cloud.i-locate.eu:8080/spatialsolver>.

7.7.4 Additional Notes

Not applicable.

³ <http://www.opentripplanner.org/>



7.8 Crowdsourcing

Provides support for gathering user-generated geographical information. In the context of the pilots this is used to:

- Gather user inputs on perceived quality of service (satisfaction)
- Letting users report issues ('sentinels') to local administration officers (through i-locate app)

The implementation used in i-locate is based on UH proprietary CIVICFLOW platform⁴.

In the i-locate project, crowdsourcing is used to collect reports from citizens about local issues in target environments. The crowdsourcing functionality is based on the CIVICFLOW civic engagement platform developed by U-Hopper.

7.8.1 Repository URL

Not applicable.

7.8.2 Documentation URL

Not applicable.

7.8.3 Cloud deployment URL

Not applicable.

7.8.4 Additional Notes

As mentioned above, the crowdsourcing engine used in the i-locate pilots is based on the proprietary CIVIC-FLOW solution of U-Hopper. The usage of the portal for setup of campaigns is described in [1]. The wrappers for usage with the i-locate app are shipped with the mobile application itself.

7.9 MQTT Broker

In the i-locate toolkit architecture, the MQTT Broker is used to handle communication among components in the toolkit using a loosely-coupled publish/subscribe paradigm. Since early 2016 MQTT is an Oasis standard⁵. In i-locate, MQTT is used to decouple the modules pre-processing positioning information from the higher-level services that use such an information.

In the i-locate project we use the Mosquitto implementation of the MQTT broker functionality. The implementation of the broker is based on C++ programming language and has some common dependencies for web connections. In the context of the project, a modification to an existing plugin has been developed for grant authentication purposes basing on the security component.

⁴ <http://www.civicflow.com/>.

⁵ https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=mqtt.

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7.9.1 Repository URL

Not applicable. The Mosquitto source code, binaries and additional details can be accessed at: <http://mosquitto.org>

7.9.2 Documentation URL

Mosquitto documentation can be accessed at: <http://mosquitto.org/documentation/>

7.9.3 Cloud deployment URL

<https://cloud.i-locate.eu:1883>

7.9.4 Additional Notes

A security plugin has been developed by the Consortium partners for easing integration with the security and privacy component; it can be found at:

<https://gitlab.com/ilocate/ILOCATE.MIDDLEWARE.MQTT.SECURITY>

7.10 Monitoring

The goal of the monitoring component is to enable system administrators to monitor the liveliness of the i-locate components, possibly distributed across multiple servers. Target users of the functionality exposed are therefore system administrators at pilot sites and i-locate technical supporting partners.

The main expected usage is for troubleshooting in case of platform malfunctioning, alerts and warnings. In the long term, it can enable the deployment of self-healing mechanisms.

The implementation shipped with the i-locate toolkit is based on the ELK (Elastic, Logstash, Kibana) stack [1]. In practise:

- Shippers read logs from VMs hosting services and send to a centralised logstash server;
- Logstash server processes logs and stores them in an ElasticSearch DB;
- A Kibana dashboard is attached to the DB for visualising logs.

7.10.1 Repository URL

The source code (configuration scripts) can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-monitoring>

7.10.2 Documentation URL

The monitoring component is based on a number of open source frameworks [1]. Documentation for the relevant frameworks can be accessed at:

- Logstash: <https://www.elastic.co/guide/en/logstash/current/index.html>.
- ELasticsearch: <https://www.elastic.co/guide/en/elasticsearch/reference/current/index.html>.
- Kibana: <https://www.elastic.co/guide/en/kibana/current/index.html>.

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7.10.3 Cloud deployment URL

<https://cloud.i-locate.eu/kibana> (kibana dashboard, requires admin login).

7.10.4 Additional Notes

Not applicable.

7.11 Security & Privacy

The security and privacy component provides support for authentication, authorisation, single sign-on and developer access (through RESTful APIs). In the current version of the toolkit the implementation is based upon the open source OpenAM project⁶. In particular v.12.0 is currently used for deployment in i-locate.

7.11.1 Repository URL

The source code (policies) can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-security-privacy>

7.11.2 Documentation URL

The security and privacy component is based on the OpenAM framework. Official documentation for v.12.0.0 (the one used in v.2.0 of the toolkit) can be found at: <https://backstage.forgerock.com/#!/docs/openam/12.0.0>

Examples for OpenAM integration are documented at: <https://gitlab.com/ilocate/ilocate-middleware-security-privacy/blob/master/openam-integration/README>

7.11.3 Cloud deployment URL

<http://cloud.i-locate.eu/openam>

7.11.4 Additional Notes

Not applicable.

7.12 Asset Management

The asset management functionality is provided through a proprietary Trilogis service called Box3. The toolkit comes with a set of open-source APIs (Java servlets) providing the capability to create assets, specifying the type and values for their attributes. Moreover, it is possible to modify and delete the asset objects. The module keeps the geographic information of the assets updated receiving the data from the MQTT broker.

The Trilogis Box3 graphic interface permits to define asset management maintenance processes on the asset objects and manage the scheduling of the maintenance activities. Moreover, it is used to define the structure of the assets and to set up the environment. The Box3 complies with ISO 55000 family of standards (asset representation) and it supports IndoorGML.

⁶ <http://openam.forgerock.org/>

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7.12.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-middleware-asset-management>.

7.12.2 Documentation URL

Not applicable (see [1]).

7.12.3 Cloud deployment URL

Not applicable (the deployment is made on a per-pilot basis, with each deployment having their own configuration of the asset management wrapper).

7.12.4 Additional Notes

Not applicable.

7.13 Mobile App

Together with backend components, the i-locate toolkit ships also a mobile app client template. As detailed in [1] the following functionalities are supported:

- Get current position and show on a map;
- Search for a geographical entity (indoor/outdoor);
- User login/registration;
- Compute indoor/outdoor route;
- Display a route on the map;
- Navigate indoor/outdoor spaces;
- Display indoor map and show user position;
- Read QR code;
- Participate to crowdsourcing tasks;
- Score the app itself;
- Pair with UWB or Quuppa tag.

From an implementation perspective, the i-locate mobile client has been developed following a hybrid cross-platform approach. In particular, the Consortium has decided to use the Titanium Appcelerator framework⁷. Titanium allows programmers to use web technologies (in particular javascript and CSS), supporting then wrapping in native applications. Titanium includes both a cross-platform API for accessing native UI components (navigation bars, menus, file system, network, geolocation, accelerometer etc.) and access to native functionality not already covered by the API. Four modules have been used for the app development and are required to correctly compile it:

- `bencoding.utterance` provides support for text-to-speech and speech-to-text capabilities. This is used for providing turn-by-turn navigation guidance.
- `eu.ilocate.tiosm` provides support for Open Street Map APIs in Titanium.
- `eu.ilocate.toolkit` allows accessing all Wi-Fi details, GPS, and MAC address of the mobile.

⁷ <http://www.appcelerator.com/>

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- com.mywaysolutions.barcode to interpret QR codes.
- The app includes a configuration file (/app/config.json), which can be tailored in order to meet the specific features of each deployment site. In particular, it allows specifying the ID of the pilot, the URLs of the various server-side component with which the app interacts as well as the set of positioning technologies available for the selected pilot.

In terms of structure of the code repository:

- All the HTTP request functions are specified in app/lib/api.js
- The logic of the application (which is based on a customary model-view-controller structure, as mentioned above, based on the Alloy framework) is found at app/controllers
- All the application configuration parameters are found in the tiapp.xml file
- Model files go in the app/models directory
- Views are specified in XML using the Alloy syntax and are in the app/views folder
- Libraries requires go in the app/lib directory and can be included using a require('name') command to load them
- Style and formatting instructions (.tss format) are included in the app/style folder

7.13.1 Repository URL

The source code can be accessed at: <https://gitlab.com/ilocate/ilocate-app>.

7.13.2 Documentation URL

Documentation can be accessed at: <https://gitlab.com/ilocate/ilocate-app>.

7.13.3 Cloud deployment URL

Not applicable.

7.13.4 Additional Notes

In order to ease the setup, a guide for how to configure titanium sdk (on Ubuntu 14.04 and Windows) and all required components has been developed and can be accessed at: <https://gitlab.com/ilocate/ilocate-app/wikis/home>

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8 Conclusion

This deliverable includes relevant links to documentation material for all i-locate toolkit components. The documentation shipped with v.2.0 of the toolkit and collected within the deliverable at hand provides sufficient knowledge for (i) system administrators to deploy a stand-alone version of the toolkit (ii) developers who want to extend and/or enhance single components for their own purpose.

As for the toolkit [1], enhancements may take place during the piloting activities, based upon feedback from technical supporting and pilot partners. The updated documentation will always be made accessible through the links indicated in this document.

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