Austrian-Slovenian Intelligent Tourist-Information Center Platform

Jernej Zupančič
Jožef Stefan Institute and
Jožef Stefan International
Postgraduate School
Jamova cesta 39
Ljubljana, Slovenia
jernej.zupancic@ijs.si

Gregor Grasselli
Jožef Stefan Institute and
Jožef Stefan International
Postgraduate School
Jamova cesta 39
Ljubljana, Slovenia
gregor.grasselli@ijs.si

Matjaž Gams
Jožef Stefan Institute
Jamova cesta 39
Ljubljana, Slovenia
matjaz.gams@ijs.si

ABSTRACT

We present the AS-IT-IC platform – Austrian-Slovenian intelligent tourist-information platform that enables live communication between tourist workers and tourists through a simple chat widget embedded on the existing tourism website, and includes TOUR-BOT, a virtual tourist assistant, for cases when no tourist worker is available. TOUR-BOT can communicate in natural language in English, German and Slovene. The AS-IT-IC platform enables trip planning by providing: attraction search in natural language, trip manipulation using natural language and traditional interaction through buttons, and optimal route calculation between selected trip points. Additionally, the AS-IT-IC platform enables attraction data management for tourist workers and data update suggestions by anonymous users.

Keywords

tourist-information system, virtual assistants, conversational platform

1. INTRODUCTION

Currently, the common way to obtain relevant information [5, 2] about cultural and natural heritage sights and plan a trip is through user-unfriendly web search and hard-to-find websites, usually managed at the government or local-authority levels. After finding relevant information, the trip is planned using route finder such as Google Maps[1] or more advanced tour planners such as e-Turist[2] [1] or TripHobo[3].

However, a new solution for tourists visiting Slovenia and Austria is emerging. Within the AS-IT-IC project [7], accepted in the cross-border Cooperation Programme Interreg V-A Slovenia-Austria in the programme period 2014-2020, a novel information communication technologies (ICT) system was implemented that enables several features for empowering the tourist:

1. Live-chat with the tourist information providers (tourist service providers, tourist offices, municipalities, and citizens).
2. Tour planing and tourism information search in natural language conversation with the virtual assistant.
3. Attraction information suggestion.

The designed ICT tools were integrated into the AS-IT-IC Platform and are accessible from the project homepage[4] through the tourist information provider access point[5] and the tourist access point[6].

The rest of the paper is structured as follows. In Section 2 an example of the platform usage is provided. In Section 3 the platform architecture and platform components are described and Section 4 concludes the paper.

2. USE CASE

To demonstrate the AS-IT-IC platform idea, consider the following example. Imagine Mary, a tourist worker who wants to enable live-chat feature on her website `https://visit-hidden-slovenia.com`. After registering on the AS-IT-IC platform, copy-pasting only a few lines of HTML and Javascript code into her website template and doing some color and text customization if so desired, she has a tourist live-chat widget embedded into her website. When John, a tourist, comes looking for information on her website, he clicks on the live-chat widget button to start a conversation. First, a virtual assistant greets him to kick-start the dialogue. John then searches for particular categories in the limited area such as: “horseriding near Bovec ”, “wine cellars in Nova Gorica”, “adrenaline sports near Soča river”, “accommodation in GoriÅąka Brda” etc. John picks some of the results and includes them into his itinerary.

During the interaction, the tourist can communicate with logged-in humans or with a virtual assistant, the later most useful when no human is on-line, e.g., at night. In our example, John invites Mary into the conversation and they chat about the transit options and other questions the tourist may have. While chatting, the tourist worker has full overview of the conversation the tourist had with the virtual assistant and the currently chosen itinerary. This helps Mary provide relevant answers quickly. In the case that Mary does not know the answer, she can simply invite another tourist worker into the conversation in order to collaborate in providing all the information the tourist needs.

[1] `https://www.google.si/maps`
[2] `http://e-turist.si`
[3] `https://www.triphobo.com`
[4] `https://as-it-ic.ijs.si`
[5] `https://asitic.docker-e9.ijs.si`
[6] `https://asitic-chat-api-frontend.docker-e9.ijs.si/asitic-app.html`

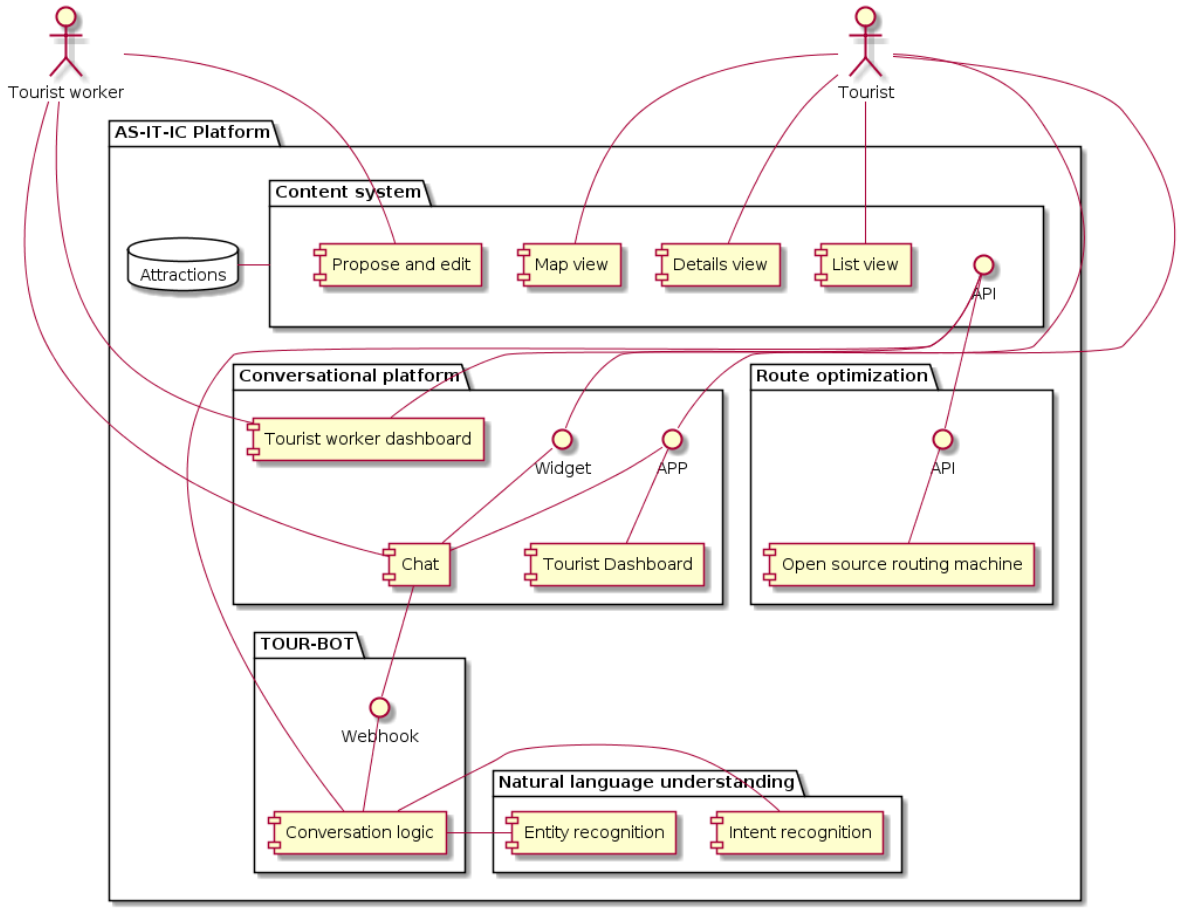

Figure 1: AS-IT-IC platform architecture overview.

3. ARCHITECTURE

The AS-IT-IC platform (Fig. 1) comprises several modules that enable the features mentioned in Sections 1 and 2. The main modules are:

1. *Conversational platform* that enables real-time communication between users and lays out the communication infrastructure.
2. *TOUR-BOT*, a virtual assistant that is able to hold a conversation with tourists by understanding the natural text entered by the user, responding to button clicks within the context, and performing actions with regards to third party systems.
3. *Natural language understanding*, a module that transforms unstructured text into structured information by recognizing entities and intent of the received text.
4. *Content system* enables to create, read, update and delete operations regarding the points-of-interest (POI) available on the AS-IT-IC platform. Additionally, it deals with the information presentation of specific POI or a group of POIs.
5. *Route optimization*, a service for finding optimal route between a set of points.

3.1 Conversation Platform

The conversation platform is based upon the popular open-source software Rocket.Chat[7], which provides a full-featured modern chat application by: enabling virtual assistant integration through webhooks, enabling the home page customization, allowing for the user interface localization, providing responsive interface for desktop and mobile screen sizes, enabling iframe integration through message posting. There are three entry points to the conversational platform:

1. Rocket.Chat app itself; meant for access by the tourist workers.
2. AS-IT-IC app: a full screen application with AS-IT-IC-specific menu and the embedded Rocket.Chat app; meant for access by frequent tourist users.
3. AS-IT-IC widget: a floating widget, which can be embedded into an existing website. It includes AS-IT-IC-specific menu and embedded Rocket.Chat app; meant for access by an anonymous tourist user visiting a tourism website.

Since two types of users are expected for the AS-IT-IC platform, the conversation platform has to enable different home-

[7] `https://rocket.chat`

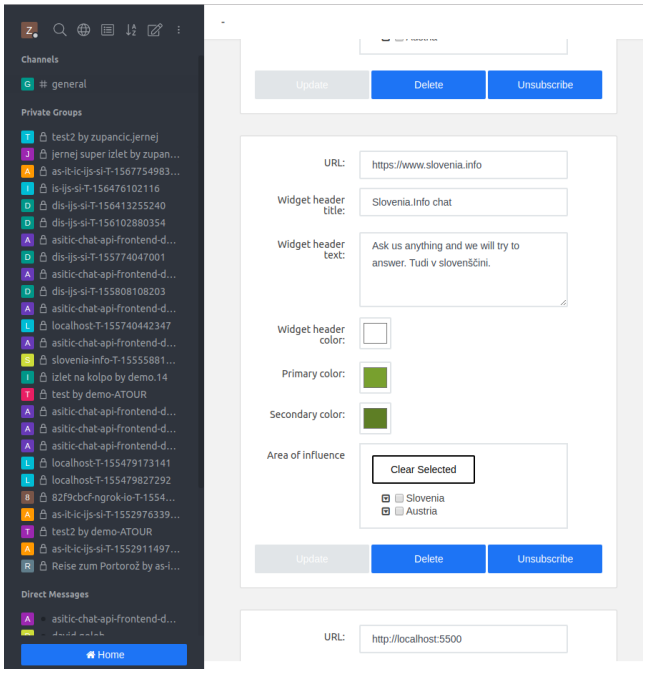

Figure 2: Tourist worker dashboard view.

page views, which are based on the user roles. To the tourist user, only the information regarding the planned trips is shown. This way, every planned trip is easily accessible from the home page. For the tourist workers, the configuration options for the AS-IT-IC widget deployed on the tourist workers' website are available (Fig. 2). This enables the tourist worker to customize the widget's appearance and converse with tourists from one central location.

3.2 Virtual Tourist Assistant

Our virtual tourist assistant "TOUR-BOT" can provide information to a tourist when no tourist worker is available or when the tourist prefers a robotic assistant (Fig. 3). TOUR-BOT has access to the conversation and the conversation context, which holds structured information about the current conversation. It responds to the users' button clicks and text inputs in natural language. In order to process the natural language it utilizes the "Natural language understanding" service, which analyzes the text and returns structured information about the text, consisting of:

1. Text intent – what does the user want to do; an example: the intent of "I want to go to Planica" is `obtain direction`), and
2. Recognized entities – what points-of-interest are mentioned in the text; an example: the entity in "I want to go to Planica" is `Planica`).

TOUR-BOT stores the conversation dialog flow rules, which enables it to hold a meaningful conversation that spans several tourist – TOUR-BOT interactions. For instance, when the tourist states "I want to go to Planica", TOUR-BOT asks "How will you visit those places" and offers different modes of

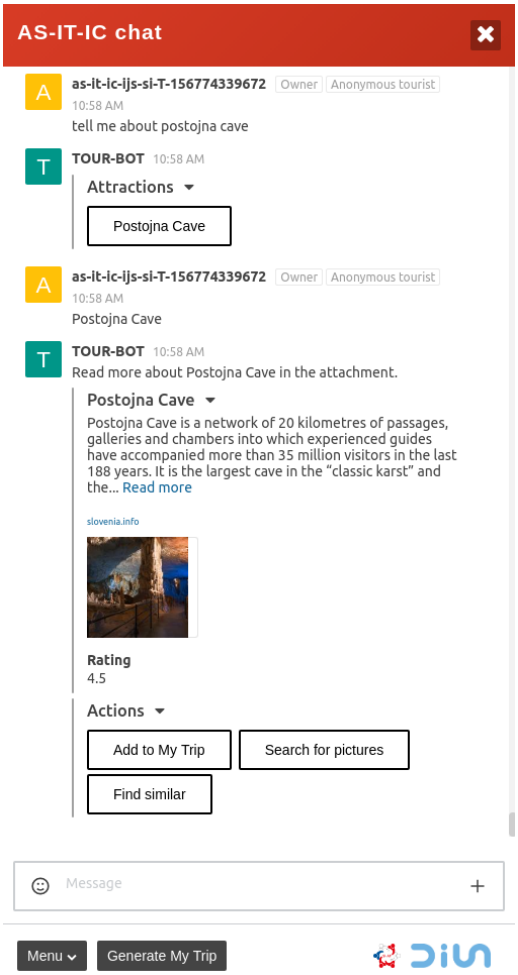

Figure 3: Tourist to TOUR-BOT chat example.

transport. After the tourist provides feedback, proper links to Google Maps[8] or Openroute service[9] are generated and displayed. The following intents are currently supported by TOUR-BOT:

1. General POI search. Examples: "Tell me about Postojna cave", "horseriding near Soča river", "accommodation near Ljubljana castle".
2. Path to attraction request. An example: "I want to go to Ljubljana castle".
3. Similar search request. An example: after reading about the Ljubljana castle – "anything similar nearby".
4. Trip manipulation actions: add a POI to the trip, clear the trip, generate route for the trip. Examples: after reading about the Ljubljana castle – "add this to my trip", "clear my trip", "generate route" etc.
5. Small talk intents: greeting, critique, about, help, praise and others. Examples: "hi", "who are you", "you are bad", "help me", "you are great" etc.

[8] `https://www.google.com/maps`
[9] `https://openrouteservice.org`

3.3 Natural Language Understanding

The natural language understanding service comprises two parts: entity recognition and intent recognition. Entity recognition is available for entities that were obtained from tourism websites and other sources. See [8] for more information. In summary, 20,999 entities are available in the system, of which 8,734 are attractions and others are mostly geographical entities. The entity recognition is based on the probability that an entity is present in the text. The probability is estimated on word distances between the entity words and the text input words. Entity recognition is further explained in [6].

Intent recognition is a text classification task. Based on the text representation, a machine learning model is built to best classify the text in the training examples. While different processing and classification pipelines were tested, the best performing pipeline is the following: First, the input text is tokenized[10]. Second, the stopwords are removed from the text. Third, word vector (using FastText embeddings [3] and the pymagnitude package [4]) for each remaining token is queried. Mean vector is computed and used as the text embedding representation. Support vector machine from the scikit-learn project[11] is then used to obtain the machine learning model. Using this pipeline we were able to achieve F1 score of about 0.8 on our tourist queries dataset that comprised about 100 queries.

3.4 Content System

The content system stores all the POI data [8] used across the AS-IT-IC platform. It enables tourist workers to create, view, update and delete specific POI information. Additionally, it enables crowd-sourcing the data-gathering by allowing anonymous users to provide suggestions for updating POI information. The suggested update is publicly visible only when the user with sufficient rights (e.g., tourist worker) approves the suggestion. The content system is further responsible for detailed POI presentation and the overview presentation of all POIs within the system, either in the form of a map or an interactive list[12].

3.5 Route Optimization

Route optimization enables finding quickest route for visiting a set of chosen points, while taking into account the preferred mode of transport and the road infrastructure within some region. We utilized the Open Source Routing Machine[13] (OSRM) for data preparation for the regions of Slovenia and Austria. Further, the OSRM `trip` endpoint was used to solve the Traveling Salesman Problem, which is solved "using a greedy heuristic (farthest-insertion algorithm) for 10 or more waypoints and using brute force for less than 10 waypoints"[14].

4. CONCLUSIONS

In this paper we presented an intelligent tourist-information platform for Austria and Slovenia as part of the AS-IT-IC project. The platform enables live communication between tourist workers and tourists. Additionally, tourists can converse with TOUR-BOT, a virtual assistant, in natural language in Slovene, German or English in order to search for relevant attractions and plan a trip. Using the AS-IT-IC platform, a tourist can easily plan a visit to a specific region, while tourist workers can establish direct communication with the tourists and obtain live feedback on their interests. In summary, the AS-IT-IC tourist platform enables several novel user-friendly functions for tourists and tourist workers.

[10] `https://repo.ijs.si/DIS-AGENTS/reldi-tokeniser`
[11] `https://scikit-learn.org`
[12] `https://eturist.docker-e9.ijs.si`
[13] `http://project-osrm.org`
[14] `http://project-osrm.org/docs/v5.22.0/api/#trip-service`

5. ACKNOWLEDGMENTS

This work was co-financed by Cooperation Programme Interreg V-A Slovenia-Austria 2014-2020, project AS-IT-IC.

6. REFERENCES

[1] B. Cvetković, H. Gjoreski, V. Janko, B. Kaluža, A. Gradišek, M. Luštrek, I. Jurinčič, A. Gosar, S. Kerma, and G. Balažič. e-Turist: An intelligent personalised trip guide. *Informatica*, 40(4):447, 2016.

[2] G. Grasselli and J. Zupančič. Tourism related ICT tools: A review. In *Proceedings of the 21st International Multiconference Information Society - IS 2018*, volume E, pages 10–13, Ljubljana, Slovenia, 2018. Jožef Stefan Institute.

[3] E. Grave, P. Bojanowski, P. Gupta, A. Joulin, and T. Mikolov. Learning word vectors for 157 languages. In *Proceedings of the International Conference on Language Resources and Evaluation (LREC 2018)*, 2018.

[4] A. Patel, A. Sands, C. Callison-Burch, and M. Apidianaki. Magnitude: A fast, efficient universal vector embedding utility package. In *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing: System Demonstrations*, pages 120–126, 2018.

[5] B. Peischl, O. A. Tazl, and F. Wotawa. Open questions of technology usage in the field of tourism. In *Proceedings of the 20th International Multiconference Information Society - IS 2017*, volume E, pages 29–22, Ljubljana, Slovenia, 2017. Jožef Stefan Institute.

[6] M. Štravs and J. Zupančič. Named entity recognition using gazetteer of hierarchical entities. In *International Conference on Industrial, Engineering and Other Applications of Applied Intelligent Systems*, pages 768–776. Springer, 2019.

[7] J. Zupančič and M. Gams. Austrian-Slovenian intelligent tourist information center: Project progress report. In *Proceedings of the 21st International Multiconference Information Society - IS 2018*, volume E, pages 5–9, Ljubljana, Slovenia, 2018. Jožef Stefan Institute.

[8] J. Zupančič, O. A. Tazl, B. Mahnič, and G. Grasselli. AS-IT-IC databases. In *Proceedings of the 21st International Multiconference Information Society - IS 2018*, volume E, pages 14–17, Ljubljana, Slovenia, 2018. Jožef Stefan Institute.