Travel Companion

A mobile system for trip assistance relying on Artificial Intelligence and Augmented Reality

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ABSTRACT

The goal of our research has been to integrate existing information systems and to design and implement a prototype of a digital personal travel assistant for travelers, called Travel Companion. Travel Companion assists a traveler through various guidance functions, and offers personalized reminders and recommendations, which are based on the traveler's current location and the information that is being collected from the traveler's cellphone camera. Travel Companion selects routes for the traveler's trip that suit best to his/her personal characteristics or potential mobility problems. Traffic data is collected from Google Maps, whereas information that refers to personal preferences are collected from Facebook. Furthermore, personal information, like having a physical condition that limits traveler's movements, are provided by the traveler and stored in an Knowledge Base.

CCS CONCEPTS

• **Information systems → Ontologies**; • **Computing methodologies → Logic programming and answer set programming**; *Mixed / augmented reality*;

KEYWORDS

Artificial Intelligence, Augmented Reality, Semantic Web, Reasoning

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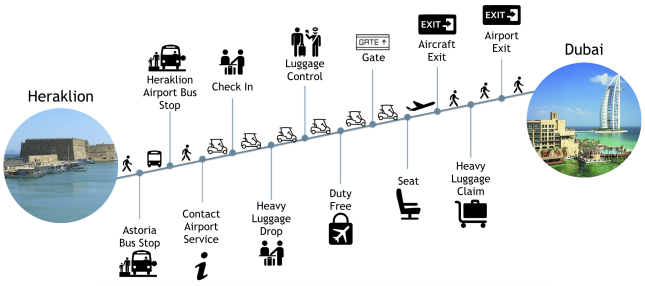

Figure 1: Travel Plan from Heraklion to Dubai

1 INTRODUCTION

1.1 Motivation and Problem Statement

Travelers usually feel insecure when traveling in another place. Especially people with lack of travel experience often face problems during a trip. Elderly, disabled or any travelers feeling insecure during a trip may need assistance. For example, let's assume that a Greek travels from Athens to Dubai and does not speak Arabic, thus being unable to follow Arabic instructions or signs in order to navigate in this airport.

Furthermore, people with little travel experience may get lost in airports, or may be unaware of the intermediate steps that need to be followed, or their order of occurrence. An important feature of such a system would be to generate travel plans, such as for example the plan appearing in Figure 1, which would detail the different steps of the trip.

1.2 Main Features of the Travel Companion

Travel Companion is going to provide a way for the traveler to claim tickets for missing route and support is provided with regards to the execution of each individual Travel Segment. This includes indoor and outdoor navigation assistance and the proposal of routes suitable for the specific traveler.

Note that different components of the Travel Plan may have different deadlines and time is an important factor when traveling. The Travel Companion organizes these deadlines and offers personalized reminders that take into account the mobility restrictions of the specific traveler.

The Travel Companion offers assistance via Augmented Reality (AR). AR will be used to improve the understanding of the traveler with regards to his/her current location; for instance, when the camera of the traveler's smart-phone detects a relevant sign in an airport, this may activate a notification with helpful directions for his/her route, even if the sign is written in a language unknown to the traveler.

Further, acknowledging the fact that a significant portion of travel time includes waiting, Travel Companion provides personalized recommendations for spare time. These recommendations are adapted to the current traveler using stated preferences from Facebook.

1.3 Components of Travel Companion

The Travel Companion was built using seven different components. Their functionality is briefly described below.

Knowledge Base: The information necessary for the Travel Companion to function is stored in an RDF Knowledge Base. Such information includes the traveler's profile, trips, tickets and any other information relates to the traveler.

Image Detection: The augmented reality component offers the feature to detect images with a mobile's phone camera, using the Vuforia API.

Preferences: The preferences of the traveler relate to Facebook likes and are used to provide recommendations that match the traveler's profile during waiting time at airports or stations.

Google Maps: The Public Transportation is based on Google Maps and is used to load any available Public Transportation for routes that user does not have tickets.

Answer Set Programming: Using Declarative Reasoning it provides an easy and extensible way to generate Travel Plans, dependent on different domains. The integration component requests its execution and the generated plan is then parsed and stored back to the Knowledge Base.

User Interface: The user interface was developed using Unity[1], and offers an easy way to interact and keep track of the trip.

Java: The integration component is implemented using Java and is responsible for orchestrating the other components.

2 IMPLEMENTATION

In this section, we describe the implementation of the Travel Companion and the technologies used to implement the features explained in the previous section.

2.1 Ontology

The data used in Travel Companion are modeled using an ontology. We proposed *Trip Ontology* that provides the schema upon which our data are stored. The Trip Ontology is implemented using RDF and offers many features.

The Trip Ontology includes three main user categories (Elderly, Disabled and Common) but it can easily be extended to more. For each category we have defined some relevant properties, including a *Max Walking Distance* that the traveler can perform and other properties that are relevant in order to meet deadlines.

We have defined information for trips, tickets, places that relate to tickets and transportation ways that a route can be performed. We consider many different *Transportation Ways* that a traveler can use in order to perform an Travel Segment. *Atomic Transportation* is any means of indoor transportation, like a wheelchair in a Train Station, or an electric car in an airport. *Transportation Means* is any outdoor mean of transportation.

Travel Segment is an action that the traveler needs to complete in order to reach his/her destination. For example, if the traveler holds a bus ticket he/she should perform four travel segments(buy ticket in kiosk, visit for spare time some stores, find your gate, get of the bus).

2.2 Augmented Reality

Travelers prefer to see information that is more relevant to them, and Travel Companion respects that by filtering relevant information about restaurants or cafes and making the best recommendations that are appropriate and personalised for the specific traveler. Another example of the use of Augmented Reality for our purposes is the use of image detection for supporting a traveler that is lost in an airport.

2.3 Reasoning Capabilities

We developed the logical part of our approach using the ASP language in order to guarantee that our method is strictly defined and our fundamental assumptions are preserved. Our system's core consists of a *Travel Segment Generator*, an *Alert Generator* and a *Personal Information Filter*.

The *Travel Segment Generator* is able to create ordered atomic actions for each ticket. For instance, a trip that consists of two tickets, plane and bus, should recommend a different plan not only for each ticket, but also for each traveler category.

The *Alert Generator* is used to activate and send notifications to the traveler when necessary. This can happen when the traveler is running late for a deadline, or if he/she is trying to execute the "wrong" action in the sequence of Travel Segments in the Travel Plan.

Personal Information Filter is used for traveler's recommendations. When the traveler is located at a recreation area, like Duty Free, our system is able to make recommendation depending on his/her social media profile.

2.4 Ticket Generator

Usually, a traveler does not have all necessary tickets and to support this, the Travel Companion uses Google Maps API to load and propose such routes, as well as to assist the traveler during these parts of the trip (e.g., provide directions).

In more details, the Google Maps API loads any available Public Transportation (where available) that "fills the gap" between other tickets or between the first/last ticket and the origin/destination of the traveler.

[1] https://unity3d.com/