MNISIKLIS: A PLATFORM PROVIDING UNIVERSAL LOCATION BASED SERVICES FOR INDOOR SPACES

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Abstract   MNISIKLIS is an integrated system aiming to provide indoor location-based services for all focusing on navigation. In the context of the Design for All approach, the system targets to support several types of users, including persons with disabilities as well as elderly, by exploiting multimodal interaction. Furthermore, MNISIKLIS exploits modern positioning techniques in order to achieve high quality positioning for indoor environments. Moreover, the system implements efficient path finding algorithms and provides advanced user experience through highly personalized services. MNISIKLIS adopts Semantic Web technologies (e.g., ontologies and reasoning methods) for representing and managing application models.

1.   Introduction - Motivation

Location-based services (LBS) constitute a popular domain of context-aware applications. Indoor pedestrian way-finding, in particular, is a very challenging area, mainly due to the unsuitability of the mature and widely

established outdoor positioning technologies for use inside buildings. The Global Positioning System (GPS) is an excellent technology that can be used for the determination of absolute location in outdoor environments, but is almost useless indoors.

2.   Sensing technologies

In the MNISIKLIS platform we have adopted three sensing technologies: UHF RFIDs, Dead Reckoning (DR) for pedestrian users and WLAN Received Signal Strength Indicator (RSSI). Regarding RFIDs, every tag is associated with a specific location of the building and the user carries a mobile RFID reader in order to scan the tags. In the context of DR, a 3-axis electronic compass and a 3-axis accelerometer used in order to facilitate the estimation of the distance travelled by the user. Moreover, the location server is the core component of the positioning subsystem. It processes the data received from the mobile device and generates the final estimation of the users current position. Specifically, it exploits two-level fusion of location information that combines information stemming from the sensing technologies. It is also based on a Dynamic Bayesian Network (DBN) which is used for the location inference.

3.   Services and Algorithms

In the context of MNISIKLIS, the following services have been implemented: 1) static navigation, 2) dynamic navigation, 3) where-am-I, 4) exploration and 5) nearest Points-Of-Interest (POIs). These services are based on a hybrid rule-based navigation algorithm that involves the creation of a user-compatible building graph and the computation of the best traversable path for each user. The route complexity, the total route distance and the user profile are the main measures that affect the path computation process. Finally, a Semantic Content Management System was developed for retrieving and updating content.

4.   Innovations

The main novelties of the implemented system are listed below:

1 Proximity sensing through passive UHF Radio Frequency Identification (RFID) technology.

2 Positioning is based on a multi-sensor fusion process, involving Wi-Fi positioning and the Dead Reckoning technique.

3 The system provides a multimodal user interface, thus implementing the Design for All paradigm.

4 The implemented services heavily rely on semantic models and knowledge reasoning techniques. Hence, the overall service logic is highly human-centered.

5.   Demo Overview

Motivated by the application of modern positioning techniques in indoor environments, we will demonstrate the functionality of MNISIKLIS system. During this demonstration, the main services of the system will be showed and tested. Moreover, a tablet-pc will be used as a user device. Users will be able to carry the appropriate equipment and select any of the available MNISIKLIS services:

- **Static Navigation**. The user will ask the system to determine a "suitable" route to a certain destination.

- **Dynamic Navigation**. An extension of static navigation that periodically traces the user position. In case it detects a significant deviation of the user from the predetermined path, it helps her to find her way by providing more detailed information.

- **Where-Am-I**. The user will ask for her current position inside a building. The system will respond by providing details about the last known user position in different levels of detail.

- **Exploration**. While the user is moving inside the building, the system provides ("pushes") information about the nearest locations that she may be interested in. During the demonstration, users will be able to explicitly state their POIs or will be provided with some defaults.

■ **Nearest POIs**. The system will find and present the POIs that are closer to the user.

The field tests will take place in the building of Department of Informatics and Telecommunications – National and Kapodistrian University of Athens.

6.   Acknowledgements