

A Contextual Geofencing Mobile Tourism Service

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Outline

- **Introduction**
- **Description of the System**
- **Description of the Architecture**
- **User Experience**
- **Related work**
- **Conclusions**

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Introduction

- **Mobile technologies** have greatly **improved** in recent years

- New mobile OS

- Android OS
- Iphone OS
- Samsung Bada

- New features

- Touch Screen
- Sensors
 - Accelerometers
 - GPS
- Internet connectivity
- Camera

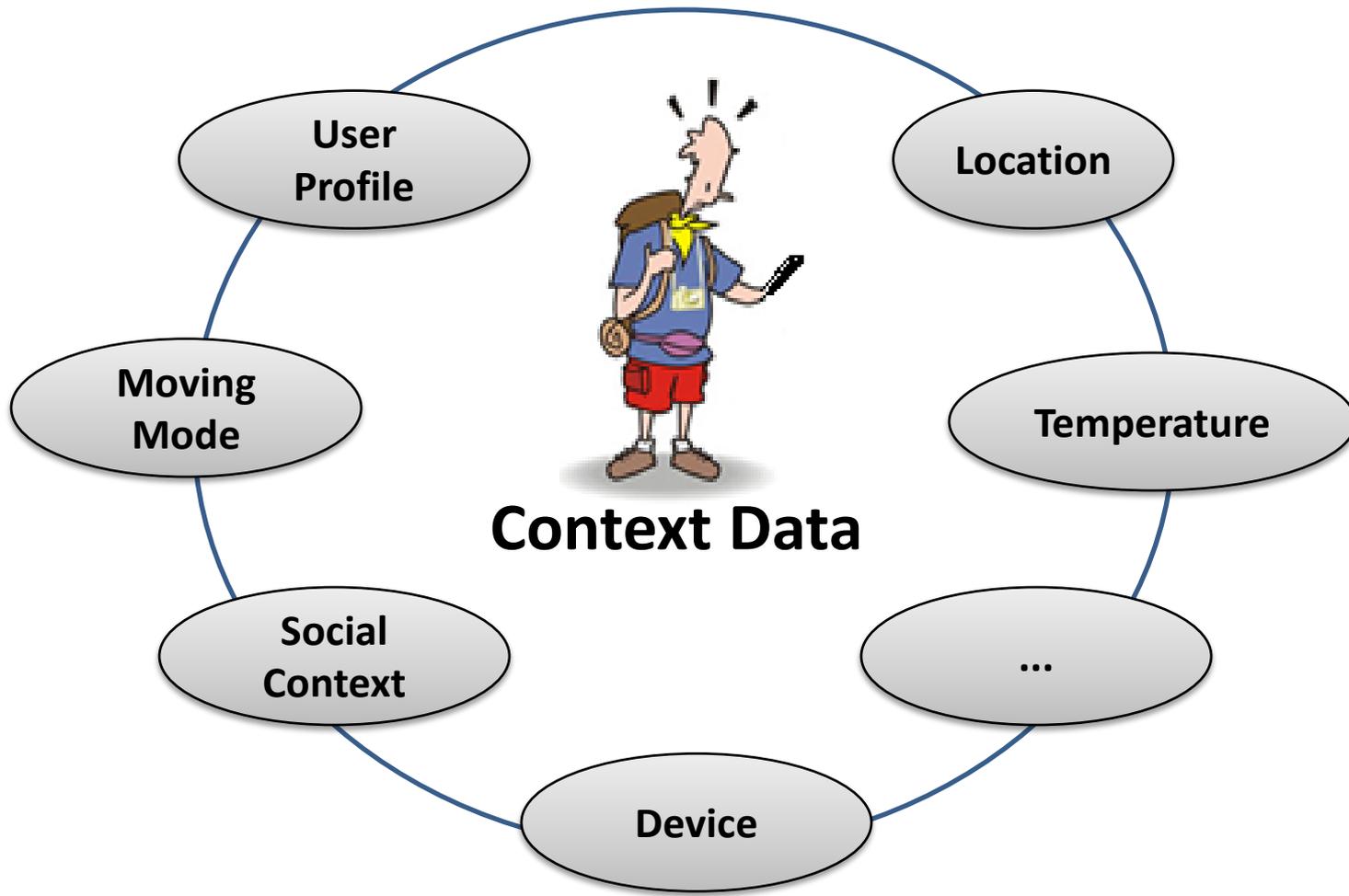


Introduction

- **People on the move are active mobile technology users.**
 - Worldwide mobile phone sales to end users totalled 1.211 billion units in 2009 (Gartner)
- Mobile devices have become a new way to **access information** and consume services on the Internet **everywhere**
- **There is a new challenge in this scenario**
 - How could we provide the correct information to people on the move at any time and place?



Introduction



Introduction

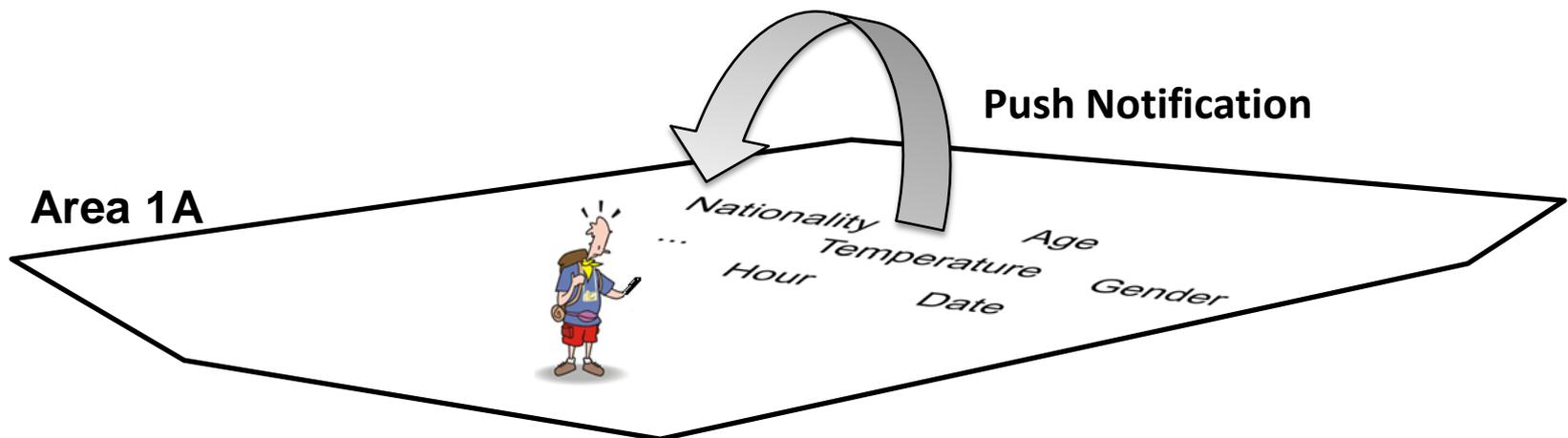
- **Location Based Services: a first approach**



- The usage of **more context parameters** could **improve the personalization process** and **increase the satisfaction** of the visitor

Introduction

- **liveCities: A Contextual Geofencing Mobile Service**
 - It is a **push** service that sends personalized notifications to mobile devices according to the visitors' context on a **defined area (geofence)**.
 - **Geo-context:** the context that is relevant to a particular area



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Description of the System

- **liveCities** is composed of two modules
 - **Mobile client:** the visitor manages received notifications.
 - **Notification Manager:** tourism entities create and configure areas, notifications and context conditions.
- **Notifications**
 - Each notification is linked to a concrete area
 - Text, HTML, link to other Internet resource (video, audio,...)
- If a visitor is **inside a registered area** and the **context values match** the ones defined for that area
 - > The **notification is pushed** to the visitor's mobile device.

Description of the System

- **Mobile Client**
 - Android native application
 - The visitor has to configure a profile
 - Username, age, gender, nationality.
 - Social Context
 - The user can scan nearby devices using Bluetooth technology and set a role: **family, friend, workmate or couple**.
 - It periodically sends dynamic context data to the Manager
 - **Location:** latitude, longitude
 - **Moving mode:** none, walking, transportation
 - **Social context:** based on nearby devices and roles.

Username

Age

0

Gender

Male

Nationality

Spain

Who is with you?

Scan Edit

Description of the System

- **Mobile Client**
 - When a new notification is received, the mobile device vibrates.



Description of the System

- **Notification Manager**

- It is a web application where all the registered tourism entities can create notifications.
- The tourism entity has to:
 - Create the **notification**: title, content and type (information, suggestion, offer)
 - Configure the **context conditions** that are relevant to that notification in that area
 - Create the **virtual area**

Description of the System

- Notification Manager

New area

Area Name: Notification Type: Information Content Type: Html Content

Rich text editor toolbar: B, I, U, ABC, x, x, list, link, unlink, image, HTML

Fonts: Colors:

Date Start: Date end:

Time start: Time end:

Weekdays: Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Profile: Family Friends Work Couple

Age: Nationality: Gender: Moving mode:

Buttons: Add polygon, Cancel

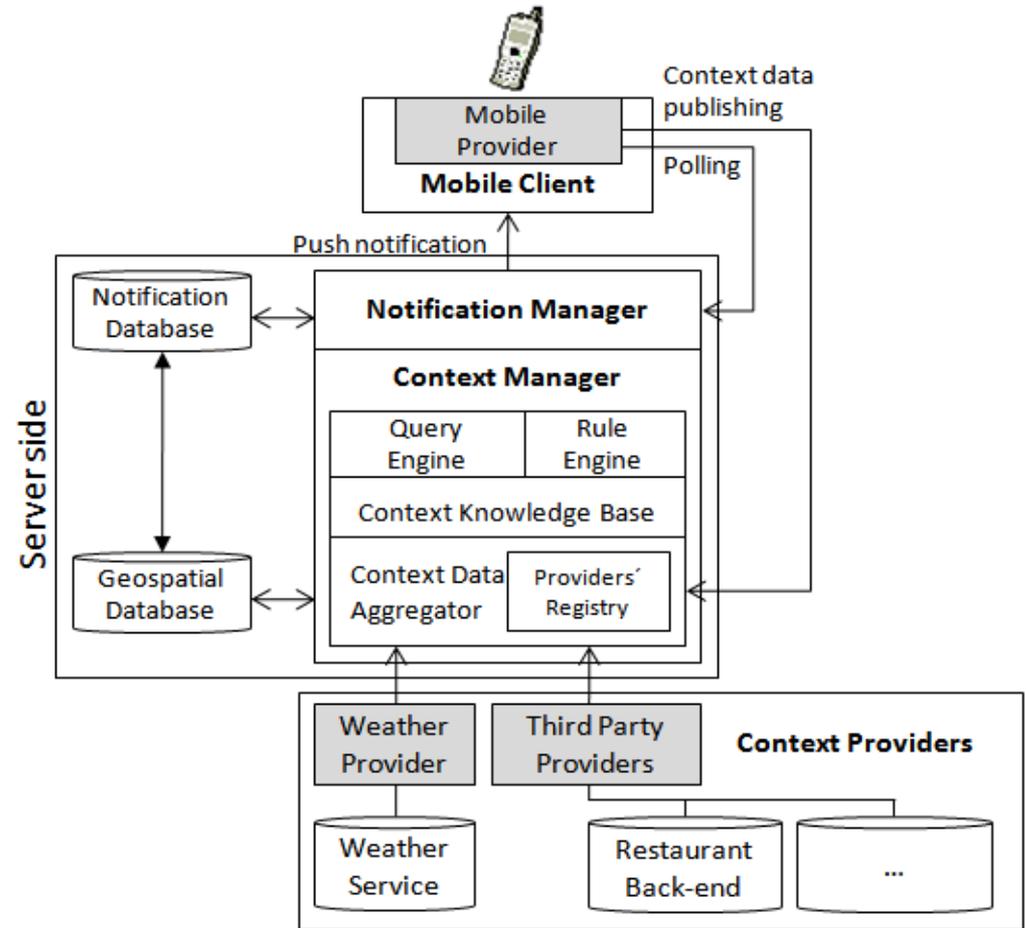
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						01
02	03	04	05	06	07	08
09	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

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Architecture Description

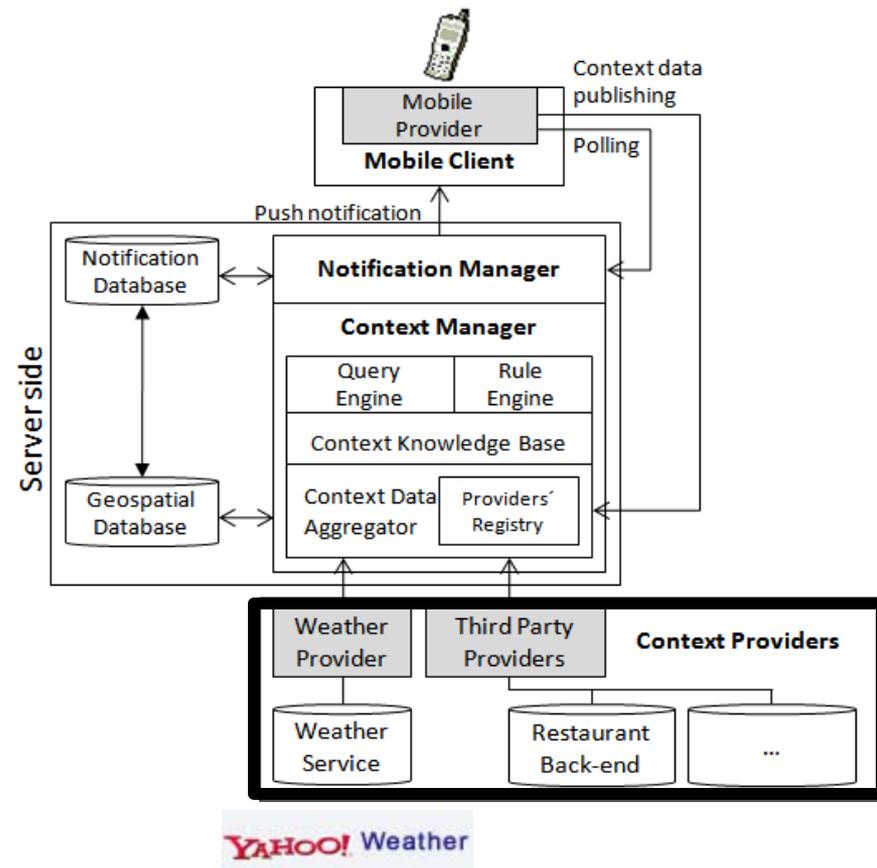
- **Four main components**
 - Context Provider
 - Context Manager
 - Notification Manager
 - Mobile Client



Architecture Description

- **Context Provider**

- It periodically **extracts** context data from the identified context data sources (web services, data bases,...)
- It **sends** data to the Context Manager in the form of key/value pairs (temperature, 21)
- liveCities
 - A weather provider that gets temperature value from Yahoo Weather web service has been implemented.

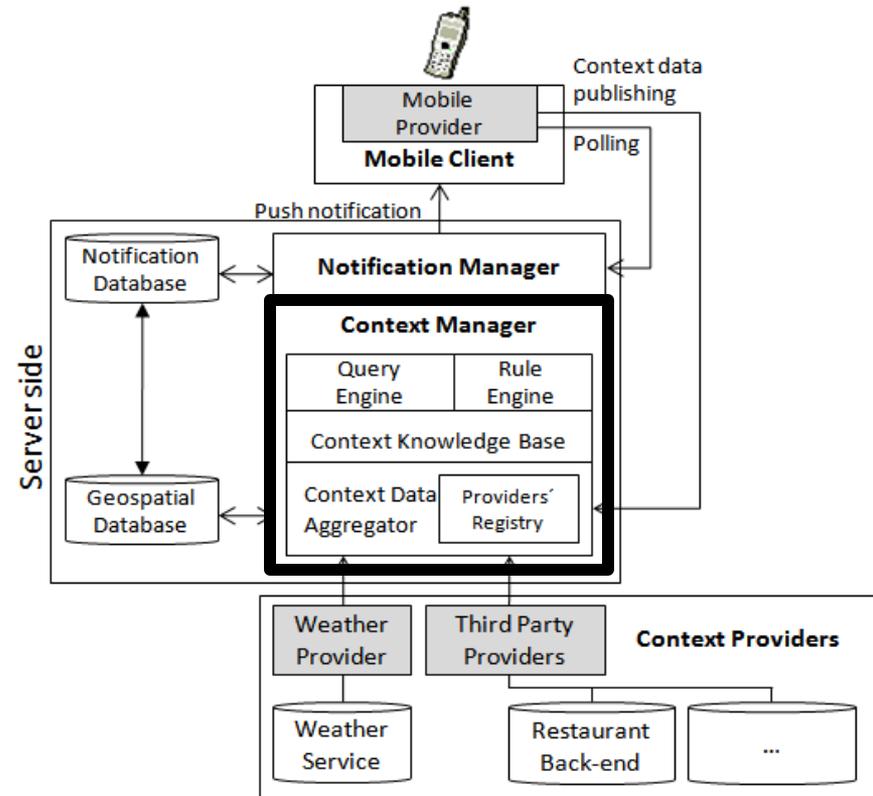


YAHOO! Weather

Architecture Description

- **Context Manager**

- It is the core component of the system.
- It **manages context data** life cycle
 - Conversion of gathered key/value pairs into the defined context model.
 - Inference of high level context.
 - Notification assignment process by the use of rules.
- It is composed of several modules
 - Context Data Aggregator
 - Providers' Registry
 - Context Knowledge Base
 - Query Engine
 - Rule Engine



Architecture Description

- **Context Manager Modules**

- **Context Data Aggregator**

- It transforms key/value pairs into the object oriented model instances that represent different context entities.
- It updates the Context Knowledge Base with up to date data.
- It has access to an external geospatial database in order to translate location coordinates into a logic area name registered with the Notification Manager.

- **Providers' Registry**

- This registry manages the providers' life cycle.

- **Context Knowledge Base**

- It contains all the context entity instances stored in memory.
 - Rule Engine: the context parameter values of the created notifications are transformed into rules that send these notifications to mobile devices.
 - Query Engine: data from the Knowledge Base can be queried.

Architecture Description

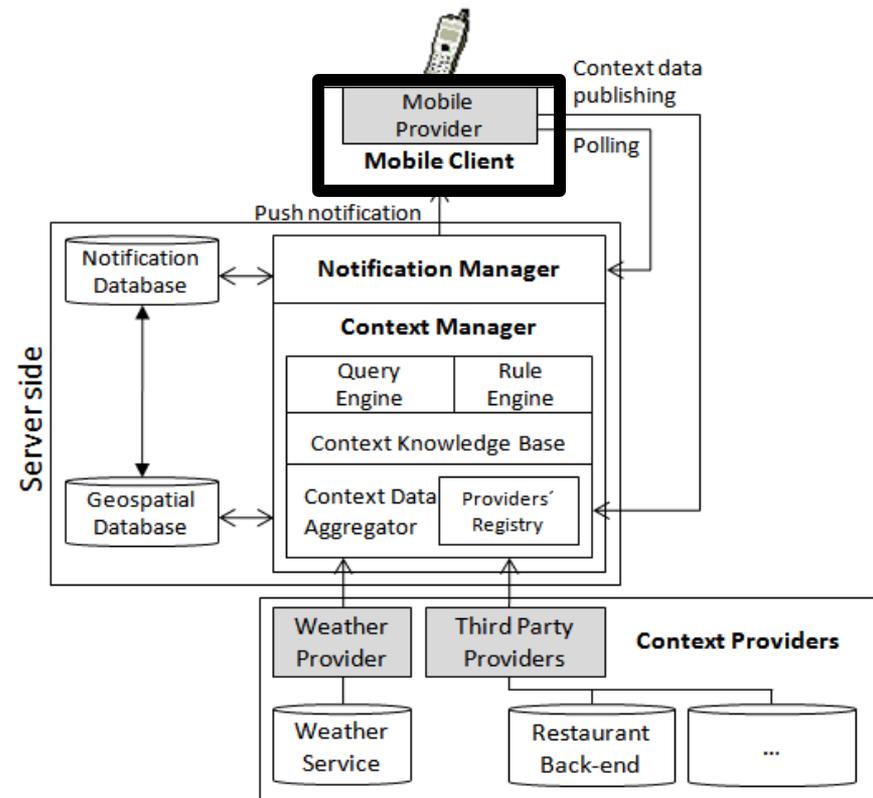
- **Mobile Client**

- **Mobile Provider**

- It acquires context data from the mobile device and sends it to the Context Manager.

- **Mobile client**

- It is an Android application where the visitor can manage the user profile and receive push notifications.
 - It makes periodical requests to the Notification Manager in order to check available notifications (polling).



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User Experience

- **Four scenarios have been designed to validate the system with users**
 - Transportation Information scenario
 - Restaurant Offer scenario
 - ...
- **Tourism entities involved**
 - Bus company
 - Restaurant

User Experience

- **Designed scenarios**

- **Transportation Information Scenario**

If a visitor is waiting for the bus, the system pushes a notification with an estimation of the remaining time for the bus to arrive.

- Tourism entity: bus company.
- Notification: the remaining time for the bus to arrive.
- Areas: several areas have been created around bus stations.
- Context parameters: location and moving mode (none).

User Experience

- **Designed scenarios**
 - **Restaurant Offer Scenario**

If a visitor is having a walk with friends around a restaurant at lunch time and the weather is nice, the system pushes an offer to have lunch at the terrace.

- Tourism entity: fast food restaurant (with an outdoor terrace).
- Notification: a discount to have lunch at the terrace.
- Areas: an area has been created around the restaurant.
- Context parameters: location, moving mode (walking), time (from 12 to 14), age (<30) , social context (friends) and temperature (>20 °C).

User Experience

- **User Experience**
 - The scenarios were implemented in a real area of San Sebastian.
 - The users had to take a tour through the different areas of the described scenarios.
 - They were informed about the system and were introduced to the experiment's objectives.
 - A total number of 15 people completed the tour.
 - The participants ranged in age from 20 till 50 and were active technology users.

User Experience

- **Results of the User Experience**
 - Each user had to fill out a questionnaire, providing a punctuation between 1 (S.D.) and 5 (S.A.) about certain statements.

	Strongly disagree		Strongly Agree			Average	St. Dev.
	1	2	3	4	5		
Like the system	0%	0%	6.6%	26.7%	66.7%	4.6	0.70
Easy to use	0%	0%	13.3%	33.3%	53.4%	4.6	0.70
Pro-activity of the system is useful	0%	0%	6.6%	40%	53.4%	4.5	0.71
Useful for tourists	0%	0%	0%	46.7%	53.3%	4.6	0.52
Useful for tourism entities	0%	0%	0%	33.3%	66.7%	4.7	0.48
Added value over other known systems	0%	0%	0%	60%	40%	4.5	0.53
Would use the system again	0%	0%	13.3%	33.3%	53.4%	4.7	0.48

liveCities can be considered as a promising system in order to assist tourists on the move.

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Related Work

	Location	User profile	Social Context	Network	Device	Weather	Moving Mode	Date	Time	Third Party Provider
COMPASS	X	X							X	
CRUMPET	X	X		X	X					
LoL@	X									
mobiDENK	X									
Guilliver's Genie	X	X			X					
m-To-Guide	X	X		X						
CAIPS	X	X				X		X	X	
liveCities	X	X	X		X	X	X	X	X	X

Related Work

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CRUMPET	X	X		X	X					
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Guilliver's Genie	X	X			X					
m-To-Guide	X	X		X						
CAIPS	X	X				X		X	X	
liveCities	X	X	X		X	X	X	X	X	X

Related Work

	Location	User profile	Social Context	Network	Device	Weather	Moving Mode	Date	Time	Third Party Provider
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mobiDENK	X									
Guilliver's Genie	X	X			X					
m-To-Guide	X	X		X						
CAIPS	X	X				X		X	X	
liveCities	X	X	X		X	X	X	X	X	X

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CONCLUSIONS

- **liveCities: a Contextual Geofencing Mobile Tourism Service**
 - It explores the usage of a **great number of context parameters** in order to customize information in a mobile scenario.
 - The usage of more context values provides a **more accurate personalization**.
 - The system improves the usability because it minimizes the user interaction and helps to get a **better user satisfaction**.
- **Future work**
 - A **real deployment** of the system is planned, making it available for download by real tourists.
 - An **analysis of the gathered context data** is planned.



Thank You!!

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