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Itour: Using Ambient Intelligence to Support Tourism

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Abstract

Technology is becoming omnipresent in public spaces: from CCTV cameras to smart phones, and from large public displays to RFID enabled travel cards. Although such technology comes with great potential, it also comes with apparent (privacy) threats and acceptance issues. Our research focuses on realizing technology-enhanced public spaces in a way that is acceptable and useful for the public. This paper gives a brief overview of the research that is aimed to unlock the positive potential of public spaces. This paper's main focus is on the acceptance of sensor technology in the realm of tourism. The ITour project which investigates the potential and acceptance of using (sensor) technology and ambient media to collect, uncover and interpret data regarding tourists' movements, behavior and experiences in the city of Amsterdam is particularly discussed as an example.

Introduction

Technology offers great potential for making public spaces more interesting, social, beautiful and effective [16]. However, the use of pervasive technology, such as sensors may sometimes be perceived as a violation of privacy, and large displays in public spaces might not always contribute to activities and needs of passers-by. Even more so, these can be perceived as useless or even annoying by some, instead of being a source of information or having social benefits. Thus, in order to fully realize this potential, examples are needed that are aimed to minimize the potential drawbacks and dangers that ambient technology withholds. For this purpose, the ITour project investigates the potential and acceptance of using (sensor) technology and ambient media to collect, uncover and interpret data regarding tourists' movements, behavior and experiences in the city of Amsterdam. The goal of this data collection and interpretation is to provide tourists with better and more targeted (ambient media) services. It focuses on developing personas and visualizing user scenarios (using techniques such as photo-based storyboards) to explore and assess these in close collaboration with the targeted groups.

ITour

In 2010, the city of Amsterdam counted more than 5,000,000 tourist arrivals [10] and a tourism growth rate of 14% compared to 2009 [11]. Indeed, according to its inhabitants and tourists Amsterdam is a highly rated city [14, 15], enabling visitors from all around the world to engage in all sorts of endeavors. Such activities range from visiting the vast variety of cultural and historical museums that Amsterdam has to offer, to canal cruising and attending art-exhibitions or concerts. Upcoming technologies, particularly sensor-mediated systems, have great potential to better identify and support such touristic activities and services. However, the wide range of tourists and possibilities make it difficult to determine the most suitable services to design and cater for, also from the perspective of the stakeholders in the tourism sector. Therefore, the focus of this study is to identify the different potential users and investigate their behavior and activity patterns for designing and developing tourist-targeted technology services. In order to increase understanding toward these new potential services, the potential end-users of such services are closely involved in the study process, through the creation and discussion of personas, (photo-based) user scenarios (such as [9]) and interviews with tourists and other stakeholders.

Related work

Research (e.g. [1,2,4]) has shown that various sensors in the environment can be utilized for mobile applications and guides that help supporting and personalizing the touristic experience. Sensors, such as GPS, electronic compasses and wireless networks, create the opportunity to determine the location of tourists, and as such,

enable personalized services on location. Research (e.g. [2-4]) suggests that offering such personalized services can be done within the real time-frame that tourists are undertaking activities, such as visiting a museum or an art gallery. Additionally, researchers (such as [5-8]) consider the data-mining of social media and other web platforms a viable basis for offering personalized information to tourists. Such data could subsequently be used to generate an overview of a tourist's personal interests, needs and intentions with regard to undertaking activities in a foreign city such as Amsterdam. Thus, a large body of research has shown that there is a wide variety of ambient technology that could support tourists in undertaking their activities. However, when regarding such ambient intelligence –a vision that combines concepts of ubiquitous technology, intelligent systems, responsive environments and advanced user interfaces– and particularly its usage and privacy implications, developing applications that are suitable and accepted by tourists remains a challenge.

There have also been a number of studies in various fields, which focus on evaluating user acceptance toward the use of technology. Some studies in health care suggest [12,13] that despite the benefits of various technologies that are specifically designed to aid patients in their daily life, these applications fail in providing the desired results due to lack of acceptance by the user. Also acceptance of technology by health care professionals is considered [19] important to maintain a high quality of service provided by health care application. Acceptance of technology is also considered important in various educational settings [20,21] such as e-learning and traditional learning. Other interesting fields of study are Law enforcement [23] and predicting consumer behavior [22] with regard to acceptance and adoption of technology.

Study

General approach to gauge public's needs and acceptance

The general approach of our research is human-centered, in which the needs of the users and the acceptance of technology of public space is key. For this research purpose, data is collected in two ways: by hand and with sensors. We use a living lab approach where we place technology in a public space for a longer period, sometimes up to several years [17].

For the collection of data by hand, well-known techniques such as focus groups, interviews, observations and surveys are being applied. In some projects targeted instruments are being developed for instance for charting the activities and needs of users of a specific public space. For the automatic collection of data we use technology such as interactive mats, RFID, GPS, computer vision, logging of touches of categories of information on a touch screen and social media. Furthermore, interactive models [18] are developed for discussing and visualizing the potential of ambient media.

This data collection approach is aimed to serve different purposes. Firstly, systems such as public displays are made more intelligent and responsive by using sensors. Secondly, the software or services, such as services for tourists, studied by collecting and analyzing data are improved by humans based on the research results. And finally, the data is used for visualizations, for instance a visualization of people's moods on an interactive map.

ITour study

In order to address the goal of supporting Amsterdam's tourist needs through utilizing (sensor) technology, the strategy is to:

- Identify and categorize different sources of data with regard to touristic activities, so to generate an overview of the available sensors to collect these data, and of available and future services that can benefit from these data.

- Develop (visual) scenarios for user-targeted and personalized ambient media, based on data that is acquired through a variety of available ambient sensors.

- Discuss these scenarios with user groups in order to match the information and service needs of tourists with the generated data and to address acceptance and privacy issues.

- Investigate whether and in what way the collected data could be applied for understanding and supporting the needs of possible stakeholders, such as tourists and organizations in the tourist sector. The resulting knowledge could then enable companies and organizations in the tourist sector to enhance and improve their existing and future services.

Engaging the targeted user group is considered key for the ITour project. Hence, a user-centered study (including interviews and the development and discussion of scenarios) is planned to be conducted to: (1) Gauge tourists' acceptance issues toward the use of various ambient intelligence and technology, and (2) Clarify what kind of (sensor) technology is considered viable and desired for the purpose of gathering touristic data.

The different types of data

A data-driven approach is chosen for the purpose of creating an inventory of needs with regard to tourists and ICT-services in the tourist sector. Examples of the types of different data that can be collected are categorized as follows:

- **Data about movements of tourists**: This kind of data depicts the movement pattern of tourists in Amsterdam. For instance; how does one transit from a hotel room to a museum nearby? What kind of transportation is used? What routes? In which order are they visiting different attractions in Amsterdam?

- **Data about activities of tourists**: This data that can be acquired through the use of available information services (such as reservation and payment systems) in the city. Analyzing such data will create an impression of how these services are being used by the tourists in Amsterdam. This type of data includes, for example, the type of service that is used, the amount of time spent by tourists using the available services and the type of locations visited.

- **Data used to gauge the total amount of time spent in Amsterdam**: a few interesting types of data are for example Hotel check-ins, check-outs and length of stay in hotels or other temporary accommodations.

- **Tourist demographics:** Tourist demographics are also a valuable type of data. Via categorizing this type of data, one could better understand different types of tourists and their individual needs.

- **Data about tourists' experiences:** A few suggested methodologies for data collection with regard to experiences are; (1) Experience sampling through mobile phone applications; (2) Data-mining the social media and web applications, such as Twitter and Flickr, for mood and emotion sampling; (3) Using text-mining on tourist forums and social media to gauge people's opinion with regard to touristic Amsterdam; (4) Experience sampling on touristic locations via cameras and similar devices.

Data segmentation, denoting the analysis and categorization of various tourist related data, could subsequently lead to more accurate understanding of creating (personalized ICT-) services. This could then catalyze more relevant and targeted communication between different stakeholders. In addition, segmentation of tourist data helps in constructing unique profiles of each tourist archetype based on their needs and characteristics.

Discussion and Conclusion

This paper presented the ITour project that investigates the employment of ambient intelligence for services for tourists. Research has shown the interesting potential of using (sensor) technology and ambient media to support tourism. However, to provide tourists with better, acceptable and more targeted services that use ambient-intelligence, these need to be discussed and assessed with the user in mind. For this purpose, personas were developed, which will be used for further user-centered study, including the development and discussion of desired scenarios. Such discussion is needed in order to fully understand the implications and requirements of ambient intelligence from the tourist perspective. Eventually, the presented study approach will lead to increased

understanding of people's attitudes and privacy concerns when regarding ambient personalized systems so that better suited services can be offered.

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