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CATCHWORD

Location-Based Services

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1 From "Mobile Services" to "Location-based Services"

Location-based services (LBS) evolved from mobile service. A mobile service is determined by the interaction of the user, the mobile device, and the mobile provider. Since the value for the users depends on the context (i.e. environmental factors surrounding them), mobile services can be assigned to different context-aware services which are characterized by integrating information about the user's environment into the service delivery process (Gummerus and Pihlström 2011). In fact, services that are centered on the user's location are named location-based services. Examples for such services fall into categories like mapping, navigation, and transport; travel and tourism; local search and information; social networking and entertainment; recreation and fitness; family and people locator services; mobile resource management; mobile advertising. LBS might consequently accompany the user during the entire day starting from finding the location of his car key in the morning via key finder service such as *Pally Smart Finder*, using *Google Maps* for navigating to the office based on the latest traffic information, searching for a post office nearby to drop off parcels on *AroundMe*, checking in into his favorite lunch place via *Foursquare*, using his running app *Runtastic* during his afternoon run, and determining the current location of his child on *FiLip* in the evening.

Consequently, as a starting point, LBSs can be defined as services that depend on and are enhanced by the positional information of the mobile device (Dhar and Varshney 2011). Since all users' activities take place in time and space, location and time are the essential elements of context for mobile devices. Because, by definition, a mobile device does not remain stationary, location is a key enabler for this new class of services (Aaltonen et al. 2005). The geographic location information can be "any type of data that places an individual at a particular location at any given point in time, or at a series of locations over time" (Cheung 2014).

Thus, LBS can be defined as any kind of network-based, mobile information services that account for and result from the positional information taken from a mobile device to provide value-added services to users, depending on their geographic context and individual preferences (Xu et al. 2009). Figure 1 reveals an overview about this concept.

The value-creation for the user of LBS results from incorporating the mobile device's location with other information and is achieved by means of timely, knowledge-based personalization. The value of the worldwide LBS market is forecasted to reach $ 39.87 billion by 2019 (Markets and Markets Analysis 2014), and the Western

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European LBS market is expected to grow by 45 % in the period from 2013 to 2018 (TechNavio 2014). Current main barriers are long and costly implementation circles of more accurate localization techniques (e.g., Galileo), challenges in business models, and users' historically prevalent privacy concerns.

From a legislative point of view, the advent of LBS was predominantly determined by the E911 mandate issued by the Federal Communications Commission in the United States in 1996. Originally, the purpose of this mandate was to improve emergency responses to wireless calls by enhancing the location accuracy of the caller's position. This mandate consequently built the technological foundation for the provision of LBS. In Europe, this mandate was established under the name E112 and was issued by the Directive for Mobile Communication in 2002 (Junglas and Watson 2008).

2 Structuring Location-based Services – Perspectives and Classifications

The perspectives on LBS are multifaceted. Besides the three "core elements" *user*, *provider*, and *technology*, it is necessary to incorporate LBS-specific components like *time* and *data collection* with respect to the major benefits of LBS (cf. Fig. 1).

Starting from the *data collection perspective*, the data generated through the location awareness of the mobile device are regarded as a new type of data (Junglas and Watson 2008). Even from a legal point of view, location data are considered to represent a distinct class that requires increased protection and special procedures. The EU Directive on Privacy and Electronic Communications ensures that location data can only be used with the permission of the user. Furthermore, users should be able to block location tracking temporally for ongoing services.

From the *user's perspective*, location-based information is not only perceived as geographical data given by latitude and longitude. Mainly influenced by philosophical science, location can be considered as equivalent to a place to which the user attributes a certain meaning. This location is in turn linked to a locale, which can be described by its shape and boundaries. This locale is given a sense by adding personal and emotional connections and hence rendering it a place in the user's perceptive world (Agnew 1987). Indeed, this perception is also demonstrated by humans defining locations by their name, sometimes without even knowing their exact coordinates, which would be applied from a mere *technological perspective*. This concept is comparable to pure data (location), which are put into context (locale) and by interpretation turned into knowledge. As a consequence, one can gain knowledge about users by investigating their location data. This knowledge can act as a powerful source for uncovering a vast amount of information about users' beliefs, preferences, and behavior. Thus, location can be considered as a very important component of contextual information, leading to in-depth knowledge about the user.

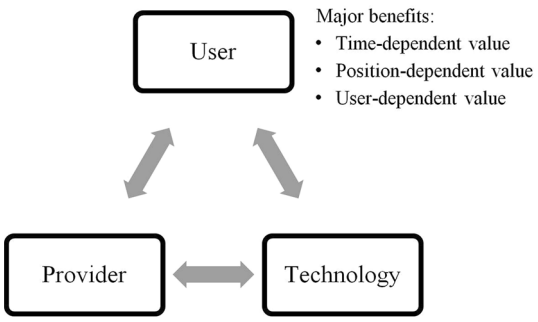

Fig. 1 Overview about the LBS concept based on Xu et al. (2009)

Not only the nature of data but also the *time perspective and real-life impact* differ. This is due to the fact that these services enable access to information about their short- and long-term implicit and explicit interests, whereas traditional data gained from user profiles (such as preferences and demographics) contain solely explicit and rather long-term preferences. Location data "cannot lie" which implies that one can for example state in a web profile that one exercises every day while the location data reveal no gym attendance for weeks (Wicker 2012). Moreover, location data provides mostly real-time information. These elements create a change in the relationship of the traditional, not necessarily connected, real-life identity and the identity created on a social network site.

From a *provider's perspective*, knowledge about the users' place is much more powerful than the single identity and time information as it can be used in two ways. For push services, the service can directly influence users' course of action (e.g., by directing them to the store on the left or the store on the right). For pull services this holds true as instances of service consumption are directly linked to the communication of that knowledge. In summary, LBS are considered to bear "potential for exerting substantially more power over individual behavior than previous modes of advertising" (Wicker 2012).

Due to new updates and features of LBS which are released daily, there is continuous change in the characteristics and development of new derivatives which makes it difficult for c*lassifications* in an ultimate manner. However, the catalogue presented in Table 1 containing seven dimensions provides a comprehensive overview.

Table 1 Classification of LBS based on Ryschka et al. (2014)

Classification title	Short description
Interaction knowledge	If the actions of the user are known to the user and the service, the LBS can be classified as *explicit*. If the actions of the user are, however, only known to the user and not made explicit to the application, LBS are named *implicit*. If the user is unaware that he is currently interacting with the service, although the service knows his actions exactly, LBS are classified as *inferred*. In rare cases, the actions are known neither to the user nor to the application which is labeled a *hidden* service
Market type	There are services for which users share their details and their location only *vertically* with the provider of the service or also *horizontally* with other users of the service
Delivery type	On the one hand, there are services in which the initiator of the service delivery is primarily the provider of the service (*push services*). On the other hand, there are services for which the user fulfills the role of the initiator by explicitly requesting the service at a certain point in time (*pull services*)
Entity supply	One can additionally distinguish between location-tracking and location-aware services. Location-tracking services supply entities other than the user (i.e. third parties) with the user's information about his or her location. Location-aware services, in contrast, provide a user with personal location data
Application area	Although researchers use varying terminology and a number of categories, some dominant application areas of LBS can be identified: *emergency, navigation, information, tracking and management, billing, advertising and entertainment*
Direction of mapping	If the service provision is centered on the user's actual position, its focus is on *targets at location* (also called self-referencing). The service can, however, also be built on the *location of a target*, which means that one or several targets are related to each other (also called cross-referencing)
Focus	If location information is primarily linked or added to digital artifacts, it is categorized under the term *locative media*. Hence, if the user's location at a certain point in time is the major reference of service delivery, it handles a *mediated locality*

3 Research Focus

Currently, research on LBS focuses on the element *user*. However, as indicated in Table 2, we can also observe research activities addressing *technology* and *provider*.

Concerning the theories and models applied in LBS *adoption and usage* research, the Unified Theory of Acceptance and Use of Technology (UTAUT) and its predecessors, the Theory of Reasoned Action, the Theory of Planned Behavior, and the Technology Acceptance Model, are mainly incorporated. The respective studies consequently analyze the adoption of LBS from a technological and rational decision-making perspective and center on the perceived ease of use and perceived usefulness as core independent variables. However, often theories and models only take the positive triggers of LBS adoption and usage into account. Exceptions are the Protection Motivation Model and the studies applying the privacy calculus perspective which include the inhibitors of LBS usage, as well. Generally, as LBS research is still a relatively young field of study, there are various (mostly descriptive) studies that do not follow an established theoretical frame.

A minority of empirical studies focusing on the *user* contribute to theory formation and building by applying a qualitative research approach. Quantitative approaches are applied purely to describe the state of usage at a certain time. Inductive approaches are based on quantitative surveys and the testing of structural relationships. A vast amount of studies examine LBS as an overall technology without taking into account the specifics of the service categories. Furthermore, as not every technology involves the disclosure of information about a user, failing to incorporate these special aspects of technology use might not lead to relevant research results. Research consequently needs to adapt to the active nature (disclosing its location)

Table 2 Overview of LBS research trends

Element	Current research focus
User	
Theories applied in LBS adoption and usage research	Unified theory of acceptance and use of technology (UTAUT)
	Theory of reasoned action
	Theory of planned behavior
	Technology acceptance model
	Privacy calculus model
Applied methods	Inductive
	Qualitative
Cultural area	Asia
Technology	Positioning techniques
	Tracking technology
	Privacy preserving schemes
	Mode of communication
Provider	Business models
	Legal environment
	Challenges

of the user as opposed to the view of a primarily passive user who solely evaluates the proposed offer.

Concerning the cultural areas studied, the majority of research is conducted with *users* of an Asian cultural background. Only few studies are based on participants from Western cultures, such as the United States or European countries. So far, none of the studies include cultural dimensions in their research models.

From a *technological* perspective, positioning techniques enabling LBS and tracking technologies represent important research areas. Linked to considerations on the legal environment, recommendations and design approaches for privacy preserving schemes are frequently elaborated and further developed. Furthermore, the potential of LBS-enabling technology as an additional mode of communication between the provider and the user is investigated.

Research conducted from the *provider's* perspective examines especially potential business models and their respective design elements (service, technology, organization, and financial domain). Several models depict potential avenues for monetizing LBS as well as the evaluation of the critical success factors and challenges for effective LBS. Furthermore, the legal environment represents the core of several studies.

4 The Role of the Business and Information Systems Engineering Community

The impacts of LBS are manifold, e.g., on users, technology, and providers. Therefore, practitioners as well as researchers from several disciplines work on LBS. This leads to various research opportunities for the Business and Information Systems Engineering (BISE) community.

Firstly, regarding the *user*, the BISE community is asked to tackle the lack of theoretical underpinning which can be observed in a high number of current studies about LBS that do not apply a stable theoretical framework. Since it is the stated mission of the BISE to attract research that focuses on both technology and theory (Heinzl et al. 2015), BISE researchers should in consequence be leading in further theoretical developments that account for the specific characteristics of LBS. Moreover, the LBS user should be regarded as an active part who chooses whether to disclose location data or not. Focusing on the cultural areas under study, the shortage of LBS research for several cultural areas, amongst others for Europe, calls for enhancement. The BISE community with its roots in German-speaking countries and a European focus could act as the driving force to fill this research gap.

Considering *technology*, various developments as well as the discovery of further application areas can be expected. The BISE community ought to contribute especially regarding its competences in Design Science Research (Bichler 2014). A special focus could be set on privacy preserving schemes which play an important role. In this segment, the legal development lags behind the technological development. Thus, legal harmonization (e.g., on a European level) constitutes a likely consequence. This would lead to certain design requirements and adjustments which could be incorporated using Design Science Research.

Finally, *providers* need to take the importance for business model-related enhancements into account. As for many "app businesses", one of the main questions for LBS applications is how to generate revenues. Veit et al. (2014) present a research agenda for the BISE community concerning digital business models covering monetization aspects. They suggest applying theories which deal with consumer behavior, microeconomics, and behavior in organizations. Furthermore, they recommend empirical (both quantitative and qualitative) as well as experimental methods. Also, prototypes which reflect a Design Science approach, ought to be developed and tested.

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