

# Scopes in Internet of Things for Active Tourism and Leisure

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## Različne razsežnosti interneta stvari za aktivni turizem in prosti čas

*Razvoj komunikacijskih in informacijskih tehnologij omogoča dopolnitev, nadgradnjo in razvoj novih turističnih storitev s področja dobrega počutja in zdravja. Nekateri tehnološki vidiki so pri tem že dobro uveljavljeni in uporabljeni, npr. spletne rešitve ali mobilne aplikacije. Pri teh je bolj kot tehnologija izziv ustezna navezava na socialne dimenzije rabe teh rešitev in vnašanje konceptov igre v njihovi uporabi. Druge tehnologije, npr. raba rešitev s področja interneta stvar ali pametna mesta, nakazujejo izreden potencial za razvoj turistične ponudbe. Ker gre za novejšje pristope, pa je potrebno njihovo jasno vlog še natančneje definirati.*

*V prispevku podrobneje predstavimo možne vplive interneta stvari na turizem, s poudarkom na segmentih spremljanja osebne aktivnosti, pametnih zgradbah in pametnih mestih. Podamo tudi dva možna scenarija novih turističnih rešitev s področja zdravja in dobrega počutja, ki povezujeja omenjene različne segmente.*

## 1 Introduction

Recent technological developments provide means for augmenting, extending and shaping existing and future health and wellbeing related travel, tourism and leisure.

The tourism industry is undergoing a constant transformation which reflects changes in global demography, economy and lifestyles [1]. Tourists are seeking advice prior to their departure, during their holiday and on their return. Planning, enjoying and sharing their experiences has become a part of their social activities. It is now more common to combine business and personal travels, certain tourist destinations are focusing on family travel. Wellness and health are becoming important and sometimes key objective of a tourist trip. All this requirements can be well supported by information and communication technologies – ICT.

However, the integration of any technologies needs to be appropriate and well-planned. Some tourist initiatives e.g. offer digital detox packages, with technology free hotel rooms, or free services as rewards for customers who part from their devices, as means to improve guest wellness and to promote human interaction [2]. This is a legitimate response to (abundant) presence of ICT, too.

In this paper we present some of the technological trends and anticipate their impact on tourism industry. In more detail we present the Internet of thing – IoT, some of its usage examples, and potential roll in tourism. We developed two use-cases that would combine recent IoT developments with needs of tourism industry.

## 2 Supportive technological trends in ICT for tourism

ICT are penetrating nearly every imaginable application domain and tourism is not an exception either. Web technologies and applications have long been used for informational and marketing purposes, route planning or online booking, and sharing experience and thoughts about past and future trips. Although these applications predominantly rely on known and proven technological approaches, recent findings [3] indicate that the way of using Web by tourists is changing. Online travel research and booking for example, has become an essential part of nearly 2 out of 3 tourist journeys. But frequently the search and exploration does not any longer rely on “Google + hotel web-site”. It is supported by dedicated travel metasearch engines, and online travel agencies (OTA), which both provide one-stop shops for selection and purchases of transport, accommodation and leisure activities for a desired travel. More than 50% of holiday destinations [4] chosen by UK travelers are based on recommendations or even only impressions from travel logs and photos by friends in ones’ online social network. Applying Web solutions in tourism has to follow such user-related trends.

Multimedia contributes to the tourism related Web applications as well as to interactive TV based hospitality systems. In hotels, TV remains the key communication terminal provided by the facility (and not brought by the costumer). Beside the provisioning of TV programs, it can serve as an interface for hotel and travel service acquisition and customization, and a marketing channel, or e.g. as a device for control of smart ambient in the hotel room. Smart TV applications promise another major step in blending e.g. travel TV programmes with instant bookings. Some travel and tourism players have already launched their own smart TV apps.

Concept of mobility strongly supports the tourist and tourism industry, including omnipresent connectivity, location based personalization and a set of mobile apps for tourists. The latter are small but highly specialized

applications, most frequently targeting needs as e.g. search for information, mobile marketing, and support for navigation, booking, or the social dimension of a trip [5]. The applications assisting in the mentioned areas are not necessarily dedicated to tourism purposes only. Although they may seem abundant, a recent survey of Spanish mobile apps for tourism [6] showed, that their role in the global communication strategies of tourism stakeholders is often not clearly defined and calls for thorough future improvements. This is at least to some extent understandable, because of much less tradition in applying mobile apps for tourism, compared to e.g. Web. The same survey pointed out the language problems (websites are commonly available in language of origin of the visitors, but mobile apps are not). But less trivial is assuring the real value for the tourist. The apps should not merely replicate the information which is (more efficiently) accessible via other channels. They need to evolve into platforms for interactive information interchange among tourists and destinations, as well as peers and friends with common tourist aspirations. In world regions with poor fixed internet access (e.g. Africa, India) mobile technologies are booming and have therefore in tourism even a greater potential.

ICT also connect people with things – in the Internet of things (IoT) [7] - a broad concept of connected devices and solutions based on data they provide. This is a relatively new technology domain in terms of established use-cases, so applications in tourism are rare. However, the potentials are immense, especially because IoT can provide really novel solutions to enhance existing and create new tourism services. The key idea behind IoT are communication interfaces (e.g. near range low-power BLE, Wifi or LTE) integrated in devices that are not (primarily) communication user interfaces. These devices range from personal activity trackers, home automation and domestic appliances, environmental sensors and so on. From user perspective IoT scopes can be divided into personal (i.e. body range), ambient (room, house, hotel, museum, fitness facility) or environment (city, landscape). Various scopes can be combined in a blended solution, too. Innovative applications in tourism can be found e.g. in video-equipped flying drones which help tourists explore a city from a different perspective [8], or augmented reality interactive tours, where online travelers receive a real-time, in-person experience of an online city visit, by directing a virtual tourist, equipped with cameras, sensors and communication connections [9]. The enabling technologies and potential applications of IoT are presented in more detail in Chapter 4.

Equally important aspects of ICT applications are various backend systems, which are facilitating deployment and management of tourist services. Similar to Web technologies and applications, implementation of these systems benefits from readily available information technologies. The challenging part is the design and development which has to accommodate and follow changes in the tourism industry.

Increasing tourism marketing spend in areas of social media indicates how influential it is becoming for

this industry. The increase in worldwide social media marketing budget had a higher percentage than for any other digital marketing tactic [10]. Facebook and not Google is tourism search engine. Consumers not only search for information about destinations and travel experiences within their social network. With social media becoming the frontline marketing activity, they expect the opportunity to have one-on-one personal interactions with businesses [11].

Gamification is integration of gaming dynamics in non-gaming environments. It can thus affect tourism applications regardless of their implementation technologies. Gamification creates synergies between social games and traditional loyalty programmes, and helps generate brand awareness. In relation with tourism social marketing, it is aiming for viral effects, too. Direct awards for customers to be involved in this type of gaming can be points, badges, or status levels, as well as more tangible benefits in terms of vouchers and discounts for complementary tourist services. Gamification is expected to have 30% value share of social media expenditure in tourism marketing by 2016 [11].

### 3 IoT potentials in tourism and leisure

The connected device is one of the building parts of IoT solutions. It employs one or more different sensors along with (at least) some basic preprocessing and local storage of the collected sensor data. If the IoT device incorporates short range communication technologies (e.g. BLE) only, additional gateway device enables synchronization of collected data with cloud-based Internet backend systems. Such a gateway is often implemented as a mobile phone or desktop application. Synchronization usually requires no or very little user intervention. The cloud backend system stores, processes, analyzes and visualizes the collected data, and creates information based on it. The backend systems commonly provide HTTP based application programming interfaces (API) for interchange of data with similar or complementary online systems. In this way mashup applications can be built, that combine IoT provided data from various devices, with e.g. location information, or publically available data sources (e.g. current weather information).

#### 3.1 Personal wellness tracking

One of the IoT approaches is focusing on data collected from or about the human body. The sensors currently enable monitoring of various aspects of persons' physical activity, monitoring of physiological parameters like heart-rate, body temperature, levels of blood sugar or oxygen and weight, or even level of stress, quantity and quality of sleep. A common self-tracking approach utilizes sensors (camera, accelerometer, GPS) integrated in hardware of modern mobile phones and mobile apps that manipulate these data. But not all parameters are measurable conveniently or measurable at all with phone-included sensors. Therefore, specialized sensor gadgets are being developed. They appear in form of e.g. hand-worn bracelets, watches and pieces of jewelry or can be

incorporated in clothes and footwear. In other cases these are standalone devices, e.g. smart weight-scales, glucometers, etc. These gadgets can be medical grade devices, appropriate for application in medical e-health solutions. But many of them only serve for personal use, with sometimes questionable accuracy.

Wearable personal activity trackers are booming example of self-tracking IoT devices. Although wearable tracking is a rapidly growing market (about 10% US population has bought a tracker), real value for the users and long-term user appeal is still a mayor issue for this industry. All wearable tracking manufacturers provide online services for personal progress monitoring. These web sites or mobile applications usually involve certain level of gamification, e.g. as a circle of friends who share the activity results and are awarded with points, badges, or status levels. Despite this, many user abandon personal tracking after about a 6 months period, if an additional objective to do so is not provided [12].

There are also third-party enabled services based on personal wearable tracking. They can be considered as successful implementation cases, because long-term engagement is assured by clearly set objectives, and additional user support (including motivational measures) is provided. E-health or mobile health is a domain where medical and wellness trackers have already been deployed to collect various biomarkers along with a broad context of the patient and provide rich dataset for successful medical analyses of the patients. These applications support health prevention or patient monitoring when certain disease is already being treated. The service is supported by physicians.

Another remarkable example are corporate wellness programs [13] where wearable personal activity tracking devices are provided to the employees by the employer, along with the supporting applications that motivate employees and direct them towards active and healthy life-style. Gamification is frequently applied in corporate wellness. The motivation for the providing company is in increased abilities of their employees, but in some cases health insurances already provide discounts for companies with such programmes.

### 3.2 Smart buildings

The second scope of viable IoT solutions is a room or a building. In such solutions sensors monitor the environment, including e.g. temperature, illumination, and air-quality. But sensing is frequently upgraded with ability to actuate, and thus affect the conditions of the monitored environment. Common example of this approach are various smart-home or smart-building control and management system. Smart-homes enable remote and automated control of heating, air-conditioning, ventilation, ambient illumination or window blinds. The management interfaces can be dedicated user-terminals in the premises, or mobile and Web applications accessible locally and/or remotely. They are often integrated with home multimedia and entertainment systems, to assure a complete user experience in interaction with the intelligent ambient. As a building component of smart-building solutions the

indoor positioning and different object tagging (e.g. by NFC) can be considered, too.

Smart-building solutions are frequently applied in hotels, not only to provide the customer a better experience and additional services, but also to reduce the operational costs. An issue with indoor IoT solutions is that their services are coupled and thus limited to the particular environment. Novel proposal to combine these solutions with e.g. personal monitoring systems could therefore expand the benefits of the former.

### 3.3 Smart cities

The broadest scope of IoT solutions applies to an entire town, city or even region. It is known as the smart-city concept, which is aiming for sustainability in terms of social, economic and environmental benefits of city and citizens via ICT enabled solutions. Application domains are most frequently related to the connectivity, environment, CO<sub>2</sub> reduction, transportation and traffic management, electric car infrastructures, intelligent lightening, energy consumption reduction, alternative energy sources and others [14, 15]. Open-data access is another important direction behind the smart-city. It assures API-s to openly access the data available on the city [16]. By reutilizing readily available open-data smart-city becomes a broad testbed for research and development of novel application.

Smart-cities are naturally an important infrastructure for innovation in tourism, too. The solutions most frequently target transportation, navigation, or information access. In Santander, Spain [17], an infrastructure with over 12000 sensors and tags was deployed. They enable environmental monitoring, outdoor parking tracking, tagging points of interest (tourist points, shops, public places). The data can be provided directly by citizens and visitors via their location aware mobile phones, too. The access to smart-city is open and project clearly encourages application developers [18] to rely on this existing infrastructure.

## 4 Epics

Based on presented potential of ICT and in particular of IoT for tourism, we propose two epics [19] that combine personal scope with building and city-wide IoT solutions. Epics are coarse-grained user stories that in our case sketch the new tourism service functionality without committing to the details. Both are related to wellbeing and health. Beside enjoying the direct service, an aim of both approaches is to raise the health related self-awareness of the customers and help them continuing with good new habits after the travel is completed.

### 4.1 Health supporting hotel

In health supporting hotel, rooms are equipped with additional tracking devices and environmental sensors. They track e.g. blood pressure, weight, physical activity, stress level, and sleep patterns. The room is monitoring the air quality, humidity and temperature. A hotel guest utilizes the room just like a regular one, but receives information and incentives to measure some of the parameters. The intelligent support system then

provides suggestions for e.g. a slightly different diet or additional physical activity. There are supportive services provided for the customers, both to facilitate the assistance in usage of the available devices, as well as consultancy about health and healthy life-style. If the hotel is directly involved in medical or wellness tourism, these information can be blended with their existing premium service offer (e.g. weight management program, active life for older adults). There is also a small shop at the hotel, where guest can purchase e.g. personal wearable trackers and enroll in the follow-up program offered by the hotel.

#### 4.2 Wellness aware city tour

In wellness aware smart-city public health check-points are installed close to the most frequented tourist sites and routes. We thus combine personal wellness monitoring and smart-city approaches. Users of this system/service are passing-by tourist. At the checkpoint they can measure weight, body temperature, and heart and breathing rate. The sensors and measurement process require no user intervention (floor integrated weight scale, infrared temperature measurement, etc). Tourist can, but does not have to provide indication of age, a simple grade of mood and key interests. At the same time smart city already collects the environment- and weather-related information. Users' physiological parameters and these data are combined in unique city guidance. It not only matches the tourists' main interests, but also guides them through the city in a way, that is most appropriate for their current fitness level, temperature in air humidity, time of the day or season. The modifications in the guidance are unobtrusive, e.g. a recommendation to take a slightly different route which is shaded on a hot day, or to make an extra stop for a glass of water, if increased physical strain is detected. With visitors using the wellness aware city services, smart-city platform is receiving additional input data for better site management. If user agrees and wishes to, he can be anonymously authenticated (e.g. via mobile app, electronic city card) to provide more personalized service.

### 5 Conclusions

ICT, and in particular IoT, promise a range of new and very innovative tourist services. These could be new services or complements of the existing ones. It is hard to anticipate which direction will indeed have the most influential results. But we are convinced that wellness related applications could be among most distinguished ones. The key to success is combination of personal, building and city-wide solutions and the support of social and gamified concepts. It is wise to follow even a broader approach, where wellbeing is not just a part of tourism service or leisure, but contributes to prevention in health, facilitates work or enables older adults longer, more active and independent living.

The two epics presented in Chapter 4 outline appealing additional services that enhance the current tourist offer. We hope these epics to be starting point for more detailed future specifications and implementation of

novel solutions, where also issues of personalization, privacy and user experience will have to be addressed.

### References

- [1] World travel market (WTM) Global Trends Report 2013, [http://www.wtmlondon.com/files/wtm\\_global\\_trends\\_2013.pdf](http://www.wtmlondon.com/files/wtm_global_trends_2013.pdf)
- [2] World travel market (WTM) Global Trends Report 2012, [http://www.wtmlondon.com/files/press\\_pr\\_globaltrendsreport\\_2012\\_file.pdf](http://www.wtmlondon.com/files/press_pr_globaltrendsreport_2012_file.pdf)
- [3] Trends in the Hotel & Travel Booking Industry, <http://www.carmelon-digital.com/articles/hotel-online-booking-travel-trends/>
- [4] The travel industry's shift from search to social, <http://e27.co/the-travel-industrys-shift-from-search-to-social/>
- [5] A taxonomy of mobile applications in tourism, <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=3559&context=commpapers>
- [6] Aplicaciones móviles de los destinos turísticos españoles, [http://www.marcasturísticas.org/images/stories/resultados/informe\\_apps\\_codetur\\_oct2013.pdf](http://www.marcasturísticas.org/images/stories/resultados/informe_apps_codetur_oct2013.pdf)
- [7] Internet of Things, Converging Technologies for Smart Environments and Integrated Ecosystems, [http://www.internet-of-things-research.eu/pdf/Converging\\_Technologies\\_for\\_Smart\\_Environments\\_and\\_Integrated\\_Ecosystems\\_IERC\\_Book\\_Open\\_Access\\_2013.pdf](http://www.internet-of-things-research.eu/pdf/Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_Open_Access_2013.pdf)
- [8] Ringgold residents abuzz over plan to buy drone, <http://www.timesfreepress.com/news/2014/mar/08/ringgold-residents-abuzz-over-plan-to-buy-drone/>
- [9] Remote Control Tourist, <http://remotecontroltourist.com/>
- [10] Travel industry to boost spend on social media marketing in 2011, <http://www.tnooz.com/article/travel-industry-to-boost-spend-on-social-media-marketing-in-2011/>
- [11] World travel market (WTM) Global Trends Report 2011, [http://www.wtmlondon.com/files/onsite\\_global\\_trends\\_v3\\_lo.pdf](http://www.wtmlondon.com/files/onsite_global_trends_v3_lo.pdf)
- [12] How the Science of Human Behavior Change Offers the Secret to Long-Term Engagement, <http://endeavourpartners.net/assets/Wearables-and-the-Science-of-Human-Behavior-Change-EP4.pdf>
- [13] In corporate wellness programs, wearables take a step forward, <http://fortune.com/2014/04/15/in-corporate-wellness-programs-wearables-take-a-step-forward/>
- [14] Amsterdam Smart City Knowledge Centre, <http://amsterdamsmartcity.com/knowledgecentre/index/category/examples-of-smart-cities/p/1>
- [15] Smarter Neighborhoods Smarter City, <http://www.usa.siemens.com/sustainable-cities/pdf/smarter-neighborhoods-smarter-city.pdf>
- [16] NYC Open data, <https://data.cityofnewyork.us/>
- [17] Smart Santander, <http://www.smartsantander.eu/>
- [18] Smart Santander testbed, <http://www.smartsantander.eu/index.php/testbeds/item/132-santander-summary>
- [19] 10 Tips for Writing Good User Stories, <http://www.romanpichler.com/blog/10-tips-writing-good-user-stories/>