Smart tourism destinations: Enhancing interconnection between stakeholders and tourist through information personalization and feedback system

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***Abstract*— Bringing "smartness" into tourism destinations requires dynamically interconnecting stakeholders through different concepts of Information and communication technologies (ICTs) with tourists. Traditionally, communication between stakeholders like the government authorities, retail business executives, retailers and tourists is realized as one-way communication pointed from stakeholders towards tourists, which implicates that stakeholders are mostly left without feedback. This research examines the smart tourism phenomena, with a focus on communication flows between stakeholders and tourist. An overview has been made on the traditional communication models, highlighting their disadvantages. We propose an architecture which supports two-way communication, in order to mitigate these problems, relying on current technical achievements such as internet of things (IoT), data mining techniques, high speed 3G/4G mobile networks, etc.**

I. INTRODUCTION

A. *"Smartness" in tourism*

Smart tourism is a new term applied to describe the increasing reliance of tourism destinations on advanced technological achievements [1]. As the urban population is constantly growing, government and other local managing structures are experiencing difficulties in sustaining the quality of life for all citizens, including tourists [2]. By bringing "smartness" into tourism [3], managers are provided with strategic tools for creating smart tourism ecosystems (STEs) models. These models can provide better tourist experience, or smart experience, and improve resource management towards maximizing both destination competitiveness and consumer satisfaction. Smart cities should base their smartness on three main pillars, namely: human capital, infrastructure/infostructure and information [4]. Providing tourists with information that correlate with their interests significantly increases their touristic potential [5].

Smart Destinations, which are special cases of smart cities apply smart city principles to urban or rural areas and do not only consider residents but also tourists in their efforts to support mobility, resource availability, allocation and sustainability [6].

B. *Smart tourism relying technologies*

The fact that technology is evolving fast, and that microdevices are becoming less expensive, is opening the door for new innovative approaches for analyzing and upgrading communication flows through ICTs in general. For example, by using technologies such as IoT and 3G/4G mobile networks, stakeholders are provided with feedback from tourists on their advertisements, and can promptly adjust their business strategy accordingly [7].

Relevant technologies, such as near field communication (NFC), radio frequency identifier (RFID), beacons, QR codes are easy to integrate into ICTs and can support this feedback system. Enhancing communication flows through methods suggested in this paper, the authors predict an increase in satisfaction from both stakeholders and tourists.

C. *Research goals*

Constantly develop of ICTs affects many aspects of our everyday life. It carries with it the constant changes in the business and daily life. It is necessary to continuously carry out improvements of existing solutions, relying on the latest technological achievements.

Aspect and mode of communication is an important factor in the functioning of every system. Stakeholders and tourists are two entities of interest in the system, between which the communication is being analyzed. Stakeholders, which represents one of the entities, is term that represents government authorities, retail business executives, retailers in general.

Communication flows between stakeholders and tourists is realized as one-way communication pointed from stakeholders towards tourists, which implicates that stakeholders are mostly left without feedback.

The aim of this paper, by analyzing existing solutions highlighting their disadvantages, is to give proper enhanced communication model which will raise communication on a higher level proposing additional communication flows, and upgrading existing (read more in chapter IV).

II. RELATED WORK

While smart tourism is a relatively new term, there are many papers trying to give an explanation and the interpretation of the concept itself.

By searching papers related to this topic, were able to notice the fact that most of work is derived from national urban projects, related to the concept of the smart city such as Chinese [8] and Spanish [9] national projects. There is a lack of research that analyzes the smart tourism concept from a technical point of view. Research [10] that came out of Chinese initiative, was good basis for this research.

Little research appears to be done on the detailed analysis of the two-way stakeholder - tourist information exchange, and the implementation of a system which supports such communication.

There are many applications being developed around the world related to smart tourism concept. For example, Belgium is developing a system for tagging places, objects and other "taggable" units named "*TagTagCity*" using above mentioned NFC and QR technologies (https://www.tagtagcity.com/) [11]. The city of Amsterdam uses beacons to let tourist signs translate

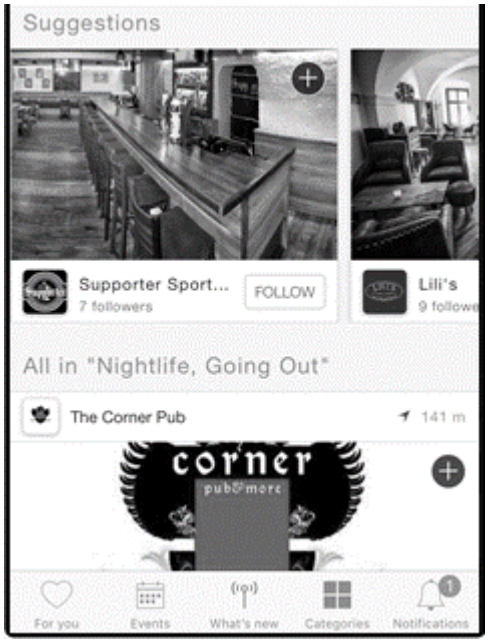

Figure 2. Urby suggestions UI

themselves into different languages based on city current state as part of global "*AmsterdamSmartCity*" project counting over 180+ projects related to smart city concept (https://amsterdamsmartcity.com/) [12]. "*Urby*" (http://www.urbyapp.com/) [13] project as part of "*AmsterdamSmartCity*" project is offering daily suggestions to citizens that could fulfill their daily life.

It is evident that stakeholders are trying to get in more direct communication with tourists through aforementioned technologies.

However, these applications are too specific and usually have one goal in mind. The goal of this paper is to propose an architecture of a more general solution, which can be used to produce a number of standalone applications.

III. COMMUNICATION FLOW ANALYSIS

The traditional communication model is represented as one-way communication, where all tourists are given the same broadcasting information - advertisement.

Analyzing the mass public advertising communication flow allows us to notice some flaws. Stakeholders are missing tourist target groups which means that they are broadcasting the same advertisement to all subscribed users. Studies have shown that such way of advertising has proved to be worse in practice [14].

One way communication flow disallows tourists to be engaged in communication leaving stakeholders without any feedback. They usually gather feedback information by

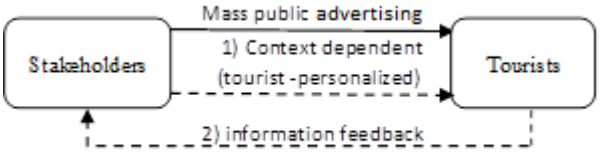

Figure 1. Extending traditional communication model

hiring marketing research agencies which conduct the surveys. Such way of gathering feedback is expensive and it takes time for agencies to conduct the surveys. If the services that stakeholders are offering require dynamic and fast adapting business models to consumers, they quite rely on survey agencies and it can provide huge expenses and time waste.

Real-time feedback system would be important feature which is able to provide stakeholders with useful data related to their offering services in order to improve their STEs [4].

IV. COMMUNICATION FLOW ENHANCEMENT SUGGESTIONS

A. Upgrading stakeholders-tourists communication flow

Stakeholders-tourist communication flow is the most important information exchange flow in smart tourism system context. This flow allows stakeholders to provide tourists with information offering their services and announcements. It represents primary information flow through which tourists are notified about provided services nearby.

Extending the traditional one-way model displayed on Figure 1, is represented through two steps:

1. evolving from traditional mass public information to the context dependent
2. personalized information content adding tourist information feedback system

First step, upgrading aforementioned communication flow from mass public information broadcasting to context dependent information broadcasting, carries with it a plenty of advantages [15].

When tourist receives information that correlate with his personal interests it affects environment by:

- enhancing of tourists experience
- exceeding their prior expectations
- stimulating tourist consumption
- increasing industry level services

One of the most important advantages of personalization as experienced by tourists is an increased comfort level in both emotional and physical, such as getting things just the way they like and the feel of being looked after and be well informed based on their preferences [16]. Understanding the needs, wishes and desires of travelers becomes

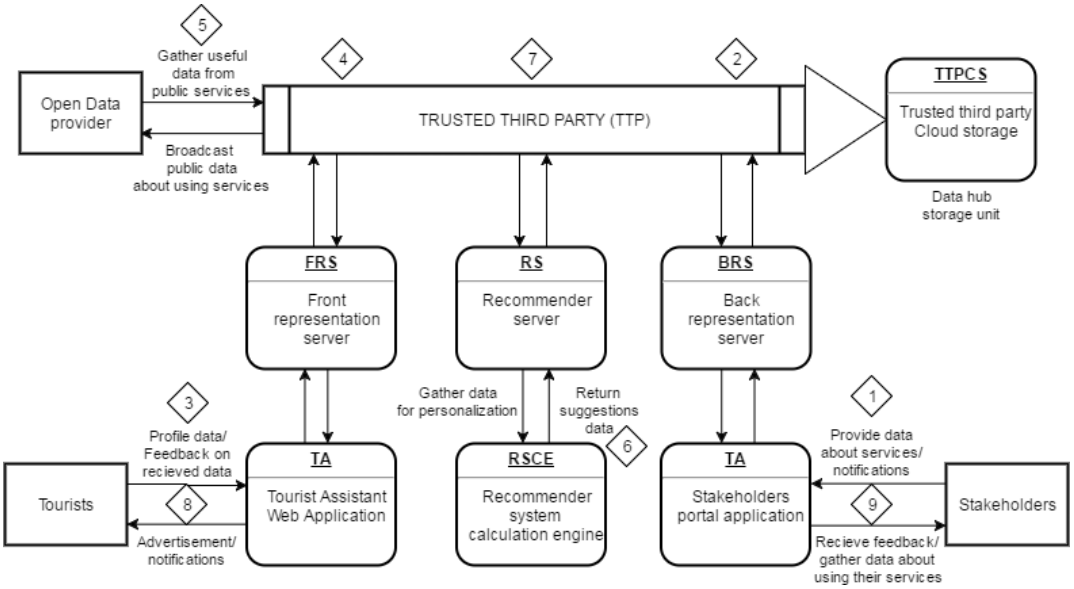

Figure 3. Data flow diagram of supporting system architecture

increasingly critical for the competitiveness of destinations [17].

Second step, would represent the introduction of feedback system communication flow (see Figure 1). In the traditional way of advertising, stakeholders are mostly left without feedback. Traditional one-way communication flow is now upgraded to two-way communication flow in which tourist is now able to leave feedback related to stakeholder's advertisements. Such feedback can be very useful for stakeholder in order to improve STEs. Benefits from introducing feedback system would affect enhancement of existing business models through:

- adapting: modifying behavior to fit the environment
- inferring: drawing conclusions from rules and observations
- classifying: making classifications based on observations
- predicting: interpolating and extrapolating from data
- learning: using experience to improve performance
- self-organizing: develop and increment their business models to a new level

techniques for improvement [18].

Some of listed methods can be automated using artificial intelligence (AI) techniques. In Data mining sphere, sentiment analysis (SA), can be useful in language text information processing to systematically identify, extract, quantify, and study affective states and subjective information. By having knowledge extracted from tourist's feedback, it becomes much simpler to reorganize and adapt business models to the mood and requests based on their feedback.

Feedback system can be abused/misused by leaving biased feedback or flooding with spam data. Which implicates that it can't be fully automated, and it requires additional human supervision for situations where knowledge cannot be extracted, for example: invalid semantics, grammatic errors, etc.

V. SYSTEM ARCHITECTURE THAT SUPPORTS COMMUNICATION FLOW ENHANCEMENT

Broadcasting advertisements that correlate with tourist interests enhances tourist's experience [3]. Increasing tourist experience stimulates tourist to fulfil his own interests for related destination. Such an action can exceed their prior expectations. Aforementioned indicates the stimulation of tourist consumption that after all increases industry level service.

Graphic representation of system architecture is shown on Figure 3, describing main entities and communication flows between them. Hereinafter will be described main system architecture entities respecting the order in which they communicate in the real system.

A. Back representation server (BRS)

First of all, it is important that stakeholder provide data to thrusted third party offering their services. Such an action is available through "*Stakeholders portal Web application*" (see Figure 3), allowing them to register themselves, and provide information about services that they are offering and receive feedback provided by tourist as well. Such application could be used from platforms that do not necessarily need to support user mobility.

Stakeholder's web portal is hosted on BRS whose main role is to gather information from stakeholders and forwards them to TTP.

B. Front representation server (FRS)

Then using FRS through TA web application which has role to allow tourists to create their own personal profiles, by entering their personal data via devices that support mobility. Most of devices that support mobility has integrated GPS feature that allows us to track user geographical position which is important attribute for information personalization used by recommender system.

Feedback data can provide us useful information through data mining techniques by spotting patterns in tourist behavior and adjust their STEs acknowledged behavior. Leaving feedback in real-time after using services, can also let stakeholders change their business models in real time allowing them to adapt on certain changes.

Figure 3. Slider of personal interests [11]

It is good practice to let user take a short survey, or present a slider (see Figure 3) containing target attributes based on most common user interest, where tourist is able to fill percent of his own interests related to certain attribute. This among the other user-provided data will be used by recommender system as required variables for suggestion providing techniques.

C. Thrusted third party (TTP)

It is envisaged that TTP should be central part of the system. In other words, it should be used as hub to connect all entities in system forming network of entities realized as star topology. Taking the role of mediator, TPP is receiving each communication attempt initiated by stakeholders on the one side or tourists on another. Each time TTP receives data, the data is automatically stored into TTP Cloud storage (TTPCS), analog each time TTP is supposed to forward data, it queries TTPCS.

It is important that all sides in system trust this entity because TTP is storing in very sensitive data provided by tourists through feedback system. All data is stored in TTP Cloud storage containing all information from both sides stakeholders and tourists. TTP Cloud storage presents security sensitive zone, which makes it the most important and the most sensitive entity in system and it requires additional security measures.

D. Recommender Server (RS)

Among TTP Cloud storage data, there is another source of information – Open data provider [19]. Open data provider contains information freely available worldwide provided by certain services. After required data is acquired, by combining those two information sources, recommender system has enough data to calculate suggestions based on each tourist personal interests.

Tourists are subscribed to TTP via “Tourist Assistant” application. When suggestion is being calculated, it is sent back to TTP hub which forwards information on FRS and information is displayed back to tourist through push notification service. When tourist receive suggestion, he is able to “like” or “dislike” suggestion. Such action feeds back RS with additional data, which is of great help for improving further suggestions for related tourist.

VI. CONCLUSION

Based on communication analysis we are able to notice flaws in communication flows between stakeholders and tourists. One-way communication flow, is now upgraded to two-way communication flow allowing tourists to express feedback based on stakeholder’s advertisement or announcements which can be later used for developing or upgrading existing STEs depending on feedback content. One of limitations related to this information flow upgrade is that acquiring knowledge from feedback cannot be fully automated process, and it requires supervision as it is mentioned in chapter IV.

Another significant flaw was mass public information broadcasting. Solution provided in this paper proposed enhancement through tourist profile context dependent information sharing instead of traditional broadcasting, allowing tourist to receive notifications with information that correlate with their own interests.

Using upgraded communication flows and suggested system architecture that supports flows enhancements, software architects are now able to perceive the participants in the system, observe the necessary resources and predict critical entities in implementation of such system. This solution provides an excellent basis for the technical implementation, and introduces software architect with the system on a conceptual level basis, drawing attention to the flow of communication among entities.

Implementation of this systems would have many benefits, rising industry level service, stimulating tourist consumption by enhancing tourist experience and exceeding their prior expectations. This system can be implemented as standalone applications, or can be integrated into existing solutions.

Further research could draw deeper research into architecture of TTP and TTPCS by analyzing and providing solutions based on distributed system architecture. Thus, deepening the architecture of the system is making a better foundation for the implementation of the system.

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