

# Aposentu: A Social Semantic Platform for Hotels

Gavina Baralla<sup>1</sup>, Simona Ibba<sup>1</sup> and Riccardo Zenoni<sup>2</sup>

<sup>1</sup>Department of Electrical and Electronic Engineering, University of Cagliari, Piazza D'Armi, Cagliari, Italy

<sup>2</sup>Logica Solution srl, Via Giacomo Benvenuti, 30, Terni, Italy

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**Abstract:** Tourism business has become competitive and dynamic and it is essential to adapt both customers' satisfaction and to market's changing needs. A hotel owner faces three big challenges: he must look to attract new guests to its location, manage his hotel in the best performant way and has to adapt their online marketing strategy using several tools such as online travel agencies (OTA) or meta-search engines website or other players from the sharing economy. All these channels can complicate the hotelier's life, making the tourism market and by removing in some areas the prices according to the seasons and the availability. In addition, consumer generated content (CGCs) influence the market and the revenue management making the web reputation even more important. This paper presents Aposentu, an innovative tool which integrates all the required components in order to successfully manage the hotel. The platform will be cloud computing technology based and it will show a proper dashboard with a lot of innovative functionalities. By using semantic tools, sentiment analysis, complex network metrics, the platform will allow the hoteliers to become more competitive in the tourism industry. Moreover, administrative complexity will be reduced and that will facilitate the management of accommodation.

## 1 INTRODUCTION

Running and managing a hotel is a complex task. It requires the ability to be flexible, the capability to understand the context which they are doing business in and to recognize the need of the travelers who look for the best possible accommodation. Furthermore high competition is one of the main challenges in this sector especially in those tourist destinations where, in a small area, you can find a lot of hotels.

Over the years a lot of software solutions have been implemented in order to replace old-fashioned, paper-based methods and to automatize hotel tasks such as booking, front-end and back-end office activities, marketing practices, accounting and so on. That kind of tool is well known as Property Management System, PMS and the first implementation dates back to 1980.

Nowadays, tourism business has become competitive and the use of appropriate dynamic tools is essential to keep up with the time and to make the difference compared with competitors. According to a recent statistic (Global Property Management Software Market Research Report 2017), the PMS market is expected to increase by 6,99% for the period 2017

through 2022. Currently this industry is highly fragmented in terms of proposed solutions, often PMS are not web-oriented (because they had been developed before the coming of the Internet) and sometimes old tools have been adapted to web functionality with bad performance and by using different standards.

Tourism market is increasingly becoming web based with the development of huge numbers of applications and websites focusing on reservation and reputation systems. Nowadays the tourist is used to looking for reviews before booking or buying something, Ye et al. (Ye et al., 2011) investigated the influence of user-generated content to hotel online booking. Gretzel et al. (Gretzel and Yoo, 2008) analyzed the use and the impact of online travel reviews written by consumers, they called these reviews Consumer Generated Contents (CGCs). Furthermore, Kim et al. (Kim et al., 2015) pointed out the importance of using social media reviews in order to manage the hotel performance.

In addition, the online Travel Agency, OTA, provide B2B2C services in which both the owner of the website and sellers offer their products. The customer benefit from this marketplace that offers multiple kind of online booking services which help users to

find a hotel, buy a ticket for air travel, rent cars. At the same time these services are oriented to different client typologies and provide competitive prices.

In this complex scenario the hoteliers need an efficient software which include some different applications that often are proposed by several online services. This multiplicity could amplify further the work of hotelier. In order to resolve this complexity we propose Aposentu, an innovative dashboard for managing a hotel. Aposentu is the sardinian name of the welcoming room, often dedicated to guests, in typical sardinian house. This room represents the first form of reception in Sardinia.

Aposentu is a smart dashboard, completely cloud-based on semantic tools, sentiment analysis and in which we want to apply complex network metrics, the platform will help hoteliers to meet tourists needs, improve their economy facing the dynamic changing tourist environment.

The paper is structured as follows: Section 1 provides an introduction with papers motivation, Section 2 presents related works, in Section 3 the proposed approach is shown. Section 4 describes the platform architecture, finally conclusions and future works are given in Section 5.

## 2 RELATED WORKS

In the last years we witnessed the development of many applications based on semantic techniques and projected to improve the tourist market.

An important overview of the use of knowledge management techniques and the applications such an approach to a tourism sector is presented by Cooper (Cooper, 2006). He discussed how to transform information and data into capabilities for the tourism sector.

However Shaw et. al, (Shaw et al., 2011) presented the concept of service-dominant logic and showed how important it is to involve hotel customers in the process of co-production and co-creation of services. Ontologies are a useful tool to define the relationships among concepts in a specific domain. For instance Hontology (Chaves et al., 2012) is a multilingual ontology for the accommodation sector that reuses some concepts extracted from Dbpedia.org<sup>1</sup> and Schema.org<sup>2</sup>. Hontology could be used in many applications that include information visualisation and extraction or text annotation in an accommodation context.

<sup>1</sup><http://wiki.dbpedia.org/>

<sup>2</sup><http://schema.org/>

The use of intelligent agents and artificial intelligence allows the development of personalized solutions. This assumption is the basis of Sem-Fit (García-Crespo et al., 2011), a semantic hotel recommendation system that, using fuzzy logic techniques, takes into account consumers' experience. However Zhang et al. (Zhang et al., 2016) presented a sentimental analysis tool based on graph method, which is applied for semantic classification of the user reviews collected from e-commerce websites. This approach can be joined to the typical metrics of complex network. In order to identify competitive sets for hotels useful to help hotels better position themselves based upon eWOM (electronic word-of-mouth messages) Xiang et al. (Xiang et al., 2017) classified hotel properties based on guest experiences along with satisfaction ratings in hotel online reviews. The results of this study described the structure of tourism industry.

Finally the system proposed by Tatiya et al. (Tatiya and Vaidya, 2017) generates recommendations taking into account the categorical preferences of present user and the feedback/comments of the past users.

In our work we analyze the consumers' experience point of view and included in this study also all data from main platforms of booking.

## 3 THE PROPOSED APPROACH

New web channels have made tourism market extremely competitive sometimes erasing season-based prices and accommodation availability often causing price dispersion and differentiation also between OTAs (Clemons et al., 2002). Conversely, a hotelier decides room rates only on the basis of its experience. The proposed platform aims at providing a tool, modular structured and cloud computing based, able to integrate different functionality and services.

The system will calculate daily a competitive price for the offered services by considering different factors: (i) tourist numbers, (ii) competitors average price, (iii) web reputation, (iv) fixed and variable costs, (v) hotel rating, (vi) reservation frequency.

We want this tool to be a solution to the on-going management hotel issues by integrating innovative marketing perspective with web reputation aspects. By using a smart dashboard a hotelier will have a single interface to monitor all web channels and at the same time he will be able to continually supervise sales record.

The innovative system will allow the management of internal data and their integration with external,

i.e. data competitors related to the same temporal period and retrieved by web scraping techniques or data coming from social networks.

The information obtained will be useful to design ad-hoc advertising campaigns. The system will be implemented following a modular architecture and it will have:

- a dashboard which integrates in a flexible way all useful information according to the user profile and his role and capability;
- a web scraping algorithm to pinpoint data coming from other booking platforms; but also a module to manage and gather internal data. Information will also consumer generated content derived from web reviews;
- a Business Intelligence tool to analyze aggregated information and based on a complex network system;
- a Booking Engine to generate dynamic pricing;
- a tool to evaluate the web reputation and based on sentiment analysis techniques;
- a contextual advertising module, it will be able to record and evaluate the customer behaviour during the web navigation (i.e. visited pages, navigation path, purchase deals etc.) in order to made an ad-hoc targeted campaign;
- a module for social network integration.

This kind of system will allow to increase the hotel turnover, manage web reputation, take over new tourist market and become competitive.

## 4 PLATFORM FEATURES

We propose a modular management platform intended for hoteliers and cloud based, it aims to combine different services in one solution. The system will consist of four components:

- a social semantic tool to organize tourist and accommodation terminology in a semantic way;
- a contextual advertising module connected with social networks integrated with the booking platform;
- a business intelligence level will allow the comparison between other competitors in the same geographical area;
- a web reputation tool to evaluate users' opinions and hotel reviews.

All functionalities will be usable through a properly implemented dashboard according to the user profile.

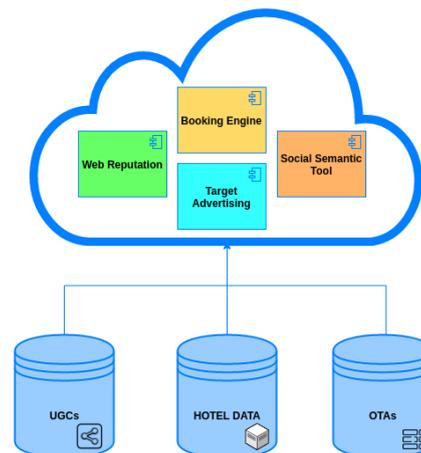


Figure 1: Architecture of Aposentu.

### 4.1 Social Semantic Tool

An efficient touristic web service needs suitable tools to improve data management and knowledge sharing. However a formal categorization of contents could be insufficient to interpret the user instances.

A dynamic business network could be contribute to the evolution of an agile and collaborative booking system in which the contents inserted by users could be a sound basis to interpret better what customers want. For instance a folksonomy allow a better customer-centric view of a hotel's proposition. However this popular categorization cannot be conceived without a formal categorization that includes its capability to be trustable and a right interaction and relationship between the service components as the metadata of an ontology (Johnston, 2007).

Consequently Aposentu will combine tags that characterize Social Web applications with an ontology to better describe the resources specific to Semantic Web in the context of tourism.

Our system will provide a semantic classification of data derived from main touristic websites, booking platform including the customers comments. This categorization will be achieved by using a double-axis. The horizontal axis to classify consumer generated contents (CGCs) and the vertical axis in order to solve word-sense disambiguation. Therefore we want to integrate a formal categorization as a taxonomy with a folksonomy.

In order to achieve a right classification, the data structure of all related information will be examined and a new innovative semantic model for tourist context will be studied. The internal data or managing information will be presented with structured or semi-structured data to which a hierarchic classification can be applied. Instead in order to manage the UGCs we will use a folksonomy and we will choose the combi-

nation of appropriate methodologies. i.e. the use of tag cloud (Sinclair and Cardew-Hall, 2008), the extraction of terms to enrich an existing classification or to develop a new one (Alruqimi and Akin, 2017) or with a social tag (Cantador et al., 2011).

We will also consider lexical database such as WordNet<sup>3</sup> to fix word-sense disambiguation. The innovative technology will also be applied to the connection between similar accommodation and in the same local area in order to analyze the impact of competitors but also the local context as well.

## 4.2 Targeted Advertising

A successful hotel offer has to take into account the recent changes of Programmatic Advertising across new media (Dawson and Lamb, 2016).

The social media tools provide an effective contextually targeted advertising solution where the opinion of a friend or other trusted web source, indicates to users new, appropriate and optimal products or services. A module of user profile-based marketing employs information technologies in order to recognise the wishes of people.

An innovative tourist system has to include tools to match the needs to the context within and around their users (Buhalis and Foerste, 2015).

Many real time information, from mobile devices can influence the tourist experience and help the hotelier to understand what its prospective clients want.

This kind of system allows to revolutionise the hotel offers and to create products and services dynamically based on consumers' needs.

In Aposentu we also want to include a software module that connects the booking platform with the most popular social networks. We will develop an algorithm, based on semantic technologies to achieve a contextually targeted advertising system.

## 4.3 Business Intelligence and Complex Network

Business intelligence (Wood, 2001) models have the capacity to study business information in order to support market management decisions. He considered the importance of analysis of the specific context in which a product shall be placed.

Furthermore Miguéns et al. (Miguéns and Mendes, 2008) discussed how the worldwide tourist arrivals, create a heterogeneous and directed complex network in which weighted and directed network measurements on its topological and weighted

<sup>3</sup><https://wordnet.princeton.edu/>

structure are really important to understand the tourist flows.

In Aposentu even a Business Intelligence module will be implemented. The features of all accommodation of the same level of the hotel of interest will be analysed. In this way the impact of competitors in a particular geographic area will be possible to find. A scraping tool will periodically download the prices offered by the competitors. This information will be processed by the business intelligence algorithm to suggest the hotelier the best price for his offers. We want to use metrics and measures from complex networks to evaluate the hotel offers in the territory through providing aggregated information about the nature, extension and articulation of these.

The application, which will compile data collected with special scraping algorithms, will allow the management of the information associated with each competitor according to a complex network concept based paradigm. This model will integrate "punctual" information, as relative to the single hotel or to the single offer, with another type of information, of topological nature, relating to the connections existing between the various hotels.

These implementation, through the analysis of the collected information, will also generate a complex network in which the hotel offers and their reciprocal connections will be highlighted (aggregated and with different levels of granularity).

This representation will be visual, schematic, easily understandable, and will allow to investigate the complex relationships of hotels.

## 4.4 Web Reputation and Sentiment Analysis

User opinions and reviews on hotels on the web are a fundamental data source in in the booking of a room. The hotel owner must know these assessments for the better management of resources.

We are going to include in our project a tool which collects all opinions from main booking systems, categorizes these comments and shows information in the best understandable way.

In our platform we want to develop a web reputation tool that analyzes comments on the biggest sites of booking (TripAdvisor, Google Reviews, Expedia, Booking, AirB&B) in order to understand the common opinion about offers and hotel features of accommodation. This component has two different purposes: it monitors the use of unfair tactics on comments and allows the system to show users exactly what they wish. In this way it's possible to keep a

high standard of service. Therefore language processing algorithms will be studied.

These algorithms will interact with the text inserted by users in all booking platforms and, as a result of queries, will show only the offers related to accommodation with appropriate characteristics or services.

The positive or negative view of a hotel offer, the intensity and frequency of that opinion, the emotion with which the assessment is expressed and the relevance of that deal in comparison with its geographical area will be analysed.

## 5 CONCLUSIONS

This paper outlines the implementation of Aposentu, an innovative dynamic platform, cloud based turned at hoteliers. The system aims to integrate different type of essential services to become competitive in the tourism market and to keep up with time.

By using Aposentu an hotelier will successfully manage the hotel to optimise the revenue management. The proposed platform will also be able to discover the users' opinion in order to monitor and improve web reputation.

Thanks to use of complex network metrics the system will evaluate competitors' offers and will provide a useful business intelligence tool.

In order to better understand customers' needs we proposed a social semantic categorization that combine tags with an ontology to better describe the resources specific to tourism domain.

Furthermore, by using the targeted advertising tool new guests can be attracted. Given the dynamic context, the presented system fits well with the new internet marketing strategies. In fact all listed functionalities will be implement according to a modular architecture system and, depending on the needs, new ones can be added as well.

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