Mass Customisation through Personalised Brochures: the Role of Emerging Technologies

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Abstract

This paper argues that despite the wide adoption of Internet technologies in destination marketing, information is still disseminated through printed brochures that have largely remained unchanged and unaffected by the trend towards greater personalisation of service. We argue that innovations in IT such as digital printing, allow for the replacement of the inflexible brochures of the past with dynamic, customised brochures. Such changes allow the Destination Marketing Organisations (DMOs) and other tourism providers to significantly improve the element of personalisation of their products, gain valuable marketing and intelligence data about their customers and substantially reduce their printing and posting costs.

Keywords: personalisation, digital printing, variable data documents, brochures, XML, web-services.

1 Introduction

The generation, gathering, processing, application and communication of information are fundamental aspects of the day-to-day operations of the travel and tourism industry (Poon, 1993). Clearly, tourism is an information intensive business, and contemporary Information and Communication Technologies (ICTs) have radically altered the way in which information is conveyed throughout the industry and to its customers, with the effect of bridging the distance between all the components of the market (Buhalis, 2000).

In tandem, the advent of the Internet and its huge expansion has generated a positioning and visibility problem for many travel operators and DMOs which find it increasingly difficult to stand out from other providers (Baggio, 2006). DMOs need to keep abreast of the pace of change, and engage more with their customers (King, 2002), but they often possess limited knowledge of their customers' needs and wants (Fayos-Sola, 1996). Increasingly, potential visitors want and expect to be addressed in personalised ways, receive information that matches their personal expectations, and live a unique holiday experience, but DMOs' websites on the whole remain static (Windham and Orton, 2000). The ICT strategy of many destinations has focused on the relay of information to the final consumer, rather than to the creation of customer-focused content (King, 2002; Stamboulis and Skayannis, 2003).

Personalised information increases the quality and reduces the amount of information that users receive (Rumetshofer et al, 2003). Mass customisation strengthens the relationship between consumer and supplier, and provides the consumer with stronger motivation, loyalty and satisfaction (Sigala, 2006). In its simplest form mass customisation can be described as a process or system through which a product that is unique to each customer can be produced. Customisation techniques such as dynamic packaging and personalised travel services (Fink and Kobsa, 2002; Franke, 2003; Norrie et al., 2005) are powerful tools that offer a high degree of flexibility and personal service. However, dynamic packaging tends to only apply on certain aspects of travelling, namely accommodation and transport, whilst personalised travel services might be beyond the budget potential for many tourism operators, who are still dependent on traditional marketing tools such as the tourist brochure.

Traditionally, destination authorities used travel brochures as their main marketing instrument to enhance awareness of their destinations, provide information and generate desire to purchase (Zhou, 1997; Yüksel and Akgül, 2006); gradually more emphasis was placed on electronic media advertising, leaving brochures untouched by technological advances. A closer inspection of the practices of many tourism providers, and especially DMOs demonstrates that the tourist brochure is still widely used for the distribution of information, despite printing and postage costs, and, the growing sophistication of travel and tourism websites.

A recent study of US DMOs (Gretzel et al., 2006) indicated that the use of the Web had created more telephone inquiries, and increased their overall marketing costs. Furthermore, consumers appeared to still have more trust in printed materials, rather than website content, and, consequently, DMOs continued to invest a large proportion of their budgets for producing and distributing brochures. Part of the problem is that tourism websites do not provide their customers with specific information (King, 2002), which necessitates the posting of additional materials to potential customers.

New and emerging technologies can help improve the personalisation potential of brochures, at a lower cost than that of conventional tourist brochures (PODi, 2004; Xerox, 2005). From its website, Tourism Bermuda offers the choice of standard and free customised brochures through an automated brochure system (Tourism Bermuda, 2006). Information about the customer's individual interests is entered through the website, and a completely personalised, four-colour, 20-page brochure is created and posted out to potential visitors from Canada, the US and the UK. Since the customised brochures were introduced, customers displayed a higher level of interest than the previous standard campaigns had generated (PODi, 2004).

Tourism British Columbia (BC), in collaboration with Xerox's 1:1 lab, tested the distribution of personalised brochures during a pilot project that ran from April to August 2005 as part of the BC Escapes campaign (Xerox, 2005). The aim of the pilot was to reduce printing and distribution costs, and test whether the customised marketing approach would lead to greater sales conversion. Customers that wished to receive additional information about BC were asked to fill in an online form answering a set of questions, that is, the nature of travel party, destination, primary activity, accommodation prices, and season of travel. In total, 5,407 brochures were distributed and the standard brochure size was reduced from 112 pages to 24. As well as earning an award by the Canadian Marketing Association, Tourism BC collected vital intelligence data about its customers (Maclean, 2006) but it was not possible to say whether the customised approach had worked better. Booking revenue did not increase and there was no impact on online bookings on Tourism BC's website but there was a significant cost reduction (Maclean, 2006).

These two examples verify the notion that DMOs are only just beginning to understand and appreciate how they can use emerging technologies to promote themselves (Gretzel et al., 2006). Tourism brochure personalisation is an emerging innovation, which can extend the brochure's conventional use beyond that of a static informative tool, which can dynamically adapt to user preferences. Moreover, the personalised brochure can be seen as a compact information package about the destination, based on each customer's personal preferences and expectations. The advantage with this is that tourists can carry these customised brochures with them to the destination, and use them as complete guides on accommodation, bus and train timetables, events of interest to them, maps that depict the *best* route according to their preferences for sightseeing and weather conditions for their duration of stay. Thus, this paper proposes a complete framework for highly customised brochures for the tourism and travel industry.

The aim of this paper is to describe a proposed tourism development framework that demonstrates how this can be achieved. The paper begins by describing the emerging technologies, which could revolutionise brochures, and transform them into highly personalised information documents. It then presents the proposed framework, and concludes by discussing the future plans for the implementation and testing of this framework.

2 Emerging Technologies

The purpose of this section is to introduce new technologies, which can be adopted and easily implemented at a low cost and which can significantly improve travel and tourism applications. These include: EXtensible Markup Language (XML), web services, Radio Frequency Identification (RFID), and Variable Data Printing and each is described in more detail below.

2.1 EXtensible Markup Language (XML)

XML is a general-purpose markup language which was designed to describe data and to focus on what the data actually is. It was developed by an XML Working Group that was formed under the auspices of the World Wide Web Consortium (W3C) in 1996 (Bray et. al., 2006). Their primary aims were to introduce an interoperable technology, where Web-based applications can exchange information in a well-defined, -structured, and -understood universal language, and to lead the Web to its full potential. A number of XML's primary goals are:

- Straightforward usability over the Internet.
- Facilitation of interoperability between Web-based applications.
- Easiness of processing XML documents, which are based on a hierarchical structure.
- Human-legible and reasonably clear.

In contrast, HyperText Markup Language (HTML), which is widely used on the Web, was designed to display data and focuses on how data looks. As a result, HTML tags (syntax elements) are fixed, whereas XML tags are not pre-defined. XML typically uses a Document Type Definition (DTD), or, an XML Schema to describe the data, and an XML-based style sheet document, known as EXtensible Stylesheet Language Transformation (XSLT) document, which is used to transform XML documents into other formats, such as Extensible HyperText Markup Language (XHTML), typically used for presentation purposes over the Internet. XML is becoming the universal standard for data exchange between online applications, such as tourism websites.

2.2 Web-services

Web-services provide the means for distributed objects to interact, irrespectively of their physical location, implementation language, and underlying execution platform, allowing remote objects to easily access valuable, dynamic, up-to-date sources of information over the Web (Milo, et. al. 2005). As an additional advantage, web-services servers communicate with their clients through XML over HTTP. As a result, exchanged messages can be easily understood by humans, and because of the pervasive nature of the HTTP protocol, messages can virtually reach any machine on the Internet, as HTTP traffic is not blocked by firewalls. The key protocols that make web-services possible are (Kalani and Kalani, 2003):

- **Simple Object Access Protocol (SOAP)**. It encapsulates object calls as XML sent via HTTP. The advantage of using SOAP as a communication medium is that it can travel to any point on the Internet, and that it can be interpreted by a wide variety of software due to the inherent pervasiveness of the HTTP protocol and the interoperable nature of XML.
- **Disco and Universal Description, Discovery, and Integration (UDDI)**. It facilitates the communication between clients and web-services servers, and enables the discovery of available web-services along with their details.
- **Web-Services Description Language (WSDL)**. It is a standard by which web-services inform clients on the type of messages they accept and the results they will return.

Web-services are often considered as a valuable solution which can significantly improve application integration, coordination, and data exchange, while, at the same time, maintaining costs at a low level.

2.3 Radio Frequency Identification (RFID)

RFID technology was invented in 1948 when Harry Stockman proposed the idea of communication by means of reflected power (Stockman, 1948). Since then RFID technology has been used successfully in various industrial applications, such as transportation, access control, animal tagging and toll roads, to name a few. An RFID system mainly consists of three elements:

- **Base station (BS)**. It contains a transmitter part, which is able to send some radiated power on a carrier frequency, and a receiver part, which collects the signal coming back from the tag (Paret, 2005).
- **Tag**. A small mobile communication circuit which includes an antenna, memory, and in some cases battery.
- **Database**. It contains information that matches the tag's unique serial number (unique ID).

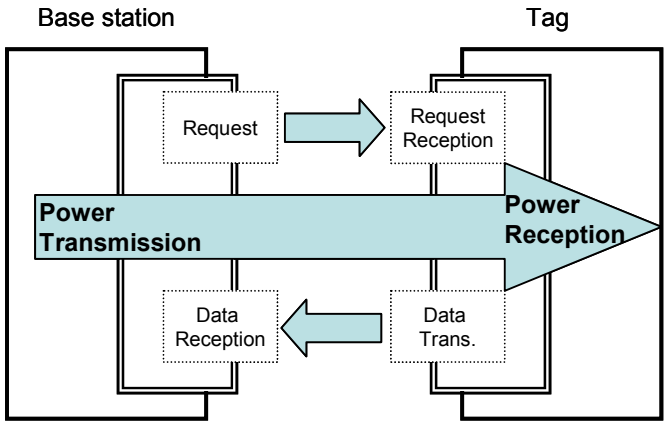

Figure 1. Simplified communication model between BS and tag (Tedjini., 2005).

In general, RFID tags are categorised in:

- **Passive**. The supplied radiated energy by the BS is sufficient to wake-up the tag, which in turn transmits the data stored in its memory back to the BS.
- **Active**. The collected radiated energy is inadequate and thus the tag needs on-board battery assistance to supply the required level of power.

RFID systems are classified as: close distance; proximity; vicinity; long distance; and very long distance, which are related to their operating frequency ranges (Tedjini, 2005):

- **Low Frequency (LF)**. It operates between 125KHz to 134.2KHz and its wireless range is limited to a few centimetres.
- **High Frequency (HF)**. It operates on 13.56MHz and can reach within a meter range.
- **UHF**. It operates on either 869MHz, 915MHz, or 950MHz and its range can exceed three meters.
- **Microwave**. It operates between 125KHz to 134.2KHz and it can reach more than 10 meters.

At low frequencies, such as LF and HF, the electronic circuits of RFID systems come at a low cost and are sufficient for a wide range of applications, whereas UHF and microwave bands typically require more expensive equipment and normally suite wide-scale applications. Blayo and Pineaux (2005) predicted that in the near future, it may become feasible to print all the components of an RFID tag just like printing information on a document, and in an efficient and cost effective way. Accordingly, the RFID applications could then become countless; for example, in the tourism industry, where brochures may contain electronic coupons that include promotional offers, for visitor attraction museums and theme parks.

2.4 Variable Data Printing

The traditional notion of brochures as being mostly static, in terms of content and layout, aiming at a broad audience of potential tourists, is changing towards the notion of being highly personalised; that is, tailored to tourist needs and preferences. The advent of digital presses has made the personalisation of brochures possible to an unprecedented degree. However, high-volume personalised print jobs are getting more complex, especially when colour, images, and various personalised elements are being used, resulting in each page being almost unique. In terms of traditional printing languages, each page has to be analysed, and a high resolution raster image is created which tells the printer what is where and how it should be put on paper. This process is called *raster image processing* or *RIPing*, which is

computationally expensive and can become a performance bottleneck, especially in high-volume personalised printing (Meneguzzi, et. al. 2004).

Variable data documents are documents which contain both static and variable information depending on a set of criteria. The Printing On Demand Initiative (PODi) has introduced a new standard for the definition of variable data documents, which is called Personalized Print Markup Language (PPML) (PODI, 2003). The primary aim of PPML is to reduce the complexity of the high-volume, personalised print-jobs by considerably reducing the time RIPing normally takes. This is achieved by allowing the definition of reusable content, that is, elements that are used on many pages. These may include: graphics; images; fonts; logos; diagrams; and so on. PPML explicitly defines the reusable resources, which allows the printer to *rasterize* reusable content once, and use many times, instead of being rasterized on every single page.

In this context, personalised brochures are called *variable information documents* as the information they contain varies in respect to tourist preferences, travel information, and various tourist specific criteria. Typically, these documents contain a number of static areas, where content such as graphics, images, and text remains the same across the complete set of replicas, and a number of pre-defined areas where the content is loaded from a data source. Bank statements and bills can be easily produced as the general layout, colour, and images typically remain the same, whereas in more complex applications, such as personalised travel brochures, variable content may include accommodation images, weather information, maps, promotional offers, and so on. Moreover, in the travel brochure scenario, information which may be of interest to potential tourists, such as weather information for each destination may not be kept locally. This type of information needs to be dynamically retrieved from an external source, and then added on to the personalised brochure creation process.

In traditional personalisation methods, a team of designers with expertise in graphics, document design, layout, and databases develops an overall layout of the document, and defines the areas of variable content, which is typically loaded from a local data source. The creator can link directly an area to a database field, or set-up custom rules on how the data should be loaded onto the template. As an example, consider a document template with special instructions, facilities, and promotions for disabled people that wish to visit the Edinburgh International Festival. The personalised brochure should include relevant information that matches each individual's needs along with specific instructions on facilities that may be available. The designer needs to define a complete set of rules that will allow relevant accessibility information to be dynamically loaded onto the brochure. In addition, the designer may have to define overall rules which automatically substitute the current template, with a more accessible template for impaired users which may conform to accessibility guidelines (Chisholm, 1999), such as minimum font size, preferred font face, and preferred text and background colours. A similar approach is taken by Stone, (2006), who proposed a profile-based document delivery system for impaired users.

The process of matching pre-defined variable data slots with database fields is commonly known as *lick and stick* as the personalisation engine produces different instances of the original document with data loaded from each database record. The resulting set of personalised documents is typically quite similar in terms of general layout and space allocation for variable data. However, space requirements of variable data can significantly differ, and thus the designer needs to spend an extensive amount of time to ensure the adequate presentation of each final personalised document. An alternative approach is proposed by Purvis, (2003), where the document layout is automatically rearranged in an attempt to optimise the presentation of each final personalised document. This is achieved by formalising custom document creation as a multi-objective optimisation problem, and using a generic algorithm to assemble and transform compound personalised documents.

3 Proposed Framework for tourism

Potential tourists usually use web-based tourist information systems and online travel agencies to acquire information on destination availability, travel prices, and book their holidays. However, traditional systems provide high amounts of information which can be irrelevant to the individual user. In addition, information about potential trips is not stored, or maintained on a user-profile basis, which may result in wasting a considerable amount of time to retrieve it again. For instance, customers can spend time defining their exact trip preferences, finding out about culture and events on the season of travel, but once they leave the website they need to repeat the process to obtain the same or relevant information.

3.1 Model for automatic brochure personalisation with external sources support

A number of innovative systems have been proposed which provide information in a personalised manner, that is, they display information according to user preferences, interests, and background knowledge (Sukonmanee and Srivihok, 2004; Fink and Kobsa, 2002). In addition, some systems also monitor user behaviour and make generalisations and predictions about the user based on these observations. Moreover, the idea of providing location-based, personalised mobile services for tourists has also been proposed in a number of studies (Weiβenberg, et. al. 2004; Zipf and Malaka, 2001). A major issue in this process is the acquisition of knowledge about the user, that is, to determine the user's interests and preferences.

Generally, two approaches exist:

- **Explicit feedback**. The system requests information from the user using a form-based questionnaire.
- **Implicit feedback**. The system infers user preferences by monitoring user's behaviour.

If the questionnaire is too long, it is likely to disturb or annoy the user, although this approach can be more precise than implicitly inferring user's interests. It is proposed that explicit feedback should be used to define the main user requirements, and the remaining can be inferred by implicit feedback, thus, eliminating time-consuming web-based feedback forms, and at the same time increasing prediction precision. For example, a short web-based form may be used to extract user specific information, such as favourite destination, primary activity, accommodation price range and season of travel, and infer certain interests in certain events, such as theatre shows, cinema and entertainment. Schwab et al. (2000) proposed an implicit acquisition method which learns user interests from observed user behaviour, based on positive evidence only. This method can be used by the implicit feedback module without interrupting the user for rating different system options.

Recommender systems are also used to assist customers in their decision making process and as a means of gaining knowledge about the customer (Loh et al., 2004). A recommender system is a piece of software that aids in the process of indicating or receiving indication about what options are better suited in a special case for a certain individual (Resnick and Varian, 1997). Ricci and Werthner (2002) presented a recommender system to help the customer in defining a travel plan.

A popular approach to customer profiling and a particular type of recommender systems, is collaborative filtering, a method of making automatic predictions about the user interests by using prior knowledge of other users' preferences who share similar characteristics. For example, older people tend to seek quieter accommodation, thus this type of accommodation would be automatically recommended to users who fit these criteria. Although this approach can produce customised products and services, it is not accurate, as misinterpretation of user profile is possible, which can detract from the customer experience.

Figure 2 depicts the front-end architecture of this paper's proposed framework. As shown in the figure, the system analyses the user's behaviour and specific preferences, and uses this information to build a user profile. The profile includes suggested user preferences as well as user specific requests, and is then stored to a local database. The learning module matches user profile attributes to current tourism and trip information which is maintained in a local database, and passes control to the *create travel data module*, which in turn links all relevant information and produces a unique record for each specific user. The record contains relationships to current tourism and trip data and is then stored in a local database.

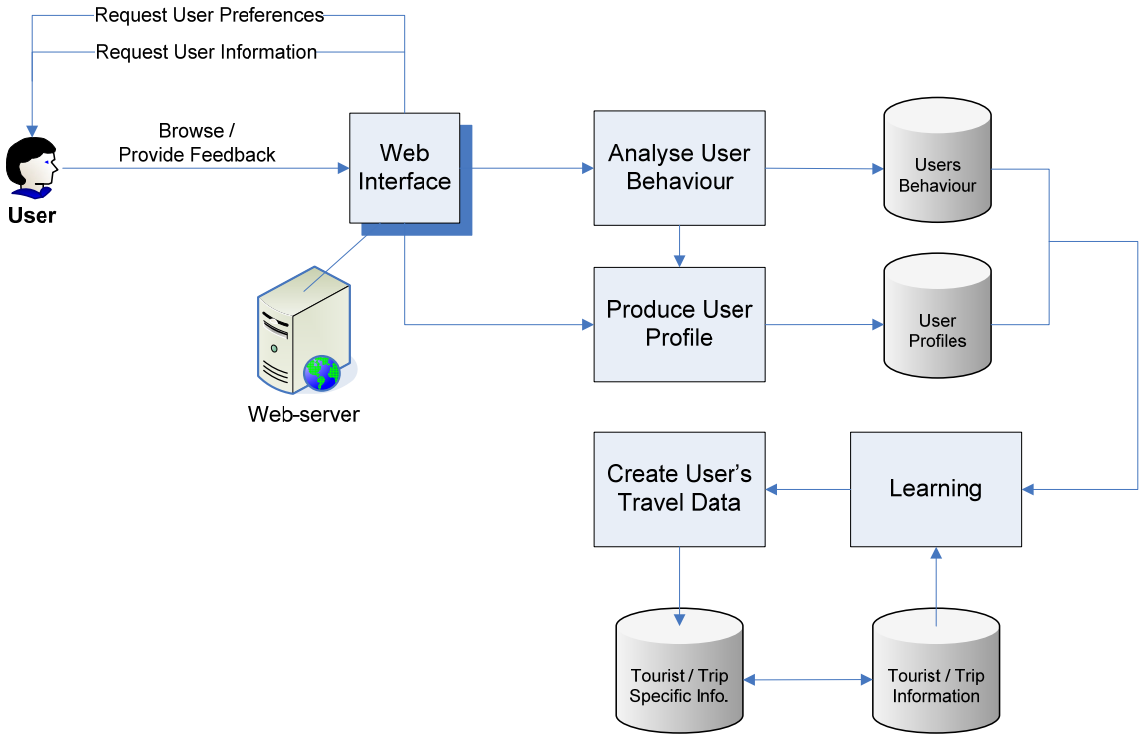

Figure 2. Front-end overall architecture of the proposed framework.

In such a dynamic scenario it is likely that required information might not exist in the local tourism and trip information database, but may be essential for the user, e.g. train timetables and prices, or bus routes from the suggested hotel to the city centre. Thus, the system should have the ability to seek this information from external data-sources through the use of web-services as depicted in Figure 3. The system could request specific services from various service brokers, using SOAP to communicate and retrieve the results. Such services may include accommodation information in the user's preferred region, travel information, such as flight availability and prices, dependent on the user's preferred season of travel, local maps, itinerary information, theatre shows and events. In some cases, external web-services may require a small fee to process a certain request. The system should inform the user of any additional costs, on top of the cost of producing the personalised brochure, and then make the payment, provided that the user accepts it. A typical case of a web-service that would request a payment is a stock image broker service, which supplies high-resolution images for a vast range of themes. Such images and graphics could be bought, and attached to the brochure to accomplish a unique personalisation experience.

Once the requested data is collected from the external sources, the system analyses the space requirements and chooses the *best fit* template from a database pool (*see* Figure 4), mostly based on

InDesign (Adobe, 2006a) and QuarkXPress (Quark Inc, 2006) which are professional software for design and layout, as they are both capable of producing high quality brochure templates. Then the system automatically loads the dynamic information, such as graphics, images and text, onto the pre-defined areas marked for personalised content and composes the personalised document. It then passes the document to the layout verification module which verifies whether the design objectives are sufficiently satisfied, and if so, it returns the document unchanged. Otherwise, it tries to find an optimal solution by rearranging the layout of the document, and returns the *best* solution. The verification module bases its optimisation methodology on the approach taken by Purvis, et. al. (2003) who proposed an automated layout optimisation process, where layout requirements are translated and encoded into good design principles, such as alignment, balance, legibility, compactness, text and image balance, rather than layout constraints, that result in better aesthetic outputs. Each individual design objective is scored separately, and then added to a weighted overall score, which is then used to decide on the *best* solution.

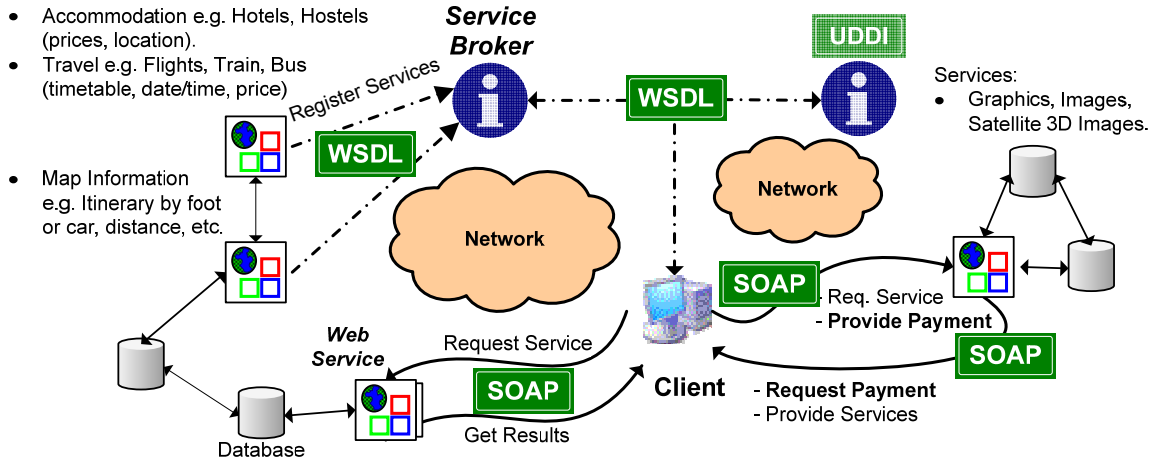

Figure 3. Information seeker sub-system with payment capabilities.

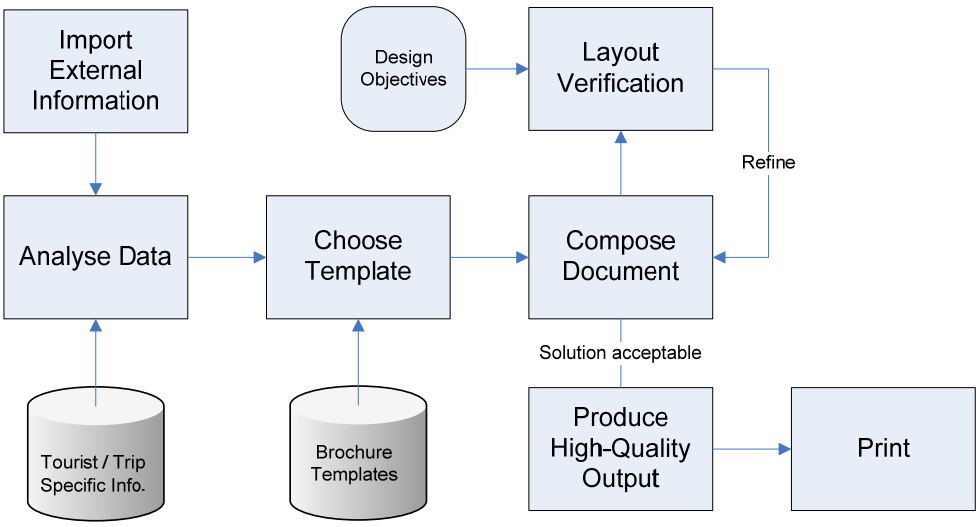

Figure 4. Back-end overall architecture of the proposed framework.

The final stage of the process is to print the brochure in a high quality Portable Device Format (PDF) (Adobe, 2006b) through automation. InDesign automation is very powerful and ranges from creating a simple procedure which produces a personalised Christmas card, to creating high-quality, fully personalised tourism and travel brochures. It allows developers to use object-oriented programming languages, such as C# and VB, to control COM objects exposed by the application, and completely automate tasks, that would otherwise require manual control. Using RFID technology, a tag can be printed on the brochure to include promotional offers which are relevant to user's preferences, or more specialised information, such as the user's tickets to certain tourist attractions and museums. The resulting PDF brochure can then be sent to a digital print press company to produce a hard-copy of the brochure, and post it to the customer.

4 Conclusion

The basic premise of this paper was that despite being a key marketing tool, printed brochures have remained unchanged by technological advances and their personalisation potential has not been realised yet in full. The aim of this paper was to propose a framework that can metamorphose the brochure into a variable data document that will include information about the destination, activities and events that is unique for each individual customer. Once printing all the components of an RFID tag on conventional paper becomes feasible and cost-effective (Blayo and Pineaux, 2005), brochures could also contain electronic coupons such as attraction free passes, based on the user preferences and implicit feedback inferred from the system. Such changes could transform the brochures from a passive to a highly dynamic implement for the consumer.

Personalised brochures have advantages for consumers and providers over conventional brochures. Consumers are provided with focused and relevant information about their trip, which reduces information overload. In addition, linking up content to other providers can help the consumer gain a holistic perspective of the destination and what is on offer. In this way the customer experience of a destination or tourism product can be enhanced, as customers want specific information and personalised feedback (Gretzel et. al., 2006). For producers, personalisation allows for a reduction of printing and distribution costs and the collection of market intelligence data through unobtrusive methods. Destinations have to manage higher and increasingly diverse consumer expectations but they often have limited knowledge of travellers' needs and wants (Fayos-Sola, 1996). Personalised brochures can help them engage with actual and prospective customers, market their products more efficiently and offer customer-focused content and services.

There are certain challenges for the future of customised brochures. First of all, consumers and providers need to be appeased that the reduced length of a customised brochure will not compromise the quality of information provided but will rather enhance it. In addition, accessibility issues will need to be addressed, especially in terms of impaired users and multi-language support. Finally, a more advanced system could enable the generation of the personalised brochure electronically and in a fully automated fashion that could be sent to the user in a PDF format.

It was beyond the scope of this paper to describe in detail the technicalities of the proposed framework and present experimental data. The next step is to implement a prototype of the proposed framework aiming at prospective students of Napier University. Specifically, the system can be added on Napier's main website allowing prospective students to create a fully personalised brochure that will contain information about their course of interest, accommodation information of their preferred area, cultural events and activities, life-style, living costs, bus routes, maps, and so on. The prototype will be available to all prospective students as an additional aid to the standard brochure. The effectiveness of the personalised brochures to attract prospective students, the usefulness in transmitting qualitative information, the usability in information finding, and, finally, the preparation and postage costs can then be evaluated. Results of the case study will be used to further refine the model, and to enhance the software system.

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