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Retail in the Digital City

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ABSTRACT

Conventional high street retailers face a multitude of challenges if they are to survive and thrive. Some of these difficulties arise from structural and economic issues; others may be sociological and demographic. However, to thrive, retailers must be perceived as being competitive, and must adopt innovative and invigorating strategies to maximise the potential of their situations while offsetting the limitations. In this paper, it is proposed that a judicious combination of low-cost Information and Communication Technologies (ICTs) could enable small retailers to harness the benefits of the information society and provide services congruent with the digital city concept. As an illustration of the issues involved, pertinent results from a systematic end-user evaluation of EasiShop are discussed.

Keywords: Digital Cities, M-Commerce, Mobile Computing, Pervasive Retail, Retail

INTRODUCTION

For many years, independent retailers have been the mainstay of commercial activities in cities, towns and villages. Yet today, their existence is under threat. Though no two situations are exactly alike in the challenges they have to overcome, certain commonalities exist, and these have emerged for the most part within the last thirty years. In the former instance, the growth of out-of-town shopping and of corporate retailers has radically altered the traditional shopping experience (Griffiths et al., 2008). Likewise, increased car ownership, changes in lifestyles and the arrival of internet-based e-commerce have altered consumer behaviour. In practice, this means consumers can and are

willing to travel further to shop. Deregulated shopping hours means that they can shop when it is convenient, resulting in a slack trade in the early days of the week, and a dramatic increase in retail activity at the weekends (Baker & Wood, 2010). For independent retailers, these developments pose significant difficulties, and many are fighting a rearguard action to stay in business. However, while there has been an undoubted decline, there is no reason to assume that this is inevitable or indeed universal (Ben-nison et al., 2010).

It is instructive to remind ourselves of the role independent retailers play in society, and what the implications of their demise might be. Clarke and Banga (2010) explored the social and economic role of small shops in the UK, an area with a strong tradition of independent retailing. From a social perspective, the following observations were made:

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- Small stores are a hub for communities: As well as being a commercial concern, stores are frequently a place for social interaction due to their proximity to local residents.
- Small stores are vital for the disadvantaged and socially excluded: Small stores, particularly grocery stores, help address the needs of disadvantaged groups including the elderly, the socially excluded and those with limited mobility. While it may be conjectured that the internet offers a solution for some members of those groups, it is interesting to note that, in the case of low-income Americans at least, such people are less likely to trust e-commerce environments, and thus not use them (Corrigan, 2008).
- Small stores enhance consumer choice and access: While choice and access has improved for car owners, other groups have not been so fortunate. Thus a variety of local stores increases choice and access at a local level.
- Small stores create consumer value: Though small stores cannot hope to compete directly with the many national and international companies, nevertheless, they can provide a service and product range more tailored to the needs of the local population.

Thus a thriving small retail sector may be perceived as fundamental to maintaining a healthy social fabric, as well as fostering a degree of innovation and enterprise (Paddison & Calderwood, 2007; Smith & Sparks, 2000). Yet small independent retailers face many challenges, including meeting the continuously changing expectations of local consumers (Lee et al., 2008).

Challenges for Independent Retailers

Ultimately, the key challenge for small scale independent retailers is to identify strategies for obtaining new business while all the time maintaining their existing customer bases. In the UK,

many independent retailers have failed in this task for a variety of reasons, resulting in some high streets being dominated by popular chain stores, and characterised by an extraordinary level of uniformity and poor consumer choice. The term Clone Towns has been used to describe areas where this has occurred (Conisbee et al., 2004). Indeed, it has been forecast that some kinds of retailers including groceries and newsagents amongst others may not survive beyond 2015 (APPSSG, 2005). To compete, retailers must build competitive advantages based on their close relationship with their customers, and develop a capacity to adapt quickly and flexibly in response to changing circumstances (Megicks & Warnaby, 2008). Furthermore, it is important that retailers are conscious at all times of what motivates shoppers. Such motivations include (Wagner, 2007):

- Shopping pleasure;
- Frictionless shopping;
- Value seeking;
- Quality seeking.

Shopping may be perceived as a multi-dimensional construct. The term hedonic shopping is occasionally used to encapsulate additional concepts including window shopping, social interaction, aesthetic architecture and so on (Clulow & Reimers, 2009). Some discerning retailers will of course be acutely aware of this, and may have factored such issues into their retail strategy in so far as their situations allow. Nevertheless, retailers should not be immune to developments in Information and Communication Technologies (ICTS), including mobile technologies, in their various facets. However, the opportunities that mobile and other pervasive technologies offer have not been harnessed for reasons that may be speculated on. In parallel, developments on so called Digital Cities continue unabated.

Digital cities (Calabrese et al., 2008; Van den Besselaar & Koizumi, 2005) represent a fusing of the physical and virtual cityscapes into a single seamless information space. The digital or smart city seeks to integrate the vari-

ous facets of an effective functioning city. Such facets might include: traffic monitoring, public transportation, utility distribution, health service management, leisure and tourism, entertainment, e-government, emergency response and of course commerce. These services need to be truly integrated into a holistic system, which is (part) accessible to the general public. The digital city should support its inhabitants in the conduct of their everyday tasks thereby delivering an enhanced quality of life making mundane and routine tasks easier and less invasive into their quality time.

The twin developments of digital city infrastructures and mobile computing technologies have significant potential to enable small retailers contribute to and benefit from the information society. Yet many barriers remain to be overcome. Rather than waiting for digital cities to materialise, opportunities exist for retailers to avail of the current state-of-the-art technologies that may be mainstream within a short period of time. Mobile commerce (m-commerce) (Ngai & Gunasekaran, 2007) offers one key avenue through which such opportunities may be availed of.

DEVELOPMENTS IN MOBILE COMMERCE

Mobile computing is experiencing burgeoning growth - the first quarter of 2010 saw data traffic surpass that of voice on mobile networks around the world for the first time (Wortham, 2010). In addition, location based services appear to be attaining critical mass; revenue is expected to reach US\$10.3 billion in 2015 (Pyramid Research, 2011). In spite of this, the corresponding development of mobile commerce has remained stubbornly sluggish. Various factors contributing to this state of affairs have been mooted, including quality and reliability of prevailing wireless infrastructures and a lack of suitable business models (Varshney, 2008); others include trust (or lack thereof), inadequate user interface features and lack of awareness - issues that are observed across all

kinds of mobile applications. Many of these factors, for example, limited hardware capabilities, restricted user interface, and intermittent network coverage are perhaps becoming less salient as the technology matures. One strategy to counteract these restrictions is to adopt some level of intelligence into delivering effective mobile commerce services; specifically, the notion of agency has proven to be particularly attractive in realising services that are adaptive, personalised and context-aware (Shen et al., 2010). Furthermore agents have been expensively harnessed in standard e-commerce solutions (Lin, 2008; Fasli, 2007; Chen et al., 2008; Kowalczyk et al., 2002). In the case of m-commerce, one of the earliest (and most influential) research efforts of this kind was Impulse (Youll et al., 2000). A cornerstone of the Impulse vision was concerned with the notion of context. By deploying a suite of agents along with a centralised product and services database (termed the Wherehoo Server), the retrieval of products and services is enabled by garnering pseudo-English location-specific search terms from the user (for example, Breakfast, 0.2km) and matching those with the current location (enabled by GPS).

One convenient means of delivering mobile commerce that is robust, scalable and inductive to competitive practice is that of auctioneering. A wide range of auction mechanisms have been incorporated into electronic commerce solutions over the years (Anthony, 2009). The mobile reverse auction agent system (MoRASS) (Shih et al., 2005) involves the utilisation of intermediate agents which mediate between the buyer and the sellers and execute bidding asynchronously and autonomously. Security is central to MoRASS and a novel double encryption key chain technique is included. Auctioneering is governed by a novel Reverse Vickrey Auction Protocol (RVAP), the goal of which is to achieve unconditional bid privacy.

It is clear that much of the research has been technology driven. More recent efforts have strived to develop prototypes with a consumer-oriented bias. The MAGICCS vision (Chen et al., 2008) is one such example. Participating stores

are encouraged to establish special servers to deploy mobile agents at their own websites. By using a mobile phone, the shopper can specify buying requirements to a proxy server that results in a set of mobile agents being generated to fulfill a particular shopping task. Other efforts have adopted a business-centric approach. Havana (Mahmoud & Yu, 2006) is an agent platform which permits the deployment of agents useful in an m-commerce context. A centralised facility permits the creation and management of shopper agents. Termed the Gateway, this server acts as a conduit between the user and the wider commercial environment. The user connects to the Gateway using a customized mobile application and the interface allows the user to verify current progress, location and whether certain tasks have been completed. The initiative encompasses a novel business model, whereby both sellers (i.e., stores) and buyers benefit. Each participating store agrees to install the necessary computer hardware and software systems which will allow mobile agents from the Gateway to run on that store's website. In return, the Gateway operator agrees to let each store insert one relevant advertisement into each mobile agent's search results. The user, meanwhile, is provided with a useful (and free) value-added service.

Not all research in the field is dependent on agent-based technologies, for example, the Mobile Shopping Assistant as described by Wu and Natchetoi (2007). This mobile shopping assistant is centred around a mobile client and offers a novel approach in that the real-time compression and decompression of embedded XML data is used to deliver, it is intended, a more speedy and robust mobile shopping experience. Santangelo et al. (2007) describe a PDA-based shopping assistant which incorporates a spoken natural language interface delivered over a Bluetooth link. The structured voice ontology format VoiceXML is used in conjunction with CYC (Lenat, 1995), the knowledge base which attempts to embody everyday common sense knowledge. The objective is that the shopper specifies in their natural language those products which are sought. The shopper assistant then

attempts to decipher the request and to find a suitable product match using a database of products specified in an XML structure.

Towards Pervasive Retail

Enabling retailers and potential customers to communicate and trade does not demand the use of sophisticated technologies; rather, a select combination of inexpensive and common devices will enable retailers to rapidly deploy a hardware/software configuration that enables them to market a range of digital products and services to shoppers.

Cellular networking systems such as 3G are ubiquitous, but come at a price. This must be paid for, but by whom? Shoppers are unlikely to sign up for services that come with a price tag, unless they are well motivated. Wi-Fi is a valid technology choice as retailers can setup their own hotspots quite cheaply, and the running costs are not excessive. A key limitation of this approach concerns the lack of support for Wi-Fi on all phones. As many phones currently on the market increasingly support Wi-Fi, it can be realistically envisaged that this limitation will be overcome in the near future.

To determine geographic location electronically, a common approach is to harness either a satellite based technology, of which GPS is the exemplar, or a mechanism that uses the features of a cellular network topology. Though valid solutions, the accuracy of each is unpredictable. Furthermore, the applicability of such systems in narrow streets and high-rise neighbourhoods is questionable, as Line-of-Sight (LoS) conditions are essential to their operation. An alternative is to use a short range communications technology for positioning and data communications. Though it does not give an explicit position, the very fact that a shopper can see the signal indicates that they are within 10 to 100 meters or so of any shop that is scanning for potential shoppers.

The ubiquity of sophisticated mobile devices with integrated communications and positioning mechanisms, or Smart Mobile Media Devices (SM-MDs) (O'Reilly & Duane,

2010), has inevitably led researchers to explore their potential in the retail sector. Likewise, other pervasive computing technologies show significant promise. Harnessing these technologies to augment the shopping experience has led to the term pervasive retail being coined, and a number of prototype solutions have been documented in the research literature, see for example (Strohbach & Martin, 2011; Kourouthanassis & Roussos, 2003; Yih et al., 2005; Sellitto et al., 2007; Quercia et al., 2011). However, many major retailers have released mobile applications so as to connect better with their customers; likewise, the number of retail applications for iPhones and Android continues to grow. But for the small retailer, how to avail of this shopping paradigm shift remains an open question as many remain unprepared (Bennett & Savani, 2011).

THE EASISHOP EXPERIENCE

EasiShop demonstrates how a judicious selection of technologies can enable retailers to reach potential customers at a pivotal moment -when they are physically near their premises and desire to acquire some merchandise that is in stock. It offers a mechanism of connecting to potential customers in an ad-hoc fashion. Furthermore, it enables competition between retailers in an open and transparent fashion. Potential shoppers must be prepared to share their shopping requirements, and retailers must be prepared to participate in an EasiShop hotspot network. A detailed description of EasiShop may be found elsewhere (Keegan et al., 2008); however a short summary of its features and modus operandi is provided here.

In summary: EasiShop is a mobile shopping system. It allows a prospective shopper to select browse a list of products using their mobile handheld device and to indicate products of interest. Participating retailers are incentivised to integrate EasiShop requirements with existing store stock control infrastructure. Details pertaining to current stock held by a particular retailer are exposed to the shopper through a

Bluetooth communications array, intended to be installed at the entrance of the retailer's premises. Should the shopper come within Bluetooth operational proximity of a particular retailer's radio array (called a hotspot), communication may occur between the user's mobile device and the retailer's hotspot controller. This communication occurs without the user's intervention. As a result, the retailer may offer the shopper a deal for any items in stock that match those on the shopper's list. In other cases, a time-limited auction ensues, during which other interested participants (retailers) vie for the shopper's business. This occurs at the EasiShop host on the internet, conventionally referred to as the Marketplace.

To illustrate the EasiShop construct further, three key components to the EasiShop architecture, as outlined in Figure 1, are now considered.

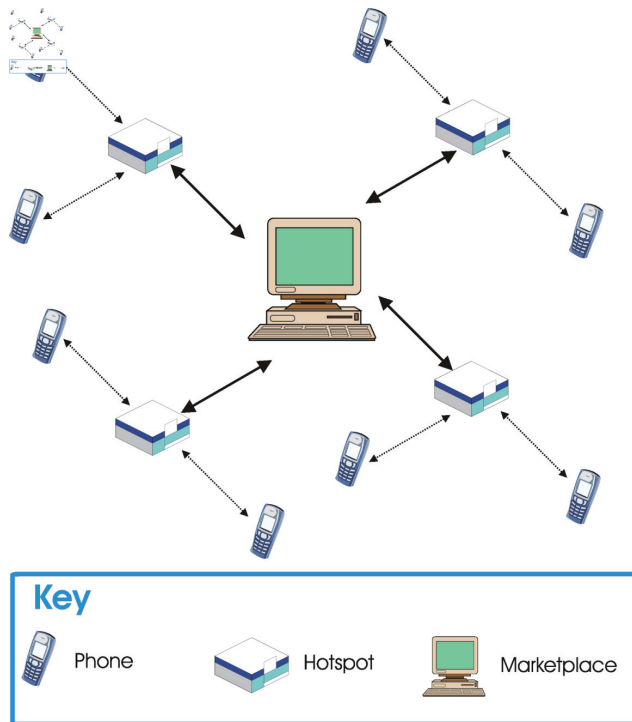
EasiShop Hotspot

In providing this service, the retailer obtains one vital piece of marketing information -they know that a potential shopper is within the physical vicinity of their shop. This assumes that the shopper has already registered for the service and that in this; the service is entirely shopper-originated. To what degree this information can be used depends on what the shopper needs and what the shop stocks. Should there be a match, then the retailer has a unique opportunity to obtain a customer. This demands that the retailer develops a strategy that can be instantaneously implemented so as to entice the shopper to physically enter their store, and, hopefully, become a customer. The EasiShop market place facilitates this process.

EasiShop Market Place

All EasiShop retailers have a presence in the EasiShop Marketplace. This is a virtual entity, hosted on the World Wide Web (WWW). Each retailer's virtual presence is instantiated as an Intelligent Agent -all EasiShop Agents are of the strong agent genre, embracing the Belief

Figure 1. EasiShop architecture showing the three key components



Desire Intention (BDI) model (Rao & George, 1995), a computationally tractable model of practical human reasoning. This model supports deliberation on the part of the agent, enabling the realisation of more adaptive and personalised behaviour on the part of the systems they underpin. The retailer's agent has access to the retailer's own stock control system, and is authorised to negotiate on the retailer's behalf. However, it can only negotiate within the constraints and policies that the retailer has explicitly set. Figure 2 illustrates the interface through which retailers can define these policies.

In the case of the EasiShop client, this is similarly represented by a proxy agent. This agent will initiate a first price sealed bid auction for those items its wishes to acquire, that is, what is on the shopping list. All retailers can bid, and the lowest bid wins. At present, for reasons of efficiency and efficacy, there is only one round of bidding by the retailers. However, the agent strategy can be easily modified

to accommodate other auction strategies such as incremental bidding.

Interestingly, when interviewed during a detailed user evaluation, it emerged from subjects that lowest cost was not always the deciding factor. A number of factors combine to determine value and convenience.

EasiShop Client

Users of EasiShop must host the client on their mobile devices. The client facilitates the definition of shopping lists as illustrated in Figure 3. It also enables the specification of the shopper's personal profile which they may wish to share with retailers, as well as hosting the shopper's proxy agent. This agent migrates to stores autonomously and transparently. It only attracts the shopper's attention once it has negotiated an offer for one of the objects on the shopping list. All shopper agents are mobile -they migrate to hotspots and marketplaces,

Figure 2. The retailer can specify how the agent will negotiate for a variety of scenarios

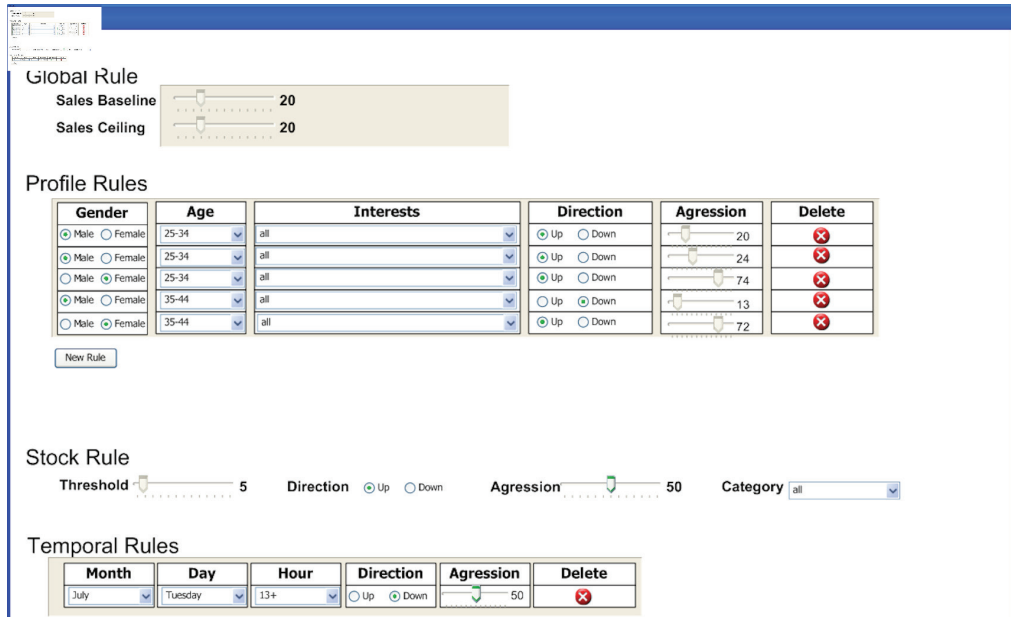
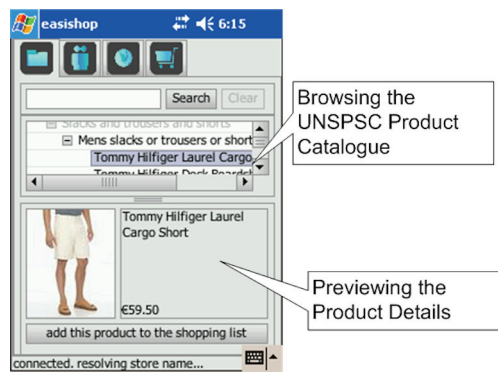


Figure 3. A snapshot of what the shopper sees when adding a product, in this case, shorts, to their shopping list

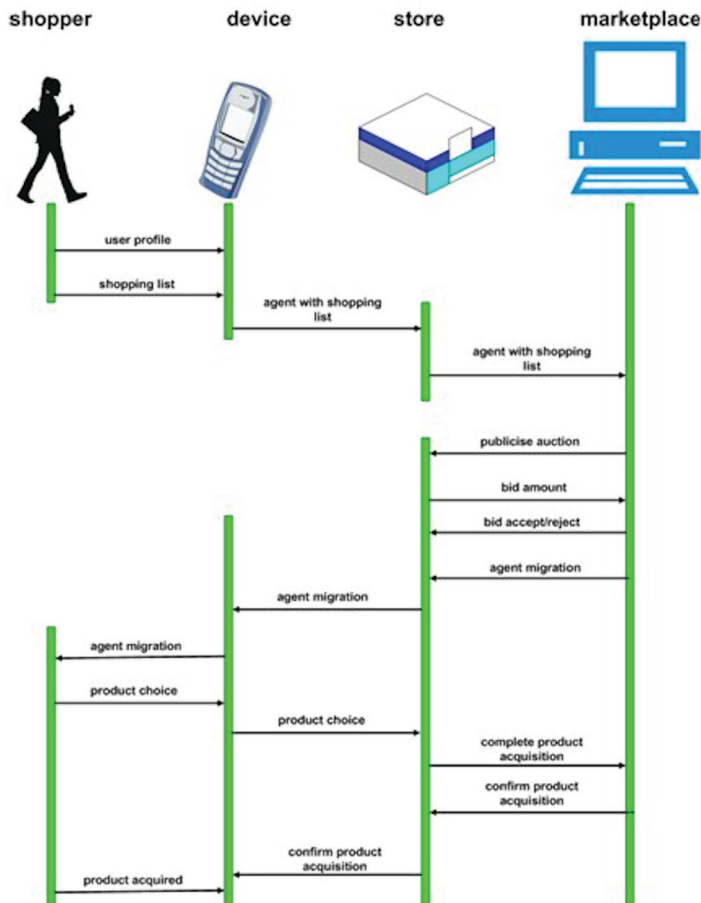


returning to the shopper’s device, ideally when they have a provisional offer for their custom, or just empty-handed if no deal is forthcoming for the shopper while they are at the particular spatial juncture (Figure 4).

Technical Characteristics

EasiShop is designed to be robust, scalable, easy to use and economical both in its deployment and operation. It uses open source software wherever possible. It uses relatively cheap hardware -a small number of USB Bluetooth dongles are adequate for managing the EasiShop hotspot. The EasiShop client is implemented in

Figure 4. Migration path of a shopper's proxy agent in its effort to secure items on their shopping list



J2ME as experience indicates that this is one of the most ubiquitous platforms available. Standard Java is used for the Hotspot and Marketplace components. Bluetooth is used for communication, and implicit shopper location determination. The EasiShop framework is modelled on a Multi-agent system, where shoppers and customers are represented via proxy agents. The agent framework adopted by EasiShop is Agent Factory Micro Edition (AFME) (Muldoon et al., 2009). This particular

agent framework is optimised so as to support the deployment of BDI-style agents on computationally lightweight devices such as the archetypical mobile phone.

Minimizing the Communications Gap

Given the commercial nature of EasiShop, it is of vital importance that both retailers and customer speak the same language. EasiShop

Figure 5. Sample rules for a bidding strategy depending on distance

```

<proximityrules>
  <rule distance="10km" biddirection="down" aggressionfactor="10" />
  <rule distance="1km" biddirection="down" aggressionfactor="50" />
  <rule distance="100m" biddirection="down" aggressionfactor="100" />
</proximityrules>

```

adopts two standards to achieve this. In the first instance, it is essential that both retailers and customers are talking about identical products. To eliminate confusion, EasiShop adopts the United Nations Standard Products and Services Code (UNSPSC) (Ramakrishnan, 2000), an international classification hierarchical scheme for products and services. Viewed horizontally, it incorporates a wide range of products and services. Viewed vertically, the range of detailed product descriptions varies but, most importantly, it can be extended. The core catalogue is based on XML thus facilitating interoperability. Using this standard, retailers describe their available merchandise, and shoppers specify what they want to buy.

When negotiating, the retailers' and customers' agents must likewise understand each other. Thus, for all inter-agent communications, EasiShop agents adhere to a standardised Agent Communications Language (ACL) (Verdicchio & Colombetti, 2009), in this case the version of ACL approved by the Foundation for Intelligent Agents (FIPA) (Poslad & Charlton, 2006). FIPA, affiliated with the Institute of Electrical and Electronic Engineers (IEEE), is the preeminent organisation for defining standards relating to agent interoperability. Naturally, an agreed ACL is a prerequisite for enabling communication between disparate agents.

The Power of Proximity

One obvious advantage of EasiShop lies in the ability on the part of a hotspot operator to prioritise those shoppers that come within range of that particular hotspot. This is achieved through judicious manipulation of the rules file. Consider the extract illustrated in Figure 5; assume that the *salesbaseline* value is 20 as illustrated in Figure 6.

Assume that a shopper is detected with product x listed on that shopper's shopping list. Product x has a catalogue price of €100. Now consider the rules presented above. These two rules together mean that for users detected within a range of 10km, a 10% factor of the sales baseline will be applied to bid offerings. 10% of .20 gives 2% or €2. That means a price of €98 will be offered. For those users detected within 1km, a factor of 50% will be applied (50% of .20 gives 10% or €10 leaving a bid offer of €90). However, for those users detected within 100m, the full *salesbaseline* discount will apply giving a bid offer of €80. Of course, the competitive ethos of EasiShop is paramount to these considerations and there is nothing to stop a competitor from bidding even more aggressively in an attempt to entice users away from a rival retailer. It should be noted this is a simple example, assuming that the shopper of most interest to the retailer is the closest. The EasiShop Rule structure is

Figure 6. The sales baseline value

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<rule salebaseline="20" />

```

flexible enough to accommodate other potential factors such as:

- 1) Returns policy;
- 2) Warranty details;
- 3) Retailer reputation.

Note that EasiShop assumes an immediate availability of product as well as a standardized product condition, that is, Brand New with Tags (*BNWT*).

REACTION OF SHOPPERS

To ascertain the attitude of potential shoppers to EasiShop, and verify the design assumptions underpinning its design and implementation, an evaluation was carried out. 52 subjects contributed to this, with over 75% being in the 21 to 30 age group and the remainder in the 30 to 70 age group. The gender breakdown was 58% male to 42% female. Ethnically, the group was diverse with over 12 different nationalities contributing. A number of usability instruments were used including a commercial one, and one of our own devising¹. Though focusing on usability -many of the questions used Likert scales but a range of ancillary questions were also asked. A detailed analysis of the usability statistics is beyond the scope of the present discussion; however, some key issues that arose have implications from a retailer's perspective and these are now highlighted.

The Perceived Need for Systems such as EasiShop

Subjects perceived a need for systems such as EasiShop. A one sample t-test was conducted that compared the group with a hypothetical group with a mean score of 5 (that is, one that perceived a need for systems such as EasiShop). A significant difference was found between the groups - $t(51)=2.262$, $p<0.05$, with the subjects having a mean of 5.58. Though favourable, this did not mean that shoppers would pay for such a system; indeed a noticeable reluctance to pay

for the EasiShop service was observed - $t(51)=2.977$, $p<0.01$.

EasiShop would Facilitate Consumers Obtaining Value for Money

EasiShop was perceived as a service that would aid people obtain value for money - $t(51) = 4.224$, $p < 0.001$.

EasiShop would Enhance the Shopping Experience

EasiShop was perceived as a system that would make the shopping easier - $t(51) = 5.828$, $p < 0.001$. Interestingly, it was perceived as augmenting the shopping experience - $t(51)=2.695$, $p<0.05$, rather than replacing it. This alleviated a concern that those who considered shopping as more of a leisure or social activity would regard EasiShop as potentially compromising their experience.

EasiShop would be Beneficial to Retailers

It was observed that EasiShop would be beneficial to retailers - $t(51) = 4.031$, $p < 0.001$. A note of caution should be exercised here in that this was the potential shopper's view, and their experience as retailers is unknown.

Analysis of Free Feedback

Subjects were asked to provide what they perceived as the advantage and disadvantages of EasiShop in free feedback form. Some of the more pertinent issues raised are as follows.

The Need for More Retailers

Subjects recognised that the success of EasiShop depended on the retailers that supported it. In short, they envisaged it being deployed throughout a high street, or indeed in a mall, if it were to be effective. However, this indicates its deployment by a single retailer would not be successful, and suggests that retailers should

form a group or cooperative to support the EasiShop service. In this way, competition would be maintained, and visible to the shopper.

Security

Issues of security and privacy were raised. In particular, if transactions were to be completed via the mobile device, security issues would need to be addressed. However, given the nature of EasiShop and its operational characteristics, the need for a transaction facility was not deemed necessary. Given that people were already in the vicinity, they could just walk to the store and complete the transactions there. By removing the transaction completion facility, the security issue is minimised and the complexity of the software reduced.

The Auction Process

While subjects perceived the capability of EasiShop to obtain value, a more flexible auction process was suggested. In some cases, shoppers might just want to know where in their locality they could acquire a certain product and for what price. The final decision remains with the shopper, keeping in mind that value is not synonymous with the lowest price. Other subjects expressed the opinion that the auction process should be more comprehensive, and that the core criteria of price and distance were inadequate. For example, if a shop contained all the items on their shopping list, it may be more convenient to go to the one store, even though this may not be the cheapest option.

Advertising

EasiShop does not support advertising and promotions in its current incarnation. Subjects believed that this should remain the case. By indulging in advertising, it was perceived that the integrity and independence of EasiShop would be compromised, an eventuality that would reduce its user base very quickly.

REFLECTION

EasiShop represents one vision of how pervasive retail might be enabled in practice. Results of the user trials indicate that potential shoppers view this vision positively. It was believed that the shopping experience could be enhanced and value for money obtained. Certainly, the ubiquity of the mobile phone, and increasingly smart phones, ensure that many potential shoppers could easily host and access the EasiShop service via their personal devices. Recalling the social and leisure dimensions commonly associated with the shopping experience, EasiShop may be regarded as complementing and enhancing these in another dimension. However, the issues of privacy and security remain valid concerns of many people in the mobile computing sphere, and addressing these remains an outstanding research and commercial objective. For mobile commerce, and implicitly, systems such as EasiShop, their resolution is a priority if their potential is to be fulfilled.

In the case of retailers, EasiShop was perceived as an initiative that would be of benefit to them. Certainly, a new channel for reaching customers would be opened, and a capability for competing with rival retailers would be enabled. The degree to which retailers could take advantage of this remains to be seen, and may be contingent on a number of external factors such as how comfortable the individual retailer is with ICTs. As is the case with the shopper, the issues of security, privacy and trustworthiness are likewise of utmost importance.

While the auction process supported by EasiShop offers a transparent mechanism for retailers to compete for custom, it must not be forgotten that the design of EasiShop endows one key advantage of the retailer: when a shopper is in the hotspot of a retailer, they will know immediately whether they have anything on the shopper's list that they can offer them. In this way, they can dynamically adjust the pricing, and auction strategy in real time. Thus other retailers can compete from a price perspective; the retailer in the immediate vicinity of the

shopper can compete on other value attributes, especially convenience.

Finally, the digital city concept is realistic, and is likely to manifest itself in a variety of ways over an extended period of time. EasiShop offers one vision of how retail may be conducted in a digital city. Indeed, its use of common affordable technologies makes it a particularly apt basis for realising the pervasive retail experience. Given the difficulties many small retailers are facing, and the ongoing battle to save the high street in this era of globalisation, digital cities may offer small independent retailers a range of new avenues to compete and generate custom, enabling high street regeneration and re-invigorating an ethos of entrepreneurship.

FUTURE RESEARCH DIRECTIONS

A priority in the revised EasiShop system will include enabling a more flexible auctioning mechanism. At present, the focus is almost exclusively on price. Though obviously important, it is only one of a number of factors that a shopper may consider when reflecting on whether to make an acquisition. Such factors may include convenience, ability to purchase other required items or the shopper's perception or prior experience of the shop making the bid for their custom. Thus EasiShop must evolve to incorporate additional factors into how the auctioning process is enabled as well facilitating a more sophisticated interface for the shopper to communicate their preferences.

A more detailed analysis of how retailers in operate EasiShop in practice is required. From a configuration perspective, a methodology for deploying EasiShop is required. In addition, the interfaces specific to the retailer need a similar kind of usability analysis to that undertaken with shoppers. Similar to the auction process for the shopper, a more sophisticated interface may be required to support retailers articulate their strategies for enticing perspective shoppers into their establishments. Indeed, enabling retailers to pitch for custom using a range of

dimensions, some of which may be unique to individual retailers, while communicating this to the potential customer, may pose a significant technical challenge.

CONCLUSION

Digital cities offer significant opportunities for retailers and shoppers alike. As the uptake of smart phones continues, the potential for enabling a raft of new and innovative services increases. For small independent retailers, relatively low-cost configurations, together with this proliferation of sophisticated mobile devices, offer alternative avenues for attracting new customers. EasiShop offers one illustration of how new and innovative m-commerce services might operate in a digital city environment. The favourable reaction derived from the user evaluations demonstrates the potential of the EasiShop approach. For retailers, the challenge remains as to best to take advantage of ongoing ICT developments to attract new customers, engage in open competition with their fellow retailers and grow their businesses.

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