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Pocket BargainFinder: A Handheld Device for Augmented Commerce

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Abstract. The Internet has engendered a new type of commerce, commonly referred to as electronic commerce, or eCommerce. But despite the phenomenal growth of eCommerce, the vast majority of transactions still take place within the realm of traditional, physical commerce. Pocket BargainFinder is a handheld device that seeks to bridge the gap between electronic and traditional commerce. It represents one of the earliest examples of a new breed of commerce we call *augmented commerce*. With Pocket BargainFinder, a consumer can shop in a physical retail store, find an item of interest, scan in its barcode, and search for a lower price among a set of online retailers. The device allows customers to physically inspect products while simultaneously comparison shopping online (where prices are often lower.) As such, Pocket BargainFinder is an example of a disruptive technology that may well transform the nature of both electronic and physical commerce. With consumers able to find the best price regardless of where they shop, the physical retailer is left at a distinct disadvantage.

Keywords. Handheld computers, mobile computing, ubiquitous computing, electronic commerce, agents, augmented reality.

1. Introduction

Within the past decade, technology has contributed to an explosive growth both in the business and consumer sectors of the retail industry. The Internet, and especially the World Wide Web, has connected people across cities and continents. This new communication channel has dramatically changed the way people learn, entertain and shop. It has also give rise to a whole new class of programs, software agents, that help people find information on the web. One type of agent, the shopping agent, is designed to facilitate web commerce (commonly referred to as electronic commerce, or eCommerce). Shopping agents help people find the products or services they want at the best price. Examples of such agents include Excite's Jango [1], C|NET's Shopper.com [2], and Accenture's original shopping agent, BargainFinder [3]. Although these shopping agents have proven their usefulness, their versatility has been some-

what restricted. Until recently, agents could only be accessed via a desktop computer at home or at work. With the advent of personal digital assistants (PDAs) and wireless Internet connections, however, these agents are now accessible from virtually anywhere.

The rise of shopping agents in the virtual world is mirrored by the rise of discount retailers in the world of physical commerce. According to a survey conducted by LJR Redbook Research [4], discounters account for 63.6% of US retail sales in 1998, versus 43.4% in 1986. Consumers are willing to drive farther and shop harder to find those bargain-basement prices. According to a WSL Strategic Retail survey [5], consumers want some kind of tangible contact with goods as they shop, demanding to “touch it, drive it, listen to it, or wear it before they buy it.” Thus, in a perfect world, a consumer would visit the store to touch, feel, and inspect the product, and then turn to cyberspace to find the best price. Pocket BargainFinder lets the consumer do just that: browse in the physical world, then buy in the virtual world.

Pocket BargainFinder combines the global scope of Internet shopping agents, the ease-of-input of a barcode scanner, and the portability of a PDA. The result is a convergence of electronic and physical commerce that we call *augmented commerce*. (The term derives from research into *augmented reality* [6], which explores the convergence of the electronic and physical worlds in general.)

Traditionally, shoppers have been forced to choose between the low-cost but intangible purchasing experience on the web and the tangible but often higher-cost experience of physical shopping: with Pocket BargainFinder, consumers can have the best of both worlds.

As its name suggests, Pocket BargainFinder is a small, pocket-sized device that finds the lowest price of an item in cyberspace. The current version is set up to find bargains for a book or similar item that can be identified by an International Standard Book Number (ISBN) number. Pocket BargainFinder scans the barcode on a book, translates that number into the appropriate ISBN number, establishes a wireless web connection, initiates a search at several electronic book retailers, displays the query results, and enables the consumer to place an online order for the book.

Pocket BargainFinder thus represents a potentially *disruptive technology* [7], providing perfect information in a hostile environment. In other words, physical retailers would not want customers logging on to compare prices—and make purchases—while standing in the aisles of their stores.

The following section presents a more detailed scenario of Pocket BargainFinder in action. We then go on to describe the hardware and software components used to create the device. We discuss Pocket BargainFinder’s relationship to previous work in the areas of shopping agents and augmented reality. We then conclude with a discussion of some of the ramifications of this disruptive technology.

2. Application Scenario

The following scenario illustrates the power of the Pocket BargainFinder device. A shopper, armed with the Pocket BargainFinder (Figure 1) system, spends a leisurely afternoon at the local bookstore.

Figure 1. Pocket BargainFinder



After flipping through a few magazines (and enjoying an espresso at the coffee bar) our customer visits the Computer Programming aisle. After browsing for a few minutes, she runs across a book a colleague has recommended she read. Noting the price marked on the book, she takes out her Pocket BargainFinder unit and scans its barcode. Within seconds, she discovers that the exact same book can be purchased at an online retailer for less than the bookstore's price. (Figure 2) Taking note of the delivery time and shipping method, our user decides that the cost savings is significant and opts to order the book directly from the online retailer, which she does at that moment using her Pocket BargainFinder. As she leaves the store, she congratulates herself on a savvy bit of shopping. The bookstore has unwittingly lost a sale.

Figure 2. Pocket BargainFinder

Mastering Visual Basic 5		
By Petroustos, Evangelos		
ISBN Number: 0782119840		
Retail Price: \$49.99 + Tax		
Pocket BargainFinder found the following information.		
Price	Merchant	Delivery
<u>\$36.40</u>	USED - Powel	10-15 Days
<u>\$37.43</u>	Kingbooks.co	14 Days
<u>\$37.44</u>	alphaCraze.co	3-7 Days
<u>\$38.90</u>	Fatbrain.com	3-7 Days
<u>\$38.93</u>	Kingbooks.co	3-7 Days

This situation can take place in any bookstore, from a large super-chain to a small, family-owned operation. And Pocket BargainFinder is just as useful in contexts where books are not for sale (for example, in a library or a friend's house).

Currently, Pocket BargainFinder only works with books (and other items that have uniquely identifiable ISBN numbers). One can imagine a time when shoppers can purchase videos, audio CDs, and other common consumer products using a device similar to Pocket BargainFinder. Virtually no store would be immune from the effects of such a device.

3. System Design

The design of the Pocket BargainFinder system had to satisfy three important requirements. First, the device had to be portable and easily stored in a purse, briefcase, or pocket. Second, it had to be compact and comfortable to hold. Third, in order to be usable in the conditions of a retail store, the unit had to have a simple input scheme and an easily readable output.

3.1 Hardware

The Pocket BargainFinder unit requires three basic hardware components: a barcode scanner for easy input; a wireless communications device for accessing the Internet; and a small computing device for converting barcodes into a format that can be transmitted to web retailers. The original prototype (built in November 1998) used an AT&T PocketNet phone, a Hamp barcode wand, and a custom-designed CPU unit. (The latest version is more compact, making use of a Symbol Palm Pilot and a Minstrel Wireless IP modem—more on this below) A remote web server is also needed to support the Pocket BargainFinder in the field. The remainder of this section will describe the hardware components used in the latest implementation.

3.1.1 Barcode Scanner and Computing Device

Ease of data entry was considered crucial for usability in the conditions of a retail store. Manually typing in ISBN numbers is possible, but this is a tedious and error-prone process. Since each ISBN is uniquely represented by a barcode, and since barcodes are printed on nearly all book covers, we decided to use a barcode scanner as a simple means of entering the data.

The computing device serves as the link between the barcode scanner and the communications device. It also runs the software, including the operating environment and applications. For the computing device we decided on the SPT 1500, a PDA jointly developed by Symbol Technologies, Inc. and Palm Computing, Inc. The device is a combination of the standard Palm III handheld computer and the SE 900 scan engine. At 0.66" H, 3.16" W and 5.46" L, the SPT 1500 is light and compact.

3.1.2 Wireless Communications Device

Due to differing wireless service standards in the United States and Europe, two different communication devices were used. In the U.S., we chose the Minstrel, a 19.2 KBPS, CDPD wireless IP modem. The Minstrel fits snugly onto the SPT 1500, only adding a few inches to the overall dimensions of the device. In Europe, where the standard is GSM, we used an Options International Snap-On modem in conjunction with a GSM compatible cell phone. The transfer rate is 9.6 KBPS with data compression.

3.1.3 Web Server

The web server hosts all of the pages and scripts used in the application. In order for the process to run as smoothly and quickly as possible, the server was connected to the Internet with a T1 line connection. For this project, we used a Compaq Proliant 800 server.

3.2 Software

Pocket BargainFinder requires a number of software components: a micro-browser that can process HDML messages; a script that can act as an intermediary between the HDML messages and the HTML-based shopping agents; and web server software that can host these other components. Each of these is covered in more detail below.

3.2.1 Micro-browser

We used a simple web browser (Created by AvantGo, Inc.) to load the pages from the appropriate server. The browser accepts simple HTML 3.2 web pages that include forms, button, and graphics. The AvantGo browser was the only one for the SPT 1500 that supports the use of the barcode scanner.

3.2.2 CGI Script

Most of the processing done by Pocket BargainFinder application is performed by a Common Gateway Interface (CGI) script stored on the web server. The script's first task is to read the data that is sent from the browser. The script then translates the data into the appropriate ISBN number. Next, it submits queries to roughly forty online book retailers, collecting such information as price, shipping time, and shipping cost from sites that respond within the 20 second time-out time period. After the query results are retrieved, they are sorted by price and formatted into a new HTML page. An alert message notifies the user that the information is ready. The user can then view the query results on the handheld device.

3.2.2 Web Server

We chose Netscape's Enterprise Web Server software to run the appropriate scripts and serve as the main connection to the Internet.

4. Related Work

We have seen how Pocket BargainFinder is an enabling and potentially disruptive application in the nascent field of augmented commerce. We now discuss its relationship to other research in this and related areas.

The idea of a comparison shopping agent was pioneered in 1995 by Accenture's BargainFinder [3], which was designed to find the best price for a given audio CD across all the music retailers on the web at that time. Since then, a number of other comparison-shopping agents have appeared, such as Jango [1] and Priceline [8]. However, these agents remain "disembodied," with no physical connection to the user's world. Pocket BargainFinder extends the capabilities of shopping agents by providing access at the point where the customer comes into physical contact with products.

A number of researchers are exploring the area of augmented reality, in which elements of the electronic world are used to augment the physical world. For example, the Touring Machine [9], developed at Columbia University, uses GPS to track a user's position, then displays information relevant to that location on the user's head-worn display. A Touring Machine user can look at objects in any direction, and the system will superimpose annotations for those objects on the scene as it appears in the display.

The Metronaut [10], a wearable computer developed by researchers at Carnegie Mellon University, serves as a schedule negotiating and guidance system. The device includes a barcode scanner, two-way pager, and computer processor. As the user moves around the campus, she scans barcodes at key locations. This information is sent to the hub of the system. The server then communicates with the user via pager, giving directions to the next scheduled meeting or alerting the user when she falls behind schedule.

Shopper's Eye [11] is a pioneering application of augmented commerce developed at Accenture. The system prompts the shopper to create a profile that includes items he wishes to purchase and other preferences. It then makes the profile available to merchants in a physically proximate area (e.g., a mall) via a PDA with a wireless modem. The merchants in turn use the shopping profiles to create specially packaged offers, which they transmit to the shopper as he passes near the store. The shopper can use this information to decide which stores to visit.

Pocket BargainFinder is most like Shopper's Eye in that both seek to provide information to a mobile shopper. The primary differences lie in how much information the shopper provides to the merchants and which merchants have access to the shopper. With Shopper's Eye, the shopper provides profile information, and the set of merchants is the physical retailers in proximity to the shopper; with Pocket Bargain-

Finder, the shopper provides a minimum of information (the ISBN number), and the set of merchants is electronic retailers in cyberspace.

Physical retailers are unlikely to welcome the scenario envisioned by Shopper's Eye, since the system provides a comparison shopping service that includes their physically proximate competitors. They will likely find Pocket BargainFinder even more disturbing, since it places physical retailers in direct competition with their web-based counterparts, who have very different operating constraints.

5. Conclusion and Future Work

The Pocket BargainFinder application has brought together some of the latest technology advances to produce a device that may turn the retail book industry on its head. Beginning with a simple prototype, the project is now a fully developed working device that could be used anywhere in the United States or Europe. There are, however, a few enhancements that could be made to make Pocket BargainFinder even better.

In an application such as this, speed is a defining characteristic. At present, it takes roughly 60 seconds to connect to the service once the modem is turned on. An instant connection, or at least one in the 10-15 second range, would make the device more attractive. Until this matter is resolved, the system's acceptance may be limited.

Second, adding other product categories would greatly expand Pocket BargainFinder's effectiveness. Support for consumer products such as videos and audio CDs would accelerate the acceptance of the product into mainstream culture.

Even with its limitations, Pocket BargainFinder has generated a tremendous amount of coverage in the media. Stories on the device have appeared in magazines, newspapers, television shows (ZD-TV) and network news reports (ABC World News Tonight with Peter Jennings). As a result, we have received numerous inquiries about the availability of Pocket BargainFinder. At the current time, there are no plans to bring the device to market. However, it is inevitable that devices such as this will become commonplace.

Online book sales are expected to account for 10 percent of total book sales by 2002 [12]. The creation of an entirely new sales channel through devices such as Pocket BargainFinder may increase that number substantially. And expanding the application to work on multiple products in the retail industry could have a dramatic effect on eCommerce as a whole.

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