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Development of a Web-Based Intelligent Agent for the Fashion Selection and Purchasing Process via Electronic Commerce

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Abstract

This paper describes a conceptual, web-based, intelligent fashion agent designed to assist the consumer in the fashion selection and purchasing process via electronic commerce. The agent is a hybrid system combining expert system software and web technology. Fashion selection is a complex process involving multiple objectives, criteria and alternatives that can be resolved by an expert system. Based on the development of the prototype Web-Based Interactive Fashion Expert (WIFE) system, problems with the conceptual system are identified and solutions proposed where applicable.

Introduction

Electronic commerce, the buying and selling of products across a computer network, is an emerging method of conducting business transactions for many industries. A number of web-based marketing benefits for firms have been identified, such as (1) creating strategic advantage, (2) providing new products or services to customers, (3) presenting information in a more concise manner or better format, and (4) improving customer relations (Lederer, Mirchandani and Sims, 1997).

To date the successes of web-based marketing have been limited despite an increase in web popularity. Users frequently cite security as the major deterrent to electronic shopping. However, the process of purchasing goods requiring assistance for purchase is cumbersome, and does not measure up to retailing in a store setting.

This paper discusses the development of a web-based intelligent agent capable of interacting with the direct consumer to assist in the selection process for fashion apparel. Problems encountered throughout system development are listed with possible solutions suggested where appropriate.

Fashion Selection Process

The fashion selection process is quite complex and highly individualistic for several reasons. Consumers have many objectives for wearing clothing, such as protection from the environment, recognition, transformation and decoration. Consumers also weigh many criteria with varying weights when selecting clothing (e.g. price, comfort and appearance). Adding to the complexity of the selection process is the multitude of clothing alternatives that are available. Fashion designers change four fundamental elements to create alternatives: line, form-shape-space, color and texture. Lines create the dimensions of length and width and also imply a particular direction. Form-shape-space refers to the contour of the clothing within the scope of a person's body, viewed from different perspectives (Kefgen and Touchie-Specht, 1986).

The objective of the fashion selection process is to identify the clothing alternative that best meets an individual's criteria. In a retail store, this objective is achieved through interaction with a sales agent possessing some level of fashion expertise. An alternative method of retailing is via catalog, which does not provide much interaction between the consumer and retailer.

The present process for purchasing fashion electronically is accomplished by searching a company's product information database containing information on price, size, color and clothing type. Fram and Grady (1997) surveyed consumers seeking to purchase items electronically and cited many problems (aside from the largest deterrent, security), including (1) difficulty in locating products and services, (2) insufficient information to make purchases, and (3) poor customer service.

Conceptual Fashion Agent System

This section describes a conceptual system enabling interactivity between a user, an intelligent fashion agent and a product database of clothing alternatives.

Figure 1 illustrates the flow of information across the overall system. In this system, an intelligent, web-based fashion agent resides between the user and a search engine; the agent provides personalized customer assistance interactively in the selection process by creating search criteria based on user characteristics.

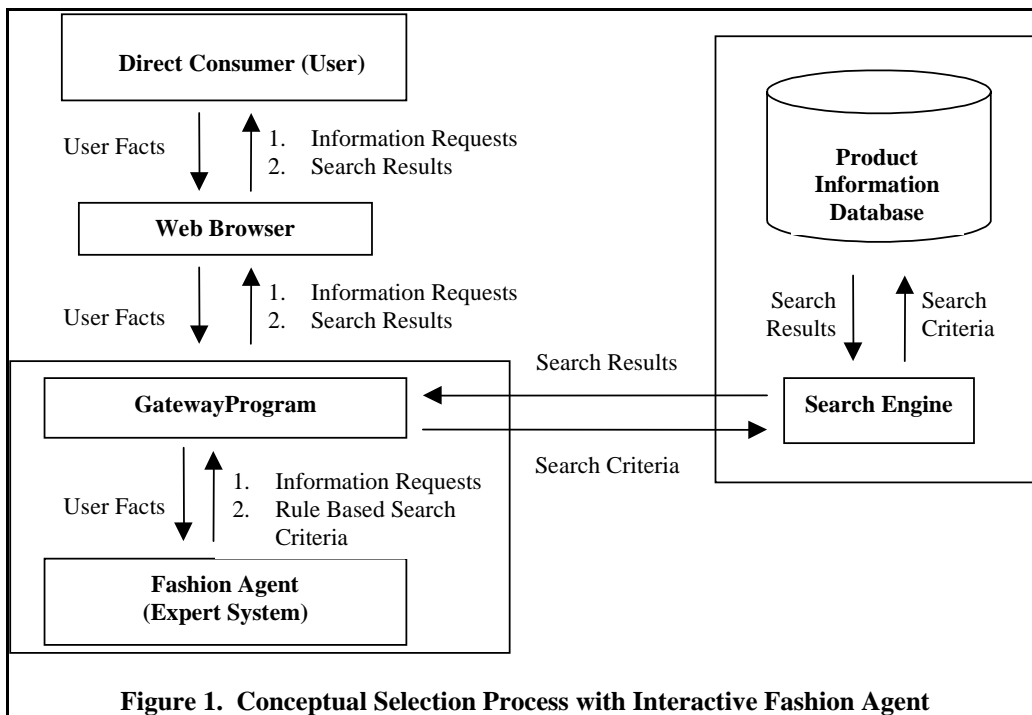


Figure 1. Conceptual Selection Process with Interactive Fashion Agent

The user invokes the fashion agent system via a web interface. The fashion agent system has two components: (1) a gateway program directing information flow and program execution and (2) a rule-based, forward-chaining expert system.

The expert system first requests information to construct a user profile of individual characteristics (age, gender, eye color, etc.), fashion objectives (look taller, thinner, more professional) and criteria for selection (cost, appearance, comfort). The expert system asserts user information as facts, which would fire rules

recommending design elements (such as color, texture, material type) to be submitted for the user's approval. After all relevant information is obtained the expert searches product databases for clothing alternatives which meet the user's preferences.

This conceptual process improves the existing process in two ways. First, it provides the personalized assistance of an expert in the selection process. Second, it reduces the problematic effects of information overload on the existing process.

Prototype Fashion Agent System Development

A prototype fashion agent system, Web-based Interactive Fashion Expert (WIFE) was developed to demonstrate user-expert interactivity and to identify technical problems associated with the conceptual system. The prototype system emulates the information flow between user and expert system as shown in the left-hand portion of Figure 1. Interaction with an electronic product database could not be demonstrated since one was not available. Instead, a product database was constructed and searched by the expert system, with the results returned to the user.

Web browser technology was chosen as an interface since it is pervasive, user-friendly and can display color graphics. The fashion agent system WIFE has two software components. The first component, a CGI program programmed in PERL, manages both the execution of programs residing on a server and information flow between the user and expert system. The second component, the expert system, is programmed in CLIPS (C Language Integrated Production System), a nonprocedural programming language developed by NASA that provides support for rule-based, object-oriented programming (Giarratano and Riley, 1994). The fashion selection problem is best solved by forward chaining inference, since it begins with a list of facts and attempts to predict certain conclusions that must follow. CLIPS was chosen since it contains an inference engine supporting forward-chaining logic.

The prototype system works as follows. The user invokes the CGI portion of WIFE via a web browser. The CGI program executes the expert system which first constructs an HTML input form requesting user profile information (name, age, gender, hair color, eye color, skin color, fashion objectives). The form is then passed through the CGI program to the user.

The form, upon completion by the user, is submitted to the CGI program, which translates the HTML name-value pairs into asserted facts for the expert system program. The expert system contains IF-THEN structured rules that are fired based on the asserted facts. Some examples of rules:

- IF the user has blue eyes AND black hair AND fair skin THEN acceptable colors to wear are violet, red, pink and light blue.
- IF the user is selecting a dress shirt AND prefers comfort to cost, THEN material type should be cotton.

The output of the rules specifies recommended values of fashion design elements such as color, texture, type of material and design. Recommendations are submitted to the user through the CGI program for approval or modification. The CGI program maintains the state of the system by storing user information as hidden variables in HTML. Upon approval, the values are used as search criteria, and the expert system conducts a search through the product database.

Discussion

The prototype system is limited in scope and capabilities, but can be expanded with the addition of rules to the expert system. Interaction and expert system functionality have been demonstrated. However, several problems regarding the specification of objectives, selection criteria and clothing attributes exist. This section introduces problems encountered and identifies solutions where possible.

Individual characteristics such as age, gender, height and weight can easily be captured in an HTML form. The specification of objectives can also be captured in an HTML form using checkboxes for specifying business or casual setting, desire to look taller / shorter / fuller / thinner, etc. The user's selection criteria (e.g. comfort, price and appearance) can be displayed and ranked with drop-down boxes and radio buttons. Partial inputs can be accommodated using checkboxes. Consumer buying patterns can be ascertained either from this information stored as a user profile or by the frequency of rule firings.

The fashion selection process becomes complex when clothing attributes are introduced. Price and material type of clothing are easily quantifiable. Clothing size can be quantified, but it is a marginal predictor of comfort. For the prototype system, comfort was not addressed; rather, clothing alternatives were matched to the individual's size.

Material texture cannot easily be expressed via the web, although some computer aided design packages for the apparel industry can emulate the appearance of clothing texture (Moreland, 1997).

The accurate presentation of design of clothing across the web is a problem. The most obvious (albeit time consuming) solution is to submit a two- or three-dimensional image of the clothing article to the user.

True color representation of images poses a major problem for web-based applications. Clothing color measurement is subject to the source device's settings and lighting conditions. In addition, the presentation of color across the web is subject to many sources of variability. Monitors can vary in white point temperature and brightness or contrast settings. PC's can vary in the number of colors being displayed. Ambient lighting conditions may vary, as well as an individual's sensitivity to color perception. The International Color Consortium (ICC) is presently addressing the problem of color management. One approach to reducing color variability across workstations would be to embed a color profile describing the source device of the image directly into the image, which in turn could be translated by a web browser into another image based on color settings of the destination device (Newman, 1997).

Conclusions

Electronic commerce for products requiring assistance prior to purchasing, such as fashion, is presently cumbersome. The process for selecting fashion apparel can be complex due to multiple objectives, criteria and alternatives varying across individuals. A conceptual system involving a web-based intelligent agent has been proposed which provides expert assistance to the consumer while reducing the negative effects of information overload presently being experienced by web shoppers.

A prototype system, WIFE, has been developed and demonstrates the interactivity required for customer assistance in the fashion selection process. WIFE is a web-based interactive system composed of an expert system and a gateway program managing information flow between the expert system and the user. While the prototype system can be expanded with the addition of rules, problems such as assessing the degree of comfort, and the presentation of design and color. ICC is addressing the color management problem across the web.

Future Research

The fashion agent system should be connected to a search engine capable of searching through an electronic product catalog to assess the overall functionality of the system. Knowledge of the product database structure will be required to encode additional rules for the expert system.

These concepts can be applied to many different types of electronic commerce product ordering systems requiring expert assistance.

References

References available upon request by contacting the authors (aburns@bsa3.kent.edu; gmadey@synapse.kent.edu).