

AN INTELLIGENT ASSISTANT SYSTEM TO SUPPORT PURCHASING DECISION IN E-COMMERCE

Dr. Ibrahim Albidewi

Faculty of Computing and Information Technology, King Abdulaziz University

Mrs. Mona Abu Ghazala

Faculty of Computing and Information Technology, King Abdulaziz University

ABSTRACT: *E-Commerce has emerged as an important information technology tool to business. Many companies and organizations have been using E-Commerce as a useful, helpful, and necessary trading tool in their daily business processes. Due to the huge amount of information available in the Internet and the difficulty to search all shopping websites and compare their prices and services, the consumers experience hard time finding products or services they look for. Intelligent systems came to resolve issues that consumers face when browsing E-Commerce sites, especially when searching for services or buying products. However, intelligent systems can effectively provide high-quality services to consumers when treating them in a personalized manner. A user profile can help the intelligent system provide personalized services to consumers to save their time. User profile and the intelligent system can filter unwanted products and services to help consumers, during their online shopping, make the right decision. There are many intelligent systems available nowadays; one of which is fuzzy logic. This paper presents a model of an Intelligent Buying Decision (IBD) that is based on fuzzy logic methodology to support the buying decision. The aim of modeling an intelligent system IBD is to Predicts consumer interest according to user profiles by sorting the output depending on their preferences. Moreover, it shows the reason behind choosing fuzzy logic as an intelligent system.*

KEYWORDS: Intelligent Assistant System, Purchasing Decision, E-Commerce

INTRODUCTION

Internet has experienced a fast change from information on and entertainment to electronic commerce. With the explosion in the growth of information in the Internet, people are faced with growing, overloading, and duplicating information. They find out that it is almost impossible on the Internet to find products or services they desire, unless they make big effort. This fact annoys most customers shopping online and leads them to quit shopping.

Consumers, who spend many hours browsing electronic commerce sites looking for a product or a service, can get lost between web sites visited without finding what they were looking for. However, if we can provide consumers with systems that can recommend, help, and support their buying decision, they will successfully achieve their goals. This will indeed change the bad image most consumers have about electronic commerce and encourage them to become on line buyers. In fact, this will be a huge jump to brand new way of shopping.

The aim of this paper is to build an intelligent system model to help a buyer search for a product that meets the user's preference; this is done by combining fuzzy logic with user profile and user preferences represented in product attributes which improve searching process to better serve web users in terms of effectiveness and flexibility.

Electronic Commerce:

Most of the company use Internet to expand their markets because Internet gives them the opportunities to face the world and get more benefits, such as increasing their consumers and becoming famous and known to partners as well as other companies worldwide. B2B is one such area where an organization conducts electronic transactions with other organizations. B2B does not just contain the transaction via the Internet, but also the exchange of information before and the service after a transaction (Gröbblinghoff, 2002). We can define B2B as buying and selling product through Internet among business partners to create and transform business relationships (Sheldon, Jerath, and Pilskalns, 2002).

E-Commerce provides a lot of benefits to the online customers; they can buy so many products from many online stores without any effort; they can just pick whatever they want from products posted online. In fact, Shopping through online stores is gaining popularity and acceptance among customers. In B2C, companies and consumers do electronically interact. As more products and services become available to customers online, B2C is becoming more common especially when people know its ease and capability to offer a fast reply to their requests and inquires. The main focus and the ultimate goal for B2C are to convert shoppers into buyers as aggressively and consistently as possible (He, Jennings, and Leung, 2003).

Intelligent Systems:

Intelligent systems are mechanisms developed to improve the communication between consumers and suppliers; they assist and help the consumers in their buying decisions. Intelligent systems help by means of information retrieval and filtering, which will help them focus on what they need. As a result, they will be lost in the huge amount of information available in the Internet.

Intelligent systems include many methods like fuzzy set, rough sets, neural networks, and others (Segovia, Szczepaniak, and Niedzwiedzinski, 2002). In this paper, fuzzy logic is the intelligent system that is suitable to predict consumer behavior because it is much closer to human thinking.

Fuzzy logic:

Fuzzy logic is a form of multi valued logic derived from fuzzy set theory. It allows intermediate values to be defined between usual evaluations like true or false, yes or no, etc (Zadeh, Klir, and Yuan, 1996). Fuzzy logic is a way of processing data by allowing partial set membership rather than crisp set membership or non-membership. Fuzzy logic control problems on how a person can make faster decisions. Unlike Classical logic which requires deep understanding of a system, fuzzy logic is another way of thinking, by using our knowledge and experience to model complex systems (Berenji , Khedkar, Center, and View, 1992).

User Profile:

User profile is structured representation of the user's needs. It is very useful to the system, agent, and other. User profile helps the consumers in his/ her tasks to pursue their goals. When we say user profile, we mean all user information, like his needs, wishes, and interest. Therefore, we can

take the profile into account. One approach to collect user information is to ask the user to clearly provide information about himself or herself, such as filling in a form that inquire about all information the system need to build up his or her user profile; thus, you can provide personalized service to that user depending on the information provided (Abbattista, Lops, Semeraro, Andersen, and Andersen, 2002).

LITERATURE REVIEW

Tewari et al (2001) present MARI system ("Multi-Attribute Resource Intermediary"). MARI is a visual technique by which buyers of multi-attribute goods and services in electronic marketplaces can express their preferences, and receive real-time feedback about the most suitably business partners that meet their needs. The work on MARI is motivated by the desire to create and implement a new model for multi-attribute preference-specification and product-space visualization.

Maand Aimeur (2001) introduce intelligent agent based on Case-Based Reasoning (CBR). The system filters out unwanted products to fulfill user's preference and get products highly similar to the user's query. Users profiles allow the XMLFinder agent provide more efficient recommendations. The system uses knowledge on users' specific needs and product characteristics to establish relation between them and thus, make the proper recommendations.

There are a lot of shopping assistant Menczer et al (2002) provide one of them the IntelliShopper. It has many advantages for online consumer. It is a personal that learns and understands the consumers from their movement during their online shopping within different ecommerce sites. It is a private shopping assistant that protects the consumer by concealing the identity and behavior of the user (e.g., IP). There are three agents in the architecture of the IntelliShopper system. One is the privacy agent located between the consumers and IntelliShopper server. The privacy of the consumer is guarantee because there are no personal information about the consumer is stored in the IntelliShopper database. The second is the learning agent that takes consumers needs and saves them in the database; it forwards those needs to the online vendors then retrieves the results back to the consumers. The learning agent that observes the users while shopping and learns their preferences to various products; so, it can learn the user profile without requiring any feedback from them. The monitor agent makes the IntelliShopper autonomous in that it shops on behalf of users; in fact, it even queries the database to retrieve what the consumer is interested at. IntelliShopper is designed to empower online consumers.

Intelligent shopping system help consumers save their time when shopping online stores. However, consumers are not only after finding the best online prices; they are also after the best quality, brand, services, and many other points of interests. Since not all consumer have the same taste and preferences so intelligent agent is important in online stores. Zeng and Meng (2005) propose system consists of five agents that interact with each other: interface agent, buyer manager, buyer agent, evaluation agent and preference agent. These agents work together by message delivery mechanism as follows:

1. Interface agent: it communicates with the user, knows the consumer requirement and personal preferences; then, it sends these information to the buyer agent .after the shopping task is done, the result is sent back to the interface agent to post it to the user.

2. Buyer manger: it creates a group of buyer agents and sends them to search for the offers from multiple suppliers. The buyer manger supervises each agent and organize task among them.
3. Buyer agent: when they are created, they are sent to search for product information and when they find the supplier, each agent asks for an offer for the product from the supplier. After buyer agents have the offers, they return and give the result to the evaluation agent.
4. Evaluation agent: after receiving all the offers of the products from suppliers, it will start to compare between offers and since online shopping is not price comparison, the system applied the multi attribute utility theory (MAUT). The evaluation agent will computes the utility value of each product and select the maximal utility value as the recommended product.
5. Preference agent: in case the consumers dislike the recommended product, the preference agent will get the consumer preferences from the preference knowledge base and make preference analyzing. According to the consumer's up to date preferences, the preference agent can improve the offers of the product until the consumer is satisfy.

From the early days, people were negotiating in order to reach an agreement. Now in E-Commerce negotiation is primitive. Thus E-Commerce need automated negotiation. To apply negotiation to E-Commerce Wang et al (2006) use intelligent agent to negotiate a solution autonomously. Intelligent agent used to retrieve information such like product information, compare prices and other services to consumers. This paper proposes FINA an intelligent negotiation system for software agents' model that uses fuzzy logic. The system takes two input from the consumers, the offered price and quality of the product. The output represents the acceptance of buyer agent. The inputs and output are modeled by fuzzy sets with three terms that are low, medium and high. The evaluation block for a buyer is implemented by c#. First, the user sets the higher and the lower prices for the product. Then the user clicks on button to generate a buyer agent which represents the user. Next the user fills the offer price and the offer quality level in a text box. Finally the user clicks on button to evaluate the offer.

They build the same evaluation model by using MATLAB fuzzy logic toolbox. Her they add a new input 'return policy' into the testing evaluation model. The fuzzy set of 'return policy' includes three terms poor, average and good. After analyzing the result with c# and MATLAB, the paper end that the evaluation blocks are acceptable, implementable, extendable and scalable.

Recommender systems help online businesses improve quality of service and increase sales. There are two ways to design recommender system: content-based filtering or collaborative filtering. The first one makes recommendation by analyzing the information content and matching keywords or classifications but have weaknesses, namely content limitation and over-specialization. Nie et al (2007) proposes approach combining semantic similarity with collaborative filtering to generate recommendation lists for users.

From the previous section, we concluded that most of the systems try to save searching time for users because Internet is overloaded with information. As a result, finding what consumer wants is very difficult; this is negatively reflected on consumers satisfaction. Consumers could use recommendation systems to narrow down their choices and make selections more efficient. Recommendation systems can meet this goal by giving attention to personalized information services to fit consumer's interests. It is necessary to understand consumer's interests and preferences. After that, we can provide suitable products or services. Fuzzy logic came to help online consumers in their decision making by using set of rules to view what is best for consumers.

The prototype IBD of this paper presents a new way to help consumers in their buying decision. The system need to know the consumers profile (age, gender, monthly income, level of education). Based on the consumer profile, the system will sort the desired product depending on the attributes presented to the consumer. Some consumer prefers the product price; thus, the system will sort the product information depending on the price. This is valid as well with other attributes that are quality and brand.

FINDING AND RESULT OF PILOT STUDY

The world has witnessed rapid growth of E-Commerce, and the number of online consumers is increasing every year since they realize the benefits they will gain from applying it to their activities while using Internet daily. This study is an attempt to discover the reasons behind the growing of E-Commerce, and to discover consumer preferences when choosing between traditional shopping and E-Commerce. Furthermore, to find out if time, product information, sites services and other reasons will affect consumers' choice of E-Commerce instead of traditional shopping. Also, this study attempts to discover the most attractive products for consumers.

The main objective of this pilot study is to find out the influence of the age; gender; education and monthly income on the online consumers buying decision. Also the most purchased product and most important product attributes.

This pilot study shade lights on the opinions of a group of Saudi citizen volunteers at King Abdul Aziza University. The pilot study results include many perspectives. It tries to give an overview of some issues in E-Commerce. Starting from reasons behind the growing of E-Commerce, comparison between E-Commerce and traditional shopping, volunteers' opinion about some online product, which product attribute motivate the buying decision, E-Commerce characteristics, E-Commerce sites services, E-Commerce efficiency, E-Commerce interfaces and the E-Commerce security.

Growing of E-Commerce Sites:

The questioner included many reasons for the growing of E-Commerce sites. The most motivated reason for the growing of E-Commerce sites was the increasing use of the Internet, closely followed by media advertising and search engines.

a) Increasing use of Internet:

Internet is one of the most frequently used technologies today. Internet users are technically defined as individuals who are 10 years and older and they use the Internet either from home or from their work place. Surfing Internet is an incredible opportunity to increase knowledge,

education and income. The more the consumer browses web sites the more he or she will learn. Internet is a chance to discover a new world.

b) Media advertising and search engine:

Internet advertising is growing every day. Advertisements appear in banners or buttons on any page of a search engine. Search engines are a core element of Internet. Using a search engine is the most popular online activity. These two important elements in Internet help the growing of E-Commerce sites by advertising about E-Commerce sites or by using search engine to offer facilities to the consumers to find E-Commerce sites.

c) People advices:

People experiences and advices about their experiment in browsing and navigating Internet are considered to be a very powerful and beneficial tool for those who surf the net.

d) Mail boxes catalogs and vendor catalogs:

The growing of the use of mail boxes and vendor catalogs among online retailers who see their Web sites as strong for ordering but weak in reaching new customers, especially those who are not frequent Internet shoppers. This growing of catalog is an example of how online companies have been pushing into the old-fashioned offline environment that they once derided.

e) Banner ads:

Banner ad is a form of advertising on Internet. It is displayed when a web page that references the banner is loaded into a web browser. Banner ads can be use as shopping assistant, by choosing a product that consumer might be interested in, then displaying banner ads that leads to shopping comparison pages, with prices, product reviews and links to merchants.

f) Other websites:

Using other websites marketing techniques is an effective online marketing strategy. Small businesses in Internet depend on some factors one of them is advertising about the sites in famous websites.

g) Work environment:

Work environment can be a good motivating reason for growing of E-Commerce sites. In the work we can meet people who are interested in online shopping. They encourage us to try online shopping. Even more if our partners are educated and open minded they will have huge impact on us to try new experiences one of them is online shopping.

Comparison between e commerce and traditional shopping:

E-Commerce has many advantages in our life compared to traditional shopping. This comparison was held by asking the volunteers whether online shopping is more interesting, more professional or better than traditional shopping. The result indicates that over 30% of volunteers disagree that E-Commerce is more interesting than traditional shopping, whereas over 20% of volunteers disagree that E-Commerce is more professional than traditional shopping, and above 40% of volunteers disagree that E-Commerce is a better way of shopping. In the other hand over 55% of volunteers agree that E-Commerce is more interesting than traditional shopping, whereas over

60% of volunteers agree that E-Commerce is more professional than traditional shopping, and 50% of volunteers agree that E-Commerce is better way of shopping than traditional shopping.

Because we are living in country that has customs and traditions, a woman cannot go out whenever she wants to. She rarely goes out even when she has multi important needs outside her house, also a lot of women find some discomfiture when she talks or deals with the sellers in the stores. But today the present time technology facilitates everything. It brings the markets for women in their houses through Internet. Women can browse hundreds of different E-Commerce sites, compare prices then buy the desired product. Despite all these features, the idea of online shopping still frightening, unacceptable and risky idea for a lot of women. The result shows that the levels of agreement for males are more than 60% where as the levels of agreement for females are 60%, which indicates that male in our country like to use E-Commerce , whereas female prefers traditional shopping than E-Commerce in spite of customs and traditions.

The most purchased product:

E-Commerce sites provide many categories to the consumers who log in to these sites to search for product in order to buy, however, some products were more attractive for consumers than others. The result shows that that Airline, books and hotel reservation are the most attractive products to be purchased on line, where as foods, clothing and jewelry and watches are the least attractive products to be purchased on E-Commerce sites.

In more details the result shows that Hotel reservation, Airline tickets and Books are the most attractive products to be purchased online for males, where as jewelry and watches, selling cars and furniture are the least attractive products to be purchased on E-Commerce sites for male. While books, movies and Airline tickets are the most attractive products to be purchased online for female, where foods, real-estate and clothing are the least attractive products to be purchased on E-Commerce sites for females.

The growing of e-commerce especially (B2C) is unevenly and differs from one country and other and some time remains concentrated in a few products. According to Dryden in 2001 the largest product segments were personal services (travel, financial brokerage) and certain goods (computer hardware/software, books) in European B2C transactions. Data for Japan show a somewhat different pattern with both computers and automobiles have high penetration rates followed by Books and music then Travel.

In the last year the percentage of online shopping consumers over the internet who had purchased products or services in Europe rise significantly from 22% to 43%. According to Brussels in 2009 there were three product categories which were most purchased online they are: travel and holiday accommodation, followed closely by clothes and sports goods then books/magazines/e-learning material. After that come household goods, tickets for events, films/music, electronic equipment, and computer software including video games

The Most Important Product Attributes:

It is hard for a consumer to buy a product from E-Commerce sites if the sites are not providing product attributes. There are many product attributes that can help consumers to choose between products in E-Commerce sites. The most important attributes are price, brand and quality. This survey points out how the three mentioned product attributes are influencing males and females when buying products online.

The result shows that a male will consider the quality then the price then the brand in making hotel reservation. However a female will consider the quality and the price then the brand. It also shows that a male will consider the price then the quality then the brand when buying online airline tickets, whereas, a female will consider the price then the quality and then the brand. Moreover, It is noticed that above 88% of the males between the ages of 21-30 years old agree that books sell better on E-Commerce sites, 100% of the males between the ages of 31-40 years old agree that books sell better on E-Commerce sites, above 80% of the males between the ages of 41-50 years old agree that books sell better on E-Commerce sites, above 90% of the male between the ages of 51-60 years old agree that books sell better on E-Commerce sites, above 70% of the males above 60 years old agree that books sell better on E-Commerce sites. In the other hand above 80% of the females between the ages of 21-30 years old agree that books sell better on E-Commerce sites, above 85% of the females between the ages of 31-40 years old agree that books sell better on E-Commerce sites, 80% of the females between the ages 41-50 years old agree that books sell better on E-Commerce sites, 80% of the females above 60 years old agree that books sell better on E-Commerce sites.

The result also shows the difference of percentage between male and female with monthly income in buying books. It is noticed that 90% of the males with monthly income between(5000-10000) agree that books sell better on E-Commerce sites, above 90% of the males with monthly income between(10000-15000) agree that books sell better on E-Commerce sites, above 80% of the males with monthly income(15000-20000) agree that books sell better on E-Commerce sites, above 90% of the males with monthly income(20000-25000) agree that books sell better on E-Commerce sites,80% of the males with monthly income above 25000 SR agree that books sell better on E-Commerce sites. In the other hand 80% of the females with monthly income less than 5000 SR agree that books sell better on E-Commerce sites, above 80% of the females with monthly income between (5000-10000) agree that books sell better on E-Commerce sites, above 90% of the females with monthly income between(10000-15000) agree that books sell better on E-Commerce sites,100% of the females with monthly income between(15000-20000) agree that books sell better on E-Commerce sites.

The result also represented the difference of percentage between male and female with ages in hotels reservation. It is noticed that above 80% of the males between the ages of 21-30 years old agree that hotels reservation sell better on E-Commerce sites, above 90% of the males between the ages of 31-40 years old agree that hotels reservation sell better on E-Commerce sites, 90% of the males between the ages of 41-50 years old agree that hotels reservation sell better on E-Commerce sites, 100% of the males between the ages of 51-60 years old agree that hotels reservation sell better on E-Commerce sites, above 70% of the males above 60 years old agree that hotels reservation sell better on E-Commerce sites. In the other hand above 90% of the females between the ages of 21-30 years old agree that hotels reservation sell better on E-Commerce sites, above 80% of the females between the ages of 31-40 years old agree that hotels reservation sell better on E-Commerce sites, 80% of the females between the ages 41-50 years old agree that hotels reservation sell better on E-Commerce sites, 80% of the females above 60 years old agree that hotels reservation sell better on E-Commerce sites.

The result furthermore shows the difference of percentage between male and female with monthly income in hotels reservation. It is noticed that above 80% of the males with monthly income between(5000-10000) agree that hotels reservation sell better on E-Commerce sites, above 90%

of the males with monthly income between(10000-15000) agree that hotels reservation sell better on E-Commerce sites, 80% of the males with monthly income between (15000-20000) agree that hotels reservation sell better on E-Commerce sites, 80% of the males with monthly income between (20000-25000) agree that hotels reservation sell better on E-Commerce sites, 90% of the males with monthly income above 25000 SR that hotels reservation sell better on E-Commerce sites. In the other hand 80% of the females with monthly income less than 5000 SR agree that hotels reservation sell better on E-Commerce sites, above 90% of the females with monthly income between(5000-10000) agree that hotels reservation sell better on E-Commerce sites, 100% of the females with monthly income between(10000-15000) agree that hotels reservation sell better on E-Commerce sites, 100% of the females with monthly income between (15000-20000) agree that hotels reservation sell better on E-Commerce sites.80% of the females with monthly income between(20000-25000) agree that hotels reservation sell better on E-Commerce sites.

Additionally, the result shows the difference of percentage between male and female with ages in airline tickets. It is noticed that above 80% of the males between the ages of 21-30 years old agree that airline tickets sell better on E-Commerce sites, above 100% of the males between the ages of 31-40 years old agree that airline tickets sell better on E-Commerce sites, above 90% of the males between the ages of 41-50 years old agree that airline tickets sell better on E-Commerce sites, above 80% of the males between the ages of 51-60 years old agree that airline tickets sell better on E-Commerce sites, 80% of the males above 60 years old agree that airline tickets sell better on E-Commerce sites. In the other hand above 80% of the females between the ages of 21-30 years old agree that airline tickets sell better on E-Commerce sites, above 80% of the females between the ages of 31-40 years old agree that airline tickets sell better on E-Commerce sites, 80% of the females between the ages 41-50 years old agree that airline tickets sell better on E-Commerce sites, 80% of the females above 60 years old agree that airline tickets sell better on E-Commerce sites.

As well the result shows the difference of percentage between male and female with monthly income in airline tickets. It is noticed that 90% of the males with monthly income between(5000-10000) agree that airline tickets sell better on E-Commerce sites, above 90% of the males with monthly income between(10000-15000) agree that airline tickets sell better on E-Commerce sites, above 80% of the males with monthly income between (15000-20000) agree that airline tickets sell better on E-Commerce sites, above 80% of the males with monthly income between (20000-25000) agree that airline tickets sell better on E-Commerce sites, above 80% of the males with monthly income above 25000 SR that airline tickets sell better on E-Commerce sites. In the other hand 80% of the females with monthly income less than 5000 SR agree that airline tickets sell better on E-Commerce sites, above 80% of the females with monthly income between(5000-10000) agree that airline tickets sell better on E-Commerce sites, 100% of the females with monthly income between(10000-15000) agree that hotels reservation sell better on E-Commerce sites, 100% of the females with monthly income between (15000-20000) agree that airline tickets sell better on E-Commerce sites.

Characteristics of E-Commerce:

E-Commerce has many characteristics. Those characteristics have a positive impact on consumers shopping online; they make shopping easier, save time and provide information such as products prices comparison. Moreover, they make stores reputation widely available. To sum up those characteristics make the decision to buy easier. The result indicates that less than 10% of volunteers

disagree that E-Commerce sites make the stores reputation widely available, make the decision to buy easier and save time compared to traditional shopping. In the other hand approximately all volunteers agree that E-Commerce sites characteristics Facilitate life for online consumers, make shopping easier, provide comparison between prices for products, make stores reputation widely available, make buying decision easier and save the time for the online consumers . This implies that E-Commerce is a brilliant Invention.

The result shows that 10% of males disagree that E-Commerce sites make the stores reputation widely available, make the decision to buy easier and saving time for online consumers. Whereas approximately all volunteers agree that E-Commerce sites characteristics facilitate life for online consumers, it makes shopping easier, proved comparison between prices for products, makes stores reputation widely available, buying decision easier and save the time for the online consumers.

It also shows that 10% of females disagree that E-Commerce sites make the decision to buy easier and saving time for online consumers. Whereas approximately all volunteers agree that E-Commerce sites characteristics facilitate life for online consumers, it makes shopping easier, proved comparison between prices for products, makes stores reputation widely available, buying decision easier and save the time for the online consumers.

Sale Services of E-Commerce Sites:

E-Commerce sites can be highly developed in customer services. It should provide before and after sale services for their consumers. It is a fact that sites provide more services to their consumer will be more attractive and commonly used. The result indicates that less than 3% of volunteers disagree that E-Commerce sites should provide warranty, return product and provide help assistant to their consumers. In the other hand, approximately all volunteers agree that E-Commerce sites should provide warranty, return product, help assistant, tracking order, and free attractive services and provide choices of delivery to the consumers. This presents a new area of attention for E-Commerce sites to focus on and improve.

It also indicates that less than 3% of males disagree that E-Commerce sites should provide warranty, return product and provide help assistant to their consumers. In the other hand, approximately all volunteers agree that E-Commerce sites should provide warranty, return product, help assistant, tracking order, and free attractive services and provide choices of delivery to the consumers.

The result furthermore shows that all the volunteers agree that E-Commerce sites should provide warranty, return product, help assistant, tracking order, and free attractive services and provide choices of delivery to the consumers.

Efficiency of E-Commerce Sites:

E-Commerce sites offer facilitation to their customers, which indicate that, the efficiency of the sites. The result indicates that less than 4% of volunteers disagree that help assistant is important when accessing E-Commerce sites. This means that online consumers prefer sites that provide more facilitation. Whereas, approximately all volunteers agree that products information and picture, comparison with similar products, help assistant and fast accessing to the sites are important when accessing E-Commerce sites.

It also shows that less than 4% of males disagree that help assistant is important when accessing E-Commerce sites. Whereas, approximately all volunteers agree that products information and picture, comparison with similar products, help assistant and fast accessing to the sites are important when accessing E-Commerce sites.

It also indicates that less than 5% of female disagree that help assistant is important when accessing E-Commerce sites, whereas, approximately all volunteers agree that products information and picture, comparison with similar products, help assistant and fast accessing to the sites are important when accessing E-Commerce sites.

Interface of E-Commerce sites:

E-Commerce sites offer many advantages for busy consumers; however, many E-Commerce sites are still too complicated to use; starting from the registration process and so on. The web site interface arrangement of each site is different from the other. Thus, the Interface of E-Commerce sites facilitate dealing with the sites. Also, not all sites update their web site interfaces which make the website week. The result indicates that less than 32% of volunteers disagree that registration process is important when accessing E-Commerce sites and less than 4% of volunteers disagree that site update is important when accessing E-Commerce sites. Whereas, approximately all volunteers agree that registration process, sites arranging and site update are important when accessing E-Commerce sites.

It also shows that less than 36% of male disagree that registration process is important when accessing E-Commerce sites and less than 7% of male disagree that site update is important when accessing E-Commerce sites. Whereas, approximately all male volunteers agree that registration process, sites arranging and site update are important when accessing E-Commerce sites.

Furthermore it shows that less than 27% of female disagree that registration process is important when accessing E-Commerce sites. Whereas, approximately all female volunteers agree that registration process, sites arranging and site update are important when accessing E-Commerce sites.

Shopping of E-Commerce sites:

The main goal for E-Commerce sites is to gain profit and make money. Nevertheless, if the sites don't support security in their transactions, consumers will not feel safe to use the sites; therefore, it would be hard to make money. Thus, security is an important issue in E-Commerce. The result indicates that less than 50.9% of volunteers disagree that E-Commerce sites have credit cards security system. Whereas, 49.1% of volunteers agree that E-Commerce sites have credit cards security system and all volunteers agree that the process of purchase product is important to accessing E-Commerce sites.

In addition it indicates that 69% of male volunteers disagree that E-Commerce sites have credit cards security system. Whereas, 31% of male volunteers agree that E-Commerce sites have credit cards security system and all male volunteers agree that the process of purchase product is important to accessing E-Commerce sites.

Moreover, the result indicates that 29.2% of female volunteers are disagreement that E-Commerce sites have credit cards security system. Whereas 70.8% of female volunteers are agreeing that E-

Commerce sites have credit cards security system and all female volunteers are agreeing that the process of purchase product is important to accessing E-Commerce sites.

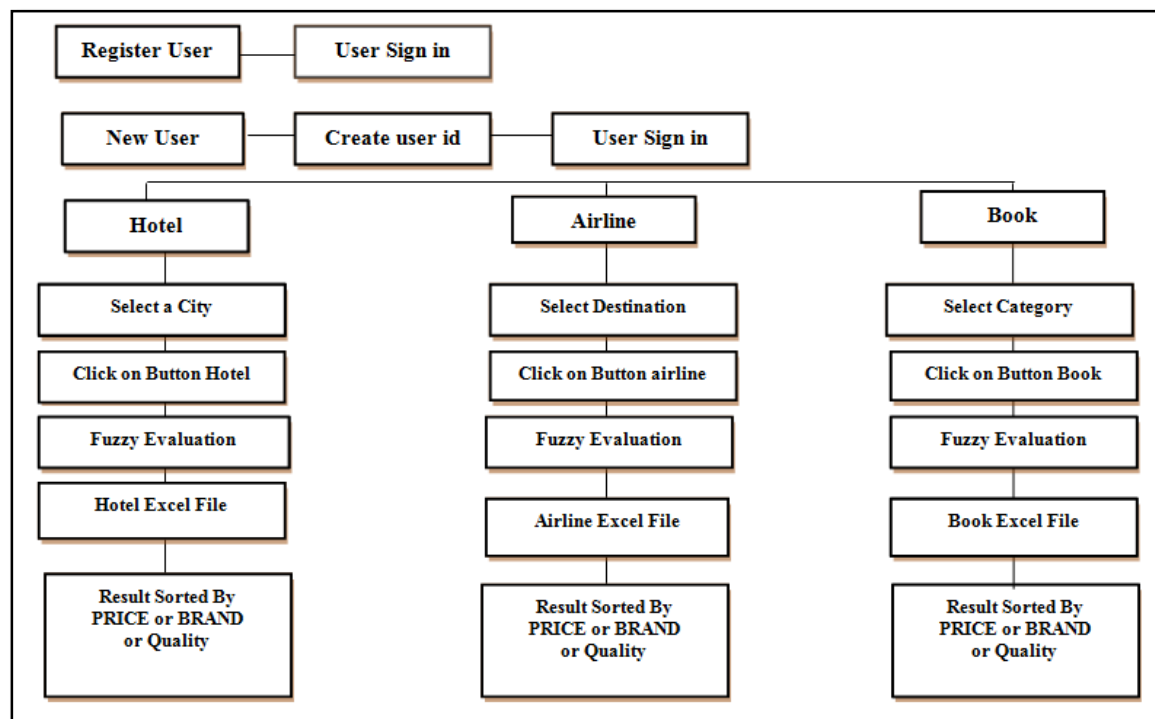
DESIGN AND IMPLEMENTATION

Fuzzy logic uses linguistic variables, such as short, medium, long. And the style of human way of thinking, mainly the common sense reasoning is near nature, so fuzzy rule with fuzzy linguistic variables are much closer to the human natural language and the human thinking mode. Fuzzy logic is a suitable way to predict consumer behavior in their buying decision.

This section presents IBD diagram in details and describes each block and show the workflow system. It will also list down all software, algorithms and tools that were used in the implementation stage of IBD system.

IBD Block Diagram:

Figure 1 shows the block diagram of the IBD prototype.



Software Layout

There are two buttons to the user:

1. Registered User: the user has to enter User Id and Password to sign in to the prototype.
2. New User Registration: the user has to enter complete user profile then the system will create user id for the user then the user can sign in to the prototype.

When the user signs in to the system he or she can choose between three categories:

1. Hotel: the user can choose a city from the list then press the button hotel.
 2. Airline Tickets: the user can choose a destination from the list then press the button Airline.
 3. Book: the user can choose a book category from the list then press the button Book.
- When the user presses the button, the system will evaluate the fuzzy inference system and calculate the result then the system will sort the product depending on price, brand, or quality.

System Workflow

Figure 2 shows the IBD workflow as follows:

- First, user has to select the button which presents his or her status in the system
 - Registered user: user has an account in the system to sign in.
 - New user: is using the system for the first time, user has to create profile in the system to sign in.
- Then, user has to decide which product to select.
- After that, user has to select between: A city if he/she wants a hotel, A destination if he/she wants airline ticket, A book category if he/she wants book.
- Once user has selected his service and clicked on the product button, the system starts the fuzzy evaluation to calculate the result.
- Depending on the value of the result the system will select the proper product data base.
- Finally, the best predicted product attribute will be presented to the user.

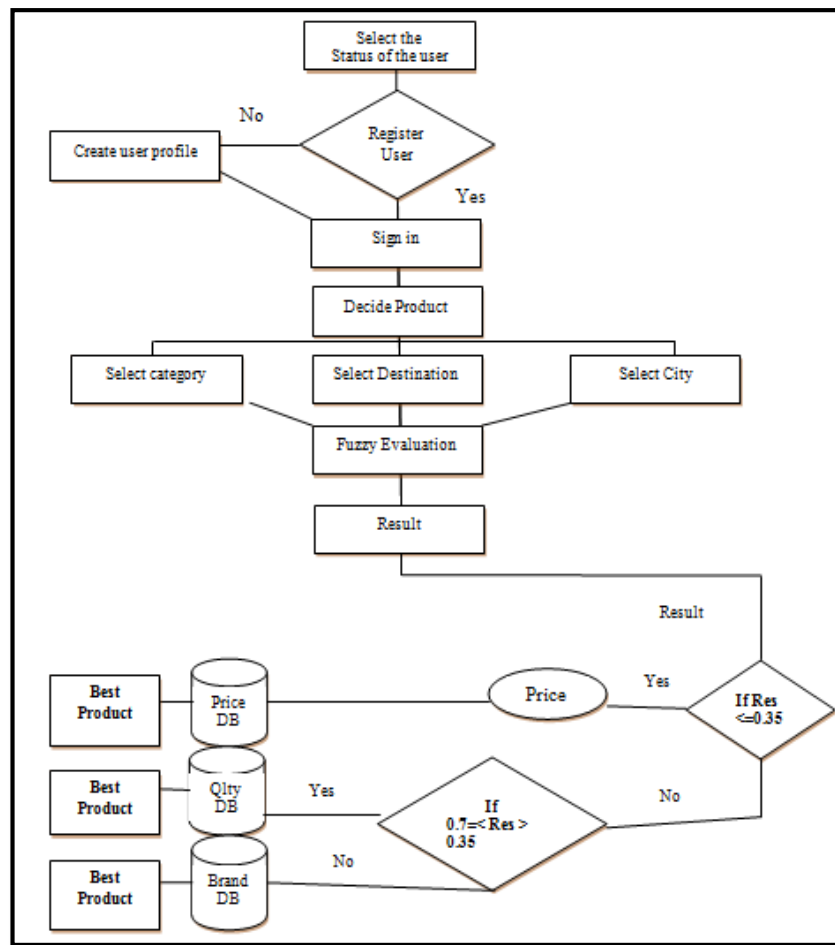


Figure 2 : IBD Workflow

Fuzzy Logic Toolbox

The Fuzzy Logic Toolbox lets us model the system using sets of rules and then implement these rules in a Fuzzy Inference System (FIS). The Fuzzy Logic Toolbox provides graphical user interface (GUI) to develop and analyze fuzzy inference systems.

4.4.1 Building Fuzzy Inference System (FIS)

Fuzzy inference system is a technique to convert the input values, based on designer-defined rules, to assign output values. Using the GUI editors and viewers in the fuzzy logic toolbox, we can build the sets of rules and define the membership functions.

Model of IBD:

Figure 3 shows the structure of fuzzy inference system in IBD prototype. User profiles have their ages, genders, education and monthly income as input values. Each user profile is passed to membership functions and sets of rules to calculate the result. Finally all the fuzzy conclusions will convert to one output values.

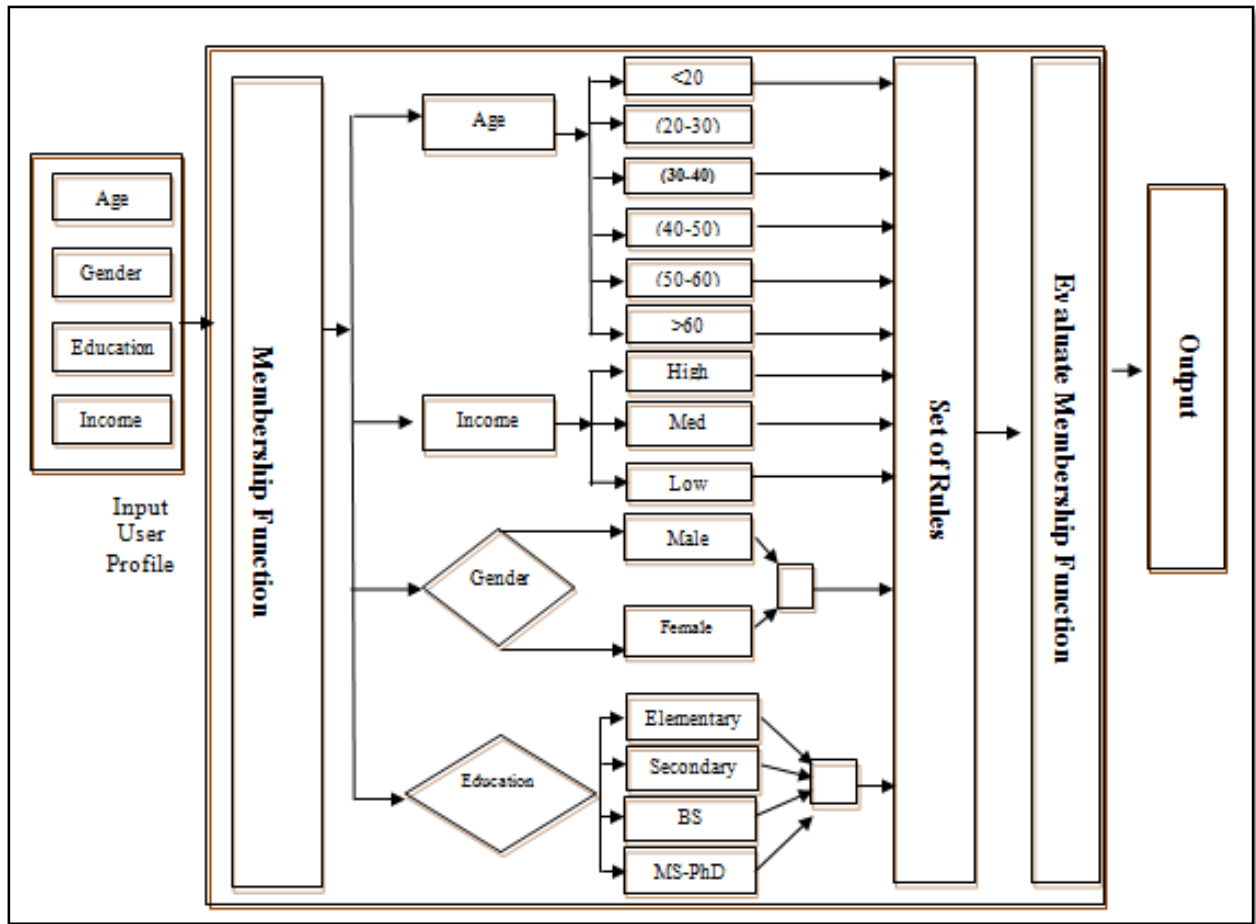


Figure 3 : FIS Model.

The Structure of the IBD model could be divided into several stages:

Stage 1: Build User Profile:

Each user has to give the system his or her profile: (monthly income, age, education, gender). After that the system will create user-id to each user.

Stage 2: Build Fuzzy Inference System (FIS):

Each part of the profile is considered a member in each membership function in the FIS. Each profile contains four inputs:

1. User Age:

Figure 4 shows the age membership function, every user age is a member in each membership function but within a certain limit. And every membership function represents an age interval .there are six age intervals:

1. Less than 20 years old (Vlow).

2. From 20-30 years old (Low).
3. Form 30-40 years old (Lmed).
4. From 40-50 years old (Hmed).
5. From 50-60 years old (High).
6. Above 60 years old (Vhigh).

For example if a user is 35 years old, the age is considered as a member in every membership function. The age 35 is considered a very weak member in the membership function Vlow, at the same time it is a weak member in the membership function Low, but it is a very strong member in the membership function Lmed. And this process continues in all intervals. at the end the stronger member will be considered.

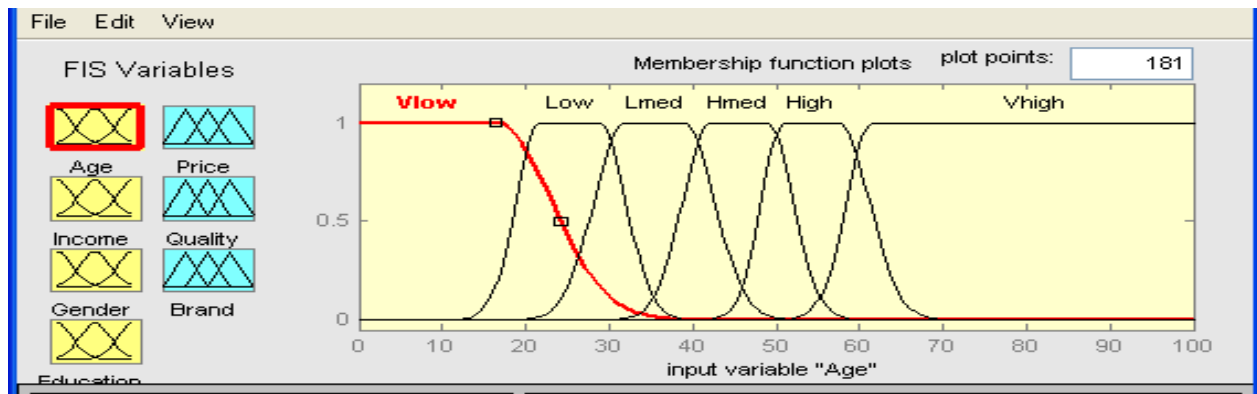


Figure 4 : Age Membership.

2.User Income:

Figure 5 shows the monthly Income membership functions, every user Income is a member in each membership function but within a certain limit. And every membership function represents a monthly income interval. There are three intervals in the income membership function:

1. Monthly income less than 5000 SR represent low income membership function.
2. Monthly incomes from 5000-17000 SR represent medium income membership function.
3. Monthly incomes from above 17000 SR represent high income membership function.

For example if a user monthly income is 20000 SR, the income is considered as a member in every membership function. The income 20000 SR is considered a very weak member in the membership function low, at the same time it is a weak member in the in membership function medium, but it is a very strong member in the in membership function high. at the end the stronger member will be considered.

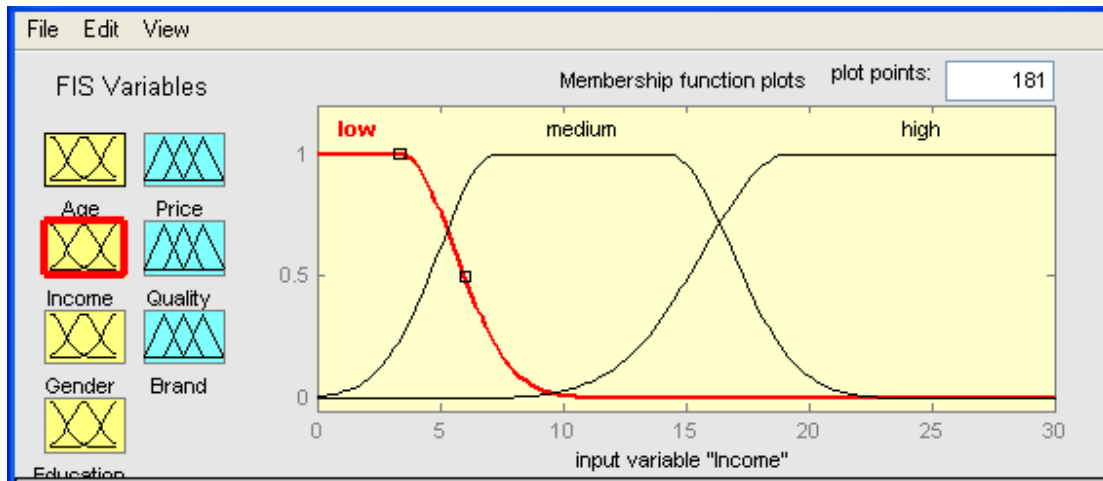


Figure 5 : Income Membership.

3. User Gender:

Figure 6 shows the gender membership function. Every membership function represents a gender. There are two gender membership functions: Male and Female.

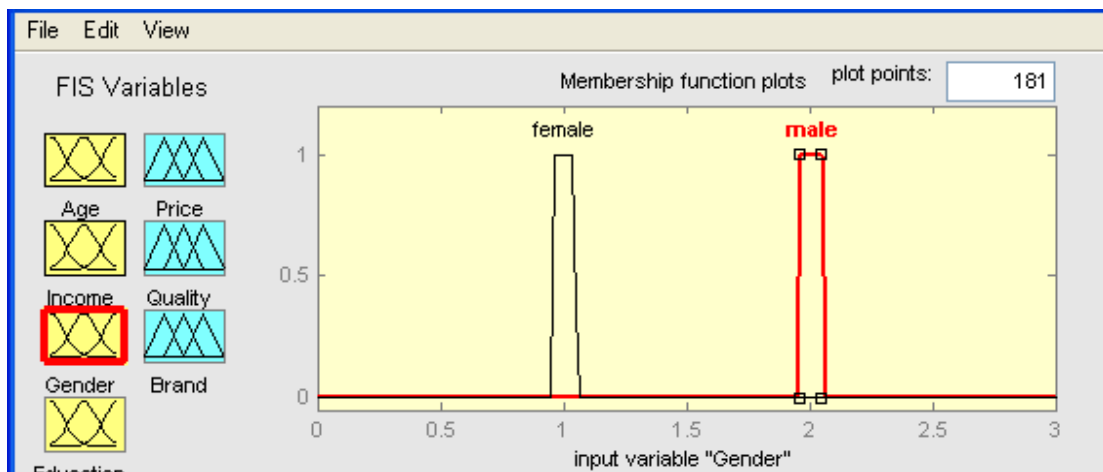


Figure 6 : Gender Membership.

4. User Education:

Figure 7 shows the education membership functions. Every membership function represents an education level. There are five education membership functions:

- Pre elementary
- Elementary
- Secondary
- Bachelor degree
- Master degree and PhD Degree.

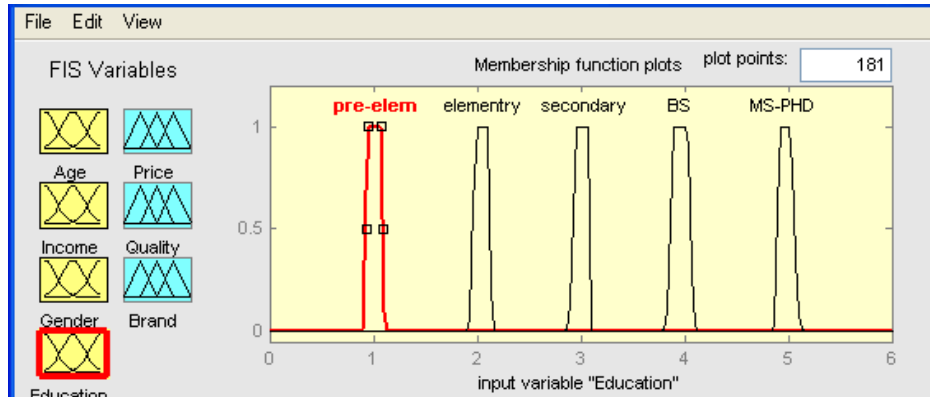


Figure 7 : Education Membership.

Stage 3: Build Output Membership Function:

Figures 8, 9, 10 shows the output membership function. each membership function is a value between 0 and 1. there are three output membership functions Price, Quality and Brand. The output values for all three output are:

1. Low
2. Medium
3. High

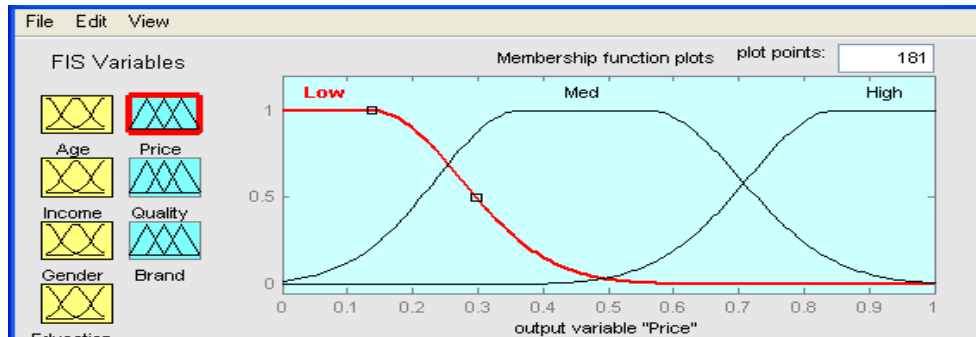


Figure 8 : Price membership.

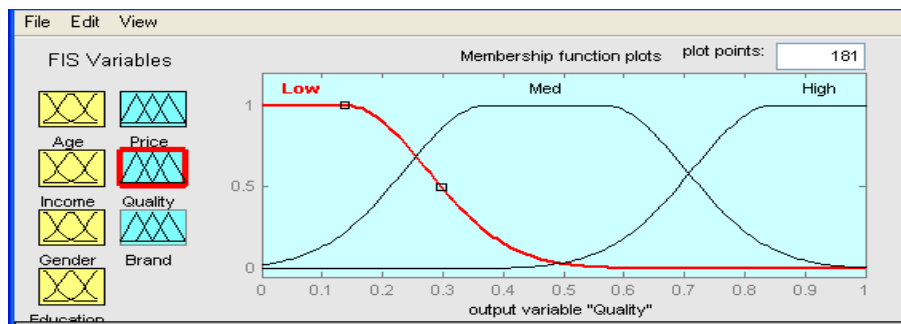


Figure 9 : Quality membership.

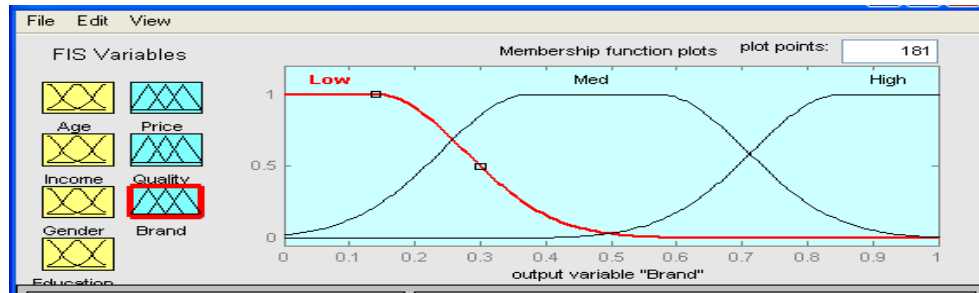


Figure 10 : Brand membership.

Stage 4: Build the Rule:

Figure 11 shows the rules which i created based on data collected from the pilot study. The pilot study represents the volunteer's opinion about which product attribute is most important for them when they make their decision to buy a product.

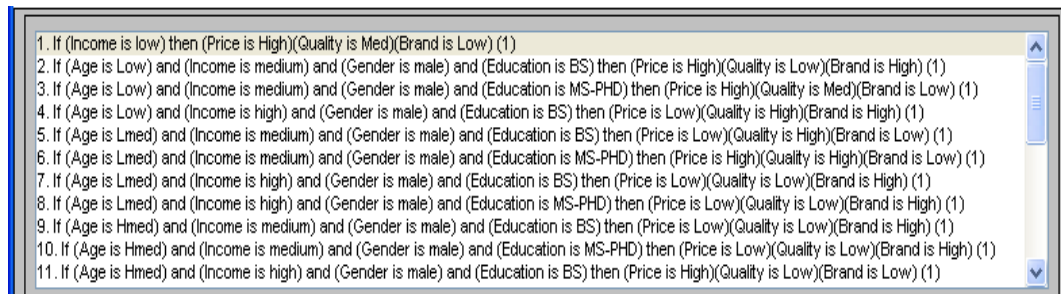


Figure 11 : Rule Set.

Stage 5: Build the Data Base:

The database which i used in my prototype was created using Excel files. Each file is divided in to three sheets: price, brand and quality. Depending on the fuzzy inference system result the system will display the data from appropriate sheet. This will help the system sort the products for the user.

IBD Implementation:

The implementation of the IBD prototype required the following tools:

4.5.1 Microsoft Excel 2007

Microsoft Excel was used to save the information about products. Products are saved in separate files. Every file is divided into three sheets:

1. Product sorted by price.

2. Product sorted by quality.

3. Product sorted by brand.

4.5.2 MATLAB 2007

MATLAB was used to program my prototype IBD system by using fuzzy logic to sort the product by price, brand, or quality to help the consumer in his buying decision.

4.5.2.1 Graphical User Interface (GUI):

A graphical user interface (GUI) is a graphical user interface system that links specific programmed function to graphical buttons. It enables the user to perform interactive tasks. GUI is one of the MATLAB features and it is used to create the IBD system application layout including buttons, text field and labels.

4.5.2.2 Fuzzy Logic:

Fuzzy logic is suitable in my prototype because consumer behavior in shopping is ambiguous and different from person to another even if they live in the same environment and get the same education their buying decision will differ.

Implementation of Fuzzy Evaluation :

The implementation of the fuzzy evaluation for Hotels shown below as an example

4.6.1 Fuzzy Evaluation in Hotel

The system will get application data then will read the fuzzy inference system after that the system will get identify the gender of the user followed by getting user profile the age, income, education

```
%
data = getappdata(gcf, 'metricdata');
b= readfis('Proj_Mona6.fis');
if strcmpi(data.user_gndr, 'f')
    gnd='1';
else
    gnd='2';
end
ddtt=str2double([data.user_age data.user_income gnd data.user_Edu]);
```

Figure 12 : Get User Profile.

After that the system will calculate the result from fuzzy evaluation that was mentioned and explain before in this chapter. Depending on the result the output of the system will be sorted by price or by quality or by brand. Figure 13 shows the code is used to evaluate the fuzzy inference system result to represent output for the user.

```
res=evalfis(ddtt, b) % Fuzzy Evaluation
[val,loc]=max(res);
```

Figure 13: FIS Result.

Then the product data will be taken from the excel file sheets witch match the result of the fuzzy inference system. Figure 14 shows the code is used to take the data from the appropriate excel sheets.

```

if choice==1
    data.prn_file = 'makkah_brnd';
elseif choice==2
    data.prn_file = 'makkah_prc
else
    data.prn_file = 'makkah_qlty';
end
elseif data.city == madina
    if choice==1
        data.prn_file = 'madina_brnd';
    elseif choice==2
        data.prn_file = 'madina_prc';
    .

```

Figure 14 : Taking Data from Excel File.

CONCLUSION

This paper presented an IBD system by using GUI layout in MATLAB. It helps users to find their desired products or services faster and without any effort. Users spend less time to search for a good deal match with their taste and shopping behavior. The IBD system of the survey helps in providing personalized services to the users and provides the best services to the users based on his or her profile. Each users has to give the system specific information which help the system to sort the products depending on their profile. MATLAB provides a powerful tool for fuzzy logic which is used to develop a fuzzy inference system.

This paper proposes a model for fuzzy logic based intelligent system. The proposed IBD tries to discover consumers' online shopping behavior by collecting data and information from the volunteers through questionnaire. Then applying the fuzzy logic to analyze the collected consumers' data and find out consumers shopping behavior using fuzzy sets and linguistics fuzzy rules. Next step is to build a system that tries to predict the attribute which match consumer preferences to help them in their buying decision.

REFERENCES

- Gröblichhoff B. (2002) B2B E-Commerce: The Future of Business Transactions & Relationships. Retrieved from <http://www.wu.uni-magdeburg.de/fwwdeka/student/arbeiten/013.pdf> (Accessed 23 Dec 2013)
- Sheldon F.T., Jerath K. and Pilskalns O. (2002) *Case study: B2B E-Commerce system specification and implementation employing use-case diagrams, digital signatures and XML*, Proceedings. Fourth International Symposium on Multimedia Software Engineering, pp.106-113.

- He M., Jennings N.R. and Leung H.F. (2003) *On agent-mediated electronic commerce*, IEEE Transactions on Knowledge and Data Engineering, 15(4), pp. 985-1003.
- Segovia J., Szczepaniak P.S. and Niedzwiedzinski M. (2002) *E-Commerce and intelligent methods*, Springer (Heidelberg).
- Zadeh L.A., Klir G.J. and Yuan B. (1996) *Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems: Selected Papers*, World Scientific Publishing Co., Inc. River Edge, NJ (USA).
- Berenji H.R., Khedkar P., Center N.A.R. and View, M. (1992) *Learning and tuning fuzzy logic controllers through reinforcements*, IEEE Transactions on Neural Networks, 3(5), pp. 724-740.
- Abbattista F., Lops P., Semeraro G., Andersen V., and Andersen HHK. (2002) *Evaluating virtual agents for E-Commerce*. AAMAS. Retrieved from <http://svn2.assembla.com/svn/synthese/Jacques/Evaluating%20virtual%20agents%20for%20E-Commerce-semeraro.pdf> (Accessed on 25 Dec 2013)
- Tewari G., Maes P. and Ariely D. (2001) *A Visual Preference-Modeling and Decision-Support Technique for Buyers of Multi- Attribute Products*, Conference on Human Factors in Computing Systems, ACM New York, USA, pp. 339-340.
- Ma Y. and Aimeur E. (2001) *Intelligent Agent in Electronic Commerce-XMLFinder*, Tenth IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, 2001. WET ICE 2001, pp. 273-278.
- [16] Menczer F., Street W.N., Vishwakarma N., Monge A.E. and Jakobsson M. (2002) *IntelliShopper: A proactive, personal, private shopping assistant*, Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 3, ACM New York, USA, pp. 1001-1008.
- Zeng Z. and Meng B. (2005) *A multi-agent based intelligent system for Internet shopping*, Proceedings of International Conference on Services Systems and Services Management, 2005. ICSSSM'05. 2005, 2, pp. 991-995.
- Wang X., Shen X. and Georganas N.D. (2006) *A Fuzzy Logic Based Intelligent Negotiation Agent (FINA) in E-Commerce*, Canadian Conference on Electrical and Computer Engineering, 2006. CCECE '06., pp. 276-279.
- Liu P., Nie G. and Chen D. (2007) *Exploiting semantic descriptions of products and user profiles for recommender systems*, IEEE Symposium on Computational Intelligence and Data Mining, 2007. CIDM 2007, pp. 179-185.