

## **Mobile commerce approach based on mobile agent**

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### **ABSTRACT**

Telecommunications technologies are advanced; they introduced new technologies to meet the needs of individuals and organizations to make commercial transactions, where we find the birth of e-commerce after the emergence of the Internet. But this approach has limits like the use of a client / server model, which limit the use of these transactions in anytime and anywhere. Recently and after the emergence of the wireless networking, the commerce increase the range of the E-commerce applications in anytime and anywhere by the technology of mobile commerce. In this article, we propose an approach of mobile commerce based mobile agent with the aim to deploy the mobile agent paradigm for mobile commerce applications.

### **KEYWORDS**

Mobile commerce, E-commerce, mobile agent, SMA, Aglet.

### **1 INTRODUCTION**

The commerce is related by the networks since the man knew the commercial exchanges, where it uses the networks road by various tools for transport until appearing of e-commerce with the emergence of the Internet into 1990 which defined by “the possibility of making a commercial transaction by an electronic medium through the Internet network” [09]. However, e-commerce has problems like the use of model client / servers, which requires a stable connection between the customer and the server and the difficulty of maintaining this connection in anytime and anywhere. To solve these problems and to meet the needs of the individuals and the organizations and enlarge the scale of the electronic transactions, a new technology known by the mobile

commerce has emerged. This technology is defined as “the exchange or the purchase of the products, of the services or the information’s on the Internet or in the market by the use of the mobile devices” [11]. The mobile commerce does not prolong only the E-commerce but offers a unique commerce opportunity with its own settings, such as omnipresence, accessibility, the portability, etc.

With the problems which arise in the client/server model and the physical constraints of the mobile devices such as the poor connectivity of the network, the low bandwidth of transmission, and the limited capacity of battery, a new paradigm was introduced to develop the M-commerce applications, it’s the mobile agent paradigm.

The mobile agents are autonomous entities can move towards other environments, contacted with other agents and complete its execution at the destination. [08] They offer advantages

such as a minimizing the use of connection between the mobile customer and the server of the data, and that which allows decreased consumption of bandwidth and the latency time.

In the next section will do a study of some similar work, in the section III we discuss on our contributions in the field of mobile commerce, and after we will present our results, in the end us will finish by a conclusion and prospects?

## **2 SIMILAR WORK**

### **2.1 Exploring mobile-agent-based architectures for m-commerce applications [05]**

Gilda pour at the International Conference of the e-commerce propose this approach in 2004, the main objective of this approach is the use of the advantages of the mobile agents for minimizing the limits of the traditional methods and to develop mobile commerce applications more improved.

This approach employed mobile agent components to design new mobile-agent-based architecture for m-commerce applications. Also developed a demonstration prototype of inventory management and tracking systems with the new architecture for mobile environments.

The architecture of Gilda pour is designed with three principal layers: (1) The front layer is mainly for presentation, (2) the middle layer for application logic, and (3) the back layer for data management.

### **2.2 Implementing a mobile agent platform for M-commerce [13]**

Li Xining and Guillaume Autran in the 33rd Annual IEEE International Computer Software and Applications Conference proposed this approach in 2009. They propose an approach based agent for a distributed environment, which makes it possible for the consumers to send mobile agents their handheld devices to visit the E-stores inventories for search, comparison, evaluation, purchase and the payment of the goods.

The proposed architecture composed of three layers: (1) the kernel layer: for the planning and the execution of agent code. (2) The layer of the virtual machine: generally for guaranteed the security by the control the incoming agents, and (3) the M-commerce applications based mobile agent layer: in this layer the authors implementing a logic programming language with a rich application programming interface for designing mobile agent applications.

### **2.3 On the Design of a Mobile Agent Environment for Context-aware M-commerce [06]**

This approach proposed by Jiazao Lin and Lian Li of Lanzhou University in China in 2010.

The aim of this approach is that the proposed system should be able to help mobile users to discover, locate, negotiate, monitor and notify, on behalf of users to carry out goal-driven commerce tasks on an anywhere and anytime basis.

The novelty of this proposal is that it uses an ontological context model to provide personal and environmental contextual information and supports the composition of context-aware services. Consequently, it not only utilizes existing web service and service discovery protocol, but also employs mobile agents to achieve flexible network roaming for interactive services.

### **3 THE CONTRIBUTION**

We arrive in the present section at the proposition of our architecture, it is based on the concept of the mobile agents to realize an approach of mobile commerce.

#### **3.1 The user need**

Today's we try to simplify the various tasks of commerce, and among the difficult tasks that we found in the purchase it is the choice of the best product for the best prices. To facilitate this task, we put the following question: can we collect the information's about a product without the need for going to the stores?

To answer this question we cite the objective of our approach.

#### **3.2 The objective of the approach**

The main objective of our study is to propose an approach based mobile agents, which allows a user of a mobile device in a determinate place to make a search for specific products in the various providers' sites. After searching,

it receives a list containing the various providers, the characteristics, the prices and the quantities of product, it will choose among these providers most adequate with its criteria, and to end it will go at this provider to finish the purchase without need to go at the others.

#### **3.3 The function of system**

To search the customer will authenticate with the system then meet its needs, at this time the system detects the place of customer and after he creates a mobile agent, which will migrate to the server. In this party the mobile agent communicated with the manager agent, it gives the customer needs and recovered the results, the manager agent extracts the addresses of the providers in this region and passed it to the mobile agent server, which he creates a mobile agent and clone this agent for sending each agent to a provider. In the site, the mobile agent communicates with the interface agent to finish the search phase; in end the researcher agent of the site returns the result to the interface agent which passes this result to mobile agent.

#### **3.4 The general architecture of our system**

Our proposed architecture (**figure 1**) composed of three principal parts: the mobile part, the server part and the providers' sites part:

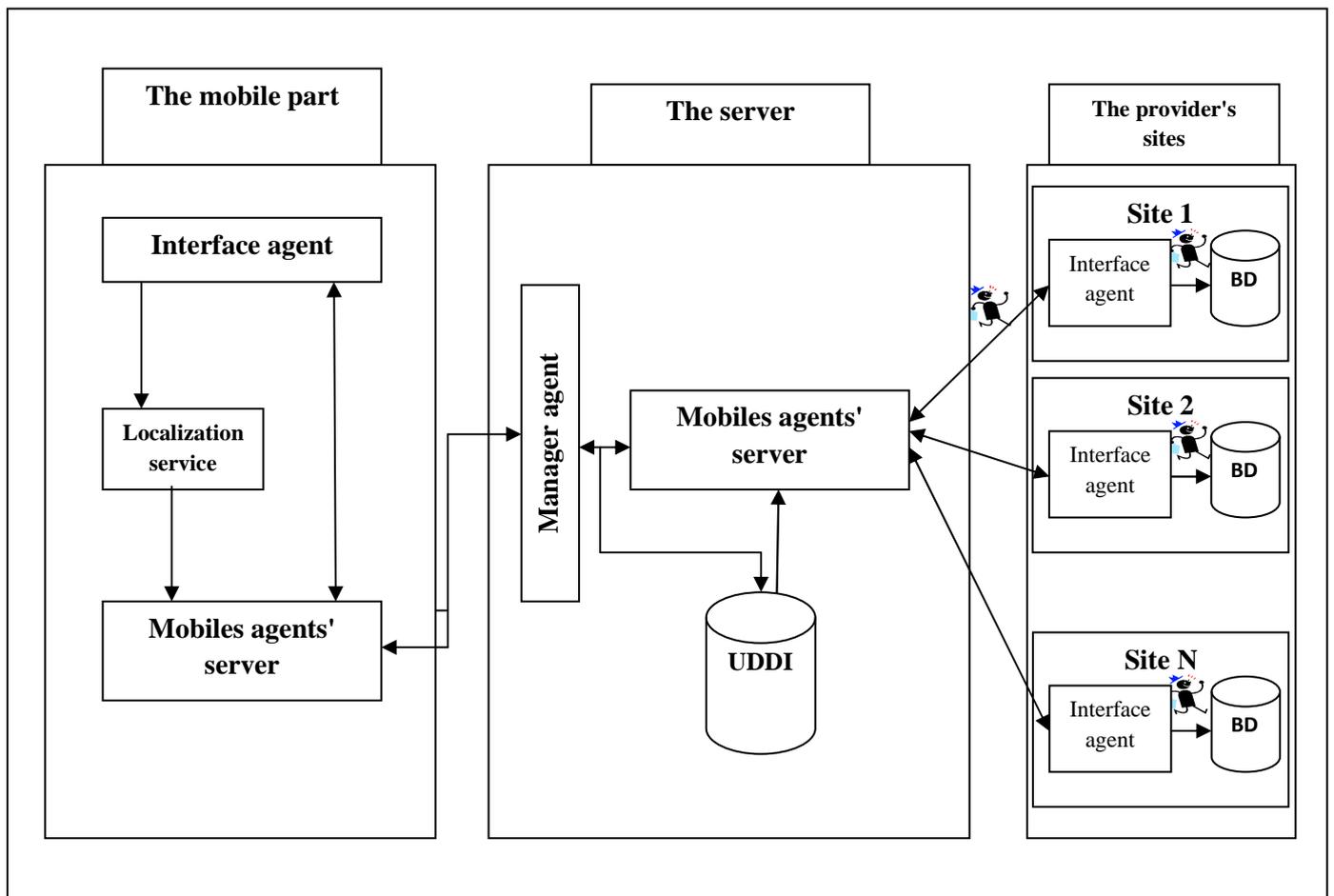


Figure 1: the global architecture of system

### 3.4.1. The mobile part

This part is the part of the mobile device; it is composed of the following modules:

#### 3.4.1.1. An interface agent

The interface agent plays a main role it collect the information from the user and reformulate them for transfer this information to the mobile agent server, at the same time he starts the localization service to determinate of the user locale.

#### 3.4.1.2. The localization service

This service is used to determine the position of the user when it began the

search. After determining the local by the localization service, it sends this information to a mobile agent server to integrate in the mobile agent.

#### 3.4.1.3. The mobile agent server

From the information about the interface agent and the localization service, it creates a mobile agent will migrate to the server to complete the tasks of research.

### 3.4.2. The server part

This part is the intermediary between the customer and the providers where it is composed by a manager agent who is responsible for the management of all tasks in the server, a directory that

contains the information of providers and mobile agent server create a mobile agent that will migrate to providers' sites.

#### **3.4.2.1. The manager agent**

The manager agent communicates with the mobile agent coming from mobile phone and extracted the addresses of all providers in the region of the UDDI directory, in the end sent the number of providers and their addresses to the mobile agent server.

#### **3.4.2.2. The UDDI (Universal Description, Discovery and Integration)**

The UDDI directory provides a set of services that allows the description and the discovery of enterprises, organizations, other web service providers, and technical interfaces that can be used to access these services.

#### **3.4.2.3. The mobile agent server**

This server creates a mobile agent from the information of manager agent, clones this agent and includes in each agent an address of a provider site.

After this step each mobile agent will migrate to the site intended to search for the products and the information required.

### **3.4.3. The providers' sites part**

This part represents the providers' sites, these sites are composed of a database and two types of agent, the first is the interface agent and the second is the researcher agent.

#### **3.4.3.1. The interface agent**

The interface agent allows transferring the customer needs from the mobile agent to the researcher agent.

#### **3.4.3.2. The researcher agent**

This agent can manipulate the database site to search for the customer needs and at the end, he returns the result to the interface agent.

#### **➤ The mobiles agents**

These agents are move around different locations, from the mobile phone to the server or from the server to the providers' sites, to put the customer needs, take the results of the researcher agent, and transmit to the interface agent of mobile phone.

### **3.5 AUML Modeling**

#### **3.5.1. Why the AUML**

The UML is sometimes insufficient for modeling agents and systems based-agent. However, no formalism exists yet sufficiently to indicate the based-agent systems development. A proposal with full specifications of life cycle of the based-agent system development is proposed by FIPA and the work group of agent of OMG, which are explored and recommended a prolongation in the UML [02, 10]

#### **3.5.2. Sequences diagrams**

##### **3.5.2.1. Sequence Diagram of Research**

When the customer authenticated it can launch a search.

- The customer requests to the interface agent to launch a search (1);

- The interface agent charge the appropriate interface to search (2), and at the same time calls the procedure of detection a locale by the sending of a message at the localization service (3). This last sending the information of customer localization to the mobile agent server after determining his place;
- The customer choose the search domain (4), seized his needs by the determination for the article and the range of the prices and the other characteristic necessary (5) and the search extent (6);
- The interface agent formula the information of customers and sending this information to the mobile agent server (7) which with its role creates a

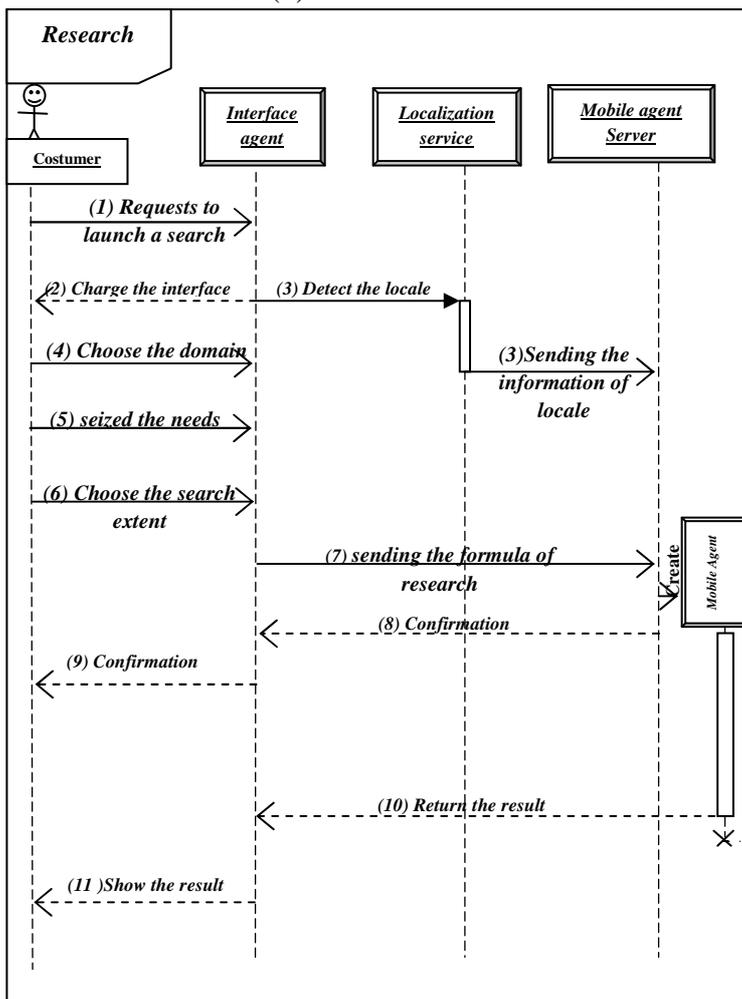
mobile agent and integrates this information into this agent, this last will migrate towards the system server.

- When the mobile agent moves and leaves the area of mobile phone, the mobile agent server sending a confirmation to the interface agent who indicates that the search is started (8);
- In the same way, the interface agent confirms to the customer that his search is in-progress (9);
- After the mobile agent returns with the result it sends to the interface agent (10);
- The interface agent shows the result to the customer (11).

The **Figure 2** shows the steps of the sequence diagram of the research.

### 3.5.2.2. Sequence Diagram of server

- Once the mobile agent is moved towards the server, it's sent to the manager agent the research domain and the current area of customer (1) and (2);
- The manager agent will extract the providers' addresses of this domain in this area (3);
- The manager agent requested from the mobile agent to him sending the customer needs (4);
- The mobile agent sending the customer needs (5);
- The manager agent sending providers addresses of sites and the customer needs formula for the mobile agent server (6) (7);



**Figure 2:** The sequence diagram of the research

- The mobile agent server creates a mobile agent and integrates the customer needs into this agent, after it clones this agent with the number of providers and integrates in each agent an address of a site (8);
- Once a mobile agent moves and leaves the area of server, the mobile agent server sending a confirmation to the manager agent, which indicate that search it started (9);
- In the same way, the manager agent confirms to the mobile agent that a search is in-progress (10);
- After the mobile agent returns with the result it sends to the manager agent (11);
- The manager agent sending the result to the mobile agent (12).

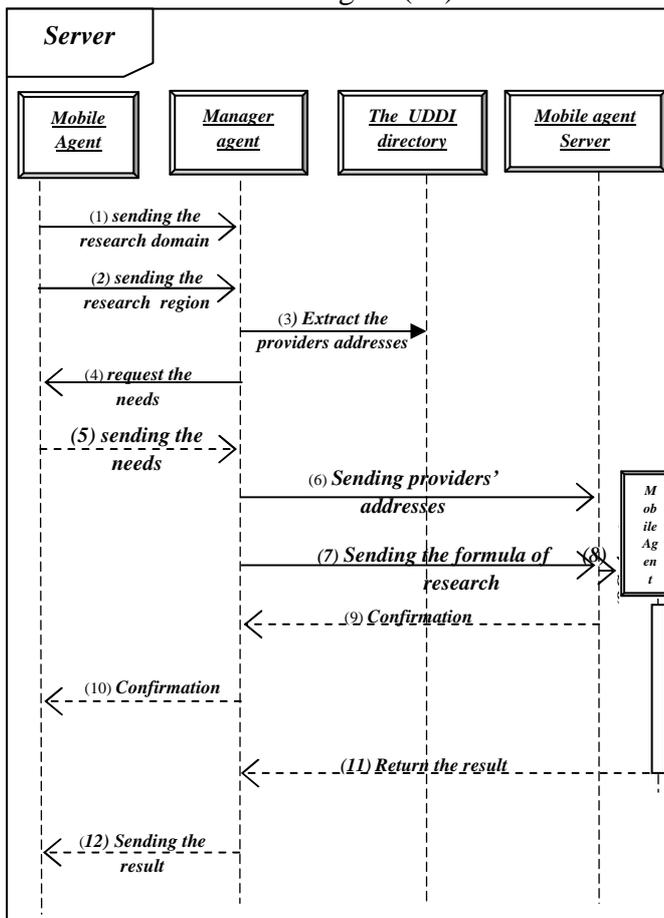


Figure 3: The sequence diagram of server

The **Figure 3** shows the sequence of these steps.

### 3.5.2.3. Sequence Diagram of site

When the mobile agents of server migrate towards the providers' sites, they communicate with the interface agent of site. Each mobile agent sends the needs of the customer to the interface agent, this agent it passes to the research agent. In the end, it recovers the result and returns to the server.

These steps are described in the **Figure 4**.

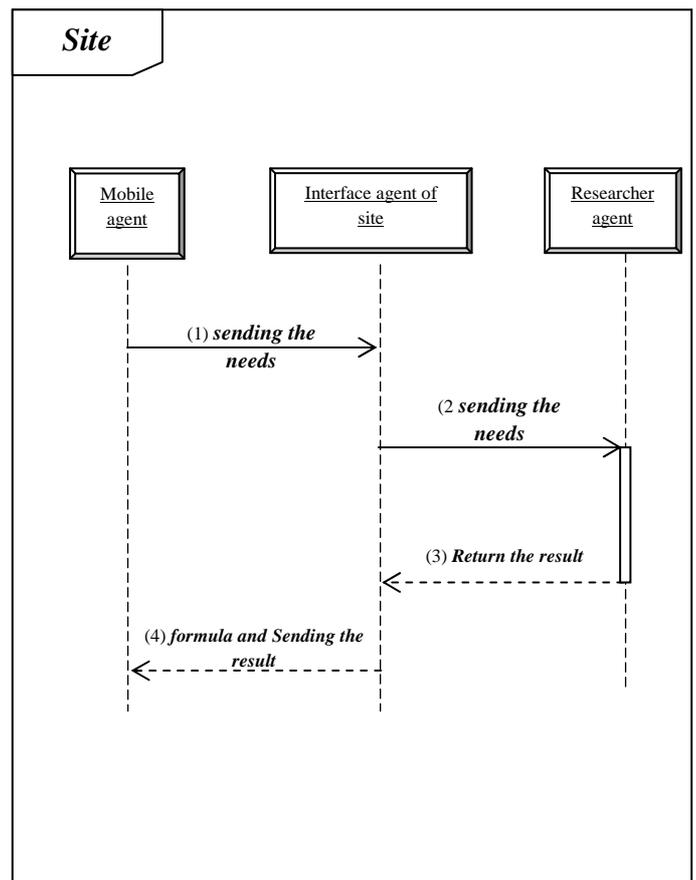


Figure 4: The sequence diagram of site

## 4 RESULTS

### 4.1 Development tools

#### 4.1.1. The Aglet platform

Aglet is a platform specified for the development of mobile agents, the original of this platform is the research group of IBM research laboratory in Tokyo in the early in 1995, its aim is to provide a uniform platform for the mobile agent in a heterogeneous environment such as the Internet, and to provide a better security.[14]

In our study, we used Aglets in the server part and the websites part, because Aglets it has specified in mobility than the other platforms, with this for the use of the advantages of the mobiles agents, where the mobile agents offer several advantages improving the performance of distributed applications. This improvement can be resumed in:

- The reduction of the network traffic;
- The dynamic distribution of charge;
- Surmount the latency of the network;
- Encapsulation of the protocols;
- Asynchronous and autonomous execution;
- Heterogeneous;
- Robust and tolerant with the failures and;
- A simply in the ability to continue the interaction with a user on a disconnected network. [07]

#### 4.1.2. JADE LEAP

With the end of 1999, a group is created to develop a platform conform to the standards of FIPA that can be used on the mobile device. In early

2000, a project named LEAP (Extensible Lightweight Platform Agent) is created. His original goal is the creation of a sufficiently middleware for the supports which having constraints with their resources. These constraints allows of selected the platform JADE like a basic platform and modifies certain parts of the kernel, at the end of this work they get an extension of JADE called JADE-LEAP. [01]

Because the aglet is heavy and we cannot use in MIDLet, will be using the JADE-LEAP in the mobile part.

#### 4.1.3. J2ME

Sun has proposed several platforms for having application development on machines of the resources reduced like Java Card, Embedded Java and PersonnalJava.

In 1999, Sun proposes to structure of these various platforms under name J2ME (Java 2 Micro Edition) for the mobile devices and embarked.

The main components of platform J2ME include in particular the configurations CDC (Connected Device Configurations) and CLDC (Connected Limited Device Configurations), profiles MIDP (Mobile Information Device Profiles) as well as different tools and technologies with the Java solutions intended for the market of the mobile device. [12]

#### 4.2 The scenario unfolding of a customer command

In this section, we will do a case study; this last is abstracted as follows:

We will create four '4' providers of materials computing (we specify the sale of the portable computers which abbreviated by "PCP" and of the office computers which abbreviated by "PC", two providers are localized in a place "1" (for example Biskra) and the others in the place "2" (for example Batna).

Each provider posed on his site the type, the mark, the name, the characteristics, the maximum price and the minimum price of each product.

The customer holding a mobile phone or a PDA, which is simulated in our case by MIDLet. He is login or register in the system and after he started a search.

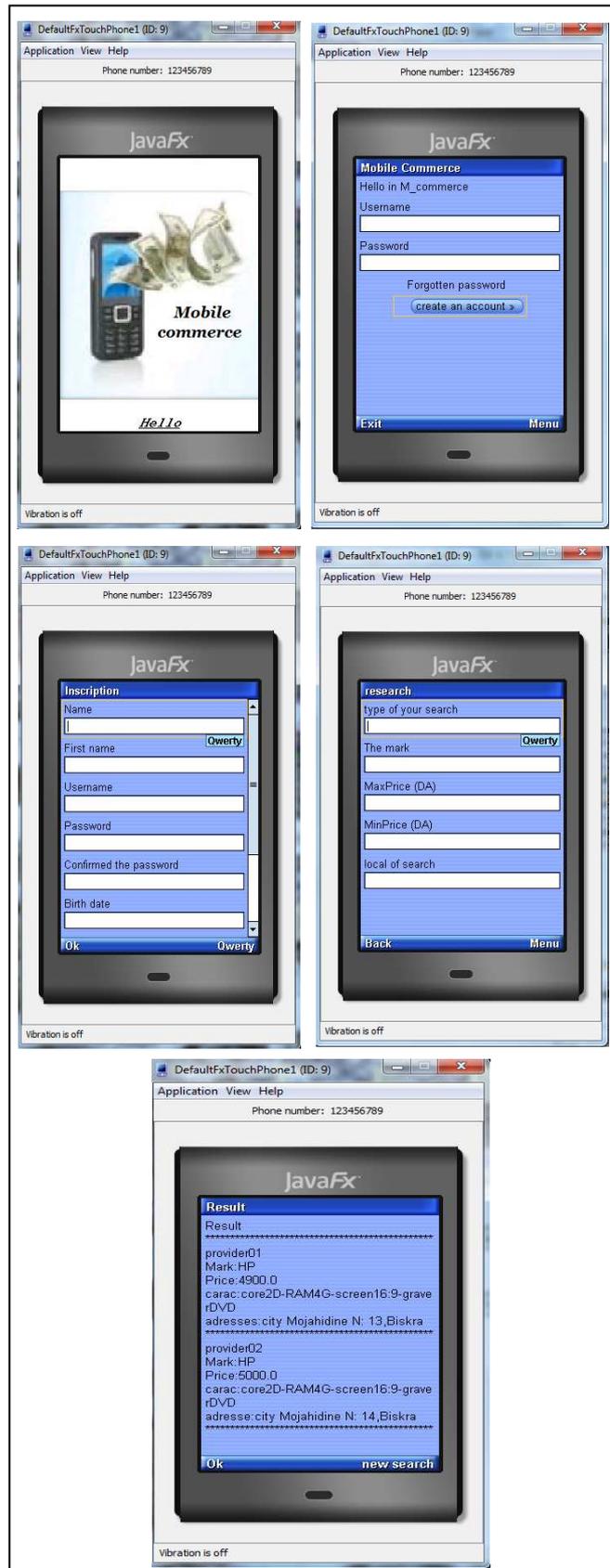
### 4.3 System Interfaces

The first interface is the user interface. In this interface, the user filling the fields by the necessary information's (the type, the product, MAXPrice, MinPrice and the local of search). After filling it in the fields, the customer launches a search and waits the result.

However, a mobile agent migrated towards the server with the request of customer. The application displayed an interface of waiting, this last show the message "please wait..."

After the return of the mobile agent with the result, another interface appears and shows the search result.

The following figures illustrate that:



**Figure V:** System interface

## 5 CONCLUSION AND PROSPECT

In this article, we discussed in the mobile commerce field and the use of the mobile agents in the development of this field.

The mobile agents offer advantages such as autonomy, mobility, flexibility, adaptability, robust, collaboration, and portability and omnipresent, all that allows of minimized the use of the connection between the mobile customer and the data server, and that which allows of reduces the consumption of the bandwidth and the latency time.

The deployment of the mobile agents in M-commerce can reduce the useless network traffic, tolerate with poor network connectivity, provide more advanced services, automation of the making decision support, reduce the costs of participation and improve the effectiveness of negotiation.

In this article, we are citing three works on the mobile commerce and specified their objective and their architectures.

In the section II, we present an approach of mobile commerce based mobile agent design and making its modeling by the AUML.

After we citing the results of our case study, which makes it possible a customer to make a search for a product in a place determinate and recovers all information necessary on this product without requires visiting all providers.

However, the difficulties put by this approach; we hope to solve them in another project like prospects:

After the customer receives the result it passes to the mobile payment where it can buy his product by their mobile device, which has a barcode readership.

With that, we can improve the security and the negotiation methods of the mobile agents with the sites agents for obtained the best results.

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