Proposing a New Architecture for Mobile Information and Consultation Support Systems

MORTEZA MOSAVI and MAHDI JALILI-KHARAAJOO
Islamic Azad University, Arak Branch, Arak, Iran

Abstract: - Access to the real-time information and consultations, irrelevant of their complexity, focused on exact needs and independent of location are essential factors to all busy people, specifically businessmen and specialists nowadays. In this paper, we present a new m-service concept, which could be employed as a very widespread commercial service among people holding any kind of mobile devices. To implement, we propose a model consists of front-end, a GUI receiving user's commands and requests through his/her mobile device and back-end, a database-support expert system, provides the expected services to users. Due regard to the nature of the m-commerce, this model should be enriched by an encrypted authentication level, also a method to determine the precise geographical location and local time of users. Predictive and situation-sensitive information and intellectual and self-tuning consultations are the most concerned services could be served. From the architectural point of view, the proposed system has a layered model, each rely on the service that its sub-layer provides and completes requests come from its super-layer. This model is formed by a five-layered architecture, namely Physical Communication (PC), Data Control (DC), Knowledge Management and Data Base (KMDB), Intelligent Process (IP) and User Interface (UI), respectively. We call this system: Mobile Information and Consultation Support System (MICSS).

Key-Words: - Services for 3G+ Networks, Mobile e-Business, Mobile information systems, Intelligent Services, Knowledge-based Consultant Systems, Expert systems, Decision support systems.

1 Introduction

Since about 30 years ago, Decision Support Systems (DSS) [1-4] and following those, Expert Systems (ES) [5-8], have joined other human beings' interactive auxiliary systems. Although, at first, those were just some means to access a large amount of information and representing them in a favorite style, nowadays developing predictive and learning algorithms and their applications in these systems have made them as a decision-making or solution-provider tools [9]. High impact of these systems on today's communities is such an impressive fact that we will see their foot prints in almost all vital and strategic applications, including business areas [10,11].

Along with this rapid growth of DSSs and ESs and contribution of Web and Internet into the daily life, some new tools, mainly Search Engines and Web directories have possessed important roles in providing solutions and classifying of information [12-14]. Today these services have such a great usage that statistics shows an average of four hits per each user internet connection period.

From a general functional aspect, these two groups, decision support systems and expert systems in one side and search engines and web directories in other side, despite their universality and comprehensiveness, have some differences [15,16]. Although these tools usually work on information stored in a base and after performing some processes, make them ready to be represented in a desired format, they do their job in various scales [17].

Decision support systems and expert systems usually work on a relatively limited- in comparison with a huge data base- Knowledge Base (KB) rather than a Data Base (DB) and have relatively large processing operations [18-20]. These systems have the capability of self-inserting and self-correcting of information housed in the knowledge base. In other words, the facts or rules inferred or concluded from available facts and conditions, could be added to the knowledge base automatically without any contradictions or inconsistencies. In the other hand, search engines and web directories usually work on massive data bases, which could not be updated automatically as a result of processing, unless some special software like Web Spiders do that job for it. Intelligent and intellectual processing functions in these systems are relatively smaller than those of members of first group. In second group much of processing time will be spent on tasks related to searching, categorizing and sorting information.

Beside these electronic services, developing of wireless communication services, especially mobile networks and devices and also intercommunication of wired and wireless systems, makes it necessary to have similar services in wireless networks same as in wired ones [21]. Here, a question would rise: while interconnection between wired and wireless systems is possible and practicable, why it is necessary to have such a dedicated services for wireless systems themselves? The answer covers many fields of interest and attention. Specifically, providing such a service for mobile users makes it possible to use effectively from mobile-related services like ones which estimate geographical location and local time of users precisely or others rely on the fact of mobility of agents. Knowledge about these valuable information describing users' situations will lead to query results, which are narrower in nature and are nearer to the exact user's needs [22]. Due regard to this essential necessity, we have proposed a new mobile service in this paper, which we have called it Mobile Information and Consultation Support System (MICSS). As its name suggests it is a combined system, consists of an expert system and a web directory. It acts like a mobile expert system while a subscribed user request it for a consultation-like task and acts same as a web directory when it is asked to retrieve required information in its raw format without any intellectual modification.

The rest of the paper is organized as follows: in Section 2 functional and architectural model of MICSS will be described. In the same section, MICSS is represented as a five-layered system. Section 3 presents various scenarios about system operations and services. Finally, the paper is concluded in section 4.

2 Functional and Architectural Model

For this system, we have proposed a distributed model, which could be employed as both Customer-to-Business (C2B) and Customer-to-Customer (C2C) relationships. Our model will consists of a number of mobile information servers, distributed around the service-coverage areas. These servers, to minimize the amount of traffic and overload costs, will be synchronized and updated just in special intervals, during off-peaks of the network utilization and consumption. On the other hand, prospective users, holding any kind of mobile devices like PDAs, Notebooks or Cell- phones will be granted access to the service after subscription, which would be in lieu of paying an annual membership and a charge that could be in the form a fixed monthly charge or dependent to the amount of generated traffic (band-with occupied) by user during previous month. By subscription, each user will be received a valid ID and Password, which could be changed later. That is by these entities that each user authenticates to the system and will be got permission to enjoy its diverse services. Other point of view is that MICSS will support user-classification and access levels. Each user according to his/her user class and its privileges will be eligible to access just some sort of information and perform some kind of consultation depends on its complexity and diversity. Regularly in this manner, privileged users will pay more than normal customers.

From the architectural point of view, this system has a layered model, each rely on the service that its sub-layer provides and completes requests come from its super-layer. This model is formed by a five-layered architecture, namely Physical Communication (PC), Data Control (DC), Knowledge Management and Data Base (KMDB), Intelligent Process (IP) and User Interface (UI), respectively. Each layer has its specific responsibilities in the system and has its own interfaces to layers bellow and above it. Fig. 1 shows the schematic diagram of the proposed architecture. From the time a user initiates a request, it has a relatively long way through these layers, until it reaches the transportation medium, which in mobile networks is air. At source side, each layer receives a massage from its top layer. After performing some processes and probably adding some extra information or notations, passes it to the bottom layer. At destination side the information stream will be directed through a reverse dimension from down the model up to the top of it. After, in this paper we will see that, due regard to the very flexible nature of the system, each information or consultation server or client (user's mobile device) could play the role of source or destination and may initiates a request to a server or client-side.

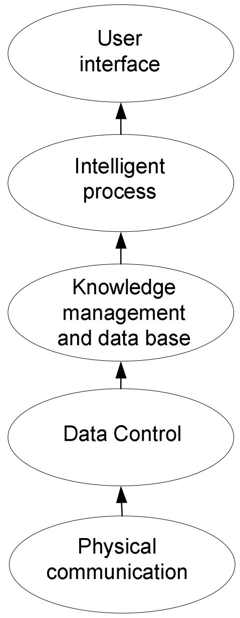

Fig. 1: The proposed architecture.

2.1 Communication Module

This module is responsible for tasks related directly to the physical representation and transportation of data between system's elements and through network medium and will serve addressing, Traffic Control and Congestion Control functionalities.

2.2 Data Control Module

This module performs structural and foundational activities, which are vital for the stability and security of the system. Any Imperfections or defects in the activities covered by this module will lead to inconsistency and vulnerability of the system, while remaining of the system in a stable and secure manner depends highly of the tasks performed by elements of this module.

User Authentication, Access Level Control, Error Control and Recovery, Redundancy Check, Data Coding (Encryption), Data Decoding (Decryption), Fragmentation and Reassembly and Data Compression are some of most important activities of this module.

2.3 Knowledge Management and Data Base Module

This Module will be mostly interacted with the information bases-including data bases and knowledge bases. Management, consistency check, synchronization and recovery of databases and knowledge bases available in system are most sensitive roles of this module.

2.4 Intelligent Processor

This module will handle most of intellectual and processing tasks, directly related to the user's request. This module will form the main structure of the expert system and web directory will build up the system. Respect to this fact, Intelligent Processor will serve most critical and vital activities related to the functionality and responsibility of the system. Utilization of high performance and efficient algorithms and modules is definitely necessary to build it. Data gathered from GIS, satellites and other information sources when combined with data retrieved from search engines or even decision support systems will really help system to absorb user trust and attraction, shortly satisfy user.

2.5 User Interface

Last module of MICSS is its User Interface, commonly in the form of a Graphical User Interface (GUI).This interface capable user to effectively interact with system and enable him/her to issue desired demands and receive responses and reactions from system in a preferable format and design. UI provide some useful scrolling windows, menus or lists through user's PDA or other mobile devices.

3 System operations and services

Many m-services can be supplied using this system. It depends on any vendor or provider that employs some or whole parts of the system. Irrelevant of specific services or functionalities that could be joint MICSS, there are two main activities each MICSS-based system should support. One is its capability to search for specific information using guidelines or keywords the user enters, classify and sort them and finally represent them in a satisfiable format [23]. Procedure of searching and information categorizing may vary from a very simple and straight forward search and retrieval from an indexed database to a very complicated content-based and pattern matching search using complex and efficient algorithms. It is completely up to the provider's strategies that how its Quality of Service (QoS) is. By the way, future world-wide usage of this system makes this opportunity for customers to find their desired QoS and pay exactly in accordance to what they really expect- in this manner MICSS is categorized as a Pay-per-Performance service.

The second main functionality of every MICSS-based system is its capability to act as a consultant or decision making agent. Equipment of MICSSs by powerful and hi-tech expert systems make them available for any customer requires interact with a expert agent and get help to solve his/her problem or ease the task of choosing a solution among many, which could be called decision making. Nowadays Expert Systems have proved their great effect and impression on almost all fields of human life including consultation, business, management, finance, attorney, health, engineering, design and so on. As the matter of the fact that mobile systems suffer from lack of such a broad and effective service, implementation and developments of MICSS-like systems is an imperative and indispensable effort. Depend on the complexity degree and comprehensiveness of the expert system, the user intends to interact to, he/she should pay accordingly. This is another vision of being a pay-per-performance service.

As other constructing parameters of the system, we could mention its access levels and also operation modes. MICSS have some predetermined levels of user access. There is no need for every customer to be able to access any kind of information or perform any form of consultations. It truly relies on pay-per-performance strategies and security considerations involved in the system. For example, sometimes security observations assert that some information or knowledge remain hidden for the view or access of some particular users. In parallel to this policy, there would be provided some certain and distinguished supervising channels for users able them to insert, remove or modify system's information or facts.

System Operation Modes are its another important property. The system depends on the type of communication and interaction initialized between its elements is said to work in one of Customer-to-System (C2S) or Customer-to-Customer (C2C) modes of operations. In C2S mode, user will communicate directly with automatic system resources and ask them perform some tasks for him/her. In this mode other customers interacting with system at the time user's request generates are not absolutely aware of existence of such a request. In other hand, in C2C mode, there would established a communicational environment between numbers of system's customers common in two conditions; having some common properties, senses or goals and being available and free at that specific time. The user tries to solve his/her problem or gain his/her information by interaction with this communicational environment's partnerships. Existence of the later mode is necessary to comprehensiveness of the system due regard to the fact that there are many facts in customers' brains while not in system's bases. This policy guarantees maximum access to customers' information and it is that we seek for.

In following two sections we describe the system in a more detailed aspect, through two applicable and realistic scenarios may occur for any person lot of times during his/her duration of life.

3.1 Scenario 1: Information view

Suppose that you have traveled for the first time to a country, whose majority of people does not understand your speaking language. It's now around 2 P.M. and you are enjoining riding in quiet and gentle road connecting two cities with the second one as your final destination. Your map shows a distance of about 100 miles to your destination. Suddenly your car goes out of working properly and hence you ought to stop it. Your map does not give any useful information about nearest round-the-clock gas station or hotel or at least direction leads to the nearest one. From the only few cars passing that road at that time, just a few stop and due regard to communicative problems arise; no one could help you safely. At this circumstance, you may imagine what if I could exactly be informed of my position and the best way can release me from this trouble. Don't worry! You are taking your cell phone with yourself, which is equipped with MICSS. You should just connect to the system and request your information. The system will do the rest. The system will first try finding your desired information using its distributed servers, contacting with each other. As we mentioned before due to communication limitations, information stored in different servers may not be exactly synchronized and hence it appears servers should communicate with each other. Two situations may occur; either the system could find useful information related to the user's exact needs and relevant to its geographical location and local time, which have been included in the request or the system is not able to satisfy user expectations. In the second case, the system suggests the user to enter to C2C mode, asking his/her questions from his/her partnerships in C2C mode. In this situation, system will post the user's request to all customers, who are available- as users may pose different modes on their behalf- and that time and have not turned off their mobile devices. In addition, it is also possible to preserve a up-to-time archive from posted massages and keep track of them by the system, and send them whenever a user changes his/her status from offline to available or even turned on his/her mobile device. Despite of any way massages are broadcasted, every user receives one and knows something useful related to the question or could help or support the request generator, will accept a direct or indirect, unidirectional or bidirectional communication through system resources with the source of the request and will contribute him/her in any exigency manner possible.

3.2 Scenario 2: Consultation view

Suppose you are as a specialist, manager, project leader, team header, business advisor or even a counselor have taken part in a very important official session, organizational conference or formal meeting. Your responsibility is to proof your opinion, make a vital decision, find or replace a critical solution, refute a week or deficient theory or support your idea. Due regard to the fatal and destructive condition which is dominant on session, you have very hard and complicated task to first control the discussion in the way you prefer and second make a right decision. Under these circumstances you wish to have an intellectual and smart accompany or companion to support you and help you by suggesting suitable solutions and right decisions. Notice that, in the above situation you do have not only enough time to concentrate on every aspects of a problem but also required information taking with yourself.

MICSS will serve its intellectual functionalities in these areas very well. While the session is continuing, you could connect to the system, ask him to help you, make decision or even review some useful historic or statistical data related to your unanswered problem. The system does this job with its DSS or ES. After authentication, you will gain access to the ultimate intelligent power of the system, which is strengthened and consolidated by its huge amount of data in its knowledge base. By doing that you would solve your precarious problem with least human's interaction, which is infected by fault and defect and also more observable and noticeable, you have done it in minimum time, cost and effort.

The functionality of system described earlier was its C2B view. You may also advantage its C2C mode as you might do in the first scenario. In this manner the system will provide you with an intensive Virtual Tele Conference (VTC), by which you could contact many other customers of the system and consult with them or just get more familiar with their opinions and ideas and apply their guidelines through your purpose. In this case you positively prefer those who are known to you and you know their positions and specialties more over. However among those you will contribute with them, there is luck of being a real professional consultant, top-level manager or even a live expert- in comparison with an expert machine. This chance will certainly increase due to rapid growth of the system and its future broad use. More valuable among all, you will access to others' experiences and knowledge without even pay for it or carry their expectancy. Beside all these advantages, using other's experiences will face you to their depravity or aberration and you may also encounter situations when you have given inconsistent or conflicted solutions to a unique problem from your contributors and it is all to you to choose or reject them and find your best answer between them. This fact is extremely dependent on the honesty and truthfulness of your participators in the VTC. That is by these considerations that C2S mode is preferable to C2C mode in the expert system viewpoint of the MICSS.

4 Conclusion

In this paper, a new architecture for mobile information and consultation systems, namely, MICSS is proposed. Access to the real-time information and consultations, irrelevant of their complexity, focused on exact needs and independent of location are essential factors to all busy people, specifically businessmen and specialists nowadays. The proposed architecture presents a new m-service concept, which could be employed as a very widespread commercial service among people holding any kind of mobile devices. To implement, we propose a model consists of front-end, a GUI receiving user's commands and requests through his/her mobile device and back-end, a database-support expert system, provides the expected services to users. The proposed model is formed by a five-layered architecture, namely Physical Communication (PC), Data Control (DC), Knowledge Management and Data Base (KMDB), Intelligent Process (IP) and User Interface (UI), respectively.

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