

Intelligent Agent based University Search & Admission System- Android Environment

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Abstract: While the Internet has already brought us humans together in new, exciting, and unexpected ways, the same is also happening to our prevalent adoption of digital mobile devices that has paved the way for the development of many innovative applications in the commercial domain. The framework of M-commerce provides services like Mobile ticketing, Mobile banking, Mobile location based services, Mobile auctions, Mobile purchasing. The possibilities and opportunities are endless when considering mobile devices, as a universal device for mobile commerce applications. In employing such an application to choose an educational institution for higher education, we generally want to choose the best Universities with quality of overall teaching, modern facilities and resources, publications/research interest, student feed back, funding for courses, clean environment and affordable rates. These tasks can be humanly time consuming and sometimes costly even with the event of using human agents. So based on these challenging tasks we hereby propose “Intelligent Agent Based University Search and Admission System”. This system would employ the use of an intelligent agent (as an alternative to the human agent) to perform similar search and admission activities that would improve the speed of the search and reduce cost considerably. The development of agents will be base on using fuzzy preference rules and heuristics, to make accurate decisions based on the user’s criteria or specifications. The implementation would be carried out using JADE-LEAP agent development kit on Android 2.2 handset

Keywords: M-commerce, Agents, JADE-LEAP, Android 2.2

I. Introduction

How often have we heard the cliché “education is the key”? Today’s world has seen a vast influx and birth of University institutions that has flooded the internet or the World Wide Web (WWW) some of these so called Universities lack accreditation and credibility and some are online scams that captures unsuspecting applicants credit card information. Jamaica is by no means exempted from these phenomena. Over the years several sites and admission systems have been developed to assist in the search and application to universities for individuals, however these systems generally require the applicant to do the bulk of the searches and application. Students often find this to be a time consuming exercise, and also frustrating at times. But with a mobile

commerce technology using Agents[1][2] these vulnerabilities can be adversely and greatly reduced. Mobile Commerce search Agents can be used to verify and validate an accredited University with in the applicant’s geographical location. Once a university name or names are obtained, the agent automatically sources the information from accredited government and regulatory bodies’ databases and websites in that countries locality to ascertain the validity and accreditation of the named university body. After gathering this information the average person can then do a comparison and make an effective selection. Based on the applicant preferences and selected choices the mobile agent can facilitate applying for admission. With these phenomena in mind we have developed an “Intelligent Agent Based University Search and Admission System” that will undertake the greater part of the search and university admissions for the various users. The implementation would be carried out using JADE-LEAP on Android 2.2. The remainder of paper is organized as follows. Section II talks about Existing University Ranking and search system. Section III gives the details on Intelligent Agent based university search and admission system with algorithm. Section IV is implementation using Android 2.2. Section V is conclusion and future work.

II. University Ranking and Search system

There exists lot of websites like webopedia which gives the list of universities in the country. But everyone wants to know how good the university is and what is their review like by other people. Also there exists many ranking system like QS ranking, ARWU ranking and Times higher education[5] which ranks the universities in the country based on certain factors like academic peer review, faculty student ratio, international faculty, international students, citation per faculty and so on[3]. But to get access to this information the user has to perform Google search. But there is no such system exists where ranking is based on feedback from the student in

addition to the one reported by the university and is accessible from mobile device.

A. Agent Based Applications

Since the introduction of software agent technology more than a decade ago, there has been a lot of discussion surrounding a proper definition of the term agent. An autonomous agent [4-8] is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future. The properties of an agent include being reactive, autonomous, goal oriented, temporally continuous, communicative, learning, mobile, flexible, and character. Agents were classified based on the subset of properties they possessed [9]. The classification of agent in this research is interested in is the mobile agent. A mobile agent is an autonomous program that can move from machine to machine in a heterogeneous network under its own control. The mobile agent can suspend its execution at any point, transport itself to a new machine, and resume execution on the new machine from the point at which it left off. On each machine, it interacts with service agents and other resources to accomplish its task, returning to its home site with a final result when that task is finished. Agent toolkits provide a platform for developing agent applications, or they may provide an environment in which an agent developer may run, monitor, analyze, and test agent applications. A number of agent toolkits are available, e.g. IBM Aglets, Fargo, JADE etc., to name a few. For the purpose of our research the most suitable toolkit viz., the JADE (Java Agent Development) toolkit [10], has been utilized since the system developed has to run on mobile devices, which include mobile phones and personal digital assistants (PDAs). This being the case the ANDROID 2.2 [11-12] language using CDC will be used along with the LEAP (Light Extensible Agent Platform) add-on for JADE. Taking these into consideration we now explain the Intelligent Agent based university search and admission system where agents would be utilized for searching the university, making selection based on the review and applying from user's mobile device which is unique and first of its kind.

III. Intelligent Agent based university search and Admission system

Normally when we want to choose an education institution for higher education, it becomes a challenging task. Many educational intuitions claim being the best in many departments like facilities, resources and so on. Also there exists many ranking system as discussed before which ranks the universities based on the information from the university only and not taking into account the feedback of the student. Also people prefer to join the institution from word of mouth. Taking these aspects into consideration, we here developed an intelligent agent (instead of the human being agent) to perform the same search operations. Mobile agents have recently gained considerable attention in the area of computer science like m-commerce, e-commerce, Telemedicine and so on which

is evident from literature[1][2]. In our research, we would propose to move the agent from one educational institution to another based on user's input and get the details on the list of available courses, price, and feedback from students, student output, and research output and feed that to the user's mobile device similar to what a normal human agent would do. But due to the fact that the University Council of Jamaica databases holds the data needed we would prefer to propose moving the agent to the UCJ databases and get the data detail lists.

We here have developed four agents- Search Agent, Database Agent, Admission Agent and Feedback agent. The university search Agent which is simple Reflex Agents has been developed using LEAP which is an add-on of JADE. It has been implemented on mobile devices which the user possesses like the mobile or smart phone. It accepts input about the university search like the type of university, Location, price, star rating and so on. This agent gets connected with the Database Agent and retrieves the information about the university based on search criteria and returns the data to the user on his mobile device.

The Database Agent which is model based Reflex Agents registers with the Directory facilitator which is like the Yellow pages. It queries the directory facilitator to find the list of registered university Agents. It holds information about every university like location, price, facilities, university rating information like student output, Research student output, publication, placement; student rating information - Customer service, Environment, facilities, infrastructure, price, security etc. Also feedback about the university is also stored by the database agent for ranking the university. This agent also updates any changes in the university website which is intimated by the university Agent. Ranking information is managed by database agent to avoid misleading information. This has been developed using JADE. The University Agent manages the university web site which publishes details like facilities it provides, location, price, star rating etc. The university Agent has also been developed using JADE.

The Admission Agent is a simple reflex Agent initiated once the user selects the appropriate university and applies to the university. Once applied, the university Agent sends the confirmation to user's mobile phone. The Admission agent has been developed in LEAP on the user's mobile device. The Feedback agent is a simple Reflex agent also developed in LEAP on user's mobile device for giving feedback on the university. This can be given only by the students who have studied and graduated and not by everyone which gets recorded in the university council database. These details are shown in Figure1

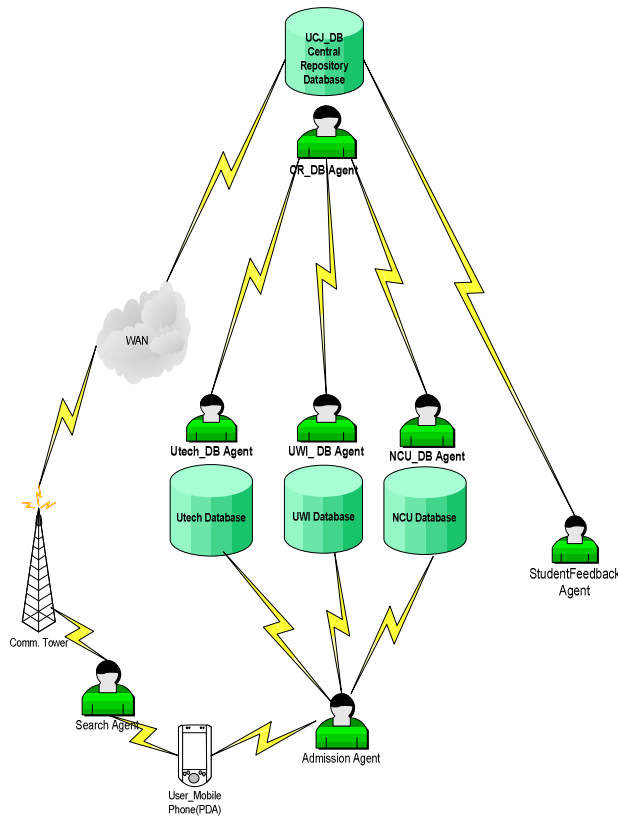


Figure 1. Intelligent Agent University System

A. The Algorithm

Based on the architecture explained above, we will now present the algorithm used in our development.

- Users enter search criteria on GUI from mobile device and submit request.
- The search agent that resides on the mobile device will be launched and pass request to Database Agent (DA) with the search criteria like Star rating, location, parish, fees, Discipline, facilities, programme offered etc.
- The DA will now match the search criteria and return the list of universities to the user's mobile phone as follows:
 - *If a university is available for lower fees with exact or closest matching of facilities in the same or different location or parish*
 - *If a university is available for the fees specified with exact or closest matching of facilities in the same or different location or parish*
 - *If a university is not available within the fees, it finds a university above the maximum price by say 10, 20 or 30% more than his/her maximum price with exact or closest matching of facilities in same or different location or parish*

- *If no universities available within the fees or so, it finds a university with the facilities for any fees in same or different location or parish*
- Upon selection of the university, admission agent will now forward the request to a Directory Facilitator (DF), that is responsible for contacting with respective universities agent to make an interim admission arrangement
- Once admission is made, confirmation is sent to user's mobile device.

To interact with the system the user is provided with a graphical user interface (GUI). This interface is used to enter the details for locating a university. The details entered are used to query the Central Database Agent, which responds with a list of facilities matching the user details. This information is then presented to the user in a format so that the user may select a facility to initiate an admission. Another user interface is used to accept the details for setting the admission with the University Agent (UA). The University Agent (UA) represents the University, and has the necessary intelligence to pursue the interests of the facility. The UA knows all the details of the facility and uses this knowledge in negotiating with the Admission Agent. It also provides the Central Database Agent with these details when requested. The Central Database Agent (CDBA) is the regulator agent within the system; it has details on all University Agents in the system. This information is used to match against the user details when search for a University is made. The CDBA is not under the control of the University Facilities, therefore it maintains unbiased information on each facility, and also maintains feedback from each user that has used the facility. This information is used for presenting the user with a ranking/rating of the various facilities based on properties such as customer service, fees, security, facilities etc. All the agents discussed above communicate using messages; the messages passed between the agents are FIPA ACL Messages. All the agents in the system are implemented to conform to the FIPA Agent Standards. The conformance of the agents to these standards ensures and guarantees agent interoperability. The fact that this system has more than one agent working together to solve the general problem of searching and admission, means the system is a multi-agent system

IV. Implementation using Android 2.2

The implementation of intelligent agent based University search and Admission system for validation has been done using JADE-LEAP toolkit [10-11]. The Graphical user interface for the mobile phone has been developed using Android 2.2. This enables the user to provide his specifications for the agent to shop around. For our research, we have take few universities and colleges like UWI, Utech, NCC, MIND, MICO etc of Jamaica which has been created in JADE environment as shown below in Figure 2.

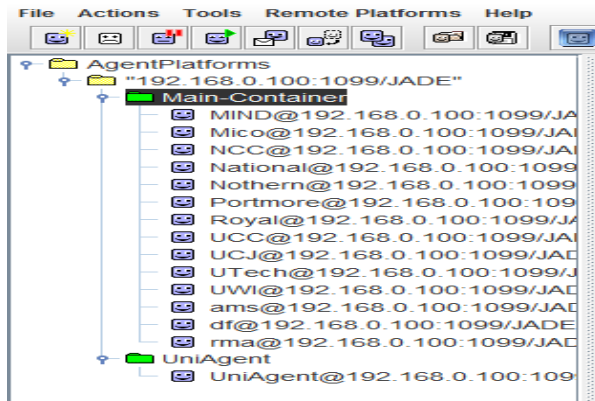


Figure 2. Universities in JADE Environment.

Figure3 shows the user entering the details/requirements of given below to perform the University search.

- parish
- Star rating
- Discipline (IT, Medicine, Engineering etc)
- Degree (Diploma, Bachelor, Master, Ph.D)
- Fees
- Price markup
- Other facilities like Distance, Sports, Research, Teaching, Reading Room, Library, Security etc
- Rating period- 1 , 3 and 5 years

The user is able to select a parish from a drop down list which is dependent on the country selected. In here we have chosen Jamaica only. The user is able to select the star rating, fees, Discipline, Degree etc from the drop down menu. Price mark up option allows the user to specify the maximum fees he can afford. The fees option allows a user to specify a fees range for the facilities offered. The option of any price, which is from \$0 to the highest listed price. The Rating Period option allows the user to specify a range to be used for considering student feedback information. Registered students of the university are allowed to submit a rating of a university service such as Infrastructure, Environment, Education & Research, Fees, Security, Customer service, General Facilities. This information is then used to rate a facility based on rating periods such as one, three and five years. In addition Student output in terms of undergraduate, postgraduate, Research is also displayed with respect to each university too. This information is given by every university to University council of Jamaica who is the authorizing body of all higher education institutions.



Figure 3. User Requirement- Search

The user specifies the criteria like the parish as Kingston, Discipline as IT, Degree selected in All, fees range of \$100-5000 with a star rating Any, price markup None, facilities like distance, sports etc been selected too and rating period of 1 year. The agent here possess the intelligence to retrieve universities with a fees of \$5000.00 with all facilities matched which fits in the price range of 100-5000 with the overall rating in the past year and current rating too as shown in Figures 4a and 4b.

Consider another scenario with the same search criteria mentioned above to search universities with the price range of \$5000-10000 in parish Kingston with a price mark up of 10%. The agent here finds no universities in the price range specified in the parish Kingston for the facilities asked. The agent possess intelligence to retrieve universities with the fees of \$110000 by adding extra 10% in the parish Kingston with the facilities asked for which fits in is shown in Figure 5.



Figure 4a. Search Agent- Results 1



Figure 4b. Search Agent- Results 1



Figure 6a. Search Agent- Results 3



Figure 5. Search Agent- Results 2



Figure 6b. Search Agent- Results 3

Let us consider another scenario for the same search criteria mentioned above. The search agent finds no universities in the parish Saint Elizabeth. The agent now possess intelligence to retrieve Universities with a fees range of \$5000- 10000 and also with a price mark up of 10% in parish named Saint Elizabeth with facilities asked for. The agent possess intelligence to retrieve universities in another parish Manchester with the fees of \$110000 by adding extra 10% with the facilities asked for which fits in is shown in Figures 6a and 6b.

Let us consider another scenario for the same search criteria mentioned above. The search agent finds universities in the parish Kingston. The agent now possess intelligence to retrieve Universities with a fees range of \$5000- 100000 with a price mark up of 20% in parish named Kingston with facilities asked for. The agent possess intelligence to retrieve universities in parish Kingston with the fees of \$120000 by adding extra 20% but with the best matched facilities only i.e. one of the facility say security is unavailable which is shown in Figures 7a and 7b.



Figure 7a. Search Agent- Results 4



Figure 7b. Search Agent- Results 4

Consider another scenario with the same search criteria mentioned above to search universities with the price range of \$5000-100000 in parish Manchester. The agent possess intelligence to retrieve universities with the fees of \$100000 in the parish Manchester with the best matched facilities only i.e. Security unavailable which fits in as shown in Figure 8.



Figure 8. Search Agent- Results 5

Consider another scenario with the same search criteria mentioned above to search universities with the any price range in parish Kingston. The agent possesses intelligence to retrieve universities with the facilities asked for in the parish Kingston which fits in as shown in Figure 9.



Figure 9. Search Agent- Results 6

Now that the search agent has retrieved the universities, the next thing is to register for the University. The admission agent is initiated which prompts the user for details like admission ID which is unique, name, age, Address, e-mail, Discipline as shown in Figure10. Once the details enter the Admission agent is started as shown in Figure 10 which contacts the respective university agent. Once Admission is successful the confirmation is sent to user's mobile phone as shown in Figure 11. If necessary the admission made can be cancelled too which is shown in Figure12.



Figure 10. Admission agent Started



Figure 12. Admission agent- Cancellation



Figure 11. Admission agent- Successful Confirmation



Figure 13. Feedback Form

V. Conclusion & Future Work

For such University search and Admission application targeted on Education industry, we normally employ a human agent to get the details for choosing the appropriate

University. But in such a mobile environment we can employ intelligent agent which can replicate the job of the human being. Also, quite recently intelligent agents have gained considerable attention in the area of computer science which is from literature. With all these in mind we have attempted an Intelligent Agent Based University search and Admission system that searches the universities by getting necessary details, much like a human agent. The University search example attempted here is mainly concentrated towards mobile phones. In this case, the Agent gathers the information about the university and compares them with the user preferences. The Agent here possesses adequate intelligence to search and select a university based on what the user needs. Also based on the university selected the registration is been made. The results of our research have been shown as screenshots. The system can also be extended to include search using Google Earth or so provided in Android to search in the inner locations & parishes and also for other countries too. Also Admission should include the financial information like credit card and so to be given wirelessly to hold the admission made which includes security in mobile payment too. Last but not the least biometric mechanisms towards detection of fraudulent in certificates towards admission too.

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Author Biographies

Suresh Sankaranarayanan received his Ph.D degree (2006) in Electrical Engineering with specialization in Networking from the University of South Australia. Later he has worked as a Postdoctoral Research Fellow and then as a Lecturer in the University of Technology, Sydney and at the University of Sydney, respectively. He is the recipient of University of South Australia President Scholarship, towards pursuing the PhD degree programme and has also bagged the IEEE travel award in 2005. Presently he is working as a Lecturer in the Department of Computing and leads the Intelligent Networking Research Group, in the University of West Indies, Kingston, Jamaica, since 2008. He has supervised twenty research students leading to M.Sc, ME and M.S , M.phil degrees. He has got to his credit, as on date, 40 research papers published in the Proceedings of major IEEE international conferences, as Book Chapters and in Journals. He is also a Reviewer and Technical Committee member for a number of IEEE Conferences and Journals. He has also given Keynote talks in IEEE conferences too. In additions he has conducted many tutorials, workshops and also given Guest Lectures in Networking and Agent Applications in various Universities, Colleges and Research Institutes. Presently he manages a collaborative research programme with Oakland University, Rochester, USA. He also received a research grant from University of WestIndies towards Wireless Sensor Network project towards patient Health Monitoring. His current research interests are mainly towards 'Intelligent Agents and their applications in Wireless Sensor based Mesh networks' used in the Health and Engineering sectors; Applications in mobile commerce.

Leighton Cox received the Bachelor's degree in Computer Science from the University of Technology, Jamaica. He is presently pursuing Master's degree in computer Science since 2008/2009. He has extensive skills in Java, PHP, XML, MySQL, JADE-LEAP and Android 2.2. His research interests are mainly in intelligent agents and Mobile commerce.