Smart Mobile and Context Aware Applications at Science Park

WORKSHOP 3 - STPs and the mobile society

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Abstract - The initiatives associated with innovation would have a great effect on the national economy once an eco-system and effective Knowledge Management have been deployed Choosing the right model for establishing the eco-system plays an important role in maximizing the interaction among all stakeholders who can contribute to the creation of products to boost the knowledge Based-Economy (KBE). In addition, different technologies can be used for making an effective process at all phases of knowledge management. An effective model for establishing eco-system at Science Park has been presented in this paper. Furthermore the use of a smart web and database application technologies for managing these different phases of Knowledge Management would enhance the business process at science parks and improve the productivities at their environments. Different web-based tools have been developed at Riyadh Techno Valley (RTV) to improve the productivity at the working place. The techniques in these tools allow authorized users to easily create and store information, share and disseminate knowledge, interact smartly with other parties, and measure the process effectiveness. In addition, using the web-based database application tools allows finding complete information about any topic smartly, from any location, at anytime. Moreover, the use of these tools allows facilitating the communication between parties at the university and RTV, and improving the productivity for effective process at work. Interactive smart web-based search has also been implemented which has many advantages including mobile access, secure access, backup and disaster recovery, flexible and easy to find information, allowing interactive communication, and scheduling event. This smart software solution is implemented at RTV allows searching for information easily, better interaction among the parties, and makes their working environment more productive.

Keywords

Smart database; business process; knowledge management; web application; innovation

1. Introduction

Effective Knowledge Management (KM) is an important process for handling knowledge which is essential for implementing successful technologically innovative R&D investment projects that can make improvement to the knowledge-based economy. By the mid-1990s, knowledge management initiatives were flourishing because of the wide spread of the Internet. A sound KM depends on its effective

distribution and not only on its efficient production. This can be done through secure Wireless network that has the advantages of flexibility, mobility, easy administration, reducing the information-related risk, and support of security [1]. Enhancing information sharing within university campus has a positive impact on the growth of knowledge content, and the innovative capabilities of the academic environment. It contributes also to increasing the opportunities and chances for new collaboratively improved and enriched basic and applied researches. In fact, the advances in mobile and wireless technology, and new the concept of location-based services (LBS) together with Geographic Information Systems (GIS) has led to the introduction of smart adaptive professional network that is needed to establish a successful eco-system. Moreover, in addition to mobility, adaptability, flexibility and smart search, users can interact with others through the same interface solution that would make the communication among the stakeholders more effective. The accelerated rapid development of wireless network and mobile computing technologies which is the driver for providing mobile information services has become the hot research topic. In particular, location-based services (LBSs) on mobile devices can convey location related information to individual users, thus helping users to obtain helpful and adaptive information [2].

The study of the KM literature revealed that IT is used pervasively in organizations, and thus qualifies as a natural medium for the flow of knowledge [3]. Kamal at [4] stated that IT infrastructure integration and knowledge management (KM) share communal objectives e.g. to transform organizations into more effective and efficient, agile and innovative, and more responsive to market changes. Frank at [5] presented a novel web service based on a dataset specifically designed for receiver operating characteristic (ROC) analysis and the investigation of alignment quality. Chen at [6] examined how web-based integration and procedure question prompts differentially affected students' knowledge acquisition and ill-structured problem solving skills, particularly in representing problems, developing solutions, and monitoring and evaluating a plan of action within the social science context. His findings showed that the presence of an integration prompt alone is not sufficient to support successful ill-structured problem solving unless a procedure prompt is provided. Peredo at [7] described a set of integrated tools to build an intelligent Web-based education system. Holze & Ritter at [8] described an approach for creating a database system (DBS) model, which serves as a knowledge base for DBS self-management solutions. Vahedi & Irani at [3] addressed the issue of the capability of information technology to help the growth and the sustainment of organizational knowledge. They pointed out that the information technologies best suited for this purpose should be expressly designed with knowledge management in view.

In next section the effective role of technology in KM is covered.

2. EFFECTIVE ECO-SYSTEM FOR KNOWLEDGE BASED-ECONOMY

In order to establish an eco-system for KBE at Science Parks, a proper model describing the role of each party and the interaction among them need to be structured. The innovation opportunities at the universities would be enhanced with the right collaboration and partnership between private research companies and government research institution nationally and internationally. This can be done through the establishment of science park eco-system which has main role of coordination and synchronization among its stakeholders and the university research sectors as well as external private research companies and its tenants. As shown in Figure 1, the Research and Business Development (R&BD) at technology park manage the collaboration between university research and innovation centres with external research organizations in order to maximize the opportunities for creating product for KBE through the support of Science Park programs that include Incubators, IP and

transfer of technologies, entrepreneurship, and financial support through investment office.

Figure 2 illustrates the role of R&BD at Technology Park by getting and evaluated the innovative ideas that have been developed at different parties including Personal innovation, Innovation coming from international and national R&D, innovation coming from the universities research and innovation centres, and innovation coming from tenants of Science Park. Some of these innovative ideas require further development technically that can be done through incubators. Then the role of Incubators is to prepare the innovation into the product phase with the help of IP and transfer of technology, and entrepreneurship program. Once the innovation becomes mature by creating a product prototype model, a Due Diligence would be done by the investment office to support this innovation through start-up companies as shown in Figure 3. Some innovation opportunities coming to R&BD Technology Park have already progressed toward product maturities at the initiator side and can be supported directly by the investment arm to develop a new research centre or start-up company at Science Park. As Shown in Figure 3, there are three phases for the innovation which are innovative applied research where the innovation would be created by initiators (Personal, R&D, innovation centre). The second phase is commercialized project phase where R&BD at Technology Park would assist Initiators to advance their innovation with the help of Science Park parties that include incubators, IP and Transfer of Technology Office, and Entrepreneurship office. The third phase is start-up's company and partnership phase where graduated projects from the incubators would be supported by the investment arm of Science Park to invest in the successful innovative projects by creating a start-up company or through selling the innovation to existing companies or through partnership model with existing companies.

Next sections present the technological infrastructure proposed and developed at the RTV to realize effective coordination and integration of the above innovation entities.

3. TECHNOLOGY AND EFFECTIVE KNOWLEDGE MANAGEMENT

The use of technologies that provide easy access to users and managers would enhance the KM processes. In order to improve the productivities at Science parks, smart software web-based application tools would make finding information done in a short time very effectively. In addition the web-based application developed at RTV would improve the productivity through executing a smart search that is based on user-profile, storing information more effectively, communicating effectively with other parties, and accessing information securely. Furthermore, it maximizes the knowledge sharing and transfer of technologies. In this paper, a novel application of mobile LBS that is based on a normal keyword-based search in addition to the two dynamic location-based search and user profile-based search is presented. The new approach uses the concept of Geographic Information System (GIS) within the platform of wireless technologies in order to develop an interactive smart context-aware University GIS that enhances the information sharing, communication, and dissemination within the King Saud University campus for the intention to create information-intensive eco-system supporting knowledge creativity and innovation in such multi-disciplinary environment. The next section presented the proposed approach.

4. SMART WEB BASED APPLICATION & KNOWLEDGE MANAGEMENT

Web-based database application if implemented properly it enables users to access stored information securely anywhere at any time whether they are stationary in the

office or mobile. Hence using this technology can improve the productivity at the workplace since it reduces the delay for accessing information, allow users to interact with others in real-time, and reduce the processing time at the work environment. Three web-based smart database applications have been developed at RTV which enhance the knowledge creation and storage, optimize the knowledge sharing and smart search, and improve the productivity for processing projects and interacting with all staff and tenants at the science parks and campus.

4.1 Web-based Assisting Knowledge Creation Application

The web-based data storing application has been developed at RTV in order to make an electronic copy of all its documents which will be stored on the MS SQL web server and make the authorized users accessing them easily over the network. Figure 4, shows a snap shot of the web-based database application that allows authorized users to store documents electronically on the web server and access them easily through the client web interface anywhere on the network.

Figure 5, shows how user is easily accessing any document stored on the web server from its client terminal anywhere through the internet connection. Storing and accessing documents and data using web-based database application at RTV allows its staff to easily access the required information over the network in a fast easy way and therefore enhancing the productivity at the workplace. This is done through storing a scan copy of the documents as well as soft copy of the attachments on the database server, where users/managers can then search for any topic or document and access them easily and remotely using RTV web-based database document application. According to the practise at RTV, finding one document in hardware filing would take sometime 2 hours if the secretary is close to the manager, and more than 4 hours if secretary is not available. This is because the mechanism for searching relies on Excel index spreadsheet which might not be updated all the times. The web-based database document application that has been developed at RTV allows mobile users to conduct search for any document in few minutes using a web html browser.

4.2 Web-based Smart Search and Knowledge Sharing Application

Managing the knowledge sharing with the relevant parties plays an important role in establishing an eco-system at the science park environment. The traditional sharing approach using hard copy, exchange of USB and CD has many disadvantages. These include insecure and control access to information, lost of information, not environmental friendly, hard to access information, and hard to find information in real time. The web based application through database search tool and the interactive web site have better advantages including mobile access, secure access, backup and disaster recovery, flexible and easy to find information, allowing interactive communication, and event scheduling. The smart software solution implemented at RTV allows searching for information easily, better interaction among the parties, and makes their working environment more productive.

Interactive - Smart and Context Aware Search for University Campus (I-SCASUC) program which is an updated version of the SCASUC that has been implemented at RTV using Asp.net and MS SQL database languages, where client can access the information using web interface [9]

On the user terminal the interface is organized into 7 distinct layers as shown in Figure 6. User would be able to select the search option on the left top corner of user

interface, while the matching research result would be displayed on the left mid window, the department location and its photo would be displayed on the top right corner, and the department information along with its associated events would be displayed on the mid right window. The left bottom window is dedicated to interactive options to allow users to interact with the selected party such as chatting, sending SMS or email, creating a new research group as well as inviting other to join existing group. The right bottom window is dedicated for event booking and finding location on the map, where the map and direction would be displayed on the right bottom window location. The same user terminal interface design is used for the three search options, where only the result of the selected researcher from the list would be displayed on the left bottom window.

Figure 5. Accessing an electronic copy of the document from the MS SQL Web server

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The I-SCASUC program represents a smart solution that is adaptive, mobility supportive, flexible, cheap, and effective search and professional networking tool which can be used by researchers and students at the university campus towards establishing a strong academic eco-system as well as professional network. This program is developed using Asp.net programming language, and MS SQL Database, and WIFI technology which is used to determine the user's location. The user location-based search along with the adaptive user profile and keyword-search, make-up together the GIS solution a smart and a very effective in determining the relevant information for researchers. This implementation proves a successful smart flexible search and professional networking tool that makes the working environment for researchers, students and managers more productive by allowing them to register their information on the database application, finding the relevant information about any departments and other researchers anywhere on the university campus, as well as interactively communicating with other party through the same interface.

4.2.1 Search by keyword and Booking event

Users are able to search for any keyword associated with other researchers, or clusters, or specialists anywhere on the university campus whether the users are stationary or mobile. As shown in Figure 7, user searches for a particular keyword in

the cluster option "scientific valley", where the I-SCASUC program displayed the list of all the matching researchers and give the option to user to select a particular researcher displayed in the founding list and then displays the relevant information about the researcher and the building.

Figure 7. I-SCASUC User Interface using keyword-search and Find Direction

4.2.2 Auto-Search by location and Find Direction

While user is moving in the university campus, the I-SCASUC program will determine the user's location and display information about the department existed in that location as well as a list of all researchers in this department. User interacts with I-SCASUC interface by booking for the event shown in Figure 8. In addition, user executed the find direction from the science building to the Engineering building, where the arrow on Figure 8 displays the direction.

Figure 8. I-SCASUC User Interface using Location-based search, event booking and find direction on map

4.2.3 Auto-search by user profile and Sending email and SMS

User profile can be set explicitly by user according to its predefined preferences or implicitly by observing user actions while applying the keyword search which can update the interest field. The auto-search by user profile would first determine the user location and then identifies the researcher's profiles that are matching with user's profile and display them on the most suitable format of the matching result as shown in Figure 9. Two options associated with user profile have been displayed for user, which are specialist, and interest. The interest list is based on previous KW search, and previous Loc search that have been added to the interest list if they have been selected by the same user with a threshold of n=5 times. Figure 6 displays the result of user profile-based search and previous KW option of the interest list, where "Network Management" is chosen, and Ghassan Kbar is selected from the founding list. User also is sending a SMS to the researcher "Ghassan Kbar" as shown in Figure 6.

Figure 9. I-SCASUC User Interface using User Profile-based search, using previous keyword search and sending email

4.2.4 Testing the I-SCASUC

The I-SCASUC program has been tested by a test engineer on the campus network to verify its functionality. The test results have proven the correct behavior according to design while tester was traveling on the campus as shown in Figure 6, 7, 8, and 9. The next step is to conduct a field test by university's researchers, students and managers in order identify their acceptance of the program and how it can be improved for better customer satisfaction. The I-SCASUC program can be updated to include GPS in addition to WIFI technology, but that requires the addition of this technology and its services to the mobile terminals. The accuracy of WIFI depends of the number of

Access Points on the campus and their configuration, which can be better using GPS technology.

4.3 Web-based Smart Monitoring and Process Support Application

A web-based human resources database application has been developed at RTV in order to make an electronic submission using form that will be submitted to the MS SQL web server over the network. The advantages of this technique are; finding relevant information about the work environment from the user terminal at anytime. In addition to facilitate the communication between parties, tracking and reporting capability, and improving the productivity for effective process at work. Figure 10, shows a snap shoot of the web-based database human resource application that allows authorized manager to store information about each employee electronically on the web server and access them easily through the client web interface anywhere on the network. This figure shows how manager can use the stored information to monitor the status of each employee and generate different reports which can be used for evaluation and promotion, for tracking the work time of employees, and for issuing recommendation to the related manager. In addition, mobile manager as well as users can access the information anywhere which makes business meeting and interaction more effective. Furthermore, RTV web site [10] has been enhanced to allow RTV staff, KSU researchers and RTV tenants as well as visitors to interact with each other and with RTV administrations effectively. This is done through the ability to create research groups, creating discussion forum, smart searching for information through the same web interface, and interacting with the local community.

Figure 10. Interactive RTV Web site

5. Conclusion

In this paper, a proper model for establishing eco-system at Science Park toward the support of KBE has been illustrated where the main parties of this model that includes university research and innovation centers, external R&D centers, and Science Park programs has been identified as well as the interaction between them which has been managed wisely through R&BD of Technology Park. Furthermore, different web-based application tools at the workplace have been developed at RTV and proven to be very effective for the knowledge management (KM). These tools allow an interactive communication among stakeholders and visitors which makes the workplace environment more productive and efficient. In addition, a variety of Web-based application tools has been developed at RTV which includes a smart web-based search application, web-based storage application tool, and human resource web-based application tool. The smart search using I-SCASUC program web interface enables finding information in a short time. The smart search that is based on user-profile make search dynamic and flexible. The web-based storing application tool makes storing information more effectively, and accessing information securely. The RTV web site interface as well and the smart interactive web-based search I-SCASUC makes communication with other parties very effective. In addition, the web-based technique maximizes the knowledge sharing and facilitates the transfer of technologies.