Enactment of Smart Library Management System

Exercising Ubiquitous Computing

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Abstract

Web services are intended for realizing, storing, processing and disseminate data from environmental resources. Context aware is concerned with reasoning and adapting the environmental context on the server side and providing services to the clients in an efficient way. With the fast growth of the internet in the developing world, web based library management prevail useful experience to the students. The server has the main role of providing accurate results to a student's query. For this purpose, RFID technology and Rule-based decision technique is proposed for student identification and sending precise information to the student's smart phone. LPC2148 processor is used for data processing and serial communication. The situation aware environment paved the way for web services to provide modified services to students searching experience. The main objective of this system is to provide the best knowledgeable environment which prefers the system to adapt its behavior based upon the context. Through this proposed system, it mitigates the challenges of context aware web services and students can query the book details in library website, and then receives the relevant details on the smart phone.

1. Introduction

The library management domain provides the finest information to the students according to their location and preferences. Mostly in the library, students search the books, journal papers, magazines with librarian knowledge; it loads more time to search a book. To avoid this, smart library management system is introduced due to advancement in technology. Smart phone [2] [6] users allow staying connected to the internet at any time. Context aware has become the hot topic in the developing environment. The user gets the services according to their situation, location and environment which are referred to as Context aware service [9] [10]. The main role of the context aware system leads to acquire, process and reason the context, then adapt the application service according to the user's request. These advancements in web services and mobile services have incorporated the smart library management system which allows the students to search, browse, and query book details via smart phone when they enter into the library without the other's knowledge. For retrieval of expected book details in library at anytime and anywhere inside the library using a handheld device through internet is done thus incorporating Ubiquitous computing [3] technique in smart environment and similarly getting information in real time based on the user's situation, environment and location in the library providing context aware web services to save precious time of students. The existing approaches elaborate the details of the customer shopping experience with mobile devices. Initially, it states that the user gets an advertisement list based on current location via GPS with the assist of location based advertisement (LBA) [8] using open street map. Before entering the shop, the customer can access and compare the product list in the smart phone. It prevents the entry of any new customer into the shop, if they have high price list. Next recognizing of shop's items by using Bar code [4] and QR code [13] is developed. In both Bar code and QR code scanner, the products are scanned directly and compared with database for displaying the product details. The difficulty faced in these techniques is to obtain item information by taking the photo and accessing through server with very low data rate. Another approach involving the revival of product details with high data rate, RFID [7] is approached. The blind people get audio information of an item placed in a supermarket with the help of RFID and PIC controller. This methodology leads to a situation of using more complex components of blind people acquire information. Then students getting details of book in library via SMS [5] is

developed. At this point, students collect book details by means of SMS only with the assist of sever application and RFID technology. The latest approach elaborates the accessing of product details by way of the mobile reader [1]. The customer finds details in mobile reader about the surrounding situation with respect to customer queries. But the difficulty is that mobile should have the capability to support the tag reader for knowing the details. All these existing approaches contain some drawbacks for identifying the product placed inside the shop/library. To overcome this, web based retrieval of an item's information placed in a library in real time without individual involvement via smart phone is proposed.

2. Library Framework architecture

The proposed system of library framework architecture depicts about differentiation of context layers for retrieval of expected details in real time. These are divided into 3 layers.

i) Context collection layer:

The context collection layer includes detection of student entry in a library by sensing of RFID tag data through RFID reader with a high data rate of 640Kbps and transmits this context information to processor for additional processing. The processor collects, models the context data and analyzes the signal characteristics and behavior, processing the digitalized data. Then transmit the authenticated digital data information (tag ID) to the PC (server) via RS232. The block diagram shown in Figure (1) depicts the library framework architecture.

ii) Context storage & processing layer:

The context storage layer is used for the purpose of storing student profile information and library details. The PC (server) maintains the database of the library information with contents of location of books placed in library, quantity, price and students profile information. The student ID present in database compares with received ID for further communication. If it matches, then the server (PC) acquires the name of the student and mobile number from student profile and sends the SMS with library website link to student mobile via GSM modem. The student receives the SMS in mobile, if the student clicks the link present in SMS, then it redirects to the web page of the library website. According to the student's request from mobile, the server sends the details of the library.
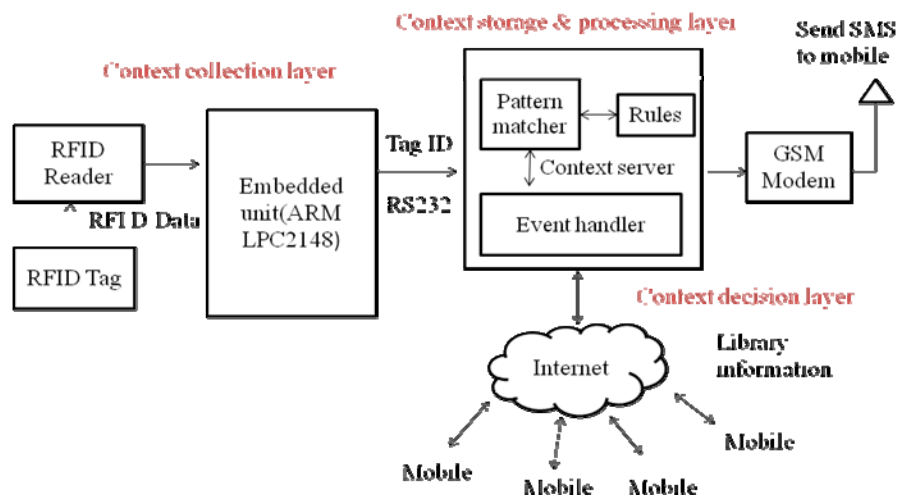
Figure (1) Proposed library framework architecture.

iii) Context decision layer:

The main task of the decision layer prevails to the dissemination of the exact results to applications from various decisions made by sever. It includes an event handler, rules technique and pattern matcher. The rules are already created and placed in the server. The rules have a structure of IF-THEN –ELSE format. If the requested data is matched with the rules then it provides generated data to the client otherwise sends 'no data match' message to the client. This is the basic principle of the rule base decision technique. This technique is used for creation of high level context data to low level context data. If the student searches the expected book name or author name in a web page, then the event handlers in server analyzes and requests for relevant data from pattern matcher. The pattern matches searches and obtain exact matching data using defined rules. Then it provides the data to the event handler, where server handles and disseminates the accurate book details to the mobile. The server analyzes all the received data, reasons the connection between them depending on the registered rules, and determines the best-fit context condition. The example for the creation of rules is described below.

Rule 1.   IF ID matches (student ID, ID in database)
             Then (send SMS to student mobile)
             ELSE (do normal work)
             END

Rule 2.   IF student send a request (requested data, data in rules pattern)
             Then (provide data to student)
             ELSE (do normal work)
             END

3. Hardware Implementation

In this smart library management system, students are authorized at the library's entrance through the implementation of RFID reader and allow them to access the web based digital library. The RFID reader has compatible with TTL logic and it is directly connected to ARM LPC2148 processor. RFID reader has 3 connection wires to connect with processor i.e. TX, Power supply and ground. The students are allowed to use RFID enabled ID card in the library which is capable of storing 2KB of student ID data in the RFID tag. When entering into library, RFID reader in the library has set up the connection within 7ms and tracks the encoded data in student ID card at a distance of 5-100m and changes encoded data to decoded one then transmit to 9th pin of port0 in ARM LPC2148 RISC processor with the data rate of 640Kbps and frequency of 13.56MHz. The processor accepts the digital ID and sends to PC for next processing. In the library, PC is maintained as a server and it receives a digital ID from processor by way of RS-232 cable. The overall setup of the system implementation is shown in Figure(2). Through the Wi-Fi, the services are accessed by xampp web server running on a PC. The web server is connected to the MYSQL database server which stores the information of student's profile data like the name of the student, course, department, mobile number, book's renewal details and library information status like location of all books placed and their details. The server has the capability of producing new knowledge from stored rules pattern for various requests from client. Then the PC compares the incoming ID and ID list present in the database. If the requested id matches with the id in the Database, then the PC retrieves the mobile number of the matched ID immediately and sends SMS via GSM modem to that mobile number. The Figure(3) Show the received SMS from server.

Figure (2) Overall system implementation.   Figure (3) SMS received by student.

The software coding for creating library website web pages are written in HTML language and the connection between database and web pages are done by using PHP language. The SMS contains the smart library website link. If the student clicks the link, then it redirects to the homepage of the smart library website. The homepage has login options. Now, the student has gained the authority of accessing the digital library by providing the username and password of student details. Based on various requests, the server replies user with book details. The Figure(4) depicts the homepage of website and figure(5) states book details provided by the server with the user's preferences.
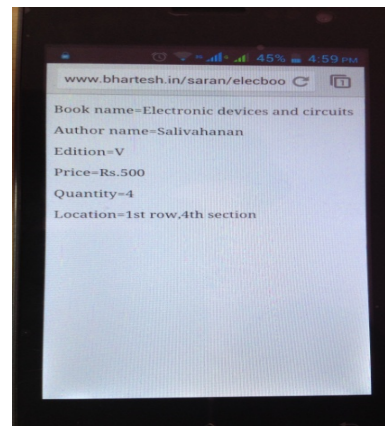

Figure (4) Home page of library website.   Figure (5) Displaying book details.

4. Conclusion and Future work

The proposed system really helps to reduce the burden for students in the academic institution for physical searching of book/articles/magazines in the library. The student gets the updated information of the library data without any guidance only by smart phone in a smart library management system by means of Rule based technique and RFID technology. In the future, identification technique will be developed for knowing student entry/exit in the library by using various other technologies for authentication purpose.

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