

<http://ansinet.com/itj>

ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Design of Portable Personal Information Management System with XML Technique

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Abstract: In this study, Xtension Markup Language (XML) technique is applied to designing Personal Information Management System (PIMS) which usually adopts the concept of database for storing data. Due to the arrival of the digital era and the evolution of Internet, it is becoming an important issue for deciding how to use and manage personal information effectively. In view of explosive growth in Electronic Commerce (e-commerce), the exchange standards of documents are getting to be the XML. Therefore, this research focuses on how to design an integrated portable PIMS that adopts XML technique to improve information portability and applies Active Server Pages (ASP), JAVA etc. technologies to designing the system for enhancing interactive interface. Besides, Wireless Application Protocol (WAP) technology is also combined to provide cellular phone query instantaneously for mobile users.

Key words: Xtension markup language, personal information management system, portability, active server pages, wireless application protocol

INTRODUCTION

With the flourishing development of industrial and commercial industries, the amount of personal information increases hurriedly. Because it is already unable to deal properly with personal information by using the early form of paper work, the standalone version of personal information management systems comes into existence. Moreover, the population of adoption is large for standalone version of PIMS, such as MS outlook which is one of typical representative. However, the heaviest shortcoming of frequent movement for the standalone version is that it can not offer the portability for personal information and offer synchronous function in time. Because of the fast development of Internet network technology, it has been no longer a dream for getting conveniently Internet access points which can be wired or wireless. Thus, it becomes an important subject to combine Internet network technology to do effective management and applications for individualized information in time.

For the age of rapid developing society and explosion growth of Internet, PIMS (Kratkiewicz and Mitchell, 2004; Bellotti and Ian, 2000; Bergman *et al.*, 2003) is an essential tool which can manage personal information efficiently and provide portability and mechanism of synchronous update. Because of the fast growth of e-commerce, it is necessary to combine PIMS with e-commerce tightly. However, the major standard of exchange document for e-commerce is evolved from Electronic Data Interchange (EDI) (Albrecht *et al.*, 2007; Angeles *et al.*, 2001; Iskandar *et al.*, 2001; Hill and

Scudder, 2002; Owens and Levary, 2002; Liang *et al.*, 2004) to XML (Vakali *et al.*, 2005; Dashofy *et al.*, 2001; Roy and Ramanujan, 2001; Klein, 2001; Wang and Cheng, 2006), thus the adoption of XML for PIMS is the best way of coupling with e-commerce. Besides, the amount of mobile users is getting larger, so it is the trend to combine the WAP technology with PIMS for providing synchronous inquiries which the mobile users can make in cellular systems.

MS outlook which is a standalone version of PIMS is regarded as the main representative for the design concept and there are also many PIMSs of on-line version proposed for the Linux platform (Kim, 2003). Although the PIMS of standalone version is the major adopted product for most PC based platforms, they cannot provide synchronous updates. Even though the PIMS of on-line version in Linux platform can provide on-line updates in time via the Internet, it is lack of integrating capability with e-commerce which adopts XML standard as the majority. Furthermore, the support of mobile inquiry is not available. In order to improve the drawback of PIMS that can not provide instant update synchronously for standalone version, in this study we propose the design method which adopts XML techniques to increase the portability of personal information and combines WAP (Fasbender *et al.*, 1999; Hwang *et al.*, 2002; Curtis, 2004) technology to achieve the requirement of mobile inquiry of personal information for PIMS.

Based on XML technique, there are the following advantages: first, it can replace the traditional access mechanisms in the database system without copyright question and the data format can be defined flexibly and

accepted by every large manufacturer; secondary, the XML technology has already become the standard of transaction document gradually for the rapid growth age of E-commerce.

With the blossom of e-commerce, it is becoming a great anxiety to process any amount of information in time, so the drawbacks of HTML (Sharma and Raman, 2003) are getting to appear. Much information, however, has been transferred into the HTML document, but the HTML document can be only presented in browser and no more description about the information content for itself. It will be embarrassed to grudgingly use HTML as the format of information interchange. Thus, the XML standard comes into being in 2000.

XML which was suggested as one of standards for Internet development by W3C is a markup language for displaying structural information. Because of its open standard, XML becomes one of data language of standard for industry. The data format of XML represents the information can be transferred, shared easily and reused. According to the content of file, we can define the relationship between tag and framework owe to the structural information language for XML. The files can be a variety of data which includes data of commercial activities. Nevertheless, a XML file of well-define should follow some regulations. For example, it should include a corresponding end tag for every active tag. Besides, there are some Document Type Declarations (DTD) (Bertino and Catania, 2001) defined for some XML files and should be followed.

It is important to distinguish database from XML. In the view points of XML, the XML document which is just a text file can be regarded as a database. For example, the XML document is regarded as the storage of database; the DTD and schema language (Roy and Ramanujan, 2001; Kirkegaard *et al.*, 2004) of XML are similar to the schemas of database; the Document Object Model (DOM) (Simeoni *et al.*, 2003) of XML has much resemblance to programming interface. Even though the XML loses the security and data integrity which are compared to the database system, it can achieve easily data interchange and format transformation. Besides, there are still some features of XML and described as follows:

Extension: Due to the feasibility of tag creation in XML, it extends application areas and can be regarded as a meta-language; thus, the use of XML brings the extension and makes more feasibility for document database.

Easy program code: The program code of XML is represented by text, so a normal text editor is needed to edit it. Additionally, the representations of XML are easy

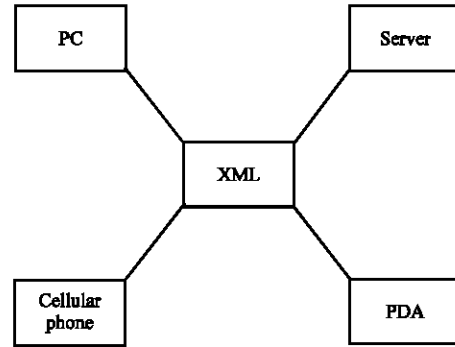


Fig. 1: Diagram of information passing for the proposed system

and clear and there is a code segment of XML shown as follows:

```
<components>
  <Name>Jacky Chen</Name>
  <Nickname>Jacky</Nickname>
</components>
```

Obviously, the code segment of the above is adopted to express personal information and the powerful features which can be applied to defining tag by users is illustrated in this example for XML.

Information exchange between different platforms: Due to the network society for today's life, if there is no communication of real time via network and then it will be difficult to obtain the latest information. Consequently, the information transmissions of different platforms and different natures are paid much attention due to the widespread of network. XML that provides a communication platform between different systems plays a medium role of information transmission. Thus, the system which plugs in an XML parser can interpret markup data and get the correct information. The application of XML for the proposed system is as shown in Fig. 1.

It becomes a new era of network revolution owe to the millions of users of cellular phones which can retrieve data from Internet with the support of WAP protocol. In order to provide variety of valued services for such a group of population, the internet content provider can use the easy semantic of Wireless Markup Language (WML) (Sriskanthan *et al.*, 2004) to achieve this goal and obtain much profits for corporations. Therefore, the join of WAP feature for mobile inquires in the proposed system is necessary for a modern PIMS.

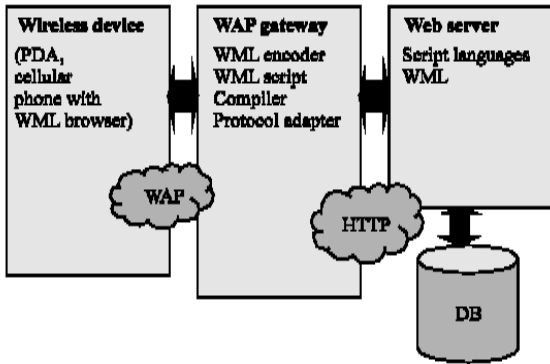


Fig. 2: Basic function blocks of WAP framework

WAP is an open standard which is designed for wireless communication devices, such as cellular phones, PDAs etc., to execute the services of internet access. Because of limited bandwidth and restricted display size for mobile devices, it is necessary to design dedicated protocol for mobile devices. Therefore, handheld devices, supporting WAP feature, can retrieve Internet resources via wireless networks and can execute commercial transactions for a mobile in future.

The basic function blocks of WAP framework is shown in Fig. 2. The first step for cellular phone connecting to Internet is to setup the IP of WAP Gateway which is similar to proxy servers for an Intranet and provides transformations between HyperText Transfer Protocol (HTTP) and WAP in order to obtain the correct data smoothly. In general, WAP Gateways are built by ISPs or telecommunication providers, so normal web sites can provide cellular user queries by adding the setup of WML Multipurpose Internet Mail Extensions (MIME).

In order to provide more valued services, the ISPs try to combine WAP Gateway with special web services into one dedicated server which is named WAP Application Server and is shown in Fig. 3. Based on such architecture, the ISP missions are not only to provide the interface for Internet between mobiles and web servers but also provide specific web services for obtaining the best profits.

WML, being similar to the semantic of HTML for HTTP protocol, is a part of specification for WAP. And it is extended from XML to design the display of text or graphic on the screen of cellular phone with WAP function. There are two important terms for WML; one is the Card which is an interface for user and one page of WML can include several cards and the other is the Deck which is composed of several Cards. There is an example of WML as shown in Fig. 4 and the executing results are shown in Fig. 5.

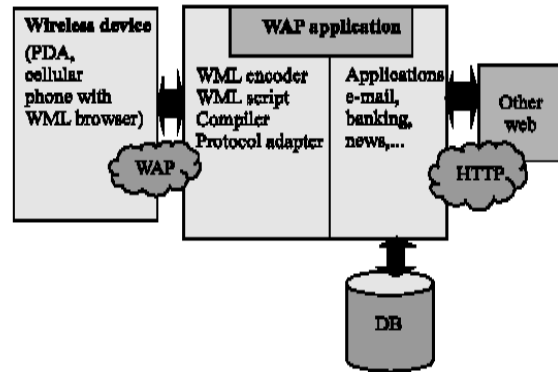


Fig. 3: Function blocks of WAP application server

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC
"-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml"
>
<wml>
  <card id="A">
    <p>
      <do type="accept" label="next">
        <go href="#B"/>
      </do>
      I am Card A
    </p>
  </card>
  <card id="B">
    <p>
      I am Card B
    </p>
  </card>
</wml>
```

Fig. 4: An example of WML

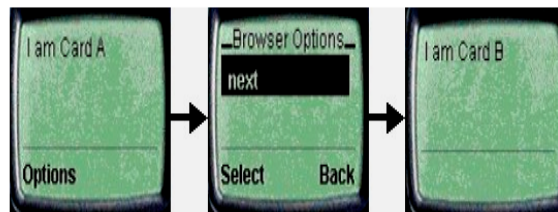


Fig. 5: The executing results of WML example

In general, WML is the same as HTML which can be edited by normal text editors, such as WordPad, Word, etc. and can be edited to text files. Because Unicode is adopted by cellular phones with WAP function, the edited text files must be transfer into Unicode whether ASC or BIG5 is adopted. We can write transformation technology to Dynamic Link Library (DLL) component and apply ASP, VB, VB_IIS, JAVA Servlet, JAVA, etc. to producing WML web pages dynamically for clients. We

can find out several design kits of WML and test tools from cellular phone vendors.

Thus, the adoption of XML technology needn't pay extra mental and physical efforts to the conversion of associated documents again in the future additionally. The combination of WAP technology can make the user free of restrictions for time and place, so mobiles can utilize surfing Internet with cellular phone of WAP to inquire about personal information at any time. In this study, we propose a concept that combines XML and WAP techniques for design PIMS. The proposed system can deal with E-commerce and M-commerce, because XML standard and WAP technique are adopted for the design considerations.

SYSTEM FRAMEWORKS

The major missions of PISM are to record and manage personal daily information which includes arrangements of schedule, remained events, address books, E-mail management, etc. In our proposed system, XML standard is applied to replacing the requirement of database and provides mobile inquires with WAP technology except the basic functions of traditional PIMS.

System functions: The proposed PIMS which provides web-based management functions for personal information is shown in Fig. 6 and the detail descriptions for each function are described as follows:

- **User:** Each user must register his personal information for the PIMS to get personal account and password that are used for the purpose of authentication, before entering the system. Furthermore, the function for modification of personal information is also provided by the proposed system to update personal information in time.
- **Calendar:** The proposed system provides the management functions of remained events and schedule arrangements. The only requirement for the proposed system is just the Internet connection and everywhere will be a mobile office for users.
- **Address book:** You maybe worry that the address book might be home when you stay at the office; in contrast, you maybe have the same consideration when you are home. You don't need to worry where the address book is with the adoptions of the proposed PIMS that manages the address book centrally for user and makes user to be able to pick it up in time since Internet connections are ubiquitous.

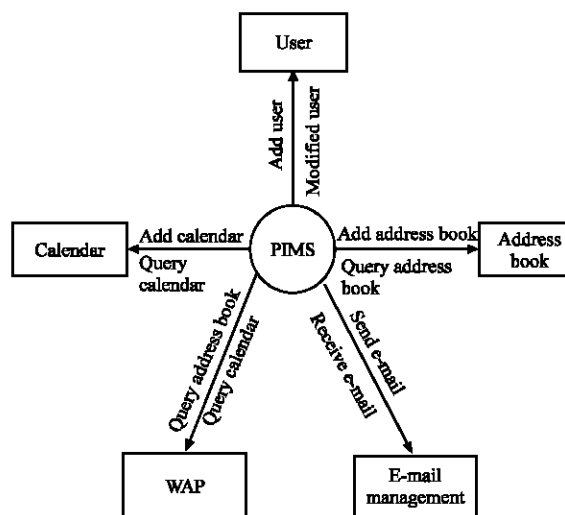


Fig. 6: Functional blocks for the proposed system

- **On-line management of E-mail:** The proposed system supports a variety of mails which can be rich texts or HTML formats and can deal with attached files. Due to the simplicity of the proposed system, users can receive and send mails ubiquitously and don't need to pay more intentions to the setups of a variety of E-mail softwares.
- **WAP:** In order to achieve the portability of PIMS for mobile users, the proposed system combines WAP protocol that provides cellular phone with WAP function for linking to the PIMS and obtains query data, such as calendar and address book, via login authentications.
- **Data flow of the proposed system:** Because the data flow diagram is the major tool for structural analysis of information system (Whitten *et al.*, 2003) that adopts simple graphical symbols which are external entity, representing external information system or interactive person, data flow representing the direction of data flowing, process representing processing operations and data store representing data storages to express the relations among the system, directions of data flows, storages and operations, the data flow diagram of level 0 of the proposed system is applied to describing the requirements for functional processes.

By way of data flow diagram, the directions of data flows among processes and the logical transformations of system data can be described clearly. Furthermore, we can understand the data flow interfaces among external entities and find out where to store data which can

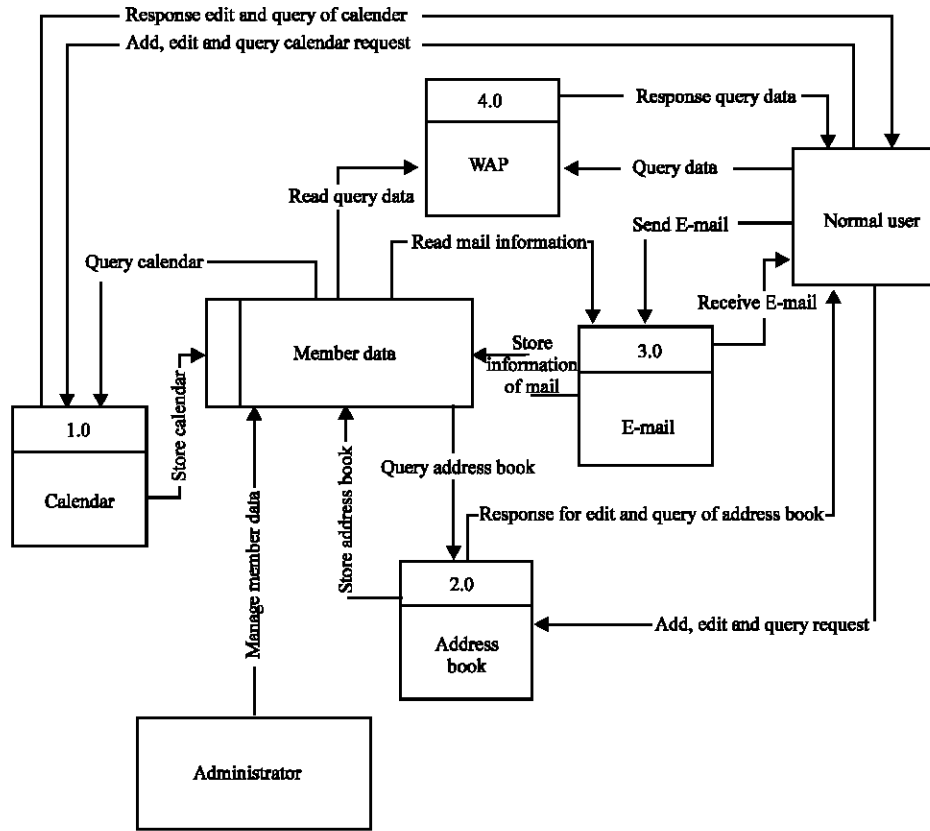


Fig. 7: Data flow diagram of level 0 for the proposed system

support or be produced by the processes. The data flow diagram of level 0 for the proposed system is shown in Fig. 7 and we will explain it in two types of user views which are included normal user and administrator and the main functions for each process.

The major mission of member mechanism in the proposed system is to manage member data, which includes registry approving for new user and edit of user data for the administrator. The design kernel of the proposed system is based on views of normal user. Besides, the processes and data store in Fig. 7 are described in detail as follows:

- Calendar is provides for query and arrangement of calendar and produces new data store for calendar file in XML format.
- Address book is designed for management of personal address book which includes insert, delete, edit and query (by name or group) and produces new data store in XML format.
- Mail management is provided to send and receive e-mail and manages mail with new data store in XML format. Besides, the address book can be used to select an e-mail address before a new mail is sent.

- WAP function is designed for mobile query with cellular phone and there are two query functions which are calendar and address book queries provided by the proposed system.
- Member data is data store in XML format for the registry information, which includes ID, Password, Name, etc.

Design of data structure: In order to combine with requirements of E-commerce, the traditional design concept of database is replaced by XML standard which allow user to define new tag according to his needs. It is the same as the traditional design to declare the data types which are used in the corresponding XML file in advance. The terminology of declaration of data type is named as document type declaration (Bertino and Catania, 2001) (DTD) which contains or points to markup declarations, providing a grammar for a class of documents, in XML standard. There are five DTDs that should be defined in the proposed system and short descriptions for each are described as follows:

- User.dtd includes eleven fields and is defined for declaration of user file (user.xml).

Table 1: Summary for the DTD of calendar

Field name	Data type	Description of field
StarHH	PCDATA	Start time (h)
StarXX	PCDATA	Start time (min)
EndHH	PCDATA	End time (h)
EndXX	PCDATA	End time (min)
Memo	PCDATA	Content of memo
Date	PCDATA	Date of memo

```
<?xml version="1.0" encoding="big5"?>
<!DOCTYPE PIMS[
<!ELEMENT PIMS(Component) >
<!ELEMENT Component (StarHH, StarXX, EndHH,
EndXX, Memo, Date) >
<!ELEMENT StarHH(#PCDATA) >
<!ELEMENT StarXX(#PCDATA) >
<!ELEMENT EndHH(#PCDATA) >
<!ELEMENT EndXX(#PCDATA) >
<!ELEMENT Memo(#PCDATA) >
<!ELEMENT Memo(#PCDATA) >
<!ELEMENT Date(#PCDATA) >
]>
```

Fig. 8: DTD of calendar

- Calendar.dtd includes six fields and defined for declaration of calendar file (calendar.xml).
- Component.dtd includes twenty-seven fields and defined for declaration of address book file (component.xml).
- Mail.dtd includes eleven fields and defined for declaration of mail management file (mail.xml).
- Wap.dtd includes two fields and defined for declaration of wap file (wap.xml).

The DTD of calendar is shown in Fig. 8 and the summary for the DTD of calendar is as shown in Table 1.

According to the observation from Table 1 and the XML standard, only a few of data types are needed for DTD.

IMPLEMENTATIONS

The design considerations of PIMS should take the currency of information technology and its expansion in the future into account. To achieve the purposes of portability comparison and low cost, XML standard which is well-defined and extensible is adopted for the proposed system.

Developing and executing platform: Due to the numerous population of Microsoft product, Microsoft XP is adopted as the operating system for developing and executing platform. The system environment diagram is as shown in

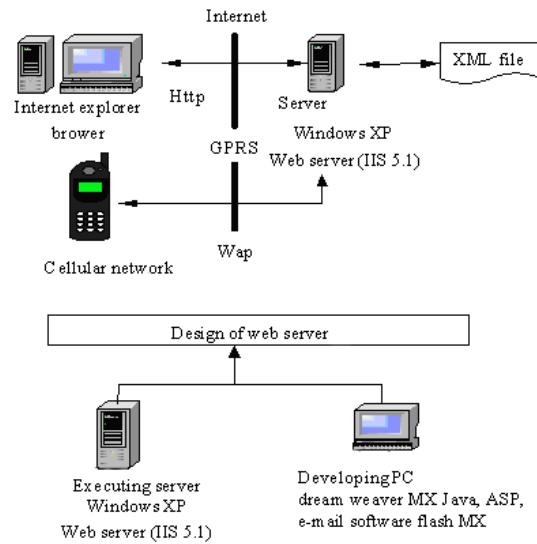


Fig. 9: System environment diagram for the proposed system

Fig. 9 which includes the connecting interfaces of executing environment for Internet users and cellular network and design of web server and relative software for web server development.

The user can access real-time information of the proposed system with a browser via Internet connection which adopts http protocol or inquire about real-time information of the system via General Packet Radio Service (GPRS) networks with WAP protocol when a cellular phone is used by a mobile. Furthermore, the proposed system is executed at MS Windows XP platform with IIS 5.1 web server and is designed by some tools and techniques which include Dream weaver MX, Flash MX, E-mail software, ASP and Java.

The kernel of implementation is data retrieve and update between the web server and database which is substituted by XML files for the proposed system. Thus, two key point techniques are used for query and update, including edit, insert and delete, respectively. Because the Application Programming Interface (API) of DOM (Simeoni *et al.*, 2003) which defines structure, access, manipulation and operation methods for the document is adopted and combined with ASP which is as a Common Gateway Interface (CGI) (Kamina *et al.*, 2001) language for the design of web server, so the proposed system can insert, modify, or delete the element of document easily. Owe to the capability of data display for Extensible Stylesheet Language Transformations (XSLT) (Abiteboul *et al.*, 1997; Chambelin *et al.*, 2001), the proposed system combines it with ASP to design query functions.

RESULTS OF IMPLEMENTATION

In order to reveal the change of kernel data which is expressed in XML files for the proposed system, the insert function of calendar is illustrated and the corresponding XML file is also observed and explained. The XML file which has only one memo before add function executed for calendar is as shown in Fig. 10 and the executing result after the add function executed is as shown in Fig. 11.

Obviously, the data fields of both Fig. 10 and 11 follow the DTD which is shown in Fig. 8. According to the observations, the additional data that includes the same elements as the <component> tag is expanded and follows the previous one. On the contrary, the deletion operation deletes all of the entries between the pair of

```
<?xml version="1.0" encoding="BIG5"?>
<components>
  <component>
    <StarHH>08</StarHH>
    <StarXX>15</StarXX>
    <EndHH>15</EndHH>
    <EndXX>15</EndXX>
    <Memo>The first test memo before add</Memo>
    <Date>2004/12/01</Date>
  </component>
</components>
```

Fig. 10: XML file before add function executed

```
<?xml version="1.0" encoding="BIG5"?>
<components>
  <component>
    <StarHH>08</StarHH>
    <StarXX>15</StarXX>
    <EndHH>15</EndHH>
    <EndXX>15</EndXX>
    <Memo>The first test memo before add</Memo>
    <Date>2004/12/01</Date>
  </component>
  <component>
    <StarHH>10</StarHH>
    <StarXX>20</StarXX>
    <EndHH>23</EndHH>
    <EndXX>30</EndXX>
    <Memo>The 2nd test memo after add</Memo>
    <Date>2004/12/20</Date>
  </component>
</components>
```

Fig. 11: XML file after add function executed

tags <component></component>. Therefore, we can understand how the proposed system manipulates the operations of insert/delete and the database system is replaced easily by XML files.

CONCLUSIONS AND FUTURE WORKS

In this study we propose the design concepts and the prototype for a portable PIMS which combines WAP technology and XML standard to replace traditional database. The proposed design of DTD for PIMS can be as a template for the future development in PIMS, because XML is getting to be the standard of E-commerce. Indeed, the implementation of the proposed system gives a good demonstration for XML standard in the application of PIMS. Besides, mobile query concept is also implemented in the proposed system with WAP technology.

In order to response to the trend of 3G mobile communications which can provide multimedia data, the features of multimedia for PIMS are tried to combine with the proposed system in the future.

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