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Environment Model for Adaptive e-Learning

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Abstract

Adaptive learning becomes a research topic that is considered as a learner-centered model. There are a lot of approaches that try to adapt the system based on learner history, behavior, activity and so on. However, very few researches concentrates on different environment, for example, speed of internet, and connecting devices. In this paper, we mainly consider on the adaptive system based on the environment of each learner. We design the system to automatically detect the environment for each learner and transfer the suitable content for his/her environment. We introduce a process on choosing type and format of data for e-Learning system according to the environment.

1. Introduction

The development of Internet and Network enables people to access and get information easier and faster. There are a lot of devices provided for manipulating information, such as desktop, laptop, Pocket PC, and mobile phone. Each device plays a different role depending on individual needs. Mobile phone is a personalized device which is easily to use in anywhere to communicate with others but cannot handle a high speed and large size of data, while laptop which is a bigger size and high performance, can apply for a high speed and a high quality content [4].

Learning, a process on transferring information from one to others, has a long history. e-Learning is a type of distance learning which learning content and data are sent through the

Internet. With the combination between learning and device, we can say that it becomes closer to achieve learning in anywhere and anytime.

One of research topic that is widely considered is adaptive e-learning. Most of them try to analyze system to match with individual needs. It collects learner history, behavior, etc to construct learner model and make the system automatically adapt to support user's need [5]. There is, however, another approach that does not concentrate on learner model. It tries to realize the important issue based on digital divide. In Thailand, there is very big gap between students in urban and rural in accessing internet, and computer performance. Based on these infrastructure, one of important issues is how to develop and analyze the content which is appropriate for each learner's environment. We call "adaptive environment model".

This paper is aimed to solve the problem in second approach. We design the system to automatically detect the environment for each learner and transfer the suitable content for his/her environment. We introduce a process on choosing type and format of data for e-Learning system according to the student's environment.

This paper is constructed as follows. Section 2 explains on our system architecture. Section 3 shows the adaptive environment module. Section 4 illustrates the implementation work. Finally, section 5 concludes our approach and future work.

2. System Architecture

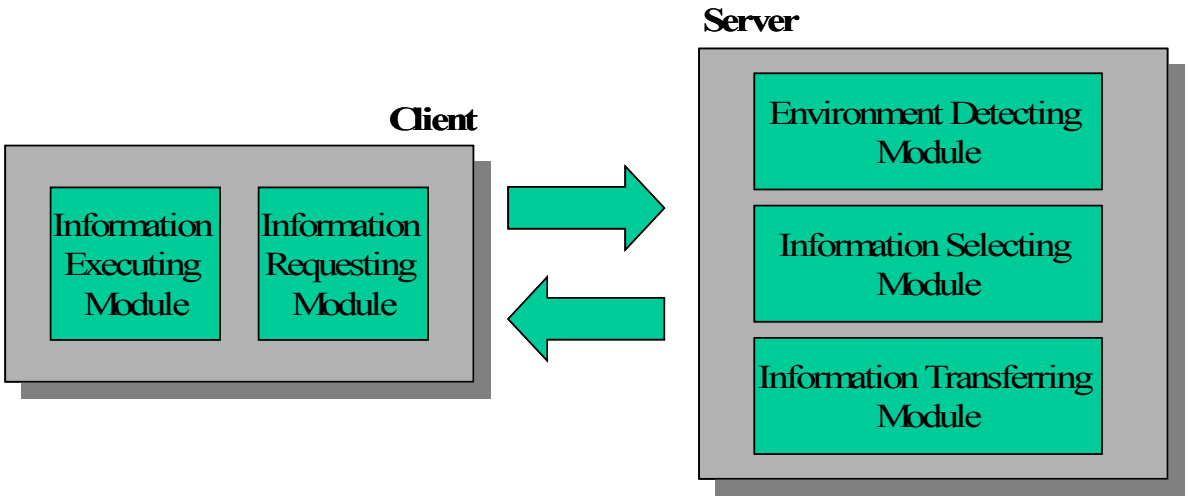

Figure 1 : System Architecture

In order to automatically detect the environment for each learner and transfer the suitable content for their environments, it is necessary to design the architecture by considering both client and server side. The system architecture is illustrates in figure1. In the client side, an appropriate LMS will be installed and executed based on device. There are two main modules which are necessary to exist in LMS, Information Requesting Module and Information Executing Module. Information Requesting Module will receive a request for information from a user and send to server. Information Executing Module will apply the information received from server and

execute it to user. It is normally a part of LMS. In the server side, there are three main modules, Environment Detecting Module, Information Selecting Module and Information Transferring Module. Environment Detecting Module detects environment for each user. Based on the environment information, Information Selecting Module will analyze and select the most appropriate content in the server which matched with the needs of user. Finally the content will be transferred to client in Information Transferring Module.

In this paper, we mainly concentrate on Adaptive Environment Module, which is the module that assists the server to send the appropriate information based on the environment.

3. Adaptive Environment Module

The process on detecting environment is explained as follows. The server starts with detecting connection speed. We detect the speed by calculating average time per a prepared data. We send a data and check the starting time and finishing time for calculating speed connection. This method will enable the server to detect the speed based on the average size of content. After that, server detects the user's operating system and web browser. Finally, it detects the supported file types. We apply the existing command in PHP for detecting operating system, web browser and supported file types.

The server classify content into three groups, text-only, picture-and-text, and full-multimedia. The server detects user environment and match with the three types of content based on environment information. The server applies the following criteria for selecting content.

1) Regarding to the connection speed, internet connection could be in many ways such as dial-up modem, broadband, Wi-Fi, satellite and cell phone via GPRS and EDGE etc. Range of the connection speed is wide. The rate is up to connection type ranged from 56Kbit/s-maximum speed of dial-up modem connection to 160-Gbit/s highest speed broadband [1]. If a server detects low connection speed, below 60 Kbit/second, text-only will be assigned for the users. If a server detects medium connection speed, at 61-200 Kbits/second, picture-and-text will be assigned for the users. If a server detects high connection speed, more than 200 Kbits /second, full-multimedia connect will be assigned for the users.

2) Regarding to device, if a server detects mobile phone device, picture-and-text will be assigned for the users. Otherwise, full-multimedia connect will be assigned for the users.

3) Regarding to web browser, Mozilla and Firefox can not fully support JavaScript, some tags type, such as DHTML, while Internet explore can support this. Moreover the supported plug-in for each web browser is different.

After the server knows the environment, the server selects appropriate learning content from information stored in an XML file [3]. In XML file, learning contents are represented in tag format. Each part of the content refer to three learning object for each user group. The system choose appropriate learning object according to the detected learning environment and then send the learning object to the user

4. Implementation

We implement the speed detection by using JavaScript [2]. We calculate the starting time, and then send some data with 54.921-Kbyte sizes [6]. After finish sending the data, we get finish

time, and calculate the speed with data size divided by sending time ($\frac{\text{Data Size (KByte)}}{\text{Sending Time}}$). Figure 2 shows the JavaScript code for detecting speed connection.

```
<script language="javascript'>
<!—
time = new Date();
starttime = time.getTime();
</script>
……
……
…….Send Some Data……
……
……

<script language="javascript">
<!—
time = new Date();
endtime = time.getTime();
downloadtime = (endtime - starttime)/1000;
connectspeed = KByte_data/downloadtime;
……
</script>
```

Figure 2 : Speed Detection Implementation

Then, we send the speed time to another PHP file with Post method. PHP file detects the user environment by applying the command in figure 3. We are able to get the information of the user's browser and operating system with `getenv("HTTP_USER_AGENT")`.Moreover, the file types that the user's system support can be detected with `getenv("HTTP_ACCEPT")`.

```
……
$user_info = getenv("HTTP_USER_AGENT");
…….
$user_accept = getenv("HTTP_ACCEPT");
…….
```

Figure 3: Environment Detection Implementation

Figure 4 shows some examples of output which are detected from each operating system and web browser. Figure 5 shows output of supported file type in each environment respectively.

Type of device	Output data
PC with Linux and Firefox	Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.7.5) Gecko/20041123 Firefox/1.0
PC with Windows XP and IE	Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1; SV1; .NET CLR 1.1.4322)
Mobile phone with Linux and Opera	Opera/8.01 (J2ME/MIDP; Opera Mini/1.0.1479/LoFi; mobile phone; no; U; ssr)
Pocket PC with Windows CE	Mozilla/4.0 (compatible; MSIE 4.01; Windows CE; PPC; 240x320)
Motorola mobile phone	MOT-E680/R51_G_0F.46.A1P MIB/2.2 Profile/MIDP-2.0

	Configuration/CLDC-1.1
Nokia with Symbian	Nokia6260/2.0 (3.0436.0) SymbianOS/7.0s Series60/2.1 Profile/MIDP-2.0 Configuration/CLDC-1.0
Nokia mobile phone	Nokia5100/1.0 (3.05) Profile/MIDP-1.0 Configuration/CLDC-1.0
Samsung mobile phone	SAMSUNG-SGH-E630/1.0 UP.Browser/6.2.2.6 (GUI) MMP/1.0

Figure 4: Operating System and Web browser information

Type of device	Output data
PC with Linux	text/xml,application/xml,application/xhtml+xml,text/html;q=0.9 ,text/plain;q=0.8,image/png,*/*;q=0.5
PC with Windows XP	image/gif, image/x-xbitmap, image/jpeg, image/pjpeg, application/vnd.ms-excel, application/vnd.ms-powerpoint, application/msword, application/x-shockwave-flash
Smart Phone with symbian	application/x-mobipocket-ebook, application/pdf, audio/wav, audio/x-wav, audio/basic, audio/x-au, audio/au, audio/x-basic, video/mp4, video/mpeg4, video/3gpp, application/vnd.rn-realmedia, audio/amr-wb, audio/amr, audio/mp3, application/sdp, audio/sp-midi, audio/x-beatnik-rmf, audio/midi, audio/aac, audio/mpeg, application/java-archive,text/vnd.sun.j2me.app-descriptor,text/html,application/vnd.wap.xhtml+xml, application/xhtml+xml,application/vnd.wap.wmlc,text/vnd.wap.wml,application/vnd.wap.wbxml1,application/vnd.wap.wmlscriptc,multipart/mixed,application/x-avascript,text/ecmascript,application/x-nokiagamedata, application/vnd.cerience.rgo, video/avi, text/x-co-desc, application/vnd.symbian.install, audio/x-pn-realaudio-plugin, audio/x-pn-realaudio,audio/mpegurl,audio/x-mpegurl,application/vnd.oma.dd+xml,application/vnd.ces-quickpoint,application/vnd.ces-quickword,application/x-wallet-appl.user-data-provision,application/ vnd.met.ticket,application/vnd.nokia.ringing-tone,text/vnd.symbian.wml.dtd,application/vnd.wap.wbxml, application/java,video/3gp,audio/mp4,audio/rmf,audio/x-rmf,audio/x-midi,application/x-java-archive, application/vnd.oma.drm.message,active/desk,application/x-x509-ca-cert,text/plain,text/x-vcard,text/calendar ,text/x-vcalendar, text/css,image/*,text/x-vcard,image/gif,image/vnd.wap.wbmp,text/vnd.wap.wmlscript

Figure 5: Supported file types information

In our experiment, we constructed a content which has two styles. The first style is a plain text. The second style is full multimedia content. Based on the environment detecting, we retrieve the first style data in low speed connection and second style data in high speed connection.

5. Conclusion and Future Work

We explained the idea on developing an adaptive environment model for transferring information based on infrastructure. We did some experiments to show that our model is work efficiently based on environment information.

For the future work, we plan to develop various contents in repository to enable user get the suitable information. Moreover, it is necessary to combine the adaptive environment with adaptive system based on user model. Finally, we plan to consider the content based on dynamic connection speed and continuous content in various devices.

6. Reference

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