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Interactive Class Room: Impact of Web services Using Distributed Learning

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Abstract- **Real-time interactive virtual classroom with tele-education experience is an important type of distance learning; while the existing accessible systems are not able to join different classrooms in un-wrap network for intercontinental and intercultural erudition. Many learning systems embedded which effectively seek a enhanced teaching and education method is called classroom based e- learning system. New necessities are raised for the openness of the structure, extensibility and scalability. To talk to these issues an improvement learning arrangement based on smart classroom using web service expertise provides further extensible and scalable features to tackle new requirements and challenges of distance learning. Open smart class room is residential based on smart space raised area, the software computing transportation for smart space, which provides new features. Open and standard boundary for better mobile device and communication. Open service incantation channel between inside modules and outside modules. Open network in which several smart spaces can unite and communicate each other. And an Integrating video copy tool in arrange to supervise the classroom sessions and updating the information to superintendent throughout the class room time. Making use of this new facial appearance, open smart classroom shows a narrative and fascinating experience to both teachers and students for intercultural and transnational distance learning.**

Keywords— Pervasive Computing, Smart Space, Web Service, Teaching methodology

I. INTRODUCTION

With the rise of a new generation of web based learning system, a traditional learning mode, where teachers and students are face to face with each other in the same classroom, however, still has its unrivalled advantages. Therefore, how to use new methods and technologies raised by pervasive computing and Smart Space to enhance the effectiveness and experience becomes a very important in learning system.

There are many learning systems embedded with these features such as Tsinghua University's Smart Classroom [17],Active Class [11],Class Talk [3],which are all seeking for better teaching and learning mode based on traditional face to face classroom learning .Smart classroom adopts the blended learning way implementing multiple modalities and human-computer interfaces to provide a tele-education experience similar to real classroom experience ,which gives both of the remote and local students more natural experience on learning.

To implement open smart class room ,we design and develop the software infrastructure Open Smart Platform, which greatly extends the function and ability of Smart Platform[15].To adapt the challenges given by Open Smart Classroom ,open smart platform adds new modules and involves new criterion. So as to give better software infrastructure support for Open Smart Classroom.

II. Existing Learning Systems in Smart Space

There are several projects working on improving the experience of traditional classroom-based learning using Smart Space technologies. Active Class [11] is an application for encouraging in-class participation using personal wireless devices. The students give feedback of the class by their own wireless devices, improving the effect of traditional learning for both of teacher and students. However, Active Class lacks of supporting mobile devices to control and interact with the whole classroom, and has few natural human-computer interaction interfaces to enhance the experience of learning.

eClass[1] in Georgia Tech is another project to study a general ubiquitous computing research theme, automated capture of live experiences for later access. Similar to the Smart Classroom project in Kyoto University they both mainly study on capturing of the live experiences of the class for better understanding and further reviewing. But both of the two projects only work for single classroom and do not take into account live-class participation to remote students. iRoom in Stanford [2], explores new possibilities for people working together in technology rich spaces, where has large displays, wireless or multimodal devices, and seamless mobile appliance integration. iRoom are used for discussion and learning, while it cannot allow remote students interaction either. Smart Classroom in Tsinghua University [17], similar to iRoom, well supports remote student interaction and communication, however, lacks of mobile devices communication mechanism without any pre installed modules and is limited to utilize useful outside services. All these projects lack of supporting multiple classrooms working together, which is one of the important features that need to be emphasized in the future learning system.

Many software infrastructures for Smart Space exist with similar but a little different key features .Smart Platform [16] developed by Tsinghua University addresses the issue of performance and usability, which has three different communication schemes and loose-coupled multi-agent encapsulation architecture. However, Smart Platform has little implementation on the terms of services and multiple Smart Platforms communication. Similar to Smart Platform, iRos [2] by Stanford is meta-OS that ties devices together that each has their own low-level OS.

As the extension of iRos, iCrafter [10] allows users of interactive workspaces to flexibly interact with the services in the workspace. Unfortunately, even with iCrafter, the software infrastructure does not consider the problem of multiple Smart Spaces communication. Hyper glue [8], which is a complement system of Met glue [9] in MIT, involves the multiple Smart Spaces resource management. Meanwhile, both Hyperglue and Metglue use Java RMI technology and their extended solution for direct coordination among different modules, which takes greater expenses because of the highly dynamic feature of Smart Space. Gaia [7] is a middle infrastructure with resource managementand provides the user-oriented interfaces for such physical spaces populated with network-enabled computing resources .Gaia enables data and applications of users to be abstracted, that can be moved across and mapping to different the Smart Spaces. Gaia support services quite well, however, lacks of emphasizing on multiple Smart Spaces communications mechanism either.

III. OPEN SMART PLATFORM

Smart Platform is a generic software infrastructure for connecting and coordinating various software and hardware modules in smart spaces to perform specified tasks developed by Tsinghua University. Since most of the modules in smart spaces are parallel working processes centralized control logic, Smart Platform adopts the Multiagent System (MAS) model and thus in nature is a MAS.

A. Architecture

Single Smart Space: From single Smart Space view, the Open Smart Platform is described as Figure 1.

Similar to Smart Platform, Open Smart Platform has a central S, several container running on each of the host, each of which lots of agents running on. The reason why we inherit the multi-agent architecture of Smart Platform is because it has been well-developed and validated by several projects and also compatibility with previous work on Smart Platform concerns. The key improvement is that there are two system modules added: Web-Service-Wrapper-Agent (WSWA) and Smart-Platform-Agent-Web service (SPAW).

WSWA is an agent, which invokes an outside web service based on the message received from other agents and returns the reply from the web service to the agents. Agents in Smart Platform can invoke outside web services by sending messages to this agent.

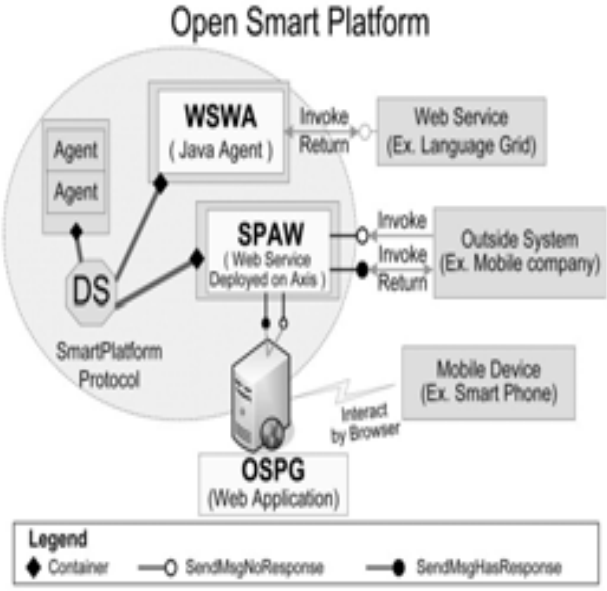

Fig: 1 Open Smart Platform architecture for single Smart Space

SPAW is a web service deployed on Axis. It receives messages from outside systems, transforms the messages to the protocol used in Smart Platform, creates a SPAW-agent to dispatch the message, and returns the reply from the agent to outside systems. Through this mechanism, outside systems can interact with agents in Smart Platform as web services. It also allows us to make and deploy workflows using agents in Smart Platform and web services, such as BPEL [13], has been involved, which makes the developer more easily customize their tasks. Moreover, as a web service, SPAW can be easily invoked by a web page server, where almost all current mobile devices can browse web pages and thus interact with modules inside of Smart Platform through SPAW.

In short, Open Smart Platform for single Smart Space is a multi-agent system with WSWA and SPAW as access point of communication between the inside and outside of Smart Space. From the inside view, communications are all based on Smart platform Protocol, which is familiar with by previous Smart Platform developer. From the outside view, functions are all web services, which is the best for web service developer to build their tasks. Using WSWA and SPAW, we construct a communication bridge between the Smart Space and outside systems, which opens Smart Platform to outside systems.

Smart Community. For Smart Community, where several Smart Spaces communicate and coordinate with each other, we establish the communication channel for them suitable for open network among them.

New Features

Three new features of Open Smart Platform will be elaborated below:

- **Extensibility for mobile devices.**

Previous Smart Platform enables mobile devices roaming with users to connect into Smart Space by pre-installed modules (eContainer and eA K-based agent of Smart Platform), however, it lacks of convenience for the users,

especially for those who first come into Smart Space to use their mobile devices. Open Smart Platform applies new mechanism named web-based-mobile-interface for mobile devices interaction in Smart Space. Open Smart Platform makes the required mobile interfaces, such as PPT upload or Turn-to-Next-Page, on web- based-mobile-interface as a website. Since almost all the mobile devices, such as Laptop, P A, Smart Phone, or even normal cell phone have integrated web browser, the only thing that user need to do is to browse that website and click the corresponding link. The link is connected to SPAW, which will create a temporary SPAW-Agent to finish the whole task. If there is any reply information for that interface, for example, 'Check the schedule for Smart Classroom', the SPAW-Agent will return the result to SPAW and then got by the web browser of the mobile devices.

- **Extensibility and Scalability by services communication channel**.

With WSWA delegation, it is unnecessary for each agent to deal with the problem of invoking web services, such as managing the life cycle of the web service stub. All is simple and easy by sending a web-service-request-message to WSWA and waiting for the result. Also, since all the services descriptions are shown on SPAW, it is very easy for the outside system to use services in Smart Space by simply invoking the corresponding services on SPAW. The services communication channel fills the gaps between the isolated services in Smart Space and outside services and systems, which makes the Smart Space more open.

- Connection of multiple Smart Platforms in open network.

The most novel feature given by O p e n Smart Platform is enabling multiple Smart Platforms to connect with each other in open network. In the architecture, we place each Smart Space in equal hierarchy, which is primary work that just suitable for small scale Smart Community. Open Smart Platform focuses on building the communication channel among multiple Smart Spaces, which gives each Smart Space a single message access point (WSWA & SPAW), and extends the previous successful Publish-Subscribe mechanism to Smart Community communication.

Using SPAW and WSWA for the single access is more convenient for message management and system safety consideration. It also simplifies the agents developing process that the programmer does not need to think about how to get through frustrating NAT, Proxy or Firewall in the open network. Additionally, as all messages between one Smart Space and the other are transferred through the link between two pairs of SPAW and WSWA, we can choose the best network link for them to get best efficiency for messages transfer between the two Smart Spaces.

Open Smart Platform provides the necessary basis for the connection of multiple Smart Spaces in open network, thus makes the application of multiple Smart Spaces, such as Open Smart Classrooms, possible and easy to build. To sum up, Open Smart Platform successfully addresses the issues raised by developing pervasive computing. It supports multiple Smart Spaces connections, easy mobile device interaction and services communication channel between inside and outside of Smart Space. These new features provide a well software infrastructure basis for building Open Smart Classroom and other Smart Space and Smart Community related projects.

IV .OPEN SMART CLASSROOM

Open Smart Classroom is an extension of previous Smart Classroom project. Besides the features such as real time interactive virtual classroom and blended learning mode, Open Smart Classroom mainly focuses on the following two issues, which make it an open classroom compared to other related works.

- Enabling multiple classrooms to connect with each other in the open network. Involving multiple classrooms to have class together, especially for classrooms in different countries, has great significance to intercultural and intercontinental learning. Open Smart Classroom tries to combine several Smart Classrooms together to give novel experience for the teachers and students in the class. Also, considering the differences of classrooms, such as the different using language, the different infrastructures and devices, necessary transformation is needed in order to gain better connection effect. In the recent Open Smart Classroom, we primarily take different languages into account by involving Language Grid [14][16] translation engine for better understanding.
- Open the classroom interface and makes the classroom open to outside services. Open concept is also for single Smart Classroom. The ease of using mobile device in the classroom to communicate and interact shows the open of the classroom. Moreover, the classroom easily taking use of the abundant resources, such as Language Grid translation service, presents the powerful extensibility of the classroom, which thus also embodies the open feature.

Classrooms Setup

Besides these display devices, there are multiple software modules working together in two classrooms, respectively, providing the functionality of this collaborative classroom. Fig. 2.illustrates the detailed runtime architecture of these two classrooms.

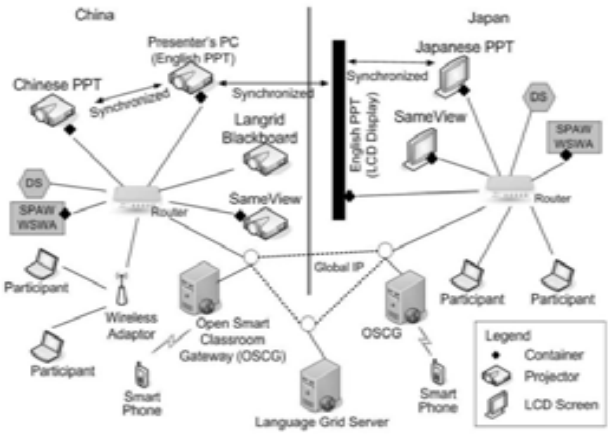

Fig.2.Runtime architecture of Open Smart Classrooms in China and in Japan. Note that this figure shows the architecture when the presenter is in China, which makes the Chinese classroom the main classroom.

Both of the classrooms run on their own Open Smart Platform, consisting of S, SPAW, WSWA, OSPG, several Containers, Same View Agent, PPTController Agent, and PPT i s p l a y Agent. Every participant brings his Laptop to join in the class using Langrid Blackboard tools to discuss with each other. In an open network, Language Grid server provides the machine translation service that can be utilized in each classroom. PPTController Agent runs on the Presenter's PC. It translates the Presentation file and dispatches it to other PPT isplay Agent. It also detects the status of the slideshow, such as the current page of the slideshow, and synchronizes all the presentations in the classrooms. PPT isplay Agent runs as a daemon process to control the presentation file on its host. It receives the presentation files and the controlling commands from PPTController Agent to show the presentation. Synchronously. Langrid Blackboard is a virtual blackboard for students to discuss with each other It automatically provides machine translation to fill the gap of the language differences among the participants. In addition, Langrid Blackboard provides real-time back translation mechanism. Back translation mechanism enables the user (e.g., Japanese) to see the translation (e.g., En2Ja) of the translation (e.g., Ja2En) of the input sentence, which makes the user, is able to revise this input sentence if the back translation has great difference from the original input one. Moreover, it also acts as a feedback platform for students to post their questions and suggestions to the teacher. Language Grid Server provides the machine translation Web Service in the open network. It is invoked by PPTController and Langrid Blackboard and helps them to translate the requested content. Each classroom has its own OSCG developed based on OSPG settled in WAN. It automatically generates an HTML page for mobile devices to invoke services in its own Smart Classroom, e.g., turning the PPT to the next page. It also provides some manually built page, such as uploading PPT and viewing current slides show, to facilitate the teacher and students to participate with their mobile devices.

IV. CONCLUSION

New requirements raised by the development of pervasive computing have been pointed out, and to meet them, we make Open Smart Classroom, which is based on Open Smart Platform to enable the teacher and students to have intercontinental and intercultural class with better mobile device cooperation experience. Open Smart classroom envisions the future learning system, where classrooms are connecting and collaborating with each other in open network while the students and teachers with different cultural background in different countries are having class together. Open Smart Platform, as an upgrade of Smart Platform, is still a multi-agent system integrated with several extensions, serving as the generic software infrastructure for Smart Space. It enables better support in three aspects: 1) Successful connection multiple Smart Platforms together in open network; 2) Service invocation channel between inside of Smart Spaces and outside systems; 3) Easy interaction for mobile device roaming with users. Currently we place each Smart Space in equal hierarchy currently; the Open Smart Platform does not have a service-management module to address the issues such as dynamical service composition or service arbitration. Moreover, how to make full use of the learning environment provided by Open Smart Classroom to enhance students' understanding in the multicultural class is still an open question, which needs further studying.

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