Virtual collaboration and training in medicine through multimedia e-learning system

Yeong-Tae Song, *Towson University, Towson MD, USA*
Chuleui Hong, *Sangmyung University, Seoul, Korea*

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ABSTRACT. Web-based virtual collaboration is increasingly gaining popularity in almost every area in our society due to the fact that it can bridge the gap imposed by time and geographical constraints. However, in medical field, such collaboration has been less popular than other fields. Some of the reasons were timeliness, security, and preciseness of the information they are dealing with. In this paper, we are proposing a web-based distributed medical collaboration system called Virtual Collaboration System for Medicine (VCSM) for medical doctors that meets the needs. The proposed system consists of two parts: multimedia presentation and recordable virtual collaboration. The former supports synchronized multimedia presentation using Synchronous Multimedia Integration Language (SMIL). It allows synchronization of the contents of a PowerPoint presentation file and a video file so that the presentation shows slides and video on the same topic at any given time. The resulting SMIL file is used to provide multimedia presentation for image intensive discussion. The presentation may be provided to the participants before the discussion begins. Participants can use text along with associated symbols during the discussion over the presented medical images. The symbols such as arrows or polygons have *x-y* coordinates within the images to represent associated participants' opinions. Those can be set or removed dynamically to represent areas of interest in digital images using so called layered architecture that separates image layer from annotation layer. Those annotations can be easily hidden for training purposes. XML files are used to record participants' opinions along with the associated elements such as arrows and polygons over some particular images.

KEYWORDS: *Multimedia presentation authoring, Real-time digital image annotation, SMIL, Virtual collaboration.*

Introduction

In modern society, Internet-based communication has become an important commodity in daily life, anywhere from instant messenger to hi-speed video conferencing. The communication mechanism can be in many different ways such as text chat, messaging, audio and video. Internet-based collaboration or virtual collaboration may be carried out in various ways, e.g., simple text exchange through web pages, text chat, voice-over-IP and IP video conferencing (Leonard et al., 2003). Olson et al. stressed and analyzed collaboration among researchers and assessed some of their collaboration projects. The demand for the virtual collaboration has been overwhelming in the sectors including research community, academia, medical and some industry for various purposes, e.g., researchers get better results by doing collaboration with their peers, schools offer distance education to serve broader community, medical doctors collaborate for better treatment of patients - by getting experts' opinions, industry use collaboration for more efficient sales and marketing meetings, etc. (Olson et al., 2002). Suebnukarn and Haddawy proposed a tutoring system for medicine that makes use of chat, discussion and experts' opinion to draw a conclusion (Suebnukarn, Haddawy, 2004). Lim et al. proposed a web-based medical image analysis tool using some image processing and web-based communication (Lim et al., 2000). Some systems regarding medical annotations were proposed. Volkmer et al. proposed a system for annotating images and videos in a collaborative way (Volkmer et al., 2005). In medicine field, such collaboration methods didn't get much attention due to some medical specific requirements that may not be satisfactorily met by currently available collaboration technologies. Some of the requirements can be:

- Accuracy of patient data
- Security: only the authorized person should have access to the data
- Time-stringent discussion
- Annotation on medical images

In this paper, we are proposing a new way of collaboration and education in medicine that satisfies the above requirements as well as a tool called Virtual Collaboration System for Medicine (VCSM) that helps researchers or medical doctors exchange opinions over

digital images with aforementioned requirements in mind. VCSM consists of two separate tools: one is called VicdilStudio that is a multimedia presentation authoring tool, and the other is called Virtual Collaboration among Experts over the Internet (VCEI) that is a virtual collaboration tool.

Collaboration among experts, such as medical doctors, should be conducted in such a way that all the participants should have prior knowledge about the case that they are about to discuss before the discussion begins.

There has been some work on multimedia authoring such as Bulterman and Rutledge. Their approach is to partition the concerns for authoring environment (Bulterman, Hardman, 2005). The VicdilStudio offers easy-to-use and efficient multimedia presentation authoring that utilizes SMIL that is Synchronous Multimedia Integration Language (James, Hunter, 2000; Kennedy, Slowinski, 2002; Schmitz, 2002; Bulterman, Rutledge, 2004).[1]

1. Also see SMIL Tutorial http://www.w3.org/TR/SMIL2/ and GRiNS Player for SMIL 2.0 http://www.oratrix.com/

It helps the meeting initiator present the case that needs collaboration by providing the capability of synchronizing video and PowerPoint file that includes medical images. The uniqueness about the VCSM is the connection between synchronized multimedia presentation authoring and real-time digital image annotation. In VCEI, annotations use layered architecture to separate images from annotation. In the annotation layer, various symbols such as arrows and/or polygons are associated with *x-y* coordinates that represent the location on the image. Those symbols are associated with valuable information such as experts' opinions on the area of interest in some images. All the discussion may be recorded in real time using XML, as proposed by King et al. (King et al., 2004), and the use of web-based database for permanent storage. With VCEI, users can place a symbol on the location of interest in a digital image and associate it with their opinions, and multicast those to all the participants in the discussion so that they may be able to exchange their opinions. Each submitted text opinion along with their coordinates is saved into an XML file during the discussion for fast loading and retrieval. When the discussion is over, all the opinions from the discussion that are saved in an XML file may be saved into web-based database for future context-based intelligent search. Location (coordinate) information can be used to retrieve opinions on some particular area of the images when selecting the region by polygon, which is typically

a convex polygon, and use it as queries to the database for the location and associated opinions.

Multimedia presentation using SMIL

The necessity of synchronization and SMIL

By far the most effective way of communication is face-to-face meeting. In virtual collaboration community, resembling it as closely as possible would be the eventual goal. In order to achieve this goal, video and other multimedia elements become inevitable choices for the communication.

In this section, we would like to consider multimedia presentation, which is uni-directional communication instead of bi-directional communication, and associated challenges. We termed a presentation "multimedia presentation" when video and other multimedia elements are used as a main means of delivering the contents. In our approach to multimedia presentation, video and PowerPoint file are used to create multimedia presentation. When used with PowerPoint file, video must be synchronized with each slide so that the audience knows what the video is referred to. The following things must be considered when synchronizing multimedia elements:

1. Duration of each slide (how long should it be displayed).
2. Position of each multimedia element such as video, slide, and/or digital image on the screen.
3. Order of each element (which one shows up first).
4. Types of supporting multimedia file and its player.

Multimedia presentation is especially useful when there are digital images or textual descriptions that need visual explanation. Adding video and digital images to PowerPoint slides in our approach would include the aforementioned considerations. Video needs to have appropriate position and size, and each slide needs to have appropriate duration so that during the execution of video corresponding slides would be displayed. Depending on the connection speed, appropriate bit-rate should also be selected. The whole process is called multimedia synchronization. For such purpose, there is *W3C Recommendation* [2] that describes Synchronous Multimedia Integration Language (SMIL), which describes multimedia presentations. SMIL became an official *W3C*

2. W3C Recommendation http://www.w3.org/TR/2005/REC-SMIL2-20050107/

Recommendation in August 2001. It is a collection of XML elements and attributes that can be used to describe the temporal and spatial coordination of one or more media objects. With SMIL, different media objects can be combined into a single coherent multimedia presentation. SMIL can be used to manipulate location, size, type of media objects, bit-rate, etc.

Multimedia presentation authoring tool - VicdilStudio

There have been many approaches in adding multimedia to presentations, but many of them are fairly complicated and require expensive equipment. In our approach, we are proposing an easy and inexpensive and yet efficient way of adding multimedia to presentations using Synchronous Multimedia Integration Language (SMIL).

The concept was implemented as VicdilStudio using Java technologies such as *JMF*[3] and *JDOM*[4] and for the synchronization of multimedia components we used SMIL. It captures video and audio from a web cam and creates multimedia presentation by merging PowerPoint presentation slides and a captured or a prerecorded movie. One of the hard parts in creating such material is to specify synchronization relationships among media elements. In our model, we synchronize the video and audio with the PowerPoint slides by creating a SMIL file that specifies the relationships among the elements in the presentation. A SMIL file can specify the duration of each slide, location and size of video and slide, and so on. Once the presentation file is created, VicdilStudio can edit existing relationships such as duration of each slide.

3. Java Media Framework JMF http://java.sun.com/products/java-media/jmf/index.jsp

JDC Tech Tips http://java.sun.com/developer/JDCTechTips/2002/tt0219.html

4. JDOM http://www.jdom.org/

JDOM Tutorial http://www.javaworld.com/javaworld/jw-05-2000/jw-0518-jdom.html

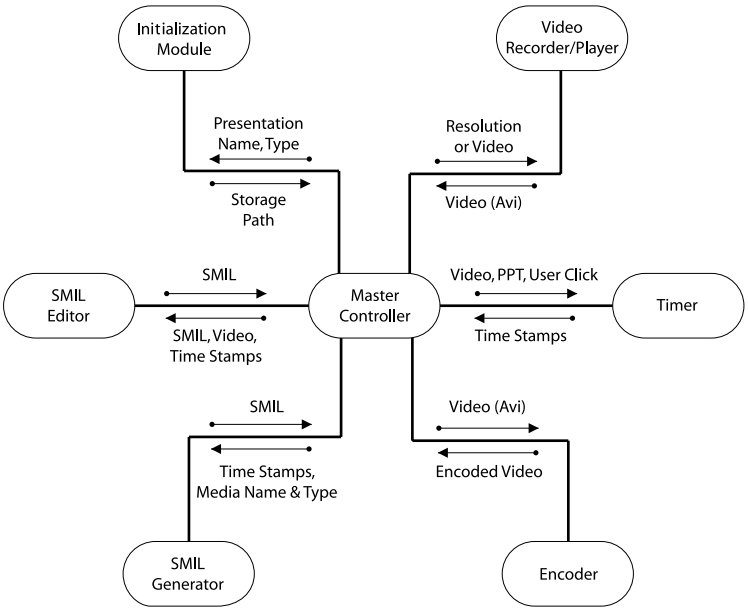


Figure 1. Block diagram of multimedia presentation tool

Main modules are described as in the following:

- The Initialization Module initializes a user session. It creates or opens an existing presentation based on user selection and initializes other modules in the tool.
- The JMF video capture module records video and renders it to the screen for monitoring. Its video playback module can play an existing video selected by user.
- Timer is triggered by user command. When the timer is started, it starts video capturing module and marks the beginning of the presentation displaying the first slide. As user moves on to next slide, it invokes the slide loader and keeps track of the time duration for each slide for synchronization with associated video. When the timer is stopped, it stops the video capturing and marks the end of the presentation.
- Encoder transforms AVI video into streamable format and compresses the size of video.
- The SMIL Generator compiles the information about slides and time stamp for each slide, captured or pre-recorded video and synchronizes those into one SMIL file that enables synchronized multimedia presentation.

- The SMIL Editor is used for fine-tuning the synchronized presentation. The editor module reads the time stamps from the generated SMIL file. It waits for user command whether to write the edited timestamps back to the SMIL file. It also ensures that the accumulated duration of the entire slides is the same as the video running time.

The resulting presentation is in SMIL format, which means the following:

- Media is in streamable format - encoded video synchronized with slides and other media elements, if any.
- A SMIL file defines relationships among the media elements used in the presentation.
- The SMIL file is playable by *Real Player*™ in our approach.

SMIL may define location and size of visual elements (video, PowerPoint slides), duration of each slide, and references to the video and slide files. Since SMIL is based on XML, an element and its attribute are identified and wrapped by tags. The elements and attributes in the generated SMIL file consist of the following:

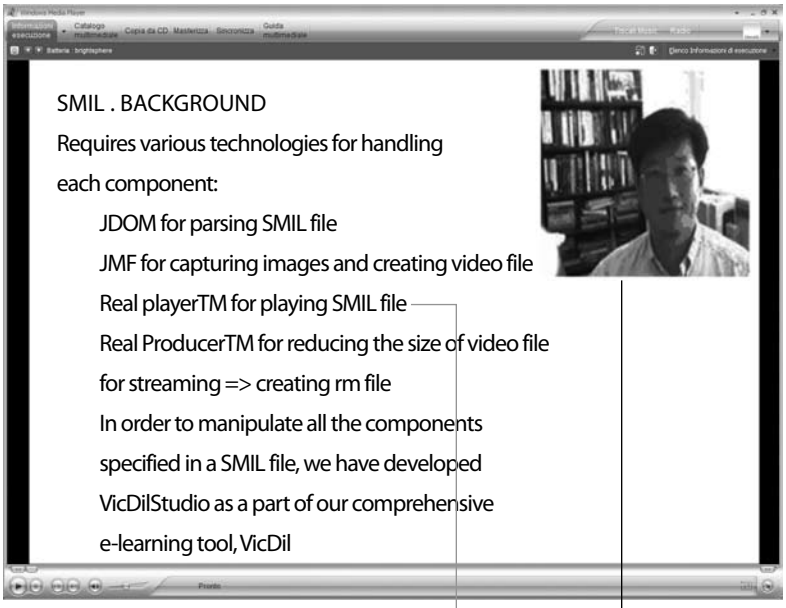
- Region for video and PowerPoint slides: regions are assigned to video and PowerPoint slides in each SMIL file using the element <region >. Each region is assigned a unique SMIL-ID.
- SMIL-ID: an ID is assigned to each child element of a SMIL element, e.g., *video* or *img* in the example code.
- Parallel execution of child elements: synchronized video and PowerPoint that are executed in parallel are child elements of <par> tag.
- Duration time: the *dur* attribute defines the duration time for each PowerPoint slide.

The example in Figure 2 is a SMIL file in action and corresponding source code. The markups for each region and media declarations are clearly shown. SMIL files contain only the references to media objects, not the actual media objects itself. Some SMIL players are currently available.[5]

The SMIL player we chose was *RealPlayer*™ due to its popularity.[6]

5. GRiNS Player for SMIL 2.0 *http://www.oratrix.com/* X-Smiles SMIL 2.0 Player http://www.xsmiles.org/xsmiles_smil.html

6. Real Networks http://www.realnetworks.com/products/free_trial.html




```
<smil>
<head>
<layout>
<root-layout width="1100" height="700"
        background-color="white" />
<region id ="ppt" left="20" top="10"
        width="720" height="540" fit:"fill" />
<region id ="video" left="750" top="30"
        width="320" height="240" fit:"fill" />
</layout>
</head>
<body>
<par>
<video src="test25.rm" region="video"
        id="1" />
<img src="slide1.jpg" region="ppt"
        id="2" begin="id(1)(0s)" dur="6s" />
<img src="slide2.jpg" region="ppt"
        id="3" begin="id(2)(6s)" dur="3s" />
<img src="slide3.jpg" region="ppt"
        begin=id"(3)(3s)" dur="4s" />
</par>
</body>
</smil>
```

Figure 2. A multimedia presentation and its corresponding SMIL source file

Relevancy to medicine

The field of medicine has plethora of image-related information such as MRI, X-ray, PECT or CT-Scan images that may be the primary consideration for any type of medical related discussion or collaboration. In some cases when there are time and geographical constraints, virtual collaboration over the Internet may help

solve the problem. However, due to its size, privacy, and lack of supporting technology, virtual collaboration over the Internet in medicine has been difficult and costly. In such situation, thanks to its capability of integrating various types of multimedia objects and being able to make it available in the Internet, SMIL has been adopted as our approach.

Discussion and opinion recording using a virtual collaboration tool (VCEI)

Virtual collaboration and VCEI

Even though face-to-face meeting is the best way for collaboration, doing so may not always be possible due to geographical and time constraints. In such situation, Internet-based applications may be of good help such as e-mail, instant messenger, chatting, IP-based audio or video. With such methods, virtual collaboration may be carried out but the Internet-based collaboration has its own limitations, e.g., discussions that involve images and location because in cyber space it is difficult to locate certain position precisely and dynamically.

To help resolve such issue, VCEI (Virtual Collaboration among Experts over the Internet) has been proposed. The VCEI is an Internet-based distributed system that enables Internet-based recordable discussions over the images. It is a socket/servlet-based three-tier distributed system. The first tier in VCEI is made up of client objects. Client objects are Java[7] applets as in Figure 3. They communicate with Session Manager or SM, which is the middle tier of the system. SM receives connection requests, participants' opinions and associated *x-y* coordinates from the front tier, and fulfills the requests by invoking XML converter. The SM multicasts the received information to the first tier, which is client objects that are in its active connection queue so that all the client objects can be synchronized. Active connections of the client objects can be periodically examined by SM by sending out query packets to the clients and verifying their reply. Only those who replied to the query will remain in the active queue. Finally, the third tier is the distributed databases such as SQL Server or Oracle. When the client objects and SM communicate, parameters can be passed as objects that contain participants' opinion or request by way of serialization. On the server side, SM

7. Java http://java.sun.com/

invokes XML converter and has the objects saved into an XML file so that it can be available for the client objects for searching and fast loading. XML converter is a distributed object that converts an object, which contains participants' opinions, into an XML file. When SM polls data from the database, XML converter converts text or any other types of information into XML files for the aforementioned reasons.

Digital image annotation through layered architecture

Motivation

When digital images are used in the discussion, it is necessary to point out where the points of interest are. In virtual collaboration, since participants cannot see each other, it is important to know where is the point of interest on the image and what are the associated opinions. In general, digital marking may be possible by drawing some type of symbols on the image. However that may damage the original image and represent only the limited amount of information. The following things need to be addressed when annotating digital images:

1. Separation of images and labels or opinions: in order for the annotations to be effective, labels must be separated from the images so that the original images will remain untouched and allow as many annotations as needed for the image. It will help manage annotations independently.
2. Association of symbols with various types of information on to the location of interest in the image: the symbols should have some meanings so each symbol needs to have some association with various types of information such as text, image, voice and video along with location information.
3. Search opinions by location in the image or by keyword: once annotation for the image is done, it should be able to search either by location or by keyword. When searched by location, *x-y* coordinates that are limited by the size of the image need to be used to select the locations.
4. In case of real-time collaboration, such information should be delivered to all the participants in real-time.

We propose a virtual collaboration tool with aforementioned considerations in mind.

Layered architecture

As discussed in the image annotation, separation of concern - image and opinion - is one of the major considerations. In VCEI, each participant communicates through client objects that display digital images, chat window, participant list and participants' opinions. It has been implemented as Java applet so that participants can access it without any particular software requirements except for some plug-ins. It allows participants to draw spatial elements on the images, such as arrows or polygons in order to express their opinion on some part of the image as in Figure 3. For that purpose, client object provides layered architecture so that each spatial element can be saved as an object apart from original images. Each client object is associated with connection manager or Session Manager or SM for the multicasting of opinions to other participants. The SM remotely invokes refresh method of each participant's client object whenever new opinion is arrived. The separate layer for annotation may be used as location-based search operation.

Opinion recording

Research-oriented or expert-centered discussions are worthwhile to record, for those may be useful for future reference. In VCEI, each submitted opinion may be recorded by using XML converter. The recorded information is saved into an XML file. The screenshot for VCEI is shown in Figure 3.

XML is known to be useful in combining heterogeneous information using so called tree structure. It can be organized in such a way that it can be possible to search for specific information in relation to other dissimilar information type such as searching for some opinion by the location in the associated image. XML has such rich properties that it is possible to combine dissimilar information and make it a coherent object. With its tree-like structure, XML can capture various types of information and yet relate each other in an organized way.

Whenever new opinion is submitted from a participant, it can be represented by a spatial symbol, such as arrow or polygon, on the image displayed at client object(s). The symbols have location

information (*x-y* coordinates) on the image and are associated with participants' opinion.

Search function is provided for the users who want to retrieve experts' opinions by their topic of interest or the areas of interest. Search can be done either by keywords or by the location of the image where experts' opinions are associated. In Figure 3, search function is implemented as "Select" button. When clicked, users can draw a polygon to select some area of their interest. After that, "Display" button will display the opinions, represented by either arrow or circle, whose *x-y* coordinates are within the polygon area.

Figure 3. VCEI screenshot and description

Label	Description
A	Image thumbnail
B	Images being used for discussion
C	Opinion board
D	Opinion detail
E	Participant list
F	Chat window

Multi-conference room

In some cases, more than one topic may need to be discussed or more than one group of people needs to share collaborative environment. With VCSM, such need can be satisfied by manipulating port number that each client object is using and group ID of each user. Users can be categorized by the topic of interest or the area of expertise within the system. Each category can be considered as a group and corresponding conference can be created. Once a conference is created, detail topics can also be created and be associated with the conference. This way, VCSM can offer multiple conferences and each conference can have multiple topics. Each conference shares the same port number with other topics within the conference. Any user can create new topics or join the existing topic by validating user's access right. Users can join multiple topics or can be assigned to multiple conferences (groups) at the same time. During or after discussion, users can express their opinions or retrieve other experts' opinions from multiple topics and possibly from multiple groups.

Figure 4 shows the screen capture of new topic creation dialog box. The creator becomes the manager of the topic, where he/she sets the name of the topic and specifies participants. It is the manager's responsibility to upload related images and/or multimedia presentation.

The Internet is the enabling engine for VCSM to support real-time interaction, sharing databases, web-based applications, and other multimedia objects. One of the important requirements of virtual collaboration is private person-to-person communication between participants, which may include face-to-face conversation, exchange of their writings or drawings, or sharing their knowledge that may need to be done separately. Since most users are reluctant to change their behavior because of a new tool, this feature may help them feel the way they used to do.

VCSM recreates face-to-face experience of traditional meeting by providing independent (or not tied with the main window) private window. The initiator can create a private session with selected participants. He/she can choose the names in the list of participants and request private session. If the recipients accept the offer, a private session may be created. The other members may join existing sessions with the permission from the initiator. Participants can withdraw from the session at anytime. If no member is left in a

session, the session will be closed. The discussion and any shared data in a private session are hidden from the other members.
In a shared window, the viewpoints of all participants are synchronized. If any participant expresses opinion using a symbol and comment, the content of every participating client object is updated simultaneously. The user can move freely between the private and shared working space.

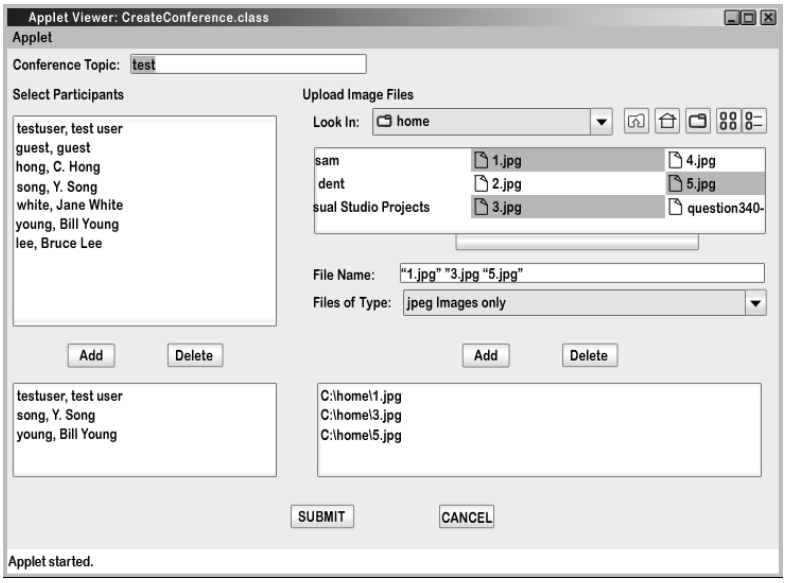


Figure 4. The screenshot of creating new topic

In VCSM, a shared working space is used for collaboration. It may be used synchronously or asynchronously. In synchronous mode, any changes in the state of the space are multicasted to all participants and update other participants' views in real-time so that all participants can see the same view. The synchronous collaboration is typical in shared working spaces such as chatting, instant messenger or whiteboard. Discussions in the shared working space may be recorded for future reference. In asynchronous mode, collaboration is performed by allowing each participant to log on at their convenient time, and leave new marks and comments on the images for other participants. The other participants may log on at their own time and reply existing opinions or add new marks and opinions.

VCSM offers access control mechanism that restricts users' access right to the available resources to protect the system and data from malicious operation. There are four types of access rights in VCSM:

Initiator: Any member who creates the topic becomes the initiator of the topic. He/she can manipulate access right of the participants for the topic.

Member: Any legitimate user of VCSM. Members need to get permission from the initiator of the topic, should they want to access the topic.

Observer: Observer can only watch the conference and retrieve stored information. He/she cannot participate in the conference or alter the information.

Restricted: They may not be able to access the topic.

The typical scenario of creating group & conference room:

1. A member requests for a new group to the system administrator.
2. The system administrator checks up the requester's access right and group, and then creates a new group and informs the requester of the decision.
3. The initial attributes, such as group name, group identification, Member Management, the maximum number of rooms and users in a group, are set for the newly created group.
4. Any user who wants to join the group sends a request to the system administrator.
5. The system administrator inspects the requested group identification and requester's access right, and then registers the user as a member and informs the user of the decision.
6. Any member in a group may create a conference room for the specified topic and be a manager of it.
7. The manager of a room sets the topic and participants, and uploads initial images.
8. Any user can request a membership to the manager of the topic. Manager has the right to accept a request or not.

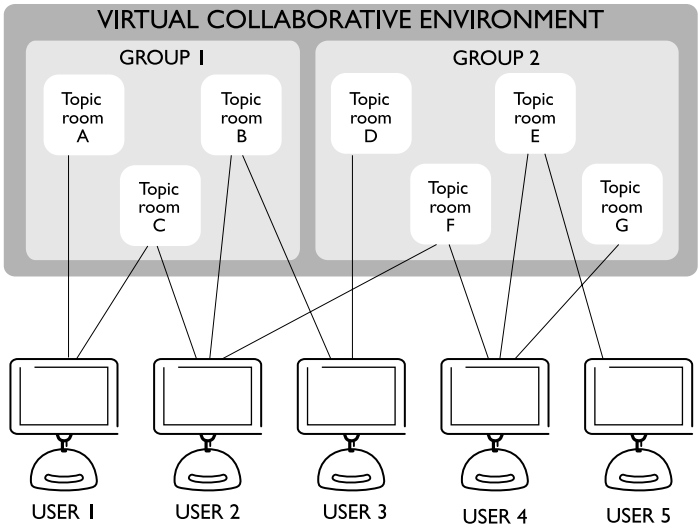


Figure 5. The group and multi-conference room in VCSM

Applications using Virtual Collaboration System for Medicine (VCSM)

Virtual medical collaboration using images

Typical scenario:

Virtual collaboration among the medical doctors can be performed in the following manner:

1. A doctor comes up with a case that needs discussion with other doctors who have the specialty in that field.
2. The doctor prepares multimedia presentation regarding the case using VicdilStudio. The presentation uses digitized medical images and other available resources such as patient information and/or lab results, if any. The images used in the presentation will be available for discussion. When finished, it will be uploaded to the designated cyber conference room.
3. The doctor then specifies the time and date, and asks potential participant(s) to log on to the designated web site where the multimedia presentation for the case will be available for them to look at before the discussion begins. Each participant is requested to watch the presentation before the specified time.

4. On the specified date and time, participant(s) log on to the web-site and the doctor who requested the meeting becomes a host of the meeting. Discussions can begin immediately as in Figure 6.
5. Participants express their opinions through their web browser along with the information on the area of interest in some digital images presented. Some relevant digitized material such as medical images can be uploaded from their location, if necessary. Their opinions are saved into an XML file and eventually saved into web-based database such as SQL server.
6. Discussion session continues and opinions are exchanged among the participants until they reach some conclusions about the case. Chat window as in Figure 3 is used for all other messages that are not directly related to the case. The messages used in the chat window will not be recorded.
7. When finished, the host can call the meeting off using chat window.

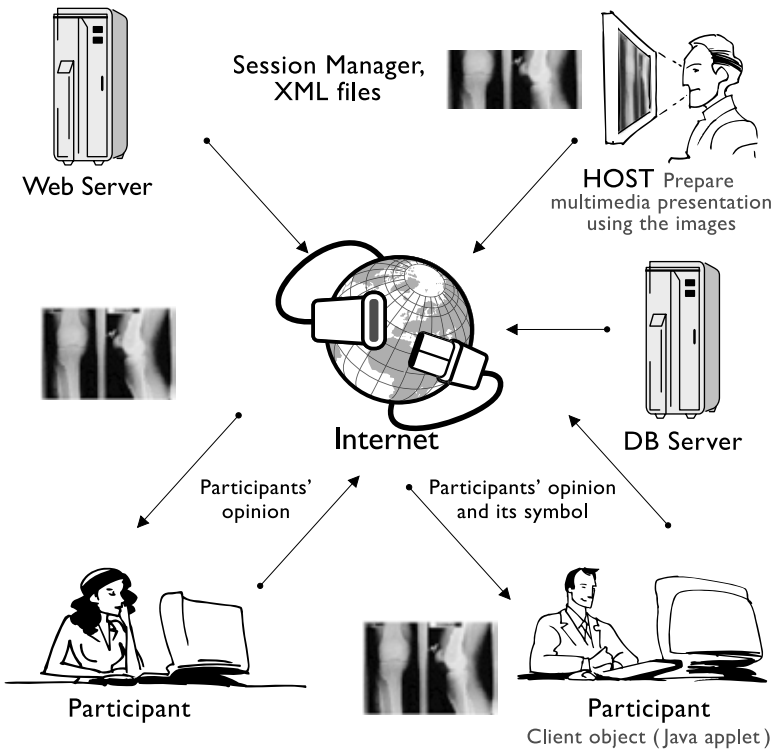


Figure 6. VCSM in action

Second opinion and medical image interpretation training

The VCSM can be used to get second opinion from specialists. In this case, the system will be used asynchronously. The steps are similar to the previous case but there is no need for all the participants to be online at the same time. The requester of the second opinion needs to prepare all the images and other supporting documents regarding the case. Once it is prepared, it will be uploaded for the specialists to see. The specialists then examine all the uploaded information, and post their opinions using symbols over the images and other supporting documents regarding the requested case.
Similar to the second opinion case, medical image interpretation training can be used in asynchronous mode. Experts on the images can post all the symbols and their associated explanations, and hide the symbols from the trainees.
The trainees then post their own opinion for the images and compare it with that of experts'.

Conclusions

We have proposed a web-based virtual collaboration and multimedia presentation authoring system for medicine (VCSM). The VCSM is a combination of two separate tools, one for multimedia presentation authoring, and the other for virtual collaboration among medical doctors. Our approach makes use of spatial database with medical images so that the participants in virtual collaboration may be able to exchange opinions using spatial data associated with medical images. We have provided two different modes for collaboration, synchronous mode and asynchronous mode. Due to the characteristics of medical data - containing many digital images - we have introduced the multimedia presentation authoring tool called VicdilStudio that enables the multimedia presentation over the Internet. The tool synchronizes video and PowerPoint file, and encodes it for streaming. Each potential participant in a discussion is required to watch multimedia presentation from their browser before the discussion begins. Discussions were performed using layered structure that enables the separation between digital images and participants' opinions. During the discussion, experts' opinions can be collected and saved for future reference. The posted opinions

have association with some kind of symbols, arrow or polygon, that represent locations on the image so that it can be searched for by location or by keywords.

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Sintesi

La collaborazione virtuale basata sul web è entrata in una fase di divulgazione in quasi tutte le aree della nostra società, per la sua caratteristica di abbattere barriere geografiche e temporali. In campo medico, tale tipo di collaborazione ha riscosso, tuttavia, un successo inferiore rispetto al consenso ricevuto in altri campi, per motivi - strettamente legati alla specificità del settore - di tempestività, sicurezza e precisione delle informazioni.

Il VCSM (Virtual Collaboration System for Medicine), pensato per rispondere a tutti i necessari requisiti medici, ha proposto alcune soluzioni. Questo sistema di collaborazione medica virtuale è costituito da due elementi distinti, ma strettamente connessi tra loro: il VicdilStudio, uno strumento per creare presentazioni multimediali e distribuirle in Internet, e il VCEI (Virtual Collaboration among Experts over the Internet), uno strumento per effettuare, ed eventualmente registrare, collaborazioni virtuali tra esperti in Internet.

Il VicdilStudio permette di creare delle presentazioni multimediali, in modo semplice ed efficace. Esso utilizza il linguaggio di integrazione e sincronizzazione di files multimediali noto come SMIL - acronimo di Synchronous Multimedia Integration Language, si pronuncia /smail/ - che aiuta il relatore a presentare in PowerPoint il caso di studio che necessita di collaborazione, sincronizzando video e file contenenti le immagini mediche. Il file SMIL viene così utilizzato per avviare una discussione sulle immagini all'interno della presentazione multimediale; questa può essere consultata dai partecipanti già prima dell'inizio della discussione stessa.

La caratteristica che rende unico il VCSM è dunque proprio la distinzione/ connessione tra la creazione della presentazione multimediale sincronizzata e l'annotazione delle immagini digitali in tempo reale. All'interno dello strumento collaborativo rappresentato dal VCEI, si utilizza l'architettura stratificata per separare le immagini dalle annotazioni. Nello strato delle annotazioni, vari simboli, quali frecce e/o poligoni, sono associati a coordinate x-y, che rappresentano la posizione sull'immagine. A questi simboli corrispondono informazioni preziose, quali le opinioni degli esperti, nell'area di interesse sulle immagini. Gli utenti possono infatti porre (o rimuovere) un simbolo ed associarvi le loro opinioni, per poi distribuirle a tutti quelli che partecipano alla discussione, in modo tale da creare uno scambio di idee. Ogni opinione che viene inserita, assieme alle sue coordinate, viene salvata in tempo reale su un file XML, durante la discussione stessa, in modo tale da favorirne un caricamento e un recupero veloci.

Quando la discussione è terminata, tutte le opinioni ad essa associate, già salvate sul file XML, possono essere a loro volta salvate su un database nel web, per una futura ricerca intelligente, basata sul contesto o su parole chiave. Per scopi formativi, le relative annotazioni possono essere eventualmente nascoste, senza alcuna difficoltà.