A General Framework for Computer Support of Virtual Meeting

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Abstract—**It is a common scene in today's work setting that occupational groups and teams meet and collaborate in reaching common goals. Brainstorming new ideas, exchanging creative thoughts, discussing labor's division, searching for a proper solution, and sharing valuable knowledge are examples of desirable outputs of successful group meetings. Conducting a successful meeting is not a trivial task. A successful meeting requires a careful planning. What is the objective of the meeting, which agenda items should be included, when and where it should be carried out, etc? These questions are samples of questions that need answers when planning any occupational group meeting.**

Virtual meetings are expanding rapidly due to the substantial advances in telecommunication tools and systems. They represent a more flexible option over traditional face-to-face meetings for various reasons, such as, better scheduling options, less traveling cost, and minimum physical space. Nevertheless, virtual meetings are difficult to handle. In virtual meetings, it is easier to deviate from meeting's goal and to lose control over participants during the process.

Although there are many Meeting Management Systems around, they either lack of an inclusive support to virtual meetings or not easy to use. There are many design's issues that need to be taken into consideration when developing an effective Meeting Management System. Firstly, it should enable meeting managers to plan and conduct their meetings in a structured and simplified manner. Managers should be able to plan their meetings according to stated goals and specific agenda. In addition, it should support meeting's workflow by providing the appropriate collaboration tools in each step. Finally, it should manage, support, and track action items that are generated out of these meetings effectively.

In this paper we have proposed a general framework for Computer Support of Virtual Meetings that has addressed the above designs' issues. The proposed framework is composed of several layers where each layer contains various components. We have developed LetsMeet, a Meeting Management System prototype, that is derived from the proposed framework. LetsMeet primary objective is to support, manage, and track teams' collaboration in an inclusive, simple, and effective way.

Keywords-Group meeting management system; Meeting agenda; Action items; Team Collaboration; Virtual Meeting.

I. INTRODUCTION

Teams' meetings are becoming a necessity in current work environment. Teamwork is based on the collaboration and the distribution of tasks between team members in reaching common objectives and goals [1]. Specialized working groups within various departments need to meet regularly to discuss important issues and agreeing on certain subjects. There are various types of meetings that a working group usually conducts, such as a project's kick off meeting, weekly team meeting, board meeting, sales meeting, annual review meeting, marketing meeting, stockholders meeting, committee meeting, etc.

Globalization has induced new business models that are mainly based on projects with employees from various sections working from different geographical locations [2]. Virtual meetings have introduced many advantages and challenges [3]. For example, feeling extended distance, partial presence awareness, and limited vision all these limitations make a virtual meeting a difficult place to manage and support. Meeting virtually without a sufficient support environment would lead to many coordination difficulties and disappointments, such as continuous interrupts, regular distractions, losing control, unable to finish within a specific time, etc [4].

Currently, there are many systems that has been used to support and manage virtual meetings such as, TeamSpace [5], Workboard [6], MeetingKing[7] ,etc. These systems enable users to define meeting goals, agenda items, and action items. Nevertheless, they partially fulfill the wide spectrum of requirements that a virtual meeting would usually have [8]. The following section focuses more on the general Computer Support of Virtual Meetings(CSVM) characteristics that a system should have in order to provide more comprehensive support in a formal and simple way.

II. CSVM MAIN CHARACTERISTICS

The CSVM primary functions are to manage, support, and track group activities within a meeting. The first characteristic of CSVM is that it should encourage a meeting manager to plan his meeting according a well defined objectives and agenda items. The second characteristic is that it should properly manage users and tasks [9]. The third characteristic is

that it should effectively support the meeting floor by providing the appropriate collaborative and supportive tools. These tools should change dynamically according to the activity nature in each step. In addition, CSVM should manage and track all the deliverables of the meeting [10]. Usually, every team member is asked to carry out and deliver a certain action item, such as reviewing a topic, estimating a schedule, analyzing a report, validating a new process, drawing a design, analyzing a problem, etc. The CSVM environment should support the creation, submission and the tracking of such tasks along with proper reporting capabilities. Finally CSVM should be able to support collaborative team meetings in a flexible and simple manner.

III. MODELING TASK-ORIENTED MEETINGS

This waterfall shape representation, as shown in figure1, models the main phases within a task-oriented meeting. In this model, there are five major phases which are: defining team's objectives phase, defining meeting agenda phase, conducting meeting phase, producing action items phase, and finally the correction phase that depends mainly on tasks' delivery status.
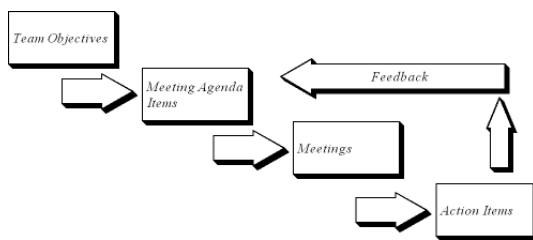

Figure 1: Modeling Task-oriented Meetings

Team objectives represent a list of long range goals that a team should achieve in a specific period of time. It represents the general team mission that is assigned by a higher management entity. In each meeting, some of these goals should be fulfilled. The **Agenda** items represent a list of topics or that need to be discussed and action items that need to be agreed upon. A clear agenda usually increases the meeting effectiveness and efficiency. These agenda items should support the main goals that were specified in the previous phase. **Action items** represent a list of discrete units of tasks that can be handled by a single participant. The Action items should be related to the meeting agenda item.

The **feedback** phase allows flexibility in this model. It allows other phases to update and correct any shortcoming caused by previous meetings. For instance, a team leader could check and see if any agenda items were not covered in the last meeting and if so, they could be included back in the next meeting's agenda.
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IV. CSVM FRAMEWORK

As shown in figure 2, the CSVM framework consists of several layers of components. These components are derived from the general model described in the previous section. These components are necessary to manage users, organize

meetings, notify participants, and track their tasks. These Components are: Meeting Management component, CSVM Tools component, Activity component, Workflow component, Tasks Management component, and Repository component. These components are essential in managing appropriate meeting space and resources within virtual meeting environment.
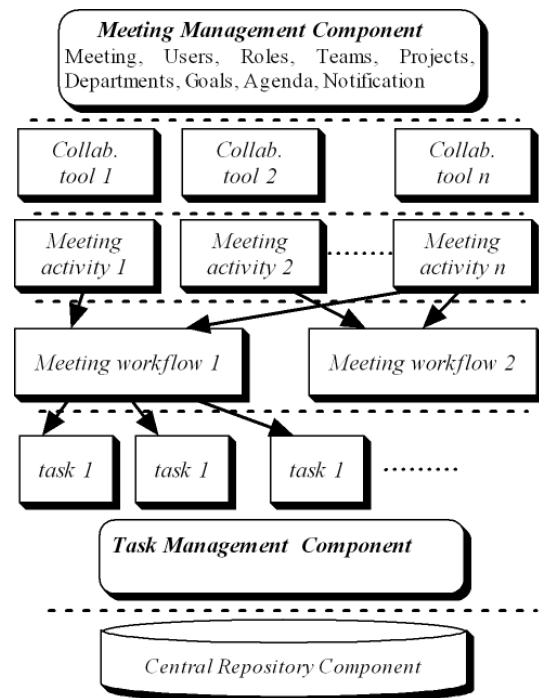

Figure 2: CSVM Framework

V. MEETING MANAGEMENT COMPONENT

Meeting Management Component is an essential component. It enables teams' leaders and mangers to create meeting sessions. In this component, a team leader needs to define all meeting's aspects and details, such as: meeting info, needed resources, related context and content, and any specific policies. This component is composed of the following subcomponents: Meeting Organizer, Context, Content, and Notification subcomponent.

Meeting Organizer subcomponent

The Meeting Organizer subcomponent is a key subcomponent within the Meeting Management Component. It allows users to plan and define various meeting details. This subcomponent contains five main objects:
1. The session's info object. This object specifies the essential information that a meeting should have, such as meeting's objective, title, date, time, duration, etc.

2. The meeting context object. This object specifies the related context entities that are related to the meeting, such as participants, roles, project, and department. In this framework, the user selects these entities based on the Meeting Context Subcomponent.
3. The content entities object. This object specifies the meeting's objective and the agenda items. The user selects these entities based on the Meeting Content Subcomponent.
4. The resources object. This object specifies the reading materials, such as reports, statements, announcement, advertisements, videos, or any external links.
5. The policies object. This object specifies the joining and accessing policies. Joining policy indicates whether the participation is open to everyone or restricted to certain participants. The accessing policy specifies who can view which meeting info and details, such as meeting's recording, minutes, tasks, attendance, etc. It could be restricted to the managerial level, team level, or open to everybody to enable more cross-company collaboration.

Context Subcomponent: *Users, Roles Teams, Projects, and Departments*.

The Context Subcomponent contains a collection of objects that defines the structural context that a specific meeting belongs to, such as Users, Roles Teams, Projects, and Departments. It allows administrators and mangers to create uses. It also allows managers to define roles which these users can take during a meeting (note-taker, leader, etc.). In addition, it allows the administrator to create teams and committees, define projects, and to specify departments. This subcomponent enables system to track meetings' activities from various perspectives, such as inquiring how many meetings a certain participant has attended or how many meeting a certain committee has done during the last month, etc.

Content Subcomponents: *Goals, Agenda items*.

In this subcomponent, there are two objects that are used to define the meeting's content, which are meeting Goals object and Agenda Items object. Agenda items represent the flow of items that needs to be covered during a meeting. They are usually specified by the meeting manager. This component enables the system to track the status of the accomplishment of meetings' goals and agendas' items and to alert team manager of any shortcomings or delays.

Notification Subcomponent

The notification subcomponent is responsible of managing invitations, reminders, and announcements of meetings going to take place. It also it specifies the medium of these notifications. These notification could be broadcasted through, email, mobile messages, calendar, event board, etc.

VI.   ACTIVITIES COMPONENT

The second component in this framework is the Activity component. There are common activities that are found in many meeting sessions. These activities as considered as the building blocks in a meeting workflow. In this framework there are eight main activities. Four of them are general activities and the other four are tasks-oriented activities. These activities are: *Presenting, Discussion, Voting, Debriefing, Task Proposing, Task* Resolution, Task Assignment and Task Reporting.

Usually, a typical flow of activity starts with the Presenting activity. It is used to allow a certain role, such as team leader, to welcome participants, present a certain case that needs a solution, introduce a new set of tasks that need to be done, etc. The Discussion activity usually follows the Presenting activity and carried out by the team members. It is used to clarify the presented topic. It also could be used to brainstorm and promote new ideas, solutions, tasks, etc. The Voting activity is used to vote on a certain issue that has been discussed or presented in a previous phase. It also could be used to vote on any issue related to the meeting, such as voting on the last meeting's agenda, etc. The Debriefing activity is used to allow a team's leader to summarize meeting's progress and to conclude their findings.

The task lifecycle starts with the Proposing tasks activity. Tasks could be proposed by a team's manager or collaboratively by team's members. A team leader usually specifies new tasks for his team to carry out. In other cases, team's members themselves suggest tasks that they should do. At the Resolution activity the proposed tasks will be accepted, rejected or delayed to a later meeting in case of acquiring additional information. Also in this activity, if the task is accepted it needs to be prioritized. The Task Assigning activity indicates who will do that task and when it is due. The Task Status Reporting activity is usually done at the beginning of the following meeting where the task assigner reports back to the group his task status. The task statues could have many forms, such as finished, delayed, aborted, if for some reason he cannot finish the task..

VII.   TOOLS COMPONENT

The tool component is divided into three categories which are Collaboration Tools, Supportive Tools, and Reporting Tools.

- Collaboration tools are used to facilitate the general activities specified in the previous section (Presenting, Discussion, Voting, and Debriefing). Each activity is supported by a specific collaboration tool. This tool would be shown in the main stage floor during that activity's run-time. For example, The Discussion activity could be supported by, Text Chat tool, Video Conference tool, and Whiteboard tool, where the Presenting activity could be supported by a Screen Sharing tool. A Voting tool could be used to support a voting activity.
- Supportive tools is a collection of tools that could be used by participants to support their work, such as Side Note

tool, Calendar tool, Inbox tool, Tasks List, Agenda Items List, etc.

- Reporting tools are tools that are used to generate reports to inform and to provide feedback to the meeting's various stakeholders. There many types of reports, such as Meeting minutes report, Agenda fulfillment report, Teams' Objectives fulfillment report, etc.

VIII. WORKFLOW COMPONENT

The meeting workflow component describes the sequence of activities that a meeting's participants should perform in formal way. The workflow should be structured according to the specified agenda items. Usually there are three phases in the workflow: the initial phase, the middle phase, and the conclusion phase. Usually in the Initial phase of a meeting, the team leader starts with approving the minutes from the previous meeting and also getting an update on the action items that were assigned. The Middle Phase is the core phase where most of Agenda Items are covered. The last phase is the Conclusion Phase where a session's output is summarized followed by a brief discussion of the next meeting agenda. The following example represents a workflow of a meeting session.

Initial phase
    Presenting (welcome talk - by the team
        leader)
    Vote (last meeting minutes)
    Tasks Reporting (last meeting assigned
        tasks – by all)
    Presenting (Current agenda - by the team
        leader)
Middle phase - Repeated for all agenda items
    Discussing (agenda item)
    Tasks Proposing (--by all)
    Tasks Resolution
    Tasks Assignment
Conclusion phase
    Debriefing (this meeting results -- by the
        team leader)
    Discussing (next meeting date and agenda)
    Debriefing (next meeting date and agenda -
    - by the team leader)

IX. TASKS MANAGEMENT COMPONENT

Since the primary outcome of a meeting is tasks, they need to be managed properly. The Task Management Component is used to manage proposed tasks and to update their status. Task management component tracks each meeting-related task for reporting purposes. For example, Tasks' Reports are used to get update on the status of unfinished tasks where Participations' reports are used to report each team member's progress

X. REPOSITORY COMPONENT

Repository component is used as a central storage to save all meetings' details and interaction. It supports all other components with a storage capability to facilitate their functionalities. This component enables users to gain knowledge of both current and past team activities and to track teams' progress if needed.

XI. LETSMEET

As a proof of concept we built *LetsMeet* a prototype tool that supports Virtual Meeting environment.
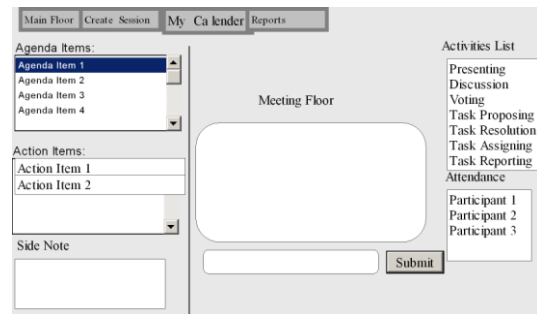

Figure 3: LetsMeet Tool main page

This prototype has followed the design model specification described in this paper. This tool allows meeting managers to specify the meeting's Agenda Items during the creation phase. These agenda items would appear in a side list during the session's run-time. The session's manager can click at any agenda item to make it active. Then he would simply drag and drop the activity item in the main floor to implement that agenda item. Also for more flexibility, a single agenda item could have more than one activity within. This could be accomplished by simply dragging a new activity item which will instantly replace the old one. A default collaboration tool will be presented for each activity item. The tool would appear in the meeting floor as shown in figure .3.

Any task that is proposed during Task Proposing activity will appear in the Action Item list. A coloring representation is used to indicate the task status, for example a green means that this task is accepted. The task status could be changed using task management tool which is used to update the of task's status according to the task activity that is preformed.

XII. CONCLUSION

Designing and managing group meeting session is a challenging task. In this paper we have defined a general framework for Computer to Support Virtual Meeting. Virtual meeting is an essential component in today's work environment. Advances in telecommunication made it more convenient to meet virtually. The current meeting

management systems partially fulfill the wide spectrum of requirements and challenges that a virtual meeting environment would need. A general set of characteristics that a meeting management system should have were discussed in this paper.

We have proposed CSVM framework that is composed of various components that are categorized in several abstraction layers. A list of CSVM components was discussed in this paper which were: Meeting Management component, CSVM Tools component, Activity component, Workflow component, Tasks management component, and Central Repository component. All these components are essential to manage appropriate meetings' space and resources within a virtual meeting.

Also we have presented as a proof of concept a prototype tool called *LetsMeet*. In the future we will continue the development of this tool and will conduct a further evaluation analysis and studies based on the usage of this meeting management tool.

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