Video-based Information Sharing in Distributed Teams

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Abstract: One downside of using distributed teams in a software engineering project is the extra burden put onto inter-team communication. A common approach to information sharing are written documents. This is very unfortunate from a communication theoretic point of view. Video can transport more information. This paper describes the use of video-based information-sharing without manual post-processing and with as little extra workload as possible. The benefit for distributed teams, the exemplary application in a project and future visions and goals are explored.

1 The Problem of Information Sharing

As a current practice, team members write minutes to collect and share information discussed in a meeting. Written documents, like meeting minutes, emails, etc. have the problem that sender and receiver of these documents not necessarily share the same background and mindset when writing (or reading) the document. This problem increases if sender and receiver are from different domains or from different cultural backgrounds with different languages. Even though video minutes might not be a full substitute for written minutes, they can complement these and help shorten the written minutes, since extended rationale for decisions and the course of the decision’s discussion can be kept in the video capture and outside of the written minutes. Other usage scenarios using video for information sharing under development here are the use of video for requirement elicitation[COB06], for end-user feedback[Sta07] or meeting capture with a more complicated setup. This paper focuses on capturing meeting information without complicated hardware setups and without manual post-processing.

Interpersonal communication has been an area of research over the last decades. There are many models and theories regarding interpersonal communication. There is the four-side-model of Friedemann Schulz von Thun, for example, stating that there are four sub-messages in each message [SvT81]. The sub-messages are: the factual sub-message, the self-revealing sub-message, the relationship sub-message and the appeal sub-message. A model aiming at the physical side of communication is the Encoding / Decoding Model described by Hall in [Hal73]. His model is based on Shannon’s model for communication channels [Sha48]. The basic message is that there is interference in interpersonal communication like ambiguity, lack of attention, limited perception, etc. Albert Mehrabian states in [Meh71] his ”7%-38%-55% Rule” which highlights the importance of the nonverbal part of communication.

1“What the writer had in mind, what the writer actually wrote, what the reader reads, what the reader thinks the writer meant...”

2It is important to stress that his findings are about communication of feelings and attitudes and not generally
A written document does not cover vocal or visual content and context at all. Given the four sub-messages and the interference in interpersonal communication together with the importance of nonverbal communication, the usefulness of video recording for information transfer seems to be evident.

2 The Idea: One-Klick Video-Based Meeting Minutes

The question following the insight that video is better than just plain text regarding mutual understanding is if it is worth the extra effort. Our idea is to capture team meetings, design meetings, brainstorming sessions and presentations on video, analyze these in post-processing steps and publish the resulting media project-internally. These video artifacts introduce the coverage of vocal and visual content and therefore improve the comprehensibility of these meetings’ content. In these video artifacts the positions of interest, e.g., new issues or decisions reached, should be marked to ease the navigation in the meetings’ captures. Theses markers (chapter marks) in the video can additionally be linked from external resources, e.g., a webpage listing the important issues or comprehensive written meeting minutes.

An additional benefit is that the post-processing of the recording is automated and therefore does not put an extra time burden on any team-member. Examples for such recordings can be seen in Figure 1.

![Figure 1: Example Team Meeting Recording](image)

Our requirements for the video-based information-sharing system are that the whole system is non-intrusive, non-distracting and works with a minimal hardware configuration. And there should be as little manual post-processing as possible. The only manual task that might still be necessary is linking the written minute points to the marked sections in the video content. Meeting attendees are not filmed individually and the technical equipment should be operated without extra staff. It should be a ”one-click” solution.
3 Technical Background

Based on the ideas of the previous section, we describe in the following section the resulting setup we experiment with. For our initial experimental setups we use simple DV camcorders connected to a computer. Both, audio and video, are captured with these cameras, there are no extra microphones or other audio recording hardware deployed. These cameras are mounted flexibly, since another benefit of having a camera in a meeting is that additional artifacts - like whiteboard drawings, acting of use-cases, gesture explanations, etc - can be recorded directly. Currently, the teams have a (web-based) user-interface, in which a member of the team needs to select the actual meeting room and the team name. Afterwards, one button is pressed to start the recording of the meeting.

When the meeting is finished, all needed post-processing is done automatically. The recorded content is sent automatically as a new job to the Podcast Producer [pod] solution, which offers a very flexible media computation engine. This workflow based system works with atomic computation tasks which can be distributed over a grid. These tasks can be processed sequentially, or more important, in parallel. Therefore, job processing scales with the number of computational nodes available in the grid.

![Figure 2: Post-Recording Workflow for Meetings](image)

The workflow in Figure 2 shows a typical post-recording workflow for the recording of team meetings. After the initial unpacking of the material, the video material gets watermarked and parallel to this, a title movie - stating author and title of the movie - is generated. Here it is possible to have several content analyzing tasks in parallel, e.g., an analysis of the audio stream with the goal to capture keywords for setting markers in the final video. Afterwards, different media versions are encoded. After these encoding steps, the streaming movie and the download link to the download version are posted to the team’s website and an email is sent to the submitter (recorder) to report the completion of the job.

Apart from the team meeting recordings, we have presentation recordings with the dif-
ference that there are two video sources in a presentation recording. The video of the presenter and the screen capture of the slides presented. Both are merged into one video presentation picture-by-picture. This kind of view has the advantage that both, the presenter’s nonverbal communication as well as the slides’ content, can be seen.

4 First Observations

The described video-based information-sharing idea is tested in a large scale student project currently running with 50 students in 11 teams at the Chair for Applied Software Engineering of the TU München. These teams are not working full-time and not on a regular schedule. Inter-team communication is done via mailinglists, instant-messaging and each team has access to the team collaboration sites of all other teams. Each team has its meetings recorded and uses the workflow described. A recording is automatically edited, processed, encoded and posted on the team’s site. For project-meetings the presentation workflow is used to record the presenter as well as the presentation slides.

The meeting recording feature was adapted quite well and it is considered easy enough to use. There was some resistance to being filmed in the beginning, but it is decreasing since. Apart from the inter-team communication aspect, the meeting records also help in-team for team members who missed a meeting. The feedback for this use-case was very positive and some team members prefer the video over the written meeting minutes or use it in addition to them. The recordings are useful to readers reading minutes, wondering what the writer of these minutes actually meant with that entry. The main challenge is currently to find the important sections in a recording. Ideas how to solve - or at least to reduce - this problem are described in the next section.

5 Next Steps

Based on the initial experimental setup described earlier, we are currently investigating strategies to resolve some of the shortcomings noted in section 4. Currently ongoing work is the question how to introduce markers (bookmarks / chapter marks) in the final video pointing to important moments in the recorded session. Initially, we focus on detecting and marking new action items and issues coming up in a team’s discussion. We currently evaluate different strategies. The first strategy is the classic speech recognition approach. With a good speech recognition in place it would be possible to generate written documentation. This can be written minutes with issues and action items, but also a full written transcript. With speech recognition in place, newly identified issues and action items in the video can be marked and can also be directly inserted into a collaboration system (e.g., Sysiphus [Sys]) and from there directly linked to the right mark in the recording. Furthermore, Sysiphus can be used to generate written meeting agendas and written meeting minutes. Therefore, the marked sections in the video can be linked to an entry in the meeting minutes. The second strategy under consideration is the use of image processing
frameworks like OpenCV to identify image patterns of certain gestures. Ideas range from colored signs, which one of the persons in a meeting has to put up in front of the camera, over certain hand gestures in front of the camera indicating a new issue or action item. These extra media analyzing tasks can be added to the earlier described post-recording workflows as tasks parallel to the encoding tasks.

Given the problem that even with markers the sections to watch in the video can be lengthy, it could be really interesting to incorporate a rapid ”skimming” feature like used in the new Apple iMovie. A similar approach of interest is using ”slit-scans” as described by Nunes et al. in [NGCG07]. To transform the information-sharing to knowledge-sharing, semantically analyzing the video is another idea under evaluation. Once these ideas are in place, we plan to conduct usability studies and want to evaluate the use of these video-capturing techniques for distributed teams and distributed inter-cultural teams.

6 Conclusion

Given the early state of our research, we have no definite result yet regarding the usefulness of these team-meeting recordings, but feedback from team members is very positive. With the additional ideas noted before on the way, we think that the usefulness will increase with each new feature added.

References


