Enrichment of Requirements Specifications with Videos

Enhancing the Comprehensibility of Textual Requirements

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Abstract. Requirements for a software product are mainly shared through a textual specification. One key ability in successful software organizations is a good requirements communication based on understandable information. Developers can only implement a useful and satisfying software product if they obtain and understand requirements properly. One challenge of writing requirements is to describe complex and interactive contents in an understandable manner.

Videos offer a large potential to achieve such an easy-to-understand representation. Attached videos can enhance the reader's understanding by using them as supplementary material for specifications. Despite their large potential, videos are not an established part of requirements specifications: The effort to produce videos is high, the corresponding motivation is low and the use of videos is cumbersome due to missing links between requirements and videos.

We propose guidelines to support the identification of content which is appropriate to be supplemented by videos. We develope a starting set of guidelines that consider the different information types of a requirements specification with their presentation modes and characteristics. This paper presents an overview of our findings about improving the content-related linking between requirements and videos. We discuss the perspectives, advantages and obstacles for enhancing the comprehensibility of textual requirements conveyed by videos.

Keywords: Requirements specifications, requirements, guidelines, supplementary videos

1 Introduction

A software product has to satisfy the customer's needs in order to be valuable and of high quality [1]. Requirements engineering is a systematic and disciplined approach to elicit, communicate and manage customer requirements [2]. Developers need to obtain and understand these requirements properly to implement a useful and satisfying software product. Therefore, it is important for all involved parties to communicate understandable requirements which are represented in an accessible way.

Around 79% of all requirements specifications are still written in natural language [3]. However, even natural language text is often very abstract and difficult to understand. Fricker and Glinz [4] evaluated the practice of handing-off written specifications. They showed that its impact on developers' requirements understanding is troublesome. Misunderstood requirements diminish a software product's value. As a consequence, documenting and communicating correct and comprehensible requirements is a prerequisite to achieve customer satisfaction [5].

Since several years, videos are known to be a good documentation option with respect to the richness of the communication channel and the communication effectiveness [6]. New technologies facilitate the usage of videos, which make them more accessible, cheaper and easier to use [7]. Furthermore, a video contains extensive information like non-verbal gestures [8]. According to Fricker et al. [7] as well as

Jirotka and Luff [9], videos are a stable reference for post-processing work. Brun-Cottan and Wall [10] additionally point out that videos provide good insights to complex situations and specific domains.

All these facts justify the large potential of videos as supplementary material for textual specifications in order to support requirements communication and understanding. Developers can retrieve more details from a video than from any written documentation [11]. Considering the results of Brill et al. [12], videos are appreciated for requirements communication due to their richness and concreteness compared to text, which is perceived to be more precise but also more abstract.

However, videos are currently not an established part of requirements specifications due to high production effort, corresponding low motivation and missing links between textual requirements and videos. Software experts are unexperienced by applying videos in professional context, why privacy, storytelling and effective use of video remain areas of concern. The identification of content, which is appropriate to be supplemented by videos, is a major problem. We want to provide a starting set of guidelines to identify potential content to support the content-related linking of requirements and videos.

This paper is structured as follows: The succeeding section examines related work. In section 3, we describe our starting set of guidelines. We discuss our findings as well as perspectives, advantages and obstacles of videos in requirements engineering in section 4. Section 5 concludes the paper.

2 Related Work

Our work focuses on using videos as supplementary material for textual requirements. By supporting the content-related linking between requirements and videos, we want to achieve a better requirements communication and understanding.

Several researchers proposed the *use of video in requirements engineering*. Creighton et al. [13] presented a high-end approach, which uses videos to describe visionary scenarios of a future system. The authors combine these videos with different types of artifacts as input to get a hybrid video consisting of Unified Modeling Language models and recordings from enacting a scenario as output.

Schneider [14] applied videos to depict user requirements of running systems. The software tool, so called VisionCatcher, enables the production of vision videos using user requirements during an interview. These created videos can be validated and reworked with the VisionCatcher to substantiate and finalize the represented requirements.

The approach of Fricker et al. [7] focused on passing requirements in form of requirements workshop videos to developers. By using such videos, they want to compensate the lack of developers' presence in requirements workshops to achieve a better requirements communication and understanding.

These approaches produce videos to elicit, communicate and document requirements. However, none of them indicates how the videos can be further used in combination with a requirements specification.

For video production, there exist a lot of *guidelines in other disciplines* like for example online education or Human Computer Interaction (HCI). In online education, especially in Massive Open Online Courses (MOOCs), videos are a widely-used resource to impart knowledge [15].

Guo et al. [15] performed an empirical study of how video production decision affects the engagement of video viewers. Based on their findings, they developed a set of recommendations to help producing more engaging videos.

Lackner et al. [16] developed a checklist for practitioners, who want to perform a MOOC. This checklist contains several points which also concern aspects of video production in order to represent the corresponding content in an understandable manner.

In HCI, video production is one of the most useful techniques [17]. In this area, videos are often used for system demonstrations or instructions of user interfaces.

Plaisant and Shneiderman [18] developed a set of guidelines for the design of visually appealing and cognitively effective video demonstrations. These guidelines consider technical and content aspects of demonstration videos to represent complex interactions between humans and software systems.

Existing recommendations, checklists and guidelines of different disciplines offer a stable base for video production in requirements engineering. However, the complexity and amount of information in a specification complicates the identification of content to be supplemented by videos.

3 Guidelines: Identification of Content for Supplementary Videos

We propose a starting set of five guidelines to help determining if a specification content is a possible candidate to be enriched by a supplementary video. A requirements specification contains several information types like product vision, objectives, requirements or test cases. All of them have one or more presentation modes and own characteristics. However, not every information is appropriate to be supplemented by a video due to aspects like change rate, versioning, scope and detail level. We derive the following guidelines based on findings of approaches which use videos for different purposes.

1. Focus on content with a low detail level.

The findings of Fricker et al. [7] point out that developers appreciate videos to represent global information of a software product, project goals, stakeholder expectations or system behavior. Brill et al. [12] support this result by highlighting that videos are well-suited for an overview. According to Carter and Karatsolis [19], various researches have repeatedly shown that short video clips of well-expressed key concepts are effective and persuasive. In consideration of these results, specification content with a lower detail level like system vision, objectives and features can be easier supplemented by a video. Other specification content with a higher detail level, e. g. functional requirements, changes various times due to evolving opinions, needs and insights of stakeholders. Therefore, corresponding videos would need multiple updates which leads to an increasing effort. Further help for content identification is offered by the detail level classification for requirements specifications and their content by Rupp et al. [8]. This classification and the above finding yield to focus on content of detail level 0 or 1 for supplements by videos. These two levels cover aspects like system descriptions, visions, overviews, use cases, scenarios, features or context boundaries.

2. Prefer visionary and interactive content.

The analysis of further researches results in a concretization of our first guideline. Many different approaches use videos to represent visionary and interactive aspects. Creighton et al. [13] stated the usefulness of videos to visualize visionary scenarios of a future system. As concrete medium, a video provides the ability to define expectations more clearly. It contains objects, relationships and activities which can directly be referred [13]. Fricker et al. [7] emphasize that developers see the benefits of videos in delivering a representation of vision statements, as-is and to-be processes. The results of Brill et al. [12] also correspond to this perception. They recommend to use videos for typical scenarios and interaction contexts of a system under development.

3. Consider the emerging video length.

A critical aspect of a video as supplementary material is the emerging length of the resulting video. Corresponding to the findings of Fricker et al. [7], a video should be short in order to be watched multiple times. Guo et al. [15] analyzed how long MOOC videos are watched to determine a median engagement time. Their results yield that videos are watched at most 6 minutes, regardless of total video length.

Therefore, they recommend that videos should not exceed a length of 6 minutes. The video length does not matter that much for the first-time watching, but supports re-watching [15]. Lackner et al. [16] also stated that a video should not be longer than 5 to 10 minutes. As a consequence, the emerging video length has to be considered before a supplementary video is created. If the selected content cannot be presented within an acceptable time range, it is not appropriate to be supplemented by video.

4. Represent each appropriate content in a separate video.

Not only the video length, but also the amount of information in a video is an important aspect. Easy identification of represented content and gaining an overview is essential for viewers. According to Plaisant and Shneiderman [18], autonomous and short videos are important to keep viewers engaged. A separate supplementary video for each selected content allows a viewer to see them individually as needed. By combining multiple contents in one video, the viewer has to identify the required part by himself. This increases his effort and reduces his motivation to work with a supplementary video. Fricker et al. [7] as well as DeMarco and Geertgens [11] indicate the need of content separation to achieve an overview and a better understanding.

5. Consider the preparation of a clear structure within a supplementary video.

Several researches identified the need of a clear structure within videos to support the viewer's understanding. In their guidelines, Lackner et al. [16] demonstrate the importance of structure. One whole category out of six covers the topic of structure with five own guidelines. Guo et al. [15] also emphasize that the planning phase has a large impact in the engagement of a resulting video. Visionary and interactive specification content like visions, scenarios or use cases support the planning and production of structured videos, since they provide structure by themselves. Pre-planning of video structure affects a good flow of the scenes within a video supporting overview, navigation and understanding [7]. Therefore, a clear introduction, main part and closure of a video are important. A viewer needs to be introduced into the represented content, before the concrete content is conveyed. Finally, a video should offer a clear closure instead of a sudden end.

4 Discussion

With our approach, we provide a starting set of five guidelines to support the identification of appropriate requirements specification content for supplementary videos. Thus, we want to achieve a better content-related linking between requirements and videos to enhance requirements' comprehensibility.

Several researchers proposed the use of videos in different approaches. Videos are known as a good documentation option due to their concreteness compared to textual descriptions. A video shows concrete scenarios within their real environment. Furthermore, all verbal and non-verbal information can be captured and accessed as often as desired at any time.

However, videos are currently not an established part of requirements specifications due to the high production effort, the corresponding low motivation and missing links between textual content and videos. The effective production, use and analysis of videos remain areas of concern in requirements engineering. While some aspects like clear sound and image stabilization are trivial from a research perspective, others require advice. For example, privacy issues and new technological concepts, e.g. for handling changes and variants of requirements and supplementary videos for a system under development lead to mixing and muddling challenges on different complexity levels.

In our opinion, these obstacles need to be faced by integrating videos as a by-product right from project's begin in a light-weight use. The idea of videos as by-product follows Schneider's *by-product*

paradigm [20], which enriches an existing practice by technical infrastructure for recording and structuring records. The aspect of light-weight use is important, since each activity is under pressure to justify any extra effort. Therefore, the distribution of effort and benefit needs to be adjusted with care.

As a first fundamental step towards the establishment of videos in requirements engineering, the threshold to use videos needs to be lowered. Therefore, we developed our starting set of guidelines to provide support and guidance by combining textual content and videos. On the one hand, the guidelines help to identify potential content which is appropriate for supplementary videos. On the other hand, they support the consideration of video production aspects like emerging video length and structure by transferring textual content in a supplementary video.

This guideline set serves only as an initial assistance. The guidelines are not sufficient to cover the entire complexity of a requirements specification. They only consider content with a higher abstraction level to be appropriate for supplementary videos. However, specific content with many details can be essential to understand and develop a software product correctly. Therefore, supplementary videos for such content can also be useful.

This aspect is part of our future work. Currently, we extend our guideline set by considering more comprehensive characteristics of requirements like priority, legal obligation and Kano model needs classification [21]. After the refinement of our guideline set, we seek for an evaluation regarding its applicability to support the identification of appropriate specification content for supplementary videos.

5 Conclusion

This work introduces a first guideline set to support the identification of requirements specification content which is appropriate to be enriched by supplementary videos. Developers need to obtain and understand requirements properly in order to develop a useful and satisfying software product. However, requirements are mainly shared through textual specifications, which are often very abstract and difficult to understand. Videos are known as a good documentation option with a large potential to achieve an easy-to-understand content representation. A reader's understanding can be enhanced with videos by using them as supplementary material for written documentation.

We propose a starting set of five guidelines to identify requirements specification content that is a potential candidate to be enriched by videos for enhancing its comprehensibility. In consideration of the different information types in a specification with its presentation modes and characteristics, we developed our guidelines to determine content which is appropriate to be transferred into a supplementary video. Thus, a better content-related linking between specification content and a video can be achieved to support the enhancement of requirements' comprehensibility.

Videos have the potential to be a future documentation option in combination with written documentation. However, the effort of video production is high and the corresponding motivation is low. Therefore, videos need to be integrated into requirements engineering as a by-product right from project start in a light-weight use. In a first step, the threshold of using videos needs to be lowered in order to make them more attractive for practitioners and researchers. We seek for this threshold of effort reduction by introducing our set of guidelines. Our future work focuses on the refinement of these guidelines to support the enrichment of requirements specification with supplementary videos more extensively.

Acknowledgements

This work was supported by the German Research Foundation (DFG) under ViViReq (2016 – 2018) and by the German Federal Ministry of Education and Research (BMBF) under grant number K3: FKZ 13N13548 (2015 – 2018).

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