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Studie über die Verwendung von Visionsvideos für die Weitergabe von Anforderungen

Study on the Use of Vision Videos for Requirement Communication

Bachelorarbeit

im Studiengang Informatik

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Studie über die Verwendung von Visionsvideos für die Weitergabe von Anforderungen

Zusammenfassung

Ein entscheidender Faktor für eine erfolgreiche Weitergabe von Anforderungen, die zum Projekterfolg führen, ist ein gemeinsames Verständnis zwischen Stakeholdern und Entwicklern bei der Anforderungsanalyse hinsichtlich der Vision des entwickelnden Systems.

Bisher ist die textuelle Beschreibung der Spezifikation immer noch als die übliche Art der Weitergabe von Anforderungen betrachtet. Diese Weitergabe von Anforderungen ist nicht leicht durchzuführen, da sie eine Lernphase benötigt und zu Missverständnissen führen kann. Deswegen sind viele Untersuchungen auf der Suche nach neuen Requirements Engineering Methoden, sodass die Interaktion zwischen den Teilnehmern erleichtet und unterstützt wird. Die Benutzung von Video war eine dieser Methoden, die Idee war die Videokommunikationskraft auszunutzen, um die Schwierigkeiten beim Verständnis zu reduzieren.

Diese Bachelorarbeit wird die Verwendung des sogenannten Visionvideo nicht nur während der Validierungsphase, sondern auch während der anderen Phasen des Requirements Analysis.

Die Studie wird der Unterschied zwischen Verwendung des Visionsvideo und die traditionellen Kommunikation (text-basierte Spezifikation) bestimmen. Darüber hinaus werden Faktoren und Merkmale definiert, die zu einem besseren Visionsvideo führen und die Weitergabe von Anforderungen maximieren.

Danach wird eine Evaluation durchgeführt. Folgend werden die Daten, die sich aus dieser Evaluation ergeben, nach der geeigneten Analysemethode ausgewertet. Die Ergebnisse der Evaluation sollten unsere Behauptung, dass das Visionsvideo zu einer Verbesserung des gesamten Weitergabe von Anforderungen führen wird, unterstützen oder verweigern.

Am Ende wird die gesamte Arbeit resümiert, um anschließend ein Fazit über die erbrachten Ergebnisse zu ziehen.

Study on the use of Vision Videos for requirement communication

Abstract

Reaching a shared understanding between stakeholders and developers during requirement analysis regarding the vision of the system to be developed is a critical and decisive factor for a successful requirement communication, thus more accurate and right specifications that leads to project success.

Till now textual description of the specification is still the common way of communication and it has proven difficulties, as it entails a learning phase and may still lead to misunderstandings. The stakeholder may be hindered to express further requirements. As a result researches focus on none standard requirements engineering methods. The goal was to help facilitate interaction between participants. One of these methods aims at exploiting the video communicational power to compensate the drawbacks and difficulties in understanding during the requirement analysis as a result of using only textual description.

This bachelor thesis will study the use of the so called Vision Video not only in the validation phase but also during the other phases of requirements analysis to help build a common ground between both stakeholders and developers.

The thesis will also define the difference caused by using the Vision Video comparing to the traditional way of communication (specification sheets). It will try to specify factors and characteristics that lead to a better Vision Video, thus improve requirement communication to the maximum.

The thesis will then present an evaluation and the data resulted by applying it. The data will be analyzed using the suitable analysis method. The result of the analysis should support or deny our claim that the Vision Video will lead to improvement in the overall requirements communication process.

At the end a conclusion will be drawn on the light of the analysis' results and some future works will be suggested.

Contents

1. Introduction

1.1. Motivation

One of the challenges during requirement communication between stakeholders and developer is the gap between the conceptual models of the participants in the communication process [8].

A learning phase in which stakeholders will be given a brief instructions about some terms that might occur along this communication like (actors, use cases) must precede the communication. This learning phase aims at making things familiar to the end user while reading the specifications documents. However, still there is a big chance of misconception.

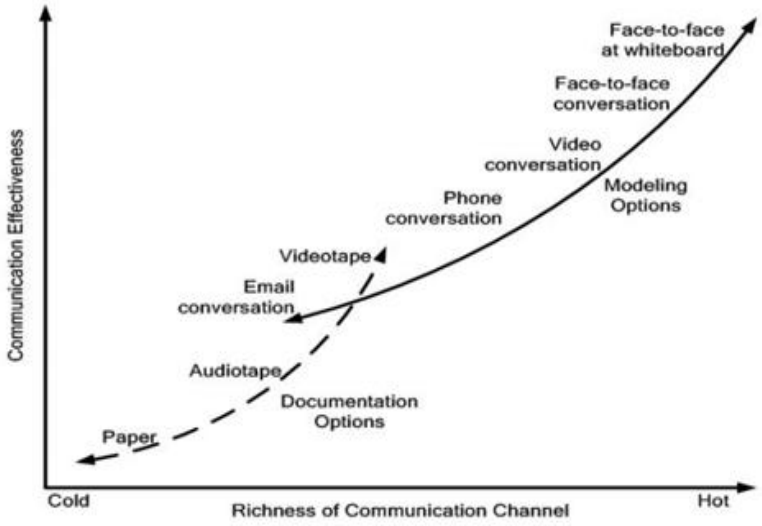
Traditional requirements engineering methods (textual description, use cases, UML model, etc.) do not deliver concrete results for validation fast enough. Stakeholders get impatient or misunderstand abstract requirements [11]. All these facts urged the need of new ways to facilitate this communication, reduce the time consumed during learning, interpreting, and validating, cut the misunderstanding to the minimum, and do not cause any extra burden to stakeholders.

With the advancements of video capabilities in today's mobile phones and digital cameras, the ease of use and the cheap cost, many researches [7] [11] [10] was toying with the idea of using visual aid along with the textual traditional description of the requirements to clear the ambiguity and come up with faster, easier and more accurate communication. In [10] the paper investigates the feasibility of recording the requirements workshop as a video to be watched later by developers. Whereas [11] proposes to use ad-hoc videos as a concrete representation of early requirements. In [7] a proposition of a new kind of interaction based on multimedia technologies in which requirements and visions of new systems are documented in a multimedia representation was presented. These researches were motivated by the fact of the high communicational power of video materials compared to textual descriptions [7]

Videos are processed by the brain 60,000 times faster than text. And it is more accustomed to processing images - ninety percent of the information sent to the brain is visual, and 93% of all human communication is visual [14].

In addition to that (see Fig. 1) below by Alistair Cockburn (2002) represents various modes of communication that can possibly be chosen by people while working together. The graph compares richness of the used communication channel with the effectiveness of modes of communication. The arc on the left contains several types of communications options for documenting (paper includes electronic media such as HTML that could be rendered to paper) and the other arc shows other interactive communication options for modeling. The figure presents lots of facts, what concerns us is that the video is one of the most effective and rich documentation option in case of any later discussion or communication. On the other hand it is hard and complex to modify a video in the future if any changes are required comparing with documentation using only text.

As a result we can say that the most effective communication is person-to-person, especially when supported by a another means of visual aid such as a Vision Video, whiteboard, mock-ups, story boards, charts, etc. And vise versa the effectiveness of communication will deteriorate by removing this visual aid or by being physically far.



1. Figure - Model of communication [21]

Adding to the above and according to [Standish], incomplete requirements and lack of user involvement were two top reasons cited for project failure (see Table 1). Both of these issues are failure in requirements engineering. As the final software system is predicated on a set of requirements, affective requirements engineering is a critical success factor in software development projects [3].

The result of this study in (1995) showed that 16.2% of the total analyzed projects were successful and were referred to as (Resolution Type 1), while 52.7% were classified as while challenged projects and referred to as (Resolution Type 2) and 31.1% of the projects were failure and referred to as (Resolution Type 3).

The study did not only classify the projects into 3 resolution type with specifying the percentage of each, but also focused on finding out the reason of these results.

Most common reasons for project failure are not technical (see Table 1). It identifies the main reasons why projects fail. The first and most critical factor that might lead to project fail and is related to the subject discussed in this thesis is requirements. Requirements can be either poorly organized, poorly expressed, weakly related to stakeholders, changing too rapidly, or unnecessary, unrealistic expectations [1]. Another important factor is the amount of user involvement throughout the project, poor communication with real stakeholders, misunderstanding user needs and ignoring the difference in the conceptual model between stakeholders and developers can definitely lead to failure.

Position	Factors for project failure (Typ-3)	Factors for project challenged (Typ-2)	Factors for project success (Typ-1)
1	Incomplete requirements	Lack of user input	User involvement
2	Lack of user involvement	Incomplete requirements & Specifications	Management support
3	Lack of resources	Changing requirements & Specifications	Clear statement of requirements

Table 1 - Reasons for project failure and success [1]

In Table 2 the Standish report of chaos for the upcoming years after 1995. It shows quite an improvement regarding the percentage of the successful projects comparing to (1995) report. Still this percentage of successful project is considered low.

The study concluded that success has come with an increase in project overhead, along with a reduction in value and innovation, and thus „the task of requirements gathering, selecting, and implementing is the most difficult in developing custom applications“ [12].

	2004	2006	2008	2010	2012
Successful	29%	35%	32%	37%	39%
Failed	18%	19%	24%	21%	18%
Challenged	53%	46%	44%	42%	43%

Table 2 - Standish chaos report 2004 to 2012 [12]

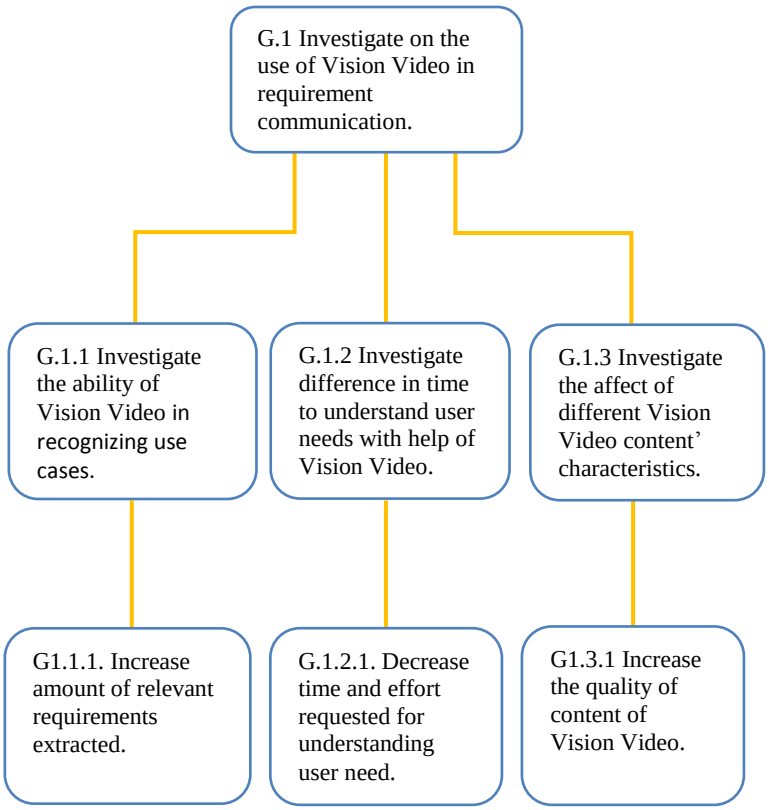
In the light of these numbers and facts, focusing on the understanding between stakeholders and developers to reach decent requirements is suppose to be of first priority and looking for ways to ease and increase this understanding must never stop.

1.2. Goal of the thesis

Main goal of the thesis

Analyzing and investigating some already available Vision Videos to prove their efficiency and ability to help in requirement communication between different stakeholders and developers.

The tree below (see Fig.2) gives an overall view on the goals this thesis is interested in achieving. The main goal was described above and the other sub-goals will be described in details throughout the design phase of this thesis.



2. Figure - Tree of goals

1.3. Structure of the thesis

In introduction a brief review and a preface of the fundamental terms and techniques that will occure during this thesis like requirements, Vision Video, and others will be described in chapter 2. In chapter 3 the complete design and planning of the experiment will be presented. The GQM method will be used and described briefly. The design will also include a detailed description of the main goal and sub-goals, the questions, the metrics, the hypothesis, the variables and other important aspect that will assure the success of the experiment. After finishing all about design, next step is evaluation. In evaluation the experiment will be applied on real subjects and objects as described in the design and the resulted data will be collected in the right forms. The analysis of the collected data will then follow. Finally a conclusion and some suggestions for any expected futur work in the last chapter.

2. Background

2.1. Requirement Engineering

Definition of a requirement

Here is a typical definition drawn from IEEE-STD-1220-1998 (IEEE 1998):

Requirement: a statement that identifies a product or process operational, functional, or design characteristic or constraint, which is unambiguous, testable or measurable, and necessary for product or process acceptability (by consumers or internal quality assurance guidelines) [1].

Another definition that was recommended by K. Wiegers and J. Beatty in [2] and comes originally from I. Sommerville and P. Sawyer (1997) [22]:

Requirements are a specification of what should be implemented. They are descriptions of how the system should behave, or of a system property or attribute. They may be a constraint on the development process of the system [2].

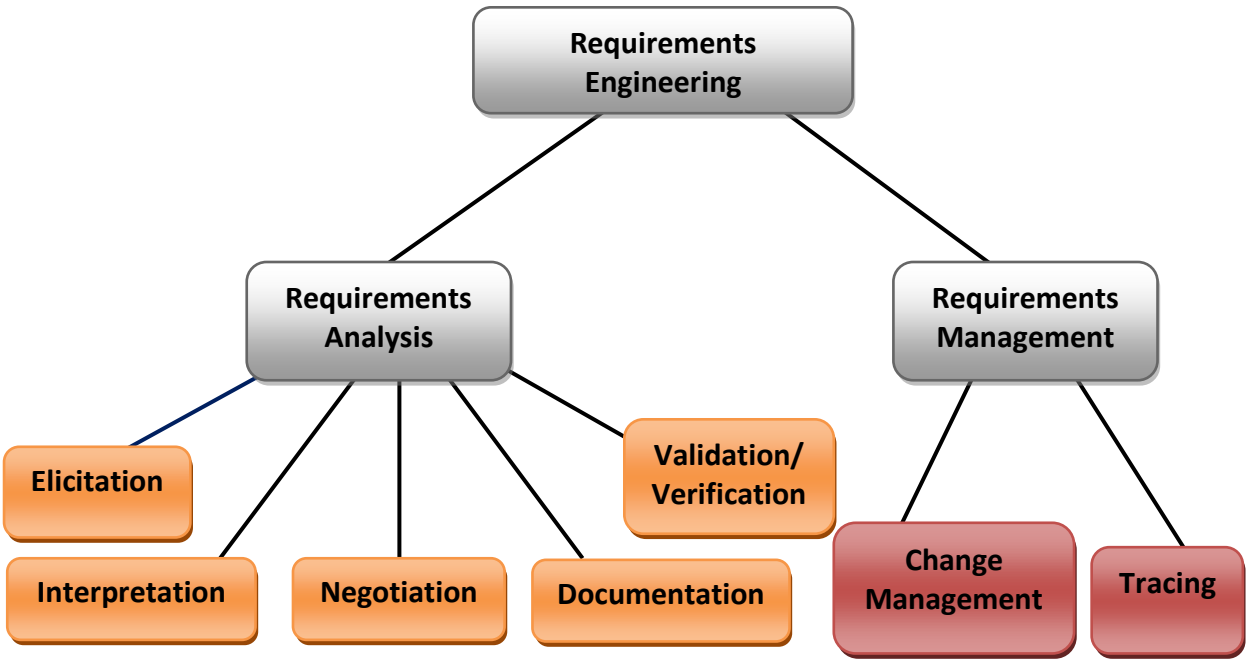
There are basically two types of requirements. The first is functional requirements that capture the functions that a system must perform. The second is non-functional requirements that define a specific property or constraint on the system [3] such as speed, usability, safety, reliability [24].

Definition of requirement engineering

Broader definition is one of the most long-standing, and comes from a DoD software strategy document dated 1991: Requirements engineering "involves all life-cycle activities devoted to identification of user requirements, analysis of the requirements to derive additional requirements, documentation of the requirements as a specification, and validation of the documented requirements against user needs, as well as processes that support these activities" [1].

Requirements engineering: the subset of systems engineering concerned with discovering, developing, tracing, analyzing, qualifying, communicating and managing requirements that define the system at successive levels of abstraction [1].

In Figure 3 bellow a general overview of the requirements engineering process [23].



3. Figure - Requirement engineering [23]

2.1.1. Requirements analysis

Requirements analysis is subdivided into five sub-disciplines: elicitation, interpretation, negotiation, documentation and validation. These sub-disciplines encompass all the activities involved with exploring, evaluating, documenting, and confirming the requirements for a product. Following is a brief description of each of these sub-disciplines.

Elicitation

Elicitation encompasses all of the activities involved in gathering information and discovering raw requirements, such as interviews, workshops, document analysis, prototyping, and others. Number of actions is included in the process of elicitation. At first the product' target users and other stakeholders must be identified. Another key action is to understand user tasks and goals and the business objectives with which those tasks align. Every product has its own environment in which it will be used.

Learning about this environment is another important activity of elicitation. Finally, in order to understand functionality needs and fulfil quality expectations, the requirement engineers should work hand in hand with individuals who represent each user class [2].

Interpretation

In this phase an analysis of the collected information and raw requirements is performed. As a first step, the raw requirements will be structured, and classified according to their aspects, such as functionality or quality characteristics. Starting from this classification all identical, complementary or related raw requirements are merged together. After merging, the resulting requierements will be refined with the help of additional information and transformed into concrete requirements. As a result of this structuring and concretization, uncertainties and incompletenesses can be identified, which must be clarified with stakeholders [30].

Negotiation

The negotiation activity aims to achieve 2 goals. First, all conflicts between the viewpoints of the different stakeholders have to be detected and made explicit. Second, the identified conflicts should be resolved (as far as possible). Depending on the cause of the conflict, different strategies can be applied for resolving it. At the beginning of the requirements engineering process, typically the viewpoints of the different stakeholders differ significantly. Ideally, at the end of the requirements engineering process, the negotiation activity has identified and resolved all conflicts which exist between the different stakeholders involved [15].

Documentation

The focus of this sub-discipline is the documentation and specification of the elicited requirements according to the defined documentation and specification rules.

In addition, other important types of information such as rationale or decisions must be documented [15].

Validation

Requirements validation confirms that you have the correct set of requirements information that will enable developers to build a solution that satisfies the business objectives. During validation a review of the documented requirements is performed to correct any problems before the development group accepts them. Next step is to develop acceptance tests and criteria to confirm that a product based on the requirements would meet customer needs and achieve the business objectives. Iteration is a key to requirements development success. Plan for multiple cycles of exploring requirements, progressively refining high-level requirements into more precision and detail, and confirming correctness with users take lots of time can be frustrating. Nonetheless, it is a pure aspect of dealing with the fuzzy uncertainty of defining a new software system [2].

2.1.2. Requirements management

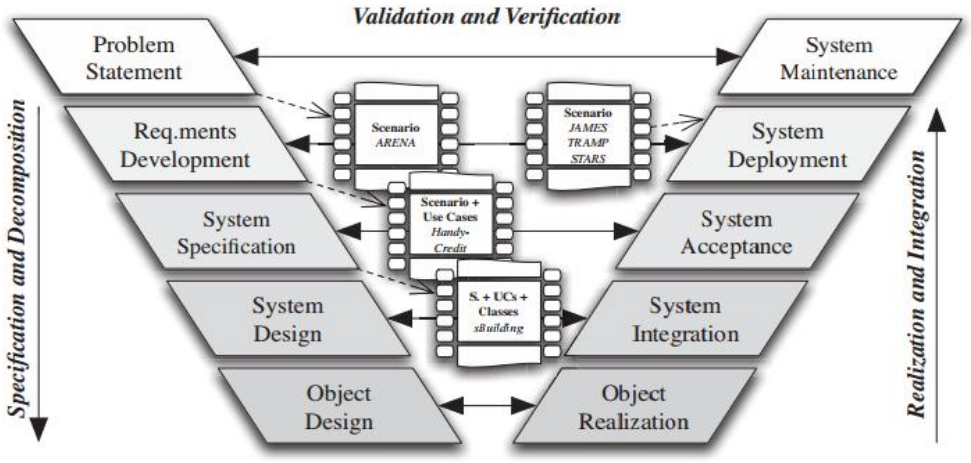
Requirements management includes many important activities starting with defining the requirements baseline, in which an approved set of functional and non-functional requirements is presented. Changes in the requirements throughout the life cycle of projects are likely to occur, the impact of these changes must be evaluated, and upon this evaluation new commitment should be negotiated by the management. Other activities of requirement management are keeping project plans current with the requirements as they evolve, defining the relationships and dependencies that exist between requirements and tracing individual requirements to their corresponding designs, source code, and tests. The objective of requirements management is not to prevent change or to make it difficult. It is to anticipate and accommodate the very real changes that you can always expect so as to minimize their disruptive impact on the project [2].

2.2. Vision Video

It is a multimedia representation of the requirements and visions of new systems. This representation is easy to create and requires no formal preparation for stakeholders to understand [7]. Till this moment there is no real model for these Vision Videos, but many studies try to build an approximation to how such videos can be built. In [7] visions were presented as videos that were supported by some special multimedia technologies. These videos were constructed during the meeting between stakeholders and requirement engineers. Each action is presented as a piece of multimedia (video-clip, photo, screenshot, hand drawn sketch, and audio-clip). These pieces are then concatenated in the right order to form a so-called Vision Video.

Visualizing a requirement as a video shows a very concrete situation and helps the stakeholder to concentrate on that [7]. The goal is to allow stakeholders to actively contribute and interact by using new multimedia technologies for requirement and documentation. Videos are easily understood for stakeholders and they do not require learning any engineering notation and this by itself a big favor to elicitation.

In software cinema [8] however, the idea was to attach several videos to activities of the software lifecycle model, represented in this case as a V-model (see Figure 4) [8]. These videos were created during real software development projects where Software Cinema technique was employed as case studies to validate occurring ideas [8]. Figure 4 shows the first example is a early produced scenario video, the second example is a video-based prototype showing the scenario and selected use cases [8], and last is a scenario, use case, and static system model. The last example is the use of video during system acceptance tests before installing. Since digital video is being dealt with. Complicated tools for manipulation and annotation the videos and photos can be developed. By making the film ‘clickable,’ i.e. allowing a viewer to directly refer to objects seen on screen [8].



4. Figure - Model of Software Cinema [8]

The Software Cinema technique has three phases. First phase is preproduction, which leads to a visionary scenario. Second phase is end-user session, in which feedback is incorporated. Third and last phase is postproduction, where analysis leads to enriched formal requirements [8].

Vision Videos were created while achieving some projects in Leibniz Universität in a real environment with real stakeholders and teams of (8 to 10) students. The Vision Video as my team built was an early, futuristic and advanced vision to how the software or system will look like upon completion and what core functionality it will provide. The purpose was to avoid any disappointment or unpleasant user experience in late stages. It scales the level of harmony between developers and stakeholders by demonstrating examples and real scenarios in the target environment. As a result a summary of some concrete concepts that represents the user needs in less than 5 minutes video. Till now Vision Video serves as a tool for validation, so it represents a guarantee of the developers' understanding and a feedback from the stakeholders themselves. Although Vision Video presents a valuable amount of information and concepts about the target environment, still believed to be lack of use. It is a client-oriented and has no role in the requirement communication, although a well done Vision Video contains a decent amount of requirements. On the light of what has been said, Vision Video is believed to have a main role in requirement communication in the future.

3. Related work

In this capital some previous related works that revolve around the same space of interest will be briefly described. Famous search engines were used like Google, Google Scholar, IEEE Xplore Digital Library and others to help find the useful material to achieve this work. The starting paper was [10] „Workshop videos for requirements communication" and many keywords were applied like (elicitation, multimedia, videos, stakeholder interaction, video-based requirements engineering, requirements communication, etc.).

Fricker et al. [10] presents an investigation about the feasibility of recording a requirements workshop as a video, driven by the fact that some important intended recipients of the requirements are often not present in such workshop. This paper presents the workshop video technique and a phenomenological evaluation of its use for requirements communication from the perspective of software developers [10]. The results show how the technique was appreciated by observers of the video, present positive and negative feedbacks from the observers, and lead to recommendations for implementing the technique in practice.

Brill et al. [11] proposed to use ad-hoc videos as a concrete representation of early requirements. The paper presents an experiment designed using the Goal-Question-Metric paradigm to compare videos with use cases as a widely used textual representation of requirements. During the experiment, even inexperienced subjects were able to create useful videos in only half an hour. Videos helped to clarify more requirements than use cases did under the same conditions [11].

Creighton et al. [8] proposed a new technique to decrease the gap between the conceptual models of end-users and formal specification/analysis models of developers. This paper presented a novel technique for the video analysis of scenarios, relating the use of video-based requirements to process models of software development. The

technique has been implemented with a tool which lets the analyst annotate objects as well as spatial or temporal relationships in the video to represent the conceptual model.

Pham et al. [7] discussed difficulties in reaching common ground among stakeholders and engineers. The paper proposed a new kind of interaction based on multimedia technologies in which requirements and visions of new systems are documented in a multimedia representation. This representation is easy to create and requires no formal preparation for stakeholders to understand. It includes video, photo and audio as a catalyst for fast-paced stakeholder interaction.

This study's objective is not to invent new ways to boost understanding and support requirement communication. It investigates and tries to prove the ability of an existing technique which is Vision Video to achieve that.

4. Experiment Planning

4.1. Introduction

The objective of this study is to apply an experiment that studies the use and affect of Vision Video on requirement communication throughout the requirement analysis [2].

It is not easy to design an experiment in software engineering. The Goal-Question-Metric Method [16] has defined rules of thumbs and guidance to finding metrics that form the pillars of any analysis. Defining the goals, questions and metrics will be discussed in this chapter besides formulating the hypothesis, finding the variables and the context or scenario in which our experiment will follow to achieve the purpose intended.

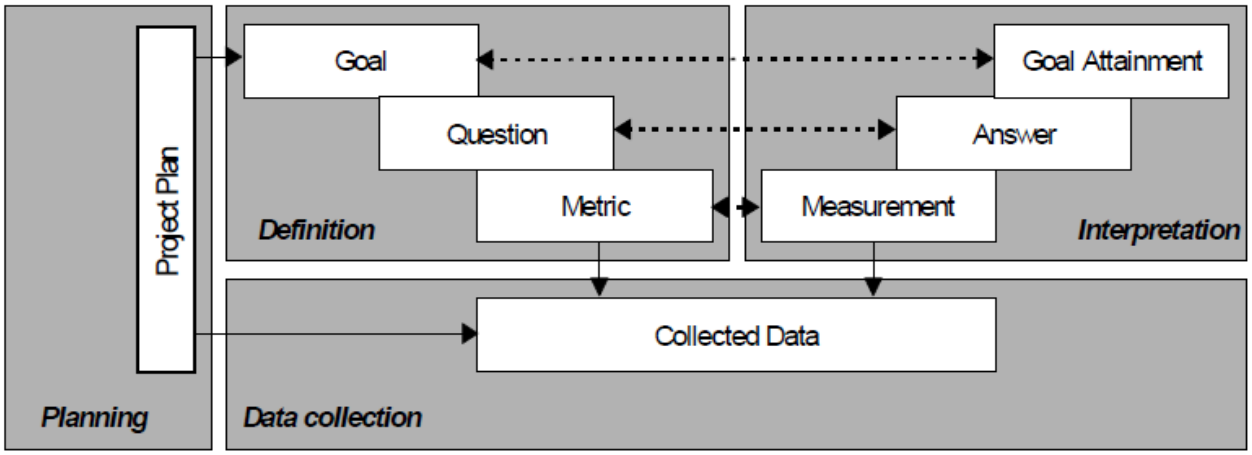
4.2. GQM method

As mentioned above The GQM paradigm [16] will be used. GQM is an object-oriented approach starts with defining a main goal to the experiment or the project in hand and then refines this goal into sub-goals. These goals will then be traced to extract the related questions for each. From questions the metrics will be derived. Metrics will provide the suitable information to answers to these questions. As a result the model of GQM consists of three levels:

- Conceptual level (Goal)
- Operational level (Question)
- Quantitative level (Metric) [17].

In Figure 5 the four basis phases of GQM are illustrated. The planning phase is performed to guarantee the success of the GQM measurement programme. This includes training, project planning and management involvement. Throughout the definition phase goals, related questions, metrics and hypothesis are identified. Upon finishing all definition steps the measurement can begin. In the third phase the data collection forms are defined, filled with suitable data and stored. Finally, comes the

interpretation phase in which an interpretation of the collected data is performed to answer the defined questions. These answers are used again to check if the defined goals have been fulfilled [16].



5. Figure - The four phases of GQM [16]

GQM offers a systematic approach that defines the goals in a way that fits to the model of software processes. The result of applying GQM is defining a measurement plan that cover a set of issues and rules for analyzing and interpreting the data. As the figure describes metrics in GQM are identified in a top-down approach, while vice versa the data analysis is accomplished in a bottom-up approach [16].

4.3. Goals of the experiments

The main goal of this thesis is to investigate the benefit of using of Vision Video in requirement communication, this goal is then refined into 3 sub-goals. The following is the detailed definition of our goals.

Goals definition

G.1. Investigates the benefit of using of Vision Video in requirement communication.

G.1.1. Investigates Vision Video for the purpose of comparing its use cases with respect to suitability and conformance with use cases in specification sheet from perspective of developer in the study on the use of Vision Video in requirement communication.

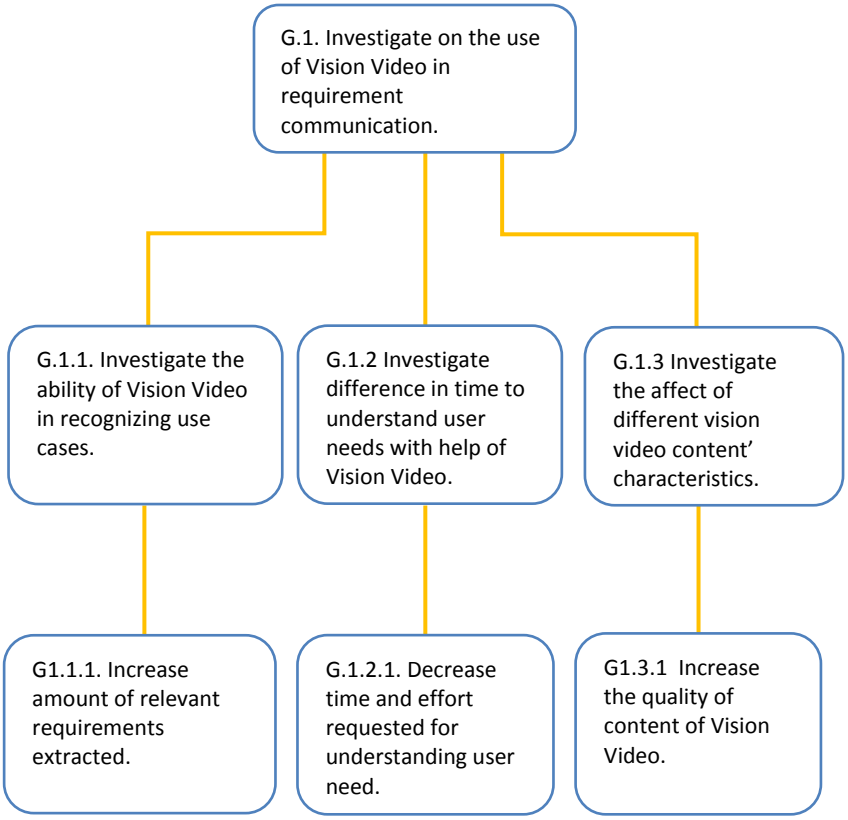
G.1.2. Investigates the Vision Video and specification sheet for the purpose of understanding the user need in each case with respect to cost and performance from perspective of developer in the study on the use of Vision Video in requirement communication.

G.1.3. Analyze the Vision Video for the purpose of improve with respect to effectiveness and efficiency from perspective of developer in the study on the use of Vision Video in requirement communication.

Object of Study	Purpose	Quality Focus	Perspective	Context
Vision Video and specification sheet	Compare	Suitability and accurecy	Developer	Communicating requirements supported by video for improving shared understanding
Vision Video and specification sheet	Understanding user need	Cost and performance	Developer	
Vision Video	Improve	Effectiveness and efficiency	Developer	

Table 3 - Facet classification of the three goals of experiment

In Figure 6 a summary of the goals is illustrated. The main goal which is to investigate the use of Vision Video in requirement communication is located above as a tree root. The main goal is too abstract, as a result it was divided into three sub-goals G1.1, G.1.2 and G1.3 each of these goals was in turn refined into a less abstract level. The leafs in this tree represent the final set of goals. The first leaf is the goal G.1.1.1 in which the study aims to Increase amount of relevant use cases extracted by using the Vision Video. The goal G1.2.1 on the other hands aims to decrease time and effort requested for understanding user need. Finally goal G1.3.1 in which the study hopes to increase quality of Vision Video's content.



6. Figure - Tree of goals

4.4. Abstraction sheet

An abstraction sheet is a way of summarizing the goals described previously in the GQM plan [16]. It is a form that serves as a helping mean to better understanding the goals and being able to ask the right questions related to each of them. The goal will explicitly be specified right at the begging or at the head of the abstraction sheet. Right under it a facet classification of the goal will be donated [25]. The body of the abstraction sheet is mainly composed of four sections. First section is the quality focus, which defines the possible metrics to measure the object of the goal. The baseline hypothesis represents the current knowledge regarding the metrics. The variation factors represent the factors that might influence the metrics, finally the expected impact of the variation factors on the metrics (see Table 4.1) [16].

In Table 4.1 an abstraction sheet of the Goal 1.1 is illustrated. The header contains the index of the goal as described in GQM plan, right under it is the facet description of the goal. The quality focus (metrics) of the Goal 1.1 is the number of relevant use cases and the values of precision and recall. Here It is important to mention that precision and

recall are the two most frequent and basic measures for information retrieval effectiveness, their values range between 0.0 and 1.0. Precision (P) is the fraction of retrieved use cases that are relevant. Precision = $\frac{\#(\text{relevant items retrieved})}{\#(\text{retrieved items})}$, whereas recall (R) is the fraction of relevant use cases that are retrieved. Recall = $\frac{\#(\text{relevant items retrieved})}{\#(\text{relevant items})}$ [27]. Back to specification sheet, next section is the baseline hypothesis; it presumes that the user will be able to get an average of 50% of the total use cases after watching the Vision Video. Five variation factors were mentioned, for example the existence of a user interface in the video. Finally the impact each of these variation factors might have on the metrics. For example embedding a user interface in the video will have a positive influence on the number of relevant use cases.

<table>
<tr><td colspan="4">Goal 1.1.</td></tr>
<tr><td>Object
Vision Video and specification sheet</td><td>Study Purpose
Compare</td><td>Quality focus
Suitability and accuracy</td><td>Perspective
Developer</td></tr>
<tr><td colspan="2"><u>Quality Focus</u>
The number of use cases the user was able to catch upon watching the Vision Video.
1- Rel. use cases retrieved.
2- P/R value.</td><td colspan="2"><u>Variation factor</u>
• The quality of the Vision Video.
• GUI or Prototype inside the Vision Video.
• Comment in the video.
• Audio description of Vision Video content.
• Duration of the Vision Video.</td></tr>
<tr><td colspan="2"><u>Baseline Hypothesis</u>
a. The use cases that the user retrieve using the video are partially (50%-60%) relevant and right.
b. The precision values are generally around (0.5-0.6) and recall values are around (0.6-0.7).
Of rel. Use cases retrieved>= 50% of total use cases.
P values = [0.5-0.6]
R values = [0.6-0.7]</td><td colspan="2"><u>Impact of Variation factor</u>
• Good quality video will affect (a) and (b) positively.
• Including GUI can be positive for both (a) and (b) if used wisely. It can also be misleading and increase unneeded use cases.
• Adding comment or headlines will affect (a) and (b) positively
• Audio comments can increase the relevant use cases retrieved and the precision and recall value.
• Too Long or too short video duration can lead to negative effect on both (a) and (b).</td></tr>
</table>

Table 4.1 - Abstraction sheet goal.1

	Quality Focus	**Variation factor**
Factors	The number of use cases (relevant) that the user was able to retrieve upon watching the Vision Video.	GUI or prototype inside the Vision Video.
Question	How many of the retrieved use cases upon watching Vision Video fulfills or matches the use cases in specification sheet?	Will including or embedding a Prototype or GUI in the Vision Video help raising the number of relevant use cases retrieved?
Metric	According to the use cases mentioned in the specification sheet, compare and come up with the number of right use cases Measured with: 1- Number of relevant use cases retrieved. According to metric (1) identify to which extent the result was precise. Measured with: 2- Precision and recall value.	Number of a relevant use cases retrieved and the value of precision and recall. Measures with: 1- Number of relevant use cases. 2- Precision and recall value.

Table 4.2 - Abstraction sheet goal.1

4.5. Research Question

Each goal will be refined into several questions. The purpose of this refinement is to reach a more operational level which is more suitable for interpretation than the abstract level of goals. Questions are used to support data interpretation towards a measurement goal. The questions of this thesis' goals are listed below. For example the first question belong to the goal G.1.1.1 ''Increase amount of relevant use cases extracted'' which is a sub-goal of G.1.1 which in turn is a sub-goal of the main goal of this thesis G.1 (see Figure 6 above).

1. Question for G1.1.1.

To which extent do the use cases in the Vision Video comply or match the use cases in specification sheet?

2. Question for G1.2.1.

What is the time consumed to understand the user needs depending on 2 cases. The first is by using only specification sheet, and the second is by using both specification sheet and Vision Video?

3. Questions for G1.2.2.

To which extent did the developer understand the user in regarding to time (number of wrong answers in a predefined test (see Appendix D) related video)?

4. Question for G1.3.1.

What impact using a GUI, prototype, or a mockup will have on Precision/Recall values?

5. Question for G1.3.2.

What impact will duration of the video have on Precision/Recall values?

6. Question for G1.3.3.

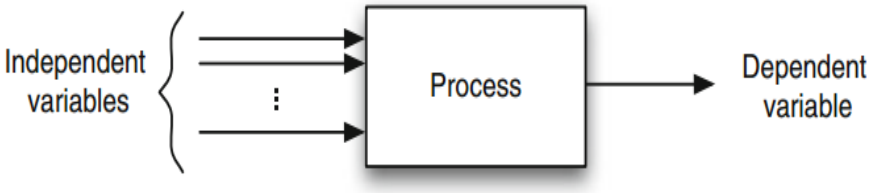
What impact do video and audio quality have on the Precision/Recall values?

7. Question for G1.3.4.

What impact does integrating text or sound have on the Precision/Recall values?

4.6. Variables definition

The purpose of conducting an experiment, is to study the outcome of varying some input variables to a process (see Fig.7)[17].



7. Figure - Illustration of independent and dependent variables

There are two types of variables in an experiment, independent variable and dependent variable. Independent variables are experimentally controlled and they are also called factors whereas dependent variables are measured regarding every change in independent variables [26]. In this experiment two independent variables (factors) will be controlled, and upon changing their values the corresponding effect on the five dependent variables will be measured (see Table 5).

Independent Variables	Dependent Variables
1. The type of information input a) Only Vision Video. b) Vision Video and specification sheet. c) Only specification sheet.	**1.** Number of relevant use cases that the subject retrieved from the video. **2.** Value of precision and recall. **4.** The time consumed to get the use cases. **5.** The time consumed to understand use needs. **6.** To which extent were the use needs understood.
2.The characteristic of the content inside video a) With or without GUI. b) With text or with no text. c) With audio or without audio. d)Good quality bad quality. e) Short duration or long.	

Table 5- Independent and dependent variables

4.7. Context selection

In order to fulfill most of the goals intended from this study and the most general results, the experiment will be conducted on already built real software projects, with subjects that have the needed expertise and know exactly what they are doing. The experiment will take place at Leibniz Universität in one of the rooms of the software engineering institute. The subjects will be computer science students. Hence the study will be executed in a well defined research environment. There are always limits in cost and time, since the experiment is being conducted as a bachelor thesis, for these reasons the context will be an Off-Line Quasi-Experiment. That will grant more control over all factors like the Vision Video characteristics, the subjects, type of information input. A possible subject for the experiments is a student who knows the term “Vision Video”, have a prior expertise in requirements communication, and done a software project before, either in or outside the University.

4.8. Hypothesis formulation

The whole idea revolves around stating the hypothesis formally and collecting the suitable data for it during the experiment. This data will then be used to reject the Null hypotheses, if feasible, as a result coming out with a conclusion based on testing the hypothesis under several conditions and risks. Hypothesis testing is the core for statistical analysis.

There are two types of hypothesis that must be formulated. The first is a null hypothesis H_0 the second is an alternative hypothesisH_1. The former is the one each experiment seeks to strongly reject, the later H_1 is the hypothesis that caused the null hypothesis to be rejected in the first place [17].

To differentiate hypothesis from each other's in this study, a special indexing was used, for example $\boldsymbol{H_{0,1,2}}$ refers to the second null hypothesis of the first question. In details 0 refers to null hypothesis, 1 refers to first question in the thesis, 2 refers to the second hypothesis of the first question knowing that first question has 3 different hypothesis.

Q.1 To which extent do the use cases in the Vision Video comply or match the use cases in specification sheet?

Metric	Number of relevant use cases retrieved
Hypothesis	Null-hypothesis $\mathrm{H}_{0,1,1}$: presumes that the subject won't be able to retrieve more than 50% of the use cases upon watching the videos: **$\boldsymbol{H_{0,1,1}}$: # of Rel. U.C. <50% of total U.C. in S.S.** Alternative hypothesis$\mathrm{H}_{1,1,1}$: explain that the subject will collect at least 50% of the requirement by watching the video. **$\boldsymbol{H_{1,1,1}}$: # of Rel. U.C. >=50% of of total U.C. in S.S.**
Abbreviation	# Of Rel. U.C.: number of relevant use cases retrieved. Total U.C. in S.S: total use cases in specification sheet.

Metric	Number of irrelevant requirements
Hypothesis	Null-hypothesis $\mathrm{H}_{0,1,2}$: presumes that all retrieved use cases upon watching the videos are irrelevant: **$\boldsymbol{H_{0,1,2}}$: # of irrelevant U.C. = # of ret.U.C.** Alternative hypothesis $\mathrm{H}_{1,1,2}$: presume that number of irrelevant use cases are less than the number of retrieved use cases: **$\boldsymbol{H_{1,1,2}}$: # of irrelevant U.C. < # of ret.U.C.**
Abbreviation	# Of irrelevant U.C.: number of irrelevant use cases.

	# Of ret.U.C.: number of all retrieved use cases (relevant, non relevant).

Metric	Precision value
Hypothesis	Null-hypothesis$H_{0,1,3}$: it presumes that precision value is less than 0.5, and it means that less than 50% of retrieved use cases are relevant. **$H_{0,1,3}$: P values <0.5** Alternative hypothesis $H_{1,1,3}$: presumes that precision value is at least 0.5: **$H_{1,1,3}$: P values >=0.5**
Abbreviation	P value: precision value

Metric	Recall value
Hypothesis	Null-hypothesis $H_{0,1,4}$: it presumes that recall value is less than 0.5, and it means that less than 50% of the relevant use cases will be retrieved every time: **$H_{0,1,4}$: R values <0.5** Alternative hypothesis $H_{1,1,3}$: presumes that recall value is at least 0.5: **$H_{1,1,4}$: R values >=0.5**
Abbreviation	R value: recall values

Q.2 What is the time consumed to understand the user needs depending on 2 cases: 1-only specification sheet, 2-both Vision Video and specification sheet.

Metric	Time consumed to understand the use needs (basic concepts, possible use cases and main functionalities) understanding is defined as answering at least 50% of the questions in a predefined test (see Appendix D).
Hypothesis	Null-hypothesis$H_{0,2}$: presumes that time consumed to understand is the same in both cases. **$H_{0,2}$: T.T.U. with S.S. &V.V. = T.T.U. with S.S.** Alternative hypothesis$H_{1,2}$: presumes that the time the user will consume to understand the requirements and user needs while using both Vision Video and specification sheet together is better than by only using the specification sheet. **$H_{1,2}$: T.T.U. with S.S. &V.V. < T.T.U. with S.S.**
Abbreviation	T.T.U.: time to understand S.S.: specification sheet V.V.: Vision Video

Q.3 What is the level of understanding (number of wrong answers in a questionnaire related video)?

Metric	Level of understanding user needs.
Hypothesis	Null-hypothesis $\boldsymbol{H_{0,3}}$: presumes that there is going to be no difference in the level of understanding: **$\boldsymbol{H_{0,3}}$: L.O.U. with V.V. &S.S = L.O.U. with S.S.** Alternative hypothesis $\boldsymbol{H_{1,3}}$: presumes that the level of understanding will improve if the user uses both Vision Video and specification sheet together: **$\boldsymbol{H_{1,3}}$: L.O.U. with V.V.&S.S > L.O.U. with S.S.**
Abbreviation	L.O.U.: level of understanding

Q.4 What impact using a GUI, prototype, or a mockup will have on P/R values?

Metric	The precision and recall value (Vision Video with GUI)
Hypothesis	Null-hypothesis $\boldsymbol{H_{0,4}}$: perfect precision and perfect recall in case the Vision Video contain a user interface: **$\boldsymbol{H_{0,4}}$: P/R (V.V. with GUI) = 1.0.** Alternative hypothesis $\boldsymbol{H_{1,4}}$: precision value and recall value are less than one if the Vision Video contain a user interface: **$\boldsymbol{H_{1,4}}$: P/R (V.V. with GUI) <1.0.**
Abbreviation	V.V. with GUI: Vision Video with user interface

Q.5 What impact will duration of the video have on P/R values?

Metric	The precision and recall value (Vision Video duration)
Hypothesis	Null-hypothesis $\boldsymbol{H_{0,5}}$: perfect precision and perfect recall in case of optimal Vision Video‘s duration: **$\boldsymbol{H_{0,5}}$: P/R (Duration Of Vid) = 1.0.** Alternative hypothesis **$\boldsymbol{H_{1,5}}$:** precision value and recall value are less than one in case of optimal Vision Video‘s duration: **$\boldsymbol{H_{1,5}}$: P/R (Duration Of Vid) <1.0.**

Q.6 What impact do video and audio quality have on the P/R values?

Metric	The precision and recall value (quality of Vision Video)
Hypothesis	Null-hypothesis $\boldsymbol{H_{0,6}}$: perfect precision and perfect recall in case of optimal Vision Video‘s quality: **$\boldsymbol{H_{0,6}}$: P/R (Quality Of Vid) = 1.0.** Alternative hypothesis **$\boldsymbol{H_{1,6}}$:**precision value and recall value are less than one in case of optimal Vision Video‘s quality: **$\boldsymbol{H_{1,6}}$: P/R (Quality Of Vid) <1.0.**

Q.7 What impact does integrating text or sound have on the P/R values?

Metric	The precision and recall value (Vision Video with text or sound comments)
Hypothesis	Null-hypothesis $\boldsymbol{H_{0,7}}$: perfect precision and perfect in case the Vision Video include audio or textual comments: **$H_{0,7}$: P/R (V.V. with Audio) = 1.0.** **P/R (V.V. with Text) = 1.0.** Alternative hypothesis $\boldsymbol{H_{1,7}}$**:** precision value and recall value are less than one in case the Vision Video include audio or textual comments: **$H_{1,7}$: P/R (V.V. with Audio) <1.0.** **P/R (V.V. with Text) < 1.0.**

4.9. Experiment design

For the experiment to deliver the intended results, design and planning should be studied carefully before starting the evaluation. So far the problem in hand was identified using the GQM method. The experiment is defined as a set of tests of the treatments. The treatment is a single possible value of the chosen factor [17]. The test must be designed carefully to get the most of the experiments. During the course of design the number of tests and the way in which they will be assigned, organized and execute will be defined in order to make the effect of the treatment clear and visible. There are three general design principles to be considered, which are blocking, randomization and balancing. It is not obligatory to use all of them at once; all depends on the problem beforehand. In the following the three principles of design will be described, and how each will be applied in this experiment.

Randomization

This principle revolves around the assignment of subjects, objects and the order in which tests will be perform. The assignment according to this principle should be done completely at random to prevent the problem of variation [19]. This random assignment and order will lead to the selection of a representative group of subjects from the entire population under study.

In this experiment the randomization will be fulfilled by first selecting the subjects randomly from the population of the computer science students that have a prior experience in software engineering techniques and their application. Second, the Vision Videos and specification sheets will also be assigned to the subjects at random.

Blocking

Some factors will affect our experiment's integrity in an undesirable way. Thus they might lead to the failure of the entire experiment. This affect must be excluded in a certain way. If these factors and the way to control them are known, then blocking can be applied. In blocking a different blocks will be created according to the different values of the disturbing factor, after that the treatment will be applied on each block.

In this experiment the blocking principle won't be needed, as the selected subjects group is considered homogeneous, and has been selected under the assumption, that all subjects have an acceptable level of expertise when it comes to what the study needs. This assumption is not precisely true as a slight difference might occur, but this won't affect the study or cause a crucial affect.

Balancing according to this principle each treatment will have the same number of subject, in this study balancing will be applied as it will help simplify and strengthen the statistical analysis of the data.

4.10. Standard design type

There are many standard design types range from experiment with one factor to complex experiments with many factors. The design of this study has two factors**.**

1. Factor-A: represents the characteristic of the content inside video, with two treatments.

These treatments are:

T.1: Vision Video.1: Argus-1.

T.2: Vision Video.2: Vollyball-1.

2. Factor-B: type of information input, with two treatments.

These treatments are:

T.1: Only Specification sheet.1 of Argus-1 and Volleyball-1 projects.

T.2: Specification sheet.1 and Vision Video.1 of Argus-1 and Volleyball-1 projects.

Table 6 assigns the subjects to the treatments for both factors in a completely randomized design. That means between-subject design [18] has been used, whereby each participant was assigned to only one of two treatments regarding first and second variable.

		Factor-A (characteristic of the content inside video)	
		Argus-1	**Volleyball-1**
Factor-B (type of information input)	**Spec.1 (Argus-1)**	No treatment	Subject.6, 2, 10, 14
	Spec.1+V.1 (Argus-1)		Subject.8, 4, 12, 16
	Spec.2 (Volleyball-1)	Subject.1, 5, 9, 13	No treatment
	Spec.2+V.2 (Volleyball-1)	Subject.3, 7, 11, 15	

Table 6 - Assigning subject to the treatment of both factors for a randomized design

A detailed design of each of the experiment scenario is shown below (see Table 7 and 8). In Table 7 the subjects number in total is 16, each will be assigned to one of the treatments in the first scenario (either Argus-1 or Volleyball-1 Vision Video). On the other hand Table 8 refers to the second scenario. It includes the same 16 subjects each assigned to one of 4 other different treatments. The hard part is though assigning the subjects to the treatments in a way that will prevent each of them from having the same material while conducting each of the two scenarios. For example subject one will see the Vision Video of Argus-1 (first treatment of first scenario) (see Table 7). Subject one must not be assigned any treatment that has anything to do with the project Argus-1, so he/she will be assigned a treatment that processes another content which is Volleyball-1 project (see Table 8).

Subjects	Argus-1	Volleyball-1
1	X	
2		X
3	X	
4		X
5	X	
6		X
7	X	
8		X
9	X	
10		X
11	X	
12		X
13	X	
14		X
15	X	
16		X

Table 7 - Assigning subject to the treatment for factor-A alone for a randomized design

Subjects	Spec.1 (Argus-1)	Spec.1+V.V. 1 (Argus-1)	Spec.2 (Volleyball-1)	Spec.2+V.V. 2 (Volleyball-1)
1			X	
2	X			
3				X
4		X		
5			X	
6	X			
7				X
8		X		
9			X	
10	X			
11				X
12		X		
13			X	
14	X			
15				X
16		X		

Table 8 - Assigning subject to the treatments for factor-B alone for a randomized design

As described above the study will apply the between-subject design [18], as the subjects will do only one treatment in each scenario. By choosing the between-subject design [18], the risk of learning affect will be eliminated, and burden on the subject will be kept at minimum.

4.11. Validity evaluation

The classification scheme defined by Cook and Campbell will be used. This schema defines four types of threads. The first type of these threats is conclusion validity. This validity type purpose is to assure that there is a statistical relationship or a connection between the treatment and the result of applying it.

Conclusion validity has different types. For example the subject might not understand all questionnaire questions due too hard formulation or language difficulties, thus irrelevant answers that will affect the final result and conclusion. It can also be that the subject watched the video in careless manner, which will lead to wrong answers to the questions in questionnaire. Expecting a specific outcome 'Fishing' is also considered a threat. Risks of this type were addressed to a certain level during the evaluation. Here are some of the treatments to avoid such threats. At first the contribution in the experiment was not obligatory. That means the subjects volunteered for the task willingly.

The study organizer will be present and will try to eliminate any ambiguity in the questions in case any subject asks. The whole experiment scenario is well prepared. If all goes as planned considering also the short length of the Vision Videos and assigning only one treatment to each user by applying the completely randomized design the user won't tend to provide any misguiding or trivial answers.

Internal validity It is concerned with assuring the casual character of the observed relationship between the treatment and the outcome. In other words assuring that the relationship is not a result of a factor that we have no control over.

In our study such risk might occur due to the uncontrolled behavior of the subjects regarding the passing time, boredom or extra effort, etc. The completely randomized design was chosen and one of it is virtue is the tendency to decrease the burden on the user, thus reducing the time consumed to perform the test for each user and the possibility of any fake data or mistake caused by boredom effect. The subjects are students and the study is unfortunately taking place in the exams period, the thing that might affect the outcome differently and negatively.This is called history threat and we will reduce its risk by giving the subject the freedom to choose the time he thinks it suits him or her better. Another critical point to focus on is not letting the subject knows about the activities of the experiment and its different tests prior to doing them, as a result exclude any possibility of learn affect. Also making sure that the relationship between me as an organizer and the subjects won't have any influence on the result.

Construct validity can also occur during the experiment. This type of validity is concerned with the relationship between theory and observation and the ability to reflect the concept or theory well starting from the observation [17]. It is divided into threats that are related with the experiment design and threats that are related with the social factors.

In this study we tried as much as possible to build a clear theory to avoid and inadequate preoperational explication of constructs. Other than that the tests include not a wide verity of Vision Videos and specification sheets to avoid under-represent of the construct.

The subject might be participating in different studies at a time, which makes it difficult to know whether the effect is caused by our treatment, treatment of the other study, or a combination of both. This interaction of different treatments can be avoided by asking the subjects whether they are part of any other study, if they are and both studies has some sort of similarity then the subject will be excluded.

Social threats include the tendency of some subjects to assume the result of the experiment, thus the subject's behavior will be based on the their assumption about the

hypothesis, other subjects are just scared of being part of such test or evaluation and tend change their behavior thinking it is going to make them look or feel better. Lately it can happen that the subject has specific expectations for the experiment either consciously or unconsciously, the thing that leads to a bias in the experiments results. To avoid such threats subjects will be chosen so that they have no or different expectations about the experiments. A comfortable atmosphere will be made provided to induce the subjects to act normal. Finally if any radical values occure the subject the values will be rejected and the treatment will be repeated with another subject.

External validity Such threats might occur by choosing participant or subject that had nothing to do with the intended population. In this study the subjects were chosen randomly from the population of computer science students that fulfill a set of qualifications to avoid such threat. The environment of the experiment and the instrument used to perform it were also picked and prepared carefully to suit the intended proposes, thus avoiding another threat to external validity

5. Evaluation

In this capital, after finishing the design and planning for the experiment. The experiment will be executed and the data will be collected to be analyzed in later stage. Evaluation includes preparing for the experiment and its execution, in which different treatments will be assigned to different subjects.

5.1. Preparing for the experiment

This section of the thesis contains the activities to prepare for the experiment. The two most important activities at this stage are first to select participants and second to select the objects or the material for the experiment.

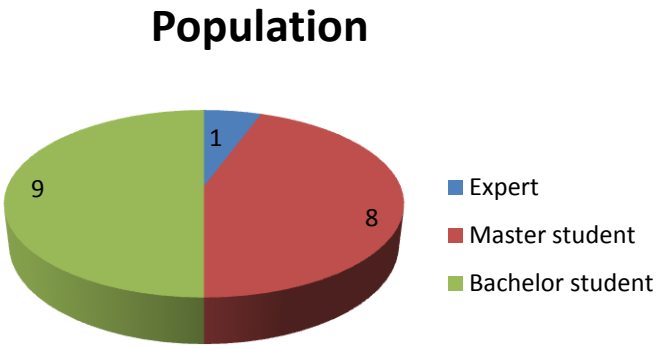
5.1.1. Selecting subjects

If the subjects were not to be selected carefully, this might lead to experiment failure. 23 Students will participate in this selection process and 18 (2 will be assigned to the pre-study and 16 to the core study) were selected according to their expertise. For more details (see Figure 8), 5 were rejected for not fulfilling the following criteria:

1- Attended Programming 1 or 2.

2- Attended Softwaretechnik or Software Qualität.

3- Did “Software Project” in Leibniz Universität or were part of similar projects.



8. Figure - Distribution of the population

5.1.2. Selecting objects

Beforehand are a number of Vision Videos and specification sheets that belong to projects that have already been conducted by groups of Computer Science students (around 10 each) in the last years as a part of a real life scenario Software Project in Leibnitz Universität. After preliminary watching the Vision Videos the sample contains, a conclusion was drawn. Some Vision Videos were not good enough to be used in the experiment and that's why a wise scientific selection of our objects must be done. The sample includes 15 videos. According to experiment design (see Chapter 4) only 2 videos are needed to achieve the purpose of this study. The pre-study will identify the best 2 Vision Videos. Hence the two selected projects (see section 5.2).

The videos were created for the purpose of assuring the understanding between the developers and the stakeholders (validation). They were never meant to be used in requirement communication, as a result the requirements that the videos in hand try to convey to the developer are unknown. Since the specification sheets for the chosen projects have no real requirements inside but only use cases. The main focus will be on use cases instead of requirements throughout this study.

During the pre-study the use cases for each project (which was extracted from the specification sheet of the project) will be presented to the subjects as shown below (see Table 9). The subjects will in turn read them and then watch the video. The subject can stop rewind or watch the video all over again in case of any ambiguity. After watching the video, the subject must decide for each written use case, whether it occurred in the video or not by writing ‘Y’ or ‘N’ in the ‘’Exist’’ column.

The subject will also give his/her opinion or first impression about whether the video is good or not as shown in the last row (see Table 8). Another important detail is the second row after the project title in the same table. The user should approve the existence of each of the video characteristic (GUI, text comments, audio comment, quality and duration) inside the video by writing ‘Y’ for approval and ‘N’ for no approval.

BioFeedback	
Video Characteristics	**Exist?**
GUI	**Y**
Text comments	**Y**
Audio comments	**Y**
Quality	**Y**
Duration	**Y**
Use cases	**Exist?**
1-.Applaus-o-meter (Wie begeistert das Publikum vom einem Vortrag war?) benutzen.	**Y**
2- Applaus-o-meter initialisieren (Name der Teilnehmer, Vortrag Thema).	**N**
3- Neue Runde starten (neuen Durchlauf des Applaus-o-meters ohne alle Informationen nochmal eingeben zu müssen).	**N**
4- Applaus-o-Meterschnellstartmodus benutzen (ohne die Teilnehmernamen einzugeben).	**N**
5- Audiovisualisierung benutzen (Visualisierung der Geräusche im Raum).	**Y**
6- Audioausgabe ändern (laut der Fall).	**Y**
Do you think it's a good video?	**Y**

Table 9 - Pre-study user version form

After gathering the data the value of the value of the Cohen's Kappa [5] was calculated to decide the agreement between the two subjects, thus deciding the use cases included in each video. The pre-study purpose is to study the sample and spots the use cases in the Vision Videos and it's done with the help of two subjects with the same skills (see Section 5.1.1) but is not included in the real study to avoid any validity threats. According to plan the Cohen's Kappa

[5] was to be used to decide agreement between two raters (subjects). After conducting the pre-study and calculating the different Cohen's Kappa for the different studied videos (see Appendix B), some unexpected problems occur. Videos that have no ''No agreement'' or ''Yes agreement'' between both subjects like in Argus-1 video, have the Cohen's Kappa[5] value of zero, which means poor agreement, even though they were good videos as they gathered 100% of the use cases according to both subjects (see

Table 9). Another cause of this problem was the low number of use cases in some projects.Table 9 shows the use cases of both ''Argus projects'' and they were only four use cases.

Argus-2			**Argus-1**		
Video Charactieristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
GUI	**Y**	**Y**	GUI	**Y**	**Y**
Text comments	**Y**	**Y**	Text comments	**Y**	**Y**
Audio comments	**N**	**N**	Audio comments	**N**	**N**
1:35 (Duration)	**Y**	**Y**	1:40 (Duration)	**Y**	**Y**
Quality	**N**	**N**	Quality	**Y**	**N**
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
1- Das System soll den statischen Seiteninhalten speichern.	**Y**	**Y**	1- Der User soll den Browser starten.	**Y**	**Y**
2- Das System soll den dynamischen Seiteninhalten speichern.	**Y**	**Y**	2- Einstellungen des Systems ändern.	**Y**	**Y**
3- Programmaktionen protokollieren.(Die Aktionen, welche Argus ausführt sollen ordnungsgemäß festgehalten werden).	**N**	**Y**	3- Das System soll die Website archivieren.	**Y**	**Y**
4- Gespeicherte Webinhalte (Statisch, Dynamisch) offline abspielen.	**Y**	**Y**	4- Das System soll die Website abrufen.	**Y**	**Y**
Total number of agreements	**3**		**Total numer of agreements**	**4**	
Total number of disagreements	**1**		**Total number of disagreements**	**0**	
Total number of ‚Yes' agreements	**3**		**Total number of ‚Yes' agreements**	**4**	
Total number of ‚No' agreements	**0**		**Total number of ‚No' agreements**	**0**	
Is it a good video?	**N**	**Y**	**Is it a good video?**	**Y**	**N**

Cohen's Kappa calculation Argus-2:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	3	0	3
	NO	1	0	1
		4	0	4

Cohen's Kappa calculation Argus-1:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	4	0	4
	NO	0	0	0
		4	0	4

Po = 3/4= 0.75 **P**yes = 3/4*4/4=3/4=0.75 **P**no = 1/4*0/4= 0.0 **P**e = **P**yes+**P**no =0.75+0=0.75 **K** = **P**o-**P**e/1-**P**e = 0.0 /0.25= 0.0 ??	**P**o = 4/4= 1.0 **P**yes = 4/4*4/4=4/4=1.0 **P**no = 0/4*0/4= 0.0 **P**e = **P**yes+**P**no =1.0+0=1.0 **K** = **P**o-**P**e/1-**P**e = 0.0 /0.0 ??

Table 10 - Pre-study experimenter for

Solution

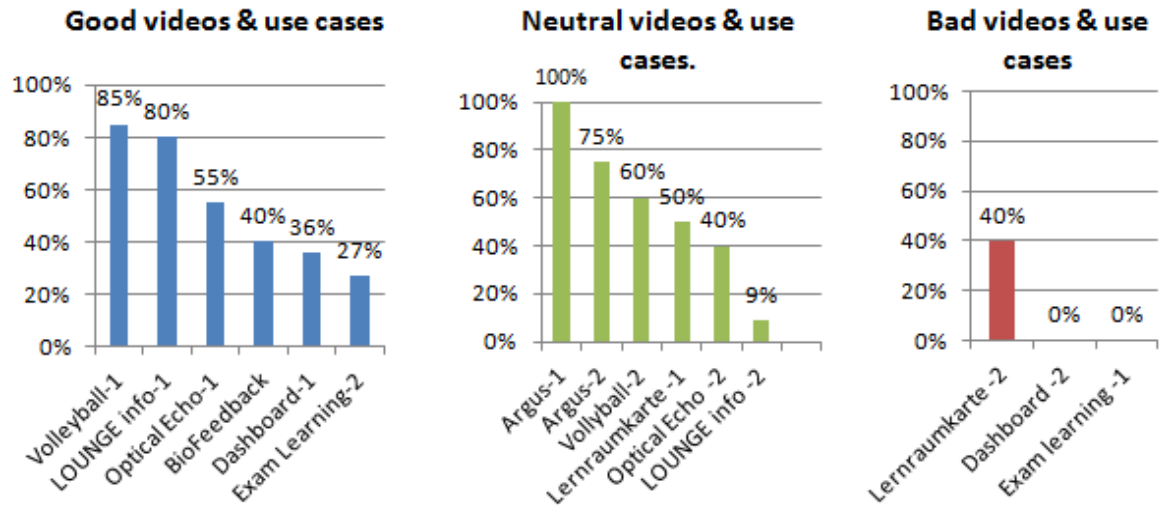
After gathering the data from both raters it was obvious that some videos were able to collect most or in some cases all use cases specified in the specifications sheet. In addition to that the overall captured subjects' impression about such videos was mostly good. For example below (see Table 11) one can notice, that ''Argus-1's video'' allowed both subjects to find all use cases as described in specifications sheet. Back to our solution which is to calculate the percentage of the ''Yes'' agreement each project has and choose the best two videos to be the materials for the core experiment.

Table 11 and Figure 9 include the percentage of the existed use cases in each video according to the subjects' opinion. Use cases column contains the percentage of the founded use cases, whereas the third column 'Video rating' contains the opinion of both subjects regarding the video. This column attribute has three different values **neutral**, **good**, **and bad.** Where good means that both subjects agreed that the video is good, whereas bad means both subjects agreed it is a bad video, and neutral means that the subjects disagreed one said it is good and the other though it is bad.

Vision Video	**Use cases**	**Video rating**
1. Argus-1	100%	Neutral
2. Volleyball-1	85%	Good
3. LOUNGE info-1	80%	Good
4. Argus-2	75%	Neutral
5. Volleyball-2	60%	Neutral
6. Optical Echo-1	55%	Good
7. Lernraumkarte-1	50%	Neutral
8. BioFeedback	40%	Good
9. Lernraumkarte-2	40%	Bad
10. Optical Echo-2	40%	Neutral
11. Dashboard-1	36%	Good

12. Exam learning-2	27%	Good
13. LOUNGE info-2	9%	Neutral
14. Dashboard-2	0%	Bad
15. Exam learning-1	0%	Bad

Table 11 - Summary of pre-study data



9. Figure - The different categories of videos and retrieved use case

Result of pre-study

In Table 11 both Argus-1 and Volleyball-1 occupy the first and second positions in collecting use cases. Both subjects approved that Volleyball-1 represents a good video and Argus-1 represents a neutral video. Hence they will be the objects of these experiments.

5.2. Execution

The experiment was conducted over 4 days. During each day 4 subjects were asked to come one at a time. Each subject has to achieve 2 assignments one after another. At first a form (see Appendix C) contains a list of all use cases as mentioned in the chosen projects' specification sheets will be assigned to each subject according to experiment plan. After reading the list of use cases the subject should watch the related Vision Video. During the assignment the subject can stop, rewind or even play the video all over again, upon watching the Vision Videoeach subject should decide whether each of the use cases in the form was encountered or not, the form must be filled accordingly.

In the second assignment each subject has to answer a test of 10 questions (see Appendix D) about one of the chosen projects (see 5.1.2.). As a helping material each subject will be delivered either specification sheet alone or both specification sheet and Vision Video as according to experiment design (see sub-chapter 4.10.). The test will determine to which extent the subjects understood the user needs, main functionalities and use cases and it will be evaluated according to a scale from 0 to 10. The time of solving the questions will also be captured, knowing that there was no limitation on time. Finally data from each subject for both assignments will be collected in special forms (see Appendix E, F) to be ready for analyzing.

5.3. Data validation

Only 16 participants are needed in the core experiments according to the design. Unfortuanately in this study 18 person participated, because the data collected from 2 of them was rejected. The first participant has less than 50% right answers in his test. Hence his data was declined and the experiment was repeated with another participant. Another participant was in a hurry and he tried to answer without paying real attention to the task given to him, so the experiment was interrupted before its end and the data was considered invalid.

6. Analysis and Interpretation

In the following the result of the evaluation will be presented, after collecting the data in the previous phase (see chapter 5), an analysis should be conducted to answer the already defined questions of this research. Finally a conclusion will be drawn about the goals defined in the target tree (see Figure 6).

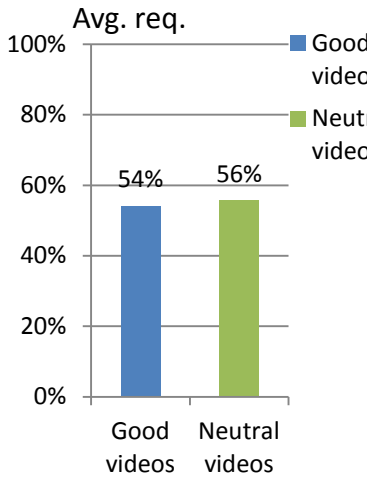
6.1. Result of the analysis

This sub-chapter presents a detailed description of the evaluation results, which form the basis for the evaluation of the research questions and the goals that are already defined in section 4.3. At first a descriptive analysis of the collected data regarding each research question will be presents. Then the Null hypotheses should be rejected, thus the right type of statistical test should be selected. Some factors should be taken into consideration during this selecting. The experiment used the between-subject design [18] (see section 4.10) and the purpose is to compare between the treatments. The suitable scale type for the collected data is the interval scale [17] in which the values are all numerical, where each interval (e.g., 1 minute, 1 correct answer, etc) is the same size. Finally all the collected data in all treatments were proven as normally distributed after testing the data using a Shapiro test online tools [6]. All previous facts imply the use of T-Test [4] [20]. The results will be presented according to each aspect emerged from the research questions. For each aspect, a study on statistical significance will be performed by using the T-test [4] [20], which can prove whether an independent variable has a statistically significant effect on a dependent variable (see Table 5), Hence rejecting the relating null hypothesis.

6.1.1. Related to question 1.

To which extent do the use cases in the Vision Video comply or match the use cases in specification sheet? The experiment claims that the use of Vision Video will improve the overall requirement communication.

Furthermore these claims were somehow supported by the result of the pre-study. Figure 10 shows the mean value of the use cases collected for each of the two categorie of the video (good, neutral) as previously suggested (see Page 37) after excluding the bad videos from the samples. According to this result, it's assumed that a decent Vision Video will be able to deliver at least 50% of the total actual use cases. This assumption also implies that both recall and precision values for each subject will be also at least 0.5. Precision and recall values are tightly related with the number of relevant use cases among the retrieved ones (see Page 18). If according to first assumption at least 50% of the retrieved use cases are relevant, that means precision value will be also at least 0.5. Recall value on the other hand depends on the predefined total number of relevant use cases according to specification sheet, and it will also be more than 0.5.



Average of retrieved use cases for good and neutral videos	Mean	median
Good videos	54%	47.5%
Neutral videos	56%	55%

10. Figure - Average of retrieved use cases for good and neutral videos

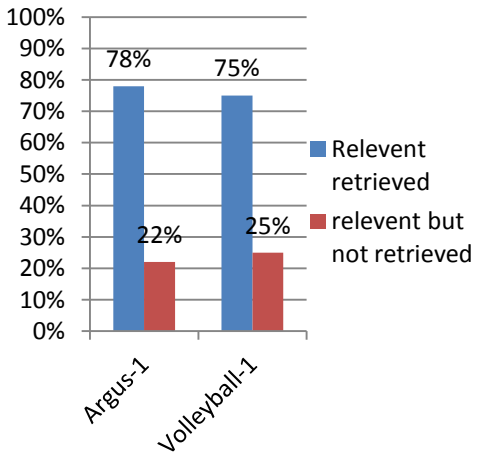
A summary of the collected data is shown in table 12. For example the treatment 2 was applied on subject 14. The relevant use cases as stated in specification sheet are 7. Subject 14 retrieved in total 6 use cases, among them only 4 relevant.

Treatment	Subject	Retrieved	Relevant	Relevant ∧ retrieved	Precision	Recall
T.1: Vision Video Argus-1	S.1	4	4	4	1.0	1.0
	S.3	4	4	3	0.75	0.75
	S.5	4	4	3	0.75	0.75
	S.7	4	4	2	0.5	0.5
	S.9	4	4	3	0.75	0.75
	S.11	4	4	4	1.0	1.0
	S.13	4	4	2	0.5	0.5
	S.15	4	4	4	1.0	1.0
T2: Vision Video volleyball-1	S.2	6	7	6	1.0	0.86
	S.4	6	7	5	0.83	0.71
	S.6	6	7	5	0.83	0.71
	S.8	6	7	6	1.0	0.86
	S.10	6	7	6	1.0	0.86
	S.12	6	7	6	1.0	0.86
	S.14	6	7	4	0.66	0.57
	S.16	6	7	4	0.66	0.57

Table 12 Result of scenario-1 each treatment

Figure 11 presents the median, mean and standard deviation for the relevant use cases that were retrieved in both treatments by the subjects. According to the diagram, in both treatments the relevant use cases retrieved were more than 74% of the overall retrieved use cases.

Relevant use cases retrieved	Mean	Median	SD
T.1: Argus-1 Vision Video	3.12 (78%)	3.0 (75%)	0.21
T.2 : Volleyball-1	5.25 (75%)	5.5 (71%)	0.13



11. Figure - Median, mean and SD relevant use cases retrieved

Before testing for this hypothesis, it should be clear that this part of experience is not concerned with comparing between two treatments, but with proving that a well made Vision Video plays a main role in the requirement communication. As mentioned earlier t-test [4] [20] is the suitable statistical test to be applied on the collected dat (see Page 41), particularly one sample t-test in this case. In Table 13, the result of the conducted two-tailed single sample t-test is presented for$H_{0,1,1}$.

Hypotheses testing Q.1

$\boldsymbol{H_{0,1,1}}$ (See Page 23) this hypothesis presumes that the number of relevant use cases retrieved by a subject after watching the Vision Video will be at least 50% of the total relevant use cases mentioned in the specification sheet of the related project.

Applying t-test on the samples from first treatment (Argus-1) yields to a significant difference in the numbers of relevant use cases (M=3.12, SD=0.21) and the assumed population mean (see Page 40) of 50% of the total use cases mentioned in specification sheet (4 use cases). In this case (population mean=4/2=2); t (7) = 3.81, p=0.007, hence $\boldsymbol{H_{0,1,1}}$ can be rejected for the first treatment. Using Vision Video has significantly boosted the requirement communication process.

The t-test on the samples from second treatment (Volleyball-1) yields a significant difference in the numbers of relevant use cases (M=5.25, SD=0.13) and the assumed population mean (see Page 40) of 50% of the total use cases mentioned in specification sheet (7 use cases).

In this case (population mean=7/2=3.5); t (7) =5.58, p=0.0008, hence $\mathrm{H}_{0,1,1}$ can be rejected for the second treatment. Using Vision Video has significantly boosted the requirement communication process.

Treatment	**1.Argus**	**2.Volleyball**
Calculated t-value	3.81	5.58
t-value **from table**	2.36	
Calculated p-value	0.007	0.0008
Result (p-value<0.05?)	significant	significant

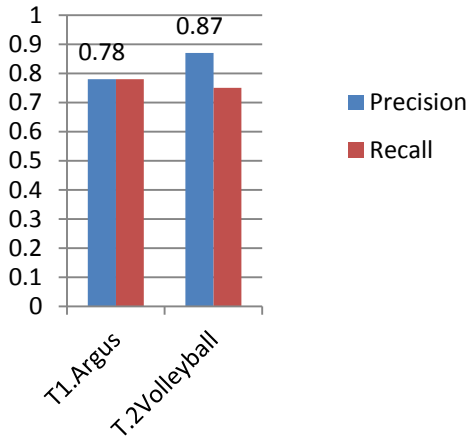
Table 13 two-tailed samples t-test related to $\mathbf{H_{0,1,1}}$

$H_{0,1,2}$ (See Page 23) in which the number of relevant use cases retrieved is presumed to be significantly greater than the number of irrelevant use cases. This hypothesis was formulated in an early stage of this thesis, back then the scenario of excuting the experiment required that the subject should write the use cases freely upon watching the video, however, this scenario was changed. The new scenario requires that the user either approves or rejects an already proposed use cases that were extracted from the specification sheet of the related project. Hence the hypothesis won't be tested.

Figure 12 presents the median, mean and standard deviation of both precision and recall for both treatments. According to the diagram both precesion and recall mean' values are more than 0.7.

T.1: Argus-1 Vision Video	Mean	Median	SD
Precision	0.78	0.75	0.21
Recall	0.78	0.75	0.21

T.2 : Volleyball-1	Mean	Median	SD
Precision	0.87	0.91	0.15
Recall	0.75	0.78	0.14



12. Figure – Mean, median and SD of precision and recall for both treatments

$H_{0,1,3}$ (See Page 23) this hypothesis presumes that precision value of each row (subject) of the collected data (see Table 12) will be at least 0.5. The t-test on the samples from first treatment (Argus-1) yields a significant difference in the values of precision (M=0.78, SD=0.21) and the already assumed population mean of 0.5 for all resulting precision values (see Page 40); t (7) = 3.81, p=0.007, Hence $H_{0,1,3}$ can be rejected for the first treatment. By using a well made Vision Video the precision value of the retrieved use cases is more than 0.5. The same applies for the next treatment with Volleyball-1 Vision Video and the difference is significant (see Table 14).

Treatment	**1. Argus**	**2. Volleyball**
Calculated t-value	3.81	6.99
t-value **from table**	2.36	
Calculated p-value	0.007	0.0002
Result (p-value<0.05?)	significant	significant

Table 14 Two-tailed samples t-test related to $\mathbf{H_{0,1,3}}$

$\boldsymbol{H_{0,1,4}}$ (See Page 23) this hypothesis presumes that recall value of each row (subject) of the collected data (see Table 12) will be at least 0.5. The t-test on the samples from second treatment (Volleyball-1) yields a significant difference in the value of recall for the first Vision Video (M=0.75, SD=0.14) and the already assumed population mean of 0. 5 for all resulting recall values (see Page 40); t (7) = 5.48, p=0.0009, hence $\boldsymbol{H_{0,1,4}}$ can be rejected for the second treatment. By Using a well made Vision Video the recall values of the retrieved use cases for each subject is more than 0.5. The same applies for the first treatment with Argus-1 Vision Video and the difference is significant (see Table 16).

Treatment	**1.Argus**	**2.Volleyball**
Calculated t-value	3.81	5.48
t-value **from table**	2.36	
Calculated p-value	0.007	0.0009
Result (p-value<0.05?)	significant	significant

Table 15 Two-tailed samples t-test related to $\mathbf{H_{0,1,4}}$

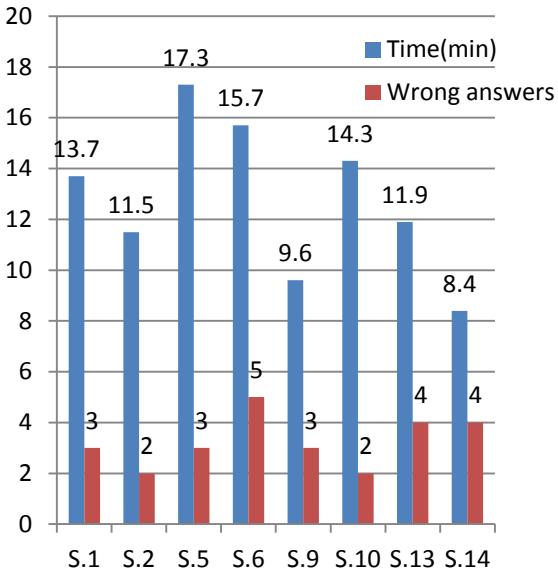
6.1.2. Related to question 2.

What is the time consumed to understand the user needs depending on 2 cases. The first is by using only specificatioin sheet, and the second is by using both specification sheet and Vision Video? In which the study is comparing between two different techniques to measure time and extent of understanding user needs and concepts behind each chosen project in the sample. In particular the influence of the independent variable ‘’type of information input’’ on both dependents variables ‘’time consumed to understand’’ represented by time to solve more than 50% of the test (see Appendix D),

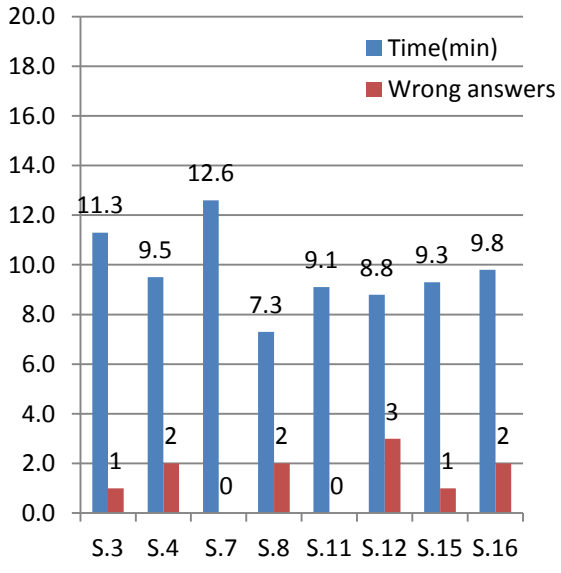
and ''level of understanding'' represented by number of wrong and right answers. A summary of the collected data is presented (see Table 16 and Figure 13&14). For example the treatment 1 was applied on subject 2. His/her time to solve the test is 11:30 and the number of wrong answers is 2.

Treatment	Subject	Time consumed to solve			#Wrong answers	#Right answers
T.1 : Only specification sheet	S.1	13:40	13.7	820	3	7
	S.2	11:30	11.5	690	2	8
	S.5	17:20	17.3	1040	3	7
	S.6	15:40	15.7	940	5	5
	S.9	9:33	9.6	573	3	7
	S.10	14:20	14.6	860	2	8
	S.13	11:55	11.9	715	4	6
	S.14	9:24	8.4	564	4	6
T.2 : Specification sheet and Vision Video	**Treatment.2**					
	S.3	11:20	11.3	680	1	9
	S.4	9:30	9.5	570	2	8
	S.7	12:40	12.6	760	0	10
	S.8	7:20	7.3	440	2	8
	S.11	9:05	9.1	545	0	10
	S.12	8:50	8.8	530	3	7
	S.15	9:20	9.3	560	1	9
	S.16	9:50	9.8	590	3	7

Table 16 Test result regarding each treatment



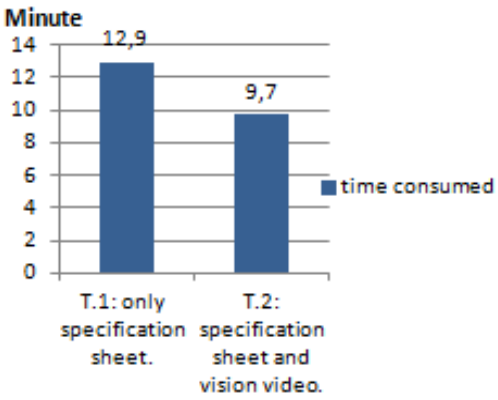
13. Figure - Test result (using only specification sheet)



14. Figure -Test result (specificatin sheet & Vision Video)

The mean, average and standard deviation values for the time consumed in seconds were calculated, Figure 14 shows the values of mean and median of the time consumed to solve the test regarding each treatment. The diagram shows a significant improve of 27% in time after using the Vision Video along with the specification sheet. In spite of the time improvement in processing the questions of the test, the amount of right answers was not affected negatively.

Time consumed (mins)	Mean	Median	SD
T.1: only specification sheet.	775.25	767.5	170
T.2: specification sheet and Vision Video.	584.37	565	97.23



15. Figure – Mean, median and SD of time consumed to solve the test

Hypothesis testing Q.2

The t-test on the collected data related to second question yields a significant difference in the time consumed to understand for the treatment with specification sheet only (M=775.25s, SD=170s) and the treatment of specification sheet and Vision Video together (M=584.37s, SD=97.23s); t(7)= 2.754, p=0.015, hence $H_{0,2}$ can be rejected for the second question. This implies that using a Vision Video along with a specification sheet has significantly improved the time consumed to understand compared to only using specification sheet alone.

6.1.3. Related to question 3.

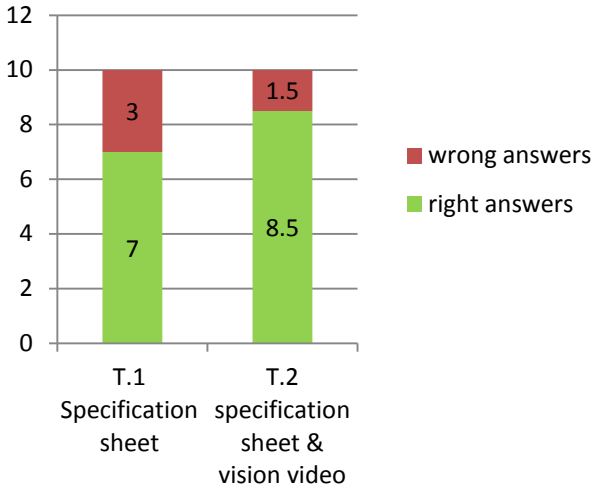
To which extent did the developer understand the user in regarding to time (number of wrong answers in a predefined test (see Appendix D) related video)?

Figure 15 presents shows the values of mean, median and standard deviation of the number of wrong and right answers regarding each treatment in the tables. It also presents the data graphically.

As shown in the diagram the amount of right answers in first treatment comparing to the counterparts values of second treatment has improve by 15% upon using the Vision Video along with the specification sheet.

Number of wrong answers	Mean	Median	SD
T.1: only specification sheet.	3.25	3	1.03
T.2: specification sheet and Vision Video.	1.37	1.5	1.06

Number of right answers	Mean	Median	SD
T.1: only specification sheet.	6.75	7	1.03
T.2: specification sheet and Vision Video.	8.63	8.5	1.06



16. Figure – Mean, median, SD of right and wrong of answers

Hypothesis testing Q.3

The t-test on the collected data related to third question yields a significant difference in the number of wrong answers for the treatment with specification sheet only (M=3.25,SD=1.03) and the treatment of specification sheet and Vision Video together (M=1.37,SD=1.06); t(7)= 3.130, p=0.0073, hence $H_{0,3}$ can be rejected for the third question. As a result using a Vision Video along with a specification sheet has significantly reduced the number of wrong answers compared to only using specification sheet alone.

6.1.4. Related to questions 4, 5, 6, and 7.

Question 4: what impact using a GUI, prototype, or a mockup will have on P/R values?

Studying the affect of embedding a graphical user interface in the video was not included in this study due to lack of time. The pre-study showed that only 4 Vision

Videos have no user-interface and in each of these videos the subjects were unable to collect more than 40% of the overall use cases. Nonetheless studying the affect of graphical user interface using an eye-tracker is required, so question-4 is not scientifically answered.

Question 5: what impact will duration of the video have on P/R values?

Duration appears to have no critical influence on the samples beforehand, as almost all Vision Videos' durations are between 1:00 and 2:00 minutes and it caused no burden or boredom for the subject. At the contrary some subjects complain the short duration of Vision Videos, the thing that implies watching the video more than once to capture use cases. Question is canceled.

Question 6: what impact does integrating text or audio description have on the P/R values?

Text description also need to be studied using an eye-tracker, question is also not answered. As for audio description, no real audio description was used in any of the videos.

Question 7: what impact does video and audio quality have on the P/R values?

Quality of all videos except for one was good, even the video with bad quality (Argus-2) allowed subjects to capture 75% of the presented use cases. Question is not answered and canceled.

6.2. Interpretation

In the following a detailed interpretation will be presented as answers to the processed questions.

1. To which extent do the use cases in the Vision Video comply or match the use cases in specification sheet?

To answer this question 3 metrics were identified, the first is relevant use cases, the second is precision value and the the third is recall value. Three hypotheses were also formed using these metrics. All null-hypotheses were rejected and alternative hypotheses were approved according to the data analysis (see Pages 41, 42, 43 and 44).

All participants approved the existence of at least 50% of the use cases related to a specific project only by watching its Vision Video (see Page 41 and 42). That means Vision Video took a significant part in the requirement communication.

To emphasize the result from first hypothesis precision and recall [27] of the collected data were calculated (see Appendix E). The precision values related to each participant were all above 0.5.

That means that the accuracy of identifying right use cases while using Vision Video according to precision range of value [0.0…1.0] exceeded half of the total retrieved use cases (see Pages 43, 44).

The same thing applies to the recall values related to each user. The values were all above 0.5 (see Appendix E). In other words, the relevant use cases that were successfully retrieved by participants exceeded half of the total relevant use cases (see Page 44).

The Goal1.1 and its sub-goal were achieved.

2. What is the time consumed to understand the user needs depending on 2 cases. The first is by using only specificatioin sheet, and the second is by using both specification sheet and Vision Video?

To say that a participant understood the user need, he must solve at least 50% of the total questions in a predefined test (see Appendix D). The analysis (see Page 46) has proven a significant gain in time when using Vision Video along with specification sheet.

The participants tended to grasp some aspects in a faster way and they were able to answer some questions before even going back to the specification sheet, in such cases specification sheet was used by the participant to emphasize correctness. Vision Video saved lots of time wasted while trying to understand some complicated concepts that are easily understood if described visually.

3. To which extent did the developer understand the user in regarding to time (number of wrong answers in a predefined test (see Appendix D) related video)?

Here the experiment was concerned with comparing the number of wrong answers provided by the participant regarding two different scenarios. In the last question it was proven that supporting textual means with Vision Video cause a significant gain in time. But does this improvement in time come at the expense of answers' correctness. The Analysis (see Page 47) has proven a significant decline in the wrong answers when using Vision Video. This implies a better understanding to the main concepts, target users, main functionality and use cases etc. in a shorter time.

By answering questions 2 and 3 goal 1.2 and it is sub-goal were achieved.

4. As for the rest of questions 4, 5, 6, 7 some were canceled like 4 and 7 (see Pages 47, 48) the other questions 5 and 6 were left open for other studies in the future, and thus goal 1.3 and its sub-goal were not achieved.

7. Conclusion and future work

In this chapter a summary will be presented and a conclusion of this study and its results will be briefly drawn in sub-chapter 7.1. Sub-chapter 7.2 presents some ideas and suggestions for any future work that discuss a similar matter, it also highlights some of the points that were not accomplished during this study due to lack of time and rescources.

7.1. Conclusion

Reaching a mutual understanding between stakeholders and developers is a critical part in software engineering and it is the main motive of this thesis. Failing to fulfill this understanding has lots of severe consequences on cost, time and sometimes on the success of the project. Textual description has always been used and still the main way to communicate requirements and user needs, it has proven to be affective to some level, but difficulties was and still present. Using visual aids like videos and pictures has also been discussed in some papers and researches (see chapter 4). Vision Video is one of these techniques. This study started with a main goal which is to investigate whether or not Vision Videos can be used in requirement communication. To achieve this goal 2 participants participated in a pre-study, and 16 in the core experiemnt. The pre-study's objective is concerned with studying the sample and determining the use cases occurred in each Vision Video. It ended up with choosing the best 2 Vision Videos, agreeing on the use cases included in each Vision Video, and classifying the 15 Vision Videos beforehand into 3 mean categories (well made video, average video and badly made video). The core experiment includes 2 assignments answering 3 questions and fulfilling the related goals. The first assignment's objective was to prove the ability of the participants to identify right use cases from the two chosen Vision Video. The second assignment's objective was to prove that using Vision Video during the process of requirement communication will lead to more understanding in a shorter period of time.

Statistical T-tests were applied on the data correlated to each assignment and the related null hypotheses were all rejected.

By using a well made Vision Video a developer will be able to identify more than 50% of the use cases intended for the problem beforehand in a significant amount of time. The subjects were able to answer the questions in a predefind test with significantly less wrong answers in a shorter period of time comparing to use only textual means. Hence By using a well made Vision Video with specification sheet (textual mean) the participant was able to better understand user needs (main functionality, main concept and vision) in less time. It is important to mention that only Vision Videos with GUI were able to boost requirement communication significantly. Other Vision Videos without GUI were rated as well made videos, as participants were able to understand the main idea, concept and vision of the project, on the contrary subjects were not able to identify use cases in the same way Vision Videos with GUI could.

7.2. Future work

What this thesis could not achieve for reasons of lack of time is investigating the affect of different video characteristics on the quality and efficiency of Vision Video. To complete the goals of this study, an investigation on the affect of embedding textual description and user interface in Vision Videos using eye tracking techniques should be conducted. The contents of Vision Videos in the sample beforehand showed no specific pattern in which Vision Videos follow, on the contrary it was arbitrary, some videos have user interface some not, some with textual or audio description some not. The point is to invent standards or rules of thumb to guarantee a decent Vision Video.

Appendix

A. Abstraction Sheet

A.1.

Object	**Study Purpose**	**Quality Focus**	**Perspective**
Vision Video alone, Specification sheet each at a time and then both	Understanding user need	Cost and performance	Developer

Quality Focus	**Variation factor**
1-Time consumed to understand user needs. 2-Level of understanding user needs. (Number of wrong answer according to a test about the matter).	Including the Vision Video in the process.
Baseline Hypothesis a. Time to understand user needs using both Vision Video and specification sheet is better than the time to understand user needs with only specification sheet. b. Level of understanding use needs using Vision Video and specification sheet is better than level of understanding using specification sheet by itself.	**Impact of Variation factor** Including the Vision Video in the process of building trust and understanding between stakeholders and developers is affected positively by the Vision Video.

	Quality Focus	**Variation factor**
Factors	• Time consumed to understand user needs. • Level of understanding user needs.	Using the Vision Video along with specification sheet.
Question	• What is the time consumed to understand user needs while using the Vision Video with specification sheet compared to only using specification sheet? • To which extend did the developer understand user needs?	Does the use of Vision Video along with specification sheet helps decrease the time consumed to understand user need and at the same time increase the quality of this understanding?
Metric	The time in minutes for the developer to understand user need along with the level of this understanding: 1-Time to understand in minutes. 2-Level of understanding in (number of wrong answer in a predefined test (see Appendix D)).	1-Time to understand. 2-Level of understanding in percentage.

A.2.

Object Vision Video	**Study** **Purpose** Improve	**Quality Focus** Effectiveness and efficiency	**Perspective** Developer
Quality Focus • The precision and recall value of the use cases the user was able to retrieve upon watching the Vision Video with different characteristics.		**Variation factor** • The quality of the Vision Video. • GUI or prototype inside the Vision Video. • Comment in the video. • Audio description of Vision Video content. • Duration of the Vision Video.	
Baseline Hypothesis **a.** The precision and recall of the use cases retrieved after watching Vision Videos with different characteristics (GUI, text and audio comments, quality, duration…) is between 0.5 and 0.7 for each. **b.** Point of focus while watching the Vision Video.		**Impact of Variation factor** • Good quality of the video will affect (a) positively. • Including GUI can be positive for (a) if used wisely, it can also be misleading, thus increase unneeded requirements. • Through adding well defined comments or headlines (a) will be affected positively. • Audio comments can increase the precision and recall values. • Too long or too short video duration can lead to negative effect on (a)	

	Quality Focus	**Variation factor**
Factors	The precision and recall values of the retrieved use cases in regards to the related Vision Video's characteristic.	• The quality of the Vision Video. • GUI or prototype inside the Vision Video. • Comment in the video. • Audio description of Vision Video content. • Duration of the Vision Video.
Question	How would use cases collecting and communication be affected by the different characteristic each video have?	• Will including or embedding a (prototype or GUI, text or audio description) in the Vision Video help raise the number of relevant use cases retrieved, thus increase precision and recall values? • Has the quality of the Vision Video or the duration any affect on the precision and recall values?
Metric	According to each characteristic that we will test on we calculate: • Precision and recall value	• Precision and recall value of the relevant use cases retrieveds.

B. Pre-Study Data
Project-1 (Argus Project)

Argus-2			**Argus-1**		
Video Charachteristic	**Exist?**		**Video Charachteristic**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
UI	**Y**	**Y**	**UI**	**Y**	**Y**
Text Comments	**Y**	**Y**	**Text Comments**	**Y**	**Y**
Audio comments	**N**	**N**	**Audio Comments**	**N**	**N**
1:35(Duration)	**Y**	**Y**	**1:40 (Duration)**	**Y**	**Y**
Quality	**N**	**N**	**Quality**	Y	N
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
5- Das System soll den Statischen Seiteninhalten speichern.	**Y**	**Y**	5- Der user soll den Browser starten.	**Y**	**Y**
6- Das System soll den Dynamischen Seiteninhalten speichern.	**Y**	**Y**	6- Einstellungen des Systems ändern.	**Y**	**Y**
7- Programmaktionen protokollieren.(Die Aktionen, welche Argus ausführt sollen ordnungsgemäß festgehalten werden)	**N**	**Y**	7- Das System soll das Website archivieren.	**Y**	**Y**
8- Gespeicherte Webinhalte (Statisch, Dynamisch)offline abspielen.	**Y**	**Y**	8- Das System soll das Website abrufen.	**Y**	**Y**
Total Number of agreements :	**3**		**Total Numer of Agreements :**	**4**	
Total Number of disagreements :	**1**		**Total Number of disagreements :**	**0**	
Total Number of ‚Yes' agreements :	**3**		**Total Number of ‚Yes' agreements :**	**4**	
Total Number of ‚No' agreements :	**0**		**Total Number of ‚No' agreements :**	**0**	
Is it a Good Video?	**N**	**Y**	**Is it a Good Video?**	**Y**	**N**

Calculation Argus-2:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	3	0	3
	NO	1	0	1
		4	0	4

Po= 3/4= 0.75

Calculation Argus-1:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	4	0	4
	NO	0	0	0
		4	0	4

Po= 4/4= 1.0

Pyes=3/4*4/4=3/4=0.75 Pno = 1/4*0/4= 0.0 Pe= Pyes+ Pno =0.75+0=0.75 K=Po-Pe/1-Pe = 0.0 /0.25= 0.0 ???	Pyes=4/4*4/4=4/4=1.0 Pno = 0/4*0/4= 0.0 Pe= Pyes+ Pno =1.0+0=1.0 K=Po-Pe/1-Pe = 0.0 /0.0 ??

Project-2 (Volleyball Project)

Volleyball-1			**Volleyball-2**		
Video Charachteristic	**Exist?**		**Video Charachteristic**	**Exist?**	
	S. 1	**S. 2**		**S.1**	**S. 2**
UI	**Y**	**Y**	**UI**	**Y**	**Y**
Text Comments	**Y**	**Y**	**Text Comments**	Y	N
Audio comments	**N**	**N**	**Audio comments**	**N**	**N**
1:05(Duration)	**Y**	**Y**	**0:55(Duration)**	**Y**	**Y**
Quality	**Y**	**Y**	**Quality**	N	Y
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S. 1	**S. 2**		**S. 1**	**S. 1**
1-Das Sytem soll die Termine der Turniere anzeigen.	**Y**	**Y**	1- Das Sytem soll die News beim Starten automatisch aktualisieren.	**N**	**N**
2- Das Sytem soll die Ergebnisse von Turniere anzeigen.	**Y**	**Y**	2-Das System bietet Pushmitteilung.	**N**	**N**
3- Das Sytem soll das Wetter anzeigen.	**Y**	**Y**	3- Das System bietet Informationen über Anfahrt.	**Y**	**Y**
4- Das Sytem soll das Restaurants anzeigen.	**Y**	**Y**	4- Anmeldung für Turnier Teilnahme.	**Y**	**N**
5- Das Sytem soll die Aktuellste Nachrichten anzeigen.	**Y**	**Y**	5- Anmeldung für Turnierhelfer.	**Y**	**N**
6- Das System soll Informationen zur Anfahrt mit dem PKW bieten.	**Y**	**N**			
7- Das System soll die Aufgaben zum Helfen bei dem Turnier anzeigen.	**Y**	**Y**			
Total Number of agreements :	**6**		**Total Numer of Agreements :**	**3**	
Total Number of disagreements :	**1**		**Total Number of disagreements :**	**2**	
Total Number of ‚Yes' agreements :	**6**		**Total Number of ‚Yes' agreements :**	**1**	
Total Number of ‚No' agreements :	**0**		**Total Number of ‚No' agreements :**	**2**	
Is it a Good Video?	**Y**	**Y**	**Is it a Good Video?**	N	N
Calculation **Volleyball-1**:			Calculation **Volleyball-2**:		

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	6	0	6
	NO	1	0	1
		7	0	7

Po= 6/7= 0.86
Pyes=6/7*7/7=6/7=0.86
Pno = 1/7*0/7= 0.0
Pe= Pyes+ Pno =0.86+0=0.86
K=Po-Pe/1-Pe = 0.0 /0.14= 0.0 ???

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	1	0	1
	NO	2	2	4
		3	2	5

Po= 3/5= 0.6
Pyes=1/5*3/5=3/25=0.12
Pno = 2/5*4/5= 8/25=0.32
Pe= Pyes+ Pno =0.12+0.32=0.44
K=Po-Pe/1-Pe = 0.6-0.44/1.0-0.32=0.29
Fair Agreement.

Project-3 (Dashboard Project)

Dashboard -1			**Dashboard -2**		
Video Characteristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
UI	**Y**	**Y**	**UI**	**Y**	**Y**
Text Comment	**Y**	**Y**	**Text Comment**	N	Y
Audio comments	**N**	**N**	**Audio Comment**	**Y**	**Y**
1:40(Duration)	**Y**	**Y**	**0:42 (Duration)**	**N**	**N**
Quality	**Y**	**Y**	**Quality**	**Y**	**Y**
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
1- Einloggen in dem System mit SAP-Anmeldedaten.	**Y**	**Y**	1- Dashboard anzeigen(die Warteliste).	**Y**	**N**
2- Dashboard starten(Login Data schreiben danach informationen werde angezeigt).	**Y**	**Y**	2- Login Vorgang.	**N**	**N**
3- Das Benutzer soll die Labordaten überprufen und akzeptieren.	**Y**	**N**	3- Das System bietet den Benutzer der Möglichkeit einen Timer für jeden patient zu aktivieren.	**N**	**N**
4-Das System soll die Aufklärung des Patienten und wer hat ihn aufgklärt dokumentieren (speichern und bestätigen).	**Y**	**N**	4- Das System soll die Laborinformationen(für jeden patient) anzeigen.	**Y**	**N**
5- das System bietet einen Manuellen Timer(Timer einstellen und starten).	**N**	**N**	5-Das Benutzer(Artz) kann durch das System ein Patient filteren oder suchen.	**N**	**N**
6- Das System soll die Patientendetails anzeigen(Patientendetails aufrufen) .	**Y**	**Y**	6- Eingeben und Speichern einer Notiz.	**N**	**N**
7- Das System soll die Auftragsdetails anzeigen (Auftragsdetails abrufen).	**Y**	**Y**	7- Eingeben und Speichern einer Komplikationseintrags.	**N**	**N**

8- Das System soll die Patientenrisiken anzeigen (Patientenrisiken aufrufen).	**N**	**Y**	8- Labordaten -werten bestätigen(Das Benutzer soll die Labordaten überprufen und akzeptieren).	**N**	**N**
9- Das System soll ermöglichen, die Interne Notizen aufzunehmen.	**N**	**N**	9- Widgets Ein und Ausblenden	**N**	**N**
10- Auftrag abschließen.	**N**	**N**			
11- Automatischer timer starten (nach Maßnahmenstatus auf 'erbracht' wechselt) .	**Y**	**N**			
Total Number of agreements :	**7**		**Total Numer of Agreements :**	**7**	
Total Number of disagreements :	**4**		**Total Number of disagreements :**	**2**	
Total Number of ‚Yes' agreements :	**4**		**Total Number of ‚Yes' agreements :**	**0**	
Total Number of ‚No' agreements :	**3**		**Total Number of ‚No' agreements :**	**7**	
Is it a Good Video?	Y	Y	**Is it a Good Video?**	N	N

Calculation **Dashboard -1**:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	4	1	5
	NO	3	3	6
		7	4	11

Po= 7/11= 0.64
Pyes=5/11*7/11=35/121=0.29
Pno = 6/11*4/11= 24/121=0.2
Pe= Pyes+ Pno =0.29+0.2=0.49
K=Po-Pe/1-Pe = 0.64-0.49/0.51= 0.29
Fair Agreement.

Calculation **Dashboard -2:**

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	0	0	0
	NO	2	7	9
		2	7	9

Po= 7/9= 0.77
Pyes=0/9*2/9=0.0
Pno = 7/9*9/9= 7/9=0.77
Pe= Pyes+ Pno =0.0+0.77=0.77
K=Po-Pe/1-Pe = 0.77-0.77/1.0-0.77=0.0???

Project-4 (Exam Learning Project)

Exam learning -1			**Exam Learning -2**		
Video Characteristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
UI	**N**	**N**	**UI**	**Y**	**Y**
Text Comment	**Y**	**Y**	**Text Comment**	**Y**	**Y**
Audio Comment	**Y**	**Y**	**Audio comments**	**N**	**N**
1:05(Duration)	**Y**	**Y**	**1: 05(Duration)**	**Y**	**Y**
Quality	**Y**	**Y**	**Quality**	**Y**	**Y**
Use cases	**Exist?**		**Use cases**	**Exist?**	

	S. 1	S. 2		S.1	S. 2
1- Anmeldung in dem App.	**N**	**N**	1- Registrierung des Benutzers.	**N**	**N**
2- Lernen für eine Klausur(ein Klausur auwählen dafür der Benutzer lernen möchtet).	**N**	**N**	2- Profilerstellung des Benutzers	**N**	**N**
3- Klausur auswählen(Das System soll List von möglichen Klausuren zeigen).	**N**	**N**	3- Lerneinheit durchführen(Zeit erfassen und Statistiken anzeigen)	**Y**	**Y**
4- Lernfortschritt vergleichen(Mit anderen Benutzern die zu dem gleichen Lerngruppe gehören).	**N**	**N**	4- das System soll jede Lerneinheit bewerten.	**Y**	**Y**
5- Gruppeneinladungen verwalten.	**N**	**N**	5-Prüfung auswählen.	**N**	**N**
6- Eine Klausur hinzufügen.	**N**	**Y**	6- Lernstatistik abrufen.	**Y**	**Y**
7- Personen hinzufügen.	**N**	**N**	7- Lernstatistik teilen.	**N**	**Y**
			8- Lerngruppe erstellen.	**N**	**N**
			9- Server starten.	**N**	**N**
			10- Zugang zu Administrationsseite.	**N**	**N**
			11- Neue Pausenideen eingeben.	**N**	**N**
Total Number of agreements :	**6**		**Total Numer of Agreements :**	**10**	
Total Number of disagreements :	**1**		**Total Number of disagreements :**	**1**	
Total Number of ‚Yes' agreements :	**0**		**Total Number of ‚Yes' agreements :**	**3**	
Total Number of ‚No' agreements :	**6**		**Total Number of ‚No' agreements :**	**7**	
Is it a Good Video?	N	N	**Is it a Good Video?**	Y	Y

Calculation **Exam learning -1**:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	0	1	1
	NO	0	6	6
		0	7	7

Po= 6/7= 0.86
Pyes=1/7*0/7=0.0
Pno = 6/7*7/7= 6/7=0.86
Pe= Pyes+ Pno =0.0+0.86=0.86
K=Po-Pe/1-Pe = 0.0 /0.14= 0.0 ???

Calculation **Exam Learning -2:**

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	3	1	4
	NO	0	7	7
		3	8	11

Po= 10/11= 0.91
Pyes=4/11*3/11=12/121=0.1
Pno = 7/11*8/11= 56/121=0.46
Pe= Pyes+ Pno =0.1+0.46=0.56
K=Po-Pe/1-Pe = 0.91-0.56/1.0-0.56=0.35/0.44=0.8
Very good agreement.

Project-5 (Lernraumkarte Project)

Lernraumkarte -1			**Lernraumkarte -2**		
Video Characteristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S. 1	**S. 2**		**S.1**	**S. 2**
UI	**N**	**N**	**UI**	**Y**	**Y**
Text Comment	**Y**	**Y**	**Text Comment**	**Y**	**Y**
Audio comments	**Y**	**Y**	**Audio comments**	**N**	**N**
2: 34(Duration)	**Y**	**Y**	**2: 34(Duration)**	**Y**	**Y**
Quality	**Y**	**Y**	**Quality**	**Y**	**Y**
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S. 1	**S. 2**		**S.1**	**S. 2**
1-Das System soll Rauminformationen vorhannder Räume anzeigen.	**Y**	**Y**	1-Raum suchen.	**Y**	**Y**
2-Das System hilft dem Benutzer die Lage zu finden durch Kartennavigation.	**N**	**Y**	2- Raumdetails anzeigen (Lage,kapasität,Ausstattung…..).	**Y**	**Y**
3- Filtern(Das System zeigt nur Standortmarker auf der karte welche die Filterbedingungen erfüllen).	**Y**	**Y**	3- Raum hinzufügen.	**N**	**N**
4- Anzeigen gruppierter Räume.	**N**	**N**	4- Raum bearbeiten.	**N**	**N**
			5-Raum entfernen.	**N**	**N**
Total Number of agreements :	**3**		**Total Numer of Agreements :**	**5**	
Total Number of disagreements :	**1**		**Total Number of disagreements :**	**0**	
Total Number of ‚Yes' agreements :	**2**		**Total Number of ‚Yes' agreements :**	**2**	
Total Number of ‚No' agreements :	**1**		**Total Number of ‚No' agreements :**	**3**	
Is it a Good Video?	Y	N	**Is it a Good Video?**	N	N

Calculation **Lernraumkarte -1**:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	2	1	3
	NO	0	1	1
		2	2	4

Po= 3/4= 0.75
Pyes=3/4*2/4=6/16=0.38
Pno = 2/4*1/4= 2/16=0.13
Pe= Pyes+ Pno =0.38+0.13=0.51
K=Po-Pe/1-Pe = 0.75-0.51 /0.49= 0.24/0.49 =0.49
Moderate agreement

Calculation **Lernraumkarte -2:**

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	2	0	2
	NO	0	3	3
		2	3	5

Po= 5/5= 1.0
Pyes=2/5*2/5=4/25=0.16
Pno = 3/5*3/5= 9/25=0.36
Pe= Pyes+ Pno =0.16+0.36=0.52
K=Po-Pe/1-Pe = 1.0-0.52/1.0-0.52=0.48/0.48=1.0
Very good agreement

Project-6 (Optical Echo Project)

Optical Echo -1			**Optical Echo -2**		
Video Characteristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S.1	**S.1**		**S.1**	**S.2**
UI	**Y**	**Y**	**video prototype**	**N**	**N**
Text Comment	**Y**	**Y**	**Text Comment**	**Y**	**N**
Audio comments	**N**	**N**	**Audio comments**	**N**	**Y**
1: 05(Duration)	**Y**	**Y**	**2:04(Duration)**	**Y**	**Y**
Quality	**Y**	**Y**	**Quality**	**Y**	**Y**
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
1- Programm beenden.	**Y**	**N**	1- Show vorbereiten(Strichmännchen und Musik...).	**N**	**N**
2- Choreographie erstellen (Strichmännchen und Musik).	**Y**	**Y**	2- Choreographie zuweisen (Bewegung von Benutzer aufnehmen und die Choreographie dem Strichmännchen zuwießen).	**Y**	**Y**
3- Modus wechseln(PaintingMode, CapturingMode, NeutralMode oder den VideoPlayerMode).	**Y**	**N**	3- Das System soll das Show anzeigen.	**N**	**N**
4-Das System soll die Bewegung von Benutzer aufnehmen.	**Y**	**Y**	4- Painting Mode(System zeigt Spezialeffekte an, in Einklang mit den Bewegungen des Nutzers).	**N**	**N**
5- (Präsentation abspielen) Das System soll die aufgenomme Bewegung auf Strichmännchen übertragen und als Präsentation abspielen.	**Y**	**Y**	5- Capturing Mode (Live bewegen die Strichmännchen nach den Bewegungen des Nutzers).	**Y**	**Y**
6- Bild bearbeiten(durch PaintingMode-Schaltäche).	**Y**	**N**			
7- Hintergrund festlegen.	**Y**	**Y**			
8- Strichmännchen setzen.	**Y**	**Y**			
9- Musik auswählen.	**N**	**N**			
Total Number of agreements :	**6**		**Total Numer of Agreements :**	**5**	
Total Number of disagreements :	**3**		**Total Number of disagreements :**	**0**	
Total Number of ‚Yes' agreements :	**5**		**Total Number of ‚Yes' agreements :**	**2**	
Total Number of ‚No' agreements :	**1**		**Total Number of ‚No' agreements :**	**3**	

Is it a Good Video?	Y	Y

Calculation **Optical Echo -1**:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	5	0	5
	NO	3	1	4
		8	1	9

Po= 6/9= 0.66
Pyes=5/9*8/9=40/81=0.49
Pno = 4/9*1/9= 4/81=0.01
Pe= Pyes+ Pno =0.49+0.01=0.5
K=Po-Pe/1-Pe = 0.66-0.5 /0.5= 0.16/0.5 =0.32
fair agreement

Is it a Good Video?	N	Y

Calculation **Optical Echo -2:**

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	2	0	2
	NO	0	3	3
		2	3	5

Po= 5/5= 1.0
Pyes=2/5*2/5=4/25=0.16
Pno = 3/5*3/5= 9/25=0.36
Pe= Pyes+ Pno =0.16+0.36=0.52
K=Po-Pe/1-Pe = 1.0-0.52/1.0-0.52=0.48/0.48=1.0
Very good agreement

Project-7 (LOUNGE info)

LOUNGE info -1			**LOUNGE info -2**		
Video Characteristics	**Exist?**		**Video Characteristics**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
UI	**Y**	**Y**	**UI**	**N**	**N**
Text Comment	**Y**	**Y**	**Text Comment**	**Y**	**Y**
Audio comments	**N**	**N**	**Audio comments**	**N**	**N**
1: 00(Duration)	**Y**	**Y**	**2:00(Duration)**	**Y**	**Y**
Quality	**Y**	**Y**	**Quality**	**Y**	**Y**
Use cases	**Exist?**		**Use cases**	**Exist?**	
	S.1	**S.2**		**S.1**	**S.2**
1- Tisch reservieren.	Y	Y	1-Benutzer informiert sich über aktuelle Raumbelegung.	**Y**	**N**
2- Im System anmelden	Y	Y	2- Benutzer reserviert einen Tisch.	**Y**	**Y**
3- Informationen ansehen(Ansprechende und schnelle Anzeige der informationen von Reservierung)	Y	Y	3- Benutzer storniert seine Reservierung.	**N**	**N**
4- Gruppenpasswort ändern	N	N	4- Administrator aktualisiert Seiteninhalte.	**N**	**N**
5- Das System zeigt dem Benutzer die Belegungsplane eines Tisches..	Y	Y	5- Administrator registriert neuen Gruppenaccount.	**N**	**N**
			6- Administrator entfernt Gruppenaccount.	**N**	**N**
			7- Administrator trägt neue Veranstaltung ein.	**N**	**N**
			8- Administrator editiert Veranstaltung.	**N**	**N**

			9- Administrator editiert Systemeinstellungen.	**N**	**N**
			10- Administrator storniert Reservierung eines Benutzers.	**N**	**N**
			Unregistrierter Benutzer wechselt Sprachanzeige.	**N**	**N**
Total Number of agreements :	**5**		**Total Numer of Agreements :**	**10**	
Total Number of disagreements :	**0**		**Total Number of disagreements :**	**1**	
Total Number of ‚Yes' agreements :	**4**		**Total Number of ‚Yes' agreements :**	**1**	
Total Number of ‚No' agreements :	**1**		**Total Number of ‚No' agreements :**	**9**	
Is it a Good Video?	Y	Y	**Is it a Good Video?**	Y	N

Calculation **LOUNGE info -1**:

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	4	0	4
	NO	0	1	1
		4	1	5

Po= 5/5= 1.0
Pyes=4/5*4/5=16/25=0.64
Pno = 1/5*1/5= 1/25=0.04
Pe= Pyes+ Pno =0.64+0.04=0.68
K=Po-Pe/1-Pe = 1.0-0.68 /0.32= 0.32/0.32 =1.0
Very good agreement

Calculation **LOUNGE info -2:**

		Rater/1		
		YES	NO	TOTAL
Rater/2	YES	1	0	1
	NO	1	9	10
		2	9	11

Po= 10/11= 0.91
Pyes=1/11*2/11=2/121=0.02
Pno = 10/11*9/11= 90/121=0.74
Pe= Pyes+ Pno =0.02+0.74=0.76
K=Po-Pe/1-Pe = 0.91-0.76/1.0-0.76=0.15/0.24=0.6
good agreement

Project-8 (BioFeedback Project)

BioFeedback		
Video Characteristics	**Exist?**	
	S.1	**S.2**
UI	**Y**	**Y**
Text Comment	**Y**	**Y**
Audio comments	**Y**	**Y**
1:45(Duration)	**Y**	**Y**
Quality	**Y**	**N**
Use cases	**Exist?**	
	S.1	**S.2**
1- Applaus-o-meter (wie begeistert das Publikum vom einem Vortrag war) benutzen.	**Y**	**Y**
2- Applaus-o-meter initialisieren(Name der Teilnehmer, Vortrag Tema).	**N**	**N**

3- Neue Runde starten(neuen Durchlauf des Applaus-o-meters ohne alle informationen nochmal eingeben zu müssen)	**N**	**N**
4- Applaus-o-meterschnellstartmodus benutzen (ohne die Teilnehmernamen einzugeben) .	**N**	**N**
5- Audiovisualisierung benutzen(Visualisierung der Geräusche im Raum) .	**Y**	**Y**
6- Audioausgabe ändern (laut der Fall) .	**Y**	**N**
Total Number of agreements :	**5**	
Total Number of disagreements :	**1**	
Total Number of ‚Yes' agreements :	**2**	
Total Number of ‚No' agreements :	**3**	
Is it a Good Video?	Y	Y

C. Goal.1 Subject forms

Argus-1

Argus-1	
Use cases	**Exist?**
R.1-Der User soll den Browser starten.	
R.2-Einstellungen des Systems ändern.	
R.3-Das System soll die Website archivieren.	
R.4-Das System soll die Website abrufen.	
Do you think it is a good video?	

Volleyball-1

Volleyball-1	
Use cases	**Exist?**
R.1-Das Sytem soll die Termine der Turniere anzeigen.	
R.2- Das Sytem soll die Ergebnisse von Turniere anzeigen.	
R.3- Das Sytem soll das Wetter anzeigen.	
R.4- Das Sytem soll die Restaurants anzeigen.	
R.5- Das Sytem soll die aktuellste Nachrichten anzeigen.	
R.6- Das System soll Informationen zur Anfahrt mit dem PKW bieten.	
R.7- Das System soll die Aufgaben zum Helfen bei dem Turnier anzeigen.	
Do you think it is a good video?	

D. Goal.2 Measuring understanding forms

Volleyball-1 Questions

Goal.2. Measuring level of understanding.

Subject Number	
Treatment	
Time	
Wrong answers	
Right answers	
The following questions aim to measure your level of understanding the user needs regarding the **Volleyball-1** software project. Please answer the question wisely.	

1. In your opinion what kind of app will suite the product at best?

a) Web app	b) **Mobile app**✓	c) PC-app	d) Both 'b' and 'c'

2. The solution is mainly about:

a) Supporting tourism in Borkum Island.	b) **The beach volleyball tournament that takes place in Borkum and all that related to it places, weather, events, etc.** ✓	c) Providing beach Volleyball fans in Germany with the latest news about matches and results.

3. Will the solution support access only to subscribed users?

a) Yes	b) **No**✓

4. Which one of the following functionalities is not required in the app?

a) Showing the news about Borkum and the volleyball tournament.	b) Guiding the visitors and provide support in finding accommodation, restaurants and others.	c) **Encourage the users to visit Borkum Island.** ✓	d) Showing the weather.

5. the app is public for all users, but what type of user will the app particularly focus on?

a) Tournament player	b) **Tournament helper**✓	c) Borkum visitors	d) Others

6. Will the app support offline access to its content?

a) **Yes**✓	b) No	c) I do not know

7) Will the app provide the user with push notification?

a) **Yes**✓	b) No	c) I do not know

8) The app will do the following (more than one answer):

a) **Show the list of all sponsors.** ✓	b) Help users finding the cheapest hotel and trip booking.	c) Add news to NWVV's Facebook page and show them instantly.	d) **Show the helper information about their tasks and accommodation.** ✓

9) The data will be fed to the app via:

a) Internal database	b) External database in the Cloud	c) Will be directly imported from different API's (ex. weather API, NWVV's API).	d) **All of the previous answers are right**✓

10) Which of the following use cases is part of the solution?

a) Information about the volleyball game rules.	b) **Information to reach the island by the car.** ✓	c) Information about the players and the referee of each game.	d) Information about the water temperature.

Argus-1 Questions

Goal.2. Measuring level of understanding.

Subject Number	
Treatment	
Time	
wrong answers	
Right answer	
The following questions aim to measure your level of understanding the user needs regarding the **Argus-1** software project. Please answer them wisely.	

1. In your opinion what kind of app will suite the product at best?

a) **Web app**✓	b) Mobile app	c) PC-app	d) Both 'b' and 'c'

2. The solution in general will:

a) Prevent online hacking.	b) **Archive the websites' contents for any expected security use in future.** ✓	c) Eavesdropping on people that have criminal backgrounds.	d) Prevent trading illegally on the web.

3. Why does the user need to archive websites content?

a) Because the user has limited access to internet connection.	b) **Because of the continuous changes of the web content, thus losing important evidences in case any serious crime.** ✓	c) Because the user is interested with the content of the website.

4. The app will operate only online?

a) Yes	b) **No**✓	c) I do not know

5. What kind of content will the app address?

a) Public static web content (especially suspicious contents)	b) Public dynamic web content videos, audio, etc.	c) Private web content of people that have criminal backgrounds	d) **Both 'a' and 'b'.** ✓

6. Which two of the following functionalities are not required in the app?

a) Archiving dynamic web pages.	b) **Playing videos and music offline.** ✓	c) Allow the user to changes the setting of archiving.	d) **Analyzing archived content.** ✓

7. What is the user need of the output from Argos?

a) Collects a big database of achieved websites for safety.	b) **Analyzes the output in case needed in the future for security matter.** ✓	c) Saves internet costs by surfing the web offline.

8. Which of the following use cases is part of the solution?

a) Send notification to people that are using the web illegally.	b) **Open the archived website through the app.** ✓	c) Block illegal website.

9. Does the app support converting the archived websites to PDF format?

a) **Yes**✓	b) No	c) I do not know

10. Read the following use cases and decide whether they exist in the solution by writing 'Y' for exist or 'N' otherwise near each:

a) Archiving dynamic websites.**'Y'**	b) Archiving static websites. **'Y'**	c) Open the browser window. **'Y'**	d) Allow the user to open the achieved websites through the app itself. **'Y'**

E. Goal.1 General froms

Argus-1

Use cases	**S.1**	**S.3**	**S.5**	**S.7**	**S.9**	**S.11**	**S.13**	**S.15**	**%**
U.C.1-Der user soll den Browser starten.	Y	Y	Y	Y	Y	Y	N	Y	88%
U.C.2-Einstellungen des Systems ändern.	Y	N	N	N	Y	Y	N	Y	50%
U.C.3-Das System soll die Website archivieren.	Y	Y	Y	Y	Y	Y	Y	Y	100%
U.C.4-Das System soll die Website abrufen.	Y	Y	Y	N	N	Y	Y	Y	63%
Precesion value	4/4= 1.0	3/4= 0.75	3/4= 0.75	2/4= 0.5	3/4= 0.75	4/4= 1.0	2/4= 0.5	4/4= 1.0	
Recall value	4/4= 1.0	3/4= 0.75	3/4= 0.75	2/4= 0.5	3/4= 0.75	4/4= 1.0	2/4= 0.5	4/4= 1.0	

Volleyball-1

Use cases	**S.2**	**S.4**	**S.6**	**S.8**	**S.10**	**S.12**	**S.14**	**S.16**	**%**
U.C.1-Das Sytem soll die Termine der Turniere anzeigen.	Y	Y	Y	Y	Y	Y	Y	Y	100 %
U.C.2- Das Sytem soll die Ergebnisse von Turniere anzeigen.	Y	Y	N	Y	Y	Y	N	Y	75%
U.C.3- Das Sytem soll das Wetter anzeigen.	Y	Y	Y	Y	Y	Y	N	N	75%
U.C.4- Das Sytem soll die Restaurants anzeigen.	Y	N	Y	Y	Y	Y	Y	N	75%
U.C.5- Das Sytem soll die aktuellste Nachrichten anzeigen.	Y	Y	Y	Y	Y	Y	Y	Y	100 %
U.C.6- Das System soll Informationen zur Anfahrt mit dem PKW bieten.	Y	N	N	Y	N	Y	N	N	38%
U.C.7- Das System soll die Aufgaben zum Helfen bei dem Turnier anzeigen.	Y	Y	Y	Y	Y	Y	Y	Y	100 %
Precesion value	6/6= 1.0	5/6= 0.83	5/6= 0.83	6/6= 1.0	6/6= 1.0	6/6= 1.0	4/6= 0.66	4/6= 0.66	
Recall value	6/7= 0.86	5/7= 0.71	5/7= 0.71	6/7= 0.86	6/7= 0.86	6/7= 0.86	4/7= 0.57	4/7= 0.57	

F. Goal.2 General forms

Argus-1 test result

Argus-1	T.1 Only specification sheet				T.2 Specification sheet + Vision Video			
	S.2	S.6	S.10	S.14	S.4	S.8	S.12	S.16
Question-1	×	×	✓	×	✓	✓	✓	✓
Question-2	✓	×	✓	✓	✓	✓	✓	✓
Question-3	✓	✓	✓	✓	✓	✓	✓	✓
Question-4	×	×	✓	✓	×	×	×	×
Question-5	✓	×	✓	✓	✓	✓	✓	✓
Question-6	✓	✓	×	×	✓	✓	×	✓
Question-7	✓	✓	×	×	✓	✓	✓	×
Question-8	✓	×	✓	✓	✓	✓	✓	✓
Question-9	✓	✓	✓	×	✓	✓	✓	×
Question-10	✓	✓	✓	✓	×	×	×	✓
Result	8/10	5/10	8/10	6/10	8/10	8/10	7/ 10	7/10
Time	11:30	15:40	14:20	9:24	9:30	7:20	8:50	9:50

Volleyball-1 test result

Volleyball-1	T.1 Only specification sheet				T.2 Specification sheet + Vision Video			
	S.1	S.5	S.9	S.13	S.3	S.7	S.11	S.15
Question-1	✓	×	×	×	✓	✓	✓	✓
Question-2	×	✓	✓	✓	✓	✓	✓	✓
Question-3	✓	✓	✓	✓	✓	✓	✓	✓
Question-4	✓	✓	✓	✓	✓	✓	✓	✓
Question-5	×	×	×	✓	✓	✓	✓	✓
Question-6	✓	✓	✓	✓	✓	✓	✓	×
Question-7	✓	✓	✓	×	✓	✓	✓	✓
Question-8	×	×	×	×	✓	✓	✓	✓
Question-9	✓	✓	✓	×	×	✓	✓	✓
Question-10	✓	✓	✓	✓	✓	✓	✓	✓
Result	7/10	7/10	7/10	6/10	9/10	10/10	10/10	9/10
Time	13:40	17:20	9:33	11:55	11:20	12:40	9:05	9:20

CD contnet

This Bacheor thesis is supported with a CD that contains the results of the design and evaluation of the experiment.

1. Digital Copy of the Bachelor thesis in the forms (PDF document, DOCX document).
2. Intermediate presentation.
3. The selected Vision Videos (Argus-1, Volleyball-1).
4. Result of the Evaluation

4.1. GQM- Goal tree, the questions and metrics, abstraction sheets metrics, variables and hypothesis.

4.2. Result of pre-study.

4.3. Question of the test.

4.4. Result of the core study.

4.5. Result of analysis.

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Erklärung der Selbstständigkeit

Hiermit versichere ich, dass ich die vorliegende Bachelorarbeit selbstständig und ohne fremde Hilfe verfasst und keine anderen als die in der Arbeit angegebenen Quellen und Hilfsmittel verwendet habe. Die Arbeit hat in gleicher oder ähnlicher Form noch keinem anderen Prüfungsamt vorgelegen.

Hannover, 25. September 2017 **Ahmad Hamadeh**