PROJECT HEL

By

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1. Introduction

Project HEL(M) is a group that consists of three members (down from four), and we've been collaborating with SINTEF on their Bridge project. Briefly, Bridge is a large scale project that revolves around the emergency departments (fire, medical, police) and how they work together during large accidents. Our assignment was to dig into the communication aspect of this project, and find a problem area to focus on. Our developed research question, which we sought to answer, was: "How can we improve the communication between, and within, the fire department(s) and their units during an accident?"

All of our group members are bachelor students at design, use and interaction. We've all been interested in, and engaged in, computer activities throughout our life. This has given us a decent understanding of how computers and most software programmes work. However, we do have a different individual qualifications that come to use in our project.

1.1 Project group

•   Eirik Tveterås – Good at structuring and writing, which will come in handy when making interview and evaluation plans, setting up tests and going through documentation.

•   Hichael Mareno Søbstad – Very creative and good at thinking outside the box, as well as being very competent in the field of interaction design. This will help us in the design process and in using the right methods and terminology throughout our project.

•   Lukas Haug Langøy – Has a good amount of programming experience, which will help us specifically when making our high fidelity prototype. He is our most technical advanced member, which will also help us see possibilities and constraints in our prototypes.

We do all have experience when it comes to interaction design, and we believe that our team composition works great with our project.

2. Data Gathering

2.1 Data gathering methods we have used

- Documentation

- Interview

At the start of our project we immediately set up a meeting with the SINTEF representative (Jan Håvard Skjetne). The data used for our first design was gathered through this conversation, as well as through the literature we were provided. We got introduced to the project and our role in it, and the total information we gathered helped us come up with an initial research question as well as being able to make some sketches with ideas.

Our primary data gathering technique has been interviews. We got a good understanding of our research question through our interview with Ragnar Kvenodd, who is the person in charge at the Oslo fire department. We chose to use this data gathering technique because we wanted to explore our research question and get as much information about how the fire department works as possible. We used an unstructured interview, because we wanted the interview objects to talk as much as possible through open questions. This would help us get a large base of data, which we could analyse in order to extract needs and requirements (see transcription, attachment).

We had a new meeting with Jan Håvard Skjetne after our second prototype was made, where we conducted an interview in order to get feedback. We used this for the design of our final low fidelity prototype. We also had a small questionnaire, or a set of questions, which we gave to our interview object after the interview.

3. Research question and user group

We started out with a very wide research question, which was directed towards all the emergency departments (Police, medical and fire department). During the project, specifically after our interview with Ragnar Kvenodd, we narrowed it down to only involving the fire department. We experienced that our former research question was too wide and involved too many departments to

be executed in a satisfactory manner. We wouldn't have the time to gather sufficient data and opinions from all the departments. We had some issues getting a hold of representatives for our user group, which is crucial in order to get insight on their routines, needs, requirements etc.

Original research question: How can we improve the communication between the emergency departments?

Improved research question: How can we improve the communication between, and within, the fire department(s) and their units during an accident?

Final user group: Fire department communication crew

4. Development model

We chose to use «Iterative Design» as our development model. The reason for this is because our project needed a user centred design approach in order to be successful. Our initial thought was that this would allow us to work in close collaboration with our user group, which would help us in creating a product they wanted. Also, this was the development model which was suggested to us by SINTEF. Even though we had troubles maintaining continuous contact with our user group, we could still test our design with proxy users.

Our project was not a request for a system with specific functionality. It was more of a research project based around a future product, which could help the fire department do their job more easily. This means that we needed to have continuous dialogue with our user group to find out what they wanted, how they work, how their current system is and to get feedback on our designs. In order to execute this project with plan driven development, such as the waterfall model, we would need way more time than what we had at our disposal in order to get all functionality and user input we needed - to go through all the stages without looking back at our user group.

Iterative design would allow us to continuously improve our design through evaluation. Below is an illustration of our development process model.
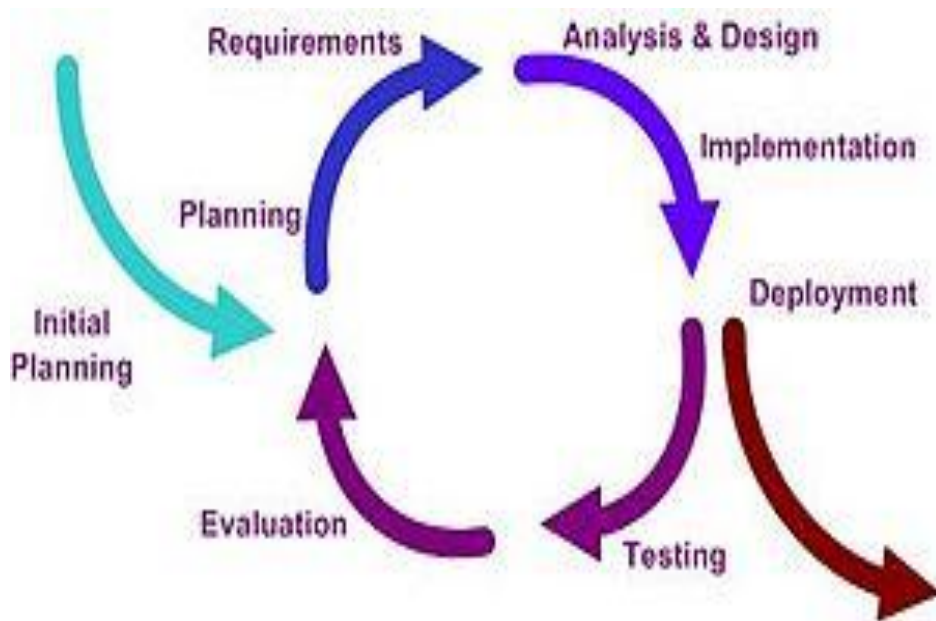
5. Requirements

Here is a list of requirements that we worked out from our interview with the Oslo fire department, and documents given by SINTEF.

5.1 Functional requirements (F):

F1. A system that gives a good overview of the situation.

F2. A function that can display information about dispatched vehicles.

F3. A function where you can call dispatched vehicles and fire stations.

F4. A function that streams video from the squad leader's helmet.

5.2 Technical environment requirements (T):

T1. The system should be compatible with pixel sense technology

Did we meet the requirements?

Our high-fidelity prototype was able to give an overview of a given situation, call stations and display information about fire trucks, fires and fire stations. However, we didn't finish implementing the live-stream function due to the tight schedule.

Pixel sense should in theory be compatible with C#, although we didn't get to test this out. Our SINTEF representative told us that the pixel sense part (integrating the program to a surface board) wasn't that important. He was more interested in the mere concept and ideas of our prototype.
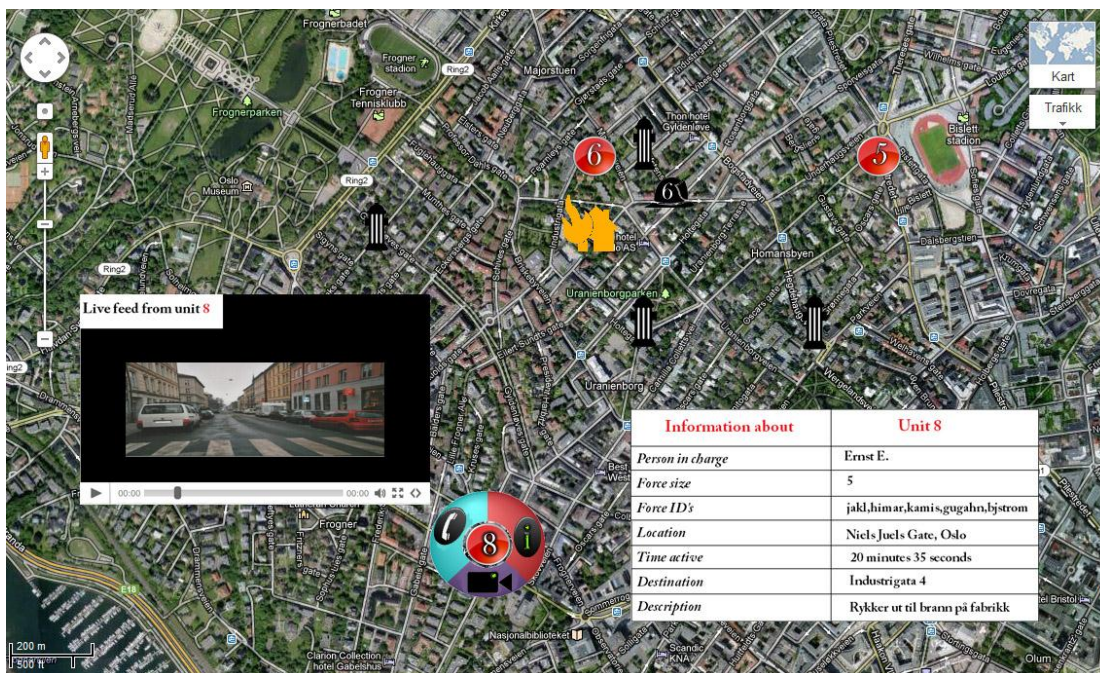
6. Prototypes

6.1 Prototype 1
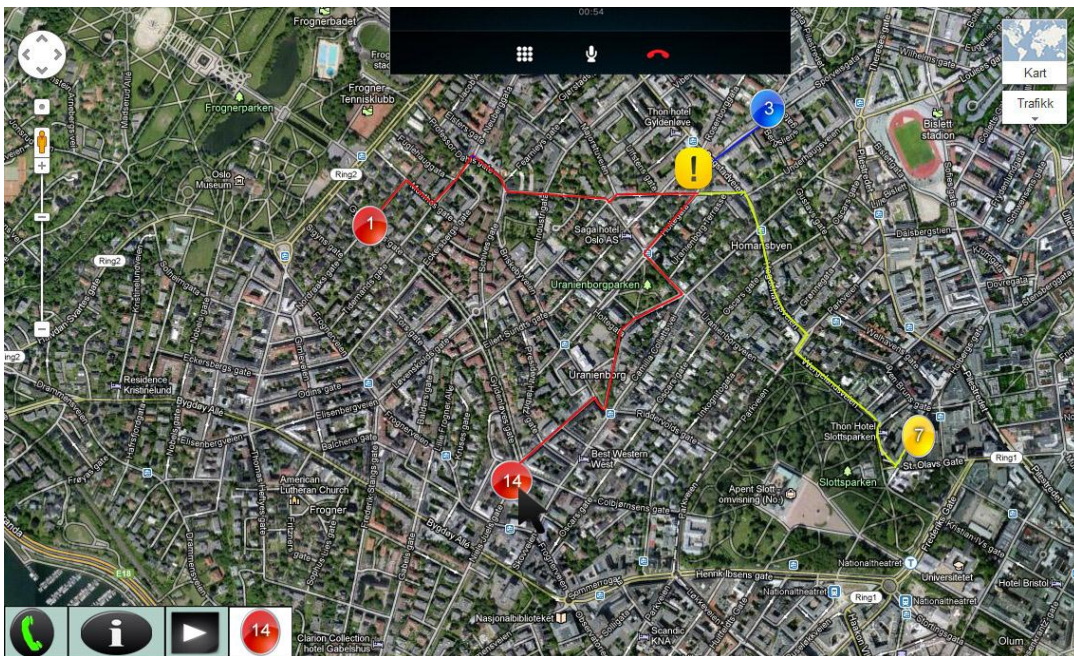
Material: Digital mock-up (made in Adobe Photoshop)

Resolution: Low-fidelity

Scope: Basic interface (overview and three functions)

Description: This prototype was made after our interview with the fire department. We implemented three functions responding to the established requirements. We wanted to truly understand how the user would perceive the interface through not having any additional information attached (for example descriptions on each of the functions et cetera). This way we gathered valuable information that would later be applied to the high-fidelity prototype.

6.2 Prototype 2

Material: Digital mock-up (made in Adobe Photoshop)

Resolution: Low-fidelity

Scope: Basic interface design

Description: This prototype is an evolved version of prototype 1. We edited it in regards to the data gathered from a formative evaluation done on prototype 1. Instead of having a rectangle menu in the lower left corner with the functions, we have now implemented a "functionality wheel". The wheel will in theory pop up when you click the respective units.

6.3 Prototype 3

Material: Program (Made in C# with XNA gaming library).

Resolution: High-fidelity.

Scope: Key functions from user-requirements (see section **1.1A**).

Functionality: Buttons in the program can be pressed to trigger actions.

Interaction type: Mix of Instructional and manipulative.

Description: This prototype was developed by the group. We were originally told that we "had" to use Microsoft Expression Blend, but we switched over to pure C # with some extra libraries to aid us. The reason for this is that no group member had any previous experience with Expression Blend, and we didn't get to implement the things we wanted to. The prototype interface is based on prototype 2, which proved to be a good interface according to users (the formative evaluation of this prototype is not included in this report).

6.3.2 Issues with prototyping

Programming a high-fidelity prototype like this is not a walk in the park. We could only get together one high-fidelity prototype due to the tight schedule. If we were told from the gecko that we could choose which program to use ourselves (in this case C# with gaming library) we're sure it would have been a different story.

6.3.3 The prototypes functions

- Display information about a given vehicle, unit or fire.

- Call stations or vehicles.

- Dragging of vehicles to mimic orders. When a truck gets close to a fire, the fire's description (percentage health) will gradually decrease based on what is happening in the real world (see below).

Our vision was that the information in the program would be automatically updated via a server, so that you would get real-time information about trucks, stations and fires.

6.3.4 Design principles applied:

Feedback: Actions are triggered when clicking on objects.

Affordance: The icons invite clicking. The "action-wheel" that pops up when you have clicked on a unit (icon) invites you to choose one of the following menu icons.

Consistency: We are using the same icons for similar object types (all fire trucks look the same for example). Interaction with the "action-wheel" is the same for all objects. Functions (Display information, call unit or distinguish fire) work in the same way for all objects.

Simplicity: Simple, understandable icons. No overcompensating when it comes to design metaphors.

6.3.5 Videos of the prototype

Browsing the map:

http://www.youtube.com/watch?v=zHA0TtPI4gE&feature=youtu.be

Display information:

http://www.youtube.com/watch?v=gl9fMo5s4Dk&feature=plcp

Calling a station:

http://www.youtube.com/watch?v=t6SmaHlmM9g&feature=youtu.be

Distinguish fire:

http://www.youtube.com/watch?v=jTorlrDK_Mg

7. Project plan

7.1 Original plan

This is our original project plan. This was made after meeting the SINTEF representative (11 September).

Period	Phase (P)	Dependency (Milestone = M)
5- 7 September	Forming of group (P1)	
8-10 September	Brainstorming (P2)	
11 September	Initial meeting with SINTEF (P3)	(M1)
11-15 September	Data gathering: Documents given by SINTEF (P4)	P3
16- 20 September	Establishing requirements (P5)	P4 (M2)
21 – 25 September	Low-fidelity prototype (P6)	P5

26 September	Formative evaluation (P7)	P6 (M2)
27 September – 7 October	Data gathering: Interview (P8)	
7 October – 18 October	First high- fidelity prototype (P9)	P5,P7, P8 (M3)
19 October	Summative evaluation (P10)	P9
22 October	First presentation (P11)	
23 October – 05 November	Second high-fidelity prototype (P12)	P8 (M3)
06 November	Summative evaluation (P13)	P8
07 - 15 November	Conduct experiment (s) (P14)	P9, P12 (M4)
26 November	Last presentation	

7.2 Did the project go as planned?

The project did not go exactly according to the initial project plan. These are some of the reasons why:

1. It took more than 2 weeks to arrange an interview with our user group. It was crucial to our project that we had a good session with our user group in order to gather data to better understand our research question. The fact that these users were hard to come by, resulted in a slow start. A proxy user group would not have sufficed as it would give us faulty data, which again would hinder us from establishing good requirements. We could use proxy users only when conducting experiments and evaluations of design.

2. We spent a lot of time trying to learn expression blend. We're familiar with C#, but expression blend didn't necessarily integrate with C# the way we hoped for. We discussed this problem with the SINTEF representative, and he said that we could use other programs as well. We decided to use pure C# with XNA gaming library (the one XBOX games are made in). This proved to be a good platform for our high-fidelity prototype, but because of time limitations, we didn't get to develop a

second program to conduct an experiment with. Instead, we decided to conduct an experiment with the single prototype that we developed.

3. We should have asked more questions, but we did not feel comfortable asking after some of the replies we got felt discouraging in a form that implied that "you should not have to ask".

7.3 Did we learn anything?

Despite the frustration we experienced halfway through the project we did reach our goal. Not only have we learned about new aspects of HCI (experiments & statistical analysis), but we've also learned to work under pressure.

8. DECIDE – High-fidelity prototype evaluation

This is an evaluation plan made with the DECIDE-framework. The prototype to be tested is our high fidelity prototype, which is the final program we made in C#. The participants will be proxy users, hence the goals of this evaluation will only revolve around design, usability, and the requirements associated with these.

Determine the goals

We want to see if the requirements and needs we acquired earlier in the design process is met in a satisfactory way. The results will be used to do prospective changes to our prototype. Following is a list of what we seek to find out:

• Is the prototype a simple and effective solution to our vision (effectiveness)?

• Are the functions of the prototype easy to understand; are they self explanatory(Affordance)?

- How is the feedback, what do the users think?

- Find usability problems, if any.

Explore the questions

- Is the response time slow?

Choose the evaluation methods

Methods to be used

- Testing in a controlled environment

- Observation in a controlled environment

It is a summative evaluation in the sense that we want the participants to test a finished prototype and see how they handle a set of tasks. We want to see if the user intuitively use the functions of the program, and measure results such as "time taken to complete tasks". With other words, we will focus on the outcome of these tests. However, we will also be of assistance to the participants during the test, and ask questions after the tests are completed.

Identify the practical issues

Participants:

- 5 participants

- 3 male, 2 female

- Background from computer sciences

The members of team HEL are going to be both observers and administrators of the test, as well as as interviewers (evaluators) after the tasks are completed. It would've been ideal to have a third party member to help analyze the test results. However, this won't be possible because of the short time we have left at our disposal.

Budget and time limitations

Since this is a course we're taking through the university, the budget is non-existent. The testing will happen during the course of one afternoon (12:00 – 16:00), at 15th of November. We want to do the tests in quick succession, so it's ideal for us to have participants ready for the date and time we plan

to do the testing. We will recruit voluntary participants at ifi, and the expenses will only regard snacks and soda for our participants.

Equipment

We will do our testing at a location nearby the university, where we'll have computers ready with the prototype running. The session will (with consent from the users) be filmed and stored for later use. The evaluators will also take notes during the test.

Decide how to deal with ethical issues

<div style="border:1px solid black;">

<u>FORM OF CONSENT</u>

•	This study is just for evaluation of a project under development. The data collected during the test will *only* be used for further development of our product.

•	The program is made to explore the possibilities of a user interface that could be used by firemen during an accident.

•	Only personal information about you should be gender and age. None of the data collected will be traceable back to you.

Signature Participant: _____   Signature evaluator: _____

</div>

It is important the the participants are taken well care of during the testing; he/she should feel comfortable.

Evaluate, analyze, interpret and present the data

•	(Reliability) We would expect the results to be reliable. We will be giving simple tasks to test our interface, and with reliable participants (computer science) to test our prototype, we expect the same potential problems to occur for almost all our participants.

•	(Validity) we have designed our tests to give us a good amount of control, and they're designed to answer the goals we described at the start of this evaluation.

•	(Ecological Validity) The tasks are pretty concrete and open, hence we don't expect that the fact that we're testing in a controlled environment will bias our results.

9. Experiments

9.1 Introduction

This part of the report is dedicated to experiments. We have included 2 experiment plans, but we conducted only one of them. The reason for this is that we didn't have time to develop a second high fidelity prototype (as mentioned in section 2.3 regarding prototype 3). The first experiment will be a hypothetical plan to show how we would have done it if we had a second prototype. The second one is the actual experiment that was conducted.

9.2 Experiment 1 (Hypothetical planned experiment)

This is a hypothetical experiment, as mentioned in section.

Date: N/A

Location: N/A

Type of experiment: We will adapt a Between-group design. The reason for this is that the impact from the learning effect would be too big. Our hypothesis is that participants will score better on the last prototype they test due to them getting a better understanding of the system (since it is only the interface that is changed).

Research hypothesis: Are there any differences in user satisfaction regarding a menu based interface vs. an action wheel based interface ?

Null hypothesis (H0): There is no difference in user satisfaction between menu based and action wheel based prototype.

Alternative hypothesis (H1): There is a difference in user satisfaction between menu based and action wheel based prototype.

Independent variable: Prototype.

Conditions: AW (Action-wheel), M (Menu).

Dependent variable: degree of satisfaction.

Design: This experiment is of type "basic" since it only has 1 DV with 2 conditions.

Participant pool: Ten participants divided on two different groups: CST and PS. Five participants of each condition (5 CST vs. 5 PS) were admitted to each group.

Population: Computer science students.

9.3 Experiment 2 (Conducted experiment)

In this experiment we wanted to see if there were any difference between computer science students and police students in regards to how fast they would complete a given set of tasks on prototype 3. Police students are proxy users designed to mimic "field personnel" such as fire fighters and police officers. Computer science student are our main proxy users for this project. We used them when evaluation prototype 3. The computer science students are supposed to mimic more technical users (such as communication/computer specialists in the fire department).

Date: 19 November 2012.

Location: Oslo.

Type of experiment: We didn't use random assignment in this experiment, which makes this a Quasi-experiment.

Research hypothesis: Are there any difference between Computer science students and police students in time spent completing a set of tasks on prototype 3?

Null hypothesis (H0): There is no difference in TCT (time completing tasks) between computer science students and police students.

Alternative hypothesis (H1): There is a difference in TCT between computer science students and police.

Independent variable: Participant's background.

Conditions: CST (Computer science student), PS (Police student).

Dependent variable: Time spent (seconds).

Design: This experiment is of type "basic" since it only has 1 DV with 2 conditions.

Type of experiment: Between group.

Participant pool: Ten participants divided on two different groups: CST and PS. Five participants of each condition (5 CST vs. 5 PS) were admitted to each group.

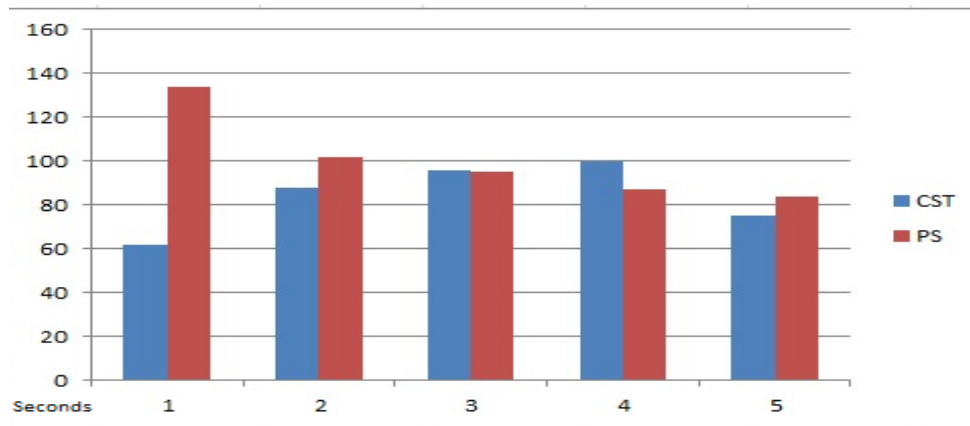**Population**: Computer science & police students.

Sample type:

The set of tasks were:

1. Find station "11".

2. Show information about station "11".

3. Find fire truck "12".
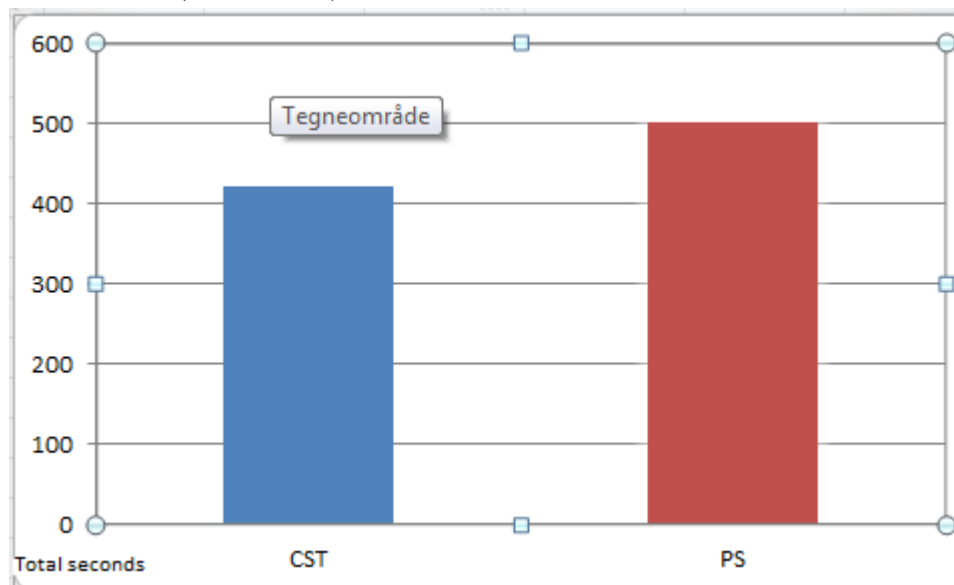
4. Call fire truck "12".

5. Find fire fighter squad leader "1".

6. Activate squad leader 1's live stream.

9.3.1 Results of the experiment:

Comparing participants

Total seconds (CST VS. PS)

From the results we can see that there is a difference between police students and computer science students in amount of seconds completing the tasks.

Raw data:

CST: 62 75 88 96100 = 412

PS: 84 87 85102134 = 502

CST_TOTAL = 412;

PS_TOTAL = 502;

CST_TOTAL / PS_TOTAL = 1,218 = **22% difference in favor of CST**.

Conclusion: The results show that police students spend 22% more time than computer science students when completing the set of tasks. This indicates that there is indeed a difference between police students and computer science students, which means that we have to reject the null hypothesis (H0), and embrace the alternative hypothesis (H1).

10. Statistical analysis

We decided to analyze the results from our experiment (see section 5.3).

The tools used for this was Microsoft Excel.

10.1 Descriptive statistics

CST: Computer science students

PS: Police students

CST		PS	
Mean	84,2	Mean	100,4
Error rate	7,00285656	Error rate	8,96994983
Median	88	Median	95
Mode	#I/T	Mode	#I/T
Stnd deviation	15,6588633	Stnd deviation	20,0574176
Variance	245,2	Variance	402,3
Kurstosis	-1,09807821	Kurstosis	2,65824047
Skjevhet	-0,65952985	Skjevhet	1,59882781
Min	62	Min	84
Max	100	Max	134
Sum	421	Sum	502
Amount	5	Amount	5

10.2 ANOVA

We chose to use the "F-test", because our experiment is of between-group design and has only 2 conditions.

F-Test: Two sample variance

	CST	PS
Mean	84,2	100,4
Variance	245,2	402,3
Observations	5	5
Fg	4	4
F	0,6094954	
P(F<=f) en side	0,3216015 5	
F-kritisk, en side	0,1565378 1	

The F value here exceeds the critical value. This normally means that the null-hypothesis has to be rejected, and conclude that there is a significant effect due to treatments. In our experiment this proved to be right.

11. Conclusion

It has been a privilege to work with SINTEF on this project. We've learned a lot, and experienced the difficulties that comes with a large scale project. Even though the project could have gone smoother, and that things would've been done differently if we started over, we still feel that this is one of the reasons why we had this project in the first place.

We managed to make a high fidelity prototype which satisfied the needs and requirements we gathered and refined throughout the project. It might not be a product that is ready to be used yet, but we think that the idea has potential.