Tablet Interface For Environment Monitoring

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Summary

Brüel & Kjær Noise Sentinel provides management of environmental monitoring in industrial settings through a number of interfaces. These interfaces currently exist only as browser based web clients, and they have all been developed without proper effort into user experience and usability design. User interface improvements will be a major part of the next step of Noise Sentinel development, as will presence on mobile platforms.

This report presents a user interface concept for one of the Noise Sentinel interfaces, the RTCA, which specifically targets real time management. The concept has been designed specifically for the Windows 8 and Windows RT tablet platform and the process has emphasized usability and user experience.

The project ran from 21. March to 2013 until 4. July 2013.

Resumé

Brüel & Kjær Noise Sentinel tilbyder styring af miljøovervågning i industrielle miljøer gennem en række grænseflader. Disse grænseflader findes i øjeblikket kun som browser baserede web klienter, og de er alle udviklet uden væsentlig indsats i brugeroplevelse og brugervenlighed. Forbedring af brugergrænseflader vil være en betydelig del af det næste trin i Noise Sentinels udvikling, sammen med en forbedret tilstedeværelse på mobile platforme.

Denne rapport præsenterer et brugergrænseflade koncept for en af Noise Sentinels grænseflader, Real Time Control Application, som er specifikt rettet mod real tids overvågning. Konceptet er designet specielt til Windows 8 og Windows RT tablet platformen og processen har haft fokus på brugervenlighed og brugeroplevelse.

Projektet løb fra den 21. marts 2013 til den 4. juli 2013.

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Tomasz

Jørgen Tomasen

Douglas Manvell

Chris Middleton

Daniel Saunders

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Chapter **1**

Introduction

1.1 About Brüel & Kjær

Brüel & Kjær (B&K) was founded in 1942 by Per V. Brüel and Viggo Kjær, who met while studying at the Polytechnic School in Copenhagen, now known as the Technical University of Denmark (DTU). The company was initially focused on the radio industry, but later turned the focus onto Sound and Vibration measurement. This decision proved to be successful, as the company grew to become a leading player in this market, and by 1960 the company had 490 staff members. Today the company is based in Nærum in the Northern parts of Zealand, Denmark, and it has a total of 1150 employees.

1.1.1 Environmental Management Solutions

Environmental Management Solutions (EMS) is a relatively young division of B&K. It was launched in 2009 when B&K bought the Australian company Lochard, a global leader in supplying environmental monitoring systems and services to the world's airports. The division is still headquatered in Australia, but development, support and administration is shared with B&K in Copenhagen. The products developed by EMS deal with monitoring and management of parameters such as noise, dust, vibration and weather in cities and airports. The main purpose of the products is to ensure compliance of national and international regulations.

1.2 Noise Sentinel

One of the products developed by EMS is Noise Sentinel. It is a solution aiming to monitor and manage environmental parameters in urban areas, where industrial activity needs to follow certain regulations. The customer could, for example, be an entrepreneur building a new train line through a populated area. In order to document that the building activity does not produce more noise, vibration or dust than

regulations allows, the company can subscribe to the Noise Sentinel service. This will provide the customer with the means to produce reliable documentation. In many cases it is required by law that the company can deliver this kind of documentation on request of the authorities.

The current list of customers features markets such as:

- Mines
- Harbors
- Construction
- Waste Management
- Sport and Entertainment
- Manufacturing
- Oil & Gas

The main focus is on Construction and Mine markets.

The Noise Sentinel solution comprise of the actual hardware sensors, several software clients and a (partially) cloud based backend. When a new customer signs the contract to recieve the Noise Sentinel service, a team of technicians will go to the site to be monitored and setup an agreed number of sensors. The sensors currently supported includes:

- Brüel & Kjær Noise Monitoring Terminal (NMT) for noise.
- Instantel Minimate vibration monitor
- Dust monitor
- Weather station

The customer can access the monitored data in a number of ways, depending on the client that the customer uses. All clients runs in a browser.

1.2.1 Noise Sentinel Client

The Noise Sentinel Client is a Silverlight web app that serves as a setup and management tool, that lets the customer define specific rules to interpret the monitored data. The customer can use the NS Client to generate reports to document if the company meets compliance standards.

1.2.2 StakeholderWeb

The StakeholderWeb is a version of the NS Client for public access. This client is meant for local population with interest in the environmental impact produced by the activity of the customer.

1.2.3 Real Time Control Application

The Real Time Control Application (RTCA) is an html based web app, that is used by the customer to maintain a real time overview of the monitoring.

1.3 Project Definition

1.3.1 Goals

The goal of this project is to present a tablet user interface concept for the RTCA.

The project can be regarded as a user experience project, with the final aim to present a validated concept in shape of an interactive prototype.

In agreement with B&K it has been decided to develop the prototype as a Windows Store App. This means the prototype will run on Windows 8 or Windows RT supported tablets.

1.3.2 Motivation

The three interfaces of Noise Sentinel that was presented in the previous chapter have all been developed without proper effort into user experience design. The road map of Noise Sentinel development includes an emphasized focus on user interface improvements, and possibly a complete redesign of the RTCA.

Another important aspect of the future of Noise Sentinel is support for mobile platforms. This is especially the case with the RTCA, because the user needs to be able to access it quickly when the situation demands it. In many cases the user has other tasks outside the office, and will currently have to travel back to the office in order to use it.

1.3.3 Process

The development process will divert from other software development processes by having more emphasis on the analysis and design phases, with only minimal implementation.

The process contains the following elements

Analysis	Analyse domain
	Define tasks and model in UML
	Analyse platform design patterns
	Create Use Cases and Requirements
Design	Create prototype in paper or on device

Implementation Implement design suggestions to make them testable.

Test Test prototypes with users and experts

Outline of the development process

The process roughly follows the Iterative Design Process presented by the UX guru Jacob Nielsen from the NN Group (http://www.nngroup.com/articles/iterative-design/). This process evolves a prototype through several iterations, from paper prototype to interactive prototype. Each iteration involves design and test evaluation. Simply put, analyse what the need is, design a solution and test it with users or experts. In the next iteration the input from the tests can be evaluated and used to design a better solution.

In this project the process was also incremental, as more and more interactive content was added to the prototype through the iterations.

In the case of this project, it has been necessary to have a substantial analysis phase before doing any design. It was necessary to collect a certain amount of domain knowledge, before it any sensible design could be made.

An important limitation in the process is the lack of actual users of the application. Noise Sentinel has very few customers – about 20 - and they are spread all over the world. The nearest customer that uses the RTCA is based in England. Because of this limitation, user needs will be collected from experts such as product managers, sales persons and supporters. The testing will be done with people who understands the usage scenarios and can pose as users, but also with people without any knowledge of the domain, who can evaluate the general usability of the interface.

1.3.4 Risks

- **Project Scope Risk level: High**
  It can be hard to set clear borders around a project of this kind, because it can always be improved with an extra feature.

- **Lack of Planning Risk level: Medium**
  In extension of the above risk, it is crucial to "plan the work and work the plan".

- **Lack of Experience Risk level: Medium**
  As a student, there is a risk that planning skills are not adequate, resulting in poor time management.

- **Changing Requirements Risk level: Medium**
  The requirements can change throughput the project.

- **Productivity Issues Risk level: low**
  The size of the project requires a consistent high level of effort throughout the project period.

1.3.5 Success Criteria

If the following points are fulfilled, the project can be considered a success.

- The stakeholders can see their input reflected in the prototype
- The prototype provides tested solutions to all A priority functional requirements
- The prototype fulfills the Usability and User Experience requirements defined in the non-functional requirements
- The product can be successfully validated by experts

1.4 Structure

List of problems to solved, and where to find them in the report:

- Analyse the requirements that Brüel & Kjær and the customers have to the program. Identify the actors are, and define the functional and non-functional requirements. (Chapter 2)
- Select a realistic subset of the requirements and create use cases that determine the interaction between the end user and the program. (Chapter 2)
- Analyze the platform specific design patterns. (Chapter 2)
- Design a prototype that simulates interaction between the system and the end user. (Chapter 3)
- Gather a group of suitable test subjects and conduct a series of usability tests in order to find flaws in the prototype design. (Chapter 3)
- Use the results from usability tests to iteratively refine the design of the prototype (Chapter 3)
- Evaluate the process and the final prototype. (Chapter 3 and 4)

Chapter 2

Analysis

2.1 Analysis Summary

This section describe the analysis of the project.

Some of the terminology used in this section require some explanation. This can be found in the Terminology section in the Appendix.

A description of the standards of environmental monitoring can be also be found in the appendix, in the Monitoring The Environment section.

2.2 Current Real Time Control Application

The RTCA currently exists only as an html based web client aimed at desktop computers. In this section I will briefly describe its design and functionality. If a new design is to be successful, it should learn from the existing design.

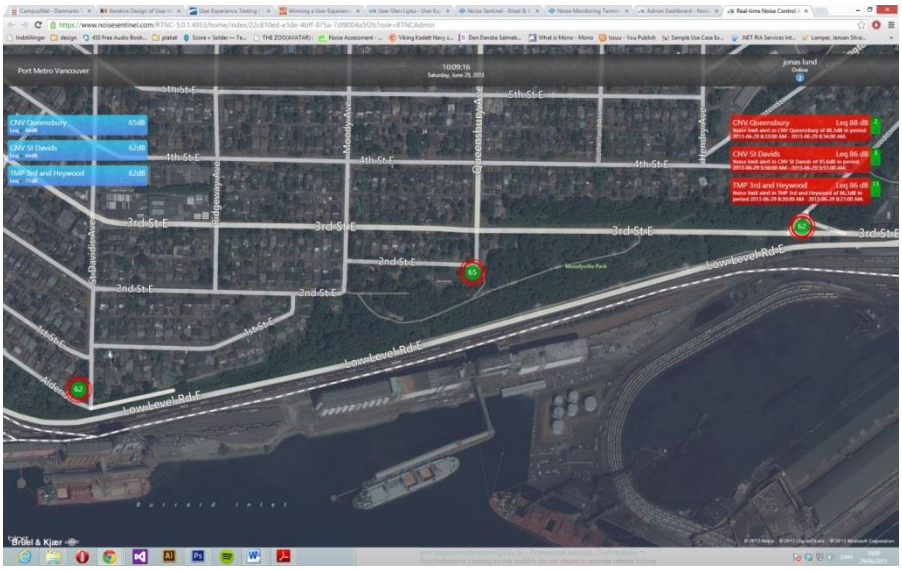


Figure 1: The main screen of the current RTCA

The screenshot above shows the main screen, which consist of a map background, with the monitoring locations placed at their respective positions. The locations are also represented in a graphical list on the left side of the screen, and on the right side of the screen, a list of alerts can be found. When an alert has been triggered, a ring will be drawn around the location where the alert was triggered, and the alert will be added to the list on the right. Double clicking the alert in the list brings up a dialog that allows the user to add a comment to the alert. This comment will be visible in the reports that can be generated from the Noise Sentinel Client. Adding a comment removes the alert from the list, because the RTCA operator has marked that he is aware of the issue, and has an idea what caused it. The alert dialog also allows the operator to listen to a sound clip from the alert interval, where the sound peaked. This is the operators main tool to evaluate the cause of the alert, besides his knowledge of the activity on the site. Double clicking the locations in the list to the left brings up a dialog with more details about the location, including a chart of the recent monitoring, information from the weather station, and latest value of the alerts rule set up on the location.

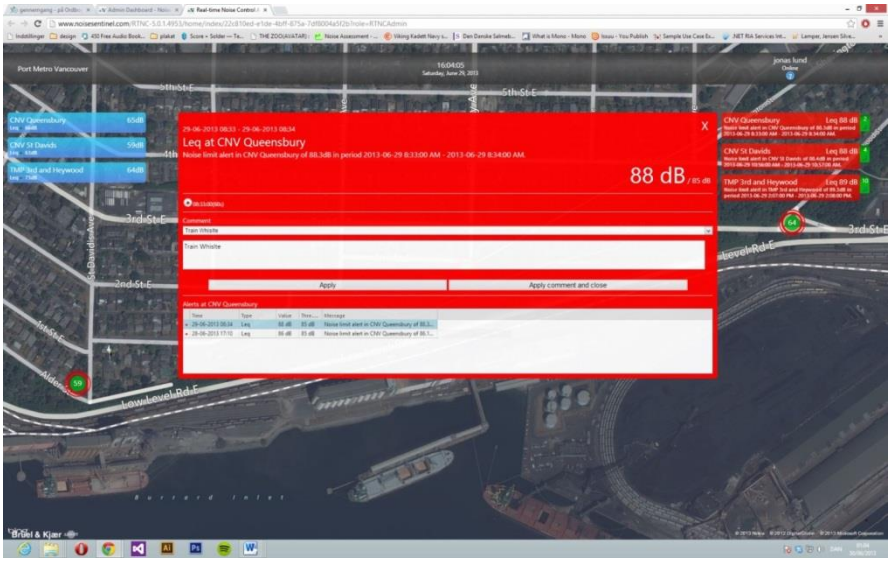


Figure 2: The alert response dialog

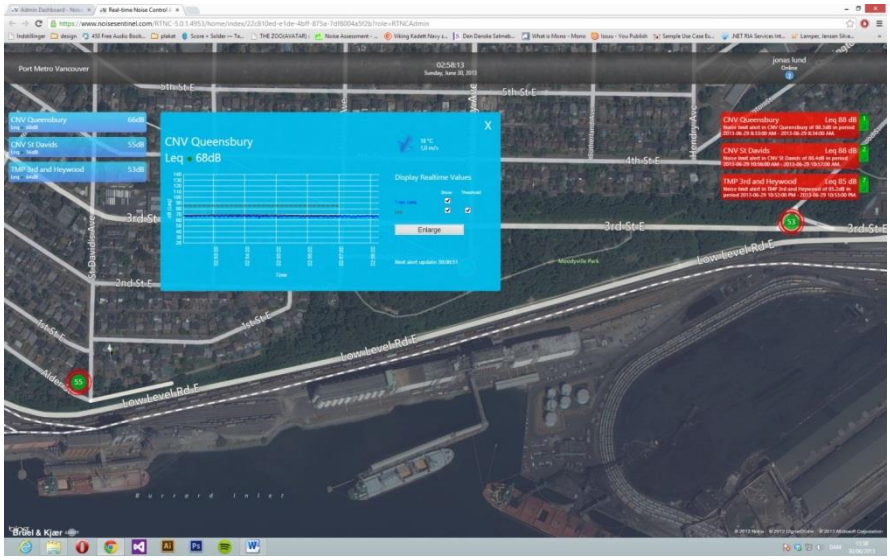


Figure 3: Details of the selected location includes a chart

It should be noted that the current RTCA has gone through several iterations, and that it has reached a point where the customers are generally satisfied with it.

A list of usability observations regarding the current RTCA can be found in the appendix in the Current RTCA Usability Observations section.

2.3 Actors

The actor identified in this segment are the operational users expected to interact with the application.

2.3.1 Site manager (SiM)

Description This person is responsible for taking action to ensure operations continue within compliance limits.

This person monitors a wide range of equipment and conditions around the site. If there is a problem or any sort the Site Manager is responsible to resolve it. This includes being notified of compliance breaches and taking action to resolve them.

Will look at the RTCA from time to time to check operation.
This person will not use other NS interfaces than the RTCA.

Background The primary person responsible for the operation of Noise Sentinel on site.

Skills Expected to be computer literate, and with basic noise skills – but no expert.

Environment **Industry**: sat in a control room monitoring the status of lots of parts of the industry.

Stadium Noise: sat in the sound control room or at the mixing desk in the middle of the field. Often in poor lighting with a large mixing desk

Motorsport: In the race control room in the pits.

Construction: Portacabin or project office on site and out and about around the site

Mine: Operational Control room, office on site and out and about around the site

Attitudes Focused on ensuring the optimal operation of the site – not particularly interested in complying with legislation and does not understand why people complain about noise.

Managing noise issues is just one of a number of things that he has to do.

Behavior Follows standard operating procedures, often dealing with multiple incidents at a time.

There will always be a site manager in place to oversee operation.

Goals Wants to keep production running.

Optimize production within compliance limits.

Resolve issues as quickly as possible.

Notes Will be using the RTCA when in the office but mostly will want to be informed about alerts with SMS so that he can take immediate action.

Tasks

Real time compliance management
SiM wants to check current levels to optimize operations within compliance.
Wants to stop an NMT alerting.

Alerting
Takes immediate action on alerts.
Will tell workers to stop working if necessary.

Reporting
Investigate and post information for reports.

Deployment and Service
Will be contact person in connection with service

2.4 Personas

The following personas have been created in order to better emphasize with users during the design of the system. The personas are focused on factors that is relevant to the interaction with the system, such as skills and tasks and attitude.

2.4.1 Site Manager 1 – Joe

Age: 38

Site type: Mine

Work Environment: Control room, where the RTCA is always running on one of several screens. Will sometimes leave control room and move around on site, for example to determine the source of noise.

Frequency of use: Continuously, will always keep updated.

Computer literacy: Good. His job consists of using computer equipment to keep a check on the site environment.

Acoustic insight: decent

Behavior: Does not want to use the RTCA, only use it when necessary.

Attitude / goal: To keep noise within limits, optimize production within these limits.

Educational background: Mid technical.

2.4.2 Site Manager 2 – Richard

Age: 59

Site type: Construction

Work Environment: Temporary project office or Portacabin on site, and out and about on the site

Frequency of use: Whenever an alert is triggered, he will receive an SMS, and he will go and check the RTCA which is positioned in the main office. This happens only a few times a week.

Computer literacy: Decent, but not great.

Acoustic insight: basic

Behavior: Focused on ensuring the ongoing operation of the site – not particularly interested in complying with legislation and doesn't understand why people complain about noise.

Attitude / goal: Optimize production within regulatory limits.

Educational background: Mid-level technical.

2.5 Scenarios

1

Richard is helping some builders setup a new temporary office on a new part of the building site. He receives an SMS that a noise alert has been triggered in opposite end of the building site, 500 metres from his current position. He takes out his tablet and opens that RTCA app. He locates the alert, and listen to the sound clip. The sound reveals that the alert was caused by a bird making noises close to the noise sensor. He apply this information as a comment and removes the alert from the RTCA.

2

Joe does not understand why a location in the north end of the site keeps triggering alerts. He listens to the sound clips, but he is not able to conclude anything. He leaves the control room and drives up to the location, and finds that a truck is being loaded with the engine running near the location. He asks the truck driver to turn of the engine, and opens the RTCA app on his tablet to see if it makes a difference in the monitoring. It does, no more alerts are triggered, and Joe drives back to the control room.

3

Joe has just met at work, and would like to get up to scratch on the current state of operation. He opens the RTCA app and access an overview of the site. Some alerts have been triggered at Location A. He access a historical view that reveals that the threshold has been breached continuously for the last half hour. He make some calls and finds out a work crew has been doing some heavy drilling around the position of the alerting location. He adds this information as a comment to the alerts and removes them. He calls the crew and asks them to work more quietly. He keeps an extra eye on the RTCA chart the following 10 minutes, to see if the threshold / value ratio of the alerting location changes for the better.

2.6 Tasks

Maintain overview

- Read current levels - are levels within the accepted limits?
- Has any thresholds been breached?
- Will thresholds soon be breached?
- Use weather information to predict alerts – e.g. dust moves with wind

Handle alerts

- Add comment to describe the cause of the alert.

Investigate alerts

a. Visualize data in chart.
b. Listen to audio recording around time of a Noise alert.
c. Review weather data.

Historic investigation

- Use chart to review recent site history

2.7 Requirements

The functional requirements of this project are defined in the shape of detailed use cases. This is the way requirements are usually captured by the Noise Sentinel product managers. Each step in the use case defines a measurable requirement.

For the readability of this report, the detailed use cases can be found in appendix, while this section will provide a summary of each use case.

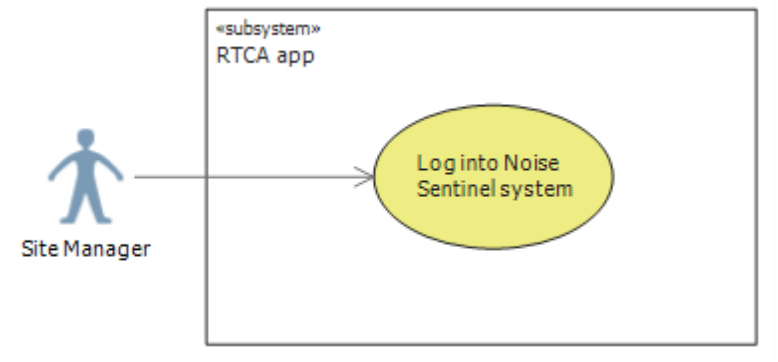
The requirements are the results of talks with B&K experts, analysis of the current version and tests of the early designs. The list of requirements has been continuously updated throughout the project.

The use cases are

1. Login
2. Site status overview
3. Alert Handling
4. Alert Investigation
5. Real Time Investigation
6. Historical Investigation
7. Calibration and Setup
8. Help
9. Alert notification beyond app environment

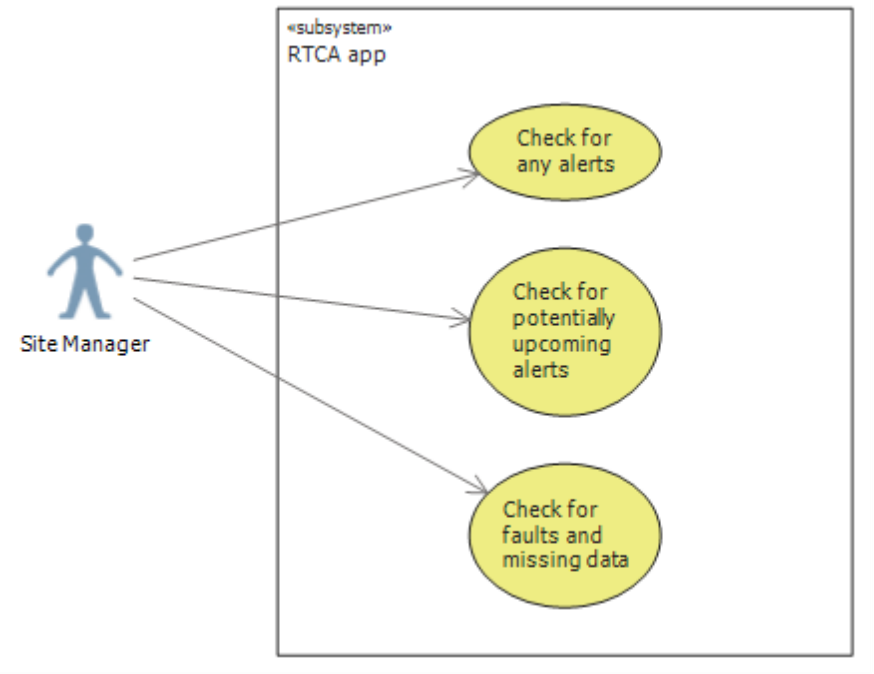
Because of the limited scope of this project, not all the use cases have been defined in detail. It was decided to focus on use case 2, 3, 4 and 5 because these use cases constitute the core usage of the system. These use cases also have a certain interdependency that makes it difficult to leave one out. The login use case, on the other hand, is more isolated. Even though it is crucial to implement Login for a final application, it can be left out for this prototype.

2.7.1 Use Case 1: Login



Not Defined

2.7.2 Use Case 2: Site status overview



Precondition
The SiM has logged in.

Flow
The SiM is presented with an overview of the site. The overview consist of a map and a list of alerts. The SiM checks if any alerts has been triggered, or if any alerts might be triggered soon.

Alert List

- The alert list represents each alert with location, rule, measurement type, severity and time.
- The alert list can be sorted by time, location and type, and only contains recent alerts (e.g. from the last 5 hours) .
- The alert list can represent the alerts in groups or individually.

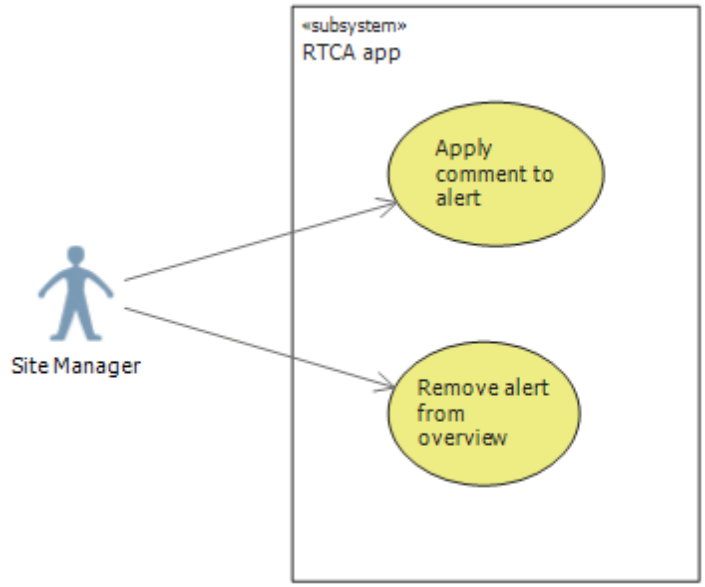
Map

- The map shows all the locations as icons on their respective positions and indicate the type of data being monitored at the location.
- The icon also shows current real time values, and indicate if there is unhandled alerts on the location.
- The location icon indicate the severity of the latest evaluations.
- Weather data such as wind and possibly also rain is represented on the map.
- If the SiM is using a tablet with a GPS, his position should be drawn on the map.

No Map

- The SiM can choose to disable the map, and view the locations in a more grid-like layout.

2.7.3 Use Case 3 : Alert Handling



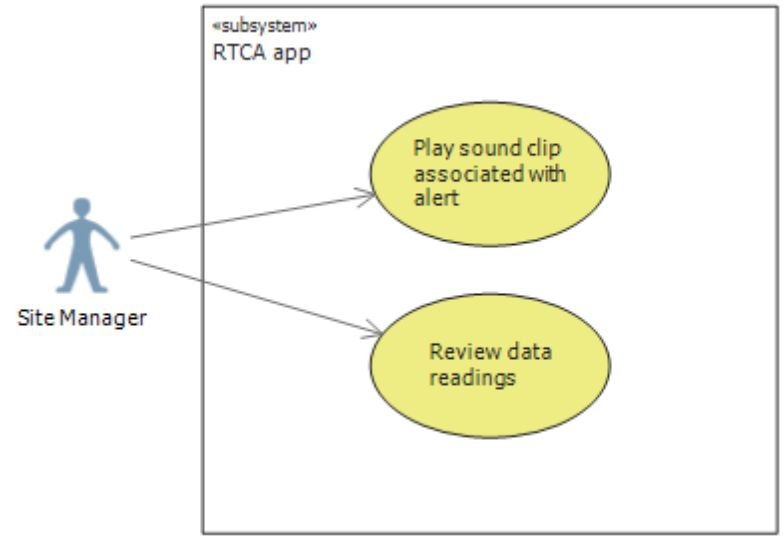
Precondition

The Site Manager has logged in to the app, and an alert has been triggered.

Flow

The SiM selects an alert, and apply a comment to it. The comment can be selected from a list of predefined comments, or it can be typed manually. After accepting the comment the alert will be removed from the list of alerts.

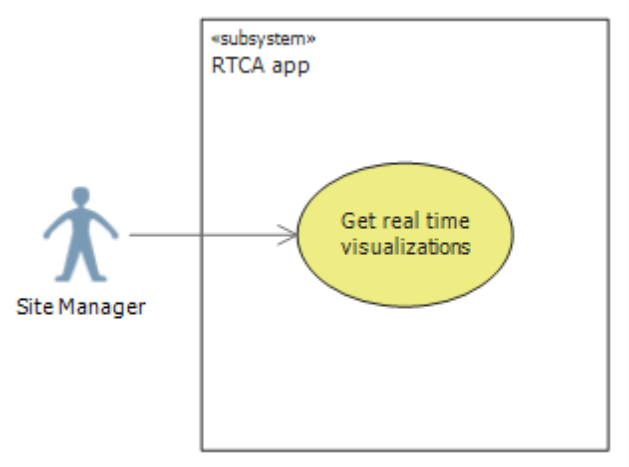
2.7.4 Use Case 4 : Alert Investigation



Precondition
The Site Manager has logged in to the app, and an alert has been triggered.

Flow
The SiM selects the alert and starts the sound clip attached to the alert. He then plots the alert on a chart, so that he can see the recorded data visualized. The chart indicates the position and span of the sound clip.

2.7.5 Use Case 5 : Real Time Investigation



Precondition

The SiM has logged in.

Flow

The SiM has identified a location he wishes to investigate. He selects it for the chart, and observe how the real time values behave in relation to the thresholds.

2.8 Non-functional requirements

Usability Goals

1. Requirement
It should be possible to learn how to use all functions of the app within 20 minutes, also for people with only basic acoustical skills.
Fit criterion
Test subjects can complete all tasks after maximum 20 minutes of instructions.

2. Requirement
The app should be easy to use.
Fit criterion
Tests show that all users can complete the tasks after limited instructions.

User Experience Goals

3. Requirement
The app should be pleasant to use.
Fit criterion
Feedback evaluation

4. Requirement
The app should follow the Modern UI design principles and adopt the Modern UI design language.
Fit criterion
Feedback evaluation

2.9 Platform

This section will describe the platform used in the project, especially with regard to design and user experience. All the information in this section has been used in the design of this project.

2.9.1 Windows Store App

A Windows Store App is an application that runs in the new touch friendly environment introduced with Windows 8 and Windows RT for tablets. This environment was initially codenamed 'Metro' by Microsoft, but because of copyright issues, they were forced to drop this name. The environment as such does not have a name, but is usually still referred to as 'Metro' or sometimes 'Modern UI'. I will refer to it as 'Modern UI'.

The Modern UI introduces a whole new design language to the Windows platform. Microsoft has made a great effort to simplify and streamline the way developers and designers design app.

2.9.2 Modern UI Design Principles

The Windows 8 User Experience Guidelines (http://go.microsoft.com/fwlink/p/?linkid=258743) condense the concept of the Modern UI down to five design principles:

Show Pride in Craftsmanship

The 'craftsmanship' refers to both that of developers and of designers. Following this principle means that extra care is put into the finish of an app regarding usability, visual design and functionality. A Windows Store App should be "polished at every stage".

Be Fast And Fluid

This principle compels the designers to make full use of the enhanced animation features in the programming framework for Windows Store Apps. This is especially important in regard to touch based user interaction, as it can facilitate intuitive control and understanding. Meaningful use of motion makes for dynamic and immersive apps, and creates a sense of continuity.

Be Authentically Digital

This principle specifically targets the visual design, and argues for a simple elegant design language, with bold colors and beautiful typography.

Do More With Less

Remove persistent navigational elements such as menus, options, status bars and so on. Integrate navigational elements into the content.

Win As One

Use the standard touch gestures and design templates, rather than invent new ones. Apps that are consistent with the platform are easier to use.

2.9.3 Modern UI Design Patterns

This section describes some of the most important new design patterns in the Modern UI.

Page Layout
The Windows 8 User Experience Guide describes a standard layout grid. It is not merely a suggestion that this grid is used, but it is not a strict demand either.

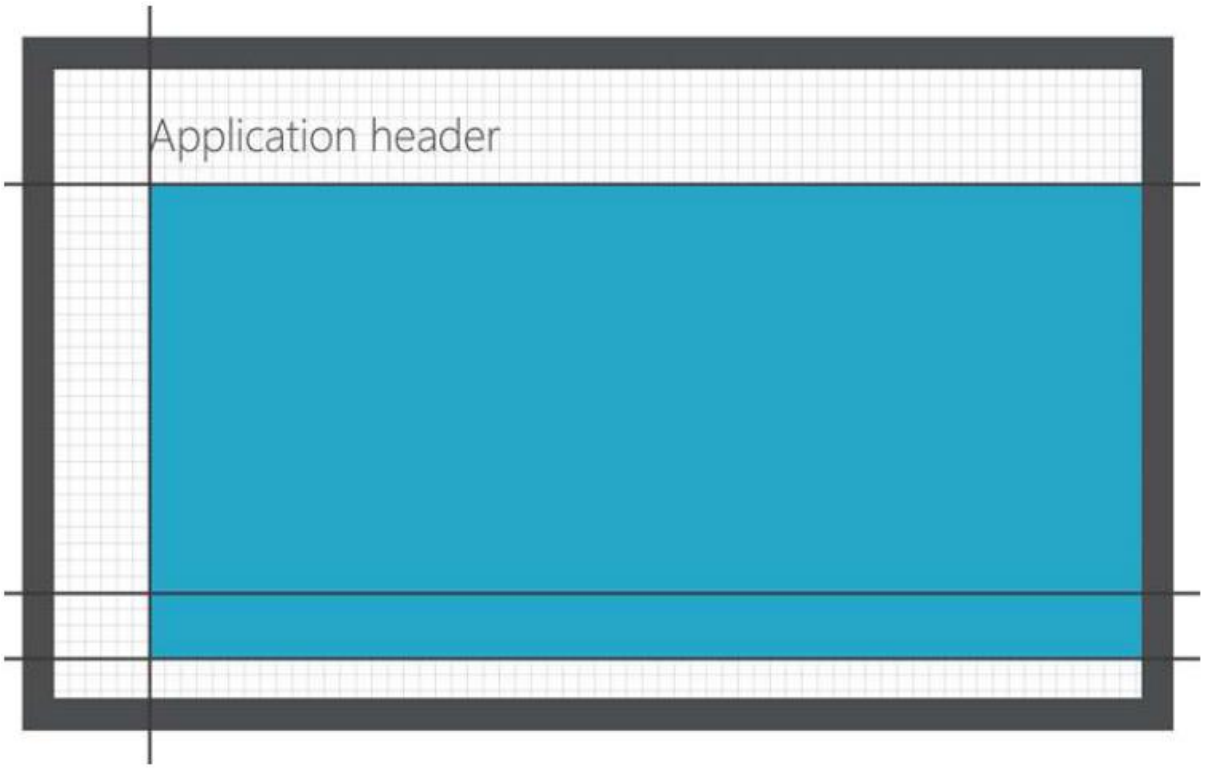


Figure 4: Content Region

The content region has a 120 pixel left margin and a 140 pixel top margin. The bottom margin ranges from 50-130 for horizontally scrolling layouts.

Content groups inside the content region are separated by 80 pixels margins, and columns are separated by 10 – 40 pixels margins depending on the content.

It is interesting to see that many of Microsoft's own apps divert from this grid. The margin between the content region and the top edge of screen is for example 160 in the News app and 110 in the Finance app.

Tiles
One of the most recognizable elements in the Modern UI is the tile. A tile represents an item in a collection as a flat rectangular shape large enough to comfortably press with your finger. The API features a very flexible and very dynamic support for tile based layouts.

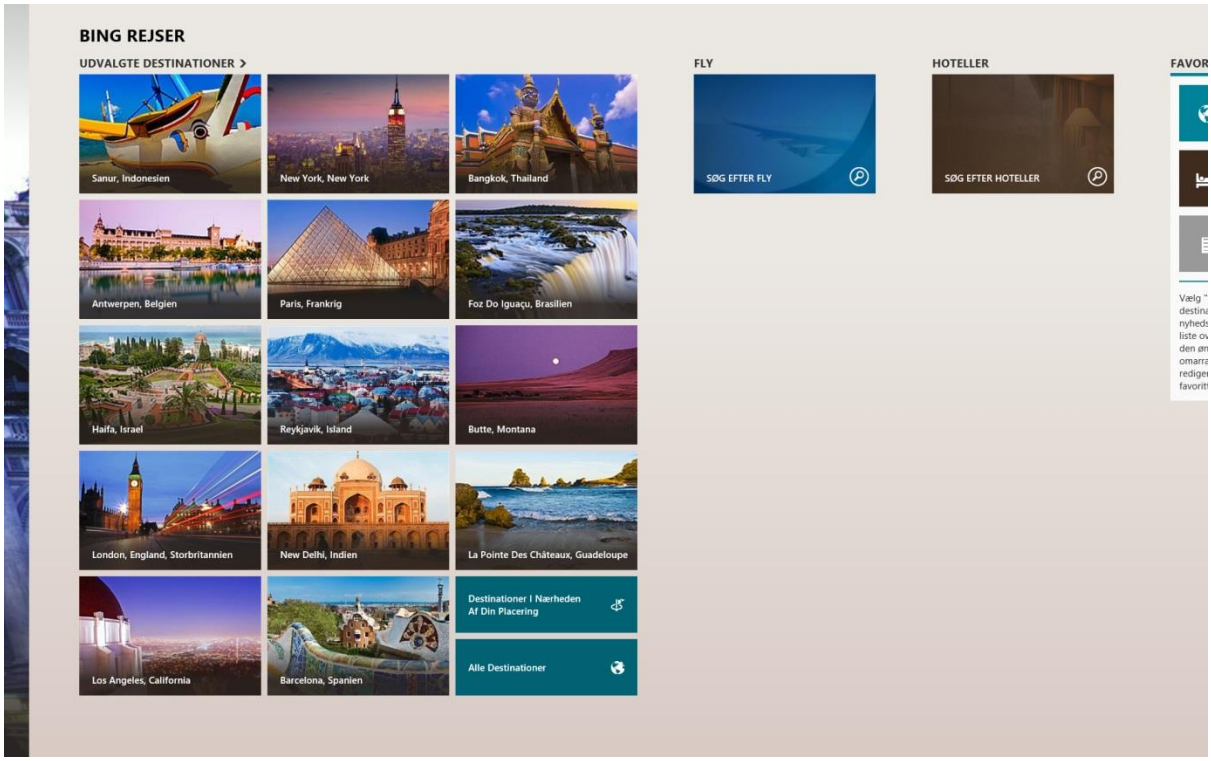


Figure 5: Tiles in the Travel app

The start menu, which lists all the installed apps on the device, features a special type of tile, the Live Tile. It is 'live' in the sense that it can be updated dynamically to show dynamic content related to the app. The headline of a newly arrived email for example.

App Bars

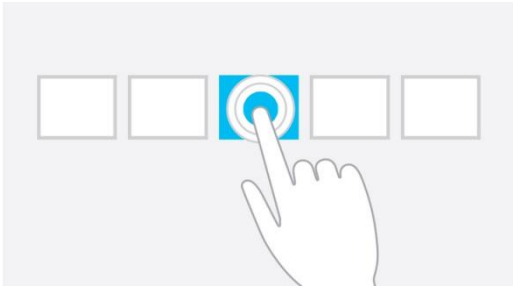
The bottom app bar and the top app bar contains buttons for commands related to the content of the page, or related to a current selection. They are hidden per default, but can be accessed by swiping up from the bottom edge of the screen.

The app bars are used in most apps, as they provide a convenient way to free the UI for clutter.

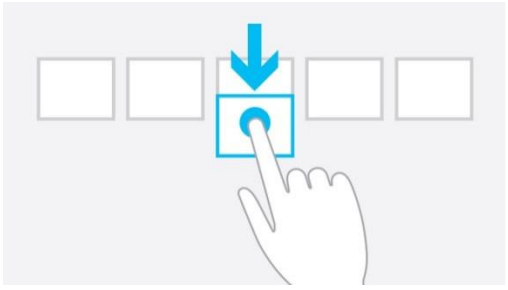
Figure 6: App bars in the Finance app

Gestures

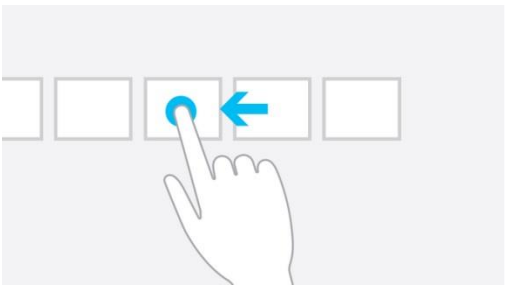
The Windows 8 User Experience Guidelines defines a list of standard gestures for touch based user input. This following list includes the gestures relevant to this project.



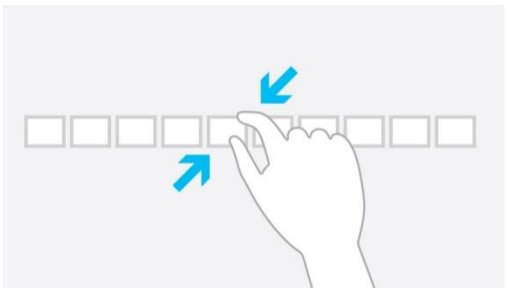
Tap item for primary action.



Swipe item for selection. This will often activate the app bar.



Slide to pan through content.



Pinch or stretch to zoom.

Touch Friendly Areas

Microsoft has researched how users tend to hold their device and which areas of the screen are most useful for interaction. This research is very useful, although it seems to be based solely on the Surface device, and might not be applicable to devices that uses a different form factor.

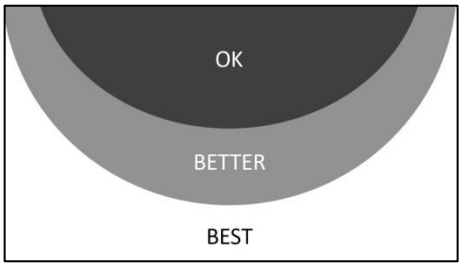


Figure 7: Touch friendly areas

As the illustration shows, the areas around the sides of the screen, as well as the bottom of the screen are the easiest to reach.

2.9.4 Development Environment

The programming environments used for this project are Visual Studio 2012 and Expression Blend. Where Visual Studio is designed mainly for writing code, Blend is a tool for creating visual content, layout and animation. It is possible to have a project open in both environments and dynamically switch back and forth depending on the current task.

Sketchflow

Sketchflow is a prototyping tool that is integrated into Expression Blend. It has been used in the early parts of this project for mock-ups and early prototypes. It is incredibly easy to use, and just like Windows Store Apps, the language is XAML based, so the code is very similar to the code used for later parts of the project. It is possible to write custom controls and test advanced ideas and features. It is in some cases possible to reuse the code, and thereby create a seamless transition from mock-up to prototype to final implementation. In theory at least. It did not work in the case of this project because Windows Store Apps are a bit different from other XAML based project types. One of the features of the tool is that it can draw everything in “squiggly” lines in order to make the visual content look hand drawn. This should make the designer and the test subjects focus on the more high level decisions in a design rather than the details in the visual design. One problem with the hand drawn style is that it can make a design look more complicated than it actually is, because text becomes harder to read, so this feature has only been use to a limited extend.

Iterative Design and Test

3.1 Summary

This chapter describes the process of designing the prototype. This process involves designing , testing and evaluating in iterations. As the design matures the process also involves some implementation in order to enable tests on the target device.

3.2 Mock-ups

The initial designs are simple mock-ups, created to quickly explore different design solutions and try out ideas.

The mock-ups were evaluated with Niels (Development Manager) and Christian (Software Architect), but not tested as such.

The mock-ups were created in Sketchflow, and can be run on a desktop, although no real interaction is supported, except for scrolling the layout left and right. For the evaluations, the mock-ups were printed in paper, so that they could be held like a tablet.

The first mock-up can be found on the following pages, and the rest can be found in the Mock-up section of the Appendix.

3.2.1 Mock-up 1

Figure 8 Entire layout as wireframes

Figure 9 Overview mode - scrolled left

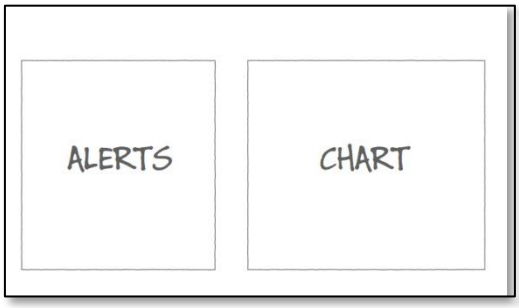


Figure 10 Investigation mode - scrolled right

Description

The first mock-up is a simple wireframe model that proposes a general layout for the app. The idea is to divide the interface into three parts; map, alerts and chart in that order. Only two parts are visible at one time, and the user can scroll left and right to see the parts that he wishes. This accommodates two different modes of operation – overview (Use case 2) and investigation (Use case 4 and 5). Since the alerts are placed in the middle, they will be visible at all times. This is an important point, because the SiM needs to stay updated on the alerts.

Another point is to keep the structure of the design as flat as possible so that the user doesn't have to enter different pages. The purpose is to maintain all functionality close at hand, and not create a hierarchical structure, that would require more interaction and less accessible information at one time.

The mock-up does not represent Use case 3 – Alert Response in any specific way, but it could perhaps be integrated in the alerts part.

Evaluation

The mock-up was approved of, although it was difficult for the reviewers to give any constructive feedback on such an abstract basis. We agreed that it would be worthwhile to continue with the proposed layout.

3.3 Prototype 1

3.3.1 Description

The design and evaluation of the mock-ups revealed some issues, which this prototype aims to resolve. This includes

- The alert response control should be available in both overview mode and investigation mode, but it should not cover the alerts.
- The control that sets the context of the chart should be available in investigation mode.
- The general layout works well, except the map should be bigger in order to accommodate larger sites with many location.

The prototype propose a general layout and a task flow – select alert, comment (UC 3) and investigate (UC 4).

Only limited effort has been put into the overview (UC 2).

The matrix below shows the included use case steps.

Use Case	Use Case Step	Step name	Element	Priority
2 : Site status overview	2.1.1	Alert Template	Alert list	A
	2.2.1	Location Icons	Map	A
	2.2.6	Indicate severity of each rule	Map	A
3 : Alert Handling	3.1	Select alerts	Alert list	A
	3.2	Choose comment	Alert response	A
	3.3	Accept alert	Alert response	A
4 : Alert Investigation	4.1.1	Activate sound clip	Sound	A
	4.1.2	Sound player control	Sound	A
	4.1.3	Stop sound clip	Sound	B
	4.2.1	Visualize Data in chart	Chart	A
	4.2.4	Alerts on chart timeline	Chart	A
	4.2.5	Select alert on chart timeline	Chart	B
5 : Real Time Investigation	5.1	Real time data from location on chart	Chart	A
	5.2	Enable / disable parameters on chart	Chart	B

3.3.2 Design

Layout

The layout of the prototype builds on the experience collected with the mock-ups. The split into an overview mode and an investigation mode is maintained, as is the navigation between them by simply scrolling the interface.

Overview Mode

The overview mode consist of a map with locations as icons, and a list of alerts.

Figure 11: Overview mode

Map and Location Icon (UC 2.2.6)

The Map is made much bigger than in any of the mock-up designs by removing the margins. This allows a more comfortable overview, and there is less chance the location icons will overlap. It also means that there is no space for information under the map. To solve this problem, the amount of

Figure 12 Location selected

information has been reduced to the essential; the location name and a list of the rules set up on the location. To access this information, the user has to tap the location, and it will appear as an extension of the icon.

Alerts (UC 2.1.1)

One alert tile represents one alert. The type of the alert is indicated with the symbols already in use in Noise Sentinel; circle = noise, triangle = vibration and square = dust. The symbol is colored to show the severity of the alert.

The list is sorted by time, and the prototype does not allow any other sorting or grouping of the alerts. The alert list is filtered by the selected location.

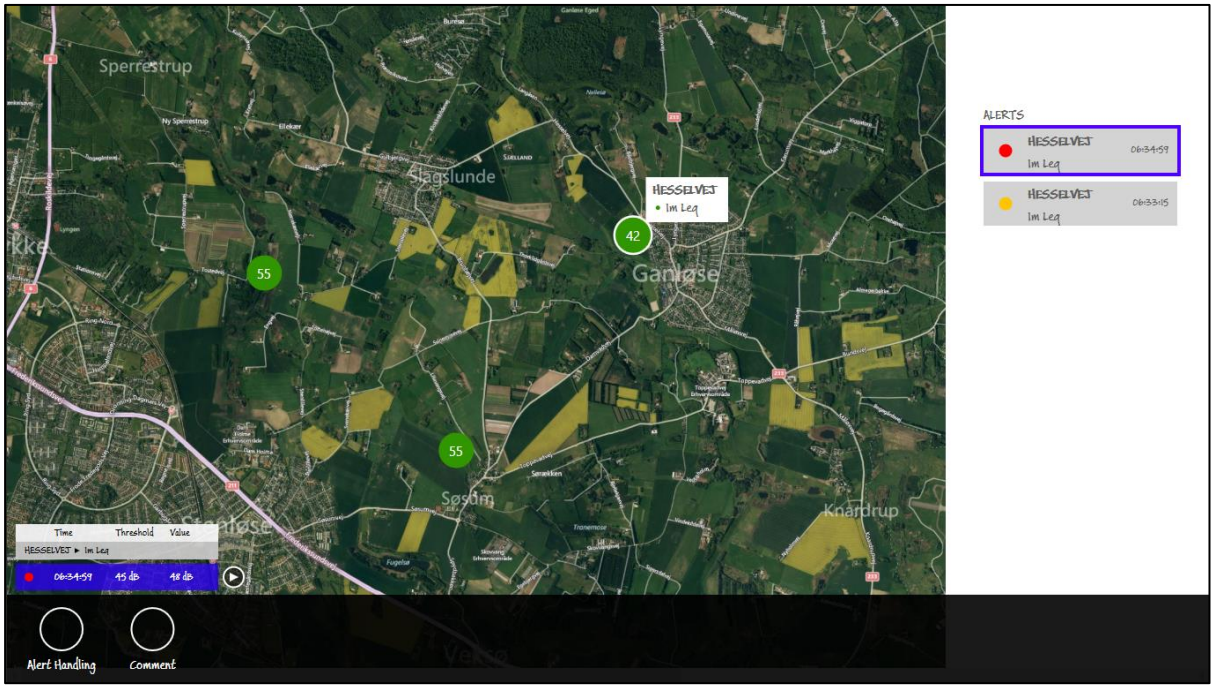


Figure 13 Selecting alert activates bottom app bar

Alert Response (UC 3)

Selecting an alert automatically brings up the bottom app bar, which contains the controls for responding to an alert. The alert selection is represented in a list over the app bar, which contains some further information about the alert, such as the threshold and the value. The list also contains a play button, that will start the sound clip attached to the alert.

Figure 14 Multiple alerts selected

This solution means that there is two different alert lists, one for all the alerts, and one for the selected alerts (referred to from now on as 'alert details'). The reason for this is to keep the amount of information in the main alert list low, but mostly because it is the intention that the main alert list can be grouped, and it is necessary to provide a way to make more fine grained selections.

The app bar contains a "Comment" button which will bring up a list of predefined comments, for user to choose from. Selecting "New Comment" will let the user type in a new comment.

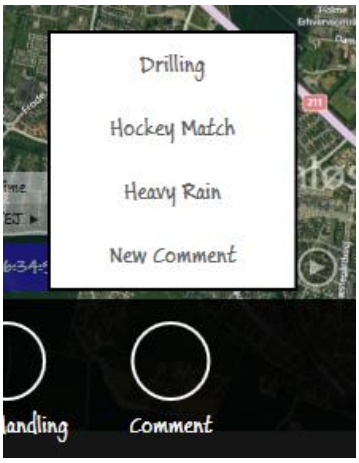


Figure 15 Choose comment

After selecting a comment, the user will see a preview of the comment next to the alert that will receive it, and the user is prompted to accept or cancel the action. Accepting will remove the alert from the alert list, and the app bar will automatically retreat below the bottom edge of the screen.

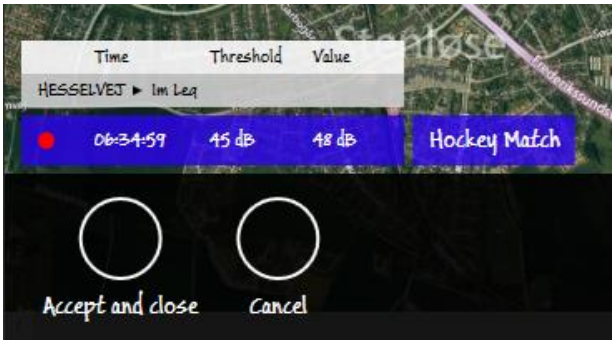


Figure 16 Preview Comment

Sound (UC 4.1.1 + 4.1.2 + 4.1.3)

Pressing the sound clip play button in the alert details list will of course start the sound clip. The sound clip is represented visually by a tile in the top right corner of the screen. Tapping the tile stops the sound clip.

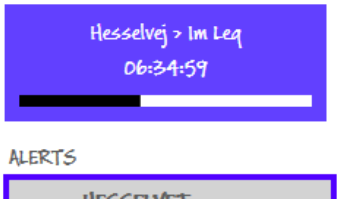


Figure 17 Sound Clip Tile

Investigation Mode

The investigation mode consist of the list of alerts and a chart.

Chart (UC 4.2.1 + 4.2.4 + 4.2.5 + UC 5)

The basic layout of the chart is the same as in the last mock-ups, so it will not be described here.

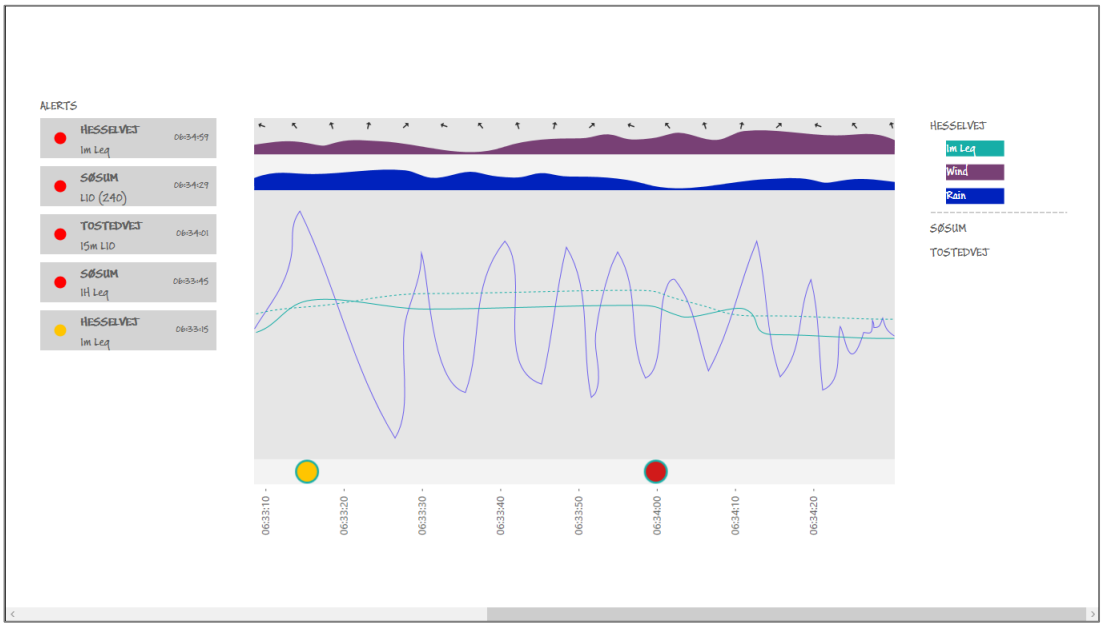


Figure 18 Investigation mode

In the mock-ups, it was attempted to control the chart context with the location selection on the map, but it did not work out well. This prototype introduce a legend on the right side of the chart, which will show which location is set as the context of the chart, and allow the user to differentiate between the individual chart elements through color coding. Under the legend is a list of the locations which is not shown on the chart. Tapping a location in the list will change the context of the chart.

Tapping a parameter in the legend, for example “Wind” in the screenshot above, will disable the corresponding chart element, creating more space for the remaining chart elements.

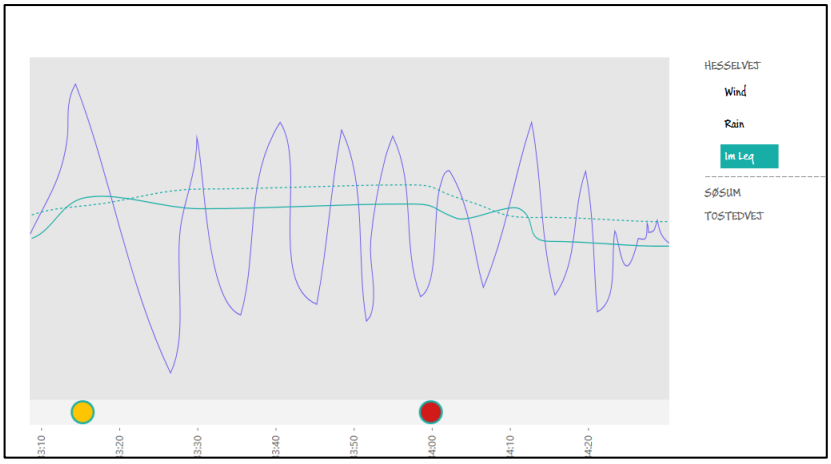


Figure 19 Wind and rain disabled

Alerts In Investigation Mode

The handling of alerts works in the same way in investigation mode as it does in overview mode, except that alerts can be selected from the chart, and selecting an alert from the alert list will also select it in the chart.

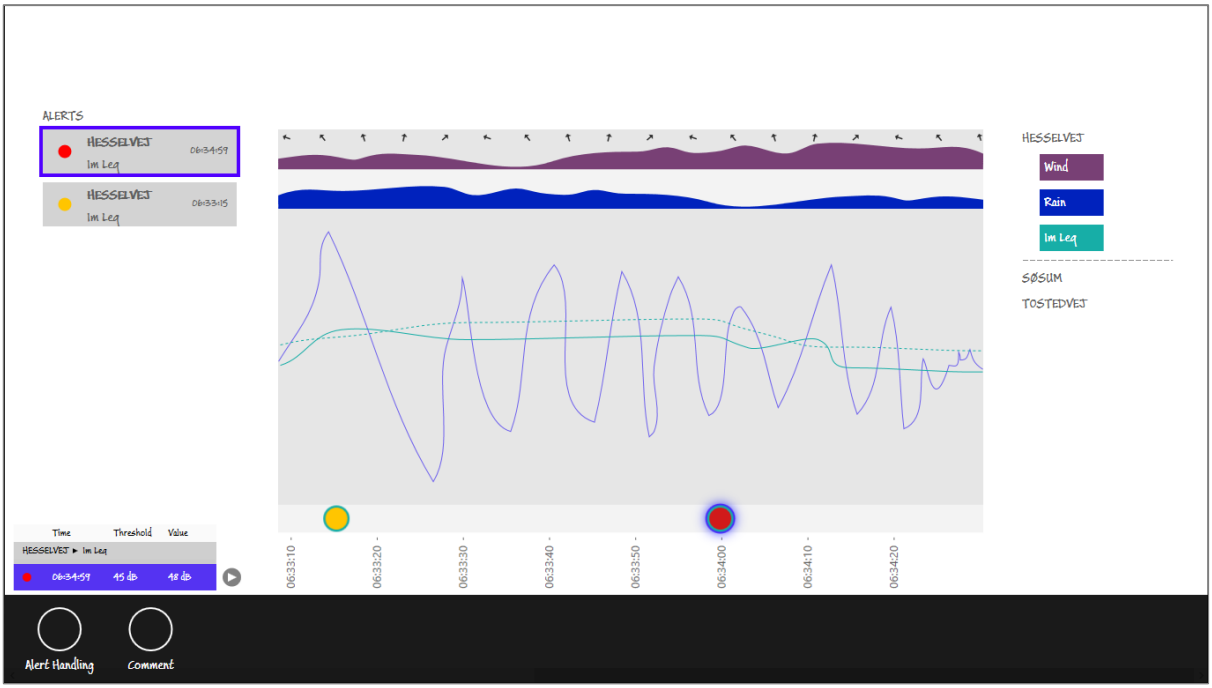


Figure 20 Alert selected in investigation mode

3.3.3 Prototype 1 Test Group

Name	Education	Age	Noise Sentinel role	Desktop RTCA experience	Tablet experience	Test role
Martin Andersen	Data mechanic	34	Support Technician	Supports and trains users	IPad	User + expert
Jørgen Tomassen	Civil Engineer	60	Support Technician	Supports and trains users	None	User + expert
Jeppe Kronborg	It engineer	27	None	None	Android	User
Niels Bruun Svendsen	Electronic engineer	50	Managing Development	Yes – from development perspective	Windows 8	User + expert
Christian Bækdorf	Computer Science	42	Software Architect	Yes – from development perspective	Windows 8	User + expert

3.3.4 Prototype 1 Test Procedure

The test procedure contains two parts. In the 'User Test', the test subject pose as Site Manager, and is asked to complete a set of tasks, while thinking aloud. Afterwards we discussed their observations.

Tasks

1. Tell me about what you are looking at.
2. Select the location to the east on the map. Describe the effect that had.
3. How many noise alerts in total are awaiting a response? / How would you get the rest of the alerts back?
4. Locate the latest noise alert and give it a comment that suits the kind of noise that caused it.
5. Give the remaining alerts the same comment.
6. Describe the chart area.
7. How would you disable Wind in the chart?
8. What would you do if you wanted to see SØSUM in the chart?

3.3.5 Prototype 1 Test Results Summary

All test subjects were able to complete the tasks. The prototype is relatively easy to use, and the test subjects did not require many instructions. Some experts mentioned that the design lets the user do more things than they are used to. While it will make some users happy, we have to make sure that we do not lose others. The design must not appear to be complicated, and the user must not end up in a state they do not understand. It is my impression that paper prototyping can make a design seem complicated, since you cannot really interact with it and get the feeling that you master it. Also, a design made with Sketchflow and set in the ”Buxton Sketch” font means that the legibility of the text suffer.

The general layout worked well, except that the chart area needs to ”peak in” along the right edge of the screen to remind the user it is there.

The alert handling via the bottom app bar works really well, although the name “Alert Handling” for button that toggles the list of selected alerts is confusing to most users. It should be changed.

The resized map is much better than the previous smaller map, both functionally and aesthetically.

The consistency of the use of gestures needs to be reviewed, but the confusion in this area might be because the prototype was in paper.

Test Group Evaluation
The response from the one test subject that had no Noise Sentinel experience was quite different from the rest. His response was interesting, because he approached the design as any other touch based design. His expectations were ”clean” from domain knowledge. The other test subjects approached the design specifically as a version of the RTCA, looking for recognizable features, and applying their knowledge of user scenarios. Both types of responses are valuable, and future tests should contain both types of test subjects.

Defects
Test results are captured and stored as *defects* in a scheme inspired by Søren Lauesen (User Interface Design, page 286).

A defect in this project is something that the test subject thinks should be changed, or something that is not in the prototype, that the user would like to have.

The defect list is used alongside the use case requirements to keep track of issues and tasks to do. The status column represents the current status of the defect – it is being updated continuously. The list below is an excerpt – see full list in the Appendix.

I have applied a color coding to indicate further action within the scope of my project:
Green : ignore
Yellow : nice-to-have
Orange : Second priority
Red : First priority
Blue: Out of scope – future improvement

Defects from Usability Test 1							
ID	**Name**	**Issue**	**Location**	**Cure**	**Found by**	**Priority**	**Status**
P1_01	”**Alert Handling**” 1	”Alert Handling” is a confusing name. It is not obvious what it covers.	**Bottom App Bar** when an alert is selected	Rename: ”Show List” / ”Hide List” ”Toggle List”	Niels, Jørgen, Christian, Martin	1.	Done
P1_02	”**Alert Handling**” 2	The ”Alert Handling” button should change color according to list visibility.	**BAB, alert selected**			1.	Done
P1_03	**Unaware of Alert List filter**	The user might forget that the alertlist is filtered when a location is selected. User might be unaware of new alerts in this state.	**Alert List**	Niels proposes a timeout on the filtration. Jeppe proposes an indicator showing that the list is not complete, and an easy way to get the full list. Eg. Write location name next to Alerts Headline. Click name to remove it, and get full list back. Jørgen: Dont filter list- just highlight.	Niels, Jeppe	2.	Done - timeout
P1_04	**Inverted Headlines**	Headlines in Alert Details seems to be inverted	**Alert Details**	Training	Jørgen, Jeppe, Niels	-1	done
P1_05	No undo	User can accidently select a wrong comment to an alert and accept it. No turning back from there.	**Bottom App Bar** when an alert is selected	Make undo button	Jeppe	-1	future
P1_06	Chart alerts looks like locations	Using color coded rings around alerts to indicate the rule that triggered them, makes them look like locations	**Chart**	Alter design (slightly) – experiment.	Niels	2	done
P1_07	Swipe / Tap consistency	Confused about swipe / tap consistency. Wants to swipe on/off parameters of chart location. So maybe it should.	**Generel**	Make sure design is consistent.	Niels, Jørgen	1	done
P1_08	Audio time indicator	The time displayed in the audio player does not represent the time currently being played, but the time where the alert was triggered.	**audio player**	Make change label to represent current time.	Niels	2	Done

3.4 Prototype 2

3.4.1 Description

The second prototype is interactive and can be run on the target platform.
The focus is entirely on the overview mode – the map and the alert list. The prototype deals with issues found in tests of the first prototype, and use case steps not previously included.

The chart is not part of this prototype, except for a single experiment.

Use Case	Use Case Step	Step name	Element	Priority
2 : Site Status Overview	2.1.1	Alert Template	Alert list	A
	2.1.2	Alert Sorting	Alert list	A
	2.2.1	Location Icons	Map	A
	2.2.3	Current value on location	Map	A
	2.2.4	Indicate alert on map locations	Map	A
	2.2.5	Indicate severity of last update on map locations	Map	A
	2.2.6	Indicate severity of each rule	Map	A
	2.2.7	Weather	Map	A
	2.3.1	Optional map	(Map)	B
3 : Alert Handling	3.1	Select alerts	Alert list	A
	3.2	Choose comment	Alert response	A
	3.3	Accept alert	Alert response	A
4 : Alert Investigation	4.1.1	Activate sound clip	Sound	A
	4.1.2	Sound player control	Sound	A
	4.1.3	Stop sound clip	Sound	B
	4.2.2	Plot alert on chart	Chart	A

3.4.2 Design

Only new or changed features are described. Minor changes are not described.

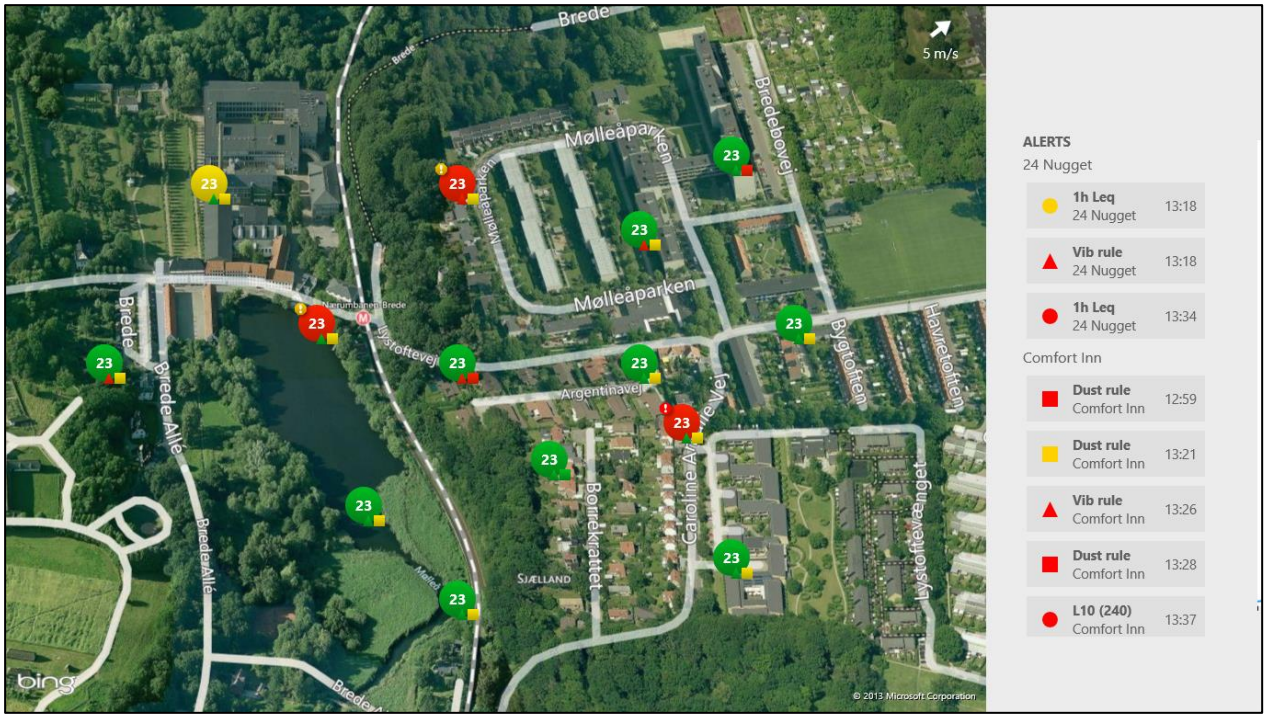


Figure 21 Overview mode

Location Icons (UC 2.2.1 + 2.2.3 + 2.2.4 + 2.2.5)

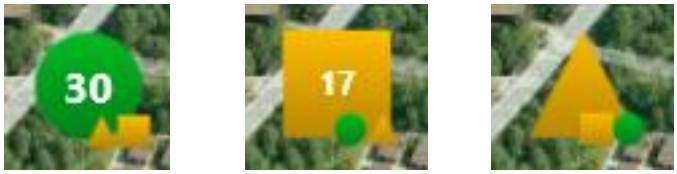


Figure 22 Location icon modes

The location icons on the map are divided into modules, representing the types of monitoring on the location. The modules are colored to show the severity of the last alert rule updates of each type. The icon will show the real time value of the largest of the modules. A button in the app bar button changes the mode of all the icons. This way only one type of real time value will be shown on the map at one time. Changing mode focusses the interface to the current need of the Site Manager.
The icons show a sextant to indicate an alert at the location.

Figure 23 Warning alert on location

Figure 24 Selected alert with information flag

Location Flag (UC 2.2.6)

When a location icon is pressed, it will be selected and, like in the previous prototype, the icon will show a "flag" with the rules set up on the location. When another location is selected, the flag will stay visible, but with a darker background to indicate that it is not selected anymore. This allows the Site Manager to observe the values of rules of more than one location at a time.

Weather (UC 2.2.7)

Wind direction and wind speed is represented in the top right corner of the map.

Sortable Alert List (UC 2.1.2)

The alert list is sortable by location, type and time. A button in the bottom app bar sets the sorting.

Figur 25 Alert list in sorted by time, location and type

Disable map (UC 2.2.8)

As an experiment, a rough design of a map-less interface was included in the prototype, in order to enable an early test of the feature. A button on the app bar disables the map, and then each location is represented by large tiles in a grid.

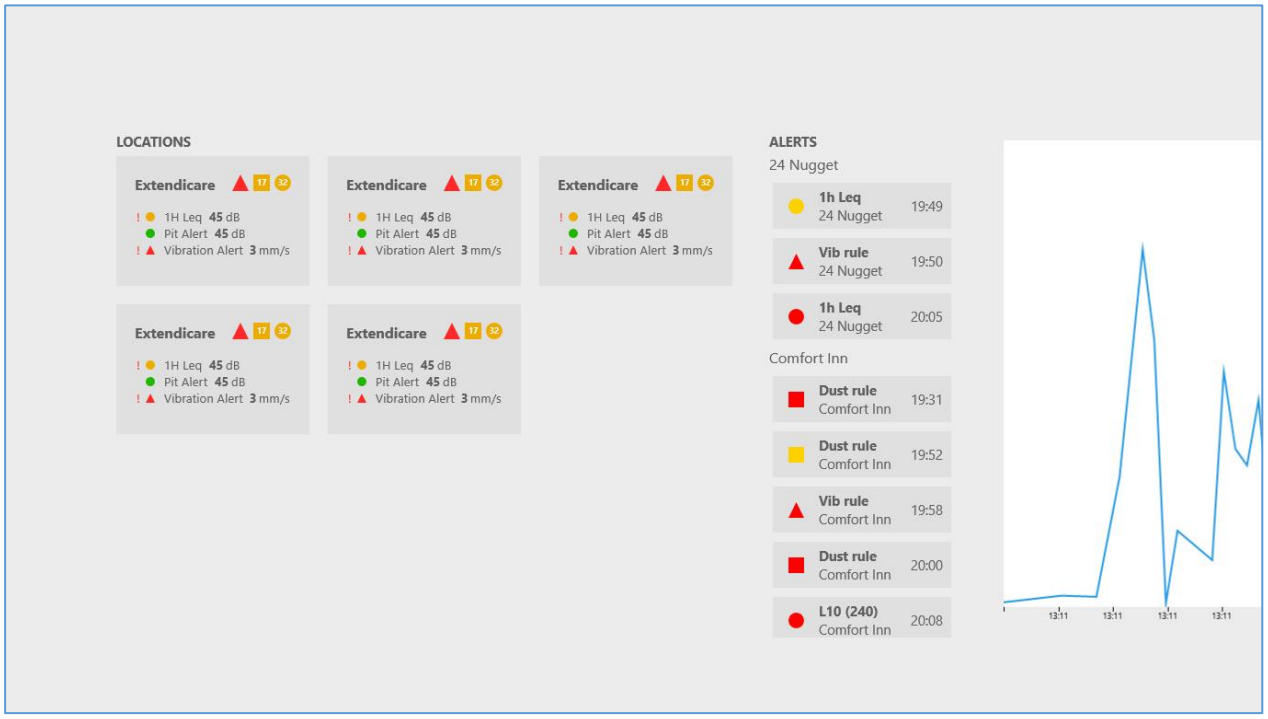


Figure 26 No map in overview mode

Drag n drop alert on chart (UC 4.2.2)

Another experiment was to enable drag n drop of alerts onto the chart area. This should change the context of the chart to the location and type of the alert, as well as zoom the time to alert timespan. In the prototype, the only effect of dropping is that the jpeg representing the chart changes.

3.4.3 Prototype 2 Test Group

Name	Education	Age	Noise Sentinel role	Desktop RTCA experience	Tablet experience	Test role
Martin Iversen	Higher Trade exam, Forwarding agent	40	Deployment PM	Setup, Checks, Daily use support. A lot of customer contact.	Almost, only a bit Ipad experience.	User + expert
Tomasz Cielecki	Engineering stud.	24	Mobile development	Dev only.	None	expert
Jeppe Kronborg	It engineer	27	None	None	Android	User
Niels Bruun Svendsen	Electronic engineer	50	Managing Development	Yes – from development perspective	Windows 8	User + expert
Christian Bækdorf	Computer Science	42	Software Architect	Yes – from development perspective	Windows 8	expert
Sissel Scharling	Humaniora student	31	none	none	Ipad	User

3.4.4 Prototype 2 Test Procedure

The test procedure contains two parts. In the 'User Test', the test subject pose as Site Manager, and is asked to complete some tasks, while thinking aloud. In some cases the test subjects were asked to do the tasks standing or walking. Afterwards we discussed their observations.

Tasks

The list of tasks below was used as a checklist, some tasks were improvised.

1. Describe the map and its contents
2. Explore the interface
3. Select a location. Describe the effect that had.
4. How would you get the rest of the alerts back?
5. Locate the newest alert and activate the sound clip
6. Give it a comment of your choice.
7. Select and comment multiple alerts.
8. Check the current thresholds and values on Claimpost and Edwards (locations)
9. Sort the alerts by type
10. How would you visualize an alert in the chart?
11. Scroll right and select all alerts ad comment them

3.4.5 Prototype 2 Test Results Summary

The response from the test subjects were overall positive, especially regarding the commenting work flow, which everybody found easy and straightforward.

The “rotating” location icons on the chart are somehow delightful to use. One test subject rotated the location icons at least 20 times.

Many test subjects request a “Select All” button for selecting all alerts with one tap.

Enabling Drag n Drop on the alerts in the alert list has the unfortunate effect that users will accidentally drag an alert when they are trying to scroll the interface. Sometimes this happens with the map as well. It is a problem that there a so many elements are using the “slide” gesture.

The list of selected alerts will cover the main alert list when in investigation mode. This is frustrating, even though the list of selected alerts can be hidden by pressing the “Show/Hide List” button in the bottom app bar.

The fact that the location icon flags stays visible after another location is selected on the map causes some confusion with one test subject. It should be considered to make a more visible difference between a selected flag and a flag not selected.

The test subjects found that the interface was generally easy to use, and they were able to complete the tasks.

Testing an interactive prototype on the target platform is very different from testing in paper. The feedback is more concrete and directly usable.

The list of defects can be found in the Defects section of the Appendix.

3.5 Prototype 3

3.5.1 Description

The third prototype contains solutions for all first priority use case steps except 4.2.3 – “Hint sound clip on chart”.

The focus with this prototype is mostly on the investigation mode – the chart and the alert list. The prototype deals with issues found in tests of the first and second prototype, and use case steps not previously included.

Use Case	Use Case Step	Step name	Element	Priority
2 : Site Status overview	2.1.1	Alert Template	Alert list	A
	2.1.2	Alert Sorting	Alert list	A
	2.1.3	Alert Grouping	Alert list	A
	2.1.4	Alert Timeout	Alert list	C
	2.2.1	Location Icons	Map	A
	2.2.3	Current value on location	Map	A
	2.2.4	Indicate alert on map locations	Map	A
	2.2.5	Indicate severity of last update on map locations	Map	A
	2.2.6	Indicate severity of each rule	Map	A
	2.2.7	Weather	Map	A
3 : Alert Handling	3.1	Select alerts	Alert list	A
	3.2	Choose comment	Alert response	A
	3.3	Accept alert	Alert response	A
4 : Alert Investigation	4.1.1	Activate sound clip	Sound	A
	4.1.2	Sound player control	Sound	A
	4.1.3	Stop sound clip	Sound	B
	4.2.1	Data in chart	Chart	A
	4.2.2	Plot alert on chart	Chart	A
	4.2.4	Alerts on chart timeline	Chart	A
	4.2.5	Select alert on chart timeline	Chart	B
5 : Real time investigation	5.1	Real time data from location on chart	Chart	A
	5.2	Enable / disable parameters on chart	Chart	B

3.5.2 Design

Only new or changed features are described here. Minor changes are not described.

Alert List Grouping (UC 2.1.3)

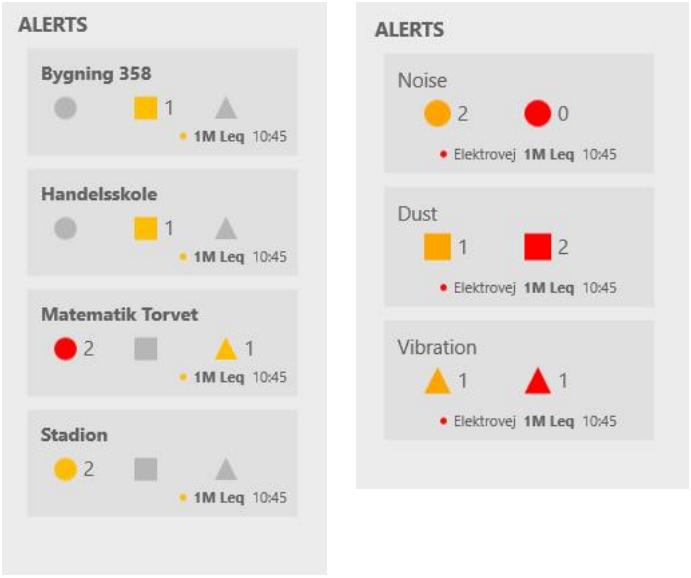


Figure 27 Alert Grouping

The alert list can be grouped by location or type by using a pinch ("zoom out") gesture over the list, or by tapping an "Alert Grouping" button in the app bar.
When grouped by location, each alert tile will display a summary of the alerts on each location that have any alerts, as well as the newest alert. Showing the newest alert is important, because the Site Manager is focused on the current status. An "old" group of alerts is less interesting than a new one.
When grouped by type, the group tiles will show a summary of the alerts of each type.

Select / clear all alerts (Defect P2_05)
The bottom app bar includes a "Select All Alerts" button, and when any alerts are selected, a "Clear Selection" button will also appear.

Alert Handling (Defect P2_02)
The list of selected alerts is now hidden as default when an alert is selected. The visibility can toggled by a button like before. The button is inverted to make it appear as if it filled with something –namely alerts. The icon on the button is the number of alerts in the list - it is updated on every new selection so that the user is confident the list is updated. The reasoning is that the Site Manager often do not care about the threshold and value – he knows that there has been a breach and he needs to why and how to stop it. He should therefore not be forced to deal with the details list, but it should be there if needs it.
In line with this decision, the list is now called "Alert Details" and a "Play Sound" button has been placed on the bottom app bar, so that sound clips can be activated without opening the Alert Details. Tapping this will add the sound clips of the selected alerts to a queue, and play them one after one.

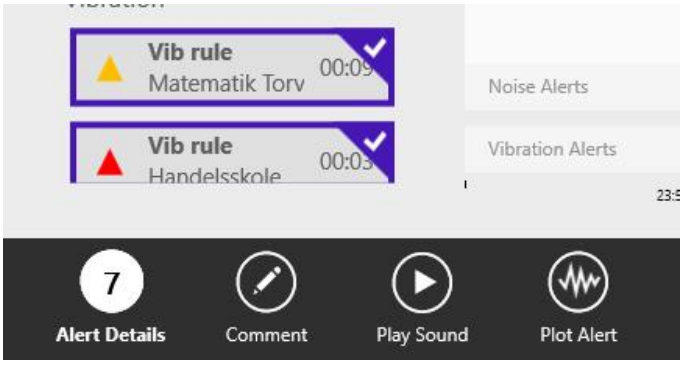


Figure 28 The list of selected alerts is now called Alert Details

Real Time Data On Chart (UC 5.1 + 5.2 + 4.2.4)

The prototype features an interactive chart. It designed like previous iterations, but with a few additions.

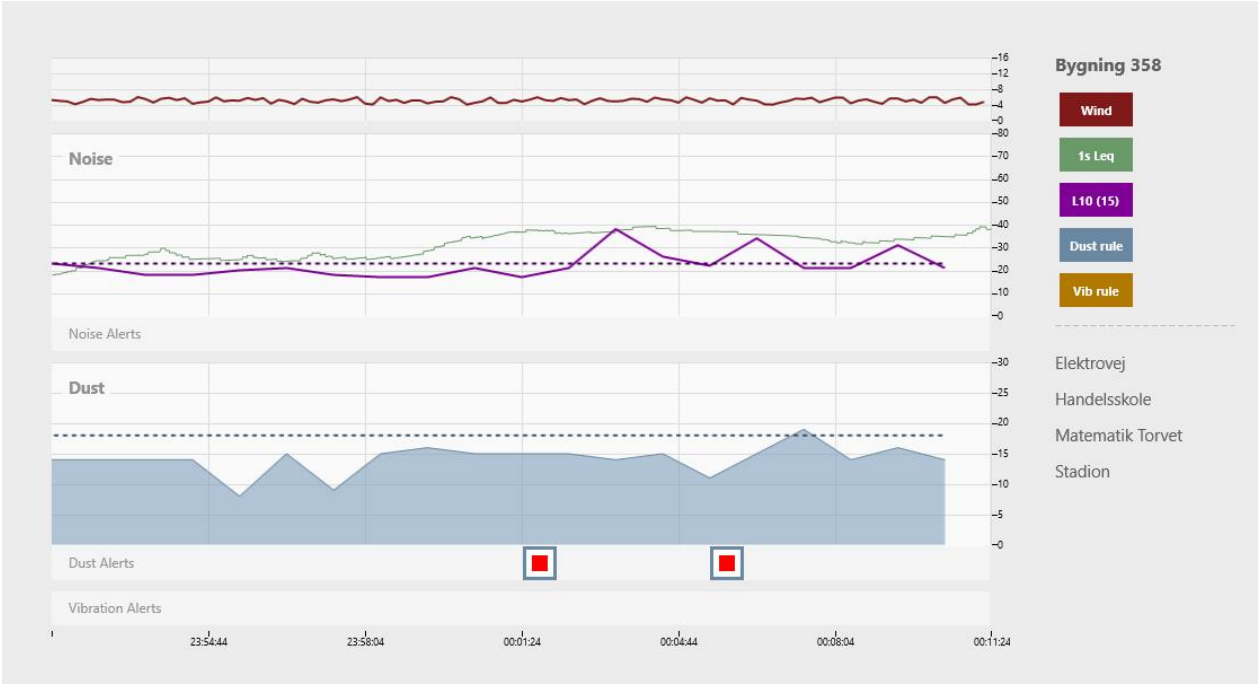


Figure 29 Interactive chart

Since vibration monitoring does not produce real time data, vibration is only represented with alerts in the real time mode.

An alert on the chart is represented with usual shape symbol. The outline of the alert identifies the rule that caused the alert, and the inner fill identifies the severity.

Figure 30 Alerts Icons for the chart

Alerts are added to the timeline as they triggered.
The alerts can be selected with the same effect of selecting an alert in the alert list.

Plot Alert (UC 4.2.2)
Using a button in the bottom app bar, the chart can be focused on a specific alert, like specified in UC 4.2.2. The time span of the alert will be slightly tinted, and details about the alert will be printed in the chart area.

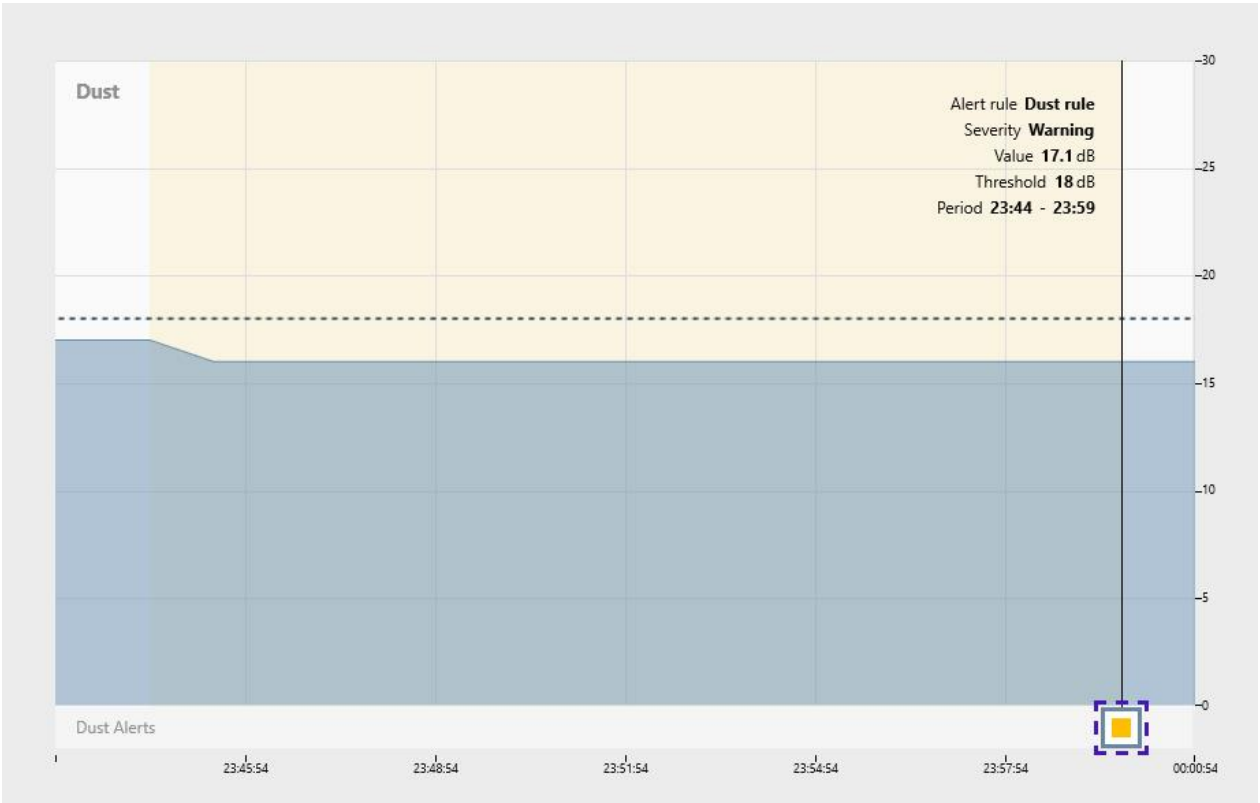


Figure 31 Alert plotted in chart

3.5.3 Prototype 3 Test Group

Name	Education	Age	Noise Sentinel role	Desktop RTCA experience	Tablet experience	Test role
Jeppe Kronborg	It engineer	27	None	None	Android	User
Niels Bruun Svendsen	Electronic engineer	50	Managing Development	Yes – from development perspective	Windows 8	User + expert
Jørgen Tomassen	Civil Engineer	60	Support Technician	Supports and trains users	None	User + expert

3.5.4 Prototype 3 Test Procedure

The test procedure contains two parts. In the 'User Test', the test subject pose as Site Manager, and is asked to complete some tasks, while thinking aloud. Some test subjects were ask to do the test walking or standing. Afterwards we discussed their observations.

Tasks

The list of tasks below was used as a checklist, some tasks were improvised.

1. Describe the map and its contents
2. Explore the interface
3. Sort the alerts by type and group them. Describe the grouped alerts.
4. Select alerts from the chart and comment.
5. How would you visualize an alert in the chart?
6. Scroll right and select all alerts and comment them.

3.5.5 Prototype 3 Test Results Summary

The test subjects regard the project as more or less done. The defects found were minor.
The list of defects can be found in the Defects section of the Appendix.

3.6 Final Prototype

3.6.1 Description

The final prototype refines the design of the previous iteration and adds a solution to the final first priority use case step 4.2.3 – “Hint sound clip on chart”.

Use Case	Use Case Step	Step name	Element	Scope	Priority
2	2.1.1	Alert Template	Alert list	In	A
	2.1.2	Alert Sorting	Alert list	In	A
	2.1.3	Alert Grouping	Alert list	In	A
	2.1.4	Alert Timeout	Alert list	In	C
	2.2.1	Location Icons	Map	In	A
	2.2.2	Feedback on no data from sensor	Map	out	B
	2.2.3	Current value on location	Map	In	A
	2.2.4	Indicate alert on map locations	Map	In	A
	2.2.5	Indicate severity of last update on map locations	Map	In	A
	2.2.6	Indicate severity of each rule	Map	In	A
	2.2.7	Weather	Map	In	A
	2.2.8	User position on map	Map	In	C
	2.3.1	Optional map	(Map)	out	B
3	3.1	Select alerts	Alert list	In	A
	3.2	Choose comment	Alert response	In	A
	3.3	Accept alert	Alert response	In	A
4	4.1.1	Activate sound clip	Sound	In	A
	4.1.2	Sound player control	Sound	In	A
	4.1.3	Stop sound clip	Sound	In	B
	4.2.1	Data in chart	Chart	In	A
	4.2.2	Plot alert on chart	Chart	In	A
	4.2.3	Hint sound clip on chart	Chart	In	A
	4.2.4	Alerts on chart timeline	Chart	In	A
	4.2.5	Select alert on chart timeline	Chart	In	B
5	5.1	Real time data from location on chart	Chart	In	A
	5.2	Enable / disable parameters on chart	Chart	in	B

3.6.2 Final Design Presentation

This section is a general presentation of the final prototype.

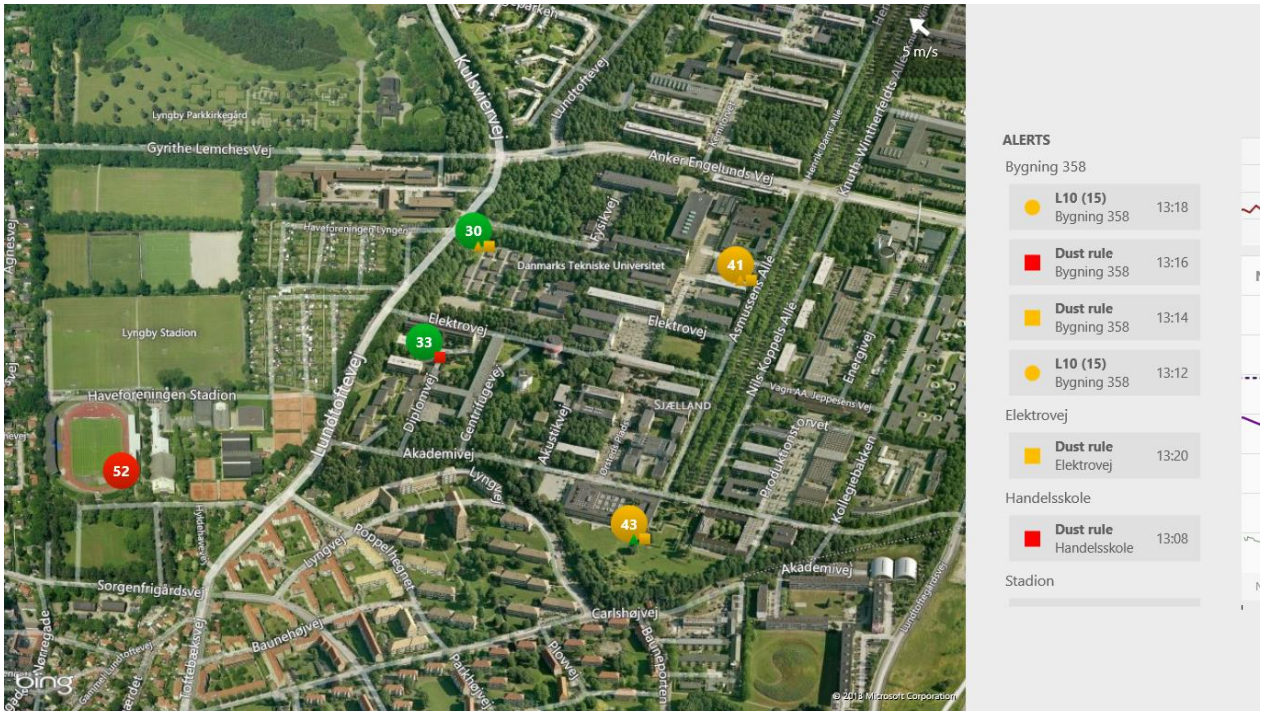


Figure 32 Overview mode

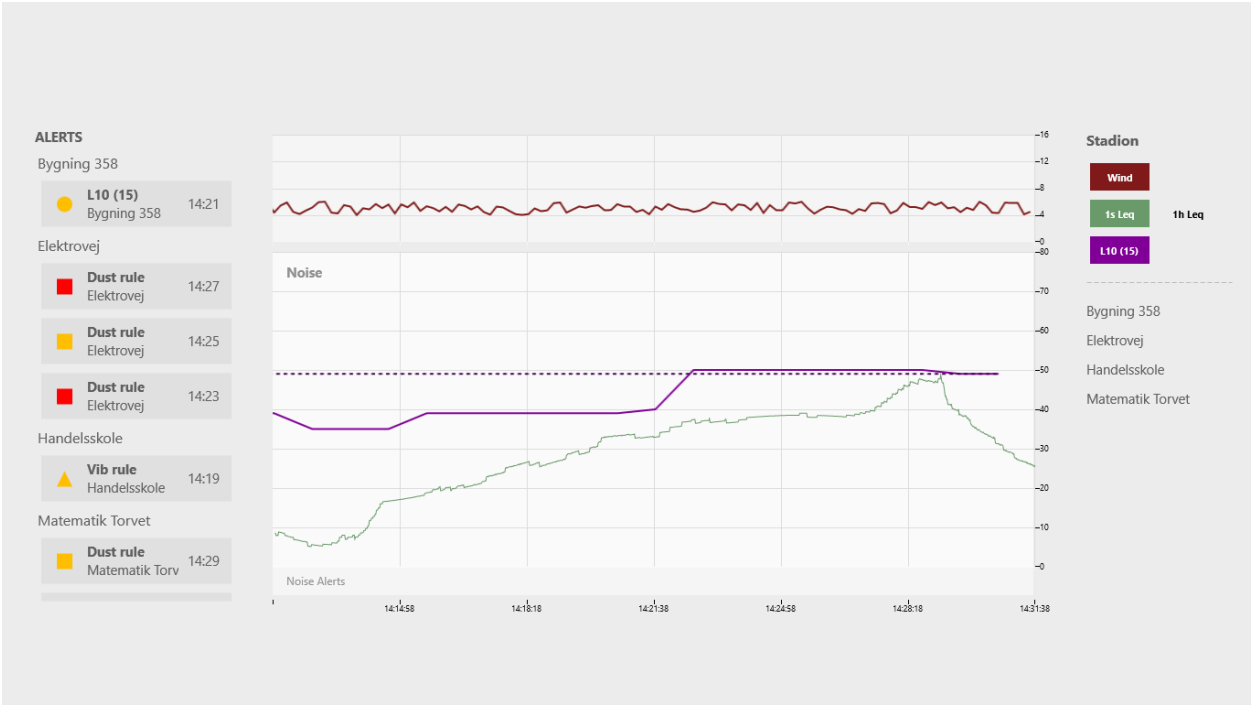


Figure 33 Investigation mode

The layout maintains the split between overview and investigation modes, that was suggested with the first mockup. The overview mode is designed to let the SiM obtain an overview of the current monitoring

across all locations and the investigation mode lets the SiM explore single locations and alerts in greater detail.

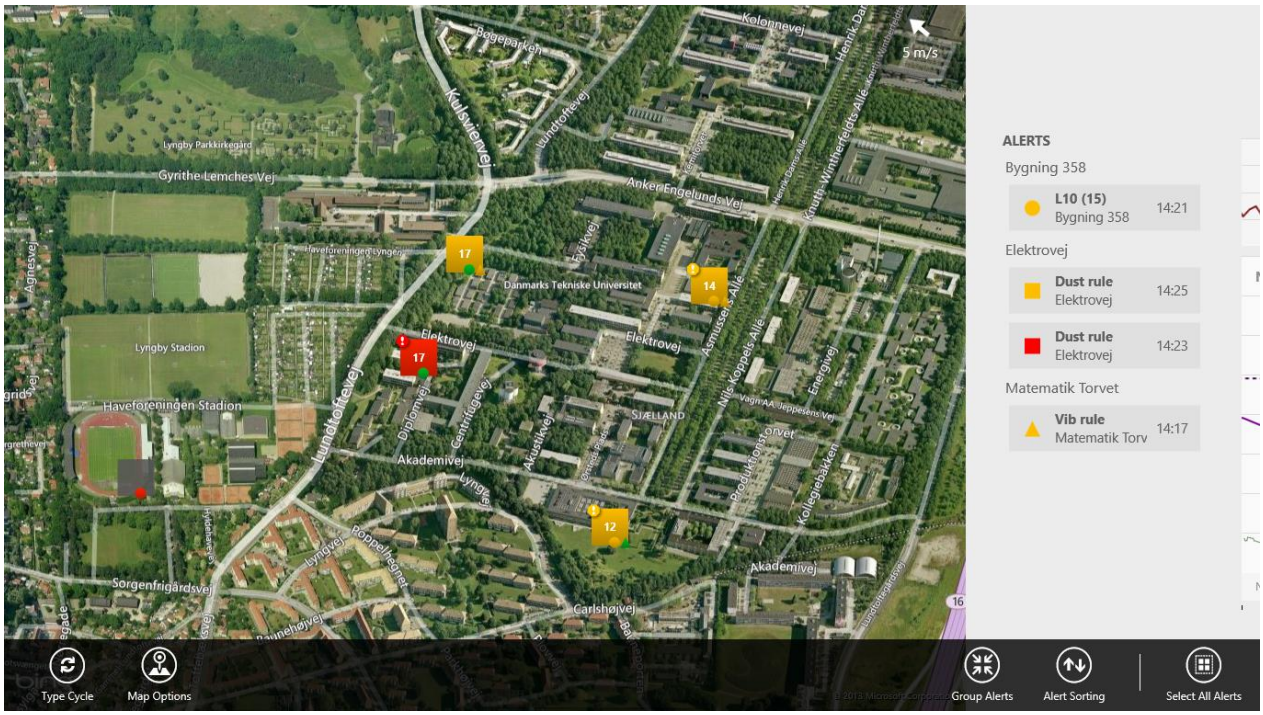


Figure 34 App bar controls

The app bar contains controls to let the SiM customize the interface to his specific needs by sorting and grouping alerts, cycle the location icons and change map options.

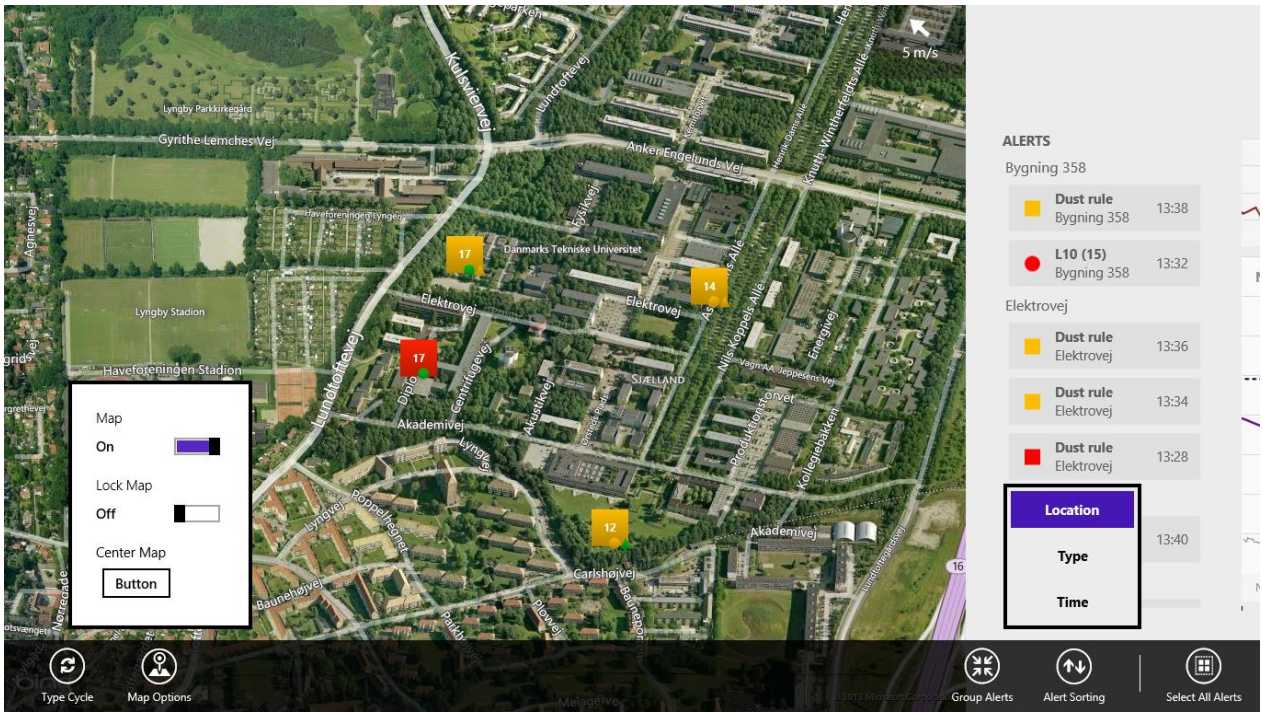


Figure 35 App bar flyouts

To limit the number of buttons in the app bar, some of them activates flyouts with additional controls.

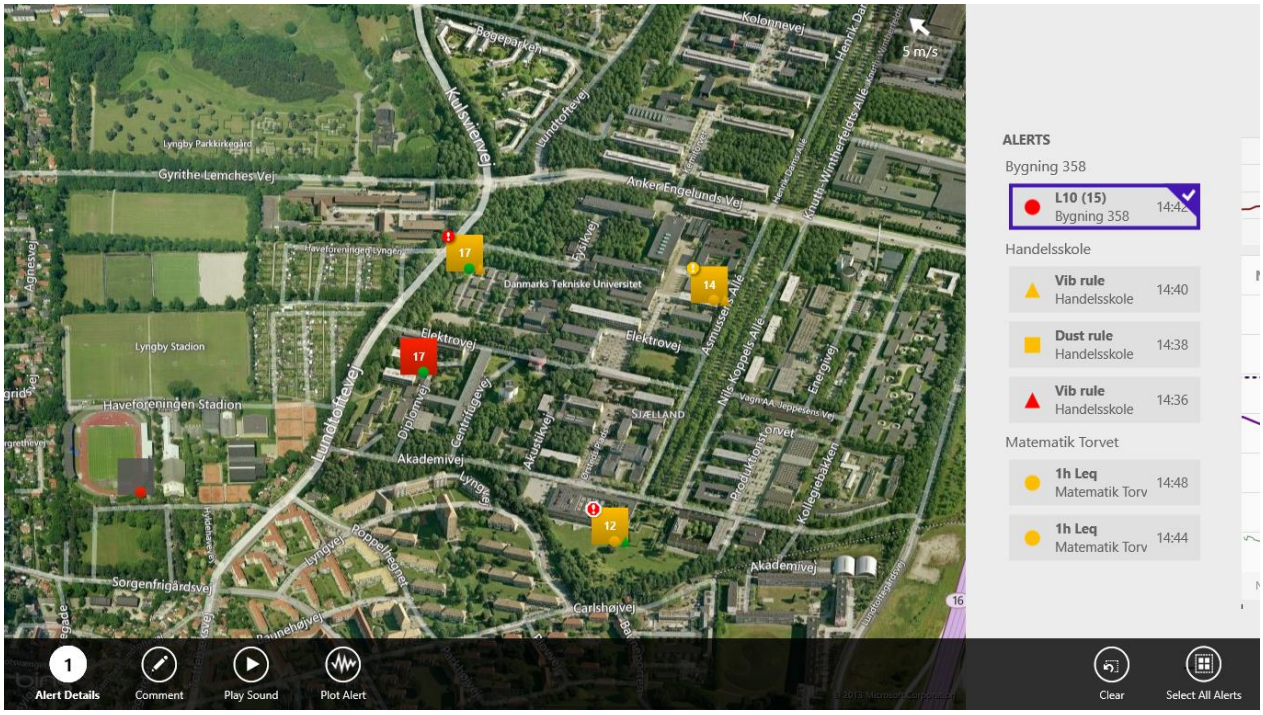


Figure 36 Alert selected

The app bar contains a different set of buttons when an alert is selected - the interface adapts to the task, and shows only the currently relevant controls.
The left group of buttons contains buttons relevant to the current selection, and the group of buttons to the left contains buttons that changes the selection.

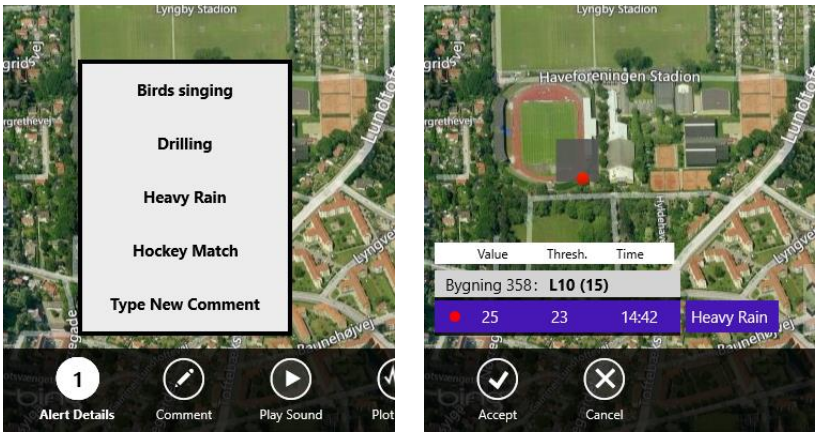


Figure 37 Commenting flow

Figure 38 Alert selected on real time chart

In investigation mode, the alerts are represented on the chart and can be selected. This makes it easier to understand how the alerts relates to the flow of data, and creates a better interplay with the alert list. By tapping the Plot Alert button, the selected alert will become the focus of the chart, time wise and in regard to the selected location and visible parameters. The timespan and position of the sound clip attached to the alert is drawn on the chart, so that the SiM can get a better understanding of the clip, and how it relates to the rest of the alert period.

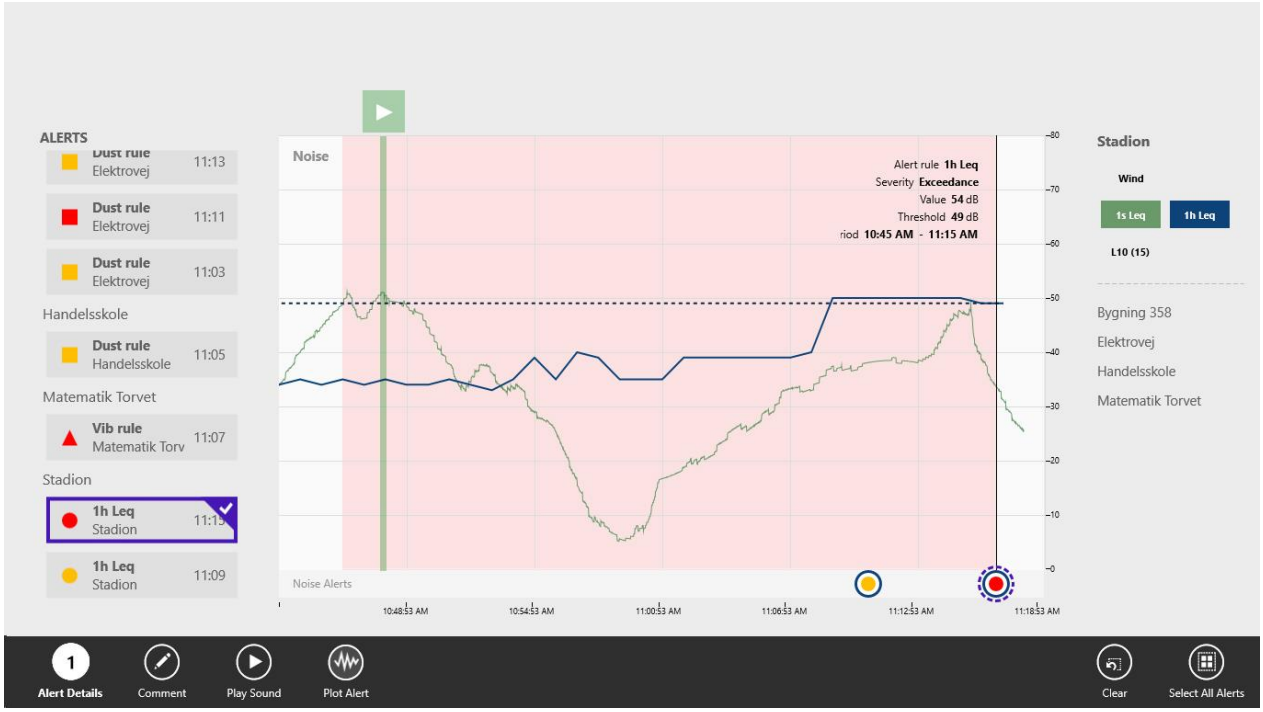


Figure 39 Plot Alert makes the selected alert the focus of the chart

The chart can be set to show real time data by selecting a location from the list to the bottom right. This will change the timespan of the chart to ten minutes, and set the context to the selected location. The chart is divided into areas for each type, these areas can be switched on and off by tapping the colored legend items under the location name to the top right.

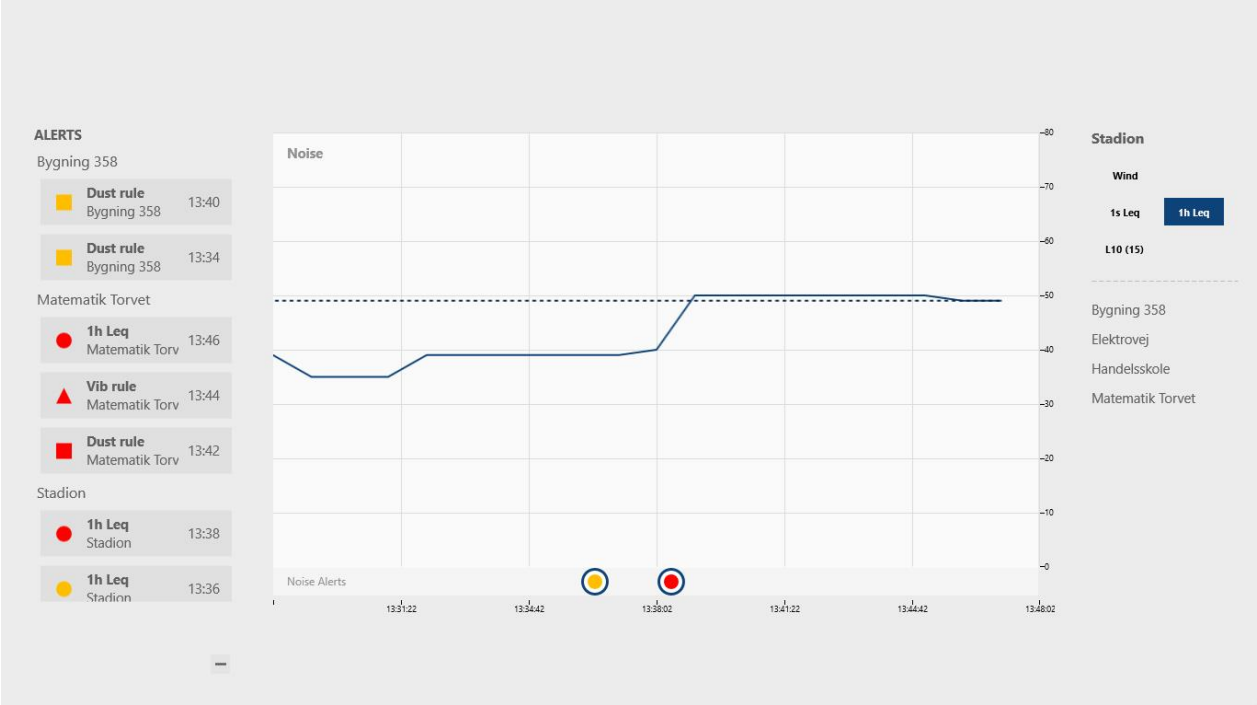


Figure 40 Real time chart

Usability Goals

The test of the third prototype is used to evaluate the usability and user experience goals, as the difference between the final and the third prototype is minimal. This test showed the users did not have any problems performing the tasks they were given, and they did not need the 20 minutes of instructions. The earlier tests also showed that the test subjects in general found the interface easy to use and quick to learn. The usability requirements are therefore deemed to be fulfilled.

User Experience Goal

The user experience goal was to adopt the Modern UI design language and design principles.
It is difficult to set up an objective criteria to determine if it was achieved, although the feedback from the final review was positive in this respect. I will argue that the goal has been fulfilled in the next section.

Modern UI Design Principles

- Show Pride in Craftsmanship
  A lot of effort was put into the final polish of the prototype, specifically in terms of interaction flow and usability. The layout builds on the standard layout grid, except that the map is drawn edge to edge.

- Be fast and fluid
  A written report is not a great medium for documenting motion, so this part of the design has not been mentioned, but the prototype makes full use of the support for animations and transitions in Windows 8.
  The use of motion aims to create a sense of tactility in the interface.

- Be Authentically Digital
  The visual design is minimalistic, and some care has been invested in the typography. Being "Authentically Digital" also means using bold colors, but in the case of this app, a lot of grey has been used, in order to make the color coded content more recognizable.

- Do More With Less
  The layout contains no persistent navigational controls, except the invisible scroll control, that let the user swipe between the left and right side of the layout.

- Win As One
  The standard gestures are used for their intended purpose, except that the alerts in the alert list are selected by tapping rather than swiping, as the UX guidelines suggest. Swipe selection was disabled because users would accidentally swipe select and alert, when they were trying to scroll the layout.

Touch friendly
The layout of the app is designed for easy interaction, by placing the controls in the touch friendly areas along the edges of the screen.

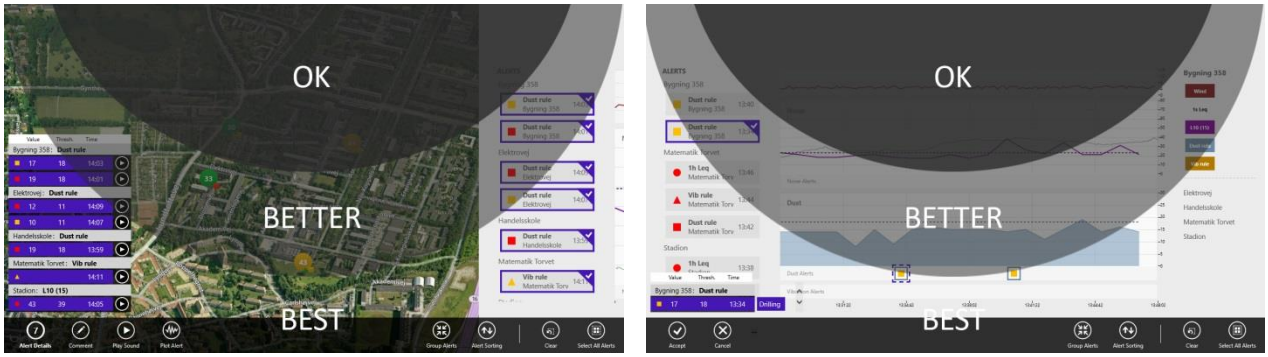


Figure 41 Touch friendly areas superimposed over the layout

Design Patterns
The design of the interface is based on tiles and the bottom app bar, which makes it recognizable as a Windows 8 interface.

Although there is no objective way to prove that the user experience goal has been fulfilled, it is at least made probable through the argument above.

3.6.3 Final Review

The final review was done with

- Niels Bruun Svendsen, manager of development
- Douglas Manvell, Application Specialist and Acoustical Expert
- Daniel Saunders, Key Market Driver in Europe

Douglas is the foremost expert in the Noise Sentinel team regarding user needs, and Daniel, as a sales person, deals directly with customer requests.

The purpose of the review was to validate the prototype as a suitable candidate for future development. Using the use case requirements as a checklist we stepped through the interface and discussed the proposed solutions.

The review was positive. They all liked the prototype and found it to fulfill the target requirements, and they were able to recognize their input in the prototype.
When asked if they could imagine this prototype set into actual use, the response was “absolutely”, although some details might have to be adjusted.
They were asked to compare it to the current RTCA and evaluate positive and negative differences.

Positive
It has a slickness to it that the current RTCA lacks. It is inviting to use. A lot of focus has been put into adopting the platform design language.

Mapping alerts and sound clips on the timeline is a step forward.

The current RTCA favors sound monitoring; dust and vibration are treated as secondary because the system originally only supported noise monitoring. The prototype is more attuned to the current monitoring types.

Negative
It is more difficult to read from a distance, partially due to the smaller tablet screen. As a control-room screen it can appear more complex from a distance.

Conclusion

4.1 Conclusion

The goal of the project was to create a user interface concept for the Noise Sentinel Real Time Control Application, designed for the Windows 8 and Windows RT tablet platform.

Functional requirements were gathered in the initial analysis phase by analyzing the domain, exploring the current version of the application, interviewing domain experts from the Noise Sentinel team, and modeling the information into use cases. Non-functional requirements were defined to set goals for the usability and user experience of the interface. The final part of the analysis was to study the platform design language and principles, by looking at existing designs and reading the Windows 8 User Experience Guidelines.

On basis of the requirements, the design phase was initiated by creating a number of mock-ups that explored different design solutions. The mock-ups were evaluated with Noise Sentinel experts and formed the foundation of the work to create more elaborate and testable prototypes.

The test of the first prototype indicated that the design was moving in the right direction, and the subsequent prototypes was more or less elaborations and refinements over the concept proposed in the first. It was fortunate that a good design concept was found relatively early, as it provided time later in the process to refine and polish the design and create a prototype that allowed almost all the design solutions to be tested interactively. It is a testament to the usefulness of mock-up experiments.

The prototype tests proved that the interface is easy to understand and easy to use. I have argued that the prototype successfully adopts the Modern UI design language and principles, thus deeming the non-functional requirements fulfilled. Design suggestions for all “A” priority functional requirements have been proposed and tested, except for use case step 4.2.3 which was only included in the final prototype and therefore not tested. It was, however, part of the final review where the design was validated.
The success criteria can be said to be fulfilled, with the exception of use case 4.2.3.

4.1.1 Known issues

Accessibility
The interface is not suitable for people who are color-blind.

Not tested with real time input
If the prototype was fully implemented to receive real time data, some hidden defects would most likely appear.

Test Group
The test group changed members throughout the project, but it is possible that there should have been more substitution. If a test subject has tried one iteration of the application, he or she will probably find it easier to figure out the next.

Also, if the prototype was tested with actual users, rather than Noise Sentinel employees posing as users, new issues would likely be uncovered.

APPENDIX

5.1 Terminology

Site

A site is the entire space where monitoring takes place. It could be, for example, a mine, a recycling plant or a construction site. From a technical perspective a site is the collection of locations set up to monitor the environmental impact originating from the activity at this space. Current sites have between 1 and about 20 locations. Customers can have multiple sites.

Location

A location is a spot where monitoring is performed in the site. It may be, for example, a noise monitor, a vibration sensor, a dust sensor, or a weather station or both all of them.

Alert

An alert in Noise Sentinel is triggered when the threshold of an Alert Rule has been breached (Exceedance), or if it is within a certain margin of being breached (Warning). The

Alert Rule

An Alert Rule defines a method of calculating the level of the monitored values, and a threshold to evaluate these values against.

Exceedance

When a threshold has been breached an alert with the severity of *exceedance* will be triggered.

Warning

An alert rule can be set up to produce alerts with the severity of *warning* if the monitored value is near the threshold.

5.2 Abbreviations

NMT

Abbreviation of Noise Monitoring Terminal, B&K's own noise monitoring hardware.

EMS

Abbreviation of Environment Monitoring Solutions, a division of B&K focussed on creating solution for

B&K:

Abbreviation of Brüel & Kjær, the company behind Noise Sentinel.

RTCA

Abbreviation of Real Time control Application.

NS

Abbreviation of Noise Sentinel.

UC

Abbreviation of Use Case.

5.3 Monitoring the Environment

In this section I will provide a short description of the standards of environmental monitoring, and how it is evaluated in Noise Sentinel.

5.3.1 Noise

Commercial environmental noise monitoring means evaluating if the monitored noise levels breach certain thresholds set by local, national or international authorities. The raw noise data is always subjected to a statistical calculation before the evaluation is done. A simplified example could be to find the average dB over an hour and see if it is higher than 50 dB. Below is a list of the most common statistical methods:

L10 (x)	The level exceeded 10 % of the time. If the value is 45dB, then the sound level was higher than 45 dB 10 % of the duration x. This is the most common rule for traffic noise monitoring.
L90 (x)	The level exceeded 10 % of the time.
LA10(x)	'A' defines a weighting in the noise level measurement. Otherwise similar to L10.
x Leq	Energy content of a noise over a duration x – similar to the mean dB. In Noise Sentinel 1second Leq is used for realtime data.

Source: http://www.epd.gov.hk/epd/noise_education/web/ENG_EPD_HTML/m2/types_3.html

Setting up a noise alert rule in Noise Sentinel thus involves selecting a statistical method and setting a threshold.

5.3.2 Dust

Dust is divided into different size ranges, for example PM10. PM is short for Particle Matter and 10 means that the sizes of the particles are 10 microns or less.
The measured amount of dust can then be denoted **30 PM10 µg/m3**, meaning 30 microns of PM10 particles per m3.
Dust regulations are defined for a given duration, for example '**40 PM10 µg/m3/8 hours**'. This means the limit is an average of 40 microns of PM10 particles per m3 over 8 hour durations. The measurement is typically made continuously, for example every 15 minutes or every hour.

A European Commission directive[i] has set the following limits:

Yearly average: 20 PM10 µg/m3/365 days
Daily average: 50 PM10 µg/m3/24 hours
Allowed number of exceedances per year: 7

5.3.3 Vibration

Vibration is usually measured individually in all three dimensions, and regulations will typically apply to vibration in individual axes, rather than the sum of vibration in all three axes. When vibration is evaluated, it is common to look at the Peak Particle Velocity (PPV). PPV is the maximum rate of displacement during an event, and it is measured in millimeters per second (mm/s).

Vibration monitoring differ from noise and dust monitoring in the sense that the values are not statistical. A typical rule could be to trigger an alert if PPV exceeds for example 10 mm/s.

In Noise Sentinel, vibration also makes a special case since no real time values are produced. Values will only be sent if alerts are triggered.

5.4 Current RTCA usability observations

Positive observations

1. It is easy to maintain an overview of the site, as long as there is no alerts.

2. The alerts are big and colourful and it is easy to see when an alert has been triggered.

3. When an alert is triggered the navigation required to comment and accept it, is minimal and very effective, unless the alert you want to comment is in a group with many other alerts.

4. The list of alerts allow multiselect, so that many alerts can be commented and accepted in one go.

5. The historic view gives a good impression of threshold contra value.

6. The realtime update of icons shows that the system is online in an informative way.

7. The icons show a lot of information in a dense and effective way, without clutter.

Negative observations

1. A location can monitor more than one kind of data (e.g. noise and dust), but only one real time value is shown in the icon, the 1sec Leq value.

2. The color of the circle indicates the most severe of the latest alert rule evaluations of any kind. so if a vibration rule was the most severe, the circle will indicate the vibration alert severity, while the triangle will remain blue, even though the circle means noise and triangle means vibration. This is misleading. The icon could be more flexible and dynamic.

3. It is not easy to get an overview of the alerts if there are many of them. It is a list of small fiddly text.

4. Alerts and data graphs are separated. It would be nice to be able to see an overview of alerts, at the same time as the graphs. It would make it possible to see if a number of events are triggered by the same continuous noise.

5. The sound clips are usually about 15- 30 second long, but the alert rule period can be as long as 4 hours, and there is no way of telling how representative these 15-30 seconds are of the entire period, except that we know that the system has picked these 15-30 seconds because this is where the sound level peaked. Plotting alerts on the graph would be a help.

6. The color palette of the graph is very narrow, meaning that it is very hard to tell the lines apart. Apart from the 1sec leq all the lines are nuances of brown-orange or orange-brown. This makes

the graph unnecessarily hard to use.

7. The enlarge button in the graph seems unnecessary – why would you have it small?

8. When one event has been accepted, the dialog closes. If you want handle 5 events, you have to open the dialog 5 times. This can be an annoyance.

9. Upon opening the window, the first alert is selected, but it does not appear selected to the user.

10. The alert boxes are filled with tiny text, arranged so that you have to concentrate in order to make sense of it. A lot of the text seems to be superfluous, for example:

The headline is the location, and the sub-headline is the alert rule with the value. The long string of text in the bottom left then contains the same information again, as well as the period over which the alert was monitored, with day, month, year for both start and end date. This could be condensed a lot.

11. Some sites display the alerts grouped by location - all alerts from one locations are represented with a single box. Other sites show the alerts individually, but theres no option that allows the user to change this option. They would have to contact B&K and order a change in the interface. The interface could be more flexible and let the user set it up as he/she likes.

12. Most of the text on an alert box is bound only to the last Alert, and much of it might be irrelevant to the other alerts represented by the alert box. In the example above, there is 111 alerts, but the text only describe the details of the last. It would make sense to make a kind of summary of the group.

13. There is a help option, but it is a pdf, and it does not present itself as good as it could. It would be more helpful if the help was visible directly in the interface where it is needed.

14. The design is clunky and not in line with other products in NS family.

15. The locations are displayed in a list that will extend below the bottom edge of the screen, and for some reason it is not always possible to scroll this list.

16. The lines connecting location icon with boxes are not necessary and looks bad.

17. Too much small text makes the system appear more complex than it is.

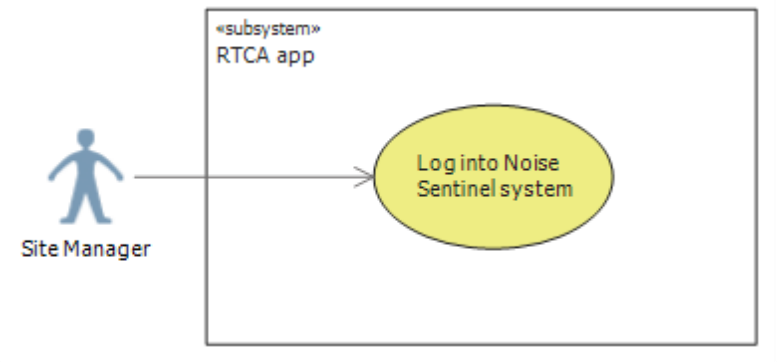
18. Not all users use the map – if the location for example contains only one location, the map does serve any practical use.

5.5 Use Cases

5.5.1 Use Case Matrix

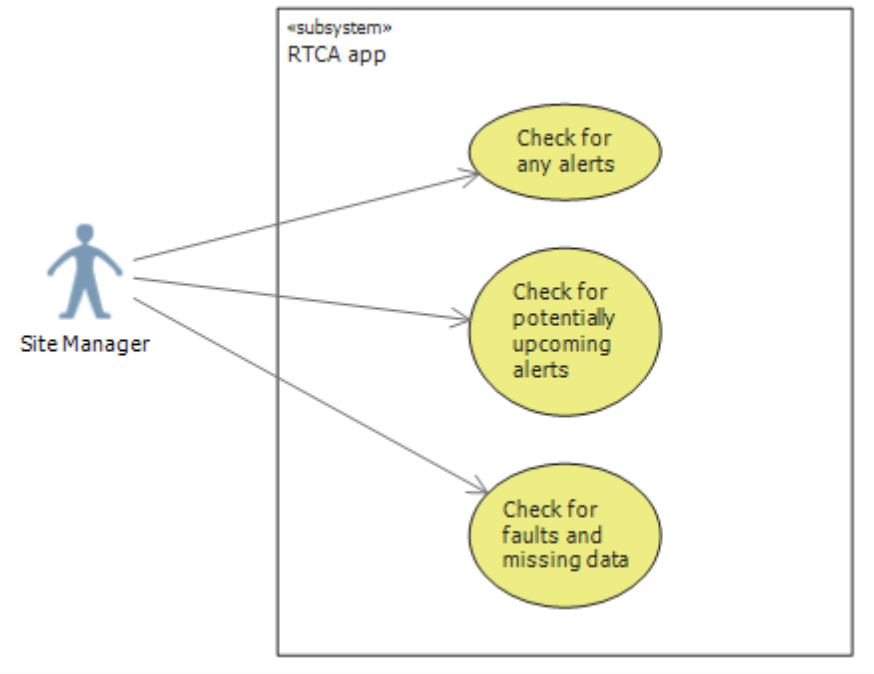
Use Case	Use Case Step	Step name	Element	Scope	Priority
2	2.1.1	Alert Template	Alert list		A
	2.1.2	Alert Sorting	Alert list		A
	2.1.3	Alert Grouping	Alert list		A
	2.1.4	Alert Timeout	Alert list		C
	2.2.1	Location Icons	Map		A
	2.2.2	Feedback on no data from sensor	Map		B
	2.2.3	Current value on location	Map		A
	2.2.4	Indicate alert on map locations	Map		A
	2.2.5	Indicate severity of last update on map locations	Map		A
	2.2.6	Indicate severity of each rule	Map		A
	2.2.7	Weather	Map		A
	2.2.8	User position on map	Map		C
	2.3.1	Optional map	(Map)		B
3	3.1	Select alerts	Alert list		A
	3.2	Choose comment	Alert response		A
	3.3	Accept alert	Alert response		A
4	4.1.1	Activate sound clip	Sound		A
	4.1.2	Sound player control	Sound		A
	4.1.3	Stop sound clip	Sound		B
	4.2.1	Data in chart	Chart		A
	4.2.2	Plot alert on chart	Chart		A
	4.2.3	Hint sound clip on chart	Chart		A
	4.2.4	Alerts on chart timeline	Chart		A
	4.2.5	Select alert on chart timeline	Chart		B
5	5.1	Real time data from location on chart	Chart		A
	5.2	Enable / disable parameters on chart	Chart		B

5.5.2 Use Case 1: Login



Not Defined

5.5.3 Use Case 2: Site status overview



Precondition
The SiM has logged in.

Flow
The SiM is presented with an overview of the site. The overview consist of a map and a list of alerts. The SiM checks if any alerts has been triggered, or if any alerts might be triggered soon.

The alert list is described in the following steps.

ID	Description	Notes	Priority
2.1.1	ALERT TEMPLATE The SiM needs to be able to differentiate the alerts, and determine where they were triggered, and which rule and measurement type caused them. Each alert should be presented with location, rule, measurement type, severity and time.		**A**
2.1.2	ALERT SORTING The SiM can regard the alert overview in a number of different scenarios: 1		**A**

	A lot of alerts of one type, e.g. Noise, have been triggered, and as he is investigating the cause, he is only interested in looking at noise alerts, and would therefore like to see them separately from the other types of events. Sort alerts by type. 2 In case of special situations on the site, for example explosions in mines, the SiM will know that alerts within a certain time interval have a certain cause. In this case it should be possible to sort alerts by time. 3 The SiM is investigating a certain area of a large site. He is only interested in the alerts that was triggered on locations which are positioned in this area. He should therefore be able to separate alerts by location. The functionality required in the 4 scenarios can be achieved with a sorted list, where the sorting method can be changed by the user.		
2.1.3	ALERT GROUPING Some sites produce a lot of alerts, and it should be possible for the SiM to get an overview of all the alerts. It should be possible to group the alerts in the alerts list. Instead of showing one box per alert, a grouped view shows only one box per for example type or location, depending on the sorting.		**A**
2.1.4	ALERT TIMEOUT If an event has been listed for a certain period of time, it becomes irrelevant, and is unlikely to be handled. The SiM should be able to set a time-out for when an alert is deemed too old for the alert list, and older alerts should not appear in the list.	Could be set in the settings menu.	**C**

MAP

The map lets the SiM tie the monitored data to the actual position on the site, and quickly assess if alerts at multiple locations could be triggered by the same environmental source.

The map is described in the following steps.

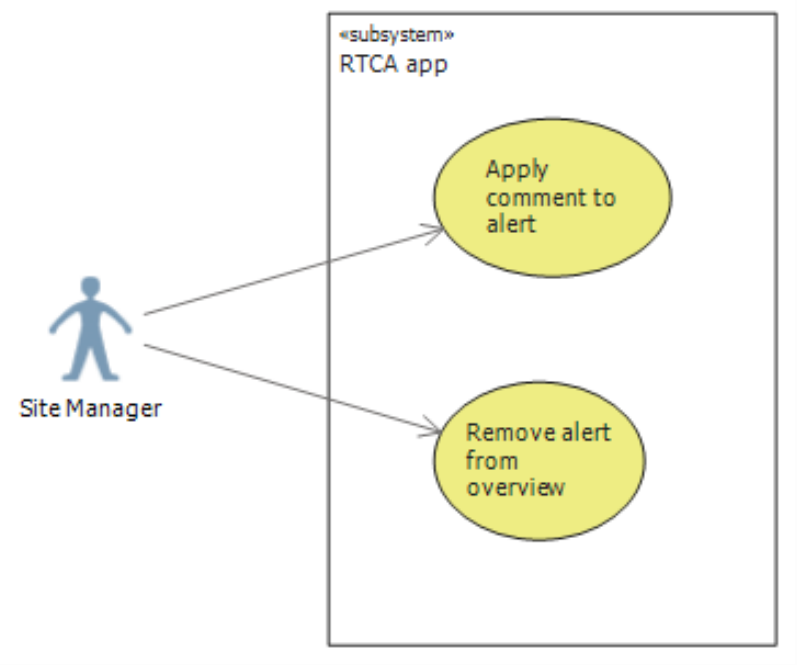
2.2.1	LOCATION ICONS The SiM needs to be able to look at the map and see each monitoring location, and he needs to be able to determine which types of measurements are made at each location. The standard symbols already used in Noise Sentinel should still be used: • noise = circle • vibration = triangle • dust = square		**A**
2.2.2	FEEDBACK ON NO DATA FROM SENSOR The SiM needs to be alerted if the system is not receiving data from a sensor.		**B**
2.2.3	CURRENT VALUE ON LOCATION This step has two parts: A) The SiM needs to get instant feedback from the system that it is online and is receiving data. If the monitored data features a current value, it should be shown in the location icon, so that the icon is frequently updated, and ensures the SiM that the location is online. B) The SiM needs to be able to look at the map and obtain an overview of the current levels of each type and on each location on the site, in order to evaluate the status of the current monitoring on the site. Like stated above: If the monitored data feature a current value, it should be shown in the location icon. However, in order to make the overview uncluttered and easy for the SiM to read*, only values of one kind of numeric data should be shown at a time on the map.	Note: Vibration does not produce a real time value. *: Imagine a site with 20 locations, and each location monitors at least two types of data that provides a current value. If all these values are shown simultaneously it will be hard to achieve an overview.	A

	If the location monitors more than one data type that features a current value, it should be possible to switch between them, either from a control next to the map, or from settings (requires some experimentation).		
2.2.4	INDICATE ALERT ON MAP LOCATIONS The SiM needs to tie alerts to a position on the site in order to evaluate possible causes, and evaluate if alerts on different monitors are related, and to decide further action. The SiM can see on the map if a location has unhandled alerts, and if the alerts are warnings or exceedances. A location with an unhandled alert should stand out visually on the map, for example by drawing rings around the icon like in the current RTCA. The SiM should be able to see if the unhandled alert is a warning or an exceedance, using the color code: Warning = orange Exceedance = red If the location has more than one alert, the color should be decided by the most severe alert.		A
2.2.5	INDICATE SEVERITY OF LAST UPDATE ON MAP LOCATIONS The map should show if an alert rule threshold has been breached at each locations, and which type of monitoring caused the breach. * The color coding should be similar to the existing, i.e.: Green = No alerts Orange = Warning Red = Exceedance	*: It would be preferable if the exact rule could be shown, but that is not expected to be feasible given the restricted space. Especially since rules change from site to site and therefore cannot be represented by general symbols.	A
2.2.6	INDICATE SEVERITY OF EACH RULE It should be possible for the SiM to see latest severity for each rule set up on a location.		**A**
2.2.7	WEATHER The SiM can see the weather status (wind direction, wind strength, possibly also rain) from all locations that have a		**A**

	weather station (not necessarily at the same time). If a Master Weather station has been set up in NS Client, then this should be shown instead.		
2.2.8	USER POSITION ON MAP The SiM can be expected to use the RTCA app while moving around on the site. If the host tablet has a GPS, the location of the tablet should be shown on the map, with an icon that sets it apart from the location icons.	Note: It can only be simulated in the prototype, because the test machine does not have a gps.	C

2.3.1	OPTIONAL MAP In some scenarios the SiM will prefer a simpler overview of locations than the map • Sites with 1 or 2 locations don't need the spatial aid provided by a map. • Even sites with many locations might only need the map occasionally, because some SiMs will know the site and the position of each location by heart. • On sites with many locations, the map might become cluttered on a small tablet screen. It should be possible to select an alternative view, which shows location information in a more grid-like manner that makes it simpler to obtain an overview. Each location should appear with the information defined in 1.3.1 - 1.3.6.		B

5.5.4 Use Case 3 : Alert Handling

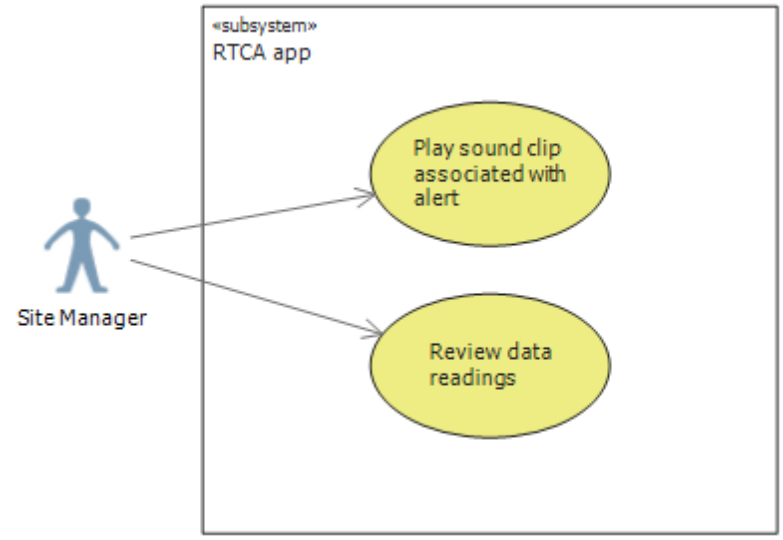


Flow

Precondition: The Site Manager has logged in to the app, and an alert has been triggered.

ID	Description	Notes	Priority
3.1	SELECT ALERTS The Site Manager can select alerts individually or in groups.		A
3.2	CHOOSE COMMENT FROM LIST In order to limit the annoyance of routinely writing the same words on the slightly awkward onscreen keyboard, it should be possible to select a comment from a list of predefined comments. The SiM should be able to add new comments to the list.	Niels: Possibly two options: Comment or Comment & save in list	A
3.3	ACCEPT ALERT The SiM can accept alerts, which marks them as seen, and removes them from the list of active alerts.		A

5.5.5Use Case 4 : Alert Investigation



The Site Manager is able to listen to a sound clip attached to the alert, in order to evaluate the cause of the alert as described in the steps below.

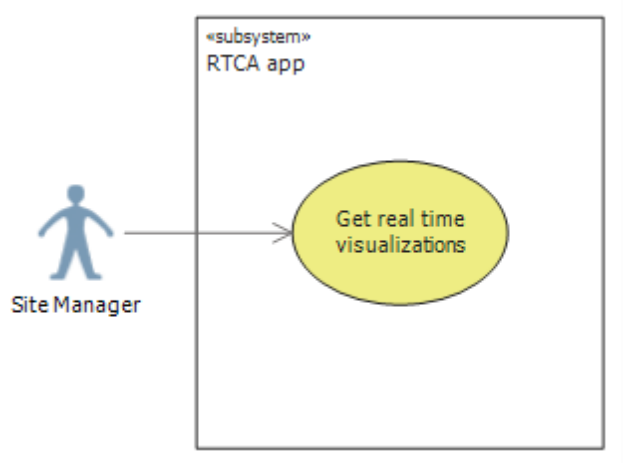
ID	Description	Notes	Priority
4.1.1	The Site Manager can select an alert and activate the sound clip attached to it.		A
4.1.2	The active sound clip should have a visual representation in the interface while it is playing, showing details about the clip: the current time and the location where it was recorded.		A
4.1.3	It should be possible to stop the sound before the sound clip ends.		B

The Site Manager is able to investigate an alert by reviewing visualized data as described in the steps below.

4.2.1	The Site Manager can observe visualized data in a Chart. The chart should show all chartable data on the same timeline, from one location at a time.	Chartable data: noise, dust, wind direction, wind strength, rain	A

4.2.2	The Site Manager can select an alert from the alert list and focus the time and location of the chart so that the alert becomes visual.		A
4.2.3	The position and duration of the sound clip is indicated on the chart, so that the SiM can relate it to the rest of the alert duration.		A
4.2.4	The Chart indicates on the timeline when an alert has been triggered, and if the alert is a warning or an exceedance.		A
4.2.5	The alerts in the chart can be selected with the same effect as selecting alerts in the alert list.		B

5.5.6 Use Case 5 : Real Time Investigation



Precondition
The SiM has logged in.

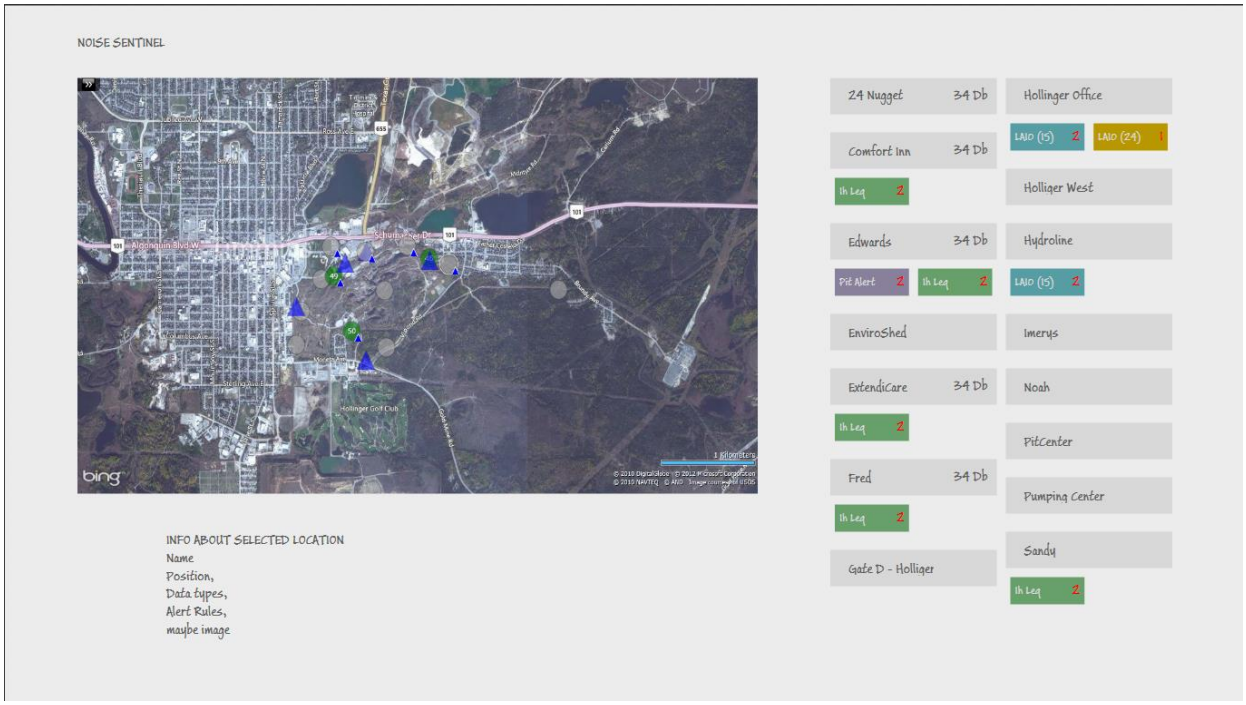
Flow
The SiM has identified a location he wishes to investigate. He selects it for the chart, and observe how the real time values behave in relation to the thresholds.

ID	Description	Notes	Priority
(2.20)	The Site Manager can observe visualized data in a Chart. The chart should show all chartable data on the same timeline, from one location at a time.	Chartable data: noise, dust, wind direction, wind strength, rain	A
5.1	The Site Manager can select a location and observe the real time data from location in the chart. The timespan of the chart should follow iso standards such as 1, 2, 5 or 10 minutes.	The current RTCA shows 5 minutes of real time data.	A
5.2	The Site Manager can enable and disable specific types and alert rules, so that the chart shows only the data he is interested in.		B
(2.23)	The Chart indicates on the timeline when an alert has been triggered, and if the alert is a warning or an exceedance.		A
(2.24)	The alerts in the chart can be selected with the		B

	same effect as selecting alerts in the alert list.		

5.6 Mock-Ups

5.6.1 Mockup 2



Figur 42 Overview mode - scrolled left

Figur 43 Investigation mode - scrolled right

Description
The second mock-up adds content to each of the three parts of the layout, and explores ideas for the interaction between the three parts. The mock-up is concerned with use case 2, 4 and 5, but does not The propose a way to handle alerts as defined in use case 3.

Map
The map area has been divided into two subsections, where the top section is the actual map with locations represented as icons, and the bottom section contains information about the location selected on the map. The actual image of the map is copied from existing Noise Sentinel software, and should not be considered.

Alert/Location list
The middle part of the layout contains the alerts listed under each locations. The idea of including the locations in this part of the layout is that it will offer a way to select locations by name, which could be useful both in operation mode and investigation mode, for example to change the data context of the chart, or to select a location you know the name of but not the position of.

The alerts are colour coded after the rule that produced them. Each alert item can represent multiple alerts generated by the same rule - the red number indicate how many.

The alerts/ location list flow vertically in columns. When one column is full, another will be created. This has the result that the area for the map and the area for the chart will shrink, but it will ensure that all alerts are always visible.

Chart
The chart visualize the monitored data from the location selected in the alert/location list. The chart is divided into areas, so that weather, noise, vibration and dust have separate areas, sharing the same timeline. The alerts for each type is listed in rows in the bottom of each area. The noise row shows both chart lines (rule value + rule threshold) and events, whereas vibration does not produce real time values, so only vibration alerts can be shown.

Evaluation:
The feedback was positive for the chart, but there was concern that the alert tiles were too small for comfortable interaction, but that if they were made bigger the alert/location list could take up too much space, making the area for the chart and the area for the map too narrow.

5.6.2 Mockup 3a

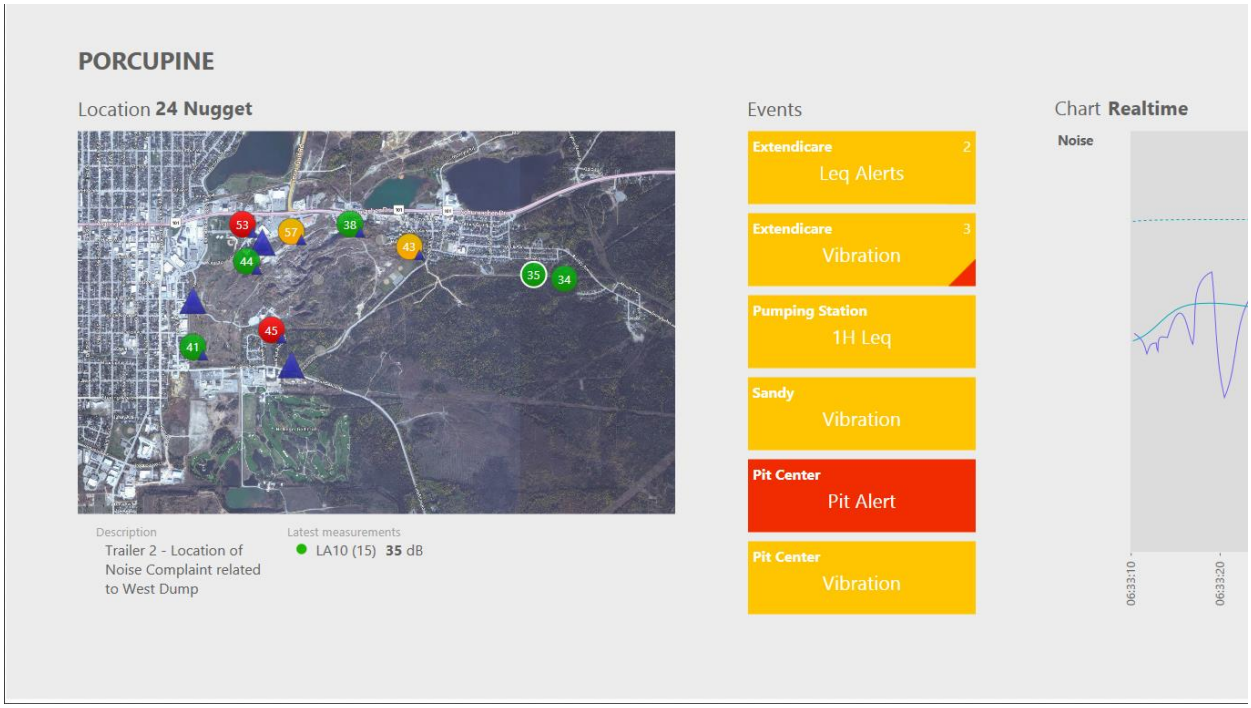


Figure 44 Overview mode - scrolled left

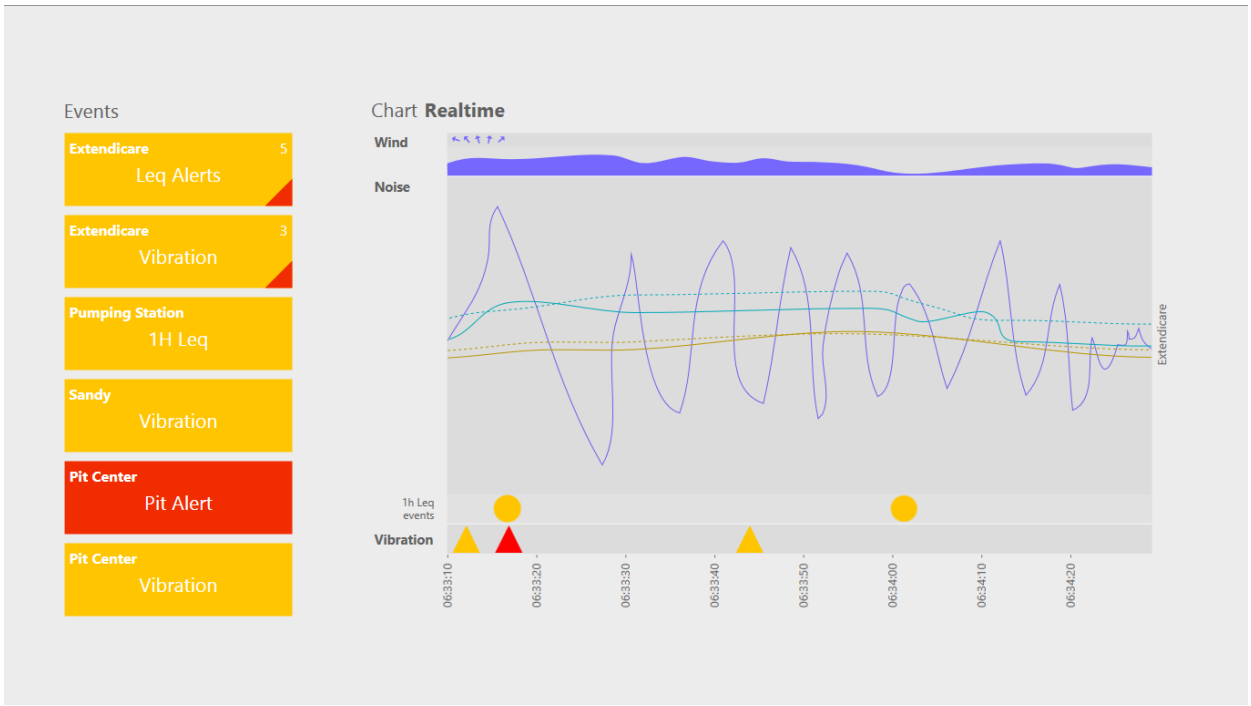


Figure 45 Investigation mode - scrolled right

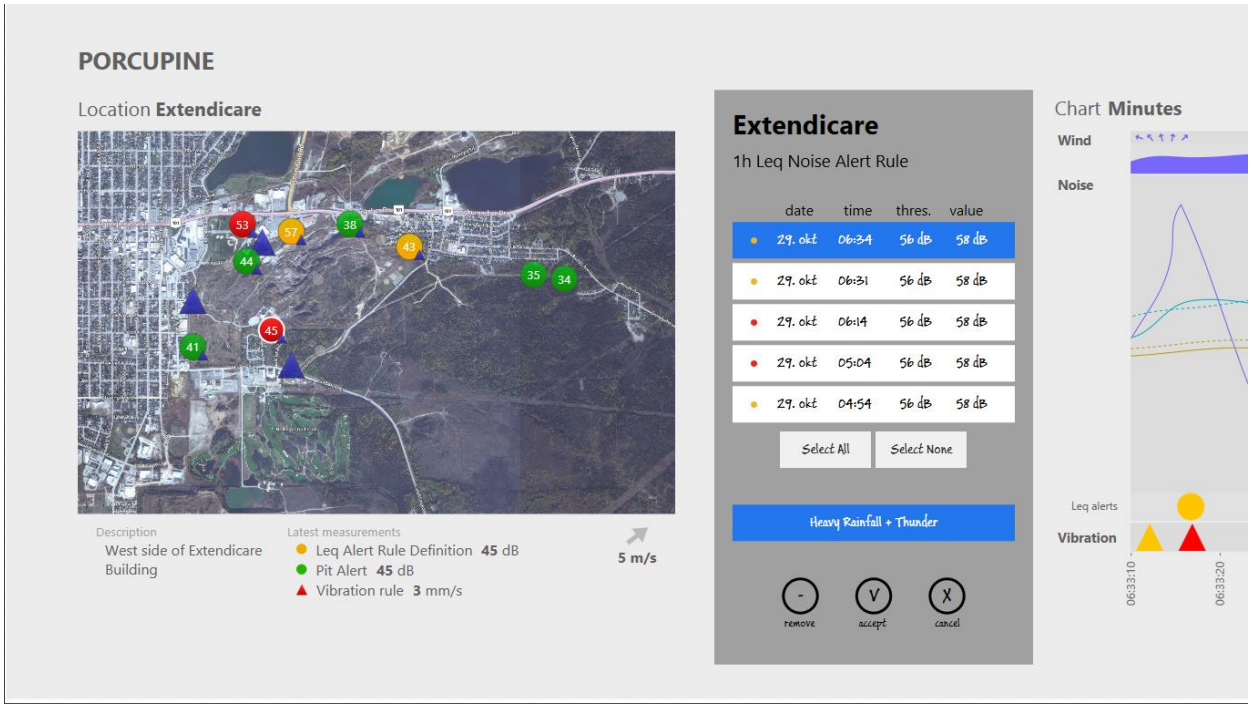


Figure 46 Alert response control

Description

This mock-up experiments with the alert list and explores an option for alert response, which also involves interaction with the chart. More effort has been invested in the map area, in order to present it in a more realistic way.

Map

Select a location on the map by tapping a circle (Noise) or triangle (Vibration). This will reveal information specific to the location in the area under the map. This information includes a list of the active alert rules on the location, with latest severity and latest calculated value. If the location features a wind station, weather information will also be provided here.

Alerts

The alert tiles in the list are very big and easy to tap, similar to the alerts in the current RTCA. The alert tiles are colour coded according to severity (warning = orange, red = exceedance). The alerts are identified after the name of the rule that produced them and the location where they were produced. Each alert tile represents all alerts generated by the same rule on the same location - the white number indicate how many.

Tapping an alert from the alert list will bring up the alert response control, with a list of alerts corresponding to the tapped

The list is scrollable, if the number of alerts requires it.

Alert Response

Selecting an alert from the alert list will bring up the alert response control over the alert list, so that it is visible in both overview mode and investigation mode. This control will let the user make more fine grained alert selection (Alert list alerts are grouped), and apply a comment to the selected alerts.

Chart
The data context of the chart is the location selected on the map. The alerts in the chart can be tap-selected and their selection status will correspond to the selection status of the alerts in the alert response control.

Evaluation
It is problematic that the chart is controlled by the map, when the map and the chart are designed to not be on screen simultaneously. The fact that they are divided by a third control makes it even worse.

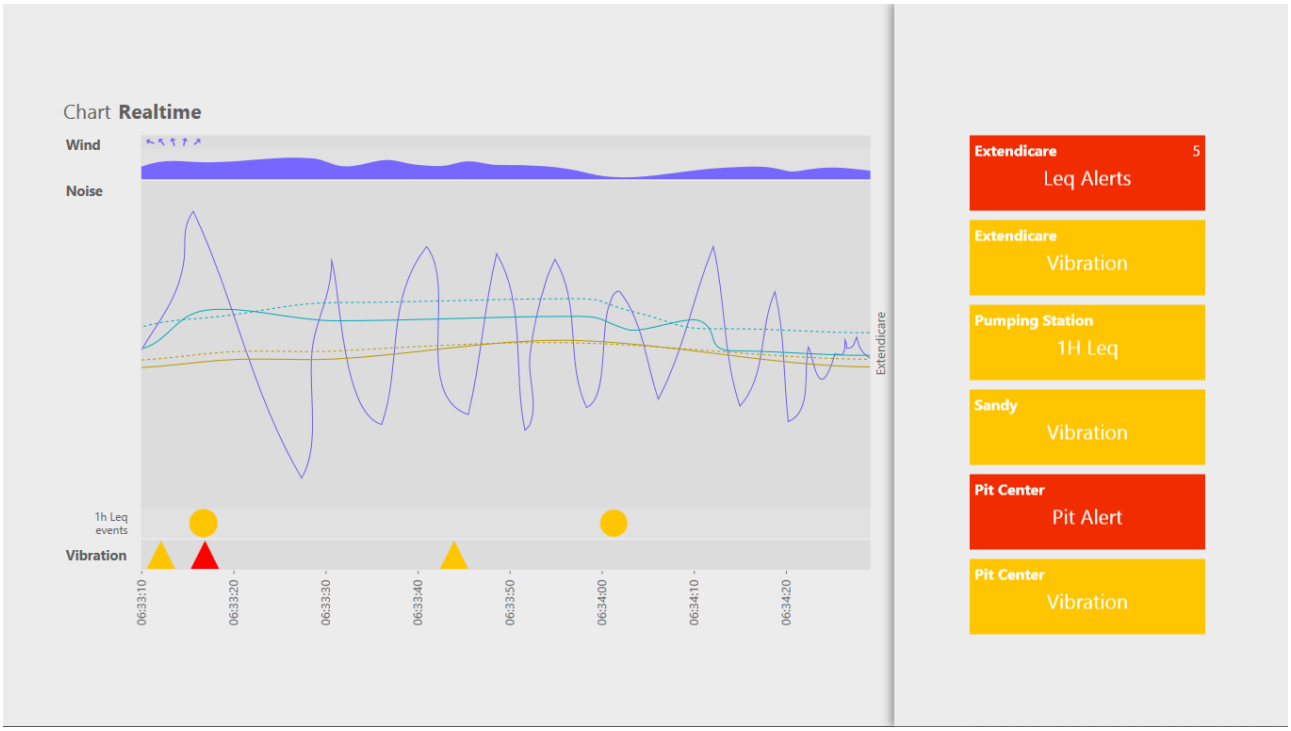
Using the area under the map for location information works well, but the map might be too small for large sites with 15+ locations.

It is problematic that the alert response control covers the alert list, because it means that the user cannot select more alerts from the list after it has appeared. If the user wants to apply the same comment to two alerts from two different locations or produced by two different rules, he would have to activate the alert response control two times. It would mean a lot of opening and closing of the dialog. The control cannot be inserted in between the alert list and the chart either, because that would disrupt the investigation mode.

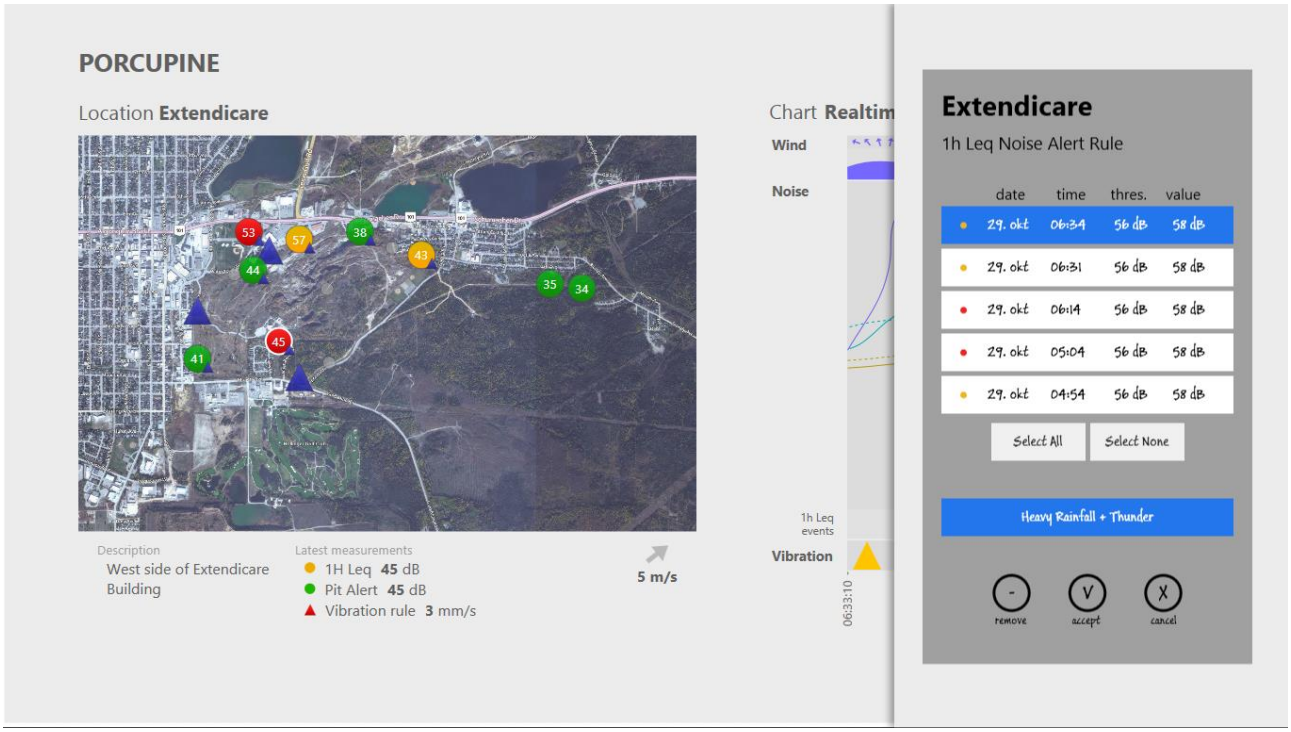
Enabling the user to select alerts from the chart timeline is good, as it ties the alert list and the chart closer together, and supports a strong mental model.

5.6.3 Mockup 3b

Figur 47 Alternative layout – overview mode



Figur 48 Alternative layout - investigation mode



Description

The purpose of this mock-up is to try out a different layout, where the alert list and the alert response control are put on a layer over the map and the chart. It aims to tie the map and the chart closer together, so that the data context of the chart can be selected on the map.

Besides the above, the description for the previous mockup also applies to this one.

Evaluation:

Since the right part of the screen is now static, only the left hand can be used to scroll the content.

The chart still needs the user to swipe away from it to change data context.

The layout is somehow less pleasant. The layering paradoxically makes the design feel more ”flat”. It does not give an appropriately ”serious” impression.

5.7 Defects

5.7.1 Prototype 1 defects

Green : ignore
Yellow : nice-to-have
Orange : Second priority
Red : First priority
Blue: Out of scope – future improvement

Defects from Usability Test 1							
ID	**Name**	**Issue**	**Location**	**Cure**	**Found by**	**Priority**	**Status**
P1_01	”**Alert Handling**” 1	”Alert Handling” is a confusing name. It is not obvious what it covers.	**Bottom App Bar** when an alert is selected	Rename: ”Show List” / ”Hide List” ”Toggle List”	Niels, Jørgen, Christian, Martin	1.	Done
P1_02	”**Alert Handling**” 2	The ”Alert Handling” button should change color according to list visibility.	**BAB, alert selected**			1.	Done
P1_03	**Unaware of Alert List filter**	The user might forget that the alertlist is filtered when a location is selected. User might be unaware of new alerts in this state.	**Alert List**	Niels proposes a timeout on the filtration. Jeppe proposes an indicator showing that the list is not complete, and an easy way to get the full list. Eg. Write location name next to Alerts Headline. Click name to remove it, and get full list back. Jørgen: Dont filter list- just highlight.	Niels, Jeppe	2.	Done - timeout
P1_04	**Inverted Headlines**	Headlines in Alert Details seems to be inverted	**Alert Details**	Training	Jørgen, Jeppe, Niels	-1	done
P1_05	No undo	User can accidently select a wrong comment to an alert and accept it. No turning back from there.	**Bottom App Bar** when an alert is selected	Make undo button	Jeppe	-1	future
P1_06	Chart alerts looks like locations	Using color coded rings around alerts to indicate the rule that triggered them, makes them look like locations	**Chart**	Alter design (slightly) – experiment.	Niels	2	done

P1_07	Swipe / Tap consistency	Confused about swipe / tap consistency. Wants to swipe on/off parameters of chart location. So maybe it should.	**Generel**	Make sure design is consistent.	Niels, Jørgen	1	done
P1_08	Audio time indicator	The time displayed in the audio player does not represent the time currently being played, but the time where the alert was triggered.	**audio player**	Make change label to represent current time.	Niels	2	Done
P1_09	Sound clip marked in chart	Niels wants to see the sound clip interval marked out in chart area.	**Chart**	Mark interval for dropped alerts, or on hold.	Niels	2	done
P1_10		Does not understand the difference between AlertList and Alert Details.	**Alert List + Alert Details**	Withdrawn after some use – understands that alerts can be grouped in alert list	Christian	-1	ignore
P1_11		Alerts in Alert List needs to show threshold / value	**Alert List**	Withdrawn after some use – understands that alerts can be grouped in alert list, and that the values are available in alert details	Christian	-1	ignore
P1_12		Play button should become stop button when playing.	**Alert Details**		Christian	2	todo
P1_13	Enable "Select all alerts" in BAB	Christian proposes a "Select all alerts" button in the bottom app bar that also must be available when no alerts are selected. It might conflict with my idea that there should be different app bars for the context it is used in. It should be availble when an alert has been selected though.	**Alert List + Alert BAB**	Experimentation	Christian	2	done
P1_14	Explain threshold and value lines	It must be clear what is threshold and what is value - the lines should be explained.	**Chart**	Explain lines – either in interface next to / on chart, or make a help overlay.	Christian	2	todo
P1_15	Hint / help 1	Drag n drop to chart is not obvious.	**Chart**	Christian: Use hints, for example the first three times a function is used. A kind of overlay. Draw drop zones and write what the outcome will be. Alternative: toggle help overlay. Provide alternative route	Christian	1	Alternative routes - done

				to same goal.			
P1_16	Hint / help 2	Semantic zoom on alert list is not obvious.	**AlertList**	Christian: Use hints, for example the first three times a function is used. A kind of overlay. Draw drop zones and write what the outcome will be. Alternative: toggle help overlay. Provide alternative route to same goal.	Christian	1	Alternative routes - done
P1_17	Indicate selected alert on map.	Selecting an alert from the alertlist should affect the map, to indicate where the alert was triggered.	**AlertList + map**	For example by growing alert indicator, or inverting colors, or both.	Jeppe	2	Done
P1_18		The map should center on the selected location, or the location to which a selected alert belongs.	**Map + AlertList**	This is not what the users want.	Jeppe	-1	Ignore
P1_19	Lockable Map	The map should be possible to manipulate.	**Map**	Toggle ”Map Lock” button.	Jeppe		Todo
P1_20	Chart should peak in	The chart should peak in to make its existece known to the user.	**Layout**		Jeppe	1	Done
P1_21		The background must be darkend when the comment flyout is on.	**Alert BAB**	This is not in line with Windows 8 design guide.	Jeppe	-1	Ignore
P1_22	”New Comment” is confusing	Commenting option ”New Comment” is confusing – it might mean to add another comment, so there are two in total.	**Alert BAB**	Change wording: Type New Comment	Jørgen	1	Done
P1_23	Flow issue	The user is likely to use similar chart configurations repeatedly. It is annoying to have to reconfigure between every use.	**CHART**	Load / save configurations	Jonas	-1	future

P1_24	Legend overflow.	The locations shown in the Legend should always be visible – they cannot be allowed to scroll. This means that if the Legend contains 3 or more locations, too little space is left for the below list of locations.	**CHART legend**	Possible solutions: Allow only 2 or 3 locations on chart at the same time. But then what happens when dropping an alertbox representing more locations? Wrap lists. When space become crammed then move the location list to a seperate column to the right. Might not be elegant enough, and not enough room horizontically to show both lists o the screen, while staying in a 'mode'.	Jonas	1	Not a problem anymore, since chart can only show one location at a time. Done

5.7.2 Prototype 2 defects

Green : ignore
Yellow : nice-to-have
Orange : Second priority
Red : First priority
Blue: Out of scope – future improvement

Defects from Usability Test 2							
ID	**Name**	**Issue**	**Location**	**Cure**	**Found by**		**Status**
P2_01		Martin interprets the two map modes as two general view modes, and doesnt understand why Chart is present in both.	MAP	Finetune map option transition to communicate that only the map change mode. This is a strange issue, no one else can see it.	Martin	2	todo
P2_02		The Alert Details grows up over the alert list as alerts are selected, when app is in right side. "Show List" button is somehow not tap inviting.	ALERT LIST	Ideas: Make Alert Details slide down by swipe gesture. Let the very top stay visible as a handle to slide up when needed. Limit Alert Details growth when in right side, so that it doesnt cover over the Alert List. Maybe include Threshold/ Value on Alerts so that the details become less needed. Also activate audio clips	Martin, Jeppe, Tomasz, Christian	1	done

				from app bar. Make the Alert List hidden as default. Update icon with amount of selected alerts.			
P2_03		Visual difference between ”selected” location and location with rules flag, is not big enough. One tester did not understand why AlertList was not filtered, although no location were selected.		Consider to emphasize the visual difference. Locations not selected could have inverted flags (white text on black). Training.	Martin	3	todo
P2_04		Enable ”select all” and ”deselect all” in Alert Details.			Multiple	-1	ignore
P2_05		Enable ”select all” and ”deselect all” in Alert List.			Multiple	1	done
P2_06		Possibility to select all dust alerts by clicking ”DUST” headline – if alerts are type sorted.		Experiment	Martin	2	todo
P2_07		One tester accidentally scrolled the map when he wanted to scroll the whole app.		Lockable map. (see P1_19)	Martin	1	Will not be done
P2_08		Tester suggests ”Accept swipe” to accept previewed comments – swipe the whole AlertDetails box left.	ALERT DETAILS	Not a plausible solution.	Tomasz	-1	ignore
P2_09		Confusion about alerts in chart: when are they selected? When selected in AlertList or in Alert Details?	CHART	Experiment	Jonas	1	done
P2_10	Soundbox transition	Sound-box appears in opposit corner of where it was activated from. It might not be noticed.	SOUND-BOX	Make transistion when SB is activated.	Tomasz	2	done
P2_11	Filter reset	After commenting, the Alert List filter is reset, even though a location is still selected.	ALERT LIST	Maintain filter after commenting.	Jonas	-1	Ignore – it’s a prototype
P2_12	Location By Name	Tester suggests to make a location list behind the alert list, and switch between them with tabs. This should be a help to find locations by name.	ALERT LIST	If there is a problem at all, this is not the solution to it. Consider an appbar button with a fly out containing location names.	Jeppe	-1	ignore
P2_13	Indicate new alerts	New alerts might not be visible in Alert List if it is sorted or filtered.	ALERT LIST	Make New Alert indicator. Give the new alerts a different background color to indicate those where the new ones. Be aware of P1_03.		1	Done

P2_14	Location Flags	Location flags will overlap on locations close to each other.	MAP	Let the user drag flags to a different position, see WebTrack. Minimize flag size.	Jeppe	-1	future
P2_15	Shared Audio Clip	Many alerts will link to the same audio clip, but it is not possible to see this in the interface.	ALERT DETAILS / SOUND BOX	Indicate if alerts share sound clip, for example by color coding.	Jonas	-1	future
P2_16	Sorting icon	Sorting method button should communicate its purpose better.	APP BAR	Find proper icon		1	done
P2_17	Space for scrolling	Its hard to swipe scroll without catching a control, especially after alert list is swipe/drag enabled.	LAYOUT	Locking the map can provide a lot of space for scroll control. Make the map a bit narrow so that more of the chart is visible. The chart provides scroll area. Or disable drag n drop on alerts. Or make the interface scroll by button tap rather than swipe.	Christian	1	Done – drag n drop disabled in overview mode
P2_18	Drop hints	It is not clear where to drop alerts. Its possible to drag alerts to map, even though it cant be dropped there.	Alert List	Make drop hint over alert being dragged. Eg. ”Drop On Chart”. When over chart, it could provide info about the effect of drop, eg. ”Replace chart” or ”Add to chart”	Christian	2	Done – can only drag in chart mode
P2_19	Center map	If you (accidentally) scroll away from site, there should be an easy way to center on the site.		Make ”Center Map” button in appbar.	Christian	1	done
P2_20	Tap location	Nothing happens when tapping highlighted Location		Deselect location on tap.	Christian	2	done
P2_21	Messed up alerts	Selected Alerts are messed up.		Manually set ”selected” state in visualstatemanager		1	done

5.7.3 Prototype 3 defects

Green : ignore
Yellow : nice-to-have
Orange : Second priority
Red : First priority
Blue: Out of scope – future improvement

Defects from Usability Test 3							
ID	**Name**	**Issue**	**Location**	**Cure**	**Found by**	**Priority**	**Status**
P3_01	Plot Alert button visibility	Plot Alert button is visible in Overview mode.	**BAB, alert selected**	Bottom app bar buttons should only be visible where they are relevant		1.	Done
P3_02	Location	location list is confusing, locations disappear when tapped	**Chart, location**	Locations should stay in list when selected		1.	Done
P3_03	Grouping icon	Alert Grouping button icon looks like “Exit Fullscreen” icon	**BAB, alert selected**	Change icon		3	todo
P3_04	Many buttons in app bar	The number of buttons in the app bar makes the interface more complicated – some of them will be not be used very much	**BAB**	Move seldom used buttons to the settings menu.		1	Todo
P3_05	No units in chart	The chart has no units	**Chart**	Add units		2	Todo
P3_06	Site name	The name of site should appear in the interface		Add site name		1	Todo
P3_07	Timespane of chart	It would be nice if the timespan of the chart was displayed	**Chart**	Add time span		2	Todo