University of Groningen

Software Architecture

Group 3

Smart Flood Monitoring

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Revision History

Version	Author	Date	Description
0.1	all	06/09/15	Setting up the working environment and the initial document structure. Draft versions of the first four chapters created, which are (respectively) Context, Architectural business information, Requirements and Analysis.
0.1.2	Menninga, ...	10/09/15	First version of functional requirements
0.1.3	Joris & Gerrit	13/09/15	Changed the context and enhanced the business information
0.2	Brandsma	13/09/15	Updated the requirements part
	Guntur	13/09/15	Updated the stakeholder of requirements part
0.3	Menninga	17/09/15	Updated the functional requirements
	Brandsma	17/09/15	Updated architectural vision and use-cases

Is the "all" ok? or do we need to split this up in multiple entries from all authors?

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1 System Context

We are the architecture team of the company RugSAG3. Our team is specialized in making smart systems for environmental monitoring.

All around the world, natural disasters cause a lot of trouble. These disasters can result in catastrophic events that cause deaths and require a huge amount of money to repair the damages caused.

Climate change and extreme weather phenomena cause these floods to get worse every year. This causes the damage of the natural disasters to increase, which means that there is a great need for a system that can reduce this damage. There is a huge need for a system that will help the people during natural disasters like these, which is what this system aims to do.

The goal of our first product is to:

1. safe lives,
2. reduce damage costs,
3. reduce the social consequences.

In order to do this, the system tries to predict upcoming floods as correctly and accurately as possible. The system will provide warnings and guidance to the necessary people during and, if possible, before a flood. By using various kinds of sensors, vehicles and control units, this system monitors certain areas. If something suspicious is happening, the system will check and verify the information in order to not give false flood warnings. When a flood indeed occurs (or will occur), the system provides warnings and guidance to the necessary people during and, if possible, before a flood.

To achieve the aforementioned goals, the system will provide predictions with regard to upcoming floods.

The first release of this system that we, as RugSAG3, build, will only focus on floods as a natural disaster. The system will provide warnings and guidance to the necessary people during and, if possible, before a flood. By using various kinds of sensors, vehicles and control units, this system monitors certain areas. If something suspicious is happens, the system will check and verify the information in order to not give false flood warnings. When a flood indeed occurs (or will occur), the system provides warnings and guidance to the necessary people during and, if possible, before a flood.

When this flood monitoring system works as planned and shows that it can indeed reduce the damage of floods, new products will be made by our company that will focus on reducing the damage of other kinds of natural disasters.

Over time, the system will reduce social, financial and human losses of natural disasters, starting with floods. This will revolutionize the way we think about natural disasters. Though the market around environmental monitoring is very competitive, this system aims at being a core part of future monitoring systems by being as dynamic and flexible as possible. Thereby allowing new features to be added easily, allowing the system to grow over time, including new upcoming user needs.

2 Architectural business information

The following section describes the different aspects of the business environment of the Smart Flood Monitor. First we will explain our vision and why there is place for us at the market. After this the product and its customers will be explained. This chapter is completed with a more detailed look at the business model and some models about the market and the financial prospect.

2.1 Business opportunity

There are many natural disasters happening each year all over the world. Each year these disasters take lives, waste a lot of properties and money and cause social disturbance. It is expected that natural disasters will cause $300 billion in losses annually in the upcoming decade. Climate change causes the natural disasters to get worse every year. Also the number of natural disasters has increased significantly since 1970.
Looking at, for example, the Indian ocean's tsunami in 2004, it looks that the damage could have been significantly reduced if the necessary people were warned. A system that would reduce the damage of natural disaster, could result in billions.
A system that warns and guides the people before or during the floods can result in billions being saved and will save a lot of lives.

2.2 Vision statement

The Smart Flood Monitor will cause a revolutionary innovation on the environmental monitoring market. RugSAG3 will offer a system which can detect floods early and correctly. This system helps us to enforce our vision, to limit the social and financial consequences of floods and avoid the loss of human lives.

RugSAG3 will not be the only player on the environmental monitoring market as there are a lot of other competitors taking part on this area of expertise. This means RugSAG3 will have to take their own strength and weaknesses into account. If we combine these qualities with an analysis of the opportunities and weaknesses on the market, we should be able to become a core part of the future environmental monitoring systems.

We try to map our position on the market by using SWOT-analysis. This analysis will map our strengths, weaknesses, opportunities, and threats as described as follows:

Strengths
    Diverse team with several skills in IT and management. Experience with working with sensors.

Weaknesses
    No experience with creating such system. Less knowledge about floods and environmental sciences. The product is a complex system.

Opportunities
    Due to climate change, the market will grow and such a system becomes more urgent. Few competitors in the market. Smart sensors are a hot topic, new sensors will be developed.

Threats
    High production costs. Competitors will enter the market because of growing market. Climate change will force to improve the system over time.

Our unique selling point is to provide a system with low selling price and high profit from the service contracts and upgrades.

Helpful	Harmful
(to achieve the objective)	(to achieve the objective)

Internal origin (product/company attributes)

- Adjustable system that is future proof
- Having a low selling price. Lower then the competitors
- Diverse team with several skills in IT and management
- Having a good management team
- Frequent discussion with technical and business experts in the field.
- Experience with working with sensors

- Decisions need to be made by the entire project team. There is a higher chance of a difference of opinion is members, holding back the project and leads to time wastes
- No experience with creating such system
- No knowledge of floods
- The product is a complex system
- Some main features rely on country-specific systems

External origin (environment/market attributes)

- Due to climate change, the market will grow and such a system becomes more urgent
- Few competitors in the market
- With a bigger program team, the pros and cons of the decisions are more clear
- Allowing the system to be flexible so it can also be used for other kinds of monitoring activities
- Smart sensors are a hot topic, new sensors will be developed. Making the system support and use the newest sensors allows it to obtain more, and a wider variety of valuable information

- High production costs
- Competitors will enter the market because of growing market
- New competitors will enter the market
- Climate change will forces the system to be improved over time.
- Changes of the external systems that our system uses to properly communicate.
- The sizes of certain area's to monitor can be too big to get a good and reliable view of them
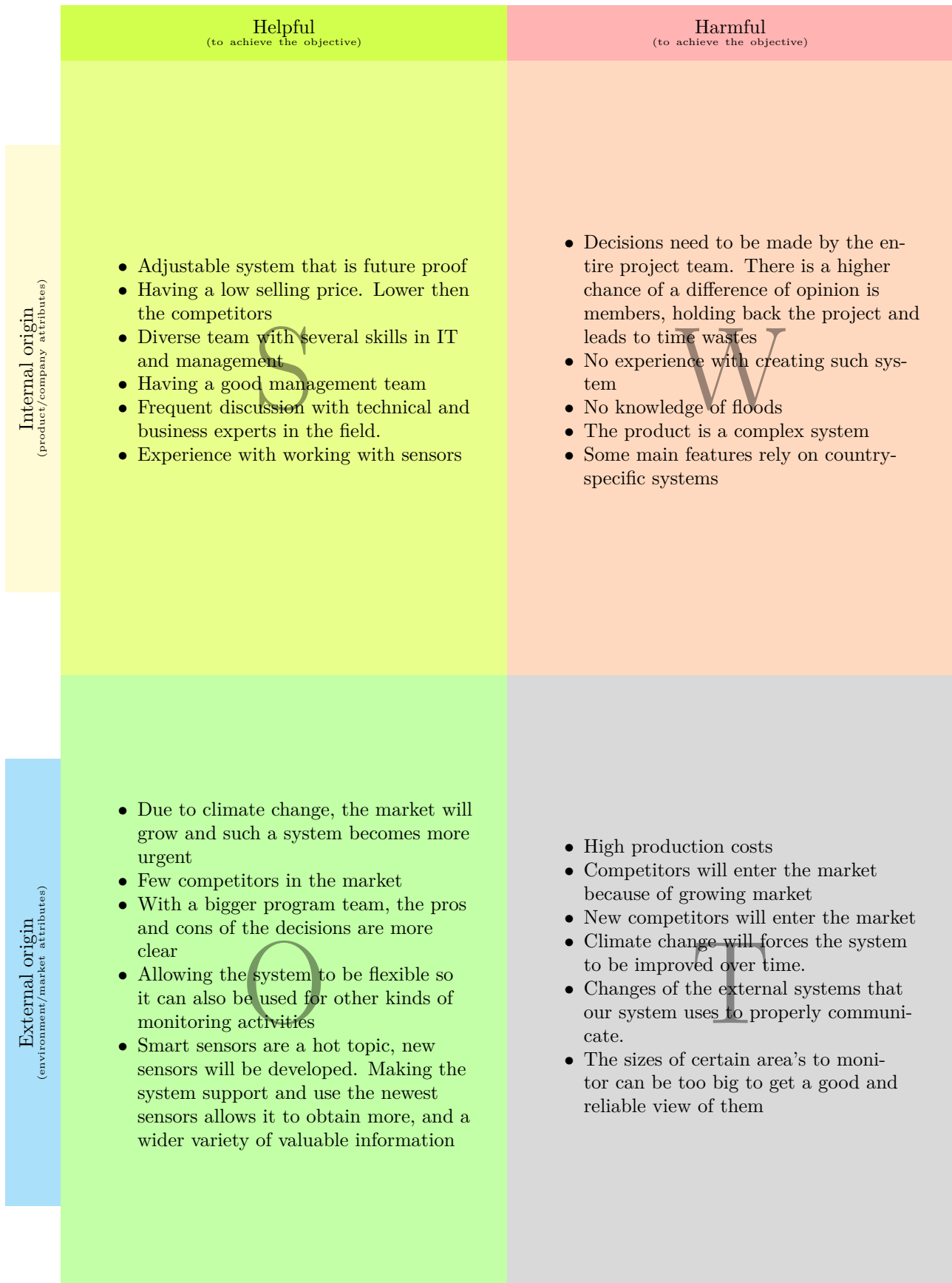
Figure 2.1: SWOT-analysis diagram.

2.3   Business rationale

RugSAG3will develop a new flood warning system in order to minimize the damage caused by a flood. In The Netherlands protection against floods is an important issue, because of the position under sea level. Global warming will increase the urgency of this issue. The people within the Netherlands must be well protected against floods. The flood warning system will detect floods, warn people and governmental institutions located in the disaster area and provide guidance where to go to. `truncated`
RugSAG3is new within the flood warning system market. By using sensors and automate the whole system a product will be launched which is reliable and adequate, but with the use of the newest technologies. RugSAG3will use hardware which is already on the market and is tested. Buying third party hardware will also speedup the development of the system and lower the costs.

The product price will be low in order to get a market share and prove the product in a real-time environment. By providing maintenance and updates in the future RugSAG3will earn money to further improve the product and sell it to other potential customers. This in combination with the increased need of a reliable warning system for imminent floods will result in a viable business.

The unique selling point's of our system are:

- To provide a system with low selling price and high profit from the service contracts and upgrades.
- Warn the people in and around the area as soon as possible if the system is very certain that a flood is or will happen.
- Inform people about the details of the flood so the right preparations are made.
- Inform people how to save themselves, others or goods.

This way, people will know when an area get's flooded, or when it's about to happen. People who requested it, will get informed on how to prepare for the flood and what to do during the flood.
These features are things that are be unique for our system and that make it successful. The main goal of this project, however, is to safe lives, reduce costs and reduce social consequences. These main goals will be met when:

1. 80% of the people in a dangerous area regarding a flood, receive a warning message. This message must contain enough information for receivers to know whether they are save or not and if not, how they can get to a save location.
2. 80% of the people who receive a warning successfully get to a safe environment in time.
3. 80% of the people receiving information before or during a flood, find these messages helpful and reported that it guided them successfully in order to save extra lives and/or goods.

When the first version of Smart Monitoringis release and is used to start monitoring actual floods, it's success will be measured according these statistics. Getting a warning message to the people who need to be warned is the most important. Using this warning message, people can move to a saver location.

2.3.1   Scope of Initial and subsequent releases

The initial release will only focus on floods as a natural disaster. It will send warnings to the necessary people, but will not yet interact much with the user. The system, however, doesn't stop there, and will get increasingly more capabilities. The extra capabilities of system include:

- Support for more kinds natural disasters
- More individual guidance
- Interaction with the system, users can give input
- Adding more sensor support
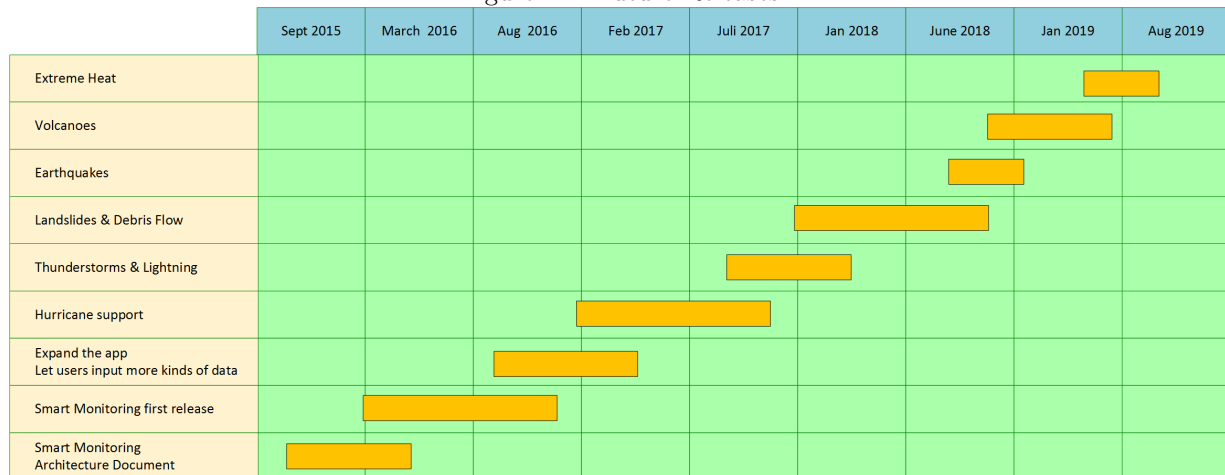- Using multiple communication networks to send information

The first thing RugSAG3Will focus on after the first release, is to let users interact with the system more. This will allow the system to have better knowledge of the area. However, mistakes can easily be made by a user and so this data needs to be verified in order to get valuable information. That's why adding this feature goes beond the scope of this project.

Adding sensor support is a continuous process. The sensors that are available is steadily increasing and their technology becomes more advanced. RugSAG3will monitor the sensor technologies and improvements to check if these can improve the system.

Depending on where the system resides, it will need to interact with various kinds of networks en media. Initially the flood warning system will focus on communicating with resouces in the netherlands. However, if a future release implements additional support for monitoring tornado' or vulcano', the system will most likely not be in the netherlans

Figure 2.2: Future Releases

	Sept 2015	March 2016	Aug 2016	Feb 2017	Juli 2017	Jan 2018	June 2018	Jan 2019	Aug 2019
Extreme Heat								▬	
Volcanoes							▬▬		
Earthquakes						▬			
Landslides & Debris Flow					▬▬				
Thunderstorms & Lightning				▬▬					
Hurricane support			▬▬						
Expand the app Let users input more kinds of data		▬▬							
Smart Monitoring first release		▬▬							
Smart Monitoring Architecture Document	▬▬								

2.4   Product and service description

RugSAG3offers a flood warning system. When a imminent flood is monitored by the sensors of the system a warning should be sent to governmental organizations and people within the danger area. Also guidance should be provided when a flood is happening to assist rescuers and guide inhabitants to safe areas.

Basically the system will consist of four subsystems: Monitor the state of dykes and water levels, monitor if a imminent flood is occurring, warn governmental organizations and inhabitants in the danger area, and provide guidance to search and rescue organizations and inhabitants.

The first subsystem, monitor the state of dykes and water levels, will consist of various sensors that are placed near and in dykes and water ways. The state of the dikes must be monitored continuously, i.e. pressure of the dyke. Also sensors must be installed to monitored continuously the water level. The data of all the sensors will be sent to a server, in a safe location, to store all the data.

The second subsystem, monitor if a imminent flood is occurring, will analyze all the data from the sensors and data from weather forecasting service. Based on this data an algorithm will monitor continuously if there are dangerous situations.

The third subsystem, warn governmental organizations and inhabitants in the danger area, will send warning messages when the algorithm identified a dangerous situations. The safety region, in Dutch Veiligheidsregio, will receive a warning message that an area is in danger. Information like place, sort danger and amount of danger will be send. The safety region will be responsible to take action based on this information. Inhabitants can receive warnings via sirens, mobile phone, radio, television, and by UAV.

The last subsystem, provide guidance to search and rescue organizations and inhabitants, will help people that are in the danger area how to flee and rescue in a save way. Rescue organizations will receive information where are probably the most casualties and how to get safe to those locations.

The service will consist of maintenance for the product and upgrades.

2.5   Target audience

The Dutch Ministry of Infrastructure and the Environment is the target customer. They have the responsibility in the government to identify unsafe situations caused by floods. When this ministry wants a new warning system they need to start a procurement. This gives the opportunity for various companies to bid on the procurement. At first the Dutch Ministry is our target audience, later on the product can be sold to other countries.

2.6   Road maps

The Dutch Ministry of Infrastructure and the Environment will end the procurement of a flood warning system on 31-12-2015. The bid must consists of the design of the system and a financial analysis must be made. The engineering part of the system will be finished on 31-12-2016. An operating system is then up and running.

Directly after finishing the initial product, new features will be developed and can be sold.

After this first step there will tried to market the system to other countries in the world.

2.7   Target audience

The product will be sold to governmental institutions.

2.8   Financial model

The financial model will be a low product price. This in order to price the product low in the market. A service description for maintenance will be offered. Also updates will be sold to the customer

2.8.1   Software Architecture costs

The software architecture team consists of seven members. The project will last 10 weeks. All team members will spend 15 hours a week on the project. This totals 1050 working hours. Each working hour costs âĆň150,-. Total spend on the software architecture is âĆň157.500

2.8.2   Development costs

2.8.3   Hardware costs

2.8.4   Total costs

2.9   Financial model

The financial model will be a low product price. This in order to price the product low in the market. A service description for maintenance will be offered. Also updates will be sold to the customer

2.10   Competitors

Siemens designed a flood-warning system via SMS in Belgium.

3 Requirements

This chapter will describe the vision and use it to derive stakeholders to be able to properly write use cases and stories. These will be used to extract functional, commercial, technical and evolution requirements. Afterwards, a risk assessment will take place, to ensure that the project is not at great risk.
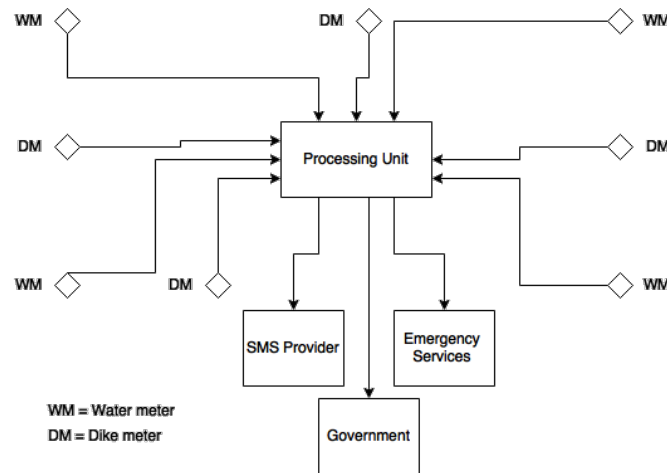
3.1 Architectural vision

Figure 3.1: Schematic overview of the flood monitoring system

The smart flood monitoring system consists of multiple parts. First of all there is the monitoring part. This part monitors the current state of the environment. To achieve this, we need a lot of data. This data is obtained by sensors and weather data. We use sensors to get the current water level of waterways. We also measure the density and structure of dikes. The data that is obtained through all sensors will be automatically processed. The processed information represents a risk level for the area in which the system is deployed.

In case of an imminent flood a warning will be issued to the government and the citizens who live in the threatened area. We do this by issuing a warning to the government. In their turn the government uses their infrastructure to warn the citizens. In the Netherlands this infrastructure consists of a siren system and an SMS-system. Besides this people can also apply for our service. People who are subscribed to this service will receive a text message with more information about the (imminent) flood.

In case of a real flood the citizens who subscribed to our service will receive a text message with a route to a safe area. These text messages are personalized to the citizens. This means that when a flood happens, different people will have different routes to get to safety.

3.2 Stakeholders and their concerns

There are eight stakeholders who are involved in our system. The stakeholders are ranged from first parties to third parties stakeholders. Detailed description is written below.

Product owner is concerned about usability, reliability, profitability, affordability. Product owner funds the whole project. Product owner has to make sure that the system is reliable and profitable. As the product owner is willing to get a good market penetration, this system has to be affordable to the customers.

Developers are concerned about usability, reliability, maintainability, and testability. They are those who are responsible for the development of the systems until its ready for production. Including designing, analysis, testing and implementing the RugSAG3.

Competitors are concerned about usability, reliability, adaptability, profitability, and affordability. Competitors give negative effect on the system because competitors will be aiming on the same customer target. Thus, competitors must also be kept in consideration.

Government is concerned about reliability, adaptability, and affortability. Government will be part of mitigation when the flood is imminent. This system will also notify government when this system detects flood. Thus, government have to make sure that the system is reliable, adaptable and affordable.

Citizens are concerned about usability, reliability, and affordability. They will be one of the main user of the system. Citizens want this system to run correctly and notify them with the reliable information. They also want to have this system to be as affordable as possible.

Insurance companies are concerned about reliability, profitability, and affordability. The damages caused by flood sometimes are also covered by the insurance companies. Thus, the insurance companies will also be part of the stakeholders and they will make sure that their business is running well.

Local companies are concerned about reliability, adaptability, and affordability. Local companies will also be affected by the flood, they also have a lot of resources that are in danger. Local companies want to know whether or not this system is reliable so that they can arrange a proper action sets when the flood comes to save their assets.

Emergency services are concerned about usability, reliability, adaptability, and testability. Emergency services are important when any accident happens, including flood. They will be really concerned about the thing that makes this system reliable, adaptable to their current system, and could be tested in order to make sure things are running correctly.

Table 3.1 illustrates the stakeholder concern matrix. In our approach every stakeholders are equally the same. Thus, each stakeholder receives 100 points in total that has to be distributed among all the concerns.

Table 3.1: Matrix of stakeholders concern.

Concerns

Stakeholder	Usability	Reliability	Adaptability	Profitability	Affordability	Maintainability	Testability
Product owner	30	30		20	20		
Developers	30	20				30	20
Competitors	20	20	20	20	20		
Government	30	40			30		
Citizens	30	30			40		
Insurance companies		30		30	40		
Local companies		30	30		40		
Emergency services	30	30	30				10
Total	140	230	80	70	190	30	30

As can be seen from Table 3.1, the most important concern for our system is the reliability, following usability as the second most important concern. Therefore, reliability is one of our significant key drivers.

3.3 Stories and use-cases

3.3.1 A citizen receives a warning about an upcoming flood

Scope: Warning part of the system

Level: Main process

Primary actor: Citizen

Stakeholders and interests:

1. Citizens - citizens want to be warned in case of a flood

Precondition: There is an upcoming flood and the citizens are not warned
Postcondition: There is an upcoming flood and the citizens are warned

Main succes scenario:
1 - The sensors send the data to the processing unit.
2 - The processing unit determines there is an imminent flood.
3 - The processing unit generates a map with vulnerable areas.
4 - A text message with a warning is send to all subscribers in the vulnerable area.

Extensions:
2a - The flood doesn't get to dangerous, it retreats. No warning mechanism is triggered.
4a - The citizen is not in the vulnerable area. No text message is send.

3.3.2 Government and emergency services receive a warning about an upcoming flood

Scope: Warning part of the system

Level: Main process

Primary actor: Government, Emergency services

Stakeholders and interests:
1. Government - the government wants to warn the citizens in case of a flood
2. Emergengy services - the emergency services want to help the citizens in times of need.

Precondition: There is an upcoming flood and the government and emergency services are not warned
Postcondition: There is an upcoming flood and the government and emergency services is warned

Main succes scenario:
1 - The sensors send their data to the processing unit.
2 - The processing unit determines there is an upcoming flood.
3 - The processing unit generates a map with vulnerable areas.
4 - A warning attachted with the map is send to the government and the emergency services.
5 - The system receives a confirmation that the government and the emergency services received the warning.

Extensions:
2a - The flood doesn't get to dangerous, it retreats. No warning mechanism is triggered.
5a - No confirmation is received within 15 seconds. Send warning message in another way.

3.3.3 A citizen requests guidance to get to a safe place in a flooded area

Scope: Guidance part of the system

Level: Main process

Primary actor: Citizen

Stakeholders and interests:

1. Citizens - citizens want to be guided to a safe place in case of a flood.

Precondition: There is a flood and the citizen is subscribed to the SMS service.
Postcondition: Citizen received his personal route to safety.

Main succes scenario:
1 - The processing unit determined there is a flood.
2 - The processing unit determines the optimal route for every known phone number.
3 - The processing unit turns this route into a MMS message with the right directions.
4 - The personal route is send through MMS message to all known phone numbers.

Extensions:
4a - MMS message can't be send. Wait a minute and try to resend.

3.3.4 The system receives data from the weather forecast service

Scope: Monitoring part of the system

Level: Main process

Primary actor: Developers

Stakeholders and interests:
1. Developers - Developers would like to have a simple to use API.

Precondition: The system needs external data from a weather forecast service.
Postcondition: The system received the forecast data.

Main succes scenario:
1 - The processing unit determines it needs forecast weather data.
2 - A call is made to the weather forecast service.
3 - The weather forecast service returns the requested data.

Extensions:
3a - The data can't be returned. Repeat this process with another weather forecast service. If non is available, proceed monitoring without weather forecast data.
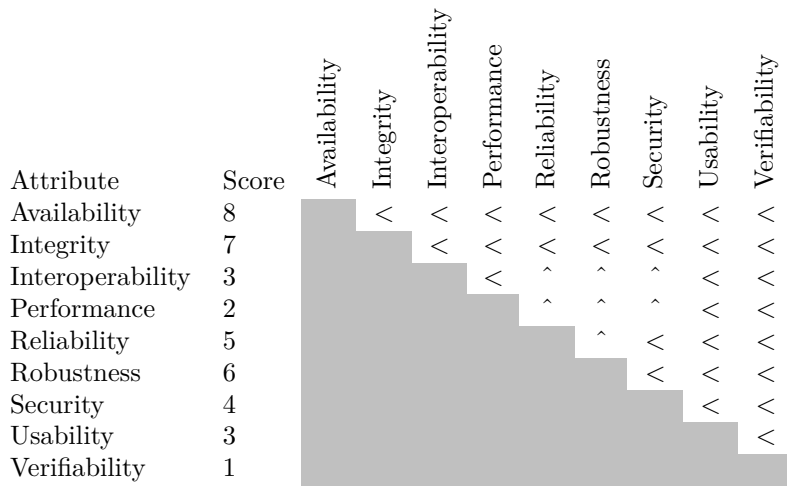
3.4 Functional requirements

Nr.	Prio	Description
FR-1	**Must**	The system is able to receive input from sensors with regards to the water level. This information will be used to determine if there is an imminent flood.
FR-2	**Must**	The system is able to process input from sensors with regards to the water level.
FR-3	**Must**	The system is able to receive input from sensors with regards to the pressure/consistency of the dykes.
FR-4	**Must**	The system is able to process input from sensors with regards to the pressure/consistency of the dykes. This information will be used to determine if there is an imminent flood.
FR-5	**Must**	The system retrieves weather forecasting data from weather forecasting services. The retrieved weather forecasting data consists of predictions about the precipitation and wind data and is used by the system to help in determining when a flood becomes imminent.
FR-6	**Must**	The system is able to detect when a flood is imminent by using the retrieved sensor data and weather forecasting data.

FR-7	**Must**	The system has access to geographic information, including road data and terrain height data.
FR-8	**Must**	The system can determine the area affected by a flood, by using the location data of the sensors and geographic information.
FR-9	**Must**	The system computes (from geographic information) the area which will be affected by a flood.
FR-10	**Must**	The system collects information pertaining to the severity of the flood: the expected water level, how fast the water level in the flood area will rise, and the number of civilians living in the affected area (population density).
FR-11	**Must**	The system provides emergency services with information about the flood. This includes the area affected by the flood and information needed to deduct the severity of the flood.
FR-12	**Must**	When a flood is imminent, the system sends a warning to the emergency services and to the authorities. The warning contains information about the area affected by the flood.
FR-13	**Must**	The system is able to compute a safe route, free of obstruction and floods, to a safe area, not affected by the flood, where citizens can be evacuated to in case of an (imminent) flood.
FR-14	**Must**	The system is able to receive and process input from sensors with regards to the pressure/consistency of the dykes. This information will be used to determine if there is an imminent flood.
FR-15	**Must**	Citizens who are subscribed for flood warnings are warned about imminent floods through by text message.
FR-16	**Must**	The system can determine the location of citizens who are subscribed for flood warnings.
FR-17	**Must**	Citizens who are subscribed for flood warnings get route information to a safe area by MMS.
FR-18	**Must**	The location of citizens who are warned through the app can be determined in order to supply them with a safe route to a safe area.
FR-19	**Must**	The system is able to predict the development of the water level. This information can be used to predict how fast a flood will develop.
FR-20	**Must**	The system uses different sources to confirm imminent flood warnings, in order to limit false positives.
FR-21	**Must**	The system can detect a faulty sensor, either when the sensor raises an error or when the data from the sensor is inconsistent with other sensor data.
FR-22	**Must**	There is a control panel, where an overview of warnings and errors of the system can be viewed.
FR-23	**Must**	The system can detect and report faulty sensors, so these sensors can be repaired or replaced.
FR-24	**Must**	In case of a flood, the system provides emergency services with safe routes to incident locations.
FR-25	**Must**	The system can determine the location of an emergency vehicle, so it is able to compute a safe route to incident locations.
FR-26	Optional	The system is able to detect extreme weather phenomena, like storms etc.

3.5   Quality attributes / non-functional requirements

Attribute priority:

Attribute	Score	Availability	Integrity	Interoperability	Performance	Reliability	Robustness	Security	Usability	Verifiability
Availability	8		<	<	<	<	<	<	<	<
Integrity	7			<	<	<	<	<	<	<
Interoperability	3				<	^	^	^	<	<
Performance	2					^	^	^	<	<
Reliability	5						^	<	<	<
Robustness	6							<	<	<
Security	4								<	<
Usability	3									<
Verifiability	1									

Nr.	Prio	Description
AVL-1	**Must**	The system shall be at least 99% available.
INT-1	**Must**	The system shall protect against unauthorized addition, deletion or modification of sensor data
INT-1	**Must**	The system shall verify unusual sensor data that shouldn't happen in normal situations, with at least one other sensor
INT-1	**Must**	The system shall send warning and guidance messages only in case of a flood

3.6 Technical non-functional requirements

In this section, the technical non-functional requirements important to this system are discussed.

3.6.1 Reliability or Resilience ?

The system will have many connected sensors, which can have failures.
The system should be able to recognize such failures timely
The system recover from failures without the QoS or the functionality of the system being affected.
The margin of error tolerated has to be as low as possible .
The system should be able to continue functioning with the same QoS in a situation where up to 5% of the sensors suffer from failures.

3.6.2 Performance

The response time and data transmission time are about 1 sec (? How to calculate)

3.6.3 Interoperability

The system will retrieve information from water forecasting services.
The system will interact with the governement, emergency services and the citizens.

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3.6.4 Scalability

The system will be able to cover more areas and use more sensors in the future.

3.6.5 Security

The access to the system and datas is controled by a firewall and passwords .
Only the developers and ??? can modify datas of the system.
The sensors are connected to each other and control each other (some kind of redundancy).
All system data must be backed up every 24 hours and the backup copies stored in a secure location which is not in the same building as the system.
All communications between the systemâĂŹs data server and clients must be encrypted.

3.7 Evolution requirements

3.8 Risk assessment

«««¡ HEAD The system is confronted by severals risks .
False positive
Hacker get access to the system
Failure (how many sensors could be damaged and the system still working ? percentage ...)
The sensors company become bankrupt
Reducing the price because of competition

HOW TO HANDLE THOSE RISKS ? ======= »»»¿ 59f51eacf127815a374f925ae1dc2ce3e75d4e49

- RI- 1 : The warning system does not detect floods in time
- RI- 2 : The system sends warnings of a non-excising flood (false positive), making people more negligent to future messages.
- RI- 3 : The system can't send messages to the necessary people because the communication platform is also destroyed by the flood.
- RI- 4 : The system sends incorrect information, causing extra damage.

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4 Analysis

Assumptions:

- People requesting guidance have access to a phone that is either connected to a mobile network or to the internet
- The system is able to monitor various kinds of sensors
- The system has access to the internet
- The sensors are (in some way) connected to the system
- The system is able to use various kinds of sensors in order to predict floods.
- When the system has enough proof of a flood, the users will be informed in a timely manner (within 30 seconds maximal).
- People within a range of (30km?) will be warned about a detected flood
- The system uses multiple weather forecasting services to make its own predictions about possible upcoming floods.

Decisions:

- Security? (What if someone tries to manipulate a sensor?)
- One or multiple warning systems (failover)
- Networking? Redundancy of cables (trunked?)
- When to alarm? What to do if only 1 sensor warns about a flood?
- Security decisions?
- Operating system decision
- Storage decision
- Push or pull updates? (Pushing IâĂŹm hoping)
- Programming language(s) for the system? Web-interface, sensor monitoring, weather forecasting system, push notification system
- In what ways will the system detect a flood? Sensors, UAVâĂŹs, forecasting?
- How to detect a flood based on the forecasting? Warn beforehand? Pay extra attention to the new upcoming flood by sending extra robots/uav's?

Name	Linux
Decision	1
Status	New
Problem/Issue	The warning system software for the natural disasters need a platform to work on.
Decision	The warning system will use Linux as a platform
Alternatives	*Linux* Linux is a free platform that has proven itself and is used by many servers. It is reliable and more secure.
Arguments	

5   System Architecture

6 Hardware Architecture

7 Software Architecture

8 Architecture evaluation

9   System evolution

A   Time Tracking

A.1   Week 1

Person	Task	Hours
Eedema	Reviewing the document, reading the assignment, initializing requirements, & installing environment for project	8
Putra	Intial preparation for the course	5
Fakambi	Reading the document and assignment	
Schaefers	Setting up the working environment, create the context page and analysis page drafts. Setting up and improving the the document structure.	8
Klinkenberg		
Brandsma	Creating working environment, reading assignment, first draft business part	8
Menninga	Reading assignment, setting up working environment, first non-functional requirements	5

A.2   Week 2

Person	Task	Hours
Eedema	Coaching session, project planning session and work on business information chapters	9
Putra	Coaching session, project planning session, project meeting, first version of stakeholder part of requirements	7.5
Fakambi	Coaching session project meeting , work on Non functionnal requirements	
Schaefers	First coaching session, improved and enhanced the context and business information chapters. Also created a quality attributes prioritization table.	8
Klinkenberg	Coaching session, meetings, providing feedback on requirements	5.5
Brandsma	First version of use-cases, coaching session, meeting, use-cases, architectural vision	6.5
Menninga	First version of the functional requirements, coaching session, meeting	10.25

A.3   Week 3

Person	Task	Hours
Eedema		
Putra		
Fakambi		
Schaefers		
Klinkenberg		
Brandsma	Coaching session, meeting, architectural vision, use-cases	5,5
Menninga		