PROJECTPLAN INSECTSENSE

“The use of insect behaviour for a better

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1. Background information Insectsense

1.1 Company description

About Insectsense
InsectSense is a technological venture that explores the possibilities of using insect-behaviour and its underlying molecular biology, to provide relevant solutions in the fields of disease diagnostics, VOC detection in environment, food and security systems. Our insect-based solutions are also applicable in the fields of Research & Development as well.

The potential of applying insect-behaviour as solutions in all these fields is well-documented. A plethora of researches have justified the incredible potential in using insect-behavioural responses as solutions, that are far more superior than conventional approaches. We have translated years of research into realisable solutions that are sure to benefit millions of people around the world.

A specific Product of the Insectsense venture is called 'BeeSense'. This is the product that we are focussing on with our HAN project team.

Mission & Vision
The mission of Insectsense is to translate research on the behaviour and molecular biology of insects into realisable solutions, that could be used for the betterment of mankind.

InsectSense has a vision to be an industry-leader in the field of insect-based innovative solutions. We believe that our technical expertise and competency will enable us to excel and prosper in this yet vastly unexplored opportunity.

InsectSense was established as a company to bring in innovative diagnostic solutions during the global Covid-19 pandemic. However, since its inception we have recognized its immense potential in bringing value to other industries as well; such as food, environmental, pharma and security industries.

1.2 Market & products

Markets

We have already created a business model canvas (BMC) for Insectsense with our project team. In this bmc we have listed a few markets that can be connected to the services/products of Insectsense. A few examples are: Healthcare industry, Animal welfare industry, Pharmaceutical industry and the Food industry. However in this project we are mainly focussing on the Healthcare and Pharmaceutical markets.

Products
We are focusing on these markets because we are going to work on the so called 'BeeSense' product. In the text below is a short explanation of this product:

Insectsense has developed a bionsensor that integrates the ability of bees in detecting specific VOCs(Volatile Organic Compounds). Training of bees for differentiating volatiles can be performed within few minutes, while detection takes a few seconds. It is a cost-effective solution that makes disease-diagnosis affordable.
BeeSense is ideal for diagnosis of novel diseases (such as Covid-19). They can differentiate between asymptomatic and symptomatic cases from healthy people within a few seconds.

2. The project

2.1 Project trigger

Insectsense is a startup company that uses insect behavior for innovative solutions in the diagnostic-device market. The company is still in the early stages and would like to know what options and possibilities there are. Because of this, the owner of Insectsense has drawn up various issues that can be addressed in a project for smart industry students. In consultation with the stakeholders, it was decided to investigate the following issues:

- What diseases can be indicated by volatile & odor? (human & plant)
- Research and engineer how to automatically catch bees for diagnostic purposes harmlessly and gently.

In the first instance, the project group will start dealing with the above issues. If there is more time left, additional issues are added that can be addressed in this project. In this way, the company hopes to gain more insight into the possibilities for Insectsense.

2.2 Problem description

Insectsense has almost no name recognition and market share because the company has just been founded. It is also not yet known which plant and human diseases can all be detected with insect behavior and how this can be converted into solutions. Preliminary research has already been done into the behavior of bees and in which markets it is already used. Insectsense wants to do more in detecting diseases in humans and plants for the realization of a better and healthier humanity. However, more research needs to be done into the detection of diseases through bee behavior to achieve good solutions.

2.3 Purpose of this project

This project aims to gain more insight into the possibilities of detecting diseases in plants and humans by volatile and odor. Besides, an attempt is being made to find a way to catch bees in an animal-friendly way.

2.4 Result of this project

Over the next ten weeks, a research report will be displayed detailing which diseases can be detected by volatility and odor. Advice will also be given on which way is best to catch bees in an animal-friendly way. Finally, an attempt is made to make a prototype ourselves to catch the bees.

2.5 Scope of this project

To make the project manageable, a demarcation is made as to what will and will not be investigated. In this project, research is exclusively carried out into possibilities for tracing and detecting diseases in humans and plants through desk research. The focus is mainly on the health industry. This research will largely be carried out for BeeSense, a product/service that Insectsense offers. Besides the research and advice, the project group will develop a device to catch bees in an animal-friendly way.

2.6 Stakeholders

For the project to run smoothly, it is important to map out the stakeholders. In this way it becomes clear which people are involved and the importance of these people in the project. The stakeholders are listed in the table below.

Tabel 1 Stakeholders

Stakeholders	Function	Influence
Aria Samimi	Founder & CEO	Aria has the most influence on the project as he is the founder of Insectsense and determines which direction the company will take. Every week the completed work is fed back to Aria.
Leon Schipper	CTO & CFO	co-founder of Insectsense and thus partly determines the direction of the project.
Pieter Bergshoeff	Project supervisor	Pieter will support the project group and help where necessary. We can always contact him with questions.
Fellow students smart industry	Students	The students of smart industry can ask each other for help or provide feedback on specific topics.
Teachers smart industry	Teachers	The project group can ask the various teachers of smart industry for help or advice.

2.7 Meetings and agreements

In the last meeting, agreements were made regarding moments of meetings. Most meetings will be through Microsoft teams and physical meetings will take place if necessary. There will be a meeting with Aria, Leon, and Pieter **every Friday at 14:00**. Also, the project group would like to visit the site to see how Insectsense is organized.

3.Research design

3.1 Main question

There are two questions we must answer:

1. What diseases can be indicated by volatile & odor? (human & plant)
2. Research & engineer how to automatically catch bees for diagnostic purposes in a harmless and gentle way

On top of that, there are a few questions which we can answer if we have enough time:

3. How to obtain a health certificate and what are the requirements?
4. How can we use data obtained from bees?

3.2 Sub questions

1. What diseases can be indicated by volatile & odor? (human & plant)
    1. What does odor consist of and what are volatile compounds?
    2. What are diagnostic biomarkers?
    3. Which volatile compounds can act as diagnostic biomarkers in humans?
    4. Which volatile compounds can act as diagnostic biomarkers in plants?
    5. How can volatile compounds be detected?
    6. What is the minimum number of volatile compounds to detect diseases?

2. Research & engineer how to automatically catch bees for diagnostic purposes in a harmless and gentle way
    1. In what ways can bees be catched and how to verify it is harmless?
    2. Are there commercially available products available and how is verified that it is harmless?
    3. Are there open source prototypes available and how is verified that it is harmless?
    4. Is it possible to anesthetize a bee, how and for how long?
    5. How to prove that the prototype is harmless and gentle for bees?
    6. Does the prototype need to be purely functional (manual operation), or smart in some way?
    7. What materials are required to build the prototype?

3. How to obtain a health certificate and what are the requirements?
    1. Which health certificates are available?
    2. Which health certificates apply to InsectSense and what are the requirements?
    3. What needs to be changed in InsectSense to meet the requirements?
    4. How much does the health certificate cost?
    5. How often does the health certificate need to be renewed?

4. How can we use data obtained from bees?
   If there is time left, a prototype will be built based on this research.
    1. What data is obtained from bees?

2. How can the data be used for the working of the products?
3. How can the data be used for feedback to its users?

3.3 Phasing

Since we are a new team, we don't know what our velocity is. So we don't know how much we can achieve in the project. Also, we have close contact with all of the stakeholders. On top of that, not all questions are clear and well defined. Because of this, we selected Scrum as our project management method.

There are many implementations of Scrum because the manifesto (there where Scrum is defined) is mainly a collection of guidelines of Scrum. It doesn't define how to implement Scrum. However, the team has experience with Scrum and based on that, we know how to implement it.

Scrum works with both incremental and iterative cycles. Each cycle is called a sprint. Incremental means that new features are added that sprint. Iterative means that the existing features will be improved. However, this doesn't mean that a sprint has to be pure incremental or pure iterative. But why does it work in sprints, one can ask. The main reason for this is that the planning is far from perfect. Before each sprint, the team will plan. They will make tasks to execute during the sprint. This will be done by estimating the amount of hours for each task so they know how many tasks they can execute that sprint. At the end of the sprint, the team will have a meeting called a retrospective where they review the last sprint. How did it go? Did we finish everything? If not, why not? What happened? The team will learn each sprint how to efficiently cooperate with each other.

Also, the point of Scrum is to have a potentially shippable product every sprint and this will be reviewed by the client at the end of the sprint in the sprint review. In flexible projects, the client can decide after the sprint review if he wants to continue the project or maybe he is already content with the result. In more fixed projects (the ones with an end date like this project), this is a status meeting in which the team shows what they have done in the past sprint.

Okay but how long does a sprint take? Well, this differs from team to team but we will have sprints of two weeks. Two weeks is short enough to correct the team by the client if the team took a wrong direction. Furthermore, in this project we will have an extra status meeting per sprint.

Another element of Scrum is the daily standup at the beginning of every day in which each team member discusses what he has done yesterday, what he will do today and if he has any impediment that prevents him from executing a task.

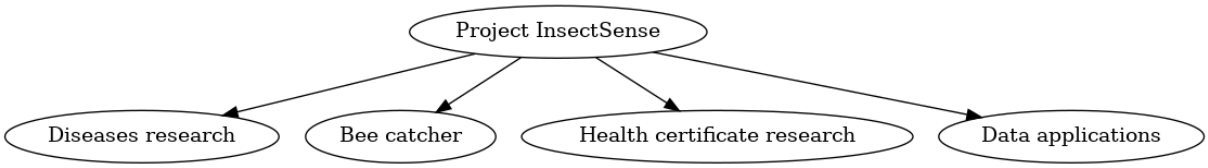
A typical workflow of a Scrum sprint will look like this. Before starting each sprint, the team will create tasks. These tasks will go on the backlog. This is a collection of tasks which needs to be done in the project. Then, the team will decide which tasks have to be done this sprint. These tasks will go to the to-do-collection. When the sprint starts, every team member will execute a task. Before executing a task, the tasks will get the "in progress" label. After finishing the task, the task will be updated by an "in review" label and another team

member will review the work. Finally, the task will be moved to “done”. This will continue until the sprint finishes. Then, a retrospective will be held where the team reviews on the sprint. This way, the process can be improved. Finally, the results will be presented to the client. Tasks that weren’t completed will have to be either refined into multiple tasks, moved to the backlog or removed from the board. After this, the team can prepare for the next sprint.

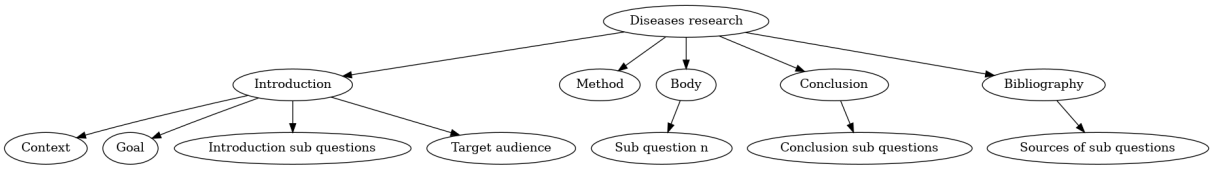
3.4 Planning

In order to create a planning, a Product Breakdown Structure (PBS) is created to lay out all the different parts of the products. Based on that, tasks or actions can be derived to create a planning graph. Here dependencies are shown which make it clear which tasks can be executed in parallel.

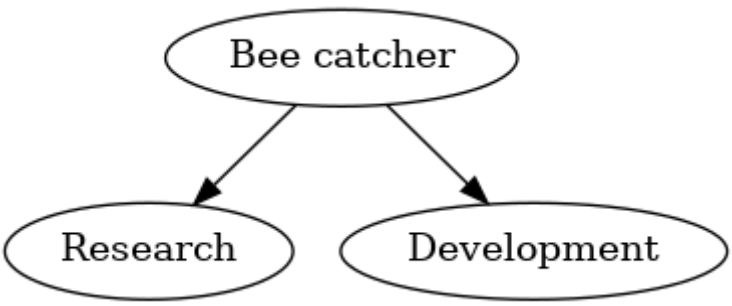
The PBS is subdivided in different sub-PBS’s to keep them readable. In the following image, the first sub-PBS is shown. Here, the project is subdivided in four different parts which can be found in the research questions section.



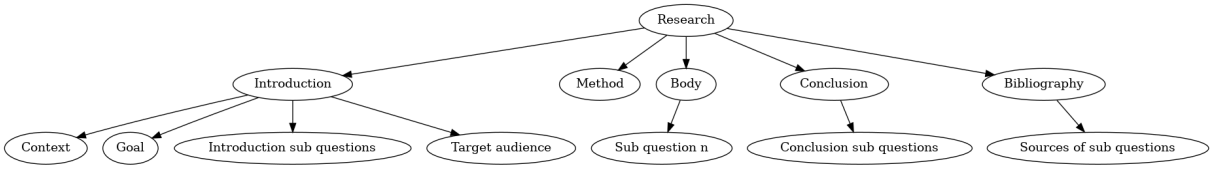
Next, the disease research is subdivided in parts. A quick note is that the body consists of the information of all sub questions which can be found in the sub questions section. Here, instead of putting all the questions inside the figure, it simply is marked as sub question n.



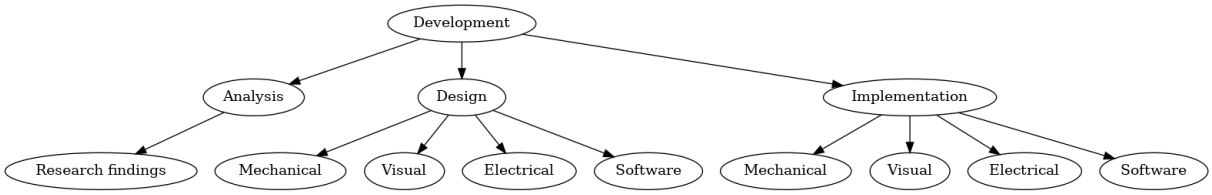
The bee catcher is a little different because it consists of a research part and an engineering part. Therefore, the bee catcher is split up in research and development as shown in the following image.



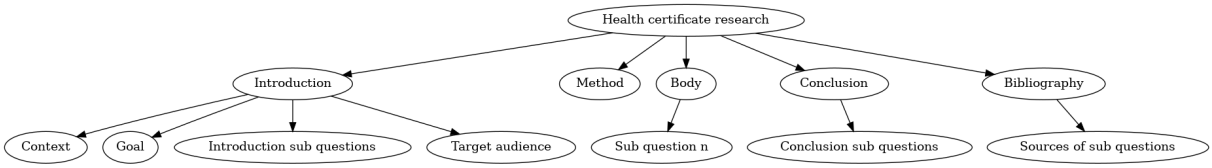
For the research part, it is basically the same as for the disease research.



The development part is split up in analysis, design and implementation. In the analysis the solutions and findings will be extracted from the research. Based on this, the design can be made which is split up in multiple aspects. These aspects are mechanical, visual, electrical and software. Because of the uncertainty of the kind of prototype that needs to be developed, these aspects won't be further subdivided for now. After that, the prototype can be implemented or created. For instance, if in the design phase a 3d model is designed then this will be manufactured using a 3d printer in the implementation phase. In the implementation phase the same aspects are used as in the design phase and for the same reason not further subdivided.

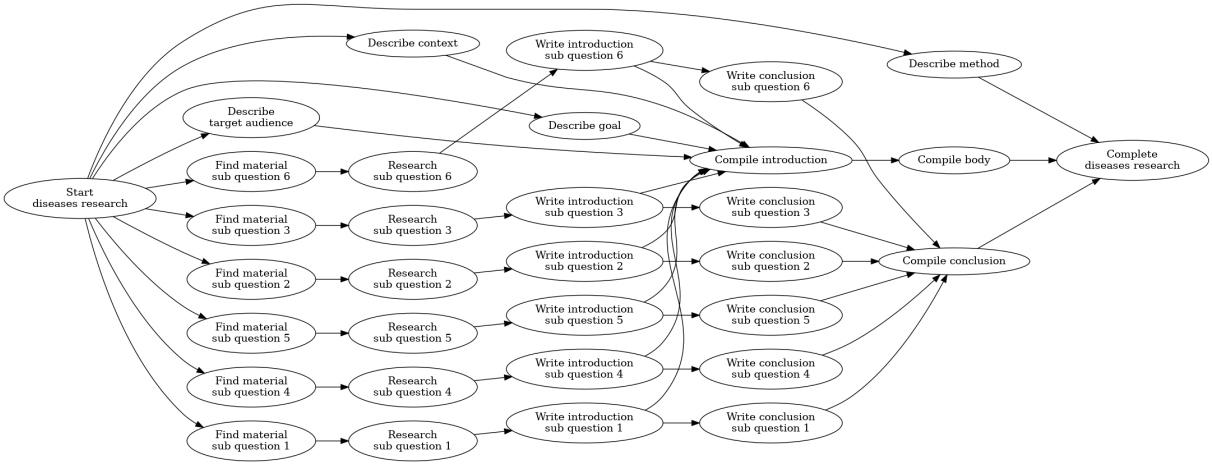


As for the health certificate research, this will follow the same structure as discussed before.



The last product that needs to be dissected into multiple parts is the data application. However, at the moment there is no information available about what kind of data is obtained from bees. Before a PBS can be created, we need to have more information. Furthermore, it is important to know who is going to use the device. Finally, we haven't discussed the wishes of InsectSense regarding this product. What is the goal they want to achieve? Do they want more insights for the user? Or perhaps develop machine learning models based on the data?

In the first sprint we will be working on the disease research. Therefore, this product is first converted into concrete tasks as shown in the following image.



For now, the remaining products won’t be converted into such graphs because of the uncertainty that it is complete.