

# IDE Master Graduation

## Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

### ! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

### STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief\_familyname\_firstname\_studentnumber\_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !



family name  
initials  
student number  
street & no.  
zipcode & city  
country  
phone  
email

Your master programme (only select the options that apply to you):

IDE master(s): ☒ IPD ☐ Dfl ☐ SPD

2<sup>nd</sup> non-IDE master: \_\_\_\_\_

individual programme: \_\_\_\_\_ (give date of approval)

honours programme: ☐ Honours Programme Master

specialisation / annotation: ☒ Medisign

☐ Tech. in Sustainable Design

☐ Entrepreneurship

### SUPERVISORY TEAM \*\*

Fill in the required data for the supervisory team members. Please check the instructions on the right !

\*\* chair Imre Horvath dept. / section: Design Engineering

\*\* mentor Adrie Kooijman dept. / section: Design Engineering

2<sup>nd</sup> mentor \_\_\_\_\_

organisation: \_\_\_\_\_

city: \_\_\_\_\_ country: \_\_\_\_\_

comments  
(optional)

The project will face many technical challenges in algorithm and electronics. As a master student, it's relatively easy for me to solve design related problems, but I need guidance for technical issues.

! Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

! Second mentor only applies in case the assignment is hosted by an external organisation.

! Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

**APPROVAL PROJECT BRIEF**

To be filled in by the chair of the supervisory team.

chair Imre Horvath date - - signature \_\_\_\_\_

**CHECK STUDY PROGRESS**

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: \_\_\_\_\_ EC

Of which, taking the conditional requirements into account, can be part of the exam programme \_\_\_\_\_ EC

List of electives obtained before the third semester without approval of the BoE

☒ **YES** all 1<sup>st</sup> year master courses passed

☐ **NO** missing 1<sup>st</sup> year master courses are:

name \_\_\_\_\_ date - - signature \_\_\_\_\_

**FORMAL APPROVAL GRADUATION PROJECT**

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked \*\*. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ☒ **APPROVED** ☐ **NOT APPROVED**

Procedure: ☐ **APPROVED** ☐ **NOT APPROVED**

comments

name \_\_\_\_\_ date - - signature \_\_\_\_\_

## Solution for managing neck pain with the principles of CPSs and Massage project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 11 - 03 - 2019 02 - 08 - 2019 end date

### INTRODUCTION \*\*

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

#### Context of the project

Neck pain has a high prevalence in the adult population due to many factors such as bad habits and accumulated injuries. It is not a life-critical problem but it is affecting people's life quality. Clinical massage as one of the main treatment methods has been proved to be effective by many studies. However, it is both costly and time consuming to frequently visit therapists.

#### Overall objective

Help people manage their neck pain on their own conveniently and effectively.

#### Main stakeholders

The main stakeholders are chronic neck pain patients who are not very rich of time nor money. They value effectiveness, time and money needed for the treatment. Some of them just live with the pain taking no action. Others may try to manage the pain on their own. For example, they may search information on Internet and buy products according to advertisements. Sometimes, when people feel painful, they may visit therapists but not continuously. Those autonomous efforts are lack of systematic guidance thus can hardly be effective. Apart from the patient, other stakeholders such as doctors, therapists and family members should also be taken into consideration. For example, therapists may fight against the product if it takes away their job. On the other hand, therapist also suffer from occupational diseases due to huge work load. Then, it would be win-win situation if the product can perform massage while involving therapists and doctors as remote assistance.

#### Opportunities

The good sale of current massage devices indicates that people have the need to receive treatment at home for sake of convenience. However, current massage devices only have relaxation effect which doesn't help for treatment. To achieve the therapeutic effect, preciseness and customization is crucial. There is an opportunity to overcome this challenge with the implementation of a massage device as a partial Cyber-physical system (CPS). It is a system that can interact with real life processes based on its sensing, computing and actuating capabilities. With the help of CPS, patients' situation and feedback would be detected and analyzed, thus the most suitable treatment is applied at the right spot.

#### Limitations

The main limitation of this project would be the cost of the product. The target group is the middle class and the product is used personally at home. So, the product should achieve a tradeoff between automation and cost. For this reason, the design should avoid using too advanced technologies, nor too many sensors or actuators. However, delicately built algorithms can composite for this limitation.

#### Main expectation:

First, the product should provide effective massage fitting for different users. Then, it should be affordable for middle class families. Though the solution won't be very automatic, the interaction between the equipment and users should be intuitive and simple.

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introduction (continued): space for images

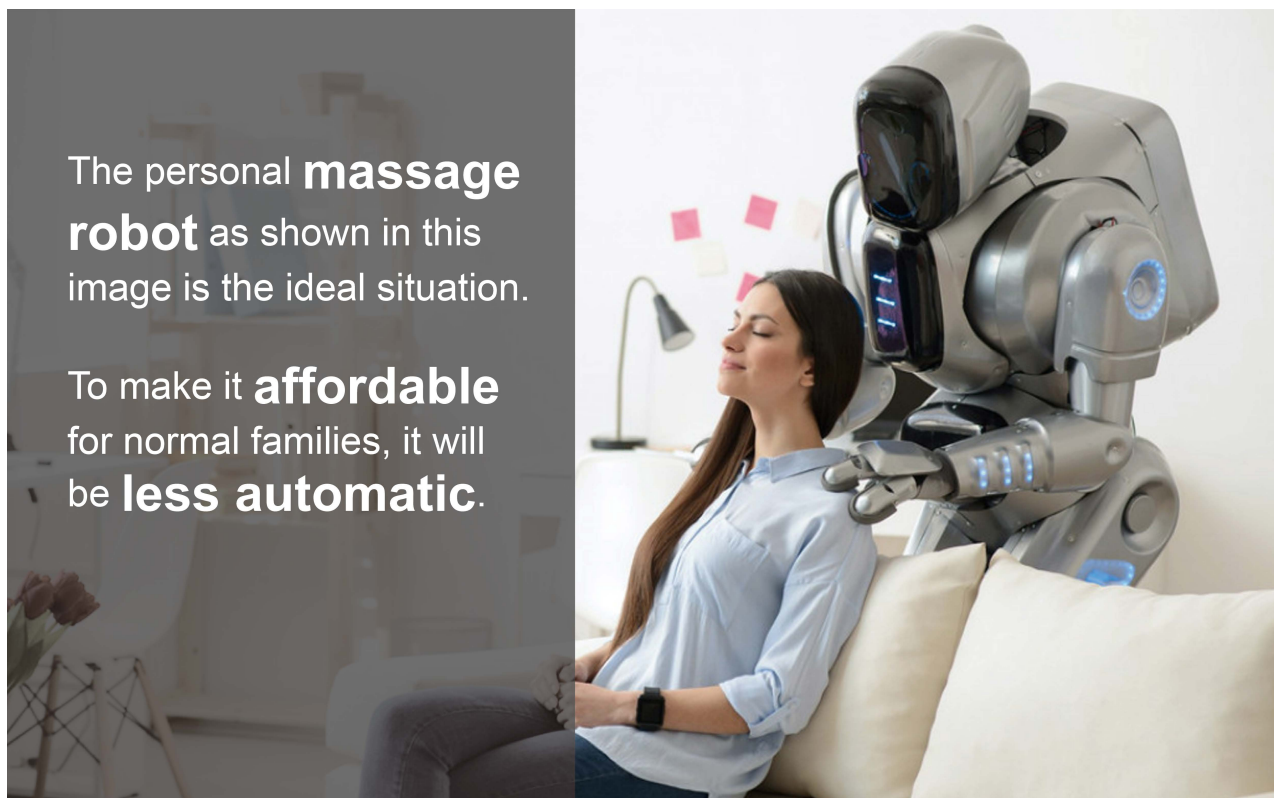


image / figure 1: Direction of the project

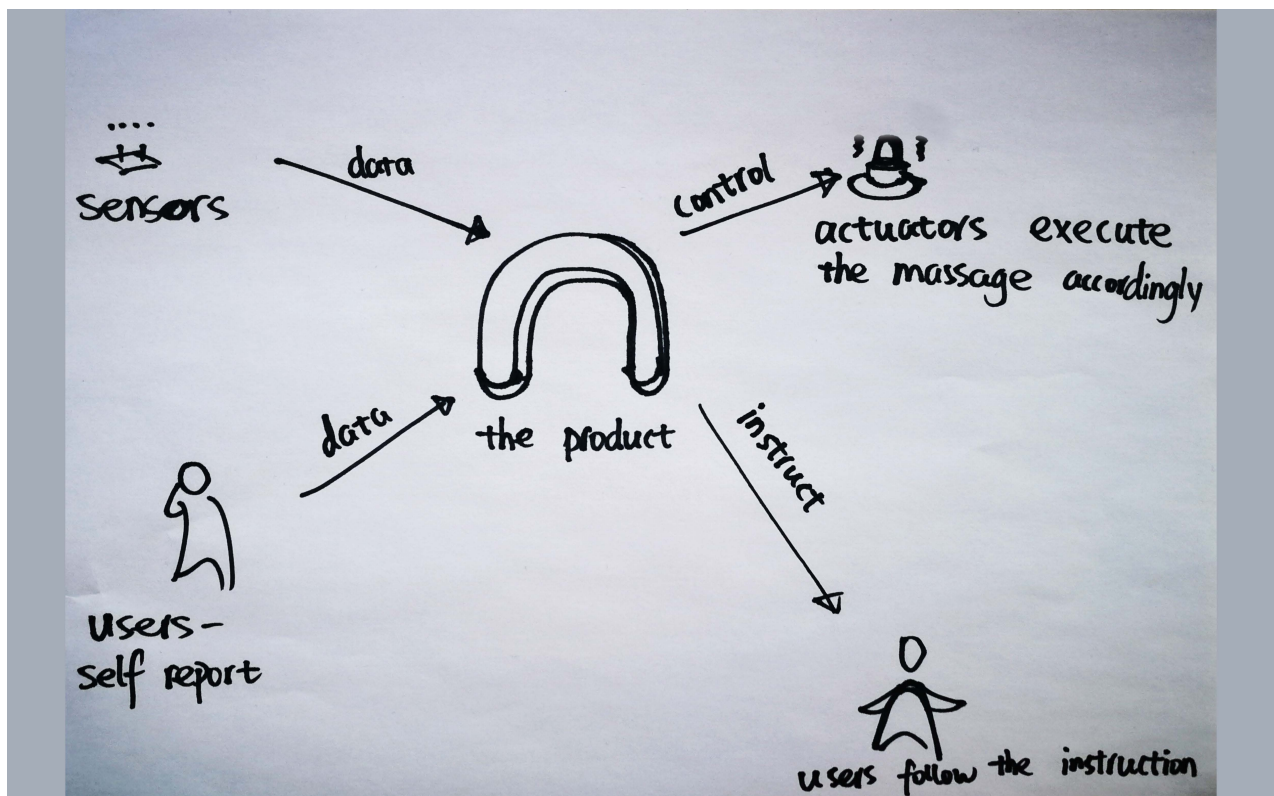


image / figure 2:

## PROBLEM DEFINITION \*\*

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The goal of this project is to enhance the autonomous neck pain management process. The neck pain here only refers to those neck problems brought by bad habits or accumulated occupational injuries rather than those caused by acute injuries. The pain management includes many aspects such as habit change, mental activation, and treatment. To fit into 20 weeks, this project will focus on the preventive treatment of neck pain. The so called "preventive treatment" means the treatment people receive regularly no matter they are feeling painful or not. By doing this in long term, their neck pain can be well managed. Moreover, the target users in this project are those office workers and students who share similar causes of neck pain and have regular routine.

### Solution space

The referential principle is clinical massage, one of the most effective treatment methods. However, people are different in body size and symptoms. Thus, the massage they receive shouldn't be same. To achieve the goal of customization, part of Cyber-Physical system will be implemented in the solution for informing or transforming or both. More specifically the solution will make use of CPSs to give instruction or directly perform customized massage or both.

### Issues to be solved

- What is the most effective massage technique that can be used as reference.
- What is the crucial data that is needed for customizing the treatment.
- How to compute the data and translate it to actions.
- How to make sure users are willing to use it continuously.

## ASSIGNMENT \*\*

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... . In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

The research part of the project includes investigation of the available technologies, user needs, existing products, and massage methodologies. The design part will include the development of a feasible concept with desirable function and thoughtful details. A testable prototype will be created including algorithms and physical components.

How I can address the issues pointed out in the last section

For the issues about massage and data, there are many studies about massage and neck pain Online. Moreover, the therapists are easy to approach to for inquiring. I can tackle those issues by reading papers and interviewing experts. For the issues about users' long-term using habits, I took the course persuasive design, which can help a lot in changing users' habits. For the issue about building algorithms to compute data, my chair is an expert in this field and learning it is part of my learning goal.

### Expected solution

The solution will be a smart neck pain treatment device with the function of detecting and analyzing users' data and providing customized massage treatment. It would be used at home or at the work spaces regularly to alleviate or prevent neck pain. Service might be also involved in the solution. For example, with a data collected by the device, doctors can provide remote assistance.

### Medisign

The aim of this project is to help people deal with neck pain problems which is related to their health status. So, it fits the requirements of Medisign specialization.



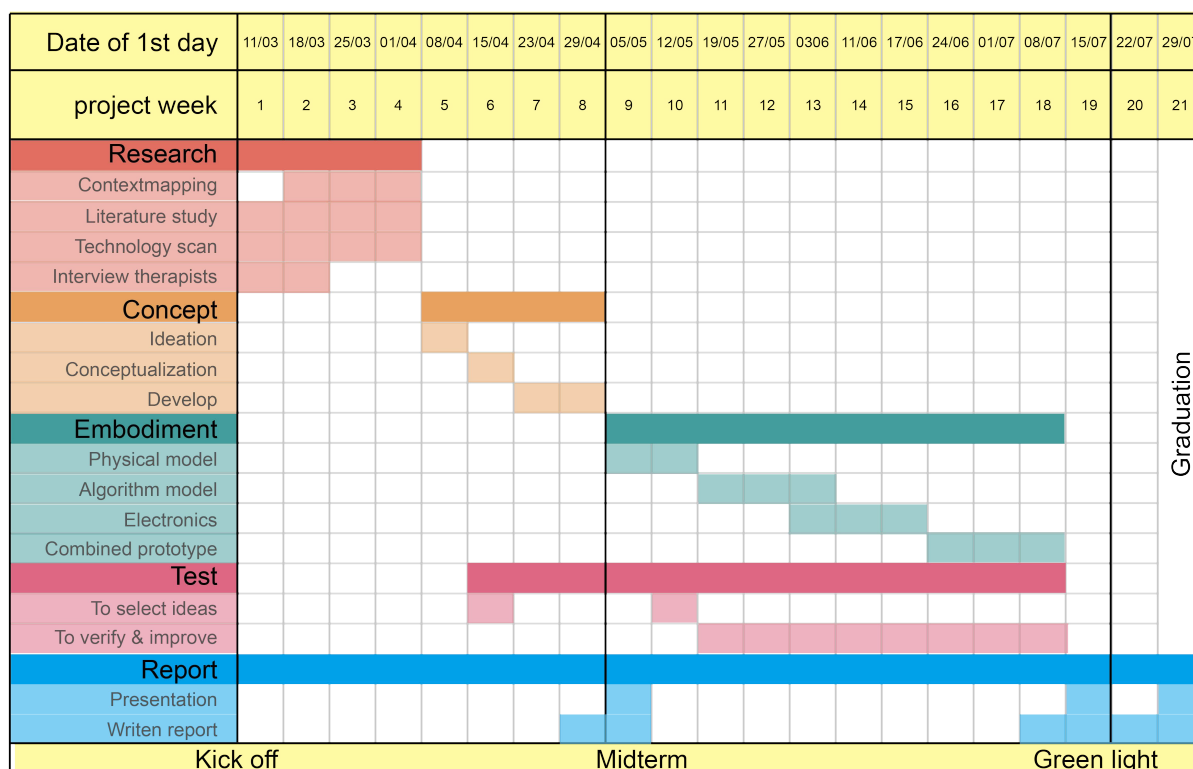
## PLANNING AND APPROACH \*\*

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 11 - 3 - 2019

2 - 8 - 2019

end date



### Explanation of the plan

I will start with analyzing current products to see their pros and cons. After that, review literatures about neck massage and related technologies such as sensor and actuators. With these basic knowledges, interview therapists to gain more insights. At the same time, conduct user study to understand their specific needs. After all those researches, ideate on subproblems. Then, select and combine the generated ideas to several concepts. Evaluate and select one concept to present in the midterm meeting. After the concept is defined, I will spend 7 weeks working on embodiment design including ergonomics, algorithms and electronics. After that, I plan to spend 3 weeks to build the final prototype combining all the features.

### Deliverables

Concept report, Concept presentation, Implementation report, Testable prototype.

### Instrumentations

The estimated material needed for building prototypes includes:

- Common sensors such as infrared sensors or pressure sensors.
- Soft materials such as cloth and sponge.
- 3D printed small components.

## MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... . Stick to no more than five ambitions.

Why I set up this project

I have been suffering from chronic neck pain for a long time. I'm a fan of doing massage. However, it is too expensive and inconvenient for me. I'm looking for an alternative treatment device but I never found one. So, I see a good opportunity and It would be fantastic if I can develop one myself. Moreover, I think smart system is a trend especially for healthcare field. If someone will develop a smart yet affordable massage device, I hope that would be me.

Competences I want to prove and learn:

- Programming
- Project management
- Prototyping

Competences you have yet developed:

- User study
- Ideation
- Sketch, 3D modeling and rendering

Personal learning ambitions

I think the knowledge about Cyber-Physical System and electronics can add to a designer's uniqueness and competitiveness. I hope I can step into those fields by doing this project. Moreover, I want to gain the experience of completing the whole product development process, from vision to embodied design, hopefully also to the market.

## FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.