

# D7039E: Project report

## Swimming Timer

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September 15, 2025

# Abstract

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# Chapter 1

## Introduction

Accurate timing is a crucial part of both swimming competitions and training sessions. Existing professional timing systems are often reliable, but can be very expensive and difficult to set up, making them less accessible to smaller swimming clubs or individual athletes. This creates a need for a solution that is both affordable and adaptable while expanding on the idea of modern functionality.

The purpose of this project is to design and implement a modular timing system for swimming. The system will be built to provide accurate lap timing, digital tracking, and support for swimmer identification, so that personal bests and results can be stored and displayed in real time.

# Chapter 2

## Three Solutions

### 2.1 First idea

The first idea of how we could implement the timing system was a touchpad timing system like they use in official swimming competitions. These systems starts measuring time after a sound plays and at each end of the swimming lane there are touchpads. When a touchpad is pressed the timing computer gets a signal and can then either measure a time split or stop the time.

The advantages with using this solution are that the timing is extremely precise being able to measure time correctly down to hundredths of seconds. Another advantage is the system is easy to understand and to use, you start to swim when the sound goes off and then just touch the wall.

The negative with this solution is the price, these touchpad timing systems are really expensive, and they are also hard to install because you need a lot of technical knowledge and it needs maintenance. When installing this system you also need to perform many calibrations so that the touchpad does not get activated by mistake.

### 2.2 Second idea

The second idea was a solution including RFID tags to track the swimmer from the start, and to later check when the swimmer reaches the distance and when the swimmer gets back to the start. The idea was to implement it in a wristband or something similar so the swimmer's location can easily be tracked.

One advantage of this solution is that it is easy to set up, and easy to use for the swimmer. It is also cheap compared to the first idea. This would also make swimmers able to track their own time without having to press a button.

The negative of this solution is that it is less accurate than the first idea, and that it might be uncomfortable or mess with the hydrodynamics of the swimmer by making the swimmer have more mass. Another problem is that the RFID (Radio Frequency Identification) signals could have reduced functionality underwater because of the water's ability to absorb radio waves. This would require a specific design for underwater swimming.

### 2.3 Third idea

Our final idea is the concept we have chosen to pursue. The system is designed to deliver accurate lap timing, digital tracking, and swimmer identification, allowing personal bests and results to be stored and displayed in real time.

The core of the system is a metal plate mounted on the swimming wall, leaving a small gap of one centimeter

near the surface. Inside this gap, a switch is installed that registers when the plate is pushed. Each time this happens, the system receives a signal indicating that the swimmer has completed a lap. The race begins with a buzzer that simultaneously starts the swimmer's timer, ensuring synchronized and reliable timing.

To keep costs flexible, the design allows each swimming lane to be equipped with either one or two timing plates, depending on the budget and the level of accuracy required.

All data processing and system control are managed by a central computer, making it possible to integrate with external displays and additional digital features. The ultimate goal is to create a modular and scalable system, suitable for everything from a single training lane to a full Olympic-standard pool, without the need for unnecessary hardware investments.

## Chapter 3

# Theory

## Chapter 4

### Method

## Chapter 5

# Results

## Chapter 6

## Summary

# Chapter 7

## Appendix

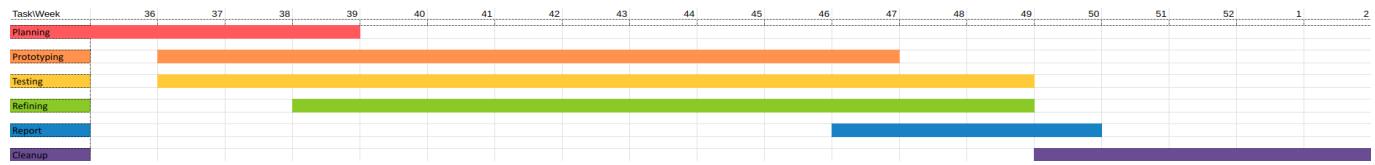


Figure 7.1: Gantt chart for the Swimming Timer project

## Gabriel Sundblad



My name is Gabriel Sundblad, and I would describe myself as a social, curious, and goal-oriented person who thrives when faced with challenges and opportunities for personal growth. I am currently pursuing a Master of Science in Engineering, specializing in Computer Science at Luleå University of Technology (LTU), with a focus on industrial computer systems. My expected graduation is in May 2026.

Outside of my academic life, I have a wide range of interests that allow me to stay active and creative. Skiing, particularly downhill, has been an important part of my life for as long as I can remember. I have even competed in the sport, which has taught me discipline, perseverance, and the importance of continuous improvement. During the summer months, I enjoy spending time on the golf course, where patience and focus are key. Another passion of mine is cars and engines, I find it both exciting and inspiring to explore new technologies in this field, and sometimes I even make spontaneous visits to car dealerships just to learn more. However, my greatest interest is in computers and technology. My fascination with how they work has been the driving force behind my choice of education and my long-term career goals.

Through my studies, I have gained solid knowledge in various programming languages. Although I have worked with many, my personal favorites are Python and C++. I appreciate them because they combine simplicity with the potential to create highly complex and powerful solutions.

So far, my work experience has been outside of my field of study, including roles as a machine operator and logistics planner. Although different from computer science, these jobs have given me valuable transferable skills. I have learned to work effectively in teams, plan strategically, solve practical problems under pressure, and take responsibility in environments where accuracy and communication are crucial. I believe that these experiences provide me with a strong foundation for applying my technical skills in collaborative projects.

In this project course, my main ambition is to bridge the gap between my programming knowledge and real-world application. I want to develop my ability to use programming in practical scenarios, from initial design to implementation. I am also eager to work on creating something from scratch, gaining insight into the entire development process. Another important goal for me is to improve my presentation and communication skills, particularly when speaking in front of new groups and explaining technical concepts in a clear and engaging way.

I believe that my role in this project will be a combination of contributing to the design and structure of the solution, supporting the programming tasks, and taking an active part in presentations. By combining my technical interests with my previous work experience and my social skills, I aim to make a meaningful contribution to the project and to the team as a whole.

## Jakob Kieri



My name is Jakob Kieri. I study for a Master of Science in Engineering, with a specialization in Industrial Computer Systems. Previously studied natural science at Tornedalsskolan, since I didn't have access to university preparatory education with a focus on technology and had previously only dealt with a small amount of programming in Basic on a calculator. I am mostly interested in creating durable minimal systems that are reliable in fulfilling their goals, which is why I am interested in the programming language Rust and what the professor Per Lindgren does.

If I were to be more specific, I am not necessarily good at neither Rust nor programming, but if I want to learn a programming language it would need to be a language with a promising future and that would hopefully allow me to program it once and then be allowed to forget it even exists (because it fulfills its' function so well).

But I have also taken optional courses that are not in Rust (Neural Networks and Learning Machines (D7046E) and Mechatronics (E7012E)) and am furthermore slightly interested in taking something like the course in Neuro-morphic Computing (D7064E).

I am furthermore interested in a future where I get to tinker with a wide range of stuff (but I am drawn to having the programming language be Rust, whenever a programming language is needed (although ability to serve its' function is still most important)): 3D-printing, self-hosting on a personal server, tinkering (fixing or improving items I have. For example, with exotic materials like, for example: PTFE, PBT, carbon fiber, and titanium (although stainless steel is very good for most circumstances)).

My main area of interest in the project is to figure out if the locally created RTIC Real Time Operating System can be used for this project. I expect various difficulties in getting everything to work and will spend my time on that. But I believe it is fitting for a project course at Luleå University of Technology, to try to incorporate what has been developed here. Furthermore, there is hope that the struggles will not be for nothing and that we will get more valuable experience.

There have furthermore consistently been and most probably will continue to be other roles that I am forced to in-officially hold in projects such as these. Among them includes being the one to remind others of requirements that are placed on us. I plan to lessen that role of mine, by clearly discussing and finding out what the group thinks about requirements and how the group wills to deal with them. I am not interested in a leader role or someone who has to constantly remind, instead I want to distribute load.

## Oliver Östrot



My name is Oliver Östrot, I was born in Västerås in the year 2002, and ever since I was little, I was interested in technology and computers. Previously, I studied information- and mediatechnology at Grillska Gymnasium, and then I continued with computer technology here at Luleå Technical University.

### Spare time

In my spare time I like to play games, interact with people and occasionally go to the gym. I also like to watch series on Netflix and sometimes movies.

### Previous work experience

I have not had any previous full time jobs, but I have had my fair share of summer jobs. I have worked as a cleaner for three summers in a row, and then afterwards i worked at GPV, as a planner where i managed work orders for the production. This year I worked as a fitter at ABB Robotics where I was assembling robots.

### About the course

What I expect from the course is to get more familiar with working as a group and setting up and contributing to projects on a bigger scale. I would also like to learn more about sensors and more, work in practice on how to put things together to build something that can measure different factors such as time, and pressure more specifically in our project.

### Work areas

During these upcoming months, i expect to get better at programming to hardware and software, learn more about how to set up hardware to solve the given problem with starting a timer when a certain signal goes off, where we should write code to get the timer to start at the same time for all swimmers. Thereafter the other part is fixing a pressure plate that stops the timer when the sensor is activated. This part is also very similar to the first part but with a pressure plate that activates the microcontroller through a sensor and not a signal. The work areas I am probably the worst in is connecting sensors and cables to the microcontroller and get that to then be connected properly so the response is working. On the contrary, I would say my strength is writing code in rust so that the program's functions do what it is supposed to with the given input signal.

## Daniel Sternalind



My name is Daniel Sternalind, 23 years old studying to become a Civil engineer in Computer science and previously I studied information- and mediatechnology at Berzeliuskolan Gymnasium.

In my spare time I enjoy going to the gym and being active. I like both watching and playing sports, I enjoy watching almost any sports and when it comes to playing them myself, right now I like to play disc golf. Some of my other interests are playing video games and spending time and socializing with friends.

When it comes to work experience I do not have any however during my time at university I have worked in projects before as well as a lot of laboratories which have been on a small and bigger scale. These have given me experience with working both alone and in groups, this has given me skills to be able to communicate and work effectively with others but also to be able to work individually.

I have always been interested in technology and computers and with my studies I have been able to learn a lot about both these things. The knowledge I have gained that will help me in this project is good knowledge of multiple programming languages, as well as a bit of knowledge about making hardware. In this course I expect to learn more and gain experience working in a group in a bigger project also planning the execution of our solution as well as having meetings with both the group and also the buyer of the project.

In this project my goals are to further my programming knowledge and gain more knowledge and experience with the actual hardware. Another goal is to gain experience with making code that then actual implements with the hardware and creates a good final product. My main area of interest in this project is how the pressure plates signalas will be able to communicate with our time keeping systems and how to be able to implement the programming for this. I am also interested in making a scoreboard where the times will be displayed.

I believe that in this project my main responsibility will be working with programming the software as I am more comfortable with programming than with building hardware. However, I also want to contribute to building and making the hardware in some way for this project in order to learn and gain more experience with hardware.