

Aalto-University  
School of Electrical Engineering  
Automation and information technology training program  
Information technology major

Research plan for bachelor's degree  
with working title

Web application for electronic textiles design

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# 1 Introduction

Electronic textiles (e-textiles) have been around for two centuries. They are still a growing industry. E-textiles are wearable pieces of clothing that have conductive materials woven into the fabric. Since the late 1800s people have worn clothing with conductive materials, like for example gold or silver. Only later did designers start using the conductivity to create circuitry out of clothing. Though e-textiles have been around for so long, have the methods for designing them stagnated.

Current methods of designing e-textiles involve paper sketches complemented by computer controlled weaving machines. The method for inputting instructions into the machine is done by converting the paper sketches to images using photoshop or similar software, converting that image to a file for the weaving machine's software and uploading that file. Simple revisions and changes to the design require reediting of the image which is time consuming and unintuitive. The software in the weaving machine has rudimentary editing tools that do not satisfy the needs of the designers.

Fabrics are woven by interlacing two different yarns, called warp and weft, with each other at 90-degree angles. The basis of weaving machines is that for each row the machine either lifts a warp or leaves it down. The Weft then goes through the warps to the other side and the cycle is repeated. The pattern that the warp and weft create is called a weave. The simplest weave, a plain weave, is achieved when for every row, every other warp is lifted. This gives us a plain chess pattern. E-textiles often employ layered weaving to create complexity and protection to the conductive threads. The basis of layered fabrics is that the warps are divided into layers and stay separate from the other layers' warps unless overlap is needed. Complexity to the weaving arises when the weave employs different amounts of layers at different points in the fabric. Designing this type of weave with pen and paper requires unreasonable amounts of resources.

Concepts:

E-textiles, Smart textiles, Weaving, Web application, Internet application, Database, Software

## 2 Objective

The first research topic of this paper is web-based applications. The research will look into what are the tools for creating we applications, what are the pros and cons of these tools and which ones best suit the type of application this paper looks to create. The second topic is user experience of computer software. This means to study how humans perceive computer programs and what features are intuitive. This does not include studying the human psyche, but simply to create a user-friendly program that has enough complexity to aid even in more complex tasks. Lastly the paper will research how the tools used and user experience can be used to aid textiles designing.

The application will be built step by step and progress will be reported in this paper. The first version will be a rudimentary version where the objective is to create the foundation, onto which the tool can be expanded. The later versions will add functionality and have user experience as the main objective. Ideas for features in the application will be discussed with the e-textile designer Emmi Pouta from Aalto university. Ideas for features include pixel based and 3D based viewing and editing of the fabric, presets for ease of use and easy conversion between fabrics of different layers. The features will be expanded upon later in the research.

The study will include the basics of weaving and textile design as they are important building blocks for the fundamental features of the application. For example, how the pixel-based textile designing works and how it translated into the finished fabric. However, it will not include extensive research of specific weaving techniques as these are unimportant to the basic features of the application. The application will have the basic tools to create weaves but will not expand the user's knowledge of weaving techniques. In short, the goal is not to create a learning tool.

This research seeks to solve the need for useful and feature rich tool for designing textiles with the particular emphasis on features that aid the design of e-textiles. Achieving this goal will ease the work of designers and allow them to focus on the important parts of designing. It will also ease the work of new designers and amateurs.

### 3 Schedule plans

Working schedule:

Monday:	3h
Tuesday:	3h
Wednesday:	3h
Thursday:	3h
Friday:	3h
Saturday:	0-3h
Sunday:	0-3h

Data Gathering  
Analysis  
Development  
Writing

Deadlines:

01.10.19	Research plan				
13.10.19	Version I				
03.11.19	Version II				
xx.11.19	Speech workshop slides				
10.11.19	Opposing exercise				
17.11.19	Version III				
01.12.19	Opposing report				
01.12.19	Final presentation slides				
2-5.12.19	Seminars				
15.12.19	Final version				

## Bibliography

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