Project Plan -
Smart Solutions Semester

REV'IT!

L.26195 Testing device membrane fabrics for motorcycling

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Saxion University of Applied Science
Mechatronica
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Preface

This research report for REV'IT! is commissioned by Saxion University of Applied Science as part of the Smart Solutions Semester. The following study fields are involved; Electrical Engineering, Mechanical Engineering and Fashion and Textile Technologies.

The goal of this research is to provide REV'IT! a breathability testing device for membrane fabrics for motorcycling garments. The purpose of this report is to implement our knowledge and to combine the knowledge of each team member to fulfill the requirements of the company.

The group exists of five team members from different specializations: Harold Kip (MT), Le Van Hoang Minh (EIE), Dimitar Rangelov (EIE), Femke Visser (FFT) and Isabel Wesselink (FFT).

September 12, 2019

Enschede

1 Introduction

REV'IT! is a Dutch company, based in Oss, which develops innovative motorcycle clothing since 1995. REV'IT! is a worldwide known company with over a thousand dealers all over the world. After five years REV'IT! introduced the 'Engineered skin design' concept, a new method for product development. A groundbreaking method to deliver higher protective motorcycling products. In 2009 REV'IT! made a license agreement with Gore-Tex. By combining Gore-Tex with the Engineered skin, the performance and safety of the products have improved (REV'IT!, 2019).

REV'IT! makes motorcycle clothing for men and women from 18 years and older. The company creates collections which are divided in three different types of motorcycle garment categories: Sport, Adventure and Urban. These categories are based on the level of performance of the motorcyclist. REV'IT! also provides a lifestyle collection for both men and women.

With the lab located in Oss, REV'IT! tests their own fabrics at their own headquarters. Before the garments are produced the fabrics will first be tested in the lab. The fabrics are tested on their safety level to see if the products fulfill to the standards. Another important factor is to test the materials on the comfort level. REV'IT! aim is to provide protective and comfortable products towards their customers. A few examples of these tests are the tensile strength test, abrasion resistance, dimensional stability and many more. While performing these tests the seam strength, the stretch ability and the wear resistance of the products are for example tested (REV'IT!, 2019).

All information is acknowledged on the 5th of September 2019 by Mr. Memel, the Lab Coordinator at REV'IT! Oss.

1.1 Problem analysis

REV'IT! currently has a laboratory in Oss to test the materials. This lab was originally built to test the safety features of their motorcycling garments. By doing that REV'IT! was able to see if a suit would pass the European Union mandatory test for motorcycling garments. REV'IT! want to take this a step further. They reckon a driver who is comfortable is safer because they are not distracted by, for instance, the warmth of the suit or the humidity. It is therefore important to test the breathability of the fabrics. REV'IT! currently tests the breathability of membranes in combination with different types of fabrics according to the ASTM 96-95 standard. The standard defines the use of a predefined aluminum cup filled with 100 grams of distilled water. The fabric is placed on top of the cup with an airtight seal around the corners, so the only way for the water to get out of the cup is through the fabric. The whole setup of the cup and fabric is placed in an oven of 32 to 37 degrees Celsius, depending on the type of experiments. After 120 hours, the cup is removed from the oven for measurements which evaluates the amount of evaporated water through the fabric. This value will be extrapolated to the international standard of grams per square meter per 24 hours (Huang & Qian, 2008).

REV'IT! is defining the current testing procedure as not efficient and would like to change it. They are not able to monitor the cup and testing environment as their only data points at the moment are the weighting of the cups before and after the test. The testing device does not have sensors which could collect data as temperature, humidity, weight of the cups at all times during the test. However, one of the most important things is to be able to monitor and test the behavior of the fabrics in combination with the membranes for breathability in different phases of the test. For example, the well-known Gore-Tex fabric requires a certain amount of time to start functioning in full capability. It is important to know when fabrics in combination with a membrane becomes breathable. This variable is of great importance for

REV'IT! as they offer biker wear for different kinds of motorcyclist, each with different requirements. Furthermore, these values and information will result in a more efficient match of fabrics with membranes for the type of bike activities (Sport, Adventure and Urban). Each activity has its own requirements for motorcycling garments as intensity and duration of the drive differs between them.

1.2 Research objectives

The most important factor for designing a motorcycling suit is protection, but the suit must also protect the rider from weather conditions such as rain, sun or wind. Ventilation is therefore key. In summer the suit can overheat the motorcyclists' body. Therefore, the appropriate protection should not disturb the thermal balance. The vapor permeability of the motorcycling garments must be high so the sweat can be evaporated. Motorcycling clothing is mainly made out of leather or textile materials, for instance nylon, polyester, polyamide etc. Suits made out of leather is more durable but makes it impossible for the human body to breathe. The clothing made out of textile currently provide protection against weather conditions while the perspiration will get through. Different fabric compositions are required for each type of motorcyclist. The fabrics for the garments are combined with membranes so it feels comfortable on the skin (de Rome, 2019) (Zwolińska, 2013).

The most commonly used membrane is from GORE-TEX. The GORE-TEX membrane is a thin stretched layer of polytetrafluorethylene (ePTFE). ePTFE is also known as Teflon. The membrane is attached to an outer fabric and the lining. GORE-TEX prevents water from penetrating the product and allows evaporation of sweat, which is known as the wicking-effect. Because of the membranes the products become windproof, waterproof and breathable. Gore-Tex provides the wearer a thermal protection, reduces heat and allows the wearer to move.

The membrane that GORE-TEX uses is only 0,01 mm thick and has about 1,4 billion pores. These pores are twenty thousand times smaller than a raindrop and seven hundred times bigger than a water vapor molecule. Because of this, the membrane is fully waterproof, but the perspiration will get through. GORE-TEX's membrane is also windproof because it has a structure of a hedge. You can only see this under a microscope (Anitlope Outdoor, 2019). (Ismal & Paul, 2018).

Another company that makes membranes is eVent. eVent is also one of the most and biggest known alternatives for the GORE-TEX membrane. The eVent membrane is made out of the same materials as GORE-TEX. But the membrane of eVent uses a dry system. This makes it possible to get the moisture out in an instant. This is also called DirectVenting, a design of the brand itself (Norway Geographical, 2019).

In combination with the membranes, the breathability of the membranes depends on the fabric its laminated to. It is important to know which combination of fabric and membrane is breathable, to make the best usable motorcycling suit. Therefore, it is important to measure the temperature, humidity, evaporation time and weight of the fabrics (Zwolińska, 2013).

While the water evaporates in the oven, humidity will develop. Inside the oven there will be an absolute humidity. Absolute humidity is the mass of water vapor divided by the mass of dry air in an amount of air at a given temperature. This means, when the air gets hotter the more water the air can contain (Chandler, 2019).

The fabrics used within the products must meet certain quality standards. One of these standards is the ISO standard. The American version of this standard is the ASTM standard. REV'IT! is currently using for permeability the ASTM 96-95 standard. REV'IT! has developed a permeability device according to the ASTM 95-96 standard. The aim is to determine when the fabrics breathe during the whole test, but this is not achieved with the current test. Therefore, the aim of the research is to create a testing device for REV'IT! which can determine the breathability of a fabric by measuring the weight of the cup, the temperature and the humidity. These measurements are taken throughout the test and displayed in a graph. With this data REV'IT! can determine how long it takes for a fabric to breathe. The device will be a REV'IT! standard and therefore the ISO and ASTM standard does not need to be followed exactly.

1.3 Research question and sub questions

To address the problem, as described in 1.1 Problem Statement, the following main and sub-questions have been composed.

Main question
To what extent can a test device be developed to get a better understanding of the breathability of fabrics?

Sub-questions
Sub question 1: What kind of equipment is required to measure the weight of the cups at all times?
Sub question 2: What kind of equipment is required to measure the temperature inside the oven at all times?
Sub question 3: What kind of equipment is required to measure the humidity inside the oven at all times?
Sub question 4: How does the outside humidity affect the breathability of fabrics?

Preconditions and project deliverables
The smart solutions semester project is completed successfully when a testing device is developed which can determine the breathability of a fabric by measuring the weight of the cup, the temperature and the humidity in the oven and can display these measurements in a graph for REV'IT!

2 Methods

This chapter describes the methods used within the research for REV'IT!

This research is a combination of quantitative and qualitative types of research. Qualitative Research is primarily exploratory research. It is used to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research. Quantitative Research is used to quantify the problem by way of generating numerical data or data that can be transformed.

2.1 Literature research

A qualitative literature research has been carried out to answer all sub questions to obtain general information about the subjects. A lot of information will be gathered from international standards as they form the basis for the current testing procedure and include a lot of in-depth information on the why and how.

2.2 Interviews

Semi-structured interviews will be conducted to answers sub questions. Interview schemes will be made before the interviews and there will be possibilities for extra questions during the interviews. As Jorrit Memel is the sole person in charge of the testing at REV'IT! he is the only person available to interview to gather more information about the current testing device and the requirements for the new testing device. Therefore, the population and the sample of the interview is one. The interviewee will be approached for the interview by email and the interview will be held at Saxion Enschede via Skype.

To make the testing device additional help and information is needed from different experts. Therefore, to gather more information about the use of the sensors and the electronics parts for the testing device the Hardware Lab/Electronics teacher at Saxion University of Applied Science, Umit Guler will be interviewed.

To collect more information about the equipment which can measure the weight of the cups and the construction of the cup the employee Mechanical Systems/High Precision Fabrication at Van der Beek's Beheer B.V. Romar Willems will be interviewed. The population and the sample of the interviews with the experts are two. The interviewee will be approached for the interviews by email and the interviews will be held at Saxion Enschede and at Van der Beek's Beheer B.V.

2.3 Measurement

Measurement will be made to test and evaluate the behavior and characteristics of fabrics and membranes. These measurements will be carried out in the chemical laboratory at the Epy Drost building of Saxion Enschede. There are already premade measurements by Jorrit Memel in the lab at REV'IT! that will be used in the research as reference. However, also the research will contain technical measurements based on the performance and accuracy of the device. This will help to develop a device which is more efficient.

Once the testing device for REV'IT! is developed various membranes in combination with the fabrics provided by REV'IT! will be tested on their breathability.

2.4 Simulation

Simulations will be used to test and evaluate the behavior and characteristics of fabrics and membranes. Also, to try to predict the ratio of the humidity inside and outside of the cups. However, the simulation will be used mainly in the developing process of the hardware and the software. On the other hand, the simulations will also help to track how the real device will behave and perform in a real environment before its even developed. Later on, this will be beneficial for the accuracy and speed of the product.

3 Role & Responsibility

Every person who is part of this project has a specific role and responsibility which corresponds to his or her specialty and interests. In this way everyone can use their full potential, and this will affect the end result.
See table 1 for the roles and responsibilities for everybody within the group.

Table 1
Roles & Responsibilities

Role	*Identity*	*Responsibilities*
Chairman and Quality Manager	Femke Visser	Establishing a connection with the client and playing a role as contact person. Testing and evaluating the behavior and characteristics of fabrics and membranes. Also writing detailed quality reports.
Quality Manager	Isabel Wesselink	Testing and evaluating the behavior and characteristics of fabrics and membranes. Also writing detailed quality reports
Mechatronic Engineer	Harold Kip	Testing and developing the mechanical system of the device. Also forming mechanical electronics of the sensors in the final product. Testing and evaluating the behavior and characteristics of fabrics and membranes.
Embedded Engineer and Software Developer	Dimitar Rangelov	Developing hardware and embedded software meeting the criteria and characteristic of the project. Also adapting or creating a firmware for representing the data of the tests. Testing and evaluating the behavior and characteristics of fabrics and membranes.
Embedded Engineer	Le Van Hoang Minh	Developing hardware and embedded software meeting the criteria and characteristic of the project. Testing and evaluating the behavior and characteristics

	of fabrics and membranes.

4 Planning

See table 2 for the planning for all weeks during the project including facilities (working place (e.g. working space).

Table 2
Planning

Week	*Outcome*	*Responsible*	*Facilities*	*Time (Hours)*
1.1	- First group meeting	All	Saxion Enschede	24
	- Kick-Off Smart Solutions Semester	All	Saxion Enschede	
	- Research on REV'IT!	All	Home office	
	- Meeting with REV'IT!	All	REV'IT! Oss	
1.2	- Group meeting: Monday, Tuesday, Wednesday and Thursday	All	Saxion Enschede	32
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Researching ISO and MVTR standards.	Harold, Femke & Isabel	Saxion Enschede	
	- Research different sensors for the device	Dimitar, Harold & Minh Lê	Saxion Enschede, home office	
	- Work on project plan	All	Saxion Enschede, home office	
	- Send Project Plan to Jorrit and Jenny	Femke	Saxion Enschede	
	- Request cup, membrane, fabrics and standards	Femke	Saxion Enschede	
	- Develop a firmware	Dimitar	Home office	
1.3	- Group meeting: Monday, Tuesday, Wednesday and Thursday	All	Saxion Enschede	32
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Brainstorm for ideas testing device	All	Saxion Enschede	
	- Interview with Jorrit Memel about the project plan	All	Saxion Enschede, Skype	
	- Literature research of the provided standards by Jorrit	Harold, Femke & Isabel	Saxion Enschede	
	- Send final project plan to Jenny and Jorrit	Femke	Saxion Enschede	
	- Personal Deadline 20/09/2019: Project Plan	All	Saxion Enschede, home office	
	- Deadline 22/09/2019: Final Project Plan	All	Saxion Enschede, home office	
	- Group meeting: Monday, Tuesday, Wednesday and			

1.4	Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Receive cup, fabric samples, membrane and standards from Jorrit - Create a technical drawing of the cup - Remake the original cup for testing - Research: Received standards of the test by Jorrit - Research: How to attach the sensors to the cup - Test the compositions of the received fabrics - Update Jorrit about project progress	All All All Harold Harold Femke, Isabel Dimitar, Minh Lê Femke, Isabel Femke	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede Van der Beek's Beheer B.V. Saxion Enschede Saxion Enschede, home office Chemical lab - Epy Drost Saxion Enschede	32
1.5	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Test: How does the original cup relate to the remake cup - Test: The behavior of the sensors with the cup	All All All Harold Dimitar, Minh Lê	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Chemical lab Hardware lab - Wolvecamp	32
1.6	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Research: Choose the best option sensor for the cup - Start prototyping - Update Jorrit about project progress	All All All Dimitar, Minh Lê All Femke	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede Hardware lab - Wolvecamp Saxion Enschede	32
1.7	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Prototyping - Personal deadline 20/10/2019: finish prototype - Deadline 20/10/2019: First version personal portfolio	All All All All All All	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Hardware lab – Wolvecamp Saxion Enschede, home office Saxion Enschede, home office	32
1.8	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working	All All	Saxion Enschede Home office	32

	- Meeting with Jenny (tutor) - Test prototype - Test different types of fabrics with prototype - Start quality report - Update Jorrit about project progress	All All Femke, Isabel Femke, Isabel Femke	OTSWO 3rd Floor - Epy Drost Hardware lab - Wolvecamp Chemical lab - Epy Drost Saxion Enschede Saxion Enschede	
1.9	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Quality report - Buffer week	All All All Femke, Isabel	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede	32
1.10	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Analyze breathability testing results of the fabrics (120 hours test) - Update Jorrit about project progress - Personal deadline 17/11/2019: finish quality report	All All All Femke, Isabel Femke All	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede Saxion Enschede Saxion Enschede, home office	32
2.1	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Analyze breathability testing results of the fabrics (120 hours test)	All All All Femke, Isabel	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede	32
2.2	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Update Jorrit about project progress	All All All Femke	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede	32
2.3	- Group meeting: Monday, Tuesday, Wednesday and Thursday - Friday: Remotely working - Meeting with Jenny (tutor) - Deadline 08/12/2019: Second version personal portfolio	All All All All	Saxion Enschede Home office OTSWO 3rd Floor - Epy Drost Saxion Enschede, home office	32
2.4	- Group meeting: Monday,	All	Saxion Enschede	32

	Tuesday, Wednesday and Thursday			
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Update Jorrit about project progress	Femke		
2.5	- Group meeting: Monday, Tuesday, Wednesday and Thursday	All	Saxion Enschede	32
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Preparations presentation Smart Solutions Festival	All	Saxion Enschede	
2.6	- Group meeting: Monday, Tuesday, Wednesday and Thursday	All	Saxion Enschede	32
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Finalize presentation Smart Solutions Festival	All	Saxion Enschede	
2.7	- Group meeting: Monday, Tuesday, Wednesday and Thursday	All	Saxion Enschede	32
	- Friday: Remotely working	All	Home office	
	- Meeting with Jenny (tutor)	All	OTSWO 3rd Floor - Epy Drost	
	- Deadline 17/01/2020: Smart Solutions Festival	All	Saxion Enschede, home office	
2.8	- Deadline 26/01/2020: Final version personal portfolio	All	Saxion Enschede, home office	
	- Deadline 26/01/2020: Final group products	All	Saxion Enschede, home office	

5 Budget

To find the best solution a few prototypes need to be built, this so different tests can be run to see the effect of different sensors, the placement of the sensors and the ability to modify the cups for sensor usage. See table 3 and 4 for the budget which is needed for building the prototype. All products above are without VAT and shipping + handling

Table 3
Electronic devices budget

Electronic device	*Amount*	*Costs per piece*	*Source*
SHT85 Humidity, Temperature Sensor	1	€25	Mouser
ADA 2857 Humidity, Temperature Sensor	1	€15	Mouser
FlexiForce A301 Sensor 1lb	1	€15	Antratek
MINI LOAD CELL - 500G, STRAIGHT	1	€10	Antratek
LOAD CELL AMPLIFIER - HX711	2	€10	Antratek
Controller	1	€20	Antratek

Table 4
Mechanical devices budget

Mechanical device	*Amount*	*Costs per piece*	*Source*
Cups	2	€150	Solidworks Cost Analisys
Oven Memmert UN30	1	€1000	Dijkstra Vereenigde

6 Risk analysis

To address the risks that can impact the research during the project a table has been made on how to manage the risks. See table 3 for the risk analysis and table 4 for the comparation of the maximum score and the actual score.

Table 5
Risk Analysis

Category	*Risk*	*Value**	*Risk Chance*	*Risk Impact*	*Risk Tot*		
Time factor							
1	Estimated duration of the project	2 quarters	1	4		4	
2	Does the project have a deadline?	Yes	0	4		0	
3	Does the project team have enough time to finish the project?	Yes	2	5		0	
Complexity of the project							
4	Is it an adjustment or a new project?		New project		2	2	4
5	Are there other projects dependent on this project?		No		0	5	0
6	Is the project divided by parts? And is the Project dependent on the connection between them?		Yes		3	4	12
The project group							
7	Who are the project members?		Students		3	4	12
8	Will the project members feel responsible for the result?		Yes		1	5	5
9	Can the project members help each other?		Yes		0	5	0
10	Are there any users of the end result in the project group?		Yes		0	3	0
The Scrum master							
11	Have the Scrum master any experience being scrum		No		2	2	4
12	Does the Scrum master feel responsible for the result?		Yes		1	5	5
13	Can the Scrum master help the project members with starting to work?		Yes		2	4	8
The tools							
14	Can the hardware crash?		Yes		4	5	20
15	Can we lose all code when lap top crashes?		No		0	5	0
16	Do we have backup hardware?		No		1	5	5
17	Does every project member have experience with hardware		No		3	4	12
18	Does every project member have experience with the programing languages?		No		3	4	12
					Total Points		113
					Total risk percentage**		25.1 %

*Value chosen by leader
**Total risk percentage is the total amount of points divided by 450 (max score) multiplied by 100

Table 6
Maximum score vs actual score

Category (with maximum score vs actual score)	*Maximum*	*Score*
Time factor	75	14
Complexity of the project	75	16
The project group	100	17
The Scrum master	75	17
The tools	125	49

Bibliography

Anitlope Outdoor. (2019, September 17). *Wat is GORE-TEX?* Retrieved from Antilope outdoor : https://www.antilopeoutdoor.nl/lp/gore-tex

Chandler, N. (2019, September 21). *What Is Relative Humidity and How Does it Affect How I Feel Outside?* Retrieved from science how stuff works: https://science.howstuffworks.com/nature/climate-weather/atmospheric/question651.htm

de Rome, L. (2019, March 9). Could wearing motorcycle protective clothing compromise rider safety inhot weather? *Accident Analysis and Prevention, 128*, 240-247.

Huang, J., & Qian, X. (2008, January 1). Comparison of Test Methods for Measuring Water Vapor Permeability of Fabrics. *Textile Research Journal, 78*(4), 342-352.

Ismal, O. E., & Paul, R. (2018, Janurary 1). 17 - Composite textiles in high-performance apparel. *High-Performance Apparel: Materials, Development, and Applications*, 377-420.

Norway Geographical. (2019, September 17). *GORE-TEX vs eVent Technolgy: which one is better?* . Retrieved from Norway Geographical: https://norwaygeographical.com/gore-tex-vs-event-technology/

REV'IT! (2019, September 11). *Onze geschiedenis*. Retrieved September 2019, from REV'IT! Sport: https://www.revitsport.com/nl_nl/over-revit/onze-geschiedenis-inspireert-mensen-om-motor-te-rijden-sinds-1995-revit/

REV'IT! (2019, September 11). *Testlab in eigen huis*. Retrieved September 2019, from REV'IT! Sport: https://www.revitsport.com/nl_nl/kenniscentrum/testlab-in-eigen-huis/

Zwolińska, M. (2013, Januari). Thermal subjective sensations of motorcyclists. *Accident Analysis & Prevention*, 1211-1220.

Appendices