

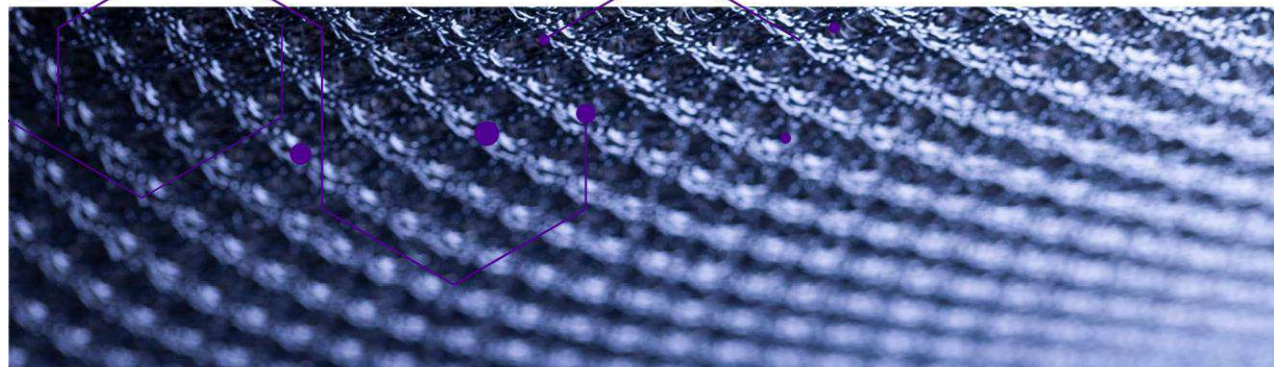
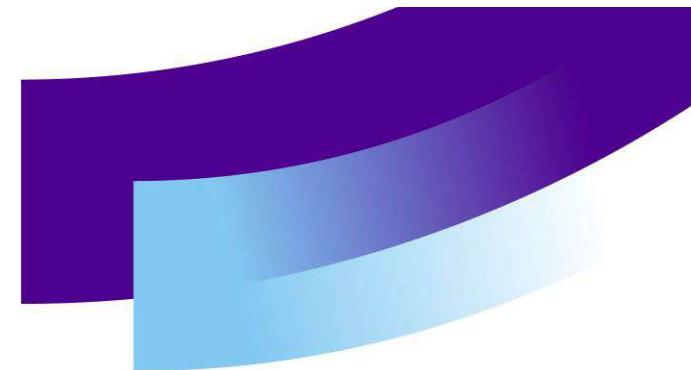


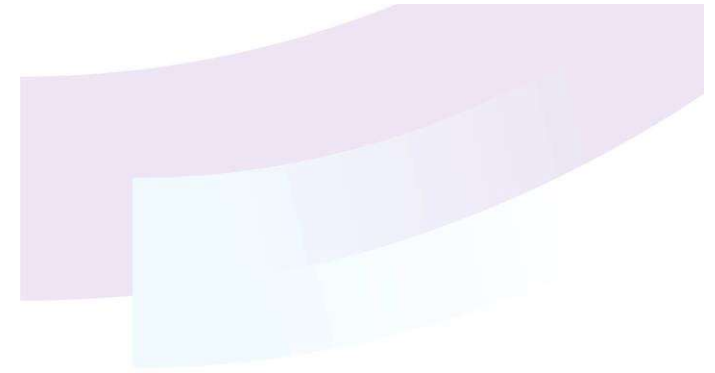
Leverage from
the EU
2014–2020

The project is funded by the REACT-EU
programme as a COVID-19 measure of
the European Union.



Innovation and competence ecosystem in Tampere region for sustainable and smart textiles





Pilot 2 Results

Washing and Pilling tests

Olamide Badara & Jaana Hännikäinen



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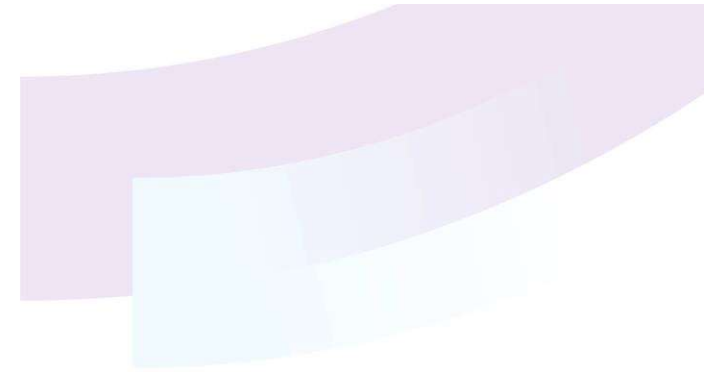
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Outline

- Tested materials and identifiers
- Pilot 2 test methods
- Results



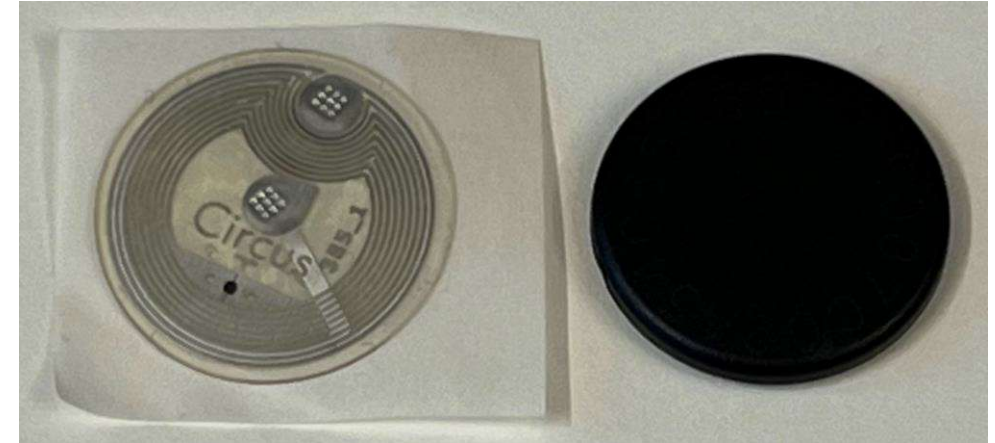
NFC (Near Field Communication)

- Easy for consumers - scanning with the phone
- No line of sight required
- Frequency of 13,56 MHz
- Short reading distance – need to know where the tag is



NFC tags

- We utilised two types of NFCs:
 - Bare NFC sticker Circus™
 - NFC covered with waterproof material (plastic)
- Goals:
 - Endurance during washing cycles
 - Usage possibilities
- Data/Message: web page or washing instructions
 - 144 bytes space



QR codes (Quick Response)

- Reading can be done by using a smartphone's camera and a scanning application installed on the phone – easy
- Line-of-sight required
- Several types of QR codes available
 - The most used are web addresses
 - Web page contains necessary information
- Webpage link to the project page, shortened web page address, and short washing instructions



QR codes

1. Printed QR codes

- Printed white ribbon, synthetic, woven fabric
- Printed beige ribbon, woven fabric

2. Embroidered QR codes

- Embroidered, white fabric



3. 3D filament printed QR codes

4. Woven QR codes

5. Laser printed codes



QR codes: Laser marked samples

| | | | |
|--|--|--|---|
|  | <p>P2_3_7 Jeans fabric 100% Cellulose Lyocell</p> |  | <p>P2_3_4 Grey B 100% Cotton, woven</p> |
|  | <p>P2_3_9 Black outerwear fabric 100% polyester, laminated, waterproof</p> |  | <p>P2_3_4 Grey B 100% Cotton, woven</p> |
|  | <p>P2_3_5 Light brown 100% Polyester Trevira CS, woven</p> |  | <p>P2_3_3 HighVis green, synthetic, woven, laminated film (workwear fabric)</p> |

Test methods

- Washing test
 - Tags were placed in the seam of fabric while ribbons were attached to fabrics.
 - Wash test was carried out using standard procedure 6M based on ISO 6330:2021
- Pilling test
 - Pilling test was carried out using standard procedure ISO 12945-2:2020.

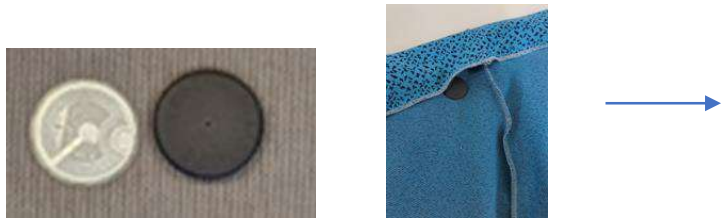
Test methods

- Functionality check
 - NFCs and QR codes were tested before and after washing using an iPhone 13 Pro
 - QR codes were read by finding the mark with the camera
 - NFCs were checked by placing the phone near the tag or using separate reader application on a phone
 - Information/data used included the address of our project web page, shortened web page address, or washing instructions

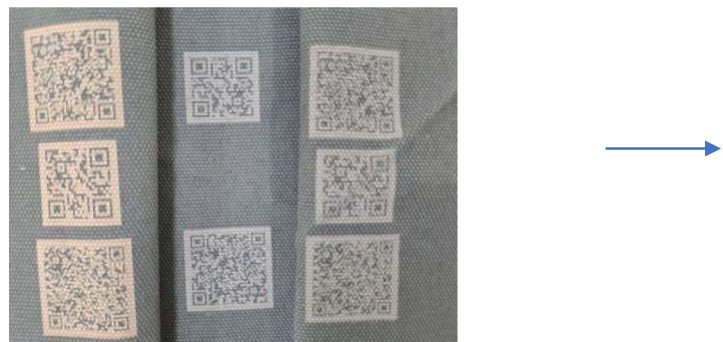
Test Results: Wash Test



QR codes printed on ribbons



NFC Tags



Laser marked QR codes



Wash Parameters: Temperature
60°C, Wash time: 15 mins,
Total rinse time: 7mins
Tumble Drying: 60°C (30mins)

Functionality of QR
Codes after 5 washes



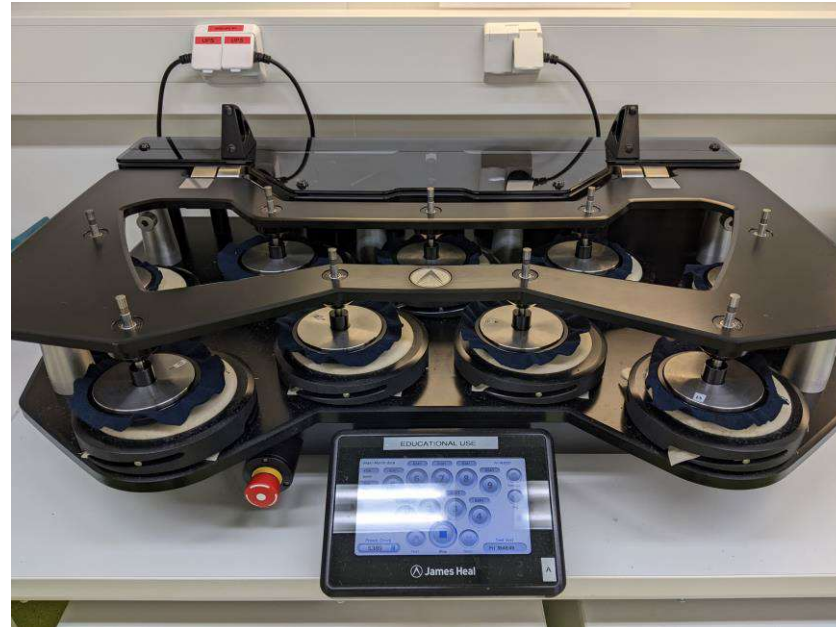
Functionality of NFC
tags after 2 washes



Functionality of QR
codes after wash 1
Not all were functional

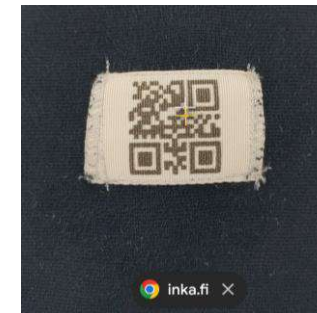


Test Results: Pilling test



-Samples were abraded against wool.
 -415g of load was applied.
 -Assessment stages (number of rubs): 125,500, 1000, 2000, 5000, 7000.

Functionality
 Before wash
 After 1 wash



After 5 washes
 -No fuzzing was observed.
 - Readable after 7000 rubs.



After 5 washes
 -Fuzzing was observed.
 -Reading was difficult as the number of rubs increased.
 -Not Readable after 7000 rubs.

Conclusions

- Commercial NFCs are reliable and bare NFCs still functional
- Laser technology samples – more experiments needed
- Printing technology - promising

