



# Location Tracking Inside the Building

*Ari Lamberg, Centria University of Applied Sciences, Finland*

*Henri Hakunti, Ruuvi Innovations Ltd, Finland*

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# Content

- ▶ Concept of location tracking
- ▶ 3D printing technology for direct printing on textile
  - ▶ 3D Printing
  - ▶ Wearable and washable electronic system
- ▶ Connectivity solutions
  - ▶ Wirepas mesh network
- ▶ Future improvements



# Location tracking concept

- ▶ Video and schematically
- ▶ What for?
- ▶ Challenges
  - ▶ reliable use of tags
  - ▶ battery life
  - ▶ connectivity → presentation how we solved those problems

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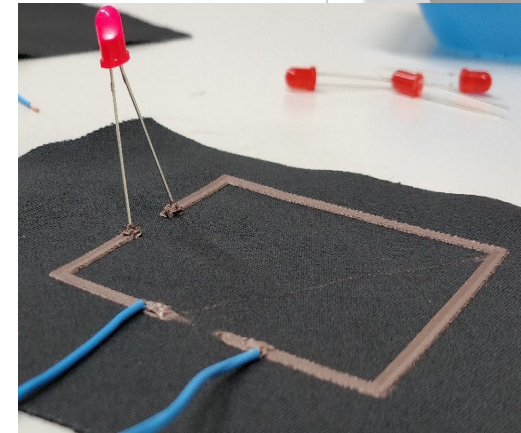
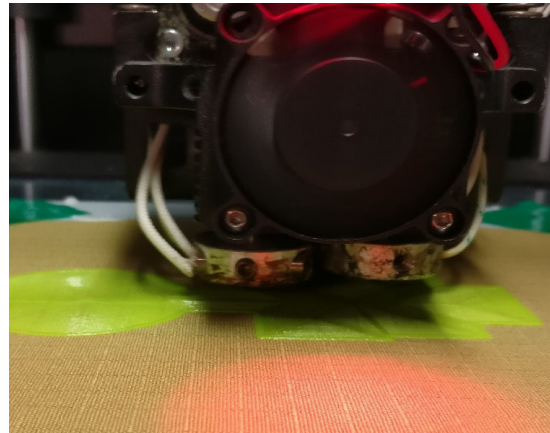


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# 3D printing technology to incorporate smart solution into work wear

It is a process in which materials are added layer by layer under computer-controlled system to build up three-dimensional objects. Almost every shape of items are possible to create by giving 3D model as an input.

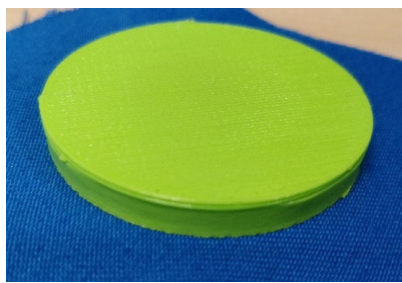
- A convenient method to incorporate smart technologies onto textile
- Less complicated to end users
- Cost-effective, material efficient
- Very good adhesion to textile
- Mechanical, chemical and thermal stability
- Low water absorption
- Good properties of printed materials



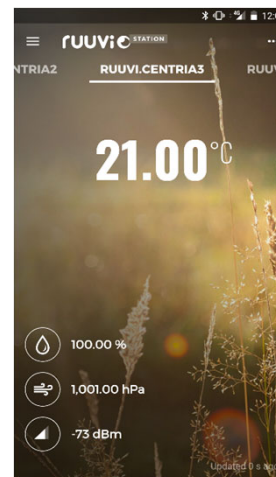
# Encapsulation of electronics



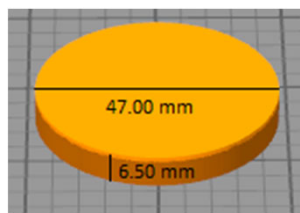
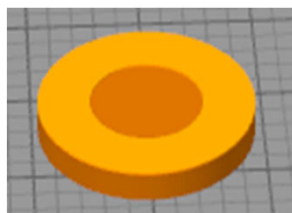
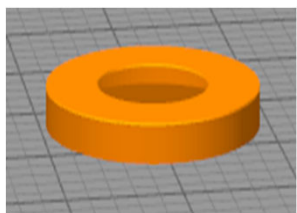
Encapsulated electronics on work wear:



After printing



Printing steps :



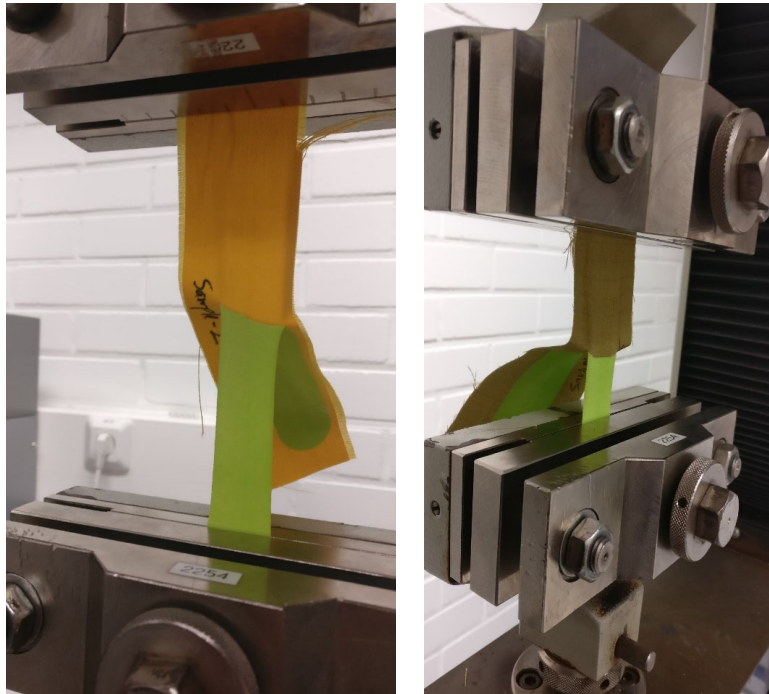
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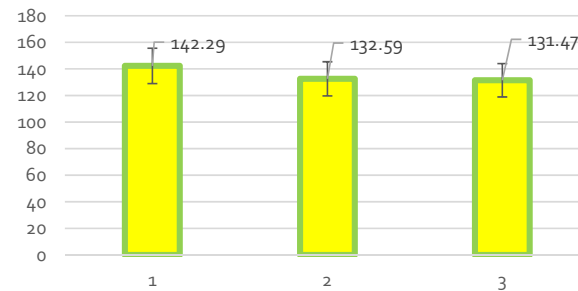
  
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# Adhesion of 3D printed TPU

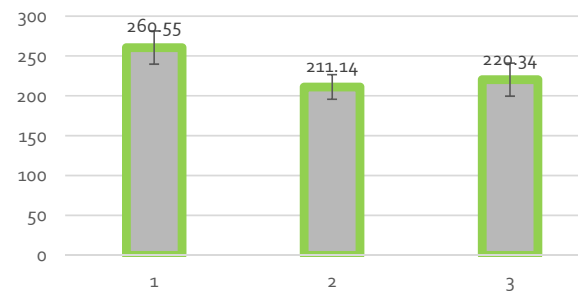


F – average (Unit: N/100mm) TPU- F1



F1–fabric 70% PES, 30% cotton

F – average (Unit: N/100mm) TPU- F2



F2–fabric 50% PA, 50% cotton

Average peeling force for printed TPU samples on fabric 1 and 2



# Technology introduced for Smart Solution in SWW project

## **Wearable and washable electronic system :**

Wearable electronic devices can be incorporated into garments. Electronic system coated with different materials are able to withstand in different washing conditions.

- Digital electronic components (microcontroller, battery, LED, sensors etc.)
- Wireless communication system (Bluetooth)
- All components integrated into one
- Water resistant materials
- 3D printing parameters
- Flexible, stretchable and good wear resistance



# Washing and testing

Encapsulated electronics were washed according to ISO standard named, ISO 15797:2017, Industrial washing and finishing procedures for testing of workwear.

Washing procedure:

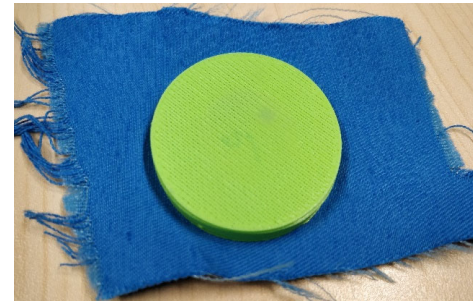
- ▶ Temperature – 75°C
- ▶ Washing period – 20 minutes
- ▶ Total cycles – 50 times washing and drying
- ▶ Washing tester – GyroWash
- ▶ Washing sample – Electronics on fabric (70% PE, 30% cotton)



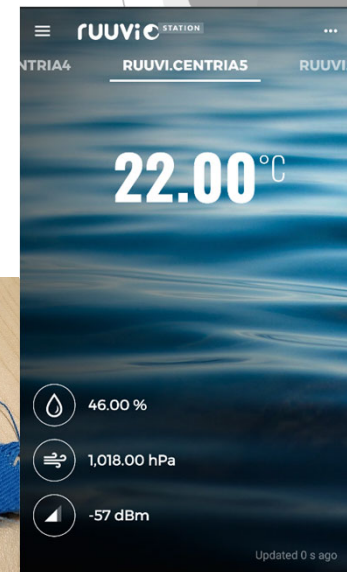
Before wash



After 30 washing cycles



After 50 washing cycles

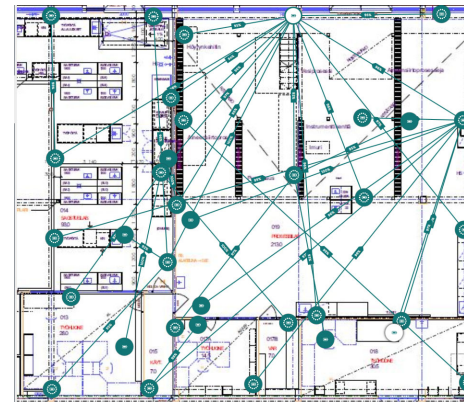
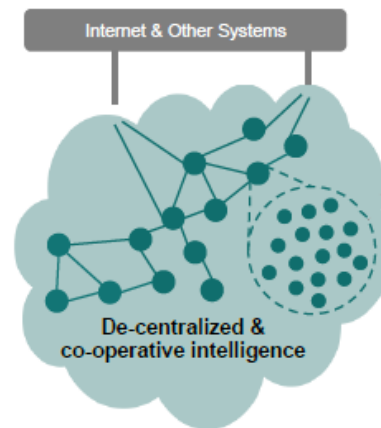




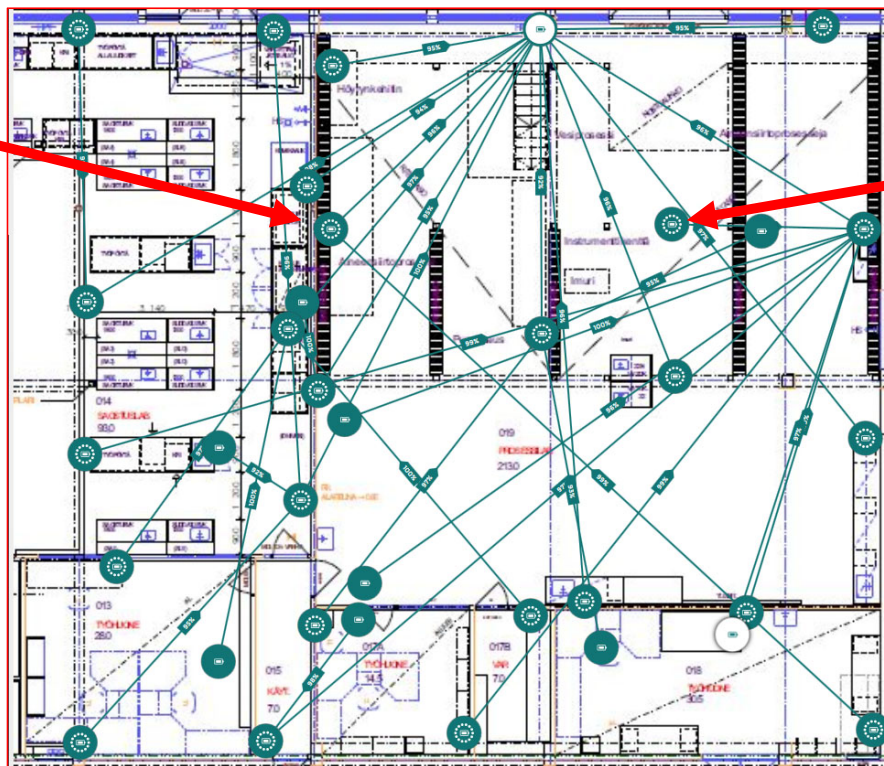
# Technology introduced for Smart Solution in SWW project

**Wirepas mesh network :** Wirepas is a proprietary mesh protocol which allows an unlimited number of nodes (e.g. RuuviTags) to be connected to the internet through a single sink (gateway).

- ▶ Goods-in and goods-out
- ▶ Inventory
- ▶ Picking
- ▶ Sensor data
- ▶ Location data
- ▶ People count



# Wirepas network in Centria



Centria video

# Mesh technology for situation awareness

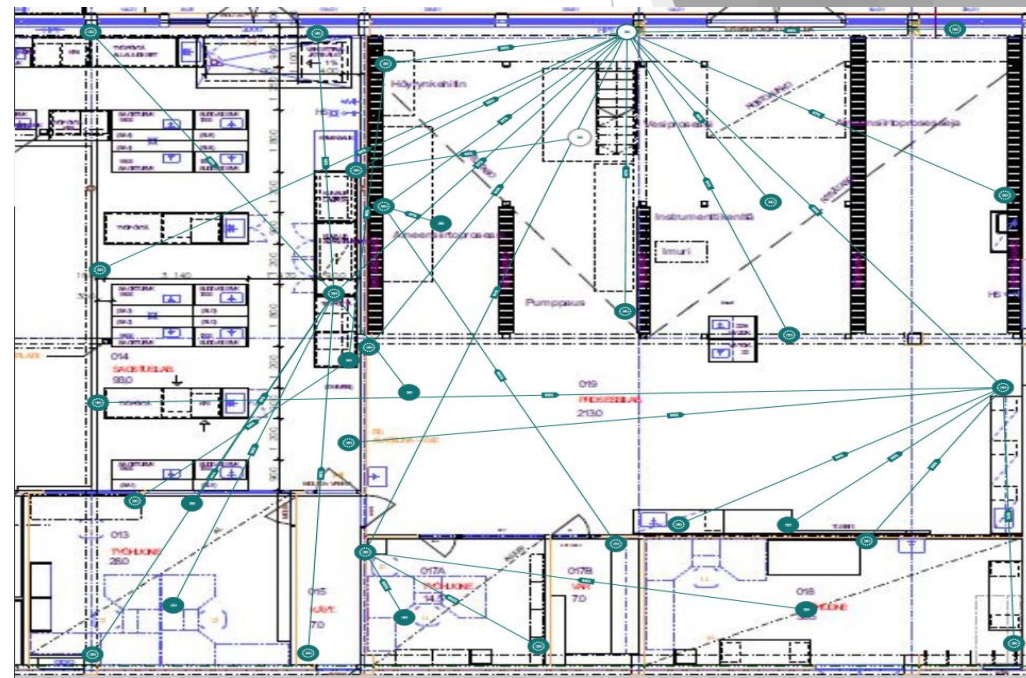
Wirepas offers a software solution that can be used on a variety of off-the-shelf radio hardware and wireless modules. One stop solution to massive IoT connectivity.

Achieves the inventory and location data of assets automatically at any given time.

- The assets can transmit BLE beacon - on demand
- Battery operated devices is a system requirement
- Wirepas Mesh runs on a broad selection of off-the-shelf chipsets and modules.
- Customizable operating parameters
- Utilizes locally available radio spectrum and energy.  
No central network controller is needed

Efficient data collection systems enable turnkey solutions that offer reports such as:

- stock levels
- Real time location
- Providing identity
- Time table (arrival and sending)
- Faster and more efficient logistic system
- Monitoring conditions of goods and around environment
- Task management for delivering



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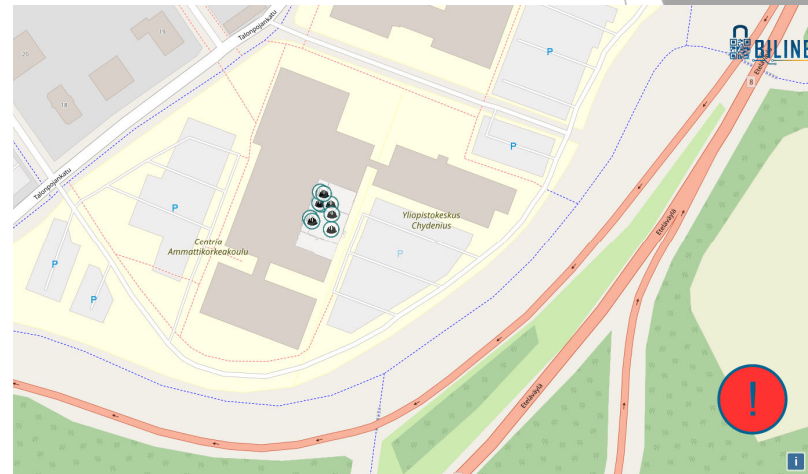
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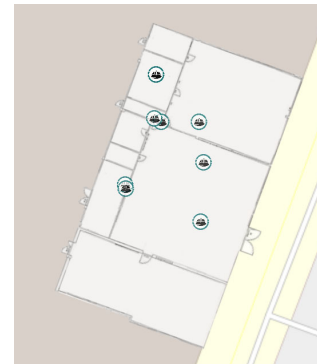
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# Centria location map



Alarm demo button



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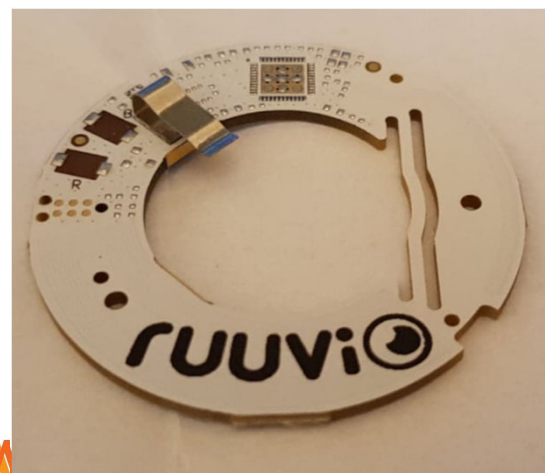
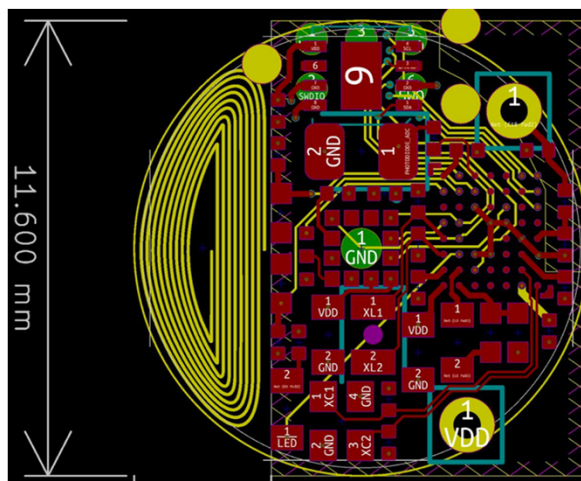
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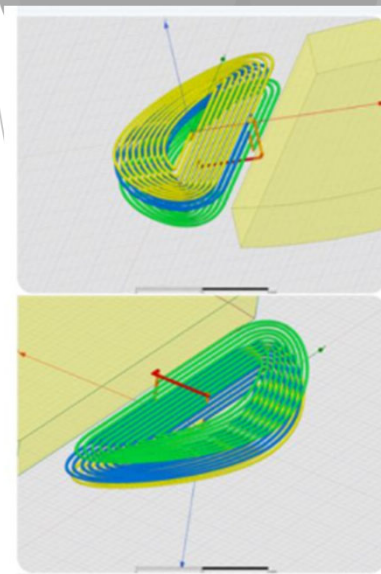
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## SWW PROJECT MODIFICATIONS AND DEVELOPMENT

- New lower battery clip design, development, prototyping and testing.
- New more powerful chip software development
  - Better usability for asset tracking
- New smaller PCB design to fit better to work wear.
- Enclosure modifications and testing.
- Antenna testing and modifications.



RUUViO



## SWW PROJECT NEXT STEPS

- Some Finnish workwear companies have heard about this project and contacted for more information.
  - They are looking to adapt sensor and location tracking technology to work wear

