

# Design Brief 1 of 3

## Smart suit

As reported in the document “Joint Research Programme”, dated 03.12.2017, the project partners have defined the need of working for research line 2 - muscular control and balance and research line 3 - functional abilities as a single line, identifying the possibility of merging the technical needs and behavioural patterns to aim at a single wearable system.

The design solution that has been identified for better positioning a wearable technology to the lower body consists in a pair of trousers to which a set of IMU sensors should be attached. The use of a clothing component pairs with the brief defined for the research line 1 - vascular circulation, proposed as a t-shirt to which attach a set of the same IMU sensors. Therefore, the 1st design brief consists on a “smart suit” (Table 1).

Table 1 - Definition of the design concept (WP3.2)

Research lines	1 - Vascular circulation	2 - Muscular control and balance	3 - Functional abilities	4 - Dehydration
Design Brief	AIM: monitoring arrhythmia during physical activities	AIM: monitoring the lack of balance and the loss of muscular tone, to stimulate correct posture during physical activities	AIM: monitoring the lack of balance during physical activities	AIM: monitoring the dehydration during the day
	upper limbs	lower limbs	lower limbs	to be defined
	<ul style="list-style-type: none"> <li>• LVL sensor</li> <li>• IMU</li> <li>• Connectors</li> <li>• USB charge station</li> </ul>	LVL sensor IMU Connectors USB charge station	<ul style="list-style-type: none"> <li>• LVL sensor</li> <li>• IMU</li> <li>• Connectors</li> <li>• USB charge station</li> </ul>	still under research



Concept	smart t-shirt	smart trousers	wearable device
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## **State of the art: suits for movement monitoring**

To proceed with the design, we conducted a research on existing suits.

For a better understanding of the state of the art of technologies for monitoring and the quality of the connection of sensors to the textiles, we have focused on the products used for motion capturing. The distinction of devices to be used indoor and outdoor is relevant to define the features of the AGEDESIGN outcome, enhancing the usability of the design in more environments as possible, plus fostering the use in outdoor green spaces and not in gyms only.

Elements of investigation are:

- OptiTrack Motion Capture
- X-Sens Motion Capture
- GK Motion Capture

The three systems present features interesting for the AGEDESIGN project:

- the systems include removable sensors;
- the systems can be used outdoor;
- the systems are used for recording movements and provide a 3D reproduction of the motion.

Given the IMU sensors propounded by the Austrian partners (attached document Mbient MetaMotion RPS v0.5) and the partners's requirements for a development kit, the elements to address for the project implementation consist on:

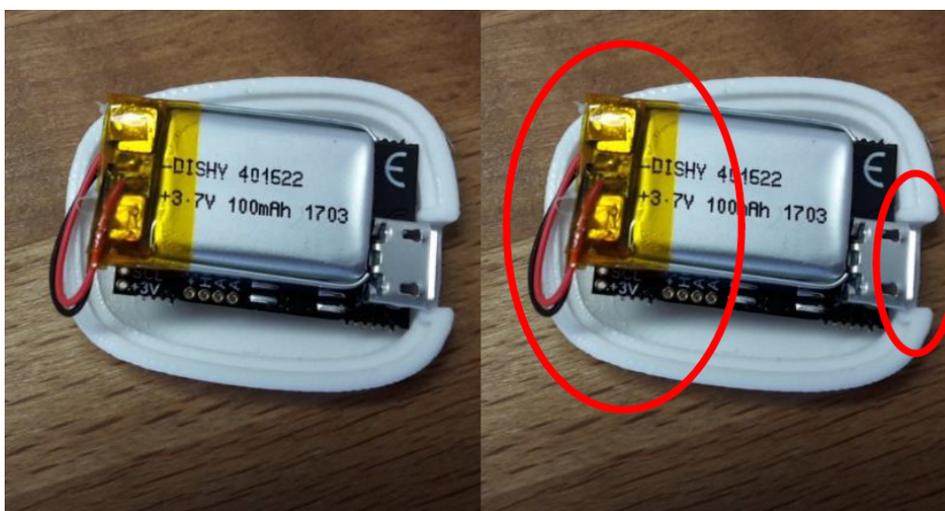
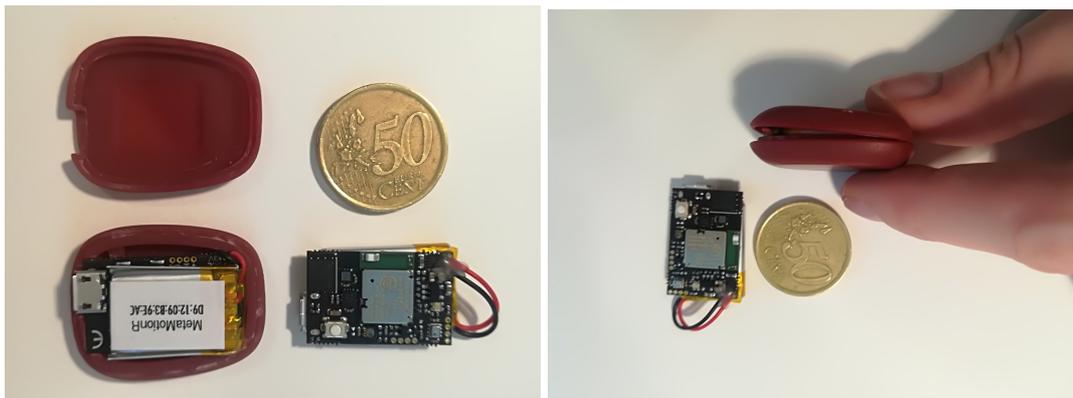
- definition of the joint between sensors and suit (cases, laces or buttons, sensors number and position);
- definition of the textiles, the quality of the tissues and the morphology of the overall suit (how to make it attractive for seniors? how the bodies change with age and which differences should the suit have?);

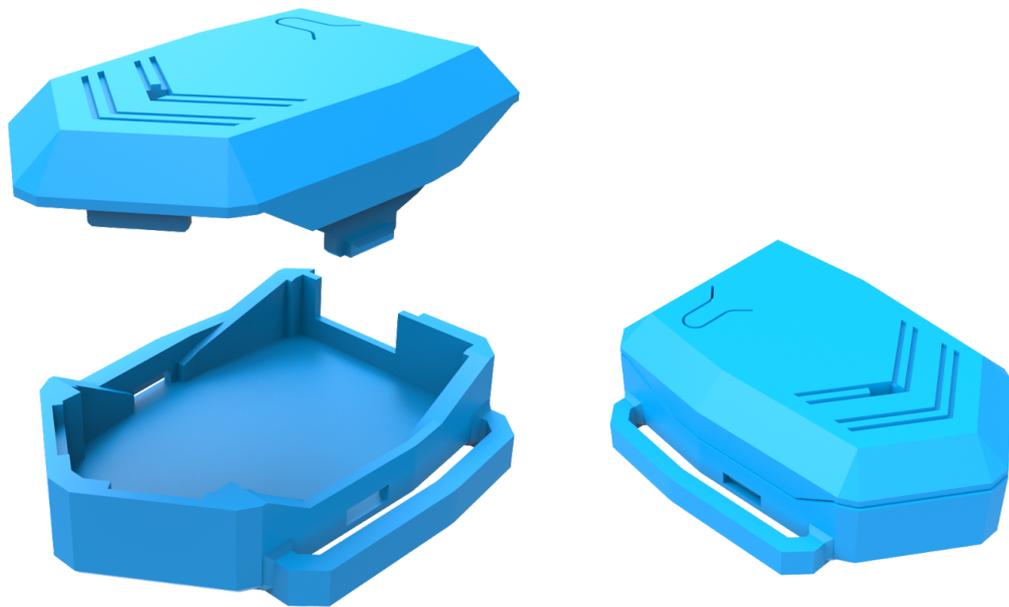
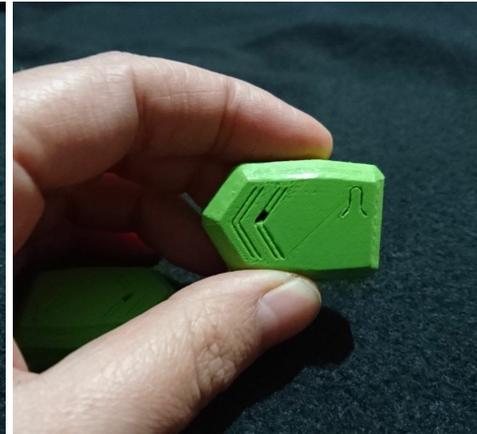
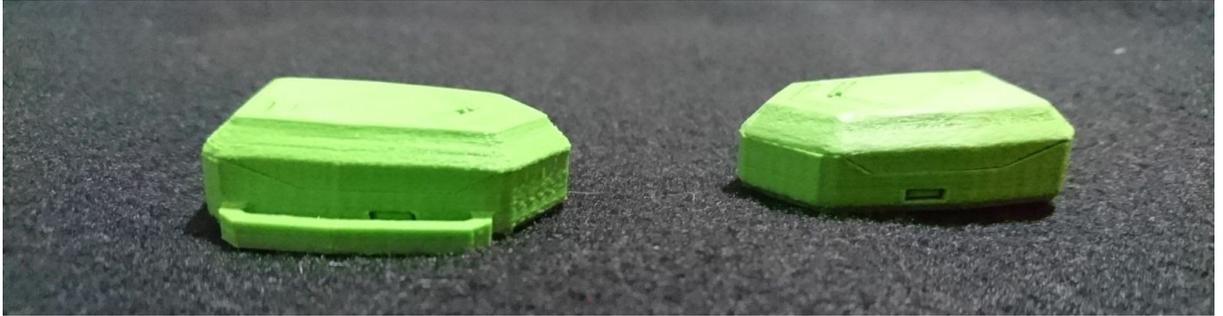
- definition of the use ( indoor/outdoor? for which specific exercises to increase the effectivity of use?);
- definition of physical parameters that provide feedback on health status or improvement (feedback by ULSS 1 and PLUS).

In order to work towards the previous goals, we have bought existing products to use as reference models. The list of products with relative technical sheets are attached (*MaterialiModelliAGEdesign.pdf*).

Trials have been done for:

- IMU cases (sketches, 3D drawings, 3D printed models);
- cardboards studies for the joints to allow the regulation of the position on the suit and comparisons with existing systems.

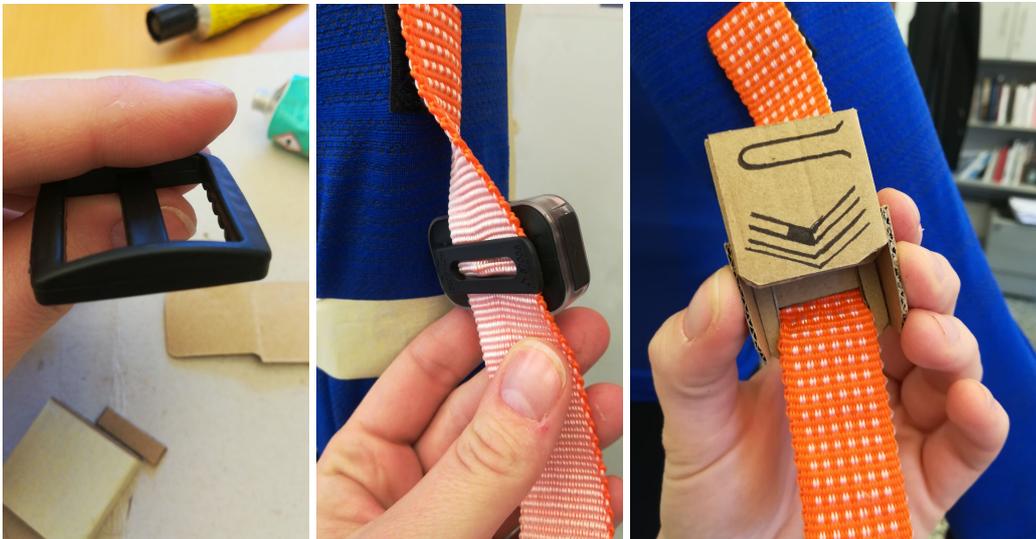
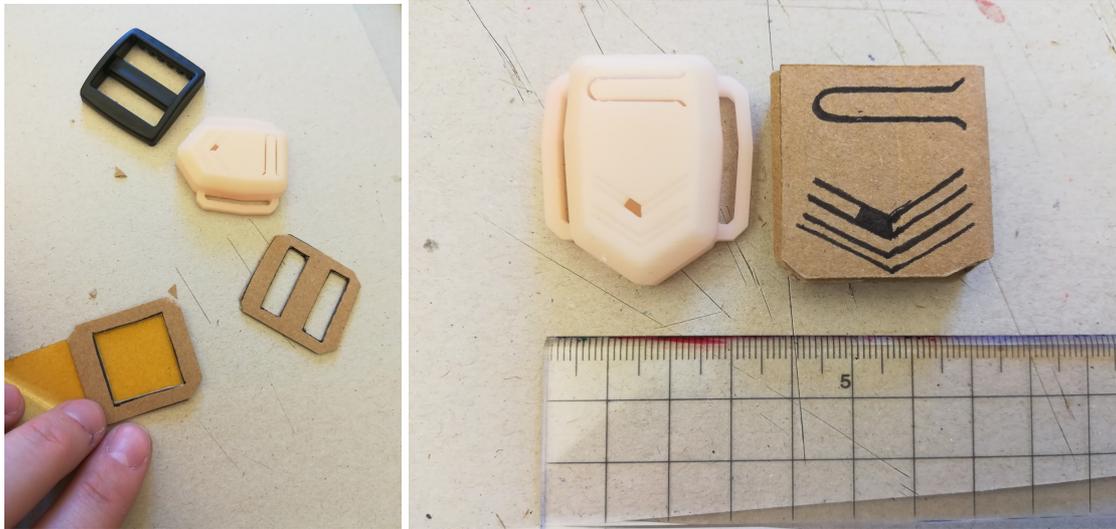




*Studies for IMU cases*

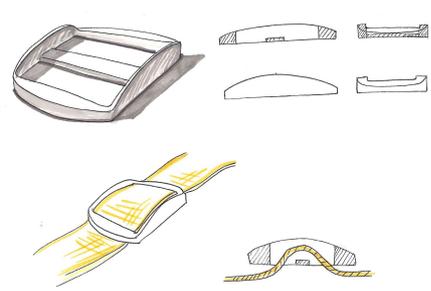
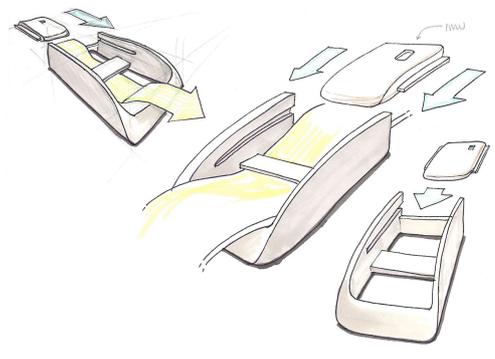
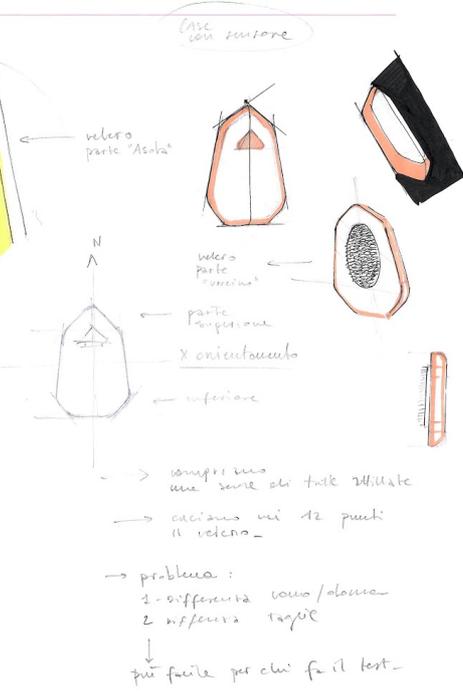


*Position of the IMU sensors on the suit*

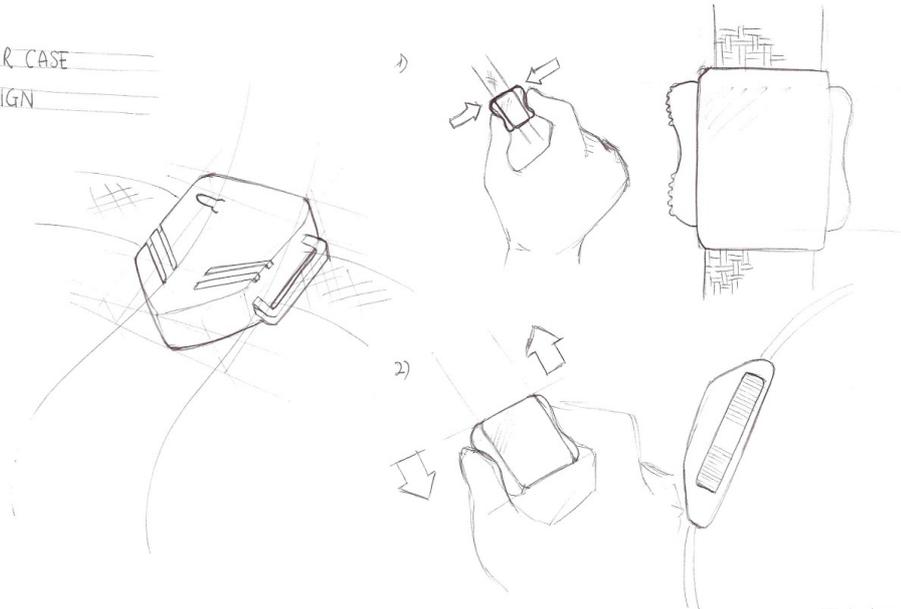


*Studies for joints*

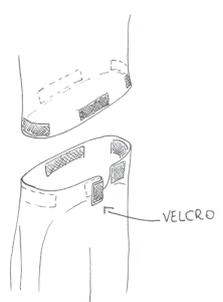
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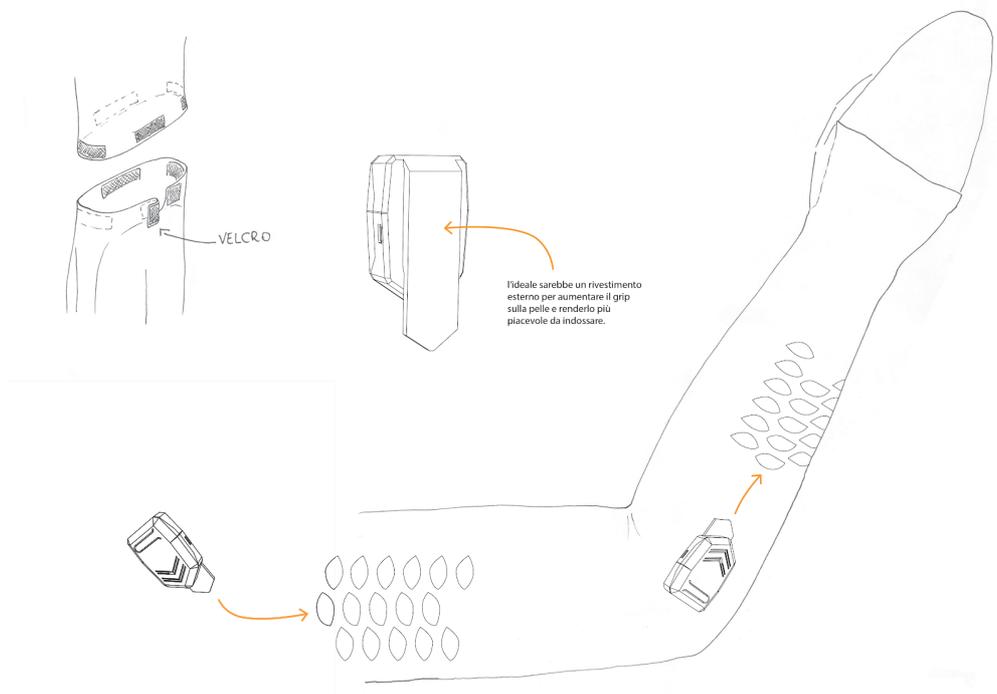
IMU SENSOR CASE  
TUAV DESIGN

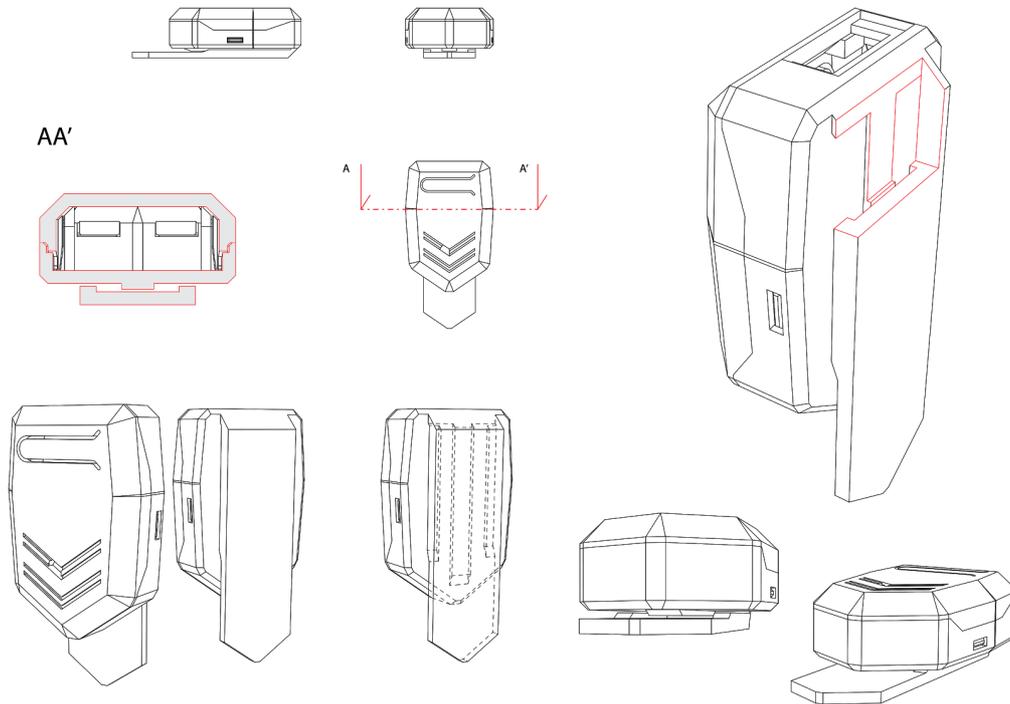


SENSOR CASE  
SIPATUERS



l'ideale sarebbe un rivestimento esterno per aumentare il grip sulla pelle e renderlo più piacevole da indossare.





*Sketches and studies for cases and joints*