

HelpMeWalk :

A magnetic system for custom foot orthosis design

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Context and application



Approche établie – moulage en plâtre avec correction manuelle

Orthotists traditionally craft each orthosis. The foot of the patient is **plaster casted**. This process is **messy and prone to errors** [1]. On the other hand, **optic scans** that have been newly developed are not adapted to children, elderly people and spastic patients [2]. Moreover, the practitioners hands are in the line of sight if he corrects the position of the foot while measuring.

The aim of the HelpMeWalk project is to manufacture a **measurement device** and create a **virtual mold of the foot**. This device avoids the constraints of other methods and allows the professionals to fully use their knowledge and expertise. It will also integrate the digitalized manufacturing process allowed by 3D impression.

Description of the system

Bandages with integrated sensors

Electronic integration

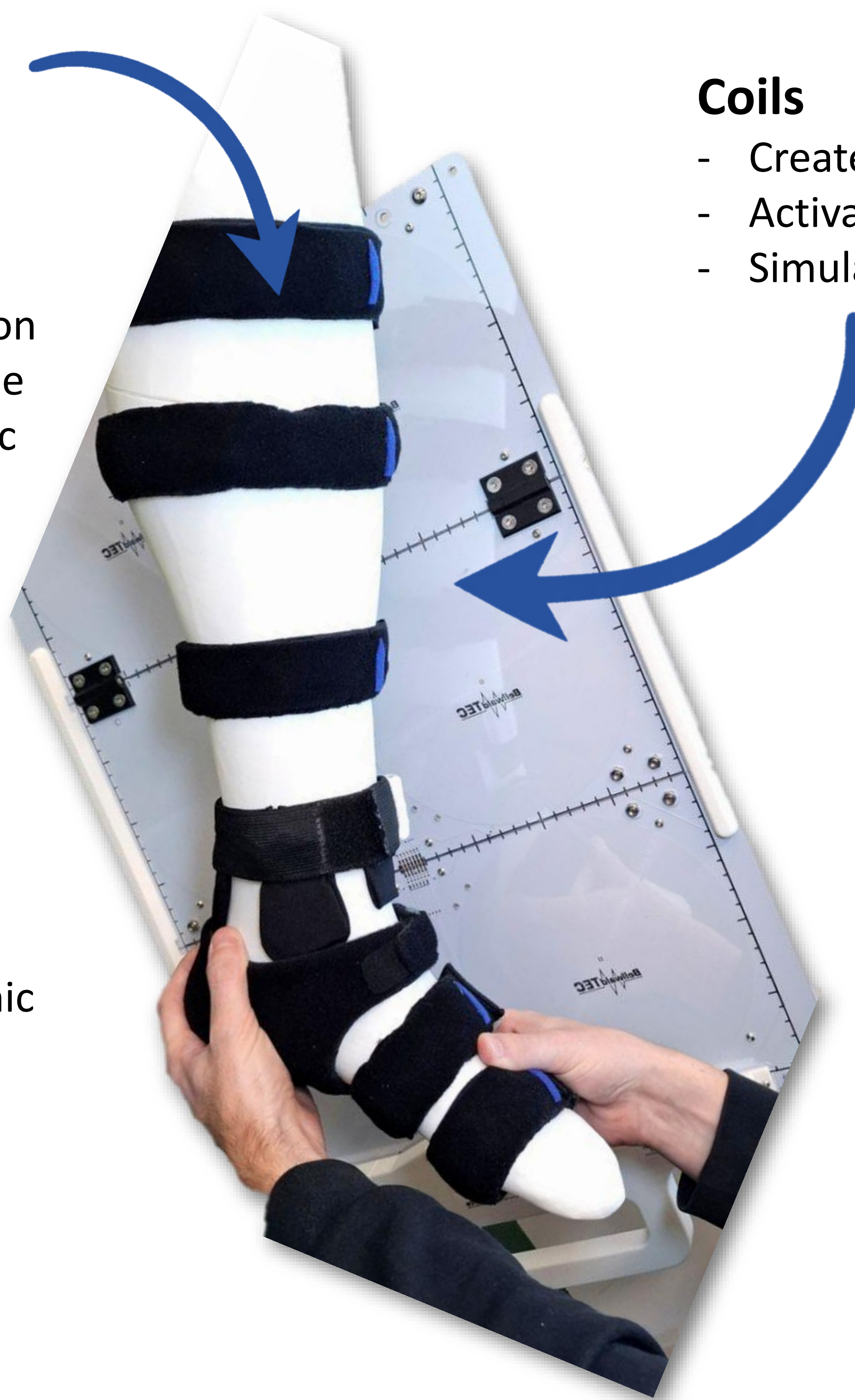
- ✓ I2C chain of flexible PCB
- ✓ Magneto-resistive sensor for localisation
- ✓ Hub with battery and bluetooth module
- ✓ Different shape of PCB to adapt specific landmarks of the foot

× Density of points

Textile integration

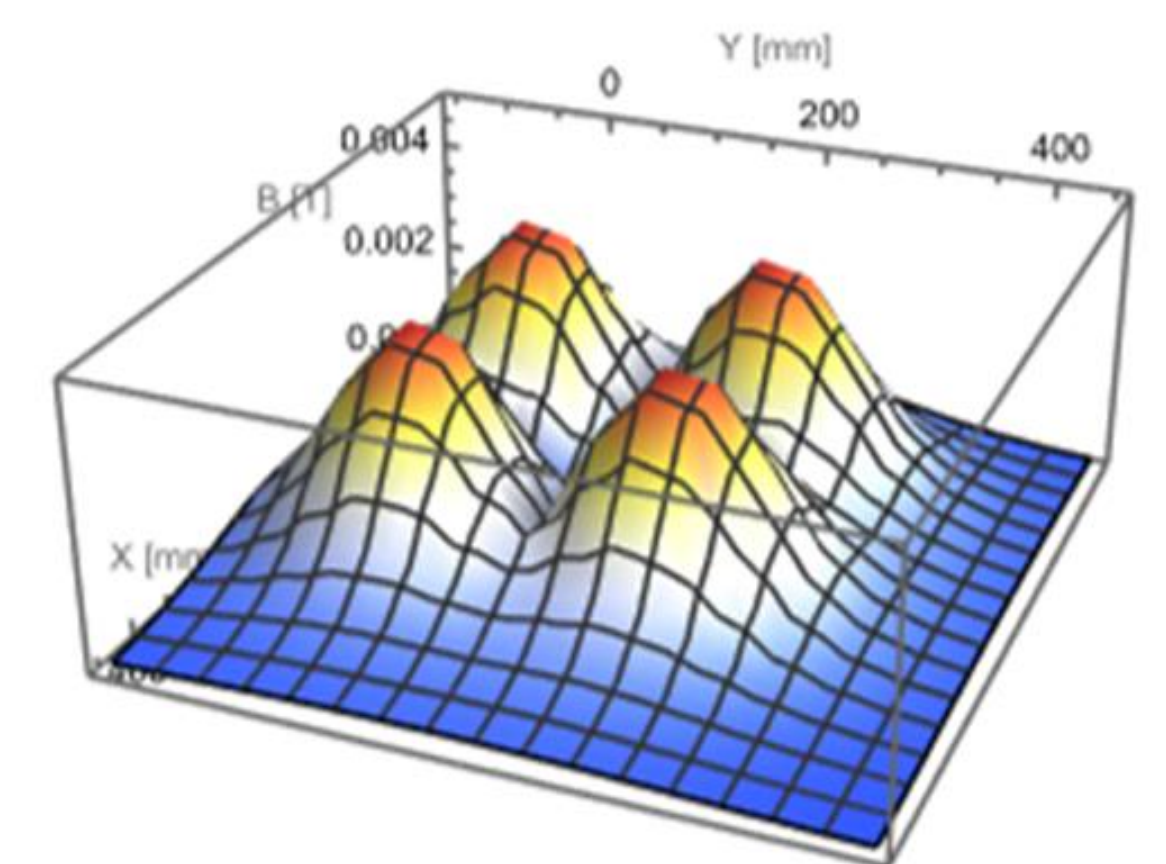
- ✓ PCB fixed with velcro in the textile
- ✓ PCB chain not integrated → easy to repair and replace
- ✓ Silicone coating to protect the electronic

× Fit of the patients on high curvature zones : malleoli & achilles tendon



Coils

- Create a magnetic field
- Activated sequentially
- Simulated magnetic map



Software and results

- ✓ Sensors localization :
2 mm mean euclidean error
- ✓ Reconstruction :
2 mm root mean square error
- × Needs fix positions (landmarks) for the reconstruction algorithm



Perspective

- Increase the density of magnetic sensors
- Improve the fitting of the textile to the patient's morphology
- Integrate orientation data to ease the reconstruction

References

[1] C. Laughton, I. M. Davis, et D. S. Williams, « A Comparison of Four Methods of Obtaining a Negative Impression of the Foot », Journal of the American Podiatric Medical Association, vol. 92, no 5, p. 261-268, may 2002, doi: 10.7547/87507315-92-5-261.

[2] Y. Jin, J. Plott, R. Chen, J. Wensman, and A. Shih, "Additive Manufacturing of Custom Orthoses and Prostheses – A Review," Procedia CIRP, vol. 36, pp. 199–204, 2015, doi: 10.1016/j.procir.2015.02.125.