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## ***SPECIAL SHOES MOVEMENT***



**ISPO 6<sup>TH</sup> CENTRAL EUROPEAN REGIONAL CONFERENCE**

**25-27 AUGUST 2011**

**NYÍREGYHÁZA, HUNGARY**

**A new non contact position sensor to track marks  
hidden by the shoe**

**Dr. Enrique Montiel, INESCOP, Spain.**





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# SSHOES

## *SPECIAL SHOES MOVEMENT*

Grant Agreement NMP2-SE-2009-229261

NMP-2008-4.0-7 Integration of new technologies and materials for  
differentiated consumer-centred product capability





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# FACTSHEET

- Project acronym: **SSHOES**
- Full title of project: **SPECIAL SHOES MOVEMENT**
- G.A. Ref.: **NMP2-SE-2009-229261**
- Start Date: **1st July 2009**
- Duration: **36 months**
- Total Budget: **4,874.025€**
- EU Contribution: **3,509.000€**
- No. of Partners: **11**
- Website: [www.sshoes.eu](http://www.sshoes.eu)





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# Project Coordinator



## INESCOP

INSTITUTO TECNOLÓGICO DEL CALZADO Y CONEXAS

# Beneficiaries



**University of Salford**  
A Greater Manchester University



**Deutsche Sporthochschule Köln**  
German Sport University Cologne



Istituto di Tecnologie Industriali e Automazione



AUTOMÁTICA Y CONTROL NUMÉRICO S.L.



TODOS PARA SUS PIES



THERAPEUTIC SHOES INDUSTRY



SYSTEMS LIMITED



SINCE 1886



SEVENTH FRAMEWORK PROGRAMME



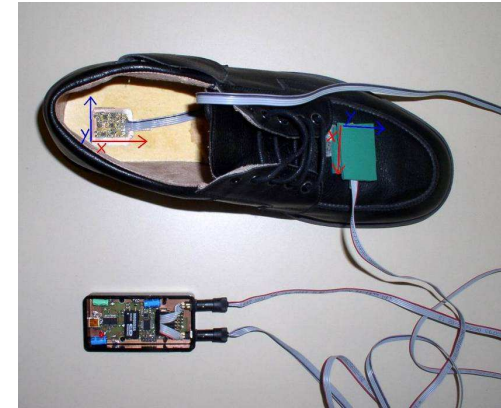
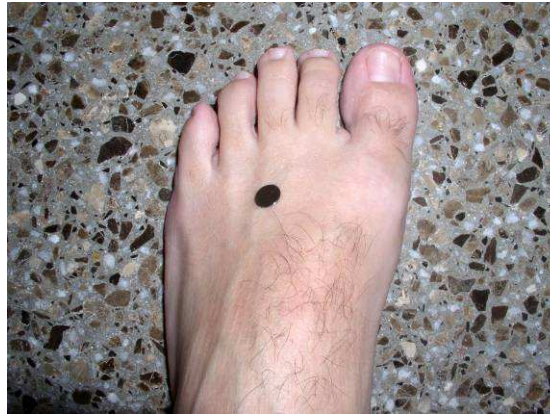
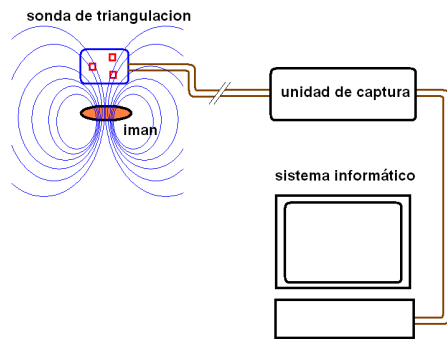
SHOES



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# MAGNETIC TRIANGULATION BASED POSITION SENSOR





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# PROBLEM TO SOLVE

- **How to determine foot-footwear relative position in hidden zones?**
- **Opening windows in the shoe: destructive biomechanical studies**
  - May influence footwear functionality.
- **X Ray , MR:**
  - Cost, complex
  - Time scale low
  - X Ray inherent problems
- **Solution: Position sensor based in magnetic triangulation.**
  - This new patented technology may support knowledge on position in hidden zones. Non intrusive, non destructive.





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# PROBLEM TO SOLVE

The aim of this activity was the development of a piece of hardware able to measure the relative position between a small marker, that could be placed anywhere on the foot, and a sensor that would be attached outside the shoe.

The prototype should be able to:

- Provide 3D coordinates of a marker placed on the foot with regards to a sensor placed on marker, but outside the shoe.
- Be synchronised with other measuring systems, especially motion capture systems and video.



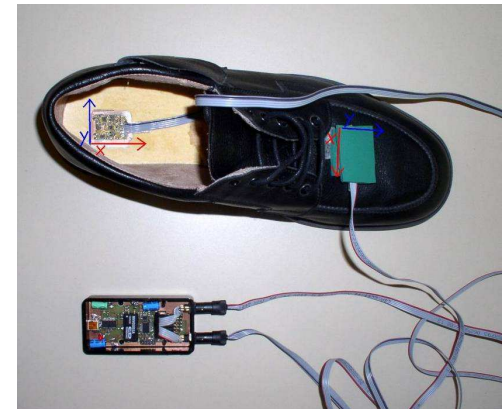


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# Description

- System based on fingerprint capture of a small magnet.
- Magnetic lines going through footwear.
- Reconstruction algorithm: from magnetic fingerprint, real position is determined.
- Application in : 20x20x10 mm
- Resolution +/- 0,5mm
- Density 27 points/mm<sup>3</sup> and total volume of 20x20x10mm.
- Plane parallelism plane magnet-sensor until 10°
- Ferromagnetic materials may interfere.



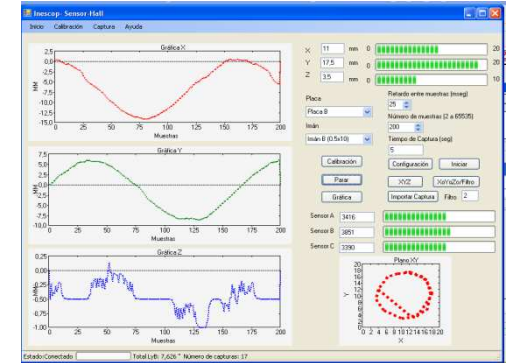
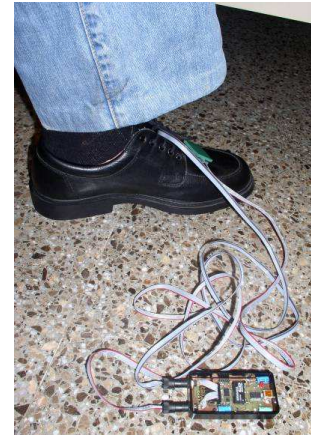
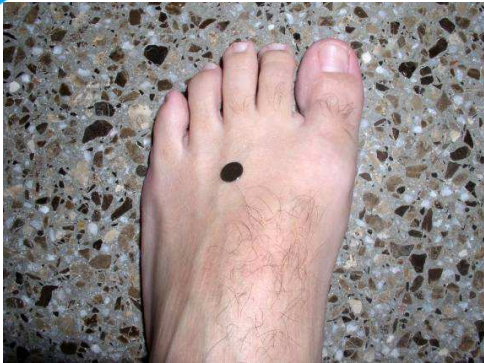




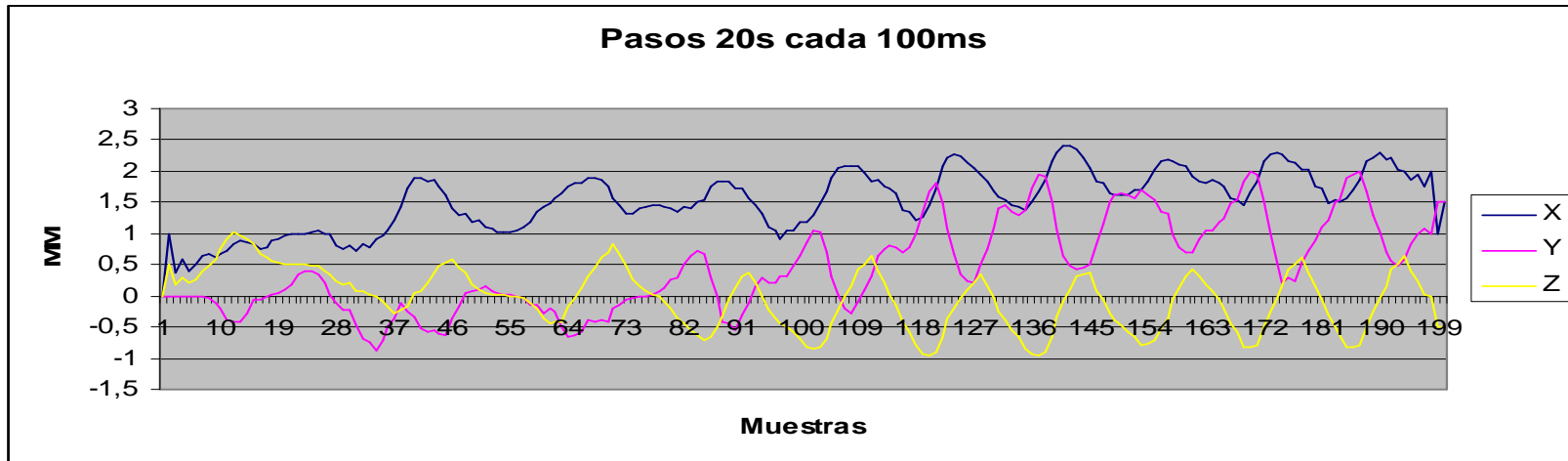
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# Examples



## Steps 20 s every 100 ms

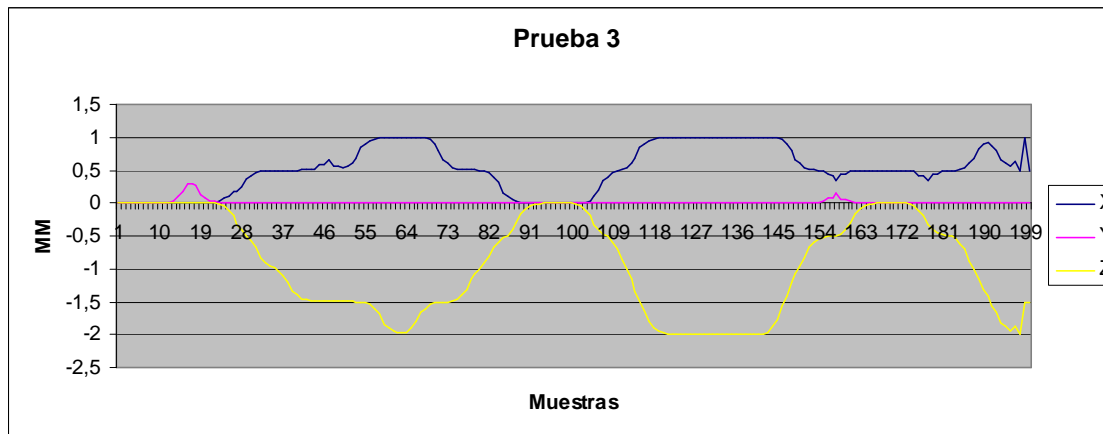
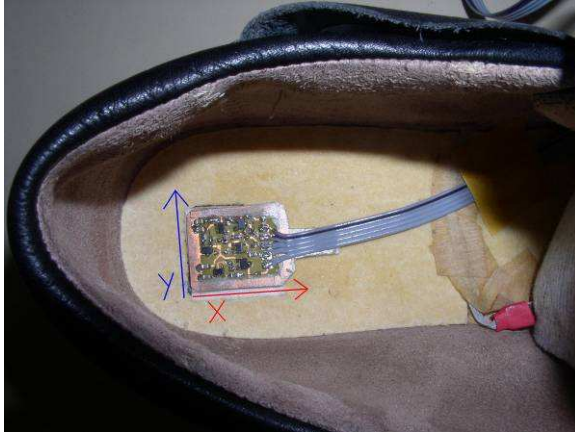




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# Balance test

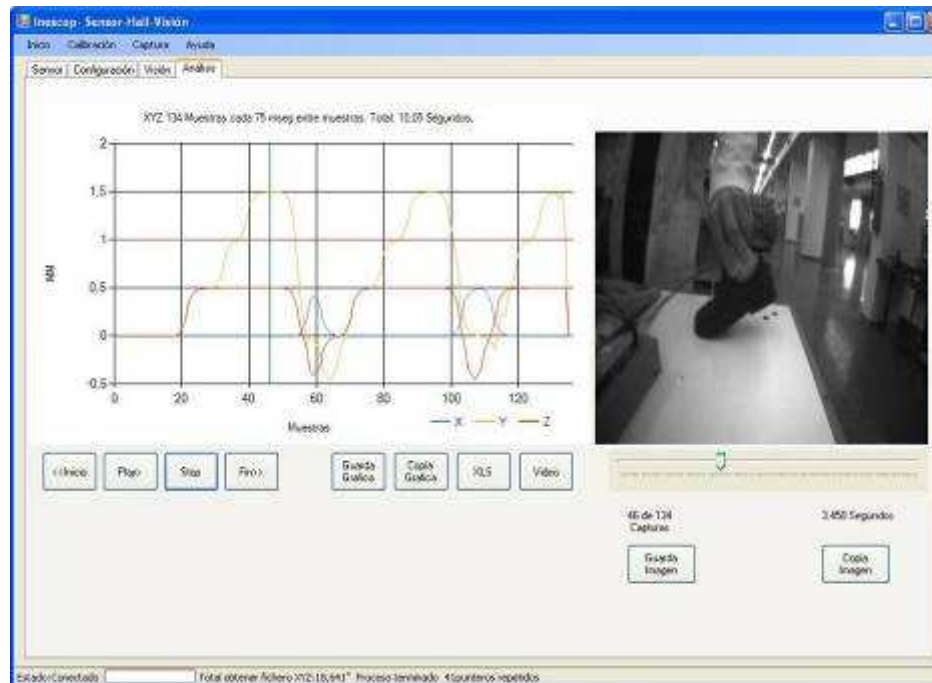




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## Signal synchronised with video



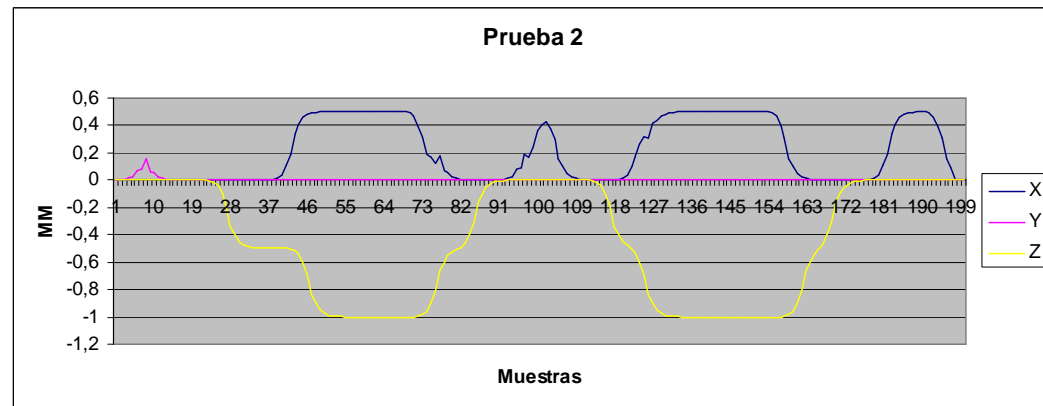
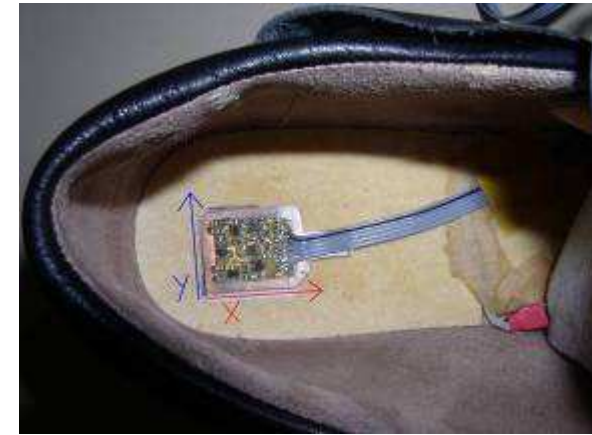


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## Heel sensor

Alternating weight from one foot to the other by moving the body from one side to another, walking on the treadmill



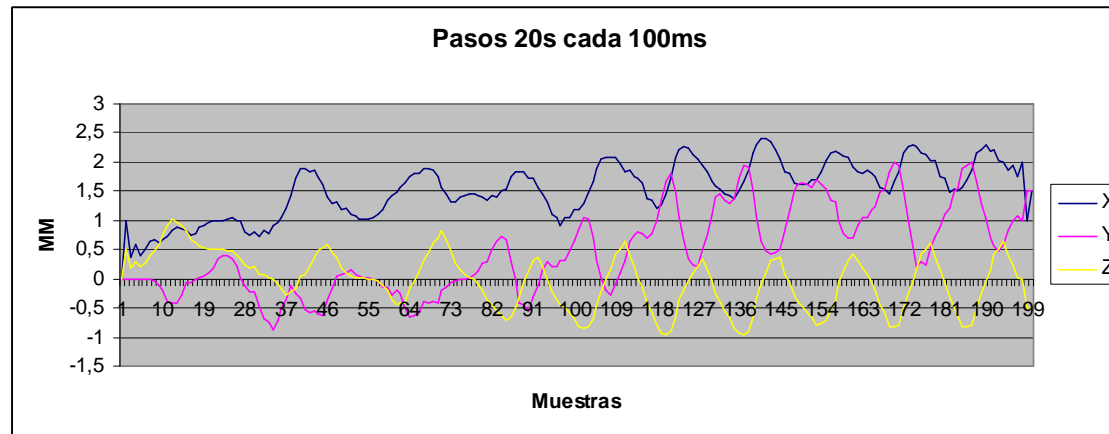


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## Instep sensor

Capture on a treadmill with the sensor located on the shoe instep and the magnet attached to the in the foot instep, on the skin.





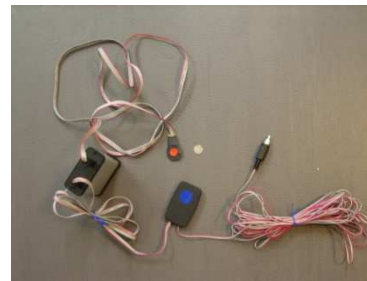
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## Conclusion

- **Technology based in Hall sensors which reconstructs relative position between a magnet and a sensor composed by three detectors.**
- **Posibility to develop sensors to a size of 2x2cm**
- **Sampling rate 40/seg**

TECHNICAL SPECIFICATIONS	
Dimensions:	
- Main circuit	100x60x20mm
- Sensor	20x15x5mm
Cable lenght:	
-Synchronism	8m.
-Sensor	2m.
Synchronism	Yes
Scan dimensions	20x20x10mm
Software	Yes
Power supply	5Vdc (via USB)





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**THANKS FOR YOUR ATTENTION**

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