



Textile sensor glove for health monitoring

Application in home assessment of Rheumatoid Arthritis

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Overview

- Introduction
- Textile Sensors
- Sensor glove
- Results
- Conclusions

CLARITY – SFI CSET



The screenshot shows the CLARITY website homepage. At the top, a blue banner contains the text "CLARITY: The Centre for Sensor Web Technologies Bringing Information to Life" and a search bar. Below the banner is a "Main Menu" with links to Home, Overview, Centre Vision, Centre Mission, Education and Outreach, Staff, Partners, Publications, News, and Vacancies. The main content area features a "Welcome to CLARITY" section with a collage of images including a network diagram, a mobile phone, a glowing sphere, a person with a magnifying glass, and a modern building. Below this is a paragraph of text about the center's establishment in 2008. Two columns of "Latest News" and "Latest Vacancies" are also visible.

**CLARITY: The Centre for Sensor Web Technologies
Bringing Information to Life**

Search Sign In

Main Menu
Home
Overview
Centre Vision
Centre Mission
Education and Outreach
Staff
Partners
Publications
News
Vacancies

Welcome to CLARITY

Mr. Micheál Martin, T.D, the Minister for Enterprise Trade and Employment announced the establishment of CLARITY a new Science Foundation Ireland Centre for Science, Engineering and Technology (CSET) on 15 April 2008. Led by Professor Barry Smyth, the CLARITY CSET is a partnership between University College Dublin and Dublin City University, supported by research at the Tyndall National Institute (TNI) Cork. More information

Latest News

- The Sentiment-al Web
- CLARITY Researchers On The Move
- CLARITY researchers working with GAA referees
- UCD Researchers Receive Research Award for Personalizing YouTube

Latest Vacancies

- Postdoctoral Researcher in Human-Computer Interaction in Information Seeking Tasks
- Research Assistant in Human-Computer Interaction in Information Seeking Tasks
- PhD Positions in Computer Science and Computer/Electronic Engineering

- **5-year, €16.4 million research program to develop next generation Sensor Web Technologies with significant focus on applications – environment, sports, health, agriculture, food**
- **Brings together fundamental materials science, functional polymers, device prototyping, energy management, adaptive middleware, wearable sensors, distributed environmental monitoring**
 - **www.clarity-centre.org/**



**INTELLIGENT
SYSTEMS**
RESEARCH CENTRE



The Intelligent Systems Research Centre, ISRC, Faculty of Engineering, on the Magee College campus

Founded in 1997 and is currently composed of 30 academic staff and 28 research students

ISRC embraces the topic of intelligent systems in the widest sense; the activities of the group encompass research into a range of intelligent and hybrid technologies, and include work on neural networks, hybrid intelligent systems, internet technologies and computer networking.

Aim of project



Figure 1



Figure 2

Around 40,000 people in Ireland have the severe inflammatory auto-immune condition called rheumatoid arthritis (RA) where the body is said to attack itself. 70% of these rheumatoid arthritis patients are women.

Aim of project

Assessment of RA is done manually, is time consuming, subject to differences between observers

Develop a customised sensor glove, to measure hand movements

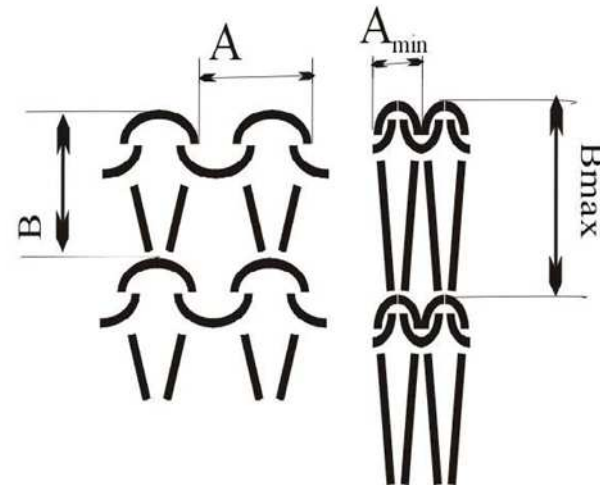
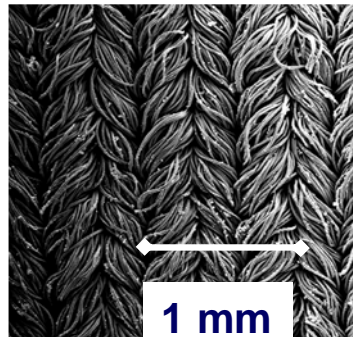
Continuous monitoring at home, carry out exercise routines defined by therapist

Easy to use computer interface, glove easy to wear

Textile Stretch Sensors

Piezoresistive fabrics – Change in resistance when a force is applied

Ppy Coated Lycra



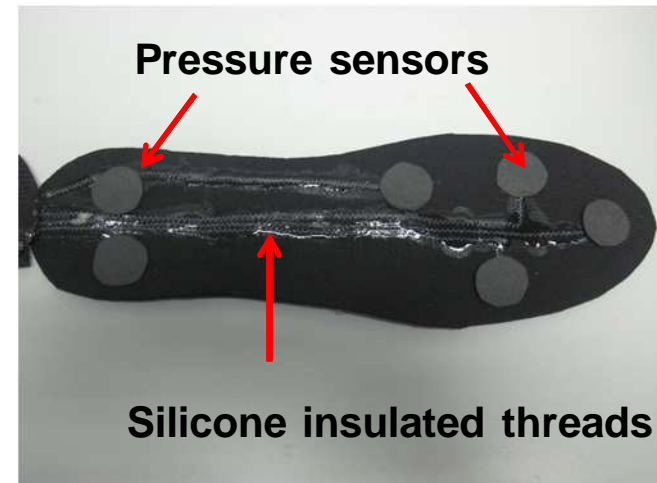
Coating with conducting polymer (e.g. Polypyrrole) makes the fabric conductive

When stretched more threads are in contact with each other giving a greater surface area for conductance
Stretching causes a decrease in resistance

Textile sensors



Breathing monitoring



Smart insole
Foot pressure monitoring

Textile Sensor Glove



Fabric stretch sensor on each finger and thumb

Connected using conductive thread

Stitched to LilyPad Protoboard



Textile Sensor glove



**Wired to
Arduino Fio
with Xbee
radio**

Cost

Sensors £10

Glove £15

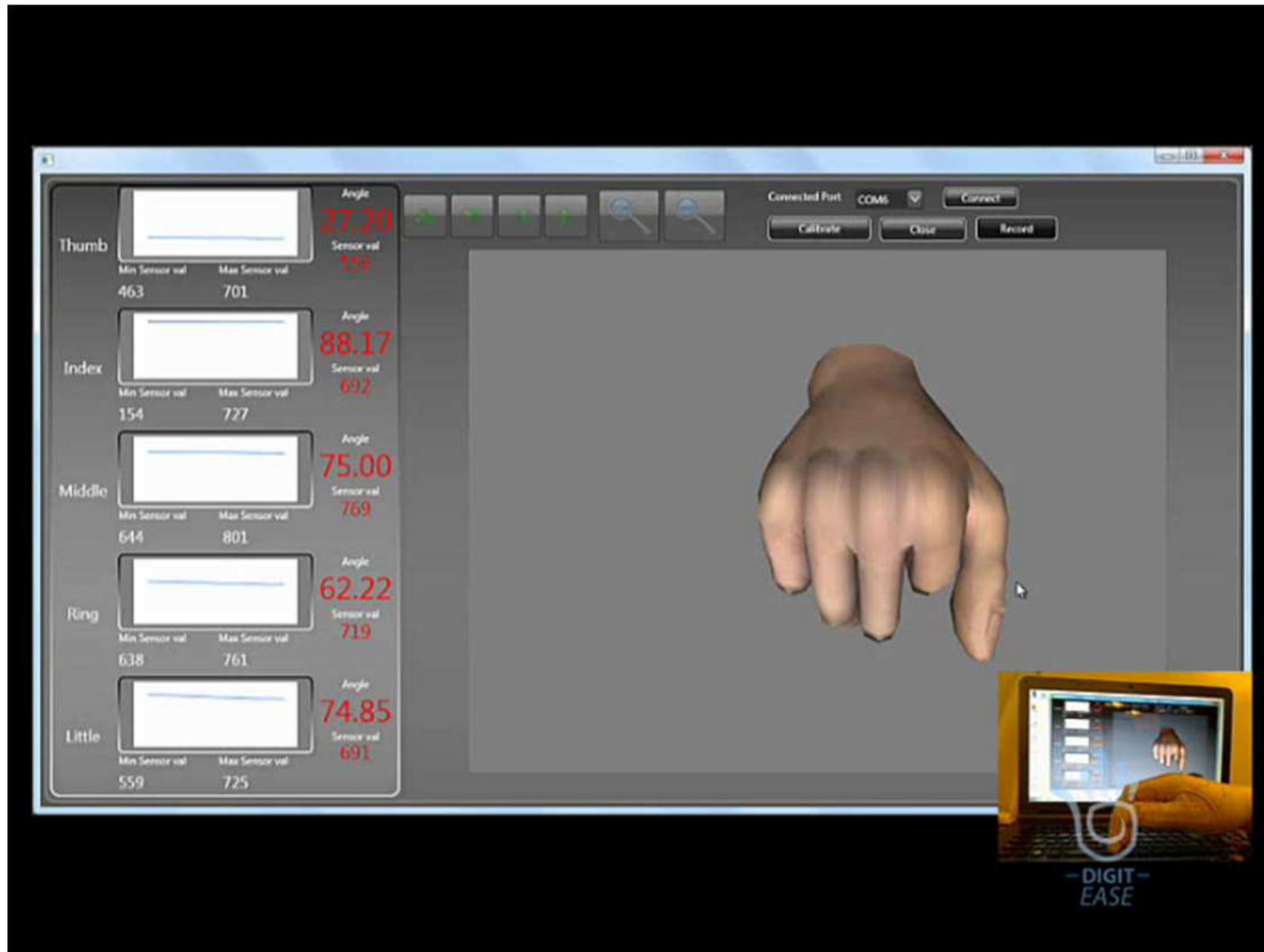
Arduino £20

Xbee £20

Components £10

Total cost ~£75

Control Software



Evaluate performance – Comparison with 5DT Data Glove



5DT Data Glove 14
Ultra Commercially
available virtual reality
glove

<http://www.5dt.com/>

Fibre optic sensors

2 sensors per finger

Abduction between
fingers.

\$5500 for glove

\$1500 for wireless kit

Comparison 5DT vs Textile Glove

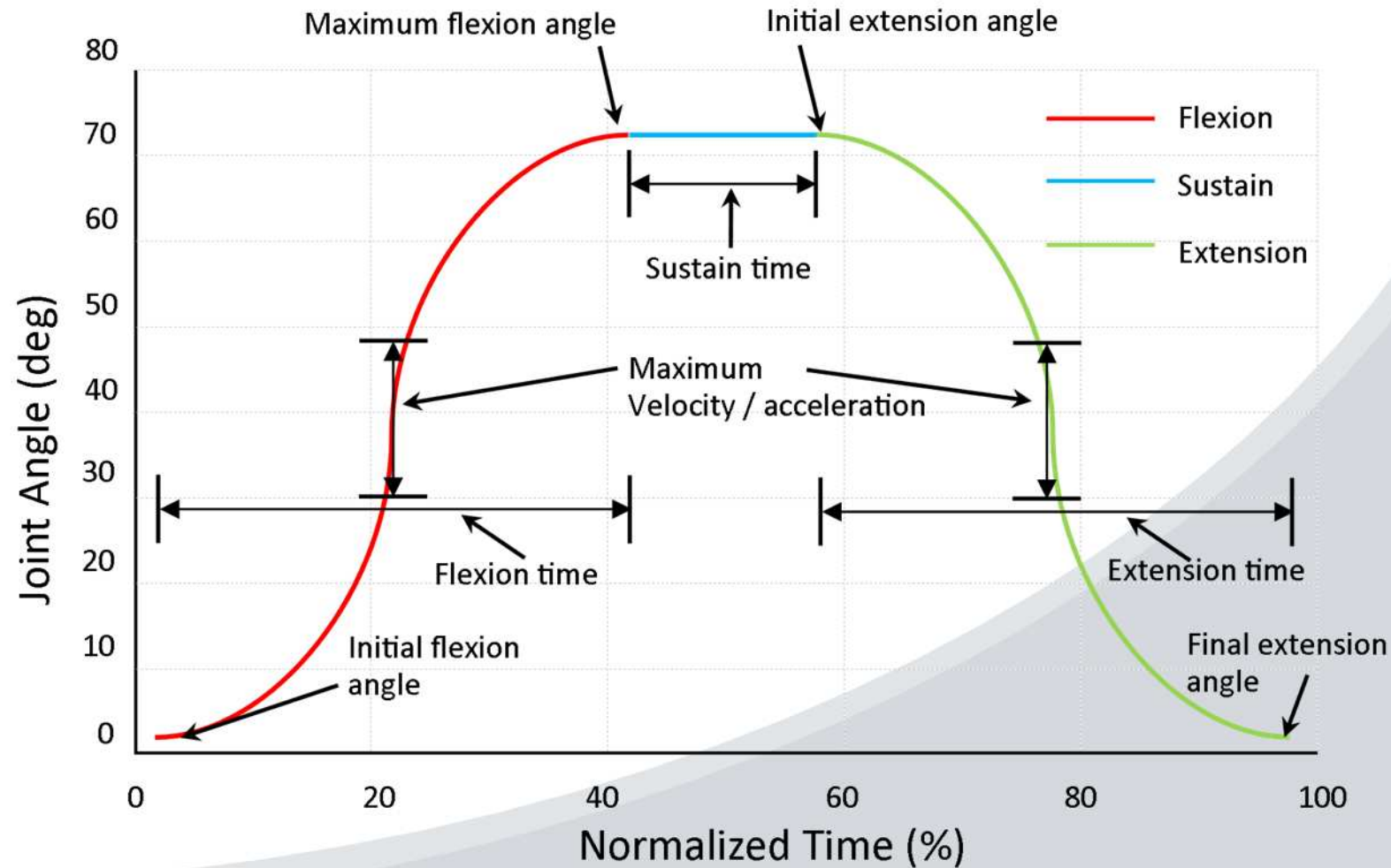
Both gloves worn on same hand and connected to 2 computers running same controlling software

An objective routine was performed consisted of 12 flexion and extension repetitions that measured movement of the middle metacarpophalangeal (MCP) finger joint.

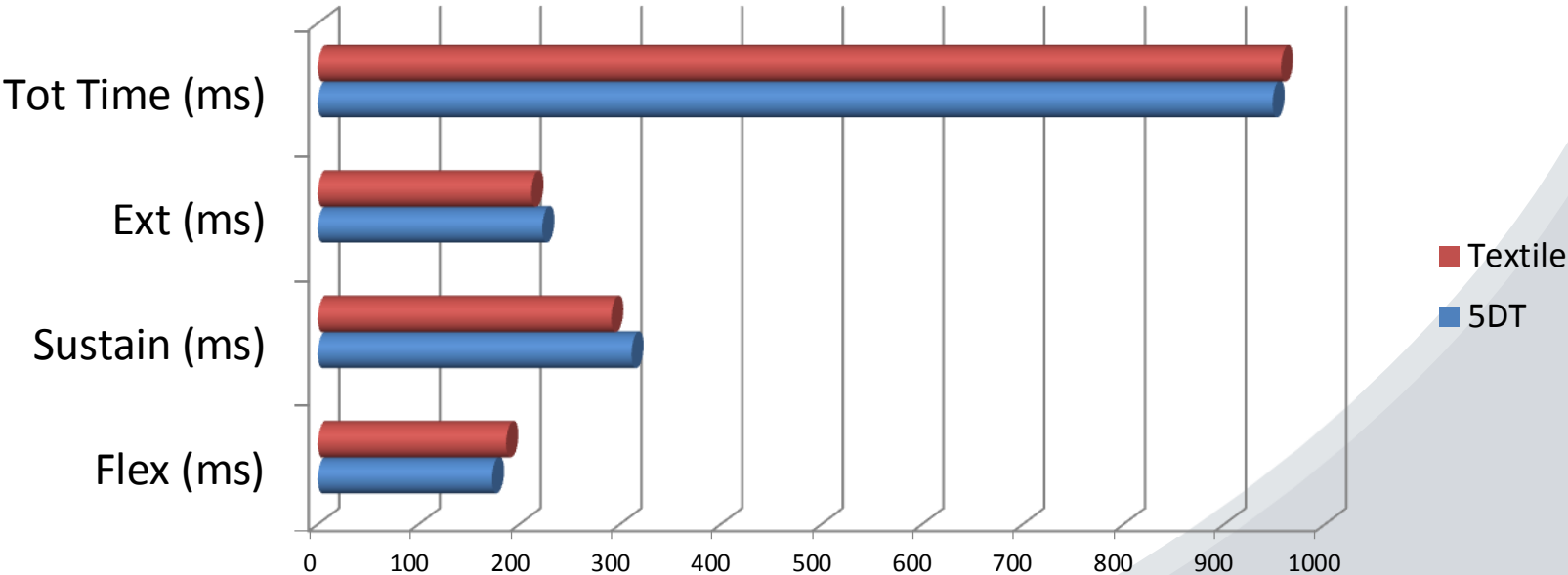


The first repetition was used to synchronise recordings between computers. Data sampled every 25ms

Comparison 5DT vs Textile Glove

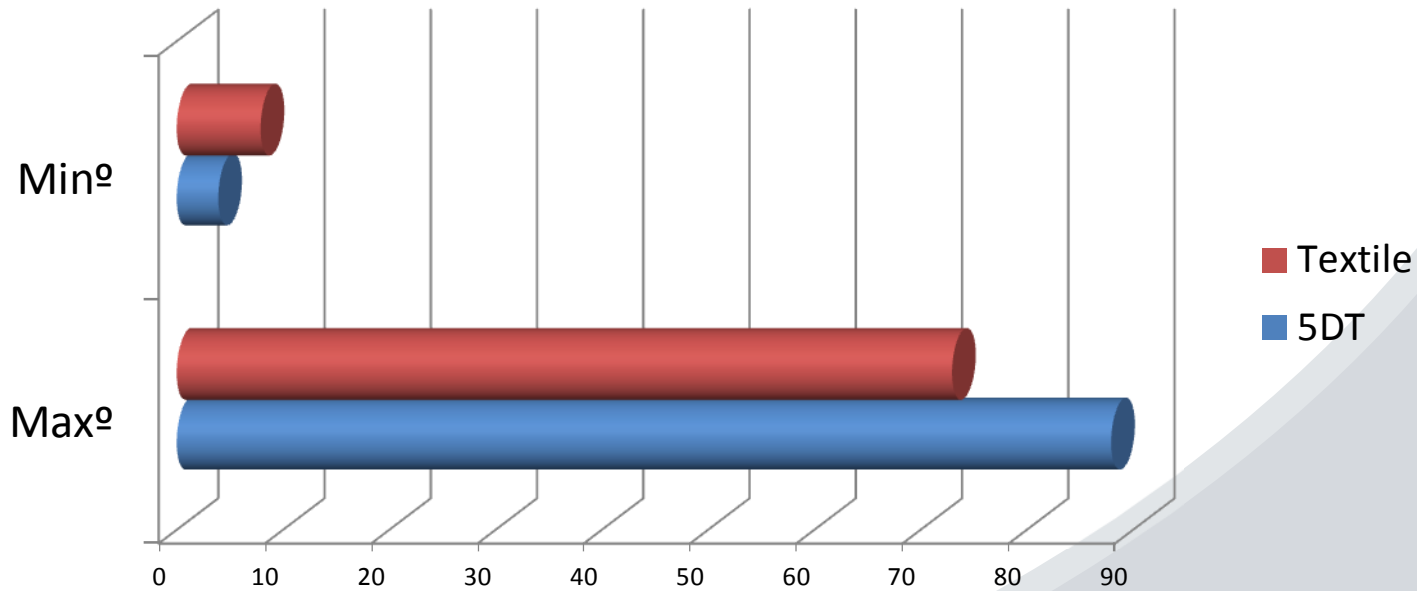


Results



Comparison of average timing measurements from 5DT and Textile Sensor Glove

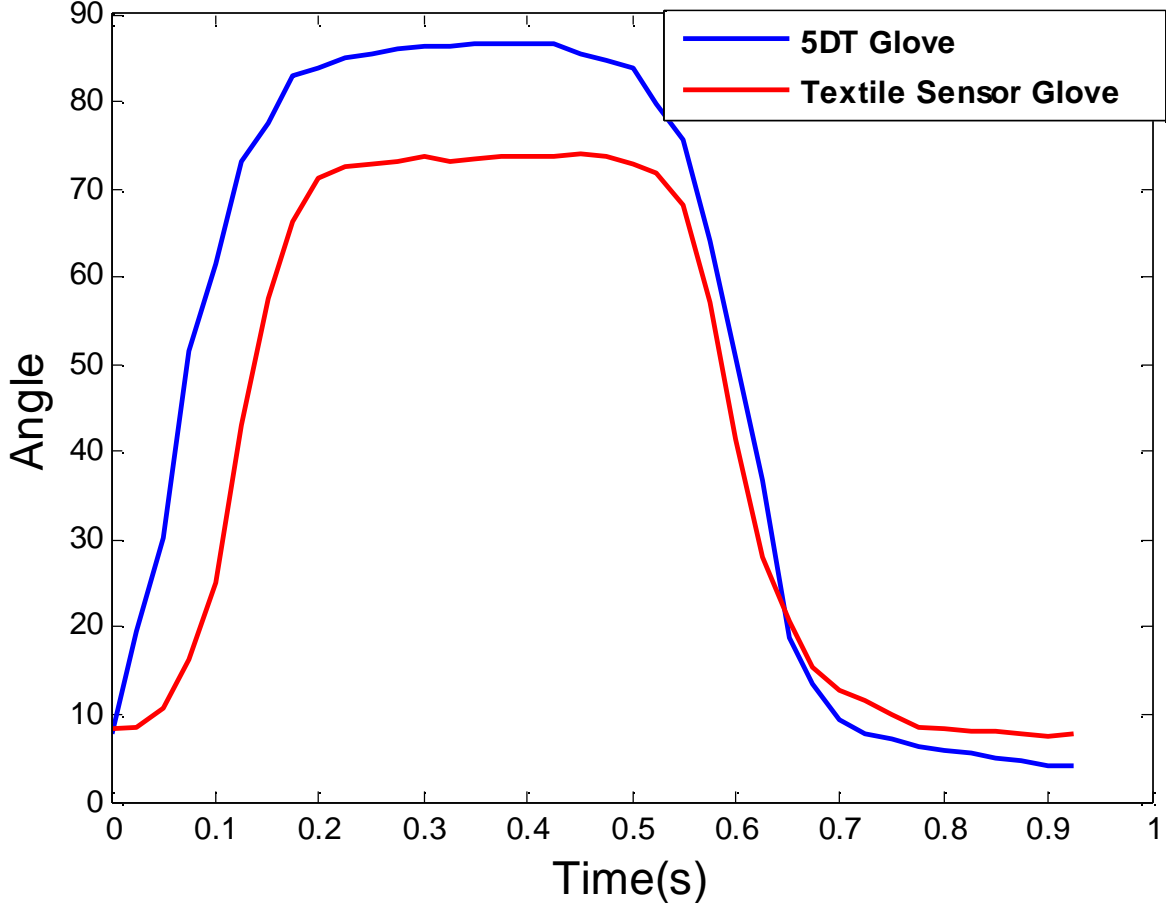
Results



Comparison of average max and min angle measurements from 5DT and Textile Sensor Glove

Results

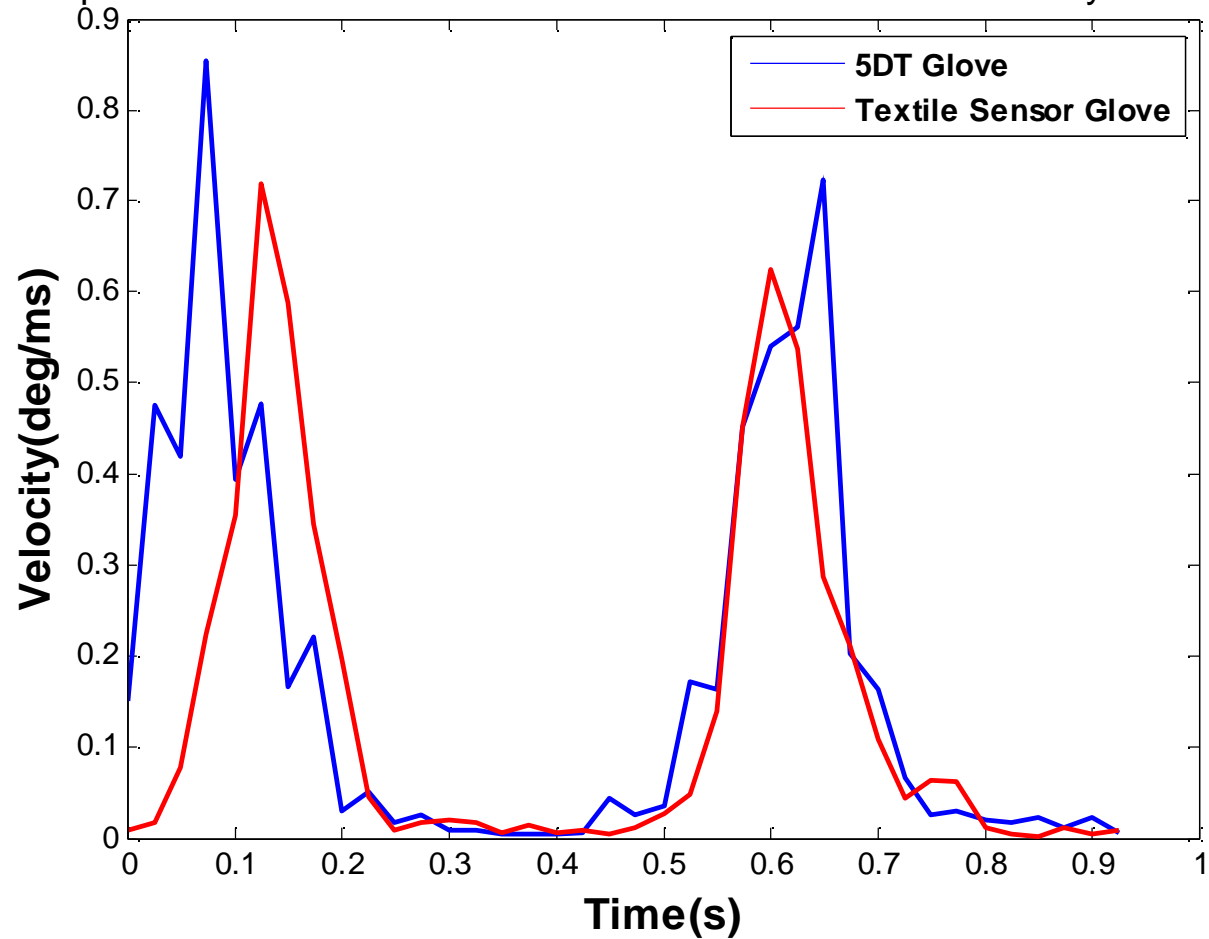
Comparison of 5DT and Textile Sensor Gloves
Recorded Angular Movement



Correlation
 $r=0.96$

Results

Comparison of 5DT and Textile Sensor Gloves - Recorded Velocity of Movement



Challenges



Fit and Sensor placement

Challenges

Calibration -

Limited range of movement

Changes in swelling day to day will affect fit



Future work

2 sensors per finger

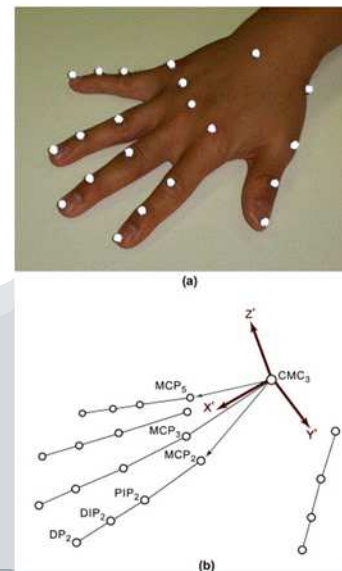
Accelerometer and gyroscope

Investigate plastic optic fibre sensors

Comparison with Vicon motion capture system



Triple Axis Accelerometer & Gyro Breakout - MPU-6050



Acknowledgements



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Thank You !