

SMART Rehabilitation: Technological Solutions for Use in the Home

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www.shu.ac.uk/research/hsc



Sheffield
Hallam University

SHARPENS YOUR THINKING

Three year project funded by the
Engineering and Physical Sciences
Research Council (EPSRC) 2003 –2006

Within the EQUAL initiative – extending quality of life
of older and disabled people

‘To examine the scope, effectiveness and
appropriateness of systems to support
home-based rehabilitation programmes for
older people and their carers’

<http://www.shu.ac.uk/hsc/smart>

Existing UK Services for Stroke

Limited availability of :-

- Specialist rehabilitation units
- Therapy staff / time
- Community based therapy

(UK Stroke Audit DoH, 2006)

Rehabilitation is effective in promoting recovery *(Pomoroy 2000, Reviews in Clin Gerontology)*

We also know that.....

- Repetition is primary contributor to functional recovery but compliance is poor
- Quality and skill acquisition are important
- Rehabilitation traditionally hands on – technology that can enable and support rehabilitation is not being exploited

This Presentation will Provide:

- Details of some of the challenges of producing the prototype device
- Insights into the critical role that therapy researchers have played to deliver this project
- Brief information of what next.....

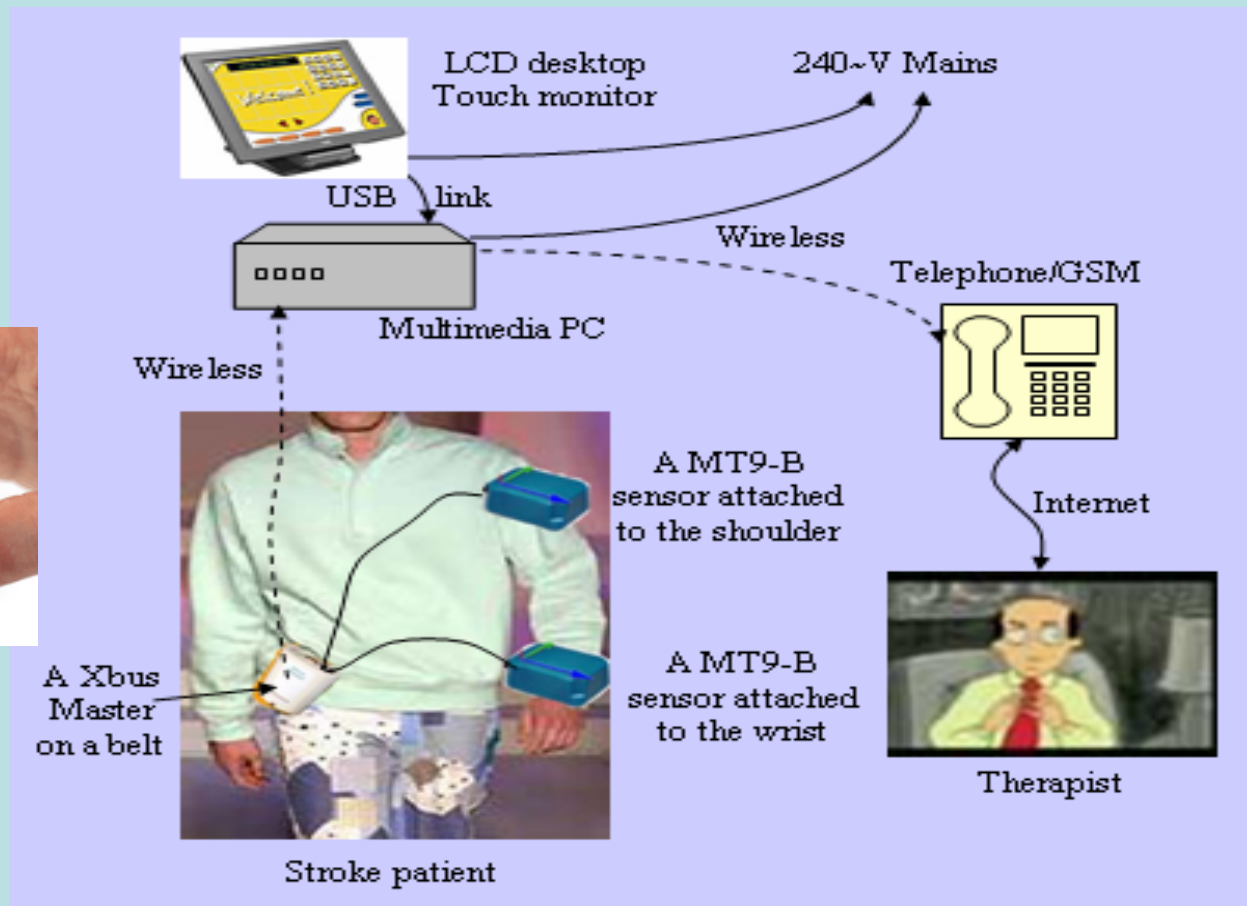
The SMART Consortium

- Occupational therapy researcher (PI)
- Physiotherapy researchers/ ergonomics
- Social work researcher
- Psychologist
- Medical physicist
- Movement scientist
- Informatics and engineering researchers

SMART Project: Initial plan: focus upon basic but essential movement

- Reach forward and return upper limb
- Hand to mouth and return (with object?)
- Lateral weight transfer on sitting
- Weight transfer on standing
- Step forward with affected limb
- Sit to stand

Smart Prototype: System Infrastructure



How the Initial Protocol Changed

- More emphasis upon user involvement; creation of an "expert group" who were involved on an on-going basis
- Involvement of designers in helping to identify and test optimum design features (Design Futures, Sheffield Hallam University)
- On-going engagement with practitioners
- Reduction of the scale of the original proposal – upper limb only and limited clinical evaluation

Stages in Producing the Prototype

1: Technical

Many challenges; for example.....

- Which sensor technology?
- Programming and calibration of sensors
- Construction of the decision support interface
- Production of a useable integrated device

Stages in Producing the Prototype

2. Clinical utility

- Identification of interventions for device replication
- Identification of movement templates - how to incorporate into sensors
- Correct placement of sensors on limb
- Feedback to therapists

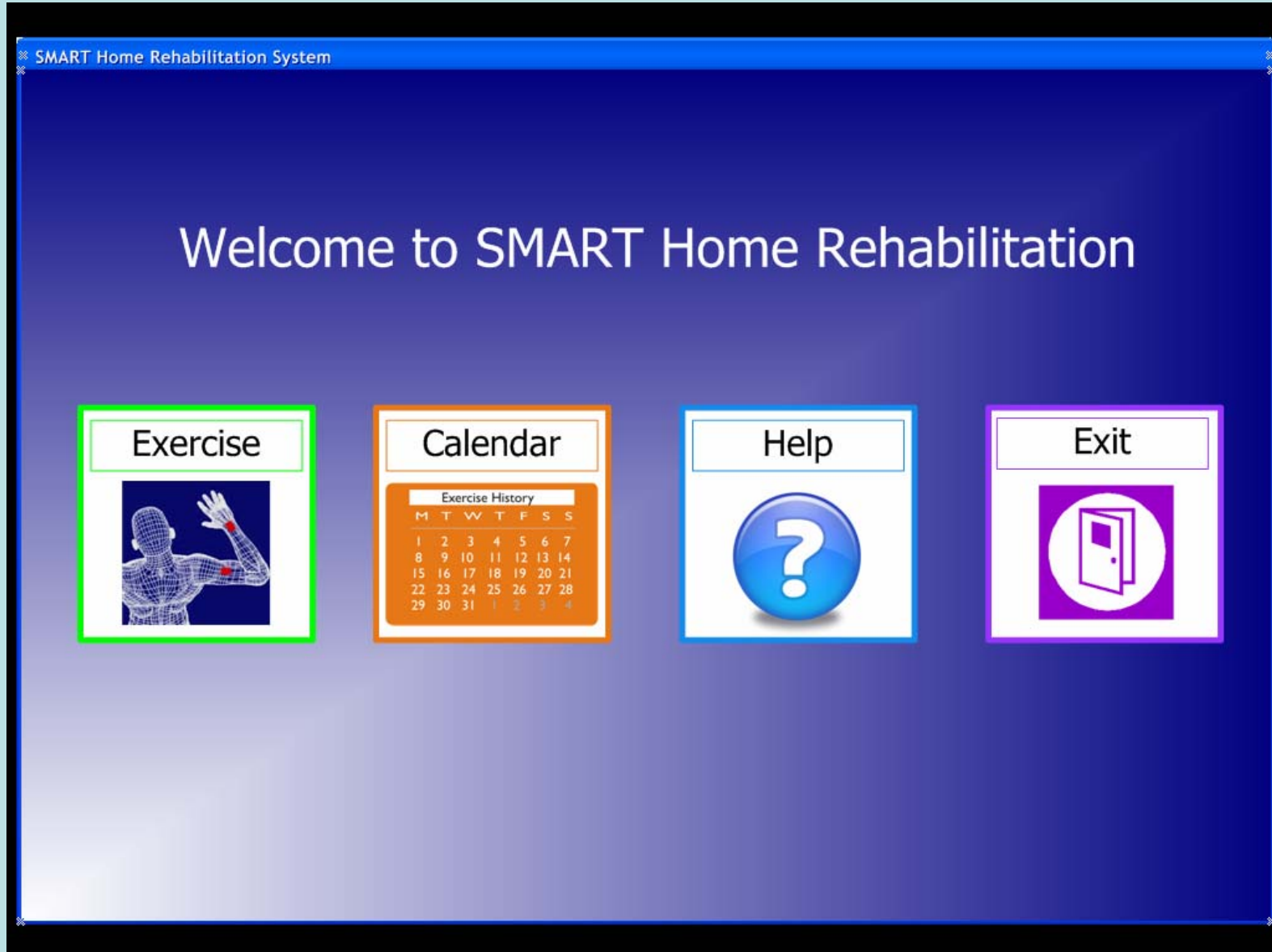
Stages in Producing the Prototype

3: Useability

- How will sensors be attached to the user's limb?
- What should decision support interface include?
- What information will users need to work the device independently
- Where will user store the device?



Patient Interface



Visualisation Feedback



Split level

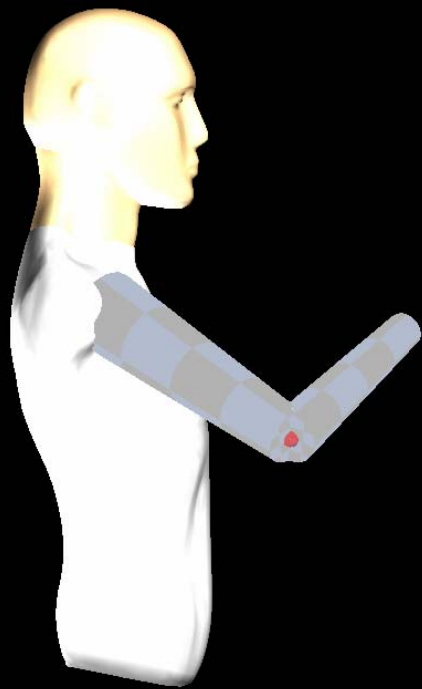
Super Imposed

SMART Rehab - Home System v1.5

Home Calendar Exercise Progress Help Exit

Play Your Exercise Stop Start Back Next End Repeat

Zoom In Pan up Pan Left Pan Right Pan Down Zoom Out Axis View



start Start Tomcat Inbox - Thunderbird SMART Command Prompt - ja... JBuilder 2005 - I;/Bu... Java Technology For... SMART Rehab - Hom... 16:42 Tuesday 10/10/2006

Home 	Calendar 	Exercise 	Progress 	Help 	Exit
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Diary

← Friday, 22th September 2006 →

no exercise today

Save Diary Entry

a	b	c	d	e	f
g	h	i	j	k	l
m	n	o	p	q	r
s	t	u	v	w	x
y	z	BACK		RETURN	
CASE		/	,	↑	.
SPACE			←	↓	→
1	2	3	4	5	SHIFT
6	7	8	9	0	

Stages in Producing the Prototype

4. Prototype Testing

- Can people with stroke use the device independently in their own homes?
- Can people with stroke and people with head injury use the device in supervised settings?
- What are the outcomes indicators of usage?

Information about Users (Community)

- Two males both with right sided stroke (affecting left side)
- User one: Aged 68 had stroke in March 06 followed by 4 months in hospital, walks with assistance and requires help with activities of daily living. MAS score 7/18. Receives physiotherapy 3 times a week.
- User two: Aged 73 had stroke in 02 followed by 3 weeks in hospital, walks independently, using stick if outdoors, but is independent with activities of daily living. MAS score 13/18. Receives physiotherapy once a month.
- Both have some experience of using computers

User Testing

- Both men had SMART equipment set up at home for two weeks December 06
- Researchers set up and supervised first session
- Both used SMART system on average twice a day
- Both had a query on first day but thereafter needed no assistance

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Therapist Focus Group

Identified the need to teach therapists how to use equipment and to record customised patient target

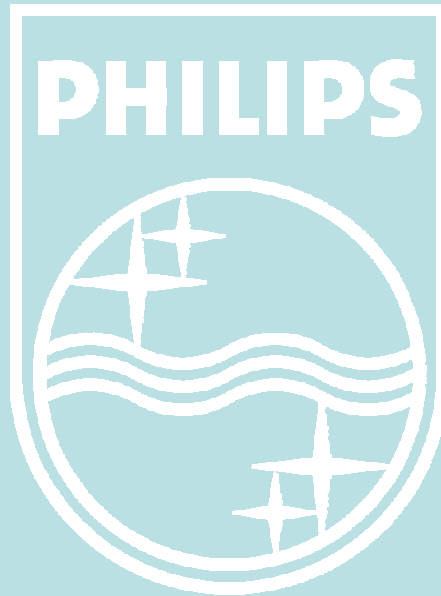
"I can't think of many reasons I wouldn't use it to be honest...Now we've seen what it can do, we can see other things we can use it for!"

Why Involve Therapy Researchers

- Working with practitioners to identify both initial and further rehabilitative interventions that might be delivered remotely
- Ensuring that engineering and design solutions match user needs (therapists and end users)
- Research dissemination and implementation through professional and user networks

What next:

Collaboration with Philips R&D Aachen,
Germany



Why the Collaboration is Important

- Philips have been working in a similar area
- They have more advanced sensor technology and many researchers involved – the device will be non wired and made robust
- They have identified our therapy/ user involvement in community settings as being both excellent and unique

Current and Planned Work to August 2007

- Fusion of Philips system with SMART device
- Usability testing of fused device
- Preparation of protocol for robust examination of clinical and cost effectiveness
- Cooperation across Europe; physio and occupational therapy

The Message for this Audience

- The involvement of therapy researchers is extremely valuable in the identification and testing of appropriate technology design solutions
- Therapists are well placed to lead projects (rather than being handmaidens)

Coming soon “Lab4living” design and health,
Sheffield Hallam University.....