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| Heriot Watt University |
| Design Report |
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# Background – Stakeholders, Context

This is a design report on our proposal to build an interactive device for people generally of age 65+ with limited mobility. The specified requirements that this device should provide are – the support of exercise, reminders to take medicine at correct times, communication of energy use and tips to decrease this, and a mechanism to request a small robot fetch small items of use within the home.

The stakeholders who will be inputting and updating information for this device and who will be interacting through this device include:

* Individual in home: primary user
* Medical staff: doctor, nurse, therapists
* Spouse, children, relatives: may or may not be present
* Emergency services: ambulance, fire personnel
* Maintenance staff: home, utilities, robot, interaction system

The location in which this device will be used:

* Primary use within home which has ‘smart’ device monitoring of energy use
* Secondary use within medical offices of doctor, nurse, and variety of therapist locations

The structure of this report is to provide initial and amended design and content for the three primary functional areas – exercise, medicine, and energy use – as well as the design and content for interaction with a robot used for the retrieval of small items in the home.

The details of the personae for whom the interaction device has been designed appear in the Appendix as Personae 7.2. The details of scenarios which have been used in this design appear in the Appendix as Scenarios 7.3.

# GUI Design

TEXT

## Initial Content

### Sub2

## Amended Content

# Exercise Screen Design

## Initial Content

The NHS recommends that older adults (65+) partake in two different types of activity every week: a mixture of aerobic activity such as cycling or walking along with strength exercises, that impact all parts of the body, including legs, hips, back, abdomen, chest, shoulders and arms (NHS, 2019).

The group discussed the possibility of Tai Chi, which appeared in China in the 13th century as a martial art, as a possible appropriate exercise. There is evidence that practicing Tai Chi can help older adults to reduce stress (Sandlund & Norlander, 2000), improve posture and balance leading to lower risk of falls (Lomas-Vega, Obrero-Gaitan, Molina-Ortega, & Del-Pino-Casado, 2017). Most importantly for those with mobility issues or who are unable to stand Tai Chi can also be practiced sitting down, bring about much the same health benefits as when done standing up (DailyCaring, 2019).

As the product was to give interaction, the initial design of exercises focused on giving the user feedback in the form of a human image with line skeleton overlaid and sensor points on that line skeleton. The display was expected to guide the user through placement of the line skeleton through a given exercise sequences and the sensor points on the screen would be mirrored in sensor devices on the user’s body.

## Amended Content

The group agreed that the Tai Chi exercise option still fulfils a NHS-approved exercise need. However, noting the feedback that our design for exercises did not address providing motivation for the user to engage in exercise, additional research was conducted to pinpoint ways in which our personae – elderly people with limited mobility – might be motivated. One observation found in several websites is that people will tend to do an activity or exercise if it something they enjoy (Baylor Scott & White Health, 2012; Myers, 2015). Two sports highlighted by Myers (2015) enjoyed by older people are golf and bowling. These sports were added to the exercises offered through the interaction system. Rather than hindering participation due to lack of equipment, the exercises would make use of sensor substitutes that would help track whether the movements undertaken would help the player ‘win’ at the sport.

The feedback highlighted in the initial design could be seen as ‘passive’ in that it relied on the persona mirroring the skeleton outlining the position of the exercise. The amended exercise feedback will show colour areas on the panel form – a red colour on the panel form’s arm, for instance, will suggest that the persona’s position of the arm during the exercise is out of alignment with what is needed, a green colour on the panel form would feedback to the person that their position for this part of the exercise movements is correct.

# Medicine Screen Design

## Initial Content

## Amended Content

# Energy Screen Design

## Initial Content

## Amended Content

# Robot Screen Design

# Appendix

## Gantt Chart

## Personae

### Al –

Age : 66

: Widowed, 8 years

: 1 adult daughter, married with small children, lives in Australia

Health : Suffered first stroke six weeks ago

Al does not smoke, drinks moderately (2-3 beers a week, some weeks no drinks). A recreational cyclist, Al also likes to swim. Does not follow sports. Has been active with his church and has taught in Bible classes for ages 8 – 12, for a number of years. After retirement, he also began to work with the same age (8 – 12) group with a neighbourhood refugee support organization.

Worked 40+ years for an architectural/building firm. Initially worked as a mechanical engineer, but then as mechanical designer. He is in demand there as an occasional trainer for new employees in the mechanical design department. Because of his past design work, Al enjoys drawing and watercolour painting.

Consequences of stroke: minor speech impairment which has largely been overcome through therapy. Difficulty in walking and difficulty in assessing placement of objects/hands to place objects.

Was in a rehabilitation unit where some progress (mainly speech) was made. However, Al is in denial about the stroke and this means he is often distracted and/or depressed. 1 week ago he mixed up when to take his medication and this led to a minor medical reaction. This seems to have depressed him further. Al has moved to assisted living accommodation but he struggles with the results of the stroke in terms of being motivated to improve his health.

Next stages for improvement

: Al wants to be in his own home but to do this he needs to be able to

1. Walk through rooms, to bathroom, to kitchen. At present, he has difficulty doing this.

* Needed: Exercises to improve muscle strength, balance coordination, overall activity.

1. At present, in addition to walking problems, Al is often unable to grasp and control many home implements such as cooking utensils and has to rely on a ready-meal delivery system and also unable to draw or paint because of the lack of hand control. He finds the process to make his hands do as he wants very frustrating.

* Needed: Exercises to improve control and coordination of hands.

1. Take medication on time. Initial assessments have shown Al is depressed with his recent stroke and feels out of control over what matters to him. This in turn leads him to not act according to instructions, such as on medication. He presently has several types of medicine that need to be taken at specific times but despite labels on containers, Al failed to take one medicine correctly which led to some minor deterioration.

* Needed: A method that makes it easier for Al to take his medication at the right times.

1. Because Al has difficulty in walking, he needs extra assistance getting small, everyday items.

* Needed: A robot which could take instructions – ‘Bring me my glasses’, for example – would ease Al’s transition to being fully independent in his home again. Items that may be needed for a robot to fetch include: aforementioned glasses, pen and paper, mobile telephone.

If these four areas can see real improvement in Al’s ability to regain independence, it could make a positive difference to Al, who deeply misses feeling like a functioning adult with much to give to others.

*Nice to have:*

Given that Al has worked for a building company as a mechanical engineer and now designer, he would enjoy checking his use of heating and electricity of his environment. It would tie in with his past employment and give him an element of control over his life, something he feels he has lost with the stroke and its effects.

## Scenarios

## Screenshots

## Logbook

## References

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