Keep Warm: a user friendly system using predictive machine learning technology to ensure no elderly person ever suffers as a result of inadequate heating in the home.

Summary

Problem

- The elderly experience physical changes, feeling more comfortable at higher temperatures.

- Their bodies do not disperse heat efficiently, in winter unaware they are getting cold.

- Leading to a higher risk of serious morbidity and mortality due to hypo- and hyperthermia caused by extreme temperature changes in the environment.

Process

- I noticed elderly relatives often choose temperatures physically uncomfortable for me. I followed this with informal discussions with carers of the elderly.

- Key sources show elderly on fixed incomes have strong incentives towards reducing heating expenses. With physical aging changes this can lead to morbidity and mortality.

- I investigated Nest but found the research complicated. I could not find that the nest had a simple interface or controls to accommodate the elderly and infirm community.

Proposal

- To design a home climate control system using machine learning to assist elderly and disabled people in their homes.

- It will allow the user to increase or reduce their heating, but at the same time to automatically notify an emergency contact if safe parameters are exceeded.

Social and Environmental Impact

- My proposal will lead to fewer people requiring emergency medical care.

- Users will feel in control of their environmental temperature, but they will not be able to achieve household temperatures outside a pre-set safe range.

- This unit will empower disadvantaged users because even someone with severe cognitive functioning issues can be given the hand controller.

- If they continually call for excess heat or chilling, an outside contact can be notified.

- Extra programming could be added for individual users as the machine learning system recognises their normal behaviour patterns and anticipates the settings they need throughout the day and seasons.

- My system will be easily accessible using tactile plus and minus icons on an ergonomically comfortable controller.

- With the machine learning, a more stable household temperature will be achieved which is more environmentally friendly than a constantly shifting temperature.

- My unit will be made from recycled plastics.

Rigorous Research and Compelling Insights

- I noticed that elderly relatives would often be sitting in temperatures that were physically uncomfortable for younger people. I followed this up with informal discussions with carers of the elderly.

- A preliminary review of secondary sources showed that poor temperature control and temperature sensing among the elderly is common.

- Formal personal interviews with the elderly were impractical due to the COVID-19 pandemic and government measures to restrict transmission to people who are 70 years or older with moderate risk, and those with pre-existing health conditions at high-risk (NHS, 2020).

- The elderly are at greater risk of morbidity from extreme temperature conditions. They are often on a fixed income, so they are inclined to save money by reducing spending on home climate control.

- This is a perfect storm of economic and environmental factors, which according to a report by the "National Center for Health Statistics" shows a significant climb in heat related deaths for people over 65 years old. Additionally, the likelihood of temperature related death sharply increases over 75 years of age. (Burling, 2017)

- The elderly often feel their control is being removed, human beings generally like to feel in control

- I had my peers test and examine my design to allow me to iterate.

Systems Thinking

- Physical changes cause the elderly to sense heat differently to younger people. They feel more comfortable at higher temperatures, their bodies do not get rid of heat easily. They can be unaware they are overheating. Thus, elderly are at much higher risk of serious morbidity and mortality through hyperthermia (Burling, 2017). Changes in the body that occur with ageing also cause the elderly to be less aware they are getting cold. An elderly person be in danger of serious hypothermia (National Institute on Aging, 2018).

- Most existing home heating systems rely on pre-programmed settings but no automatic seasonal adjustments. Although some boilers can be fitted with weather compensation there is usually no programming available to automatically adjust for the occupant, to maintain a safe temperature band or anticipate the user's needs.

- There is the potential for some users to spend more on heating and cooling because the system restricts the temperatures allowed to safe values.

- Carers could be called out more often if the person continually requests unsafe temperatures.

Viability, Creativity & Innovation

- This could be a private venture, users buying the device because it would save them money or relatives purchasing the device to keep their family members safe. However, in line with government supported programs, such as home insulation, double glazing and solar power this could be promoted through care of the elderly charities with government funding. It is a system having wide reaching long-term environmental impact, to save money and improve health.

- Success would be measured by
  - the number of units installed
  - improved temperature-related health
  - KW/h saved in energy
  - more stable temperature control
  - less emergency medical services involvement because health issues are detected and dealt with earlier.

- This system is different from other interventions because:
  - It combines a home automation system with machine learning for smooth temperature control
  - It disallows unsafe temperatures to be achieved
  - It links to outside resources, calling for help and support when unsafe temperatures have been requested by the user.