One, Two, Buckle My Shoe

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Abstract
Older Adults (>65 years), Physically Challenged population (Amputee) or Population facing challenge to reach their feet, finds it difficult to wear socks and shoes. We aim to address this issue with design of a robot who can help mentioned population to complete this - day to day life task. Following Human Centred Design Process, we will take our users in each step of design, implementation and evaluation process. The findings from this study will provide insights from Robot – Older Adults/Amputee Interaction for complex tasks concerning this population for the UIST community.

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Shoe, Shocks, Older Adults, Amputees, DIA Cycle

ACM Classification Keywords
H.1.2 User/Machine Systems, H.1.m Miscellaneous, H.m Miscellaneous

Introduction
To support older adults to live longer and healthier lives in the familiar surroundings of their homes, technological developments, such as robots and avatars, have a great potential.

Authors from their life experiences with their grandparents and people who have physical impairment

with hand have found that this population faces various issues with their life. In a group discussion between the authors following an experience sampling approach [1], we categorized various problems that this population faces in their day to day life. We boiled down our conversation to the fact that we selected only those problems where the person's hand is occupied or can not use it because of physical impairment.

We arrived at wearing of shocks followed by shoe as the problem to work upon. Older Adults and Amputees finds it difficult to bow down to their feet to wear shocks and shoes. Sometimes they simply cannot reach their feet or their hand is pre-occupied by holding onto a walking stick or nearby support. In this scenario, it falls upon their care-taker to help them wear a shoe. This often increases psychological stress in them [2]. We aim to design a robot for this population to wear socks and shoes. A person can either be standing or sitting and can use voice commands to activate the robot. The robot has the socks and shoes pre-loaded, and it can navigate to the person's feet and helps in putting on the socks and shoes. A typical behaviour of robot is explained as follows:

1. The robot will be signaled by voice command to start.
2. The robot will identify the person's feet.
3. The robot will navigate towards the feet.
4. The robot will put the sock on lifted/extended foot.
5. The robot will put the shoe (without shoelace) on foot as foot comes down towards the floor.
6. This process will repeat for the other leg.
7. Navigate back to designated start position, waiting for next command.
8. Voice command deactivation/instant abortion: At times the robot might cause distress to the user while putting on their socks or shoes. A simple voice command "stop" will make the robot stop putting on the sock or shoe and roll out all changes.

The required components for this robot are: Voice command activation: Microphone - Listen to the audio; Identify and locate feet: RGB camera or RGB-D stereo camera; Navigation: 4 Wheel drive, 4 motors, 4 motor drivers; Putting on the sock: 3 gripers, 4 servo motors; Putting on a Shoe: 2 servo motors, 2 gripers; Loading of shoes and socks: 4 servos

Our users can wear their own shoes by simply placing their feet in robot hands. The robot will facilitate the motion of the foot off the ground more easily. Also, the shoe connects to the robot with a flexible support and a drivable and frictional ankle joint. Also, we aim to add flexible support bent to keep contact of the sandal-type shoe and ground when the user shifts his/her center of mass laterally from learnings from Cheng et. al. [3].

References

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