



USE CASE 12

Aids for the Elderly or Disabled

Age & Level

Leon, Germany
Hamburg, Germany
16 years old

Leon is 16 years old and lives in Hamburg, Germany. He has some previous experience in 3D modelling and 3D printing gained from visiting his local FabLab. The facilitators at the FabLab are a small group of enthusiastic makers with a lot of practical experience under their belts but with no formal teaching experience. One of the facilitators, Paul is particularly helpful and Leon has built up a good relationship with him benefiting from his experience and advice.

Primary Actor and Main Goal

Leon is good at mathematics and technical subjects in school. He is interested in cars and cannot wait to learn to drive. He works at a local food takeaway on Saturday afternoons and is saving towards getting his own car.

Currently he is applying for an Engineering course at a technical college and ultimately would like to be an engineer at BMW. Last year he went on a school visit to the BMW headquarters in Bavaria and was amazed and impressed by the facility and location.

Leon visits a FabLab in his town most Saturday mornings to gain some additional skills, he knows that 3D printing is being used a lot in the automotive industry and thinks that by learning the technology will give him an advantage in future college and job applications.

At the FabLab he has taught himself the basics of 3D modelling. He started by downloading interesting models from Thingiverse to 3D print, but has progressed to designing and 3D printing a few small items for his home such as a stand for his mobile phone and a tealight holder as a birthday present for his older sister.

Topic and Content

Leon has a very close relationship with his grandma, she lives close to him and he visits her most days after school as his parents were out at work. His grandma has always had difficulty with movement in one hand due to a trapped nerve at birth, however as she has got older she has developed severe arthritis in both her hands and this has limited the movement of her fingers and restricted her ability to grip things.

Leon has noticed that his grandma finds it increasingly more difficult to do everyday tasks due to the limited mobility of her hands, he often helps her at home by opening bottles and jars for her, chopping vegetables etc. He wonders if there is another way he can help. He thinks he may be able to use the 3D printer and 3D design software at school to design and make tools and aids that will help his grandma to use her hands to complete everyday tasks.

Leon talks to Paul, one of the FabLab facilitators about the problem and asks if he thinks it would be possible to use the 3D modelling software and 3D printer to design and make something to help his Grandma. Paul thinks it is a great idea and offers his expertise to feedback on his ideas and designs before 3D printing, as he is also keen to not waste materials on printing designs that won't work in practice.

Description of Environment and Possible Pre-conditions

The FabLab in Hamburg is relatively new and contains a variety of making facilities and equipment. This includes:

- a traditional workshop space with benches that contain wood and metal vices, a range of hand tools, a vacuum former, band saw, belt sander and lathe
- a small electronics lab with soldering irons, electronic components, breadboards for prototyping and a range of programmable micro-controllers. This also includes a digital fabrication area with Raspberry Pis, a laser cutter, a PC and a 3D printer.

The small team of three permanent staff have different skill sets to assist the FabLab visitors, one is an electronics expert, one a former joiner who is an expert with the traditional workshop tools and machinery and Paul who is an experienced CAD designer and specialist in digital fabrication techniques. The team work different shifts so are not always all available at the same time, but Paul is usually at the FabLab on a Saturday morning when Leon visits.

Preparatory Work

Leon plans and then records a short video interview with his grandma, where he asks her a series of question about what she finds difficult. He shares this video with Paul, this helps

them to understand the real problems his grandma faces and to generate ideas for bespoke 3D printed tools and devices that could help.

Leon also takes various measurements of his grandmas hands to help with his designs as he thinks these might be useful for determining the various size requirements for his designs.

Description of Activity

First of all Leon watched the video interview of his grandma and used the ideation tools in the eCraft2Learn UUI to record all of his ideas. He discussed various options with Paul and decided that the thing that would be the most useful would be to concentrate on cutlery. His grandma has difficulty gripping cutlery and finds it particularly difficult to cut meat, reluctantly she has had to change her diet to include things that are easy to cut and scoop up. His grandma did get some special foam grips that went onto the ends of her cutlery. These did help but the problem is they only lasted a week or two before they needed replacing and they were too expensive for his grandma to keep replacing. Leon decided to try and design and 3D print some special handles that would slot onto the ends of the cutlery.

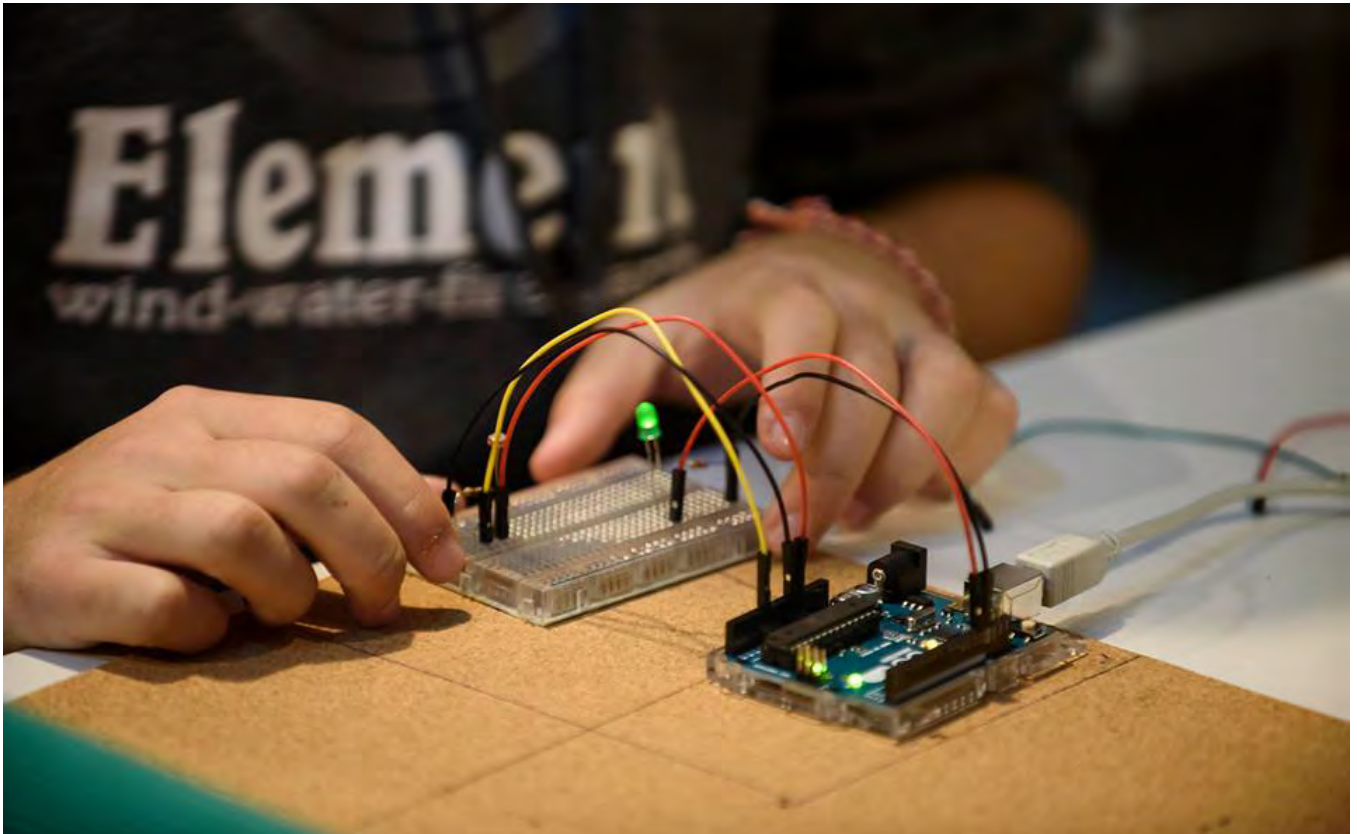
First of all Leon purchased some new cutlery with a cylindrical handle as he thought it would be easier to work with than his grandmas cutlery that had a complex shaped handle. He worked with his grandma to produce a prototype by using plasticine shaped around the cutlery to see what approximate size she would be able to grip. He also looked at how her hands wrapped round the handle to see where he would need to put grips. Using the prototype Leon then took measurements and started to draft up a 3D model in Tinkercad. First he made a basic large 3D cylinder the required diameter, he also placed a cylindrical hole down the centre for the cutlery handle to slide into. Then using the torus shape as a hole he made indentations into the surface of his object to add finger grips.

After a few tweaks to solve some object alignment issues he saved the design as saved the design as a .STL file. This file was opened up in the Cura slicing software. He realised that to minimise overhangs it would be best to print the handle upright on the printer, so he changed the orientation of the model in Cura. The file was checked and sliced then saved as a Cura Project and a .GCODE file for 3D printing.

A single prototype of the handle was then 3D printed and he assembled it onto the knife and gave it to his grandma for testing.

Success and Condition

Upon testing Leon discovered that his grandma's hand would slide down the handle sometimes, so he adjusted his design to include a raised ridge at each end of the handle to stop his grandma's hands from sliding.



This second iteration was a great success, so Leon printed 2 more and glued them securely onto a knife, fork and spoon so that they could be used permanently by his grandma.

He also decided to share his design as he thought other people with similar difficulties to his grandma might find it useful. In the Share area of the UUI, he selected Thingiverse and uploaded his model design to the Thingiverse community.

Failure and Conditions

When printing the first prototype, as it was a relatively tall print, towards the end it started to wobble and became detached from the print bed, this caused the print to fail. He wasn't sure how to stop this from happening again so he watched the Cura Build Plate Adhesion video in the UUI.

After learning about the two options he decided to add a raft as it provided more adhesion and was easier to break away from the finished print afterwards. Following this his second printing attempt was successful.

After Leon's success, he is now working on a kitchen knife design with two handles, one at each end so that his grandma can push down on both ends to chop vegetables.

Variations

Leon's grandma is thrilled about her new aid and since it works so well for her, she shows it to her friends in her union for elderly people where she goes once a week and several other friends of her are wondering how he did this and are astonished how gifted her grandson is. One friend even asked her if her grandson could find a solution for his crutch he tends to lose due to his Parkinson.