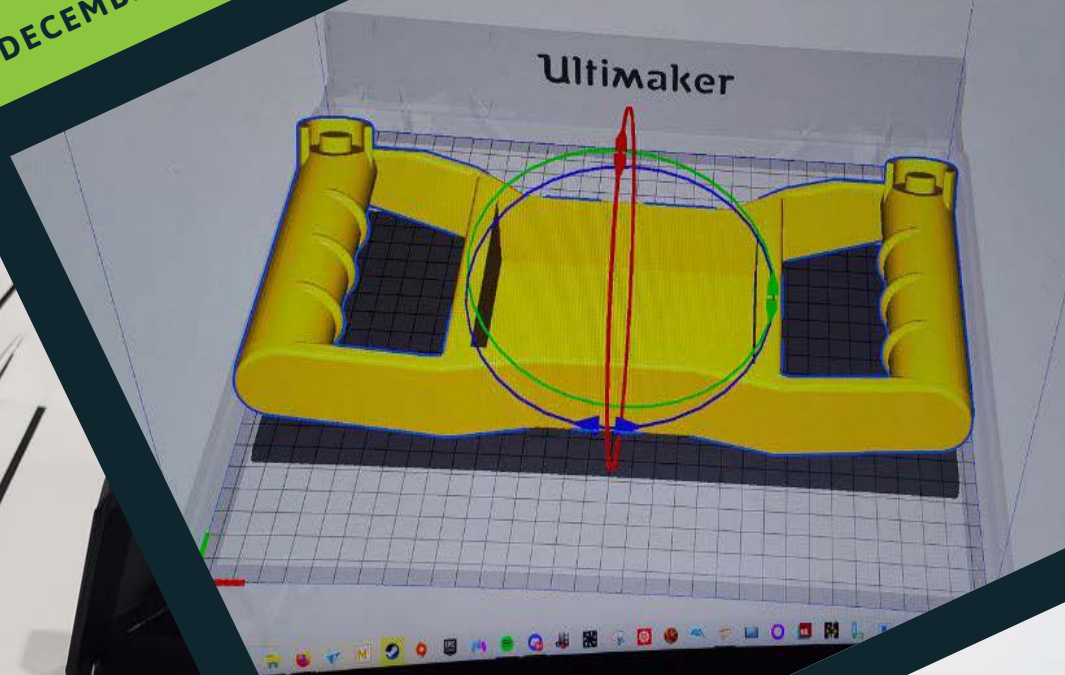


A!
Aalto University

TU Delft

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SPOT

SOCIETAL PERSPECTIVES TO
INNOVATION OPPORTUNITIES IN
TECHNOLOGY

3D PRINTED PROTOTYPES
WITH META-HIGHLIGHT
TECHNOLOGY

Report:

ACCESSIBILITY & INCLUSIVE USE THROUGH PROTOTYPING: *A student perspective*

Prepared for:

META-HIGHLIGHT

Projects completed within the course:
Mechanical Engineering in Society
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This compilation of student prototypes represents a curated selection from 23 team submissions. The prototyping process supported students' critical review of accessibility and universal design in relation to a handheld device. The process required students to consider the broad range of individuals' physical attributes who would be working with the device when characterising biological tissues. The context of use was also an important consideration.

Students were introduced to the META-HIGHLIGHT consortium and technology through the ATTRACT technology card. Prototyping focused on the consortium's objective to create a portable digital histopathology system for medical diagnostics. Within this context students were tasked to prototype a handle for a physical testing unit within this system.

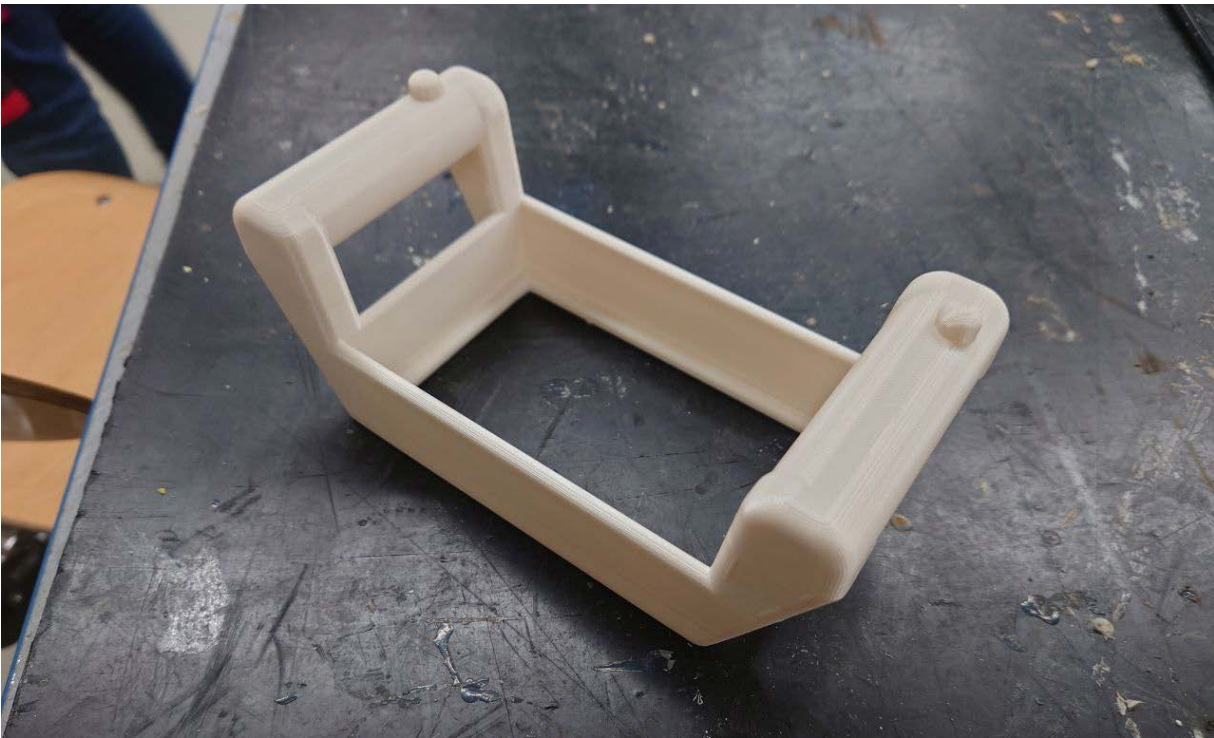
Students were tasked to design a handheld device for an operating room to allow for on-site diagnosis. The prototypes assumed that the technology would be housed within a 125mm x 80mm x 30mm space, weighing 350 grams with 2 buttons that could be pressed independently of one another during use. Student teams first conceptualised the end-use interaction with clay, after which they translated their concepts into CAD drawings to enable 3D printing of the final designs. Students considered the equitable design of such a device to make it useful and marketable to people with diverse abilities. Focus was placed on simple and intuitive interaction, while trying to minimize effects and consequences of accidental or unintended actions

The final device handle prototypes represent a range of interpretations. 19 prototypes were designed to be held in one hand, and 4 of these used a trigger-based button system, while the rest featured either thumb or forefinger button access. Of the 19 single hand prototypes, 2 were created to slide around the testing unit, while 17 would require permanent attachment. 4 prototypes were designed to be held with both hands, positing the buttons alongside the imagined device display.



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Prototype #1: Two-handed prototype



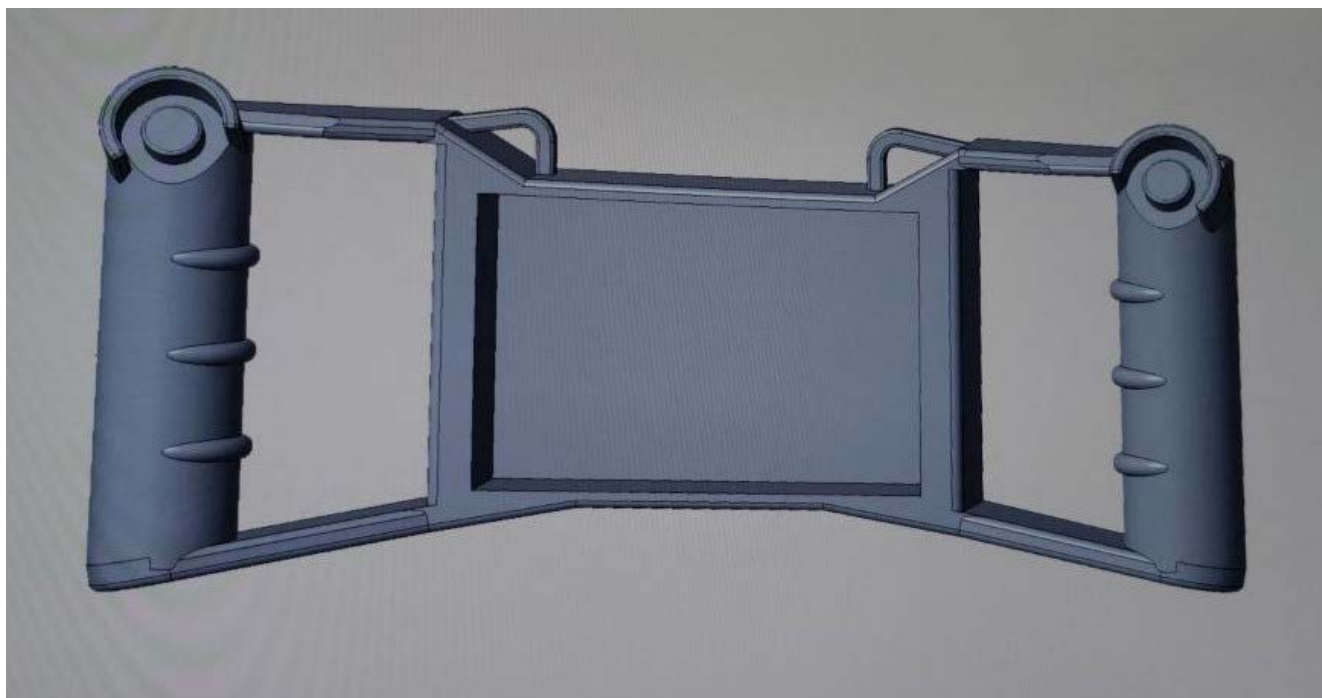
The team wanted the device handle and buttons to be intuitive, with the buttons clearly positioned and easy to reach. The final design was inspired by hand-held game console controllers.

DESIGN CONSIDERATIONS

The three key considerations in producing the 3D prototype for the device was that the analyzing device would fit in the cradle between the two handles, that the handles are comfortable and that the buttons on the device are easy to use.

Prototyping is a very important step in gathering user input during the engineering design process. Because of the convenience of producing a super realistic three dimensional prototype using modern 3D printing technologies, users and designers can not only touch and feel the product in their hands, but also potentially use the product in the field.

Prototype #2: Two-handed prototype with recessed buttons



Central to the design was the need for comfort and a secure grip. The final prototype includes a range of considerations to support this including slightly elevated ridges on the grips and an elongated handle area to ensure that even users with larger hands can fit all four fingers comfortably around the grip.

DESIGN CONSIDERATIONS

The final design extended the distance between the testing device and the handle unit that cradles it. The slight extension would make it easier to access and maintain the components used to manufacture the device.

Each handle features three ridges which align with the general width of a person's fingers. The comfort of this was tested with multiple group members to ensure the design did not represent a highly individual profile. The ridges are intended to stop the end user's hand from slipping when wet or slippery.

The buttons are recessed at the top of the handle unit to avoid accidentally depression during use – the user should take an intentional action. Separating the two buttons will also lessen the likelihood of the wrong button, or both buttons, being pushed.

Prototype #3: Single-handed prototype with a trigger action



After all team members tested the clay version of the prototype the handle was shaped to follow the curve of one's hand and the second button was relocated to the back of the handle for increased accessibility.

DESIGN CONSIDERATIONS

The three key considerations when designing this handle were the physical strength, the desirability and finally, the functionality.

The physical strength and durability of the product is important to ensure longer term use. This is especially true as the device will possibly be an investment for the hospital or clinic. The second consideration is the overall design and whether buyers, and end users, will find the product attractive and valuable. Finally, one needs to consider the functionality. Focus was placed on making the handle easy to hold and use.

The buttons are placed far apart to avoid accidentally pressing of the wrong one, and feature two different interaction – one as a trigger action and the other the depression of a raised button positioned on the handle, with one's thumb.

Prototype #4: Single-handed prototype with only push buttons



The final prototype opted for a button positioned on the inside of the user's grip, allowing one to depress the button with the middle section of an index finger, while the index fingertip is positioned to depress the second button.

DESIGN CONSIDERATIONS

Prototyping proved to be a useful way to explore how things would work in a real-life setting. The key considerations were ease of usage, ergonomics, and reliability.

Firstly, the final design needs to be firm in the end-user's hand. Given the context of use the device may be used when liquids are present and should not slip even if used with wet or slippery hands.

Secondly, the buttons need to be findable and easy to push with bare hands as well as when wearing gloves. This again speaks to the diverse contexts of use one may encounter in a hospital or clinic.

Finally, the product should be aesthetically pleasing to provide a competitive edge when marketing the final product.

Prototype #5: Single-handed prototype with joystick function



During planning the team identified the positioning of buttons on only one side as a possible challenge to persons who are not right-handed. One solution included buttons on both sides, allowing the user to activate the side they prefer. As this could potentially lead to accidental button activation when swapping between users, a joystick option usable by both left-and-right handed users was incorporated.

DESIGN CONSIDERATIONS

Three key considerations when designing the 3D prototype were to make the handle as easy to hold as possible, to make the handle and thus device less likely to be dropped and to allow for multiple input options.

The final design includes a space to place one's index finger and the two buttons required by the challenge in addition to a joystick style button that could be activated to support different user preference or abilities. Diverse end user considerations included whether they are left-handed or right-handed, wearing gloves or experienced permanent or temporary mobility decrease in their hand. Temporary mobility decrease could be associated with a sprain, broken finger, or other similar limitation.