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Reimagining smartphones: Modular mobile devices against the flood of electronic waste

One cannot imagine modern life without smartphones. These small electronic helpers make our lives easier and better. But they also do real ecological damage. How can the production and use of smartphones be brought back into a healthier balance with our environment? This is the question that two industrial designers wanted to answer at Fraunhofer IZM as part of the BMBF-funded MoDeSt project, researching whether modern technology and a circular economy can go together. As a result of their efforts, the presented two designs for long-lasting and recyclable smartphones with striking looks.

It seems that the next generation of smartphones is always around the corner, waiting to replace devices that are still perfectly functional and artificially shrinking the working lives of smartphones everywhere. Studies show that Western European users tend to use their mobile phones for longer than before¹, but the average lifespan is still nowhere near the real life expectancy of the devices. Apart from putting enormous competitive pressure on manufacturers, this only adds to the flood of electronic waste, with dramatic consequences for the environment: the discarded smartphones contribute to the approximately 1.7 million metric tons of electronic waste in Germany per year. To stem that tide, the European Union decided to launch an action plan for a circular economy in 2020, with the express mission to reduce the amount of e-waste. The circular economy is also the fundamental concept underpinning the MoDeSt project: It tries to understand how the lifespan of smartphones can be extended and how modularity can be achieved, both technologically and commercially. Put simply: It is about making longer-lasting, repairable, and recyclable phones without compromising on their functions.

The project revolves around the circular toolkit developed and made available to the public by Fraunhofer IZM. With that toolkit, the two industrial designers Tapani Jokinen and Robin Hoske dared to reimagine what smartphones should look like. They came up with two completely revolutionary designs. The initial design, the MODEST CUBE, was

¹ https://www.allianz-trade.com/content/dam/onemarketing/aztrade/allianz-trade.com/en_gl/erd/publications/the-watch/2022_02_035G.pdf

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made from 100% recycled PCR plastic, and was created with the intention to make the device as repairable as possible. This made the MODEST CUBE vivid proof of how product lifecycles could be extended if hardware can be replaced quickly and without fuss. This is modularity writ large and not limited to individual modules.

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When trying to define which functions the CUBE should come with, the researchers scrutinized all the data they could get about the individual needs and habits of their users and refined their insights in workshops with experts on issues ranging from business or the environment to consumer goods and design. Hoske explains their vision: „The MODEST CUBE is a smartphone that does not age. With its mix&match design, you can easily swap out parts of the hardware, even including the displays. And this is not just great for repairability - it gives you that power to match your device to any user's needs and expectations: For instance, some people might need an extremely good camera, so they can upgrade that part without having to shell out for a completely new phone. Our design shows how you can avoid electronic waste and keep the product's value intact.“

For their second design, the team dared to take everything a step further: With its innovative looks, the MODEST ARCH reimagines what a mobile phone can look like, and it includes the psychology of smartphone use at the same time. The basic idea is to balance its use in the sense of digital self-sufficiency. This can protect the mental wellbeing of users and avoid the many negative repercussions of excessive use, such as poor concentration. „As much as necessary, as little as possible“ was the principle the researchers followed when testing people's usage patterns and reduce use to a minimum, saving energy and resources at the same time as an added bonus.

The ARCH uses a creative design that banks on the forecasts made by industry designers about future connectivity. „We can all assume that many applications will be handled by virtual reality or AI-supported voice assistant in the next decade. This is why we purposefully went with a compact and minimalist design that keeps the hardware down to the bare bones and uses a cloud-based operating system. In its essence, the backbone of the system is a web browser in the form of a personal token with little in the way of actual hardware components. You can add more functions as you need, and the ARCH becomes your interface with the connected IoT environment around you“, Jokinen explains. The ARCH could, for instance, be hooked up to the user interfaces of other devices for comfortable access to custom services or data.

The choice gave the designers lots of creative freedom to play around with. In the end, Hoske and Jokinen went with a round interface measuring just 0.6 by 2 inches and made from recycled steel. Like a stopwatch, the ultramobile design means that the ARCH can be worn on a bracelet, lanyard or necklace, or even as a brooch. It fits neatly into one hand, and patches around the screen can give the user tactile haptic feedback. Motion sensing technology is integrated, so that the ARCH can even be used as a desktop or air mouse. It also comes with a high-resolution camera and the full range of vital sign sensors on board.

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Both MODEST designs, the CUBE and the ARCH, are still living on paper only, but the researchers behind the project are ambitious in their thinking: They intend to construct and put real prototypes to the test once the project has finished. The two key elements of their vision - a longer lifespan and a modular design - have the potential for lasting change in the electronics industry, taking the looks of smartphones in a completely new direction and reducing electronics waster at the same time.

The joint MoDeSt project was supported by Germany's Ministry of Education and Research as part of the „Resource Efficient Circular Economy - Innovative Product Lifecycles (ReziProK)“ program (funding ID 033R231). It included the Technical University of Berlin (later replaced by the BTU Cottbus-Senftenberg), the Centre for Sustainability Management (CSM) of the Leuphana University of Lüneburg, the Integrated Quality Design (IQD) unit of the Johannes Kepler University of Linz (as an associate member), the SHIFT GmbH and AfB gGmbH.

(Text: Olga Putsykina)



Modular, made to last, and ready to be recycled – Fraunhofer IZM researchers reimagine the smartphones of the future. © Fraunhofer IZM/ Tapani Jokinen & Robin Hoske, Images in print quality: www.izm.fraunhofer.de/pics

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