minimum, the use of salt-marsh plants as a nature-based solution can save policymakers large amounts of money. In an example given by the authors, building on the work of others, even a small wave reduction can decrease the height that an engineered levee needs to be to provide protection from even the most extreme storms. Moreover, a height difference of only a few dozen centimetres is worth at least US$1 million in both avoided construction costs and storm damages. Unlike engineered structures, such as sea walls, vegetated ecosystems also provide habitats for both globally threatened species and ones that are specific to that area. Overall, the benefits of salt marshes and other nature-based solutions will only prove more valuable as Earth warms, the sea rises and storms become more extreme.

Rusty A. Feagin is in the Department of Ecology and Conservation Biology and the Department of Ocean Engineering, Texas A&M University, College Station, Texas 77845, USA. **M. Luisa Martínez** is at the Network of Functional Ecology, Institute of Ecology (INECOL), Xalapa 91073, Mexico.
e-mails: russell.feagin@ag.tamu.edu; marisa.martinez@inecol.mx

1. Martínez, M. L. *et al. Ecol. Econ.* **63**, 254–272 (2007).
2. Willemsen, P. W. J. M. *et al. Nature* **658**, 1194–1199 (2026).
3. Möller, I. *et al. Nature Geosci.* **7**, 727–731 (2014).
4. Silva, R., Martínez, M. L., Odériz, I., Mendoza, E. & Feagin, R. A. *Coast. Eng.* **109**, 53–62 (2016).
5. Nepf, H. M. *Annu. Rev. Fluid Mech.* **44**, 123–142 (2012).
6. Leonardi, N., Ganju, N. K. & Fagherazzi, S. *Proc. Natl Acad. Sci. USA* **113**, 64–68 (2016).
7. Maximiliano-Cordova, C. *et al. Estuaries Coasts* **42**, 1730–1741 (2019).
8. Howes, N. C. *et al. Proc. Natl Acad. Sci. USA* **107**, 14014–14019 (2010).
9. Feagin, R. A. *et al. Proc. Natl Acad. Sci. USA* **106**, 10109–10113 (2009).
10. Feagin, R. A. *et al. Sci. Adv.* **9**, eadg7135 (2023).
11. van de Koppel, J., van der Wal, D., Bakker, J. P. & Herman, P. M. J. *Am. Nat.* **165**, E1–E12 (2005).

The authors declare no competing interests.
This article was published online on 21 October 2026.

Electronic engineering

Fabric user interface can be worn on your sleeve

Shanshan Yao

Touch-sensitive, light-emitting yarn can turn everyday clothing into washable, bendable user interfaces with dynamic graphics and versatile computing functions. **See p.1167**

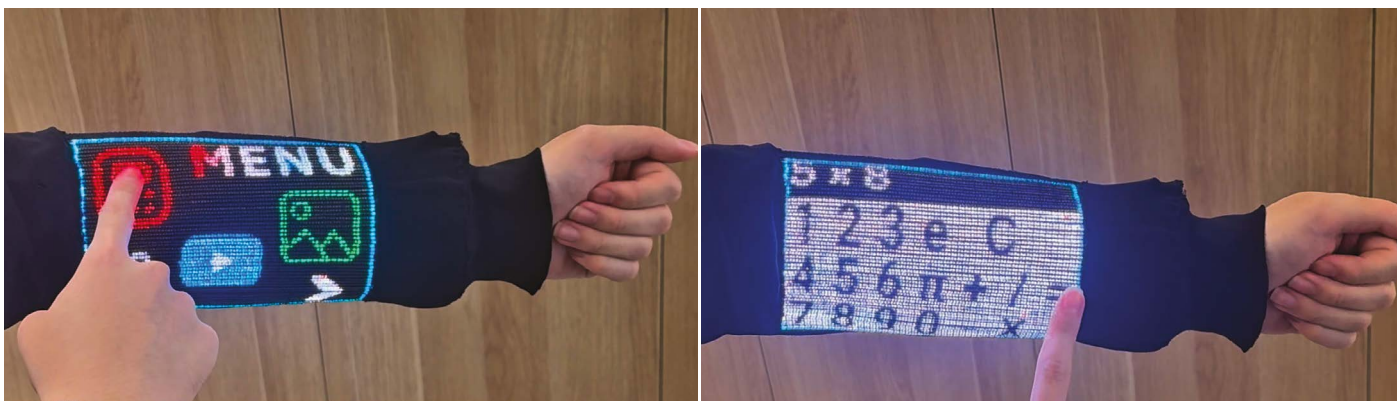
On page 1167, Fu *et al.*[1] report a fabric sleeve that displays graphics, senses touch and environmental conditions, and conducts simple computational tasks, all while stretching and breathing like ordinary cloth. By seamlessly assembling electronic devices directly into fibres, the authors have turned everyday clothing into a graphical user interface (GUI) — a visual display, similar to a smartphone screen, that allows people to interact with electronic devices.

Conventional GUIs rely on flat, rigid 2D screens, whereas fabrics are constructed by intertwining flexible 1D threads. Previous attempts to build textile displays generally involved attaching 2D display panels or sparsely distributed light modules onto fabrics[2,3]. However, these approaches often either compromise the fabric's softness and stretchability or offer limited pixel density. Specialized light-emitting threads have also been used as the basis of textile displays, but these are often dim, slow to react to user prompts, require high operating voltages or do not support individually coloured pixels that can be easily controlled[4,5]. Fu *et al.* have solved the mismatch between 2D circuitry and 1D fibres by building the entire fabric-based GUI directly from flexible, touch-sensitive and light-emitting yarn.

The researchers developed a scalable process to make their millimetre-thick fibres. First, they used lasers to strip the protective insulation from specific spots on hair-thin copper wires that were aligned in parallel. Tiny light-emitting chips were then attached to the exposed sections using a solder that bonds exclusively to the stripped copper, creating electrical connections to the chips. This approach enabled thousands of chips to be connected along the wires with extreme precision. The resulting constructs were then incorporated into a transparent plastic tube — a precursor structure, which was 20 by 18 by 200 millimetres, that would eventually be turned into the final fibres. To achieve this, the wires were fed into a channel running along the long axis of the tube.

Next, Fu *et al.* added a pressure-sensitive structure made from two strips of a compressible, conductive polymer into a second longitudinal channel in the tube. To make the fibres, the whole assembly was passed through an apparatus that heats and stretches the structure, maintaining the arrangement of its components but greatly reducing the area of its cross-section. A custom funnel was used to prevent the chips on the wires from twisting out of alignment during this process.

The authors' method can produce fibres up to 10 metres long that are thin and flexible



TURAL KHUDIYEV; H. FU *ET AL./NATURE*

Figure 1 | A textile that acts as a graphical user interface. Fu *et al.*[1] report a graphical user interface made from light-emitting, pressure-sensitive fibres. The device has the flexibility and breathability of conventional fabric and was integrated into the sleeve of a garment. It responds to touch and executes various functions, including acting as a calculator.

enough to be integrated into fabrics. When one of these fibres is pressed, the physical force squeezes the pressure-sensitive layer, changing its electrical properties and instantly signalling the exact location of the touch. The fibre responds by illuminating the light-emitting chips nearest to the pressed location.

Fu and colleagues integrated 54 fibres into a knitted textile to make a fabric display. Each fibre contained 96 individual light-emitting chips and acted as one row of the display. Because every row was controlled independently, the device could refresh quickly enough to play videos and register several touches simultaneously.

The authors went on to use their fabrication method to make multimodal fibres that contained other functional components, such as a microphone, a speaker, a temperature sensor and a light sensor. By integrating one of these 'peripheral' fibres alongside the light-emitting fibres, the researchers constructed an interactive sleeve-mounted interface capable of audio–video playback, wireless data exchange and computing, as well as producing dynamic graphics (Fig. 1). The sleeve remained breathable, stretched naturally with movement, survived 50 gentle machine washes and withstood 1,000 bending cycles without losing its functionality.

The main advance of this work is achieving seamless textile integration using a bottom-up approach — building functionality directly into fibres that were then assembled into a fabric — without sacrificing the fabric's natural properties. If the fibres prove to be compatible with standard industrial weaving, knitting and embroidery processes, the findings would pave the way to producing multifunctional electronic textiles in almost any shape or size.

"The main advance of this work is achieving seamless textile integration using a bottom-up approach."

The work is also a big step towards replacing rigid displays with fully integrated wearable interfaces, moving everyday computing away from flat screens to fabrics that comfortably conform to the human body.

The interactive features of the GUI that have been demonstrated so far are relatively simple, comparable to those of early-generation smartphones and tablets. Moreover, although the textile display is soft and flexible, the current prototype still relies on separate microcontroller circuits connected to the fibres through cables, and external battery packs to supply power. Future research should focus on integrating the control electronics more seamlessly to improve wearability, and on integrating flexible, energy-harvesting threads that can generate power from body heat or movement[6,7]. Nevertheless, Fu *et al.* have taken an important step towards clothing that can function as an interactive interface, rather than just as a surface for attaching one.

Shanshan Yao is in the Department of Mechanical Engineering, Stony Brook University, Stony Brook, New York 11794, USA.
e-mail: shanshan.yao@stonybrook.edu

1. Fu, H. *et al. Nature* **658**, 1167–1175 (2026).
2. Cherenack, K., Zysset, C., Kinkeldei, T., Münzenrieder, N. & Tröster, G. *Adv. Mater.* **22**, 5178–5182 (2010).
3. Rein, M. *et al. Nature* **560**, 214–218 (2018).
4. Wang, Z., Liu, Y., Zhou, Z., Chen, P. & Peng, H. *Nature Rev. Electr. Eng.* **1**, 466–477 (2024).
5. Shi, X. *et al. Nature* **591**, 240–245 (2021).
6. Huang, L. *et al. Adv. Mater.* **32**, 1902034 (2020).
7. Yang, W. *et al. Science* **384**, 74–81 (2024).

The author declares no competing interests.
This article was published online on 21 October 2026.

nature progress
oncology

New for 2026

Nature Progress Oncology is an open access journal publishing papers representing significant advances that bring new insight. The journal covers fundamental, preclinical and translational research, tumour characterization, clinical studies and population studies to inform our understanding of cancer incidence and risk factors.

Learn more about the journal
nature.com/natprogoncology

nature portfolio

074NF