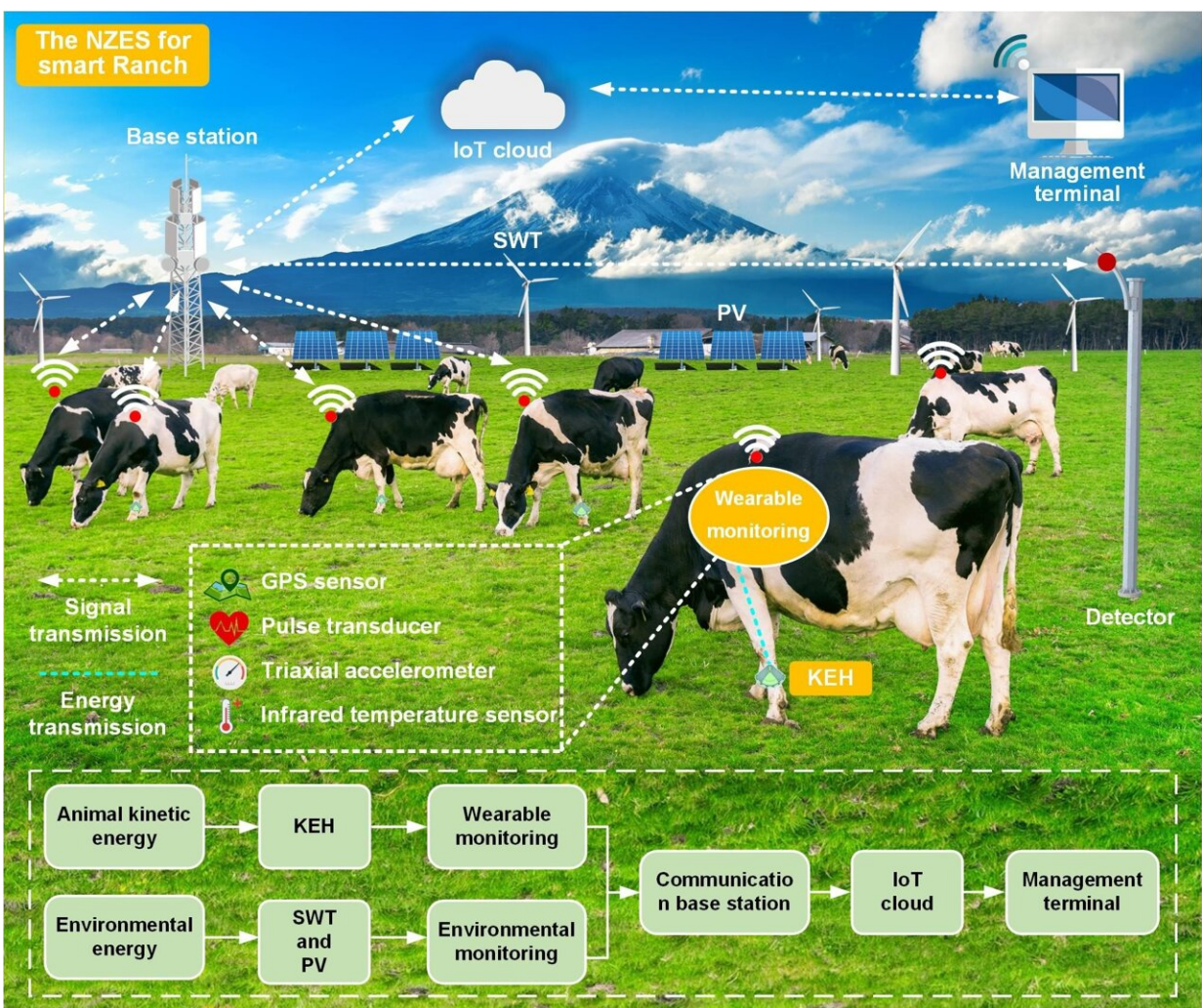


Ranches of the future could be home to cows wearing smart-watch-style sensors powered by their movements

December 1 2022



This diagram shows cow smart monitors and detector systems. Credit: Kong et al. *iScience*

Using smart technology to monitor the health, productivity, location, and environmental conditions of cattle can help with food safety and supply chain efficiency, but this monitoring adds energy cost to an already highly emissive industry. To combat this, researchers publishing in the journal *iScience* on December 1 have designed a wearable smart device for cows that captures the kinetic energy created by even their smallest movements and uses it to power smart ranch technology.

"On a ranch, monitoring environmental and health information of cattle can help prevent diseases and improve the efficiency of pasture breeding and management," says co-author Zutao Zhang, an energy researcher at Southwest Jiaotong University in China. "This information can include [oxygen concentration](#), air temperature and humidity, amount of exercise, reproductive cycles, disease, and milk production."

The team's smart ranch design involves cows wearing small sensory devices around their ankles and necks that are powered by everything cows do as they go about their regular ranch activities. "There is a tremendous amount of [kinetic energy](#) that can be harvested in cattle's daily movements, such as walking, running, and even neck movement," says co-author Yajia Pan, also an energy researcher at Southwest Jiaotong University. Once captured, the energy is stored in a [lithium battery](#) and used to power the device.

"Our kinetic energy harvester specially harvests the kinetic energy of weak motion," says Zhang. The team's design is unique because it contains a motion enhancement mechanism that uses magnets and a pendulum to amplify small movements the cows make.

Zhang hopes that implementing [smart technology](#) in ranches will be part of a larger effort to improve the world's food systems. "With the

development of 5G technology and the Internet of Things, the operation of the entire industrial chain of the food system is more intelligent and transparent," he says.

Zhang and his colleagues also tested the devices on humans and found that a light jog was enough to power temperature measurement in the device. The researchers see future applications in sports monitoring, health care, smart home, and the construction of human wireless sensor networks.

"Kinetic energy is everywhere in the environment—leaves swaying in the wind, the movement of people and animals, the undulation of waves, the rotation of the earth—these phenomena all contain a lot of kinetic energy," says Zhang, "We shouldn't let this energy go to waste."

More information: Zutao Zhang, A near-zero energy system based on a kinetic energy harvester for smart ranch, *iScience* (2022). [DOI: 10.1016/j.isci.2022.105448](https://doi.org/10.1016/j.isci.2022.105448). [www.cell.com/iscience/fulltext ... 2589-0042\(22\)01720-5](https://www.cell.com/iscience/fulltext/S2589-0042(22)01720-5)

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