How to develop affordable sensors using slime mold

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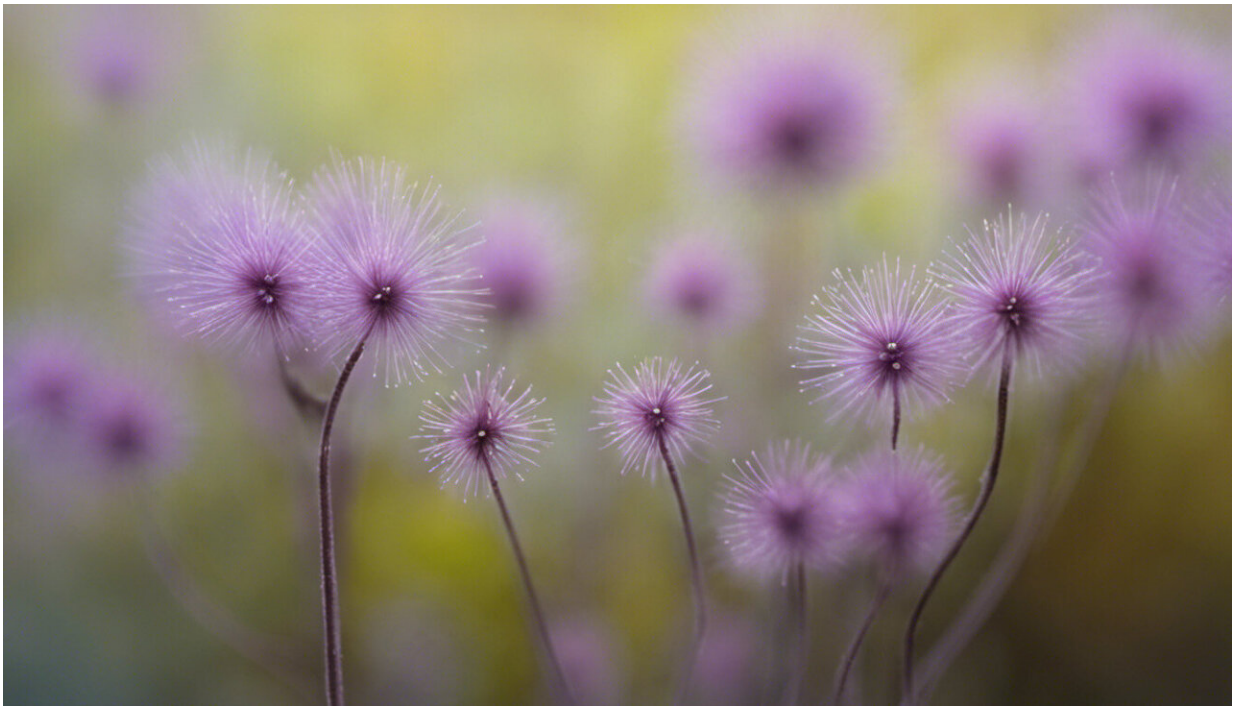

Credit: AI-generated image (disclaimer)

Physarum polycephalum, which literally means "many-headed slime," is a slime mold that inhabits damp and dark habitats, such as decaying wood. Thanks to its ability to respond to stimuli such as light, chemicals and vibrations, this single-celled, self-growing organism has attracted the attention of scientists in recent years. With its behavioral pattern of

forming a network of protoplasmic tubes to move towards its food source along the shortest paths, slime mold has been useful for computer science where path planning is a frequently studied topic.

Utilising slime mold, the EU-funded PhySense project is developing marketable biosensors for various applications, including environmental monitoring and health. As explained in a news item by the European Commission, the project team has made the low-cost prototype biosensor technology available to universities, schools, research centers and citizen scientists. The project also has an online portal and database where participants can share their findings.

Wide range of applications

According to the same news item, the project's co-investigator and lead developer, Neil Phillips, says: "With the addition of more environmental contaminants which may be a threat for humans and the overall ecosystem, the need for faster and more accurate biosensors is high."

A biosensor converts a biological response into an electrical signal. Using the same logic, the mold is made to grow between electrodes connected to electronic devices that amplify and measure the organism's reactions to various stimuli like ambient light, humidity and nutrients. The PhySense software calculates and tracks any changes in the frequency and amplitude of oscillations in the tubular structures that form most of the body of *Physarum polycephalum.*

Project coordinator Prof. Andrew Adamatzky emphasizes that anyone could run a slime-based biosensor since it doesn't need a highly developed life-support system. "Therefore we decided to consider an autonomous living creature which does not require sophisticated support and can survive for a long period of time without laboratory equipment," he says, according to the news item. The areas where biosensors can be

used include drug discovery, biomedicine, food safety, defense and security.

Ideal tool

PhySense (Physarum Sensor: Biosensor for Citizen Scientists), which ended in 2018, is an extension of the PhyChip project that ran between 2013 and 2016. PhyChip (Physarum Chip: Growing Computers from Slime Mold) showed that slime mold could be used as a transducer, or a living energy converter, in mechanical, optical and chemical sensors. The project website states: "We found that plasmodium of *P. polycephalum* is an ideal biological substrate, because it is 'simple' enough to be studied as spatially extended nonlinear media, yet robust and rich behaving to implement a wide range of computational procedures." These tasks involved maze-solving, calculation of efficient networks, construction of logical gates, subdivision of spatial configurations of data points and robot control.

More information: PhySense project website: www.physense.eu/

Provided by CORDIS

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