Improved algorithm enhances precision of pressure sensors for wild bird tracking

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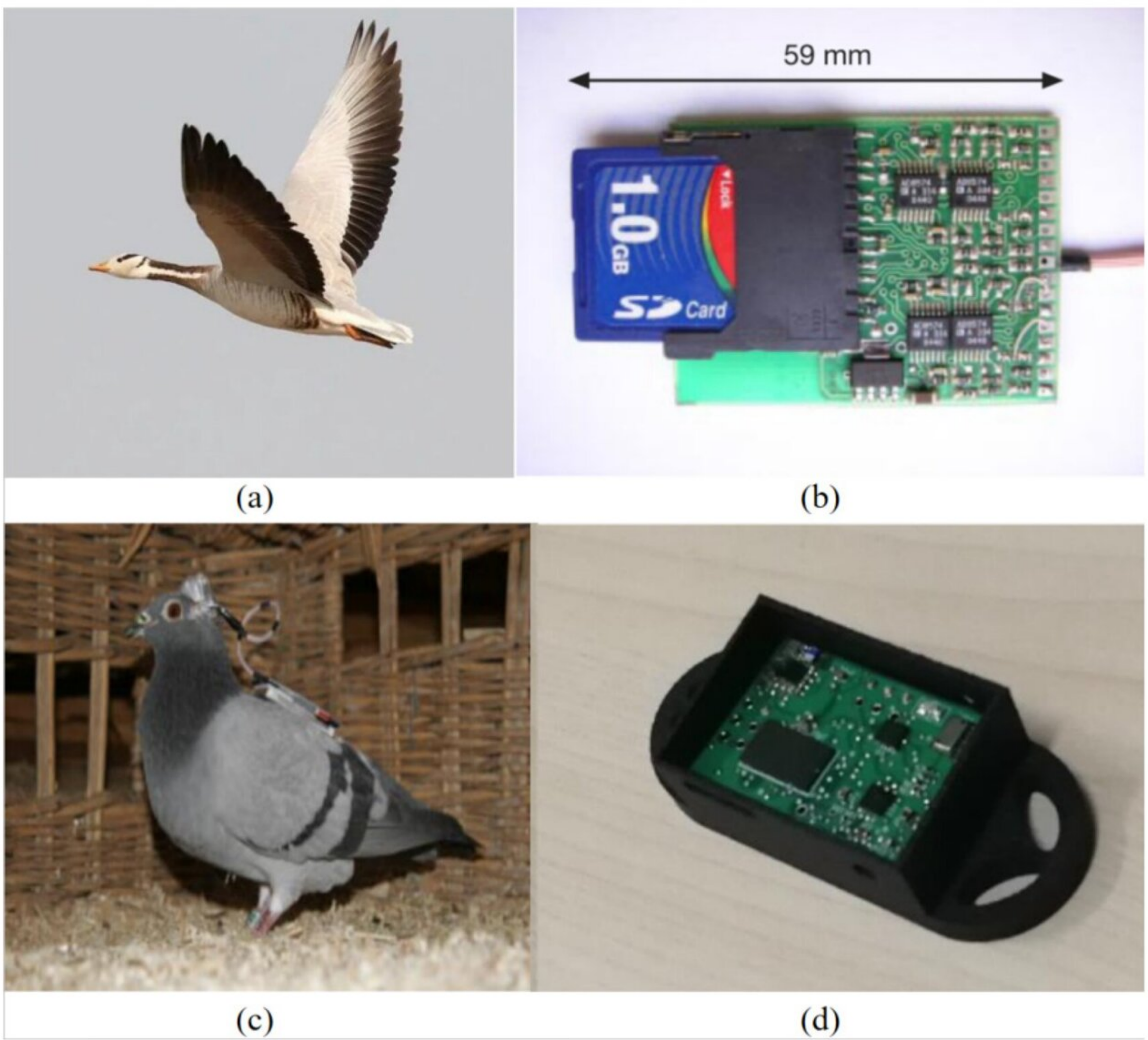

(a) Large migratory bird, the bar-headed goose, in flight. (b) Neurologger: collects pigeon EEG signals and GPS position information and records them on an SD card [7]. (c) Neurologger installed on the head and back of carrier pigeons. (d) Wearable biologger for birds collects information on heart rate, blood oxygen saturation, acceleration, magnetic field, air pressure, and temperature. Credit: *Electronics* (2023). DOI: 10.3390/electronics12204373

Researchers from the Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences (CAS) have proposed an improved algorithm called Dynamic Quantum Particle Swarm Optimization (DQPSO) to improve the accuracy and reliability of pressure sensors used in tracking and monitoring wild migratory birds. This algorithm optimizes the performance of a Radial Basis Function (RBF) neural network, specifically designed for temperature compensation.

The study was published in *Electronics* on Oct. 22.

The DQPSO algorithm takes a holistic approach to address the challenge of sensor accuracy in the face of fluctuating temperatures. It incorporates a temperature-pressure fitting model, which includes critical parameters such as rate of temperature change and gradient reference terms. This model ensures that the pressure sensors can effectively adapt to varying environmental conditions, a crucial requirement when monitoring the movements of wild migratory birds.

The proposed algorithm is featured with an innovative loss function, which considers both fitting accuracy and complexity. This approach enhances the robustness of pressure sensors, making them capable of delivering reliable data in the presence of complex temperature variations.

The researchers conducted calibration experiments to validate the algorithm's effectiveness. As determined by commonly used commercial sensor algorithms, the pressure sensors exhibited an average absolute error of 145.3 Pascals during dynamic temperature changes. However, with the DQPSO algorithm in place, this error was reduced to 20.2 Pascals.

They deployed and verified the algorithm in an embedded environment, ensuring low-power, high-precision, real-time pressure compensation during the tracking and monitoring of wild migratory birds. The research opens new doors for understanding and safeguarding the journeys of wild migratory birds.

More information: Jinlu Xie et al, Dynamic Temperature Compensation of Pressure Sensors in Migratory Bird Biologging Applications, *Electronics* (2023). DOI: 10.3390/electronics12204373

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