Wireless Low-Power Animal Tracking for Behavioral Analysis

Degree programme: BSc in Electrical Engineering and Information Technology
Specialisation: Communication Technologies
Thesis advisor: Dr. Lorenzo Bergamini
Expert: Martin Sénéclauze (Swiss Center for Electronics and Microtechnology, CSEM)
Industrial partners: Swiss Center for Electronics and Microtechnology, CSEM, Neuchâtel; Research Institute of Organic Agriculture, FiBL, Lausanne

With the steady rise in demand for high-quality organic eggs in Switzerland, ensuring animal welfare is crucial to meet the strict standards of Bio Suisse. Although outdoor areas meet size requirements, laying hens are often crowded together. This behavior increases stress, aggression and feather pecking. The project aims to develop a wireless tracking system to monitor hen movement and quantify the impact of evolving environments on animal distribution.

Initial Situation

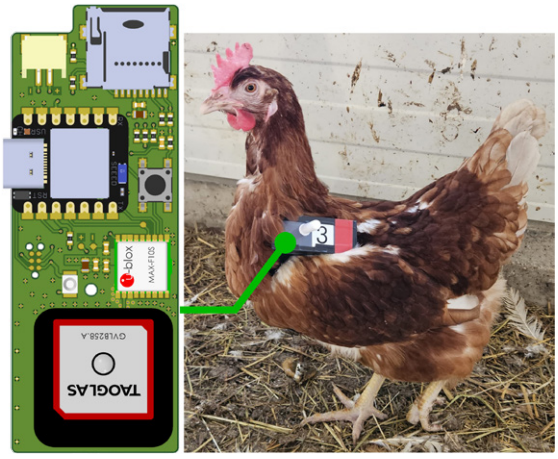
The farmers have struggled to comply with the requirements regarding the animals' use of space. It has been observed that laying hens currently only use a fraction of the available space. Full utilization of the area is critical for their well-being and resource protection. Uneven distribution and overcrowding lead to additional stress and aggressive behavior, particularly feather pecking. Encouraging poultry to explore the area helps to avoid the risk of soil and groundwater pollution. In an attempt to improve distribution, farmers plant trees, bushes, and other installations to encourage hens to move further away from the barn. Initially, it was unclear how to measure the effectiveness of these attractions.

Concept

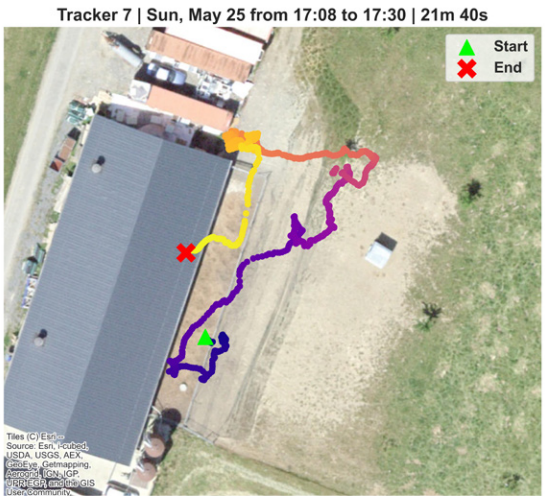
The objective of this project is to develop a system that can continuously track and record the positions of 20 laying hens across the entire outdoor area, in order to evaluate the effectiveness of interventions. This project was carried out in collaboration with the „Swiss Center for Electronics and Microtechnology" (CSEM) and the „Research Institute of Organic Agriculture" (FiBL), with the aim of developing a prototype for a cost-effective solution that does not place an additional burden on the system operator. A wireless, low-power tracker was developed that uses a u-blox GNSS module to determine the position. Data is stored on a microSD card and periodically transmitted via Bluetooth® Low Energy to a central base station, where the live data is visaulized on a local web server. To extend battery life and reduce power consumption, the system uses low-power approaches to ensure autonomous operation in a farm environment for several days.

Results and Outlook

Field tests confirmed the functionality of the system for long-term behavioral studies. Initial data revealed that the tracked hens mostly stayed inside their house and utilized less than 15 % of the outdoor area. The infrastructure provides a tool to FiBL, enabling relevant measurement data to be recorded and presented to the Federal Office for Agriculture. The project is scheduled to run until 2027. In the future, the use of the system should also be extended to other animal species, such as cows and sheep.



Wireless Animal Tracker Mounted on a Laying Hen



Illustrative Path of a Tracked Laying Hen

Nils Jäggi
n-jaeggi@gmx.ch

Lorenz Philipp Widmer
lorenz.widmer01@gmx.ch