

BirdGuard: Avoiding Bird-Window Collisions (2x MSc Thesis)



Collisions with windows are one of the major causes of death for birds¹. Alone in Switzerland, more than a million birds are estimated to die from such collisions every year – events that could be avoided. This project aims to develop a solar-powered and computer vision-based sticker that can be mounted at the outside of a window to visually monitor the birds, estimate their trajectories, and deter them if an imminent collision is predicted, saving their lives.

BirdGuard is an applied research project at CSEM Zurich, offering interested students to contribute solving a real-world problem with state-of-the-art machine learning (ML/AI) technologies to make the planet more bird-friendly and enable a respectful cohabitation with nature. The goal of this project is to develop the required algorithms and deterrence mechanism to build a prototype for field testing. CSEM has developed hardware and software solutions for a wide range of ML applications. Its latest machine learning platform (shown below) features solar energy harvesting to enable battery-less operation, an image sensor, and CSEM's ML system-on-chip for processing acquired images (e.g. detection algorithms). This system will be used as a basis for prototyping the BirdGuard algorithms and the deterrence sub-system. Swiss research institutes are at the forefront of researching birds and applying this knowledge to make houses more bird-friendly. Thus, our partner institutes will serve as advisors to the project.

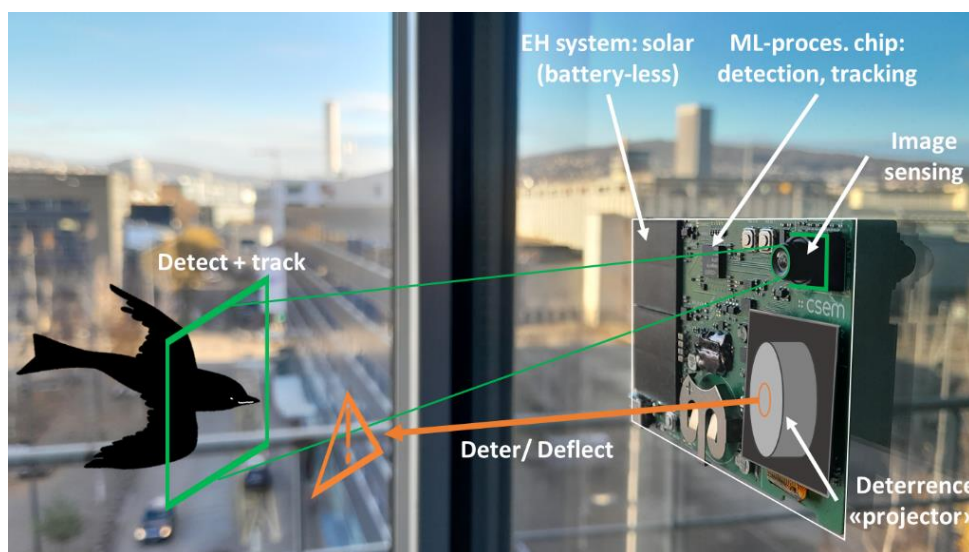
The BirdGuard system aims to complement existing passive approaches by providing an easy-to-use patch that enables laymen to retrofit existing windows while being completely self-sustaining through solar power, requiring no batteries. The project is divided into 2 tracks, each one offering a Master's thesis (or similar) for 1-2 students:

A) Development of bird detection/tracking system:

Robust detection and tracking of birds is essential to monitor their trajectory and estimate the collision probability in real time. Machine learning-based detection algorithms have revolutionized the field of computer vision and will thus be adopted for this application. The algorithm shall be validated on a camera/PC setup in the field and later optimized for low power execution on the ML chip to enable continuous tracking with a limited power budget.

B) Evaluation of deterrence and deflection system:

To warn a bird on a collision trajectory early enough to change its course, an effective warning mechanism (bird understands that there is an obstacle) must be developed, ensuring low-latency (bird has sufficient time to change course). This requires studying and evaluating potential mechanisms and the birds' flight behavior (minimum required warning time and distance). The results shall be implemented in a prototype and validated in a field pre-study.



CSEM solar-powered machine learning platform prototype, illustrating the BirdGuard functionalities.

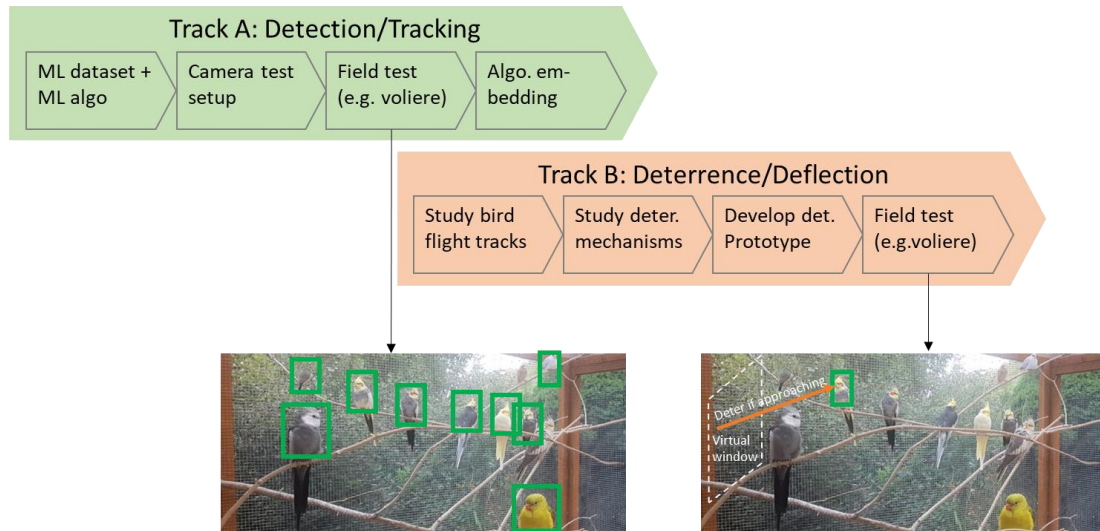
¹ M. Rössler et al., «Vogelfreundliches Bauen mit Glas und Licht», Schweizerische Vogelwarte Sempach, 2022

Timeline:

As the algorithm developed within track A will be used to control the deterrence system studied in track B, the tracks will be executed (partially) sequentially.

2023

2024



Your profile:

- Interest in studying (bird) animal behavior in urban areas and/or machine learning technology
- Motivated to work on a real-world problem that can help saving bird lives
- Relevant scientific background and/or willingness to learn it:
 - Track A: Experience in machine learning (data augmentation, model setup & training in TensorFlow), path estimation, field work (voliere/bird house, test building, bird ringing station); optional: embedded programming (C), electronics (testing on prototype PCB)
 - Track B: Research on animal behavior, prototyping skills (deterrence projector), field work (voliere/bird house, test building)

Contact:

Interested students are encouraged to contact us: Dr. Petar Jokic, Senior R&D Engineer, petar.jokic@csem.ch

About CSEM

CSEM is a Swiss research and development center active in the fields of precision microfabrication, digitalization, and renewable energy. CSEM builds links between industry and academia, supporting companies as a center of technological innovation.

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