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Title:

From proactive monitoring to ecosystem hacking: the role of robots in the ongoing ecosystem crisis

Author:

Thomas Schmickl

Abstract:

Ecosystems are currently breaking down world-wide, especially insect species are dramatically disappearing. In order to protect our society, which depends on the ecosystems it is a part of, we have to prevent further decline of bio-diversity. However, damages are already present and crucial ,,keystone species" are threatened. I have developed a three-step contingency strategy based on biological studies, mathematical modelling and autonomous robotics to react to this crisis. In various collaborative projects, my lab and international partner labs developed technology to monitor ecosystems with robot swarms on the large scale and on the long term. We also developed autonomous robots to directly interact with organisms (animals and plants) in order to be capable of rapid intervention, if necessary. We studied the collective swarm-behavior of two highly threatened animal groups (honeybees and fish) and, as a proof-of-principle demonstration, we have designed two "robot species" that can infiltrate those swarm systems and coordinate these very different animals with respect to each other. This way we have created, for the first time in history, a novel ecological link between two species by embedding autonomous robots in a small artificially created ecosystem. This shows that robots might offer a viable option to externally stabilize fragile, or even already broken, ecosystems. In my recent research, I try to use robotic devices to turn whole honeybee colonies into bio-hybrid robotic super-organisms to use them as a novel ecological agent.