Robee: A Novel Autonomous Pollinator

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The world is currently facing a significant ecological challenge - the rapid decline of bee populations. Bees, one of the most pivotal insects in our ecosystem, are responsible for pollinating approximately one-third of the world’s food supply, posing a serious threat to global food production. In response to this pressing crisis, this project introduces "Robee," a technological innovation that harnesses the power of artificial intelligence, to complement bees' natural pollination processes. Robee is an autonomous, intelligent drone, designed to augment the pollination behavior of bees and serves as a testament to the potential of machine learning and robotics in addressing pressing environmental issues. In this first year of design, we achieved three major milestones: 1) proof-of-concept of Robee’s manual pollination technique; 2) training of a machine learning model to recognize flowers to pollinate; and 3) development of a low-cost Robee prototype that achieved flight. To demonstrate proof-of-concept, a preliminary experiment was conducted in which various low-cost manual pollination methods were used to pollinate radish plants. The average pollination efficiency for plants exposed to manual pollination was higher than the control group, confirming that Robee’s proposed mechanism of action is feasible. A convolutional neural network was then trained on experimental images to allow Robee to recognize flowers to pollinate with 77% accuracy. The Phase I Robee underwent approximately twenty major iterations before achieving flight. During this process, a gyroscope was carefully calibrated to ensure stable flight. The current prototype costs less than $25, providing an inexpensive and effective method for machine-assisted pollination.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,