Sensor-Assisted, Noninvasive Monitoring for Operational, Investigative and Predictive Hive Health Management for Honeybee Colonies – Sustainable Bee Keeping

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Motivated to create an early warning system to predict Colony Collapse Disorder, our research focuses on developing a technological solution to constantly monitor beehive health. We present a platform that integrates data from a strategically deployed array of weight sensors, sensors measuring variables of the beehive & wirelessly transmitting measurements to the cloud using monitoring infrastructure to continuously assess health of beehives. The synchronous sampling of all sensors every hour allows us to form a multivariate time series that serves to: (a) provide immediate alerting in case a measurement exceeds predefined boundaries that characterize a healthy beehive and (b) based on historical data predict future hive health. Through analysis of collected data, a significant discovery emerged: approx. 150-200 hours before a collapse, weight patterns exhibit a notable increase in standard deviation. Using Pandas & Matplotlib, raw data is processed to parse time-series information. By employing the standard deviation within specific data windows, a transition point from a healthy to unhealthy state can be identified, enabling the prediction of hive collapses. We have been able to test the predictions & understand that the data gives us a good indicator of how the hives are doing. Our algorithm detects when there is unusual activity. In our trials & testing period, we were able to monitor & salvage hives. Our goal is to roll out the technology & have been talking to weight sensor manufacturers to make it available to all beekeepers for free. Ultimately, saving bee colonies & enabling more crops to be pollinated will benefit us all. We believe that the the problem's importance along with the simplicity of this algorithm is the most effective part of this solution.

Awards Won:
Fourth Award of $500
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $58,000 each)
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