HiveSpy

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Beekeeping is a labor intensive job which requires the daily inspection of every frame of every hive in an apiary. Apiaries are easily scalable via the addition of new hives or the expansion of existing hives by the addition of hive boxes; however, human labor cannot so easily be scaled to meet the added need as human labor is costly, often political, and time consuming.

Furthermore, beekeeping can be dangerous. Without the proper gear, the potential for bee stings is very high and for individuals allergic to bees it is potentially deadly. Therefore the minimization of interaction needed between beekepers and agitated bees which have been evicted from their hives via smoke during inspections and harvesting activities is very well appreciated by beekeepers.

HiveSpy is a proposed and under research and development automated Internet of Things (IoT) solution for monitoring and reporting the weight of every frame of a hive effectively, efficiently, and remotely. Existing beekeeping and monitoring systems available on the market are very costly and do not provide per-frame information to their users. Thus, although they are successful in generating a slew of useful information regarding the health, status, and even overall honey yields of a hive, they fall short in enabling beekeepers the luxury and/or safety of only inspecting and harvesting the frames that are ready. As a result, the existing systems do not contribute to harvest related labor reduction nor are as effective as HiveSpy will be in the prevention of swarming: a condition where the lack of room for honey storage triggers a hive reproduction cycle resulting in the departure of the queen and 60% of the workers, leaving behind the brood of the next generation.

Our initial results in collecting per-frame weight have confirmed the complexity and costliness of this task though have also provided us with a clear path to the reduction of both the complexity and cost of a per-frame harvesting scheduler. We utilized low cost off-the-shelf force sensors along with a mathematical model for data normalization which produces accurate data. The calibration complexity and cost to quality ratio of force sensors however prevent the product's marketability.

The solution is the reduction of the complexity and cost via the design and development of new custom sensors in order to create a viable and marketable product. Here we report on the results and propose a new electro-mechanical design for custom sensors which are currently under research and development at Santa Clara University's Ethical, Pragmatic, and Intelligent Computing (EPIC) lab.

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