

Automated Bee Hive Excluder

Department of Electrical Engineering

Background

- 90% of wild plants and 30% of crops assisted by cross-plant pollination by pollinators
- Bees also essential to local economy: 20 581 hives used in 2016 for crop pollination
- Varroa Mites, a parasite that attacks bees, weakens bees and transmits viruses, resulting in destruction of hive without treatment
- Poisons for mites lose effectiveness over time and are also toxic to bees



Bee with Varroa Mites



Varroa Mite

Project Scope

- Design a device capable of excluding bees from entering hive, triggered from a signal from a detector, along with a suitable power system
- Create a prototype of the device
- Provide client with input requirements of prototype, a test plan, build instructions, operation and maintenance manuals, final report, and requirements for continuation of project

Completed Work

Key problem defined:

- Chemical mite pesticides toxic to bees and lose effectiveness over time
- Need non invasive solution affordable for most farmers

Overarching solution:

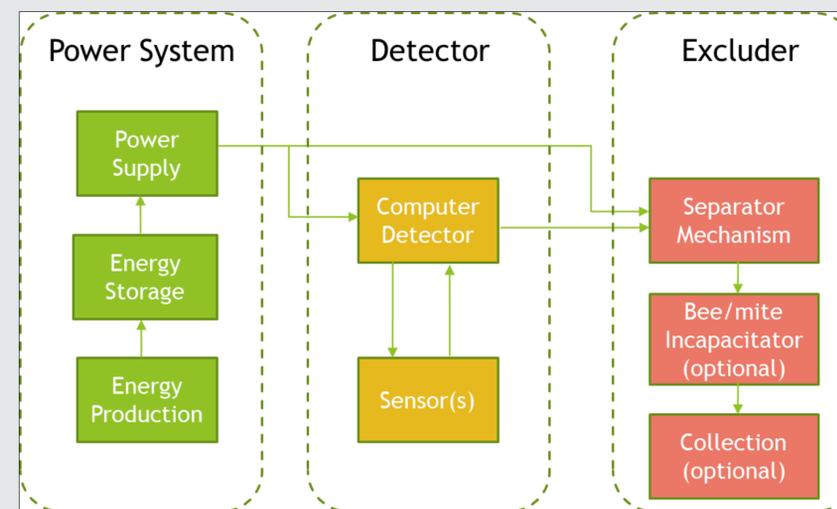
- Automated detector to prevent bees with mites from entering hive

System Architecture:

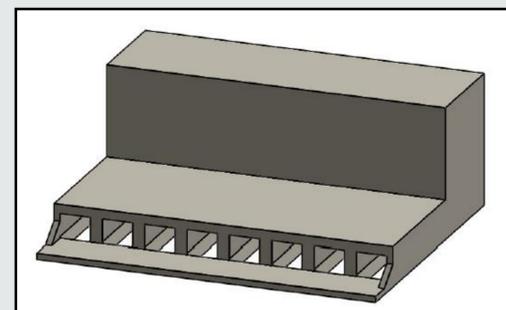
- Separated into power system, detector and excluder
- Scope limited to power system and Excluder

Build prototype mechanical excluder:

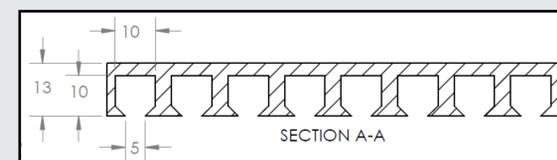
- Excluder structural model designed in CAD
- 3D print testing prototype



Prototype System Architecture



Excluder Test Prototype



Cross Section of Excluder Prototype

Design Process

- Identify key problem at hand
- Assess Mechanical/Electrical solution
 - Automated detector to prevent bees with mites from entering hive
- Define system architecture
- Build prototype mechanical excluder
- Test excluder prototype

Next Steps and Recommendations

- Begin testing Honey Bee Mobility in 3D Printed Test Prototype with different sized gateways
- Test possible exclusions methods
 - Success rate
 - Effect on bee behaviour
- Record and evaluate environmental concerns
 - Tree shade and wildlife may affect energy production
- Develop power requirements for excluder and estimate requirements for detector

References

- https://www.animalhealth.bayer.ca/en/images/icons/varroa_mites_on_adult_bee.jpg
- <https://www.nrdc.org/sites/default/files/bees.pdf>
- https://en.wikipedia.org/wiki/Varroa_destructor