Questions

smartHive
Smart Monitoring for Thriving Hives.

What it does

Our project provides an innovative beehive monitoring system designed to provide an automated method of detecting the presence of Varroa while also providing smart monitoring of essential hive metrics such as hive weight, internal temperature, and humidity. It's main purpose is to serve as an automated and extremely responsive early-warning system against the spread of Varroa mite.

Your inspiration

The inspiration for our project was the emergence of the threat of Varroa mite in Australia just two years ago. We first became aware of the issue when the first detection of Varroa mite in New South Wales in June of 2022 raised significant concerns among Australian beekeepers. And by September 2023, when efforts to eradicate the mite were deemed unfeasible, we realised that Varroa would continue to spread throughout the country.

With the beekeepers and bees of Australia in mind, we decided that our project would attempt to address this issue and help prevent it from affecting more of our hives.

How it works

The system is able to detect the Varroa mite using a system of cameras. As bees enter the hive though a specially designed entrance tube equipped with multiple cameras, a AI vision model is able to detect the individual bees entering and leaving the beehive.

Captured images of each bee is then processed by a image classification model that detects the presence of Varroa mite. By repeating this process for every bee, we are able to detect the presence of Varroa far earlier than manual inspection is able to.

The system also uses multiple sensor modules to consistently measure the weight, internal temperature, and humidity of the hive. This information is relayed the beekeeper and is displayed in real-time.

HAILEYBURY
BIOTECH FUTURES
THE UNIVERSITY OF MELBOURNE

TL Contact
Brandon Zhou
s1072489@haileybury.com.au

Team Members
Joshua Wang, Brandon Zhou
Vinuka Gamage, Saad Ashraf

Mentors
Rebecca Guo
Daniela Arenas

Questions

smartHive
Smart Monitoring for Thriving Hives.

How it is different

Our solution stands out by providing an automated method for Varroa detection, exponentially shortening the timeframe between the initial infection and detection.

Currently, Sentinel hive programs in places like New South Wales and Queensland rely on manual inspections conducted approximately once every six weeks. However, "six weeks is too long. In six weeks the mite levels can explode." Our system addresses this critical gap by providing constant, real-time monitoring. By implementing our monitoring system, we effectively transform every equipped hive into a Sentinel hive, dramatically increasing the scope and frequency of monitoring.

This level of responsiveness through immediate alerts when Varroa is detected enables beekeepers to protect not just their bee populations but also the beekeeping industry by helping preventing any further spread.

Design process

After deciding address the issue of Varroa mites, we began out design process. We started by researching current detection methods and identifying gaps that needed innovative solutions, and after extensive brainstorming and consultations with experts, we conceptualized smartHive, focusing on integrating Varroa detection though our unique camera system.

We eventually began work on a prototype of our project. We began by collating our own dataset by collecting hours of video data of bees leaving and entering hives in our school apiary. After labelling over 400 images by hand, we were able to train a vision model to achieve a 96% accuracy at identifying bees. Moving on to our Varroa detection model, we leveraged a open-source dataset to achieve 98% accuracy, however, this model would likely perform much worse in a production environment due to the nature of the dataset we used.

HAILEYBURY
BIOTECH FUTURES
THE UNIVERSITY OF MELBOURNE

TL Contact
Brandon Zhou
s1072489@haileybury.com.au

Team Members
Joshua Wang, Brandon Zhou
Vinuka Gamage, Saad Ashraf

Mentors
Rebecca Guo
Daniela Arenas

Questions

smartHive
Smart Monitoring for Thriving Hives.

Future plans

Although our Varroa detection model currently achieves 98% accuracy, we believe that this performance will not directly translate to real-world conditions. Factors such as varying lighting conditions or different camera positions would impact the model's accuracy. Therefore, we will focus on collaborating with beekeepers to collect images from active beehives in NSW in order to collate a custom dataset to resolve this issue.

While controlled testing does provide many valuable insights, a system's real-world effectiveness can only be determined in real-world conditions. Deploying a testing model with beekeepers in NSW involves several challenges, such as finding willing testers, developing a user-friendly prototype, conducting regular check-ins, and ensuring that proper support is available to testers who may run into issues with the system.

Ultimately, our long-term goal is to continue developing our solution to allow beekeepers worldwide to protect bee populations and contribute to sustainable agriculture and biodiversity conservation.

HAILEYBURY
BIOTECH FUTURES
THE UNIVERSITY OF MELBOURNE

TL Contact
Brandon Zhou
s1072489@haileybury.com.au

Team Members
Joshua Wang, Brandon Zhou
Vinuka Gamage, Saad Ashraf

Mentors
Rebecca Guo
Daniela Arenas