Honey Bee Dance Language Translator App Proposal

Narrative:

The Science Museum of Virginia wants to improve their beehive exhibit. In order to accomplish this, they have expressed the need for some sort of application. This could end up as an informative, user-friendly app or an intense machine-learning app that tracks the bees' dances. Either way, engaging the public seems to be the primary end goal for the app.

Stakeholders:

This project will serve as an educational app for museum visitors, a program for use by the scientists at SMV, and a teaching tool for museum employees.

Importance:

In a period where climate change is impacting the world more than ever before, understanding species like bees is valuable to the public. In addition, a surprisingly large portion of the general public remains fearful of AI. This application demonstrates an innovative and informative application of AI for the public to observe.

Usability:

Museum educators would be the primary users of the app, and they will use it to demonstrate the interpretation of the bee waggle dance to visitors. The employees would point out when a bee is waggling and show how the waggle relates to the location of the flowers.

Project Clarification:

Purpose - What is the end goal for this year?

- Collect data (foundation)
    - (1) Create discussion among researchers
    - (2) Create interactive activity for children

Environment - How will our setup be structured?

Having a permanent or semi-permanent installation of a camera setup on the hive will allow for long-term data collection and is required to train AI.

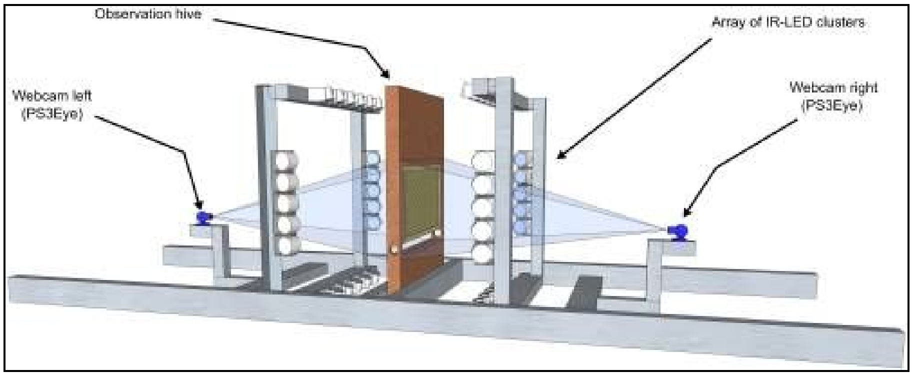
The AI component will require thousands of film snippets to accurately work.

- (1) Camera set up on both sides of hive (most efficient)
- (2) Camera set up on one side of the hive (most interactive)
- (3) Using cam inside the hive (worst case)

Other Components:

- ~~(Device to read the Sun Cycle?)~~ (Google Maps integration?)
- Separate TV/device to display google maps data

(This is an example of option (1) that we found in a research paper)



Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5728493/

User-ability:

- (1) Employee will assist the AI in detecting a waggle dance
    - Camera is stationary and semi-permanent, as shown above
    - Employee can give the AI a time frame that the AI will use
    - Detecting waggling in live time might be difficult, so using the clipping tool might be necessary
- (2) Completely autonomous AI system - (self managed)
    - Also requires a fixed, permanent camera
    - This is extremely complex and difficult to implement due to the bees being seasonally dormant
- (3) Audience will capture and enter data (later stages?)
    - No camera is required, but no AI is used
    - Setup could be converted to this later

High-Level Requirements

- This app will need to be able to use several pieces of information to determine the meaning of the waggle dance
- This includes the time of day, sun location, and general analysis of the dance. The time of day and sun location determine what the direction and movements of the dance mean, so this will be an important factor
- The analysis of the movements of the dance will require determining what direction the bee is moving in and if they are performing the circle dance or waggle dance
- Another possibility for refining the AI is to focus on bees that have pollen on their legs

Project Overview:

Museum educators would be the primary users of the app, and they will use it to demonstrate the interpretation of the bee waggle dance to visitors. The employees would point out when a bee is waggling and show how the waggle relates to the location of the flowers. Listed below are the future steps required to create such an application. After our meetings with the science museum, it appears that our team will be primarily focused on the first step in order to pave the way for future development of the project.

- **Step 1:** Gathering data and information ← (this could take the whole year)

- **Step 2:** Machine learning / Analysis of the beehive

- **Step 3:** Public involvement with the app