Bugs Need the Code
The Future of Computer Science in Bee Biodiversity Conservation

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Autumn 2019 | Instructor: Dr. Laurie Anderson, School of STEM

Bees in Peril

- Bees pollinate 90% of crops, 1/3 of our food [1]
- Bees are threatened by human activity
- Scientists know little about native bees, especially in the United States [2]

Citizen Science

- Using volunteers to collect ecological data
- Collecting more data than research teams could alone
- **Examples of citizen science projects**
    - Audubon Society (Birds)
    - UW Seed Bank (Plants)
    - Pacific Northwest Bumble Bee Atlas

A Crowd-Sourced Solution:
Discover-bee, a Citizen Science Application

How it works

- Targeted at children age 8-15
- In-app games promote use
    - Users can earn badges/rewards
    - Mini-game tutorials
- Users upload images of bees
- Discover-bee processes bee images
    - App records date, location, etc.
    - Machine Learning & Computer Vision algorithms sort images into categories
    - Taxonomy experts identify the bees
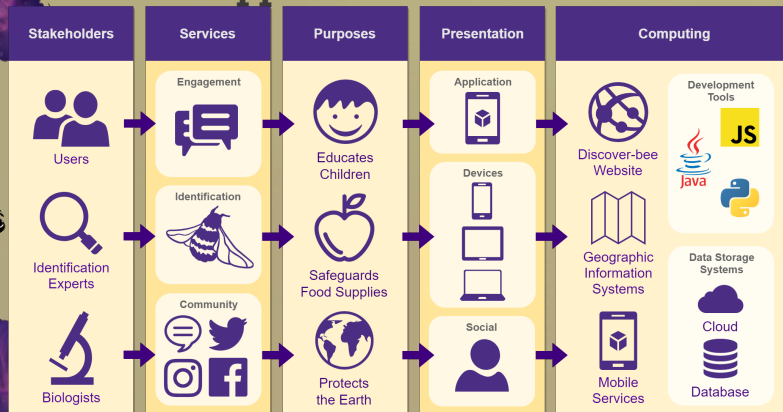- Users are notified when their image is identified

Human Outcomes

- Children & teens learn through participation and gain appreciation for nature
- Citizen science spreads awareness
- People like to make a difference
- Plants, food sources, and Earth are protected

Ecological Outcomes

- Analyze statistically significant data after 5-10 years regarding species richness and abundance
- Inform types of flowers to plant for bees
- Track changes in timing in plants and bees

Application Structure

Stakeholders	Services	Purposes	Presentation	Computing
Users	Engagement	Educates Children	Application	Discover-bee Website / Development Tools (JS, Java, Python)
Identification Experts	Identification	Safeguards Food Supplies	Devices	Geographic Information Systems
Biologists	Community	Protects the Earth	Social	Mobile Services / Data Storage Systems (Cloud, Database)

CCUWBEE

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Research Initiative

[1] The Importance of Bees. Celebrate World Bee Day (accessed 2019 Sep 14). https://www.worldbeeday.org/en/about/the-importance-of-bees.html
[2] Dickinson, Janis L., et al. "Citizen Science as an Ecological Research Tool: Challenges and Benefits." Annual Review of Ecology, Evolution, and Systematics, vol. 41, no. 1, 11 Aug. 2010, pp. 149–172., doi:10.1146/annurev-ecolsys-102209-144636.