VectorCam: Fighting Malaria One Image at a Time

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Abstract

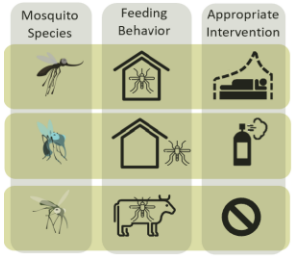
Vector control is key to malaria prevention and elimination in sub-Saharan Africa. The appropriate distribution and implementation of vector control programs hinge on robust and widespread vector surveillance data coverage. Vector surveillance activities are limited because of a lack of trained entomologists to carry out this specialized work, thus hindering intervention decisions.

VectorCam enables automatic mosquito identification to put vector surveillance in the hands of community health workers. VectorCam is a hardware-software field tool that aims to expand vector surveillance programs by deskilling the mosquito identification process. The tool allows users to snap an image of a mosquito with a smartphone, and using novel computer vision models, it provides defining characteristics of the specimen. This information is saved for high level visualization of surveillance efforts by decision makers.

Vector Surveillance

Bottleneck: Experts need 3 years of training. A lack of experts leads to a lack of surveillance coverage

Mosquito Behavior

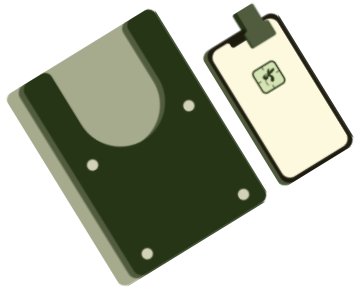


Mosquito feeding behavior determines the appropriate resource needed to fight malaria

Goal

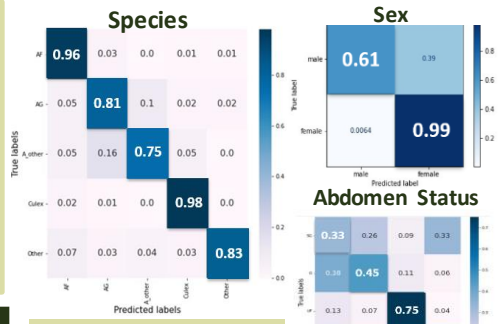
A deskilled identification process that allows for increased surveillance coverage to enable better informed malaria intervention decisions

VectorCam Solution



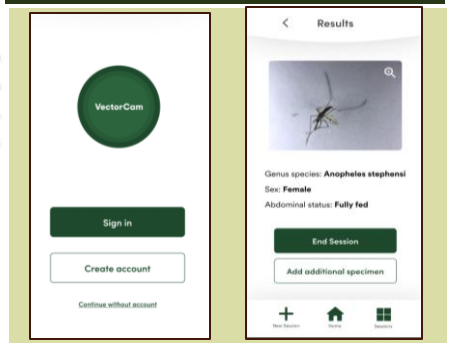
VectorCam is a simple system comprised of two main components: a handheld field tool and mobile phone application that work together to enable automatic mosquito identification

Algorithms



Models are built from a dataset of 10,000+ images

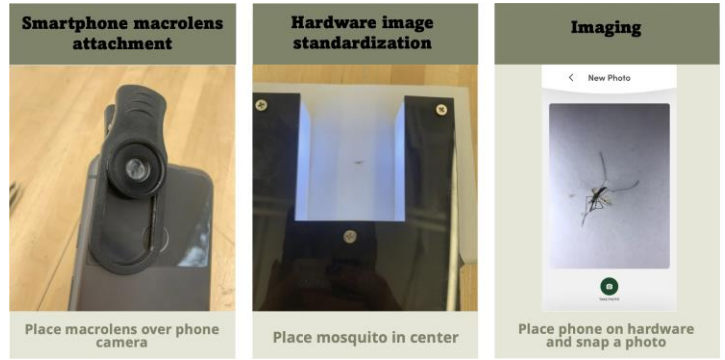
Mobile Application



Enter background information. Take image.

View results & continue imaging

Hardware

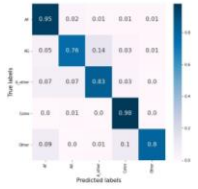


Technical Validation

Results		
Species	Accuracy	Total
An. Funestus	92.8%	195
An. Gambiae	35.0%	123
Culex	1.7%	116
An. Other	0.0%	15
Other	0.0%	12

Poor accuracy on certain species led us to run additional tests

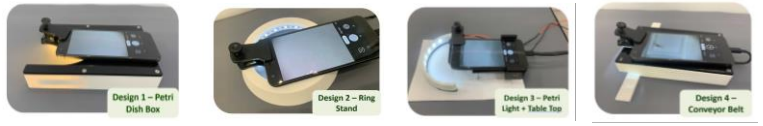
Adding an additional 100 images to An. Gambiae led to an increase in accuracy of about 40%



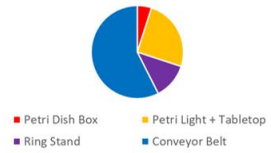
Takeaways

- Improved accuracy when more pictures are added
- Can quickly retrain when additional images are added
- Need for high levels of data collection

Usability Study



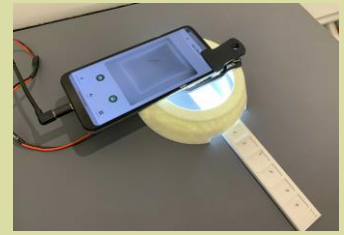
Which Prototype do you Prefer?



Qualitative Feedback

1. Prefer system to be completely contained
2. Prefer batch running of mosquitos
3. Prefer not having to pick up hardware

Final designs moving forward incorporates key features from preferred designs



Next Steps

Vector Cam

The VectorCam team is working to finalize a prototype design and improve algorithm accuracy with hopes to conduct a pilot study in Uganda beginning in 2023

Our Partners

IVCC Combating Insect Borne Disease

Makerere University

Malaria Institute at Jhpiego

vectorlink

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