LarvaCam

AI-Enabled Morphological Identification of Mosquito Larva

Norah Crowley[#1,2], John Cutrone[#1,2], Madison Ferris[#1,2], Catalina Muñoz Duhart[#1,2], Minh Tran[#1,2], Scout Rice[#1,2]
[#] Equal Contributor
[1]Center for Bioengineering Innovation & Design, Department of Biomedical Engineering, Johns Hopkins University, Baltimore, Maryland
[2]Department of Biomedical Engineering, Johns Hopkins University, Baltimore, Maryland

Background

Vector-borne diseases (e.g. malaria, dengue, Zika virus, yellow fever, chikungunya) cause a significant burden worldwide.

1 BILLION People Impacted Globally **700K** Deaths from VBDs Annually

Vector Surveillance and the Current Workflow

Vector Surveillance = Adult Surveillance + Larval Surveillance

Entomologists and field workers travel to larval breeding sites → Larval specimens are sampled and contained → Species of larva are identified by an entomologist → Field workers apply species-specific interventions

~3 Weeks Long & Reactive

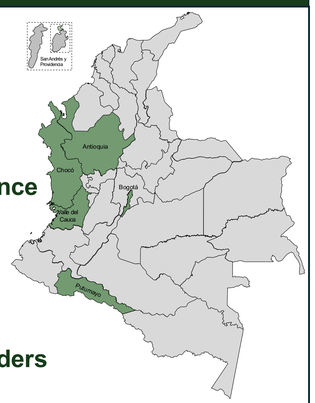
Vector Surveillance informs specific vector control, such as larvicides, community education, bed nets, and residual indoor spraying.

Effective vector surveillance & control can dampen epidemics!

Our Process

Ethnographic Research in Colombia (August 2025)

- **Surveillance**
  - Mosquito Collection
  - Mosquito Identification
  - Larval Collection
  - Larval Identification
- **Stakeholders**
  - INS
  - PAHO
  - Entomologists Field Technicians
  - University Researchers

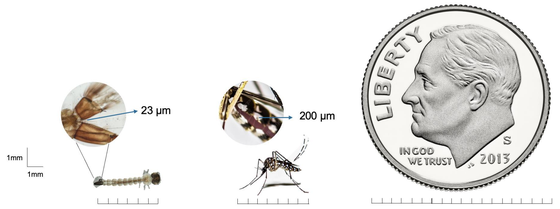


Our Critical Insight

Entomologists and **field technicians** in Colombia needs a way to perform **in-field morphological identification** of **Aedes larvae** in order to optimize constrained vector surveillance resources and **implement species-specific intervention** in the **same visit.**

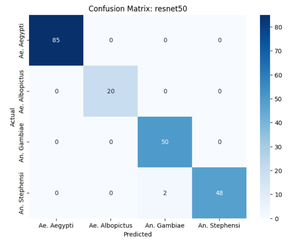
LarvaCam: AI Software Application

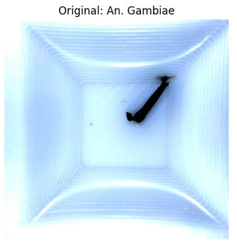
Use of AI for Larval Identification

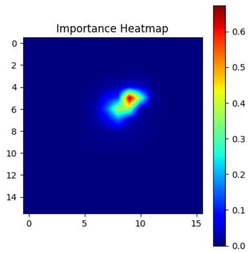


"With a magnification lens of up to 4x, the computer vision and deep learning technology is able to identify Aedes larva" – Hossain et. al

Best AI Model: ResNet-50



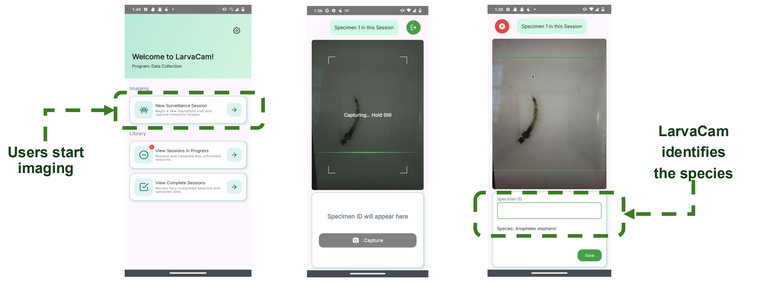




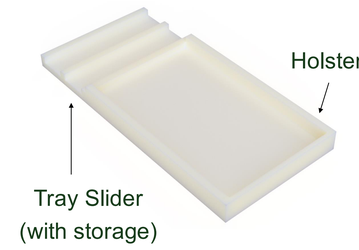
1700+ Proprietary Image Dataset Created

Species	Image Count	Key Diseases Transmitted
Anopheles stephensi	485	Malaria
Anopheles gambiae	340	
Aedes aegypti	816	Dengue, yellow fever, Zika, chikungunya
Aedes albopictus	130	

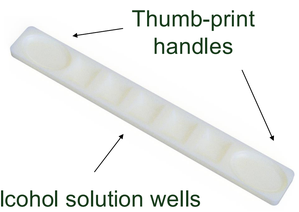
LarvaCam App Prototype



LarvaCam: 3D-Printed Hardware



Tray Housing



Larval Specimen Tray

Complete Design

Low-Cost, Scalable, Open Solution

- **$115** Production Cost (with smartphone)
- Scalable global distribution model
- **Open-source** hardware & sustainable app & software maintenance

Future Steps in Colombia

Colombian Implementation Plan

12+
Departmental Public Health Laboratories (LDSP)

22+
Secretariats of Public Health

Colombia Usability Study

- Field testing with technicians & entomologists and expansion of current image dataset
- US & local IRB approvals pending

Funding Milestones

- Pursuing grant funding for usability studies & implementation plan
  - e.g. Gates Foundation Grant

Value Proposition

- **$25k/yr** in excess transport costs
- **8,750** hours/yr in manual entomological ID
- **$225k**/yr in ineffective larvicide usage

Reduced by

LarvaCam

Note: Estimated average per mid-sized Colombian city.

Acknowledgements

References