# Mosquito Trap

Team Members: Jeff Theisen, John McGuire, Ryan Nessman, Courtney Krueger
Department of Biomedical Engineering
Advisor: Chris Brace
Client: David Van Sickle

## Abstract

It is important to be able to trap and analyze mosquitoes in order to determine what steps should be taken to prevent the transmission of the diseases they carry. Current mosquito traps require an incredible amount of time and tedious work for entomologists. A mosquito trap which implements remote transmittance of data could be extremely useful, as it would not only decrease the amount of work for entomologists significantly, but it could also provide real-time data of the environmental conditions when mosquitoes are entering the trap. Three additions to the current trap were taken into consideration: sensing (the ability to count the number of mosquitoes in the trap), communication (wirelessly transmitting the data) and differentiating and speciating the mosquitoes. Through research and evaluation of the design ideas, a GSM module will be used as the communication device, and audio frequency detectors were chosen to carry out differentiation and speciation aspects. Testing will be conducted on a laser trip wire and motion sensor to determine which method is most effective in sensing mosquitoes.

## Problem Statement

### *Motivation*

Because entomologists have to individually count all of the mosquitoes that enter the trap and individually speciate them under a microscope, the process of mosquito trapping takes a vast amount of time. Given this, the main motivation behind this project is to decrease the amount of man hours needed to accurately monitor mosquito populations in the area. Other problems with the current design are that it has no way of communicating remotely, and that it has no way of establishing real time data. If these given problems were solved, monitoring the populations of mosquitoes would be made much easier and more effective, while the amount of man hours devoted to the monitoring would be significantly decreased.

### *Current Traps:*

Current traps consist of a plastic tube with fan inside of it, which sucks the mosquitoes through the trap into a receptacle. They have the following components:

- Mesh filter to keep larger bugs out of trap.
- Powered by a standard 6V battery.
- Two different forms of attraction:

***Light Trap***

- Carbon dioxide is emitted from a canister of dry ice
- Light is emitted from an incandescent bulb.

***Gravid Trap***

- Uses carbon dioxide-emitting swamp water resting in a pan.

Figure 1: Light Trap

Figure 2: Gravid Trap

### *Client Requirements*

- Prototype must be durable and able to withstand frequent exposure to outdoor elements, including rain, dust, and wind
- Device must reliably capture and count samples of mosquitoes
- After collection, the data must be transmitted remotely, in order to provide real-time data
- Differentiation and speciation must be conducted in order to analyze mosquitoes, and not other insects
- Device must be small enough to be carried and set by one person

### *Constant Features of the Design*

- Arduino Microcontroller to interface electronics
- Waterproof case to house electronics
- Powered by 6V battery, which is currently used by our client

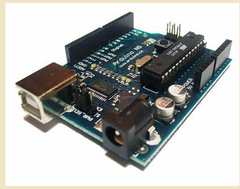

Figure 3: Arduino Microcontroller

## Acknowledgements

Special thanks to: Professor Chris Brace, David Van Sickle, Susan Paskewitz, Patrick Irwin

## Design Aspect 1: Sensing

***Laser Trip wire***

- Uses a laser beam focued on a photoresistor
- When beam is broken, resistance changes

***Motion sensor***

- Detects moving infrared sources
- May have a broader range, as opposed to a single beam

| Criteria | | Possible Designs | |
|---|---|---|---|
| Considerations | Weight | Laser Trip Wire | Motion Sensor |
| Effectiveness | 70 | 65 | 30 |
| Ease of Use with Arduino | 20 | 18 | 18 |
| Cost | 10 | 10 | 8 |
| Total | 100 | 93 | 56 |

## Design Aspect 2: Communication

***GSM Cellular Network***

- Has a long range
- Amount of data transmitted is limted by cost

***Wifi***

- Transmittance via internet source
- Short range

| Criteria | | Possible Designs | |
|---|---|---|---|
| Considerations | Weight | GSM | Wifi |
| Cost | 25 | 17 | 22 |
| Ease of Construction | 15 | 15 | 15 |
| Ease of Use | 30 | 25 | 25 |
| Range | 30 | 29 | 10 |
| Total | 100 | 86 | 72 |

## Design Aspect 3: Differentiation and Speciation

***Pictures***

- High-resolution image necessary to speciate

***Audio Frequency***

- Record sound of mosquito wing beat
- Frequency varies between species

***Light***

- Analyzes light pattern on photoresistor to find wing beat frequency

| Criteria | | Possible Designs | | |
|---|---|---|---|---|
| Considerations | Weight | Frequency | Pictures | Light |
| Implementability | 40 | 35 | 35 | 30 |
| Data Transmission | 10 | 6 | 2 | 5 |
| Differentiation | 30 | 28 | 29 | 15 |
| Speciation | 20 | 7 | 6 | 5 |
| Total | 100 | 76 | 72 | 55 |

## Final Design

### Conceptual Operation

The final design

### Fabrication

Assembly of the prototype

## Testing

### Sensing Mosquitoes

We conducted testing

### Data Transmittance

To test whether or not our prototype was able to successfully transmit useful data from the trap,

## Future Work

All components in the final device

## Cost Analysis

| Item | Cost |
|---|---|
| IR motion sensor | $35.38 |
| Photoresistors (x4) | $8.86 |
| Laser Diode (x7) | $37.59 |
| Luxeon Collimator Lens (x4) | $10.40 |
| Collimator Holder (x2) | $3.38 |
| LED (x4) | $20.54 |
| LED Lens (x2 | $4.20 |
| | |
| | |
| TOTAL | $ |

## References