

Mosquito Trap

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Overview

- ▶ Mosquito Trapping
 - ▶ Current Traps
 - ▶ Design Requirements
 - ▶ Alternative Designs
 - ▶ Design Matrix
 - ▶ Final Design
 - ▶ Future Work
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Problem Statement

- ▶ To apply a variety of electronic technologies to current mosquito traps, in order to:
 - Improve ease of use
 - Provide valuable timely data for public health
 - ▶ In particular, we plan to:
 - Integrate a variety of sensors to collect data on mosquitoes
 - Provide a means to remotely monitor and operate the device
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Mosquito Trapping

- ▶ Mosquitoes can carry deadly diseases and transmit them to humans
- ▶ Trapping allows for monitoring of mosquito populations
- ▶ Based on this information, decisions are made regarding mosquito control



Current trapping methods

- Attraction methods
 - CO₂ – from dry ice
 - Light – currently utilizes incandescent bulb
 - Stink water
- Types of trap
 - Gravid trap
 - Light trap



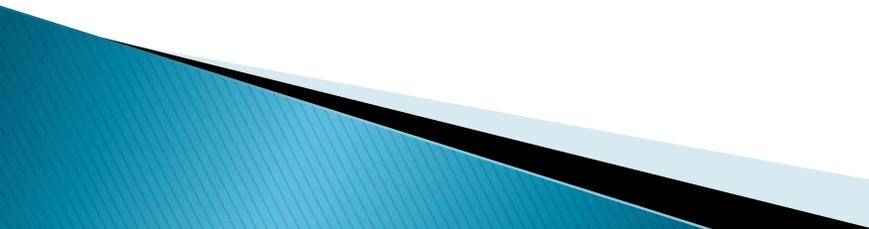
<http://blog.newsok.com/ofinterest/files/2009/10/mosquito.jpg>

Problems with current methods

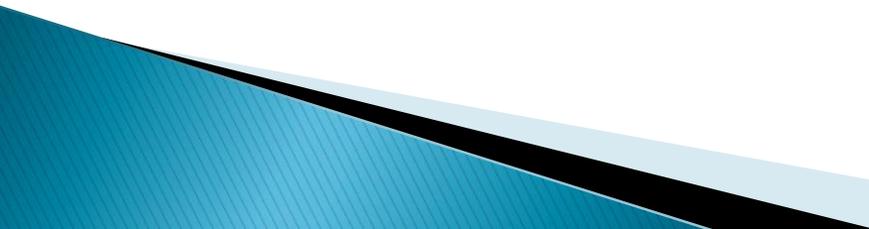
- ▶ Very time-consuming process
 - Trap set-up, collection and analyzing
 - ▶ No real-time data
 - ▶ Does not read temperature, humidity, etc.
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Design Specifications

- ▶ Durable and rugged
 - ▶ Reliably captures, and accurately counts mosquitoes
 - ▶ Preserve battery life
 - ▶ Relatively simple to operate
 - ▶ Could be used as an add-on to other traps
 - ▶ Remote transmission of data

 - ▶ IF POSSIBLE
 - Differentiate or speciate
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Potential Improvements

- ▶ Remote control
 - ▶ Automated counting
 - ▶ Differentiation (mosquitoes vs. other bugs)
 - ▶ Speciation
 - ▶ Real-time data
 - ▶ Solar charger
 - ▶ LED
 - ▶ CO₂ dispenser
 - ▶ Camera
 - ▶ Temperature sensor
 - ▶ Humidity sensor
 - ▶ Kill mosquitoes once in trap
 - ▶ Bug sorting (based on time, size, species)
 - ▶ Increase battery life
 - ▶ Light sensors
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Priorities

- ▶ Detect and count mosquitoes
 - ▶ Remotely transmit data
 - ▶ Improve data by potentially differentiating or speciating
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Constant Features of Design

- ▶ Arduino microcontroller to interface electronics
- ▶ Waterproof case to house electronics
 - Attached to current PVC of trap
- ▶ Powered by battery currently used by client



Design Aspect 1: Sensing

- ▶ Laser trip wire
 - Laser beam focused 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 laser beam



Design Matrix for Sensing

Considerations	Weight	Motion Sensor	Laser Tripwire
Effectiveness	70	TBD	TBD
Ease of Use with Arduino	20	TBD	18
Cost	10	8	10
Total	100	TBD	TBD

Design Aspect 2: Communication

- ▶ GSM cellular network
 - Has a long range
 - Amount of data transmitted is limited by cost
- ▶ Wifi
 - Short range
 - Mad City broadband covers almost all of campus



Design Matrix for Communication

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

- Individual pictures of entering mosquitoes
- High resolution needed for speciating

▶ Audio Frequency

- Record the sound of mosquitoes wings beating
- Frequency varies between species

▶ Light

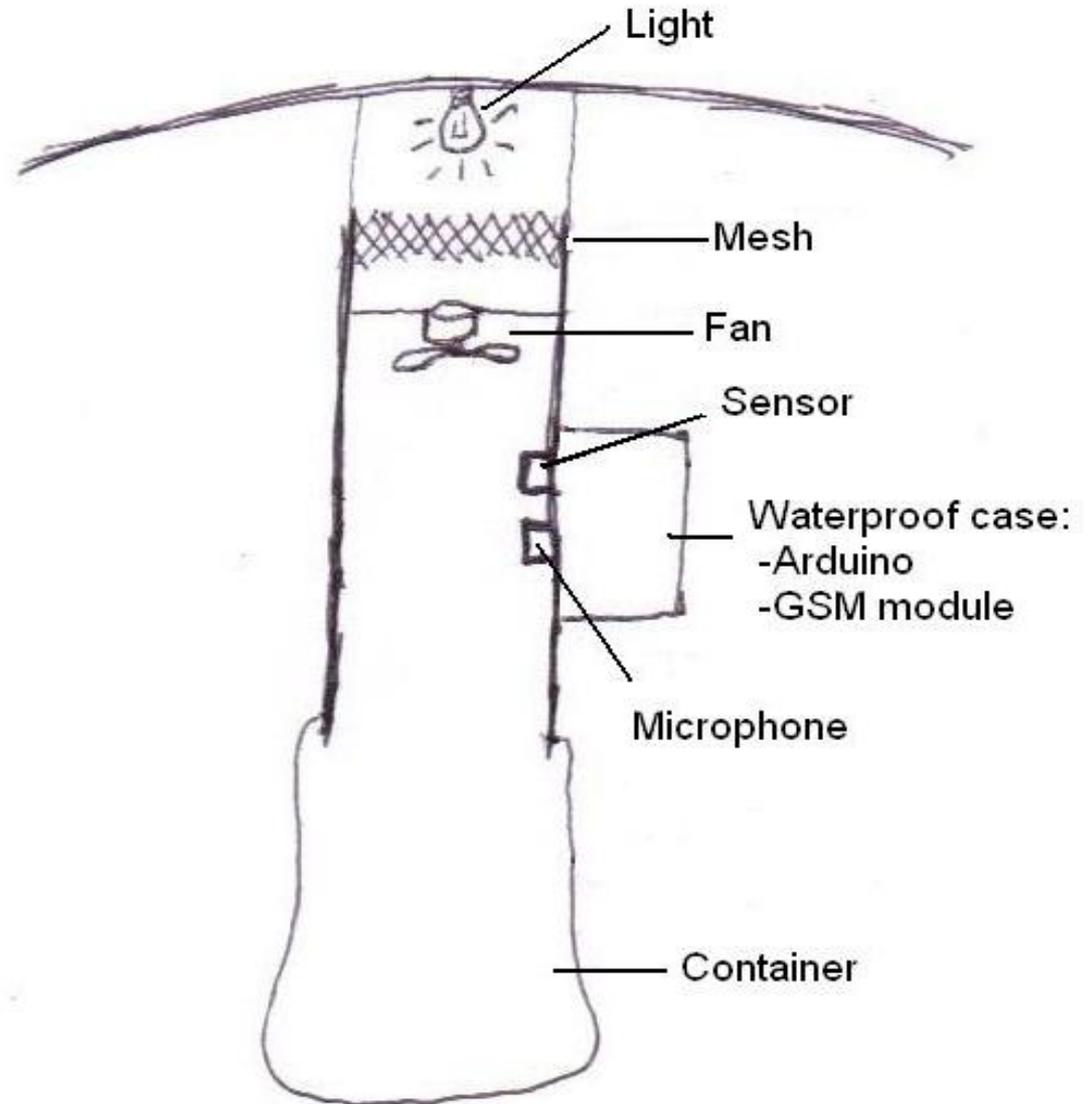
- Analyzes light pattern on photoresistor as mosquito passes by to find frequency of wing beat

Design Matrix for Differentiation and Speciation

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

Summary of Final Design

- ▶ Sensor TBD
- ▶ GSM for communication
- ▶ Audio-based differentiation
- ▶ Arduino
- ▶ Waterproof case



Future Work

- ▶ Test sensors with real mosquitoes
 - ▶ Integrate GSM to Arduino
 - ▶ Order additional parts
 - ▶ Testing speciation method
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 - ▶ Dr. Susan Paskewitz, UW Entomologist
 - ▶ Patrick Irwin, Entomologist
 - ▶ Chris Brace, Advisor
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Questions?