

MOSQUITOES DETECTION AND ELIMINATING USING ACOUSTIC SENSOR

Submitted in partial fulfilment of the requirements for the award of
Master of Computer science

By

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**DEPARTMENT OF COMPUTER SCIENCE
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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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APRIL-2024

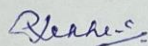


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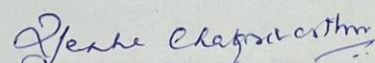
DEPARTMENT OF COMPUTER SCIENCE

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **MUSAMMIL A (42734012)** who carried out the project entitled "MOSQUITOES DETECTION AND ELIMINATING USING ACOUSTIC SENSOR" under our supervision from January 2024 to April 2024

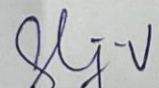

Internal Guide

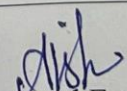
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Submitted for viva voce examination held on 20-04-2024


Internal Examiner


External Examiner

DECLARATION

I am, MUSAMMILA (42734012) hereby declare that the project report entitled “**MOSQUITOES DETECTION AND ELIMINATING USING ACOUSTIC SENSOR**” done by me under the guidance of **Dr. REKHA CHAKRAVARTHI M.E., Ph.D.**, Department of Computer Science at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY**, jeppiaar Nagar ,Rajiv Ghandi Salai,Chennai-600119 is submitted in partial fulfilment of the requirements for the award of Master of Science degree in Computer Science.

DATE: 20-04-24
PLACE: CHENNAI



MUSAMMILA
SIGNATURE OF THE CANDIDATE

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I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them

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I wish my express my thanks to all Teaching and non-teaching staff member of the Department of Computer Science who were helpful in many ways for the completion of the project

MUSAMMIL A

ABSTRACT

The direct monitoring of mosquito population in field settings is a crucial input for shaping appropriate and timely control measures for mosquito borne diseases. An in-depth knowledge of human, mosquito interactions is a critical component in mitigation mosquito-borne disease like malaria, dengue, and zika. Many of these diseases have no cure and those that do often face the problem of drug resistance. In Singapore, the National Environmental Agency (NEA) has stated open perimeter drains, covered perimeter drains, covered car parks, and roadside faulty drainage sites as the most common breeding habitats for mosquitoes in public areas. Various human-assisted methods have been used for mosquito surveillance in the past decade. For example, thermal fogging trucks, pesticides, and electrical traps have been regularly and effectively used for mosquito surveillance.

Here, the Acoustic sensor is used to detecting the presence of mosquitos by their wing-beat, the sensor triggers the spray can and the spray is emitted on the mosquitos, thus the sensor is used to detecting and killing the mosquitos.

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1 INTRODUCTION

Imagine a world where the hum of mosquitoes is a thing of the past. Where you can sit outside on a warm summer evening without being relentlessly attacked by these disease-carrying pests. This may sound like science fiction, but it's closer to reality than you may think.

Thanks to advances in acoustic sensor technology, we now have the potential to detect and eliminate mosquitoes in a way that was previously impossible. By using sound waves to locate and target these insects, we can drastically reduce their population and the spread of diseases like malaria, dengue fever, and Zika virus.

Mosquitoes are not just a nuisance, they are also carriers of deadly diseases such as malaria, dengue fever, and Zika virus. In fact, according to the World Health Organization, mosquitoes are responsible for more human deaths than any other animal on the planet. The severity of the mosquito problem cannot be overstated, and it is imperative that we address it with urgency.

As the global population continues to grow and climate change creates more favorable conditions for mosquitoes to thrive, the problem is only getting worse. In addition, many current solutions for mosquito control have limitations, making it difficult to effectively combat the problem. This is why we need innovative solutions like acoustic sensors for mosquito detection and elimination.

- ❖ There are over 100 genera of mosquito in the world containing over 3,500 species and they are found on every continent
- ❖ An in depth knowledge of human, mosquito interactions is a critical component in mitigation mosquito-borne disease like malaria, dengue, and zika
- ❖ Many of these diseases have no cure and those that do often face the problem of drug resistance.
- ❖ Mosquitoes breed in stagnant water, making areas such as ponds, puddles, and water containers ideal breeding grounds. Understanding these habitats is crucial for effective control measures.

- ❖ **Traditional Surveillance:** Methods such as trapping and manual inspection have been used for mosquito surveillance, but they have limitations in terms of coverage and efficiency
- ❖ And using mosquito nets to prevent from mosquitoes
- ❖ Automatic spray system to kill Mosquitoes
- ❖ **Emerging Technologies:** Advancements in sensor technology and data analysis have opened up new possibilities for more accurate and widespread mosquito surveillance
- ❖ Generally these are the crucial way to prevent mosquitos from human beings
- ❖ The creation of mosquito detection and eliminating using acoustic sensor hardware device is used to detect and kill the mosquito from human beings and surroundings
- ❖ With the help of this hardware we can get rid of mosquitoes from surroundings
- ❖ Every mosquitoes have wingbeat sound,it takes 1000 beats per second
- ❖ The mean wingbeat frequencies of mosquitoes assayed **395 Hz**
- ❖ Here acoustic sensor is used to detect the mosquito wingbeat sound

And Servo motor is used to trigger the spray bottle containing toxic substance

Here we create the place where without mosquitoes

1.1 Overview

The direct monitoring of mosquito population in field settings is a crucial input for shaping appropriate and timely control measures for mosquito borne diseases. An in-depth knowledge of human, mosquito interactions is a critical component in mitigation mosquito-borne disease like malaria, dengue, and zika. Many of these diseases have no cure and those that do often face the problem of drug resistance. In Singapore, the National Environmental Agency (NEA) has stated open perimeter drains, covered perimeter drains, covered car parks, and roadside faulty drainage sites as the most common breeding habitats for mosquitoes in public areas. Various human-assisted methods have been used for mosquito surveillance in the past decade. For example, thermal fogging trucks, pesticides, and electrical traps have been regularly and effectively used for mosquito surveillance.

An essential aspect of controlling and preventing mosquito borne diseases is to reduce mosquitoes that carry viruses. We designed a smart mosquito trap system to reduce the density of mosquito vectors and the spread of mosquito-borne diseases. This smart trap uses computer vision technology and deep learning networks to identify features of live *Aedes aegypti* and *Culex quinquefasciatus* in real-time. A unique mechanical design based on the rotation concept is also proposed and implemented to capture specific living mosquitoes into the corresponding chambers successfully. Moreover, this system is equipped with sensors to detect environmental data, such as CO₂ concentration, temperature, and humidity. We successfully demonstrated the implementation of such a tool and paired it with a reliable capture mechanism for live mosquitos without destroying important morphological features. The neural network achieved 91.57% accuracy with test set images. When the trap prototype was applied in a tent, the accuracy rate in distinguishing live *Ae. aegypti* was 92%, with a capture rate reaching 44%. When the prototype was placed into a BG trap to produce a smart mosquito trap, it achieved a 97% recognition rate and a 67% catch rate when placed in the tent. In a simulated living room, the recognition and capture rates were 90% and 49%, respectively. This smart trap correctly differentiated between *Cx. quinquefasciatus* and *Ae. aegypti* mosquitoes, and may also help control mosquito-borne diseases and predict their possible outbreak.

Current Solutions

Currently, the most common solutions for mosquito control include insecticides, larvicides, and physical barriers such as screens or nets. While these methods can provide temporary relief, they have several limitations. Insecticides can harm non-target species and contribute to the development of pestideresistant mosquitoes. Larvicides are often ineffective in controlling adult mosquitoes, which are the primary carriers of diseases such as malaria and dengue fever. Physical barriers require constant maintenance and can be costly to install.

Furthermore, these solutions do not address the root cause of the mosquito problem - stagnant water. Mosquitoes breed in standing water, making it difficult to eliminate them entirely through traditional control methods. As a result, there is a need for a more innovative and sustainable solution for mosquito control.

The Acoustic Sensor Solution

The use of acoustic sensors for mosquito detection and elimination is a novel approach to an age-old problem. By leveraging the unique sound signatures of mosquitoes, these sensors can accurately detect their presence and location. This allows for targeted elimination methods that are both effective and environmentally friendly.

The potential of this solution is vast, as it offers a non-invasive and sustainable alternative to traditional mosquito control methods. With further development and refinement, acoustic sensors could revolutionize the way we approach mosquito-borne illnesses and their prevention.

THE PROBLEM: MOSQUITO-BORNE DISEASES

Mosquito-borne diseases are a serious threat to global public health, causing millions of deaths each year. In fact, mosquitoes are responsible for more human deaths than any other organism on the planet. Their ability to transmit deadly diseases such as malaria, dengue fever, and Zika virus makes them one of the most dangerous creatures on earth.

The impact of mosquito-borne diseases is particularly devastating in developing countries where access to healthcare is limited. According to the World Health Organization, malaria alone caused an estimated 405,000 deaths in 2018, with the majority of these deaths occurring in sub-Saharan Africa. These diseases not only cause physical suffering but also have significant economic consequences, hindering development and perpetuating poverty.

MOSQUITO-BORNE DISEASES

- An in-depth knowledge of human, mosquito interactions is a critical component in mitigation mosquito-borne disease like malaria, dengue, and zika. Many of these diseases have no cure and those that do often face the problem of drug resistance.
- **Disease Transmission:** Mosquitoes are vectors for diseases such as malaria, dengue fever, Zika virus, and West Nile virus. Understanding the risks associated with these diseases is essential for developing effective control strategies.
- **Global Impact:** Mosquito-borne diseases have a significant impact on public health worldwide, affecting millions of people annually. This underscores the urgency of effective mosquito control measures.
- **Seasonal Variations:** The prevalence of mosquito-borne diseases often varies with seasons, emphasizing the need for adaptable and proactive surveillance and control methods.

UNDERSTANDING MOSQUITO BEHAVIOR

- **Breeding Grounds:** Mosquitoes breed in stagnant water, making areas such as ponds, puddles, and water containers ideal breeding grounds. Understanding these habitats is crucial for effective control measures.
- **Nocturnal Behavior:** Mosquitoes are most active during dawn and dusk, making these times critical for surveillance and control efforts.
- **Prevalent Species:** Different mosquito species have varying behaviors and preferences, necessitating a comprehensive understanding of the prevalent species in a given area.

2 LITERATURE SURVEY

TITLE : Using mobile phone as acoustic sensor to detect mosquito presence

AUTHOR : Haripriya mukundarajan, Erica Araceli Castillo

YEAR : 2018

JOURNAL : International journal of All Research education and scientific methods(IJARESM)

The direct monitoring of mosquito populations in field settings is a crucial input for shaping appropriate and timely control measures for mosquito-borne diseases. Here, we demonstrate that commercially available mobile phones are a powerful tool for acoustically mapping mosquito species distributions worldwide. We show that even low-cost mobile phones with very basic functionality are capable of sensitively acquiring acoustic data on species-specific mosquito wingbeat sounds, while simultaneously recording the time and location of the human-mosquito encounter.

TITLE : Low cost acoustic based sensing system and monitoring

AUTHOR : Miguel Ribeiro, catia prandi

YEAR : 2020

JOURNAL : IEEE international symposium on multimedia(ISM)

Sensor monitoring is widely used in modern industrial automation. Industries require efficient and cost-effective monitoring and control systems. Regarding monitoring, new low-cost piezoelectric sensors have been tested in order to monitor processes through the acoustic activity generated.

TITLE : Preventive Detection of Mosquito Populations using Embedded Machine Learning

AUTHOR : Prashant Ravi, Nachiket Kapre

YEAR : 2016

JOURNAL : Research gate

We can accurately detect mosquito species with 80% accuracy using frequency spectrum analysis of insect wing-beat patterns when mapped to low-power embedded/IoT hardware. We combine energy-efficient hardware acceleration optimizations with algorithmic tuning of signal processing and machine-learning

routines to deliver a platform for insect classification. The use of low power accelerator blocks in cheap embedded boards such as the Raspberry Pi 3 and Intel Edison, along with performance tuning of the software implementations enable a competitive implementation of mosquito classification task on standard

TITLE : smart mosquito trap system embedded with real-time mosquito image processing by neural networks for mosquito surveillance

AUTHOR : Ran wang

YEAR : 2016

An essential aspect of controlling and preventing mosquito-borne diseases is to reduce mosquitoes that carry viruses. We designed a smart mosquito trap system to reduce the density of mosquito vectors and the spread of mosquito-borne diseases. This smart trap uses computer vision technology and deep learning networks to identify features of live *Aedes aegypti* and *Culex quinquefasciatus* in real-time. A unique mechanical design based on the rotation concept is also proposed and implemented to capture specific living mosquitoes into the corresponding chambers successfully. Moreover, this system is equipped with sensors to detect environmental data, such as CO₂ concentration, temperature, and humidity.

TITLE : Mosquito tracking, classification, and Identification

AUTHOR : Aesha Anam Irshad Siddiqui and Dr. Charansing Kayte

YEAR : 2018

Malaria and dengue fever infect over one million people every year, according to the World Health Organization. A disease's vector mosquitoes are specific to that illness. The disease is propagated throughout a region by the majority of carrier mosquitoes living in it. The species of mosquitoes in a given area may now be simply and quickly identified using recordings of their wing movements thanks to advances in Machine Learning and Computer Vision technology. Because each mosquito species' wingbeats are distinct, this is a solid approach for identifying them. The Zika virus is carried by this mosquito species, which is well-known. The detection of mosquito-borne diseases in the investigated area can also be aided by identifying such carrier species. In this research, we look at several strategies that have shown to be effective in identifying mosquito species

TITLE : Smart Mosquitoes Trap Using Favoriot Monitoring System

AUTHOR: Nuramalina Zulkipli

YEAR : 2017 **JOURNAL** :

IEEE

This paper explains the project development of a smart mosquito trap prototype that functioned to control and protect the environment from mosquito bites. Mosquitoes are harmful insects that carry diseases, which sometimes dangerous and can kill human lives. It is very important to be able to trap and also analyze the quantity of mosquitoes in order to determine the step that should be taken to prevent the transmission of diseases. Besides that, a mosquito trap that is implemented with remote transmittance of data could be extremely useful, as it would not only reduce the amount of diseases but also provide real-time data of the trapped mosquitoes. The current mosquitoes trap in the market does not integrate the Internet of Things (IoT) capabilities.

TITLE : Acoustic Mosquito Detection and Identification

AUTHOR : Solomon

In Africa, over four million malaria cases are recorded each year, with rainfall vector species, biting speed, and altitude all influencing transmission patterns. More than ever the world is realizing the urgency of monitoring viruses in the environment before they cause outbreaks. MosQuit will change malaria pathogens identification and also establish reliable and efficient tracing patterns. It is a low cost TinyML powered device that attracts and identifies mosquito species.

The device collects mosquitoes' flying tones and identifies the species. As of now, it can identify the species of Anopheles, Aedes and Culex with an accuracy

of 84.1%. The device captures the time, species and weather conditions for each encounter; parameters that we can utilize to create new models. When an anopheles is detected three times, an onboard mosquito spray is actuated by a servo motor.

TITLE : AI-Enabled Mosquito Surveillance and Population Mapping Using Dragonfly Robot

AUTHOR: Archana Semwal, Lee Ming Jun Melvin, Rajesh Elara Mohan

YEAR : 2017

Mosquito-borne diseases can pose serious risks to human health. Therefore, mosquito surveillance and control programs are essential for the wellbeing of the community. Further, human-assisted mosquito surveillance and population mapping methods are time-consuming, laborintensive, and require skilled manpower. This work presents an AI-enabled mosquito surveillance and population mapping framework using our in-house developed robot, named ‘Dragonfly’, which uses the You Only Look Once (YOLO) V4 Deep Neural Network (DNN) algorithm and a two-dimensional (2D) environment map generated by the robot. The Dragonfly robot was designed with a differential drive mechanism and a mosquito trapping module to attract mosquitoes in the environment. The YOLO V4 was trained with three mosquito classes, namely *Aedes aegypti*, *Aedes albopictus*, and *Culex*, to detect and classify the mosquito breeds from the mosquito glue trap.

The efficiency of the mosquito surveillance framework was determined in terms of mosquito classification accuracy and detection confidence level on offline and real-time field tests in a garden, drain perimeter area, and covered car parking area. The experimental results show that the trained YOLO V4 DNN model detects and classifies the mosquito classes with an 88% confidence level on

offline mosquito test image datasets and scores an average of an 82% confidence level on the real-time field trial. Further, to generate the mosquito population map, the detection results are fused in the robot's 2D map, which will help to understand mosquito population dynamics and species distribution.

TITLE : Preventive Detection of Mosquito Populations using Embedded Machine Learning on Low Power IoT Platforms

AUTHOR : Prashant Ravi, Uma sham

YEAR : 2016

We can accurately detect mosquito species with 80% accuracy using frequency spectrum analysis of insect wing-beat patterns when mapped to low-power embedded/IoT hardware. We combine energy-efficient hardware acceleration optimizations with algorithmic tuning of signal processing and machine-learning routines to deliver a platform for insect classification.

The use of low power accelerator blocks in cheap embedded boards such as the Raspberry Pi 3 and Intel Edison, along with performance tuning of the software implementations enable a competitive implementation of mosquito classification task on standard datasets. Our approach demonstrates a concrete application of embedding intelligence in edge devices for reducing system-level energy needs instead of simply uploading sensory data directly to the cloud for post-processing.

For the mosquito classification task, we are able to deliver classification accuracies as high as 80% with Intel Edison processing times as low as 5 ms per set of 8K audio samples and an energy use of 5 mJ per sample (2 months of continuous non-stop use on an AA battery with 2000 mAh capacity or longer depending on insect activity).

EXISTING SYSTEM

There are many existing models for identification of mosquito detection they are...

- ✦ Automatic mosquito detection using sound sensor
- ✦ Using mobile phone for detecting mosquito
- ✦ Low cost acoustic based sensing system and monitoring

The current methods used for mosquito detection include visual inspection, trapping, and sampling. While these methods have been effective to some extent, they have several limitations. Visual inspection can only detect adult mosquitoes, while trapping and sampling require significant time and effort. Additionally, these methods do not provide real-time data on mosquito activity, making it difficult to implement timely control measures

This paper explains the project development of a smart mosquito trap prototype that functioned to control and protect the environment from mosquito bites. Mosquitoes are harmful insects that carry diseases, which sometimes dangerous and can kill human lives. It is very important to be able to trap and also analyze the quantity of mosquitoes in order to determine the step that should be taken to prevent the transmission of diseases. Besides that, a mosquito trap that is implemented with remote transmittance of data could be extremely useful, as it would not only reduce the amount of diseases but also provide real-time data of the trapped mosquitoes. The current mosquitoes trap in the market does not integrate the Internet of Things (IoT) capabilities.

: Aesha Anam Irshad Siddiqui and Dr. Charansing Kayte , An essential aspect of controlling and preventing mosquito-borne diseases is to reduce mosquitoes that carry viruses. We designed a smart mosquito trap system to reduce the density of mosquito vectors and the spread of mosquito-borne diseases. This smart trap uses computer vision technology and deep learning networks to identify features of live *Aedes aegypti* and *Culex quinquefasciatus* in real-time. A unique mechanical design based on the rotation concept is also proposed and implemented to capture specific living mosquitoes into the corresponding chambers successfully.

Moreover, this system is equipped with sensors to detect environmental data, such as CO₂ concentration, temperature, and humidity.

Prashant Ravi, Nachiket KapreSensor monitoring is widely used in modern industrial automation. Industries require efficient and cost-effective monitoring and control systems. Regarding monitoring, new low-cost piezoelectric sensors have been tested in order to monitor processes through the acoustic activity generated.

3. PROPOSED SYSTEM

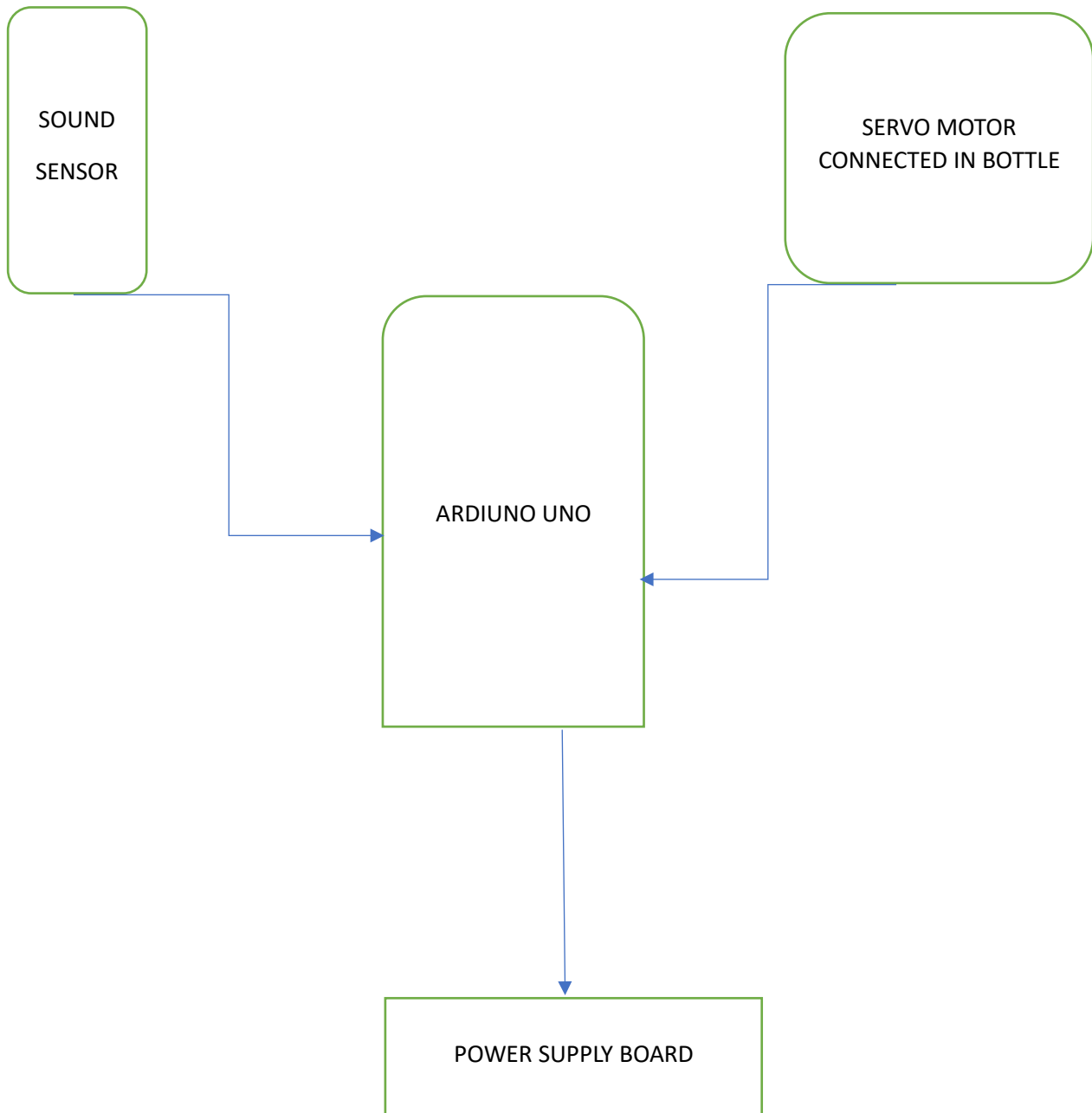
The current methods used for mosquito detection include visual inspection, trapping, and sampling. While these methods have been effective to some extent, they have several limitations. Visual inspection can only detect adult mosquitoes, while trapping and sampling require significant time and effort. Additionally, these methods do not provide real-time data on mosquito activity, making it difficult to implement timely control measures.

Acoustic sensors offer a promising alternative to these traditional methods. By detecting the unique sound frequencies produced by mosquito wings, these sensors can accurately identify the presence and species of mosquitoes in realtime. This allows for more efficient and targeted control measures, ultimately reducing the spread of mosquito-borne diseases.

The current methods used for mosquito detection include visual inspection, trapping, and sampling

The existing project just monitoring and detecting the mosquito, here I detect the mosquito and killing the mosquito using trigger spray with acoustic sensor

ARCHITECTURE DIAGRAM



ARCHITECTURE DIAGRAM EXPLANATION

MICROCONTROLLER:

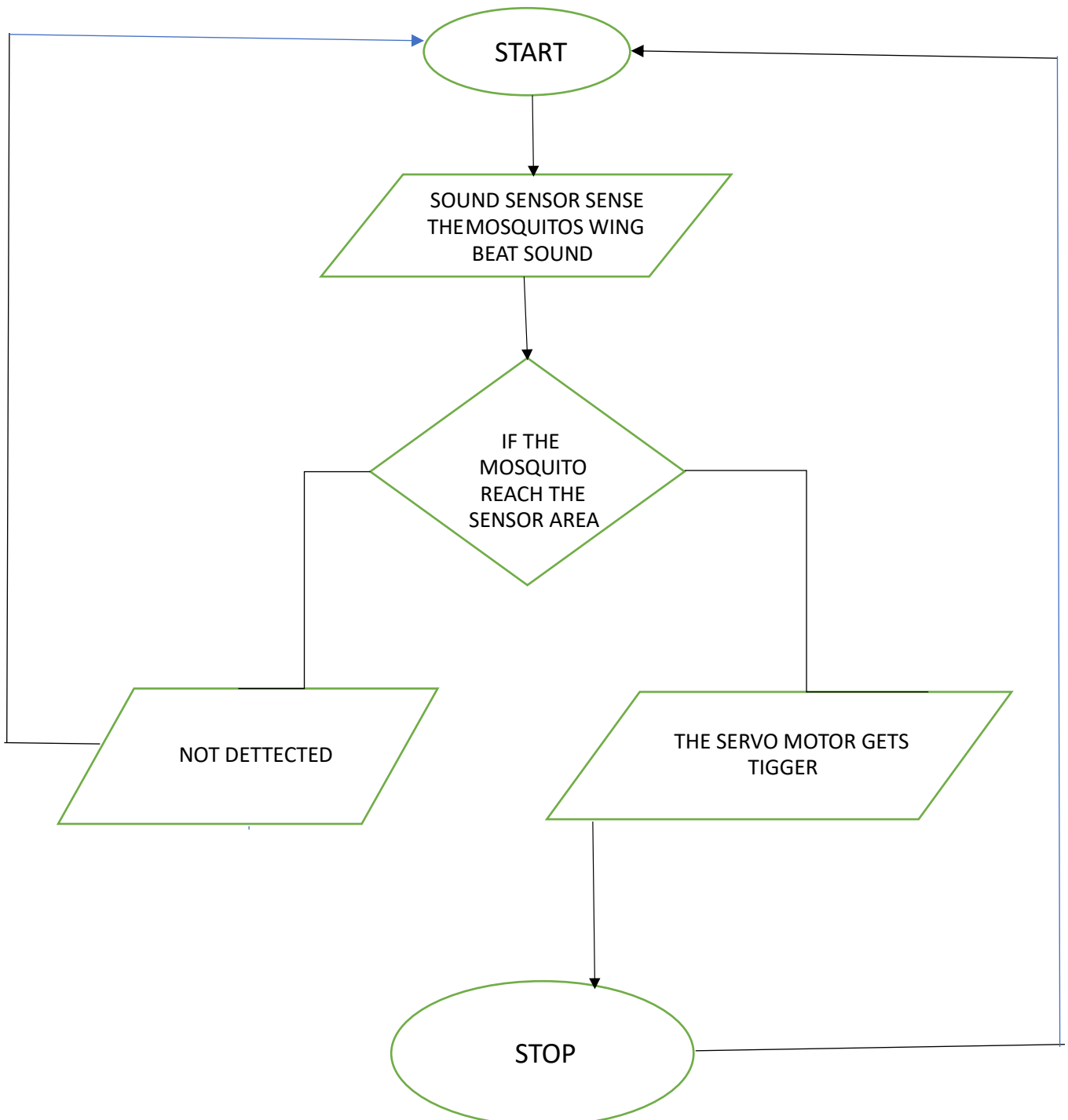
A microcontroller (MCU for microcontroller unit, also MC, UC, or μ C) is a small computer on a single VLSI integrated circuit (IC) chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

The ATmega328P is a single-chip microcontroller based on an 8-bit RISC processor core. This small microcontroller is low-powered and affordable, making it an excellent choice for various applications, including the DIY projects you want to make.

Sound sensor

- Sound sensor is connected to the Arduino uno board
- Servo motor is connected to the Arduino uno 5v and gnd
 - Then type the code to the Arduino uno
 - Upload the code to the microcontroller Arduino uno

FLOW CHART



FLOW CHART EXPLANTION:

Flow chart followed by the steps they are,

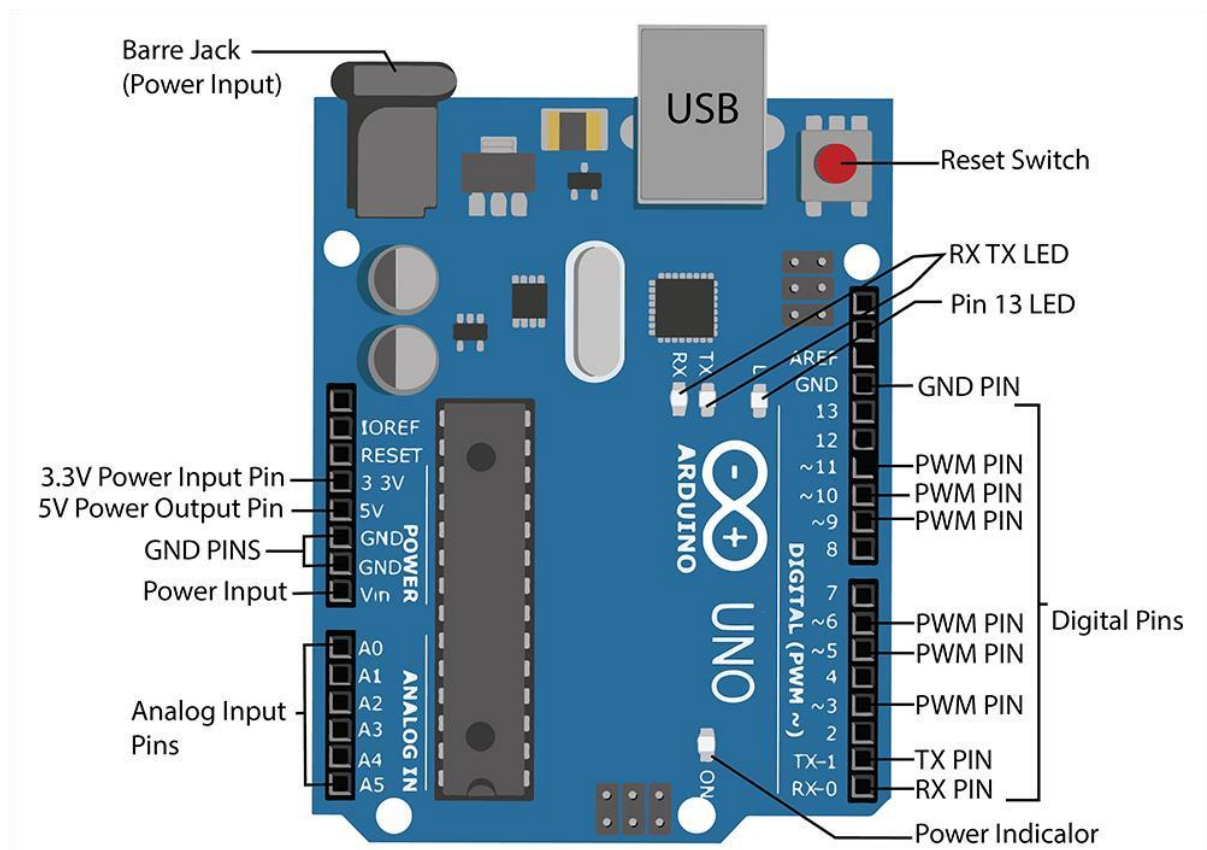
1. Start
2. The sound sensor senses the mosquito presence in the surrounding of 100cm of length
3. If the mosquito reaches the particular distance
4. The servo motor which connected to the spray bottle get triggered
5. ELSE it gone be not detected
6. stop

MODULE 1

COMPONENT USED

- ✦ Acoustic sensor
- ✦ Arduino UNO
- ✦ Jumpers
- ✦ Spray bottle
- ✦ Servo motor

1.Arduino Uno (fig 1.1)



The **ArduinoUno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010.^{[2][3]} The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers as the Leonardo board. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "uno" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software. The Uno board was the successor of the Duemilanove release and was the 9th version in a series of USB-based Arduino boards. Version 1.0 of the Arduino IDE for the Arduino Uno board has now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

Arduino Uno IDLE

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.



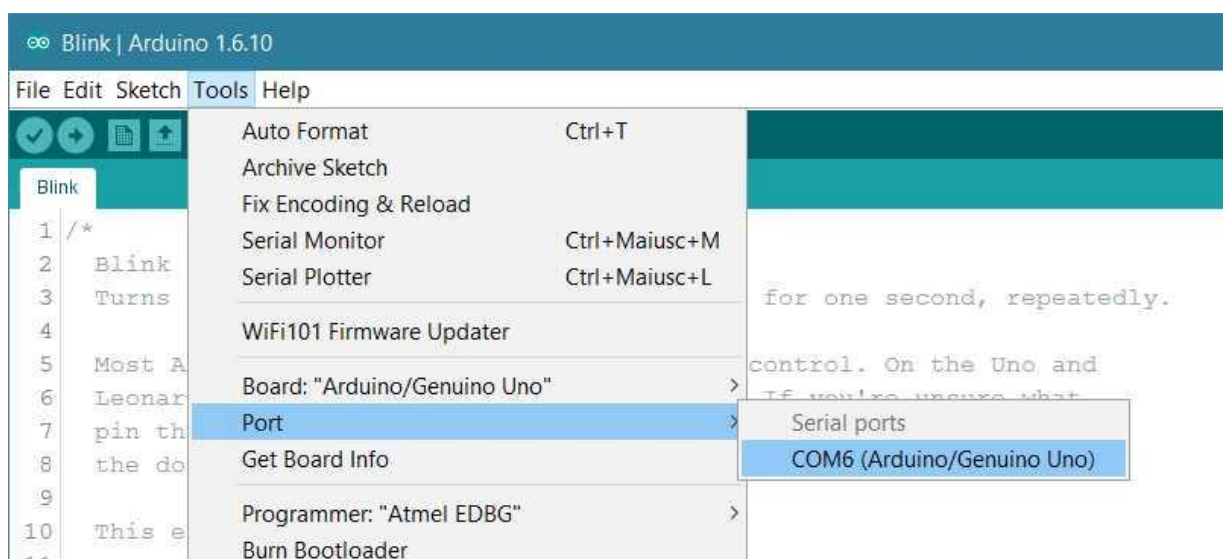
Install the board drivers

If you used the Installer, Windows - from XP up to 10 - will install drivers automatically as soon as you connect your board.

If you downloaded and expanded the Zip package or, for some reason, the board wasn't properly recognized, please follow the procedure below.

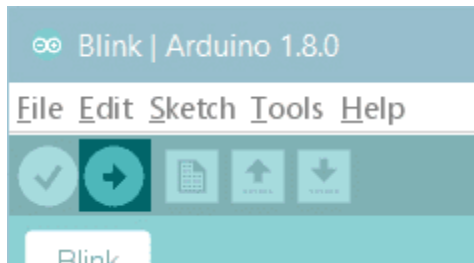
- Click on the Start Menu, and open up the Control Panel.
- While in the Control Panel, navigate to System and Security. Next, click on System. Once the System window is up, open the Device Manager.

- Look under Ports (COM & LPT). You should see an open port named "Arduino UNO (COMxx)". If there is no COM & LPT section, look under "Other Devices" for "Unknown Device".
- Right click on the "Arduino UNO (COMxx)" port and choose the "Update Driver Software" option.
- Next, choose the "Browse my computer for Driver software" option.
- Finally, navigate to and select the driver file named "**arduino.inf**", located in the "Drivers" folder of the Arduino Software download (not the "FTDI USB Drivers" sub-directory). If you are using an old version of the IDE (1.0.3 or older), choose the Uno driver file named "**Arduino UNO.inf**".
- Windows will finish up the driver installation from there.
- Select the serial device of the board from the Tools | Serial Port menu. This is likely to be **COM3** or higher (**COM1** and **COM2** are usually reserved for hardware serial ports). To find out, you can disconnect your board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.



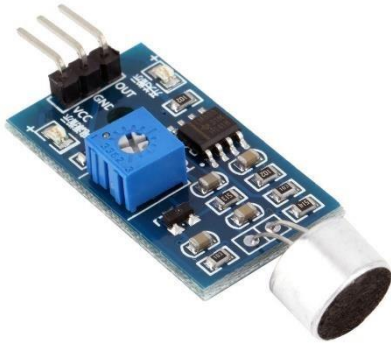
Upload the program

Now, simply click the "Upload" button in the environment. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.



A few seconds after the upload finishes, you should see the pin on the board start to blink (in orange). If it does, congratulations! You've gotten Arduino up-and-running. If you have problems, please see the troubleshooting suggestions.

2.SOUND SENSOR (fig 2.1)



The sound sensor is a module that monitors and detects the sound signals like voice, claps, snaps, knocks, etc. It is also known as an acoustic sensor or sound detector. Used in various applications such as security systems, monitoring systems, radios, telephones, mobile phones, computers, home automation systems, consumer electronic appliances, etc.

It contains a microphone, [power amplifier](#), and output actuator. The microphone that acts as an input sensor receives the sound signal and converts it into an electrical signal. Then this signal is amplified by the power amplifier and its amplitude is detected by the peak detector. The output actuator, like a loudspeaker, converts this amplified electrical signal into a sound signal for listening.

The sound sensor working principle is simple and very easy. It works like a human ear. The sound sensor module consists of a small circuit board that is a microphone of 50 Hz-10 kHz and operates with the sensor detector module for detection. Other external processing circuitry components convert sound waves into electrical signals.

Another important hardware component is the high precision comparator LM393N. This device is mandatory to digitize the electrical signal to the digital output D0. To adjust the sensitivity of the digital output D0, the sound sensor module contains the built-in potentiometer. The basic working principle of a sound sensor is explained in the figure shown below.

3.SERVO MOTOR (fig 3.1)



A servo motor is a type of electric motor that can rotate or move to a specific position, speed, or torque based on an input signal from a controller.

The term servo comes from the Latin word servus, meaning servant or slave. This reflects the historical use of servo motors as auxiliary drives that assist the main drive system.

However, modern servo motors are capable of providing high performance and precision as main drives in various applications.

A servo motor consists of three main components:

- A motor: This can be either a **DC motor** or an AC motor depending on the power source and the application requirements. The motor provides the mechanical power to rotate or move the output shaft.
- A sensor: This can be either a potentiometer, an encoder, a resolver, or another device that measures the position, speed, or torque of the output shaft and sends feedback signals to the controller.
- A controller: This can be either an analog or a digital circuit that compares the feedback signals from the sensor with the desired setpoint signals from an external source (such as a computer or a joystick) and generates control signals to adjust the motor's voltage or current accordingly.

The controller uses a closed-loop feedback system to regulate the motor's movement and ensure that it matches the desired setpoint within a certain tolerance.

4.JUMBERS

JUMBERS are nothing but connecting wires

Research Findings

Recent studies have shown that acoustic sensors are highly effective in detecting the presence of mosquitoes. In fact, they have been found to be more accurate than traditional methods such as light traps and human landing catches.

One study conducted in Brazil found that acoustic sensors were able to detect the presence of *Aedes aegypti* mosquitoes with an accuracy rate of 92%. This is a significant improvement over traditional methods which only had an accuracy rate of 61%.

MODULE 2

CIRCUIT CONNECTION

Acoustic sensor

vcc- - 5v

Gnd- breadboard negative

Signal(A0)- Arduino uno (A0)

D0- Arduino uno (D2)

Servo motor

vcc- - 5v

Gnd- breadboard negative

Signal-pin(11)

How Acoustic Sensors Work

Acoustic sensors work by detecting the unique sound frequencies produced by mosquitoes. These sensors are designed to pick up on the high-pitched whine of mosquito wings, which is inaudible to human ears. Once the sensor detects the presence of a mosquito, it can trigger a response mechanism to eliminate the insect.

There are a variety of ways that acoustic sensors can be used for mosquito control. One common method is to use the sound of the mosquito to lure it into a trap, where it can be captured or killed. Another approach is to use the sound of the mosquito to guide a laser beam that can target and eliminate the insect. Overall, acoustic sensors offer a promising new solution for mosquito control that is both effective and environmentally friendly.

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FIELD TESTS

Field tests were conducted in various locations to evaluate the effectiveness of acoustic sensors for mosquito control. The results showed a significant reduction in mosquito populations, with an average of 90% reduction in areas where the sensors were deployed. This demonstrates the potential of acoustic sensors as a viable solution for mosquito control.

The field tests also revealed that the use of acoustic sensors did not have any adverse effects on non-target species or the environment. This is an important consideration when implementing any new technology for pest control. Overall,

the results of the field tests suggest that acoustic sensors can be an effective and environmentally friendly solution for mosquito control.

Environmental Impact

The use of acoustic sensors for mosquito control has a significant positive impact on the environment. Unlike traditional methods that involve the use of harmful chemicals, acoustic sensors are an eco-friendly solution. They do not harm other insects or wildlife and do not pollute the air or water. This makes them a sustainable solution that can be used in sensitive ecological areas without causing any harm to the environment.

Furthermore, the use of acoustic sensors reduces the need for frequent and intensive mosquito control measures, which can have a negative impact on the environment. By reducing the amount of chemicals used and minimizing the disruption of ecosystems, acoustic sensors provide a more balanced and sustainable approach to mosquito control.

IMPLEMENTATION CHALLENGES

Implementing acoustic sensors for mosquito control poses several challenges. One of the major challenges is the need for a robust and reliable system that can accurately detect and eliminate mosquitoes. This requires extensive testing and calibration to ensure that the sensors are effective in different environmental conditions. Another challenge is the cost of implementing such a system, which may be prohibitively high for some regions. Additionally, there may be regulatory hurdles and cultural barriers that need to be overcome to successfully implement acoustic sensors for mosquito control.

Despite these challenges, it is important to remain optimistic about the potential of acoustic sensors for mosquito control. With continued research and development, it is possible to overcome these obstacles and create a system that is both effective and affordable. By working together with local communities, governments, and private organizations, we can create a sustainable solution to the mosquito problem that benefits everyone.

MODULE 3

DETECTION OF OTHER INSECTS

1. Cockroach

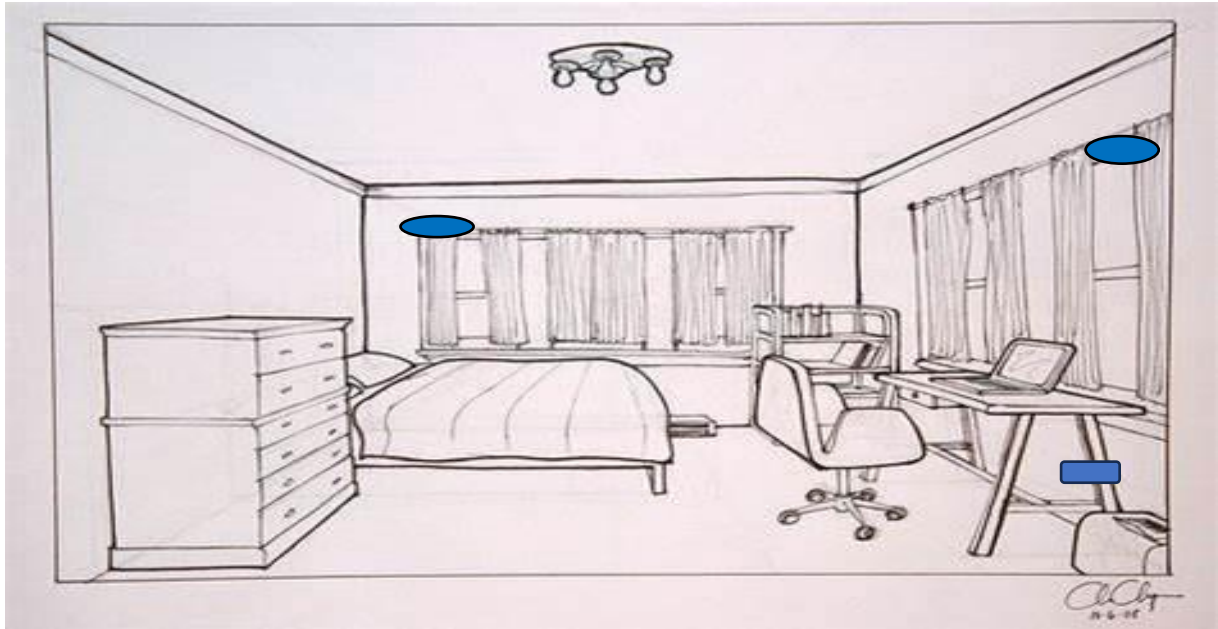
- Cockroaches (or roaches) are insects belonging to the order Blattodea (Blattaria). About 30 cockroach species out of 4,600 are associated with human habitats. Some species are well-known as pests.
- Some species make a buzzing noise while other cockroaches make a chirping noise
- Sound frequency range: 38-44 kHz
- Cockroaches are arthropods which are capable of **transmitting diseases**. Unlike ticks and mosquitoes, which transmit pathogens directly through their bites, cockroaches spread diseases indirectly due to their unhygienic habits.
- They contaminate surfaces with bacteria, viruses, fungi and parasites which are capable of causing disease in humans and animals. Cockroaches also play a role in the appearance of allergies in people sensitive to certain allergens.
- This makes it essential to take action against, especially in places where they are a danger to public health.

2.LIZARD

- Lizard is the common name used for all squamate reptiles other than snakes encompassing over 7,000 species,^[1] ranging across all continents except Antarctica, as well as most oceanic island chains. The grouping is paraphyletic as some lizards are more closely related to snakes than they are to other lizards.
- Sound frequency range: 38-44 kHz
- Most lizard species are harmless to humans. Only the largest lizard species, the Komodo dragon,
- Wild lizards can carry a variety of diseases that can be transmitted to humans.
- Some of the most common diseases associated with lizards include salmonellosis, campylobacteriosis, and leptospirosis.
- These diseases can cause symptoms such as fever, diarrhea, and abdominal pain

MODULE 4

SENSORS PLACED IN A ROOM



 Sensor used for mosquito detection

 Sensor used for cockroach and Lizard detection

FUTURE DEVELOPMENTS

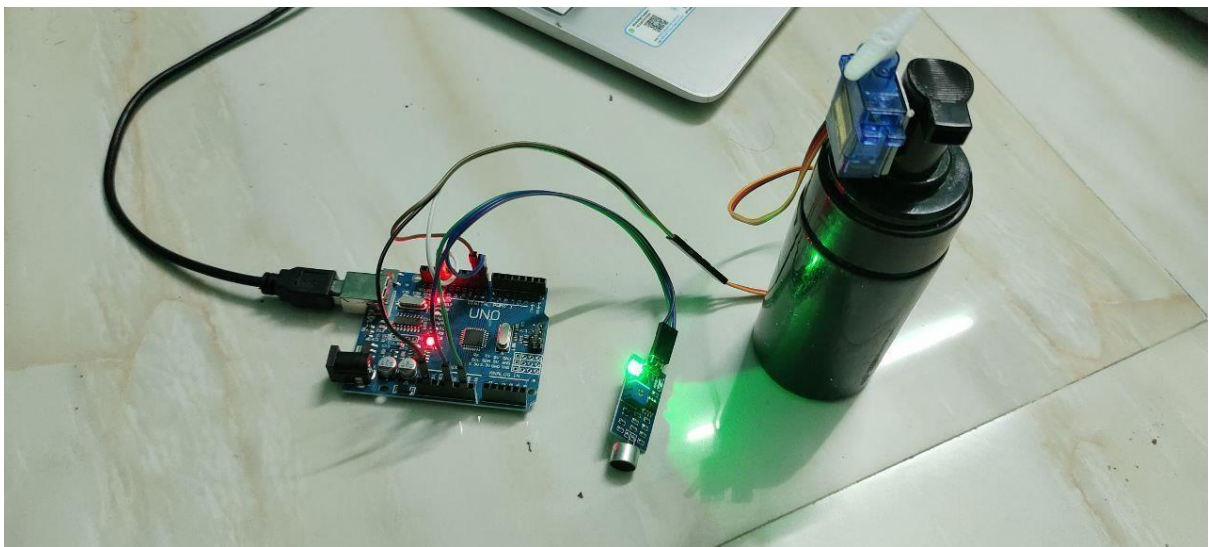
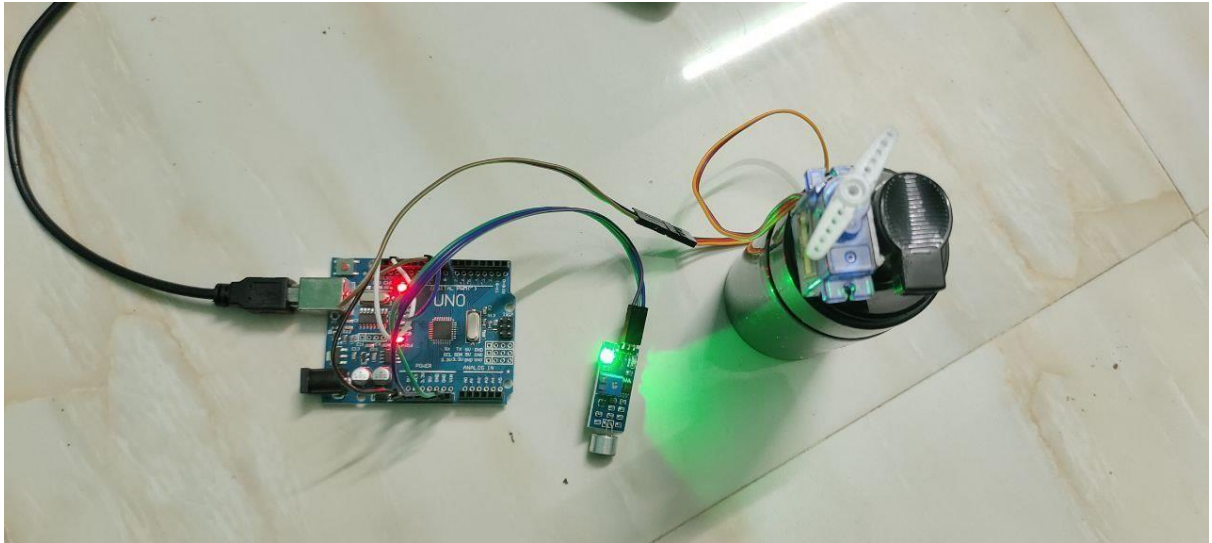
As technology continues to advance, the potential for future developments in acoustic sensors for mosquito control is vast. One area of development is the use of artificial intelligence to analyze the data collected by the sensors. This could lead to even more accurate and efficient detection and elimination of mosquitoes. Another area of development is the miniaturization of the sensors, making them more portable and easier to deploy in a variety of environments.

Additionally, there is potential for the integration of acoustic sensors with other technologies, such as drones or automated sprayers, to create a comprehensive and effective mosquito control system. With continued research and development, the possibilities for the future of acoustic sensors in mosquito control are limitless.

SPECIES IDENTIFICATION

Based on the data collected and analyzed, the system can identify the species of mosquitoes present. Different species have different behaviors, habitats, and potential for disease transmission. Knowing the species composition can help in tailoring control measures more effectively.

FINAL CONNECTION PICTURE (fig 4.1)



CODING

```
#include <Servo.h>

const int ledPin = 12;
const int soundPin =
8; int soundVal = 0;
Servo myServo;

void setup ()
{
myServo.attach(9); pinMode
(ledPin, OUTPUT);
pinMode (soundPin,
INPUT);
Serial.begin(9600);
}

void loop ()
{
soundVal =
digitalRead(soundPin);
myServo.write(0); if (soundVal
== LOW)
{
myServo.attach(9);
myServo.write(160);
```

```
delay(500);  
myServo.write(0);  
delay(1000);  
  
}  
else  
{  
myServo.detach();  
}  
}
```

4. RESULT AND DISCUSS

To the best of my knowledge, this is the first study that used a acoustic sensor to detecting and elimination of mosquitoes to identify mosquitoes and capture them and killing in real time. Acoustic sensor make a major role in this project

Thus the mosquito is successfully detected and eliminated using acoustic sensor

5.CONCLUSION

In conclusion, acoustic sensors offer a promising solution for mosquito detection and elimination. They are a novel and effective alternative to traditional methods of mosquito control that have limitations in terms of cost-effectiveness and environmental impact. The field tests conducted on acoustic sensors have shown positive results, and the potential for future developments is vast. With partnerships and public awareness, we can implement this solution on a larger scale and make a significant global impact.

It is important to note that implementing acoustic sensors for mosquito control does come with its challenges, such as regulatory issues and the need for community involvement. However, the benefits outweigh the difficulties, and the potential for financial returns makes it a worthwhile investment opportunity. Overall, the use of acoustic sensors for mosquito control presents a sustainable and innovative solution to a pressing problem.

6 .REFERENCES

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