# Voice Activated Light With Sound Sensor & Raspberry Pi Pico

**A PROJECT REPORT**

***Submitted***

*In the partial fulfillment of the requirements for the Mid-Term Project Assignment*

*Evaluation of*

**BACHELOR OF TECHNOLOGY**

in

**COMPUTER SCIENCE AND ENGINEERING**

by

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**UNDER THE GUIDANCE OF**

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**INSTITUTE OF TECHNICAL EDUCATION AND RESEARCH**

**SIKSHA 'O' ANUSANDHAN (DEEMED TO BE UNIVERSITY)**

**BHUBANESWAR-751003, ODISHA, INDIA.**

**DECEMBER-2022**

# DECLARATION

I HEREBY DECLARE THAT THE WORK DESCRIBED IN THIS THESIS "VOICE ACTIVATED LIGHT WITH SOUND SENSOR & RASPBERRY PI PICO" WHICH IS BEING SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF **BACHELOR OF TECHNOLOGY** IN THE DEPARTMENT OF **COMPUTER SCIENCE AND ENGINEERING** AFFILIATED TO SIKSHA 'O' ANUSANDHAN (DEEMED TO BE UNIVERSITY), BHUBANESWAR (ODISHA) IS THE RESULT OF INVESTIGATIONS CARRIED OUT BY ME UNDER THE GUIDANCE OF **DR. TUHINANSU PRADHAN, ASSOCIATE PROFESSOR AND** OF **DR. SHAKTIJEET MAHAPATRA, ASSISTANCE PROFESSOR, CENTRE FOR IoT**, **INSTITUTE OF TECHNICAL EDUCATION AND RESEARCH (ITER), BHUBANESWAR.**

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The work is original and has not been submitted for any Degree/Diploma of this or any other university.

**Place: Bhubaneswar**

**Date:**

ANKUR ROSAN DAS [1941012555]

AMARTYA MISHRA [1941012317]

# CERTIFICATE

This is to certify that the project report entitled "Voice Activated Light with Sound Sensor & Raspberry Pi Pico" being submitted by Ankur Rosan Das (1941012555) and Amartya Mishra (1941012317) in partial fulfillment for Mid-Term Project Assignment Evaluation of **Bachelor of Technology in** the Department of **Computer Science and Engineering** affiliated to Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar (Odisha)**,** is a record of bonafide work carried out by them during the academic year 2022-2023 under our guidance and supervision.

The results embodied in the report have not been submitted to any other University or Institution for the award of any degree or diploma.

**(Dr. Tuhinansu Pradhan)**

**Project Guide**

**(Dr. Shaktijeet Mahapatra)**

**Project Guide**

# ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Dr. Debahuti Mishra, Professor, Head of the department, Computer Science and Engineering, Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar for his continued support and valuable guidance and encouragement extended to me during my project work. I thank her for his painstaking efforts to guide me throughout my work.

I thank Dr. Tuhinansu Pradhan, Associate Professor of Center for Internet of Things (CIoT), Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar for his valuable advice, support and help during my project work.

I thank Dr. Shaktijeet Mahapatra, Assistance Professor of Center for Internet of Things (CIoT), Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar for his valuable comments and suggestions that greatly helped in improving quality of report.

I thank Mr. Pradeep Ku. Bebrata, Mr. Bipin Ku. Karan, Ms. Mamata Sutar, Mrs Shradhanjali Nayak, Mr. Upendra Kumar Prusty, Institute of Technical Education and Research (ITER), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar for their valuable comments and suggestions that greatly helped during circuit analysis and housing of the project.

I thank to all my teachers and professors for their valuable comments after reviewing my project reports.

I wish to extend my special thanks to all my colleagues and friends who helped directly or indirectly to complete my project assignment work.

I extend my thanks to my parents and all my family members for their unceasing encouragement and support who wished me a lot to complete this work.

**Signature of Students**

# ABSTRACT

The main purpose of this project is the sound sensor that detects the level change of the sound sensor through Raspberry Pi Pico. When the sound loudness is greater than the threshold, the sensor is triggered, and then the **RGB LED** is controlled to light up. Then the LED will turn off when we make noise. The RGB light will on when we make noise like clap etc. It will continue to glow until we make noise like clap etc. It is kind of smart home light project.

# INDEX

**TOPICS**

**CHAPTER 3: SOFTWARE DESCRIPTION**

# CHAPTER 1: INTRODUCTION

## 1.1 Introduction:

A new generation of Voice Activated Light using a Sound Sensor & Raspberry Pi Pico Board.

The main purpose of this project is the sound sensor that detects the level change of the sound sensor through Raspberry Pi Pico. When the sound loudness is greater than the threshold, the sensor is triggered, and then the **RGB LED** is controlled to light up. Then the LED will turn off when we make noise like clap etc.

The sound sensor acts like a microphone, which is used to receive sound waves. The sensor has a built-in condenser electret microphone that is sensitive to sound. Sound waves make the electret film in the microphone vibrate, resulting in a change in capacitance and a small voltage corresponding to the change. This voltage is then converted into a 0-5V voltage, which is received by the data collector after A/D conversion and transmitted to the microcontroller.

The Sound sensor module has 4 pins VCC, GND, Digital Out, and Analog Out. We can either use the AO pin as an output for analog reading or the DO pin as an output for digital readout. In this module, we only have D0 Pin which is the digital output pin.

A sound sensor is a simple, easy-to-use, and low-cost device that is used to detect sound waves traveling through the air. Not only this but it can also measure its intensity and most importantly it can convert it to an electrical signal which we can read through a microcontroller.

The modules in the project are: Raspberry Pi Pico Board -1, Sound Sensor – 1, RGB LED Module – 1, Breadboard -1, Jumper Wires – 12, Micro-USB Cable and Adapter.

**The main objectives of the project are:**

1. The sound sensor that detects the level change of the sound sensor through Raspberry Pi Pico.
2. When the sound loudness is greater than the threshold, the sensor is triggered, and then the RGB LED is controlled to light up.

3. Then the LED will turn off when we make noise. The RGB light will on when we make noise like clap etc. It will continue to glow until we make noise like clap etc.

**1.2 Project Overview:**

THE PROJECT " VOICE ACTIVATED LIGHT WITH SOUND SENSOR & RASPBERRY PI PICO " USING PYTHON.

The project explains the implementation of " Voice Activated Light with Sound Sensor & Raspberry Pi Pico" using Python. The organization of the thesis is explained here with:

**Chapter 1** Presents introduction to the overall thesis and the overview of the project. In the project overview a brief introduction of Sound Sensor.

**Chapter 2** Presents the topic Internet Of Things. It explains about what is Internet Of Things, Need for Internet Of Things and its applications.

**Chapter 3** Presents the hardware description. It deals with the block diagram of the project and explains the purpose of each block. In the same chapter the explanation of

**Chapter 4** Presents the software description. It explains the implementation of the project using Python.

**Chapter 5** Presents the project description along with

**Chapter 6** Presents the advantages, disadvantages and applications of the project.

**Chapter 7** Presents the results, conclusion and future scope of the project.

# CHAPTER 2: HARDWARE DESCRIPTION

**3.1 Introduction**:

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in fig: 3.1

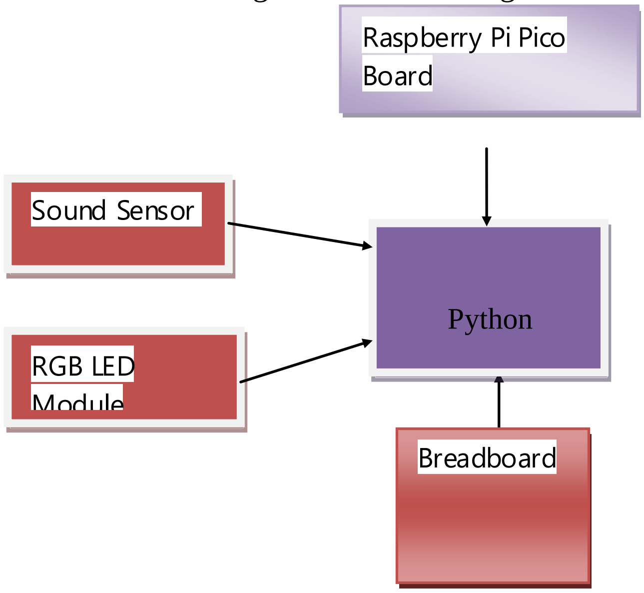



**FIG 3.1: Block diagram of Voice Activated Light using a Sound Sensor & Raspberry Pi Pico Board.**

**The main blocks of this project are:**

- Raspberry Pi Pico Board
- Sound Sensor
- RGB LED Module
- Breadboard
- Jumper Wires
- Micro-USB Cable

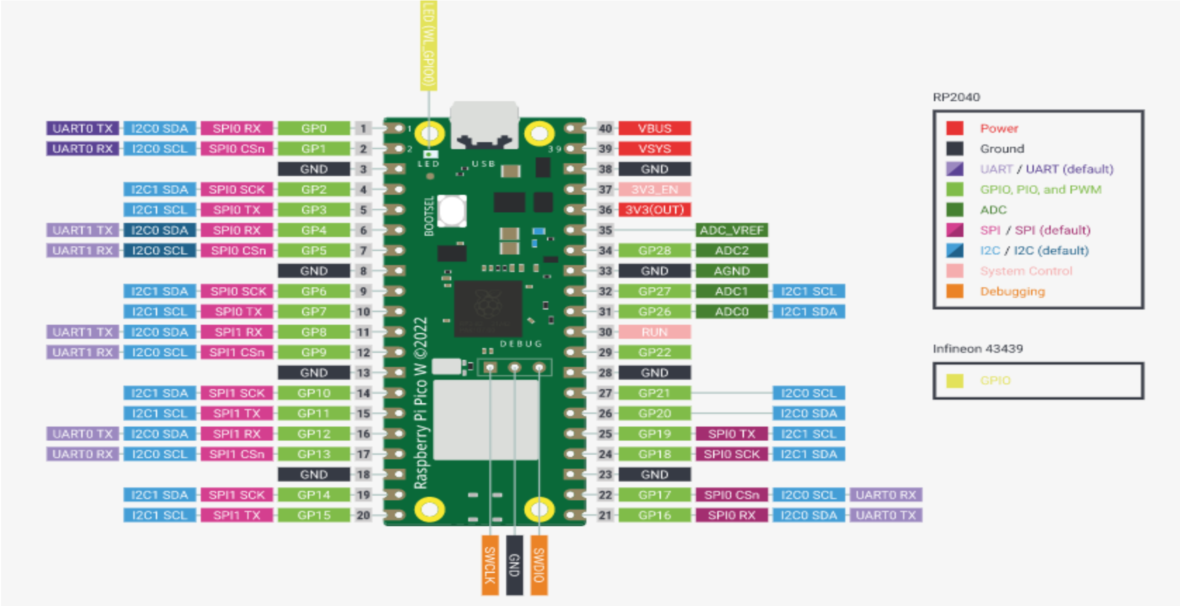
**RASPBERRY PI PICO:**

Raspberry Pi Pico is a low-cost, high-performance microcontroller board with flexible digital interfaces. Key features include:

- RP2040 microcontroller chip designed by Raspberry Pi in the United Kingdom
- Dual-core Arm Cortex M0+ processor, flexible clock running up to 133 MHz
- 264kB of SRAM, and 2MB of on-board flash memory
- USB 1.1 with device and host support
- Low-power sleep and dormant modes
- Drag-and-drop programming using mass storage over USB
- 26 × multi-function GPIO pins
- 2 × SPI, 2 × I2C, 2 × UART, 3 × 12-bit ADC, 16 × controllable PWM channels
- Accurate clock and timer on-chip
- Accelerated floating-point libraries on-chip
- 8 × Programmable I/O (PIO) state machines for custom peripheral support

The Raspberry Pi Pico comes as a castellated module allows soldering direct to carrier boards, while the Pico H comes with pre-soldered headers.

**Pin Definition:**

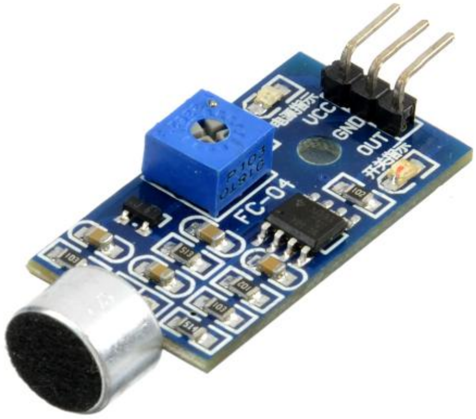



Raspberry Pi Pico pairs RP2040 with 2MB of Flash memory, and a power supply chip supporting input voltages from 1.8-5.5V. It provides 26 GPIO pins, three of which can function as analogue inputs, on 0.1”-pitch through-hole pads with castellated edges. Raspberry Pi Pico is available as an individual unit, or in 480-unit reels for automated assembly.

Raspberry Pi Pico is the debut microcontroller-class board from Raspberry Pi. Built around our RP2040 silicon platform, Pico brings our signature values of high performance, low cost, and ease of use to the microcontroller space. Raspberry Pi Pico is the debut microcontroller-class board from Raspberry Pi.

**SOUND SENSOR:**

The sound sensor acts like a microphone, which is used to receive sound waves. The sensor has a built-in condenser electret microphone that is sensitive to sound. Sound waves make the electret film in the microphone vibrate, resulting in a change in capacitance and a small voltage corresponding to the change. This voltage is then converted into a 0-5V voltage, which is received by the data collector after A/D conversion and transmitted to the microcontroller.




**Features**:

 The Sound sensor module has 4 pins VCC, GND, Digital Out, and Analog Out. We can either use the AO pin as an output for analog reading or the DO pin as an output for digital readout. In this module, we only have D0 Pin which is the digital output pin.

 VCC is the power supply pin of the Sound Sensor that can be connected to 3.3V or 5V of the supply. But note that the analog output will vary depending upon the provided supply voltage.

 GND is the ground pin of the Sound Sensor module and it should be connected to the ground pin of the Arduino.

 DOUT is the Digital output pin of the board, low output indicates that no sound is detected by the sensor, and high indicates that the sensor has detected sound.

**Key Specifications**:

 Power Requirements: 0-5V voltage.

 Communication: Microphone.

 Dimensions: 45 x 17 x 9 mm.

**Theory of Operation:**

The working of the sounds sensor module is very simple and easy to understand, the main component in this module is a condenser microphone. The microphone gives out only analog signals when a sound wave hits the diaphragm of the sensor, this analog signal gets processed by the op-amp and we get the digital output. The main component of a sound sensor is a microphone. There are many different types of microphones, like Carbon Microphone, Fiber Optic Microphone, Ribbon Microphone, and Laser Microphone, but the sound sensor module we are using has a condenser microphone. a condenser microphone consists of two charged metal plates. The first plate is called the diaphragm and the second plate is the backplate of the microphone. These two plates together form a capacitor. When a sound wave hits the diaphragm of the microphone the diaphragm starts to vibrate, and the distance between the two plates changes. The movement of the diaphragm and the change in spacing produces the electrical signal that corresponds to the sound that's picked up by the microphone and this signal then gets processed by the onboard op-amp. This module also has two built-in onboard LEDs, one of which lights up when power is applied to the board and the other one lights up when the incoming audio signal exceeds the threshold value set by the potentiometer.

***SOUND SENSOR MODULE:***

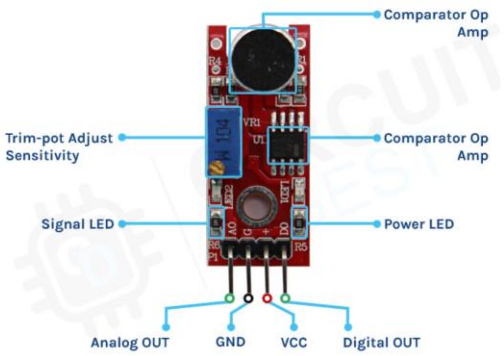



*FIG. 8 SOUND SENSOR MODULE – PARTS*

This sensor has three pins, two of which are power pins leveled VCC and GND and the other two pins are analog and digital pins which are shown in the diagram above. It has an onboard power LED and a signal LED. The power LED turns on when power is applied to the board and the signal LED turns on when the circuit is triggered. This board also has a comparator Op-amp that is responsible for converting the incoming analog signal to digital signal. We also have a sensitivity adjustment potentiometer; with that, we can adjust the sensitivity of the device. Last, we have the condenser microphone that is used to detect the sound. All these together make the total Sound Sensor Module.

**Summary:**

- Raspberry Pi Pico Board
- Sound Sensor
- RGB LED Module
- Breadboard
- Jumper Wires
- Micro-USB Cable

**Applications :**

Sound sensors are used in many other day to day applications including:

- Consumer electronics such as phones, computers, music systems
- Security and Monitoring systems such as burglar alarms, door alarm, etc.
- Home automation such as lighting your house by detecting whistle/clap instead of physically turning the light switch
- Ambient sound recognition and sound level recognition

**Features:**

- Analog output signal
- Wide supply voltage range: 4V-12V

- Low quiescent current drain: 4mA
- 2.0cm x 2.0cm twig module
- Minimum external parts

**Product parameters**:

| Item | Value |
|---|---|
| Operating Voltage Range | 5 V |
| Operating Current(Vcc=5V) | 4~5 mA |
| Voltage Gain(V=6V, f=1kHz) | 26 dB |
| Microphone sensitivity(1kHz) | -60~-56dBV/Pa |
| Microphone Impedance | 2.2k Ohm |
| Microphone Frequency | 16-20 kHz |
| Microphone S/N Radio | 54 dB |

**Pin Description**

1 Pin1 (VCC): 3.3V DC to 5V DC. Pin2 (GND): This is aground pin.

2 Pin3 (OUT): This is an output pin.

**Attentions of application**

**(1) Operating conditions**

It works similar to our ears. Our Ears have a diaphragm which converts the detected the vibration and converts it in the signal. Similarly, the sound sensors convert the vibration into audio signal (voltage and current proportional) with the help of a microphone.

**(2) Attention to chemical materials**

The sound sensor is a simple device which can detect the sound. The sound sensors are very simple to use. The sound sensor consist of Microphone as a transducer, potentionmeter to adjust the intensity, LM386 low power audio amlifier, LED and other passive components like resistors and capacitors.

**(3) RGB LED:**

RGB LED means red, blue and green LEDs. RGB LED products combine these three colors to produce over 16 million hues of light. Note that not all colors are possible. Some colors are "outside" the triangle formed by the RGB LEDs. Also, pigment colors such as brown or pink are difficult, or impossible, to achieve. An RGB LED is basically an LED package that can produce almost any color. It can be used in different applications such as outdoor decoration lighting, stage lighting designs, home decoration lighting, LED matrix display, and more.

RGB LEDs have three internal LEDs (Red, Green, and Blue) that can be combined to produce almost any color output. In order to produce different kinds of colors, we need to set the intensity of each internal LED and combine the three color outputs. In this tutorial, we are going to use PWM to adjust the intensity of the red, green, and blue LEDs individually and the trick here is that our eyes will see the combination of the colors, instead of the individual colors because the LEDs are very close to each other inside.

(4) **USB CABLE:**

The very small USB port found on many non-Apple cellphones, tablets and other portable devices is a Micro USB socket. Considerably smaller than USB Type A and B, Micro USB is also half the thickness of Mini USB (see illustration below). Micro USB has been superseded by USB Type C on many new products.

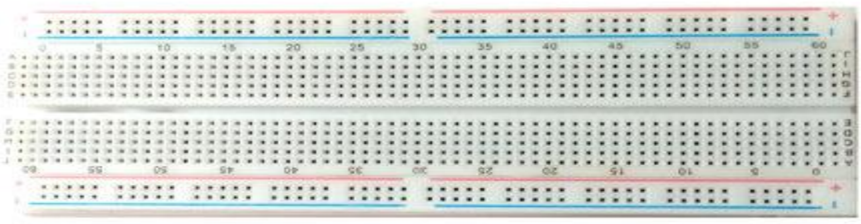
(5) **ADAPTER:**

Power Adapter 5V 2A Power Supply AC Input 100-240 V and Output 5V-2A, Input Voltage: 100-240V DC, Output Voltage: 5Volts. DC 5V/2A, means that the input voltage, to recharge the battery is 5 volts of direct current. 2A Is the amount of amperage that is suggested to recharge the battery.

**(6) Jumper Wire:**

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit. Male to female jumpers are especially handy for connecting standard 0.1″ male header pins like commonly found on breakout boards to female header contacts such as on a solderless breadboard. They also can be used to make extension cables by connecting the female end to the male end of another cable. The individual wires are easily pulled apart by hand to create single jumper wires or to make smaller cables consisting of multiple wires which are handy for keeping wires together when connecting small buses or running multiple wires to a sensor.

***Boards:***



A thin plastic board used to hold electronic components (transistors, resistors, chips, etc.) that are wired together. Used to develop prototypes of electronic circuits, breadboards can be reused for future jobs. They can be used to create one-of-a-kind systems but rarely become commercial products.Breadboards are used to help you connect components to complete your basic circuit. The reason it's called breadboard dates back to when electronics components were much bigger and people would actually use wooden breadboards (boards used to cut bread) to connect electronic circuits.The vertical columns of the breadboard are called **terminals**, while the horizontal long rows are called **power rails** because they are mostly used to connect the power supply to the breadboard. The positive rails are indicated by red lines, while the negative rails are indicated by black ones.

A breadboard connection with an electronic component is made with the help of leg-like structures made of metal. These are called “leads”, and they can vary in size. The shorter ones are often referred to as pins. So, if your electronic component has leads, it can be connected directly to the breadboard. DIP-based (that's dual inline package) integrated circuits are built to fit perfectly into a breadboard, with each pin fitting over a breadboard hole.These leads can be pushed into the holes that are designed to hold them in place and prevent them from getting loose or falling out of the breadboard. You can even turn the breadboard upside down and these connections wouldn’t come off. They are tight enough to insert and remove, but, not enough for breadboard connections to come off on their own.The tightness comes from the fact that breadboards have small metal clips hidden under these holes, which hold everything in place. They basically grab onto the leads that you insert. Other than that, breadboards usually have a backing layer as well, to hold the clips themselves in place.

# CHAPTER 3: SOFTWARE DESCRIPTION

**Thonny IDE:**

Thonny is an integrated development environment for Python that is designed for beginners. It was created by Aivar Annamaa, an Estonian programmer. It supports different ways of stepping through the code, step-by-step expression evaluation, detailed visualization of the call stack and a mode for explaining the concepts of references and heap

Programs written in thonny can be both in python and micropython.

**Features:**

Statement stepping without breakpoints

• Live variables during debugging

• Stepping through evaluation of the expressions (expressions get replaced by their values)

• Separate windows for executing function calls (for explaining local variables and call stack)

• Variables and memory can be explained either by using simplified model (name → value) or by using more realistic model (name → address/id → value)

• Simple pip GUI

• Support for running and managing files on a remote machine via SSH

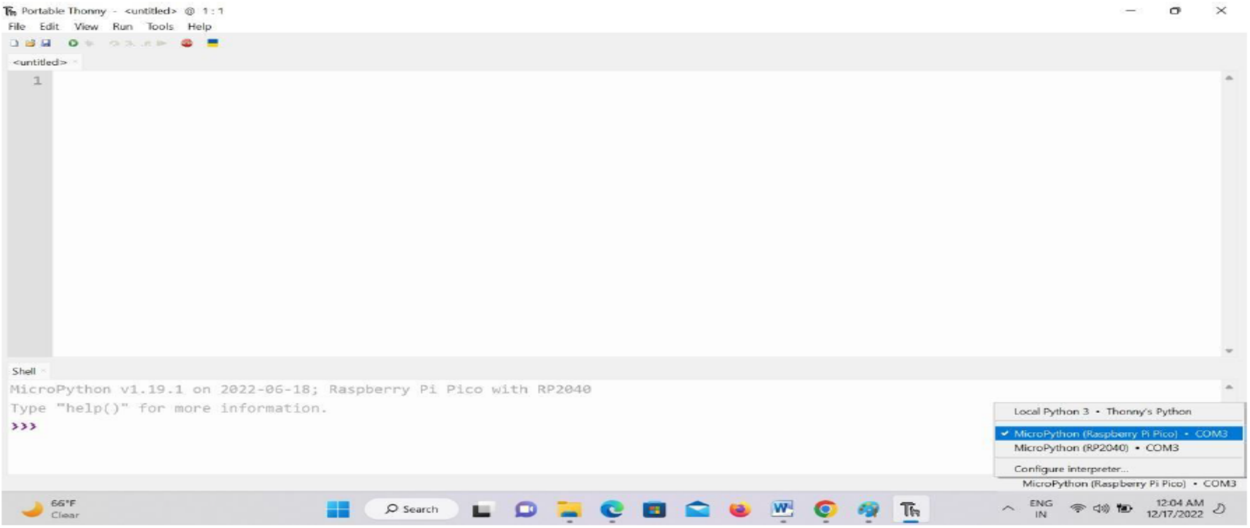
• Possibility to log user actions for replaying or analyzing the programming process

The version of thonny which we are using is 4.0.1 windows portable.

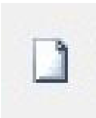
**Connecting pico with Thonny**

Connect the pico with the USB cable with laptop and then move to the thonny window and

Select Micropython (Raspberry Pi Pico) . COM3 option




Now you can run all the programs on the pico.


**new**

Used to create a new file


**open**

Used to open a file


**save**

Used to save a file


**run**

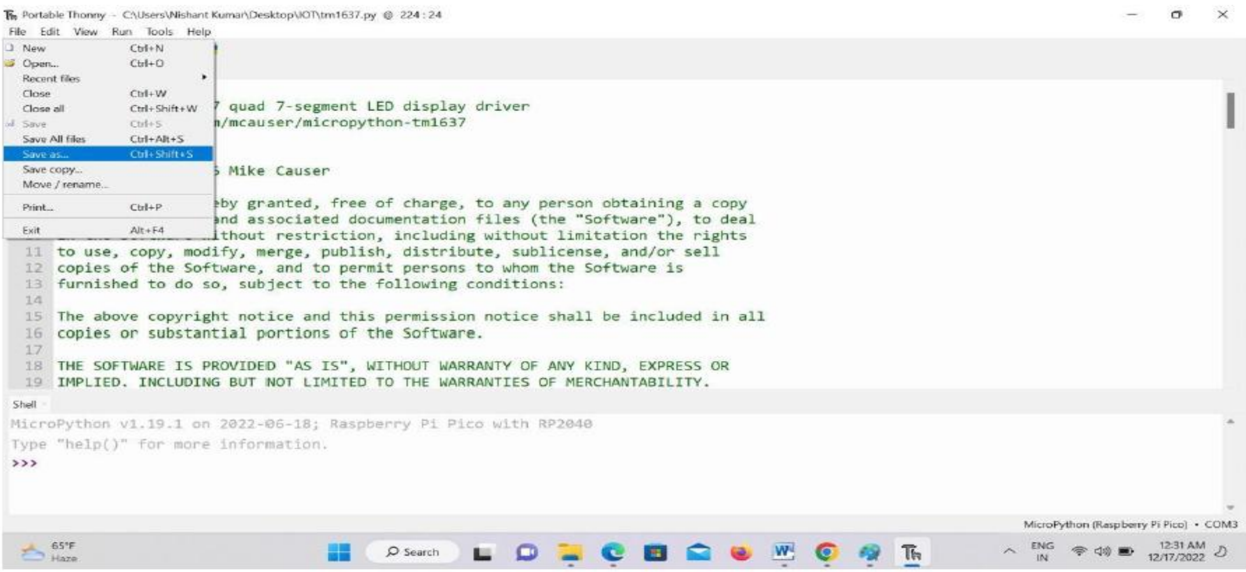
Used to execute a code

 **stop**

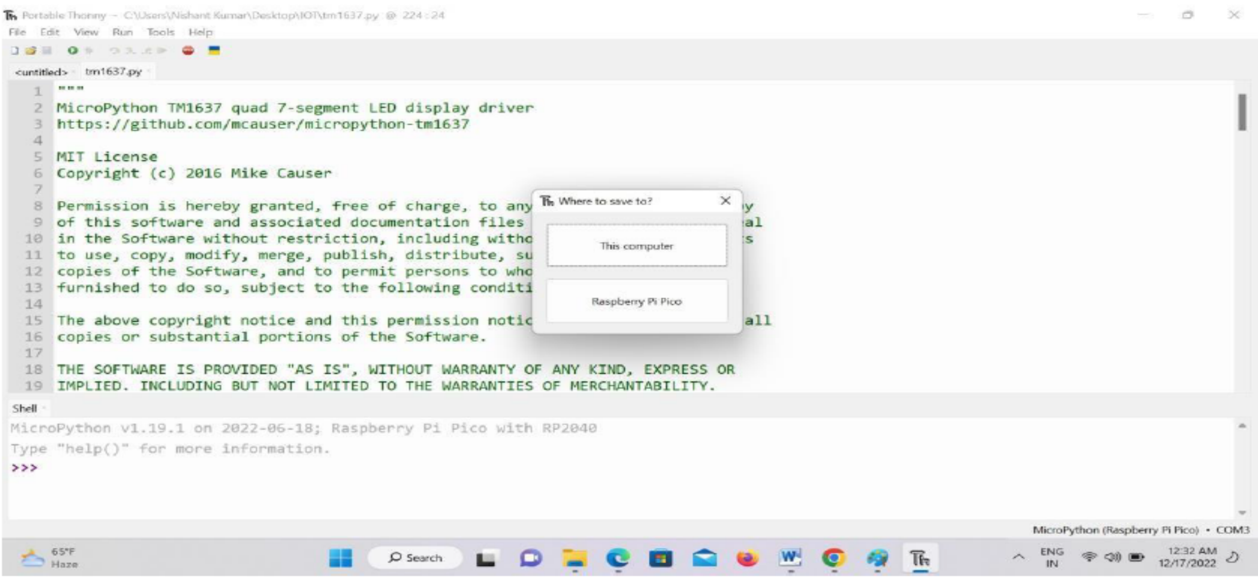
Used to stop execution of code

**Saving a file in pico**

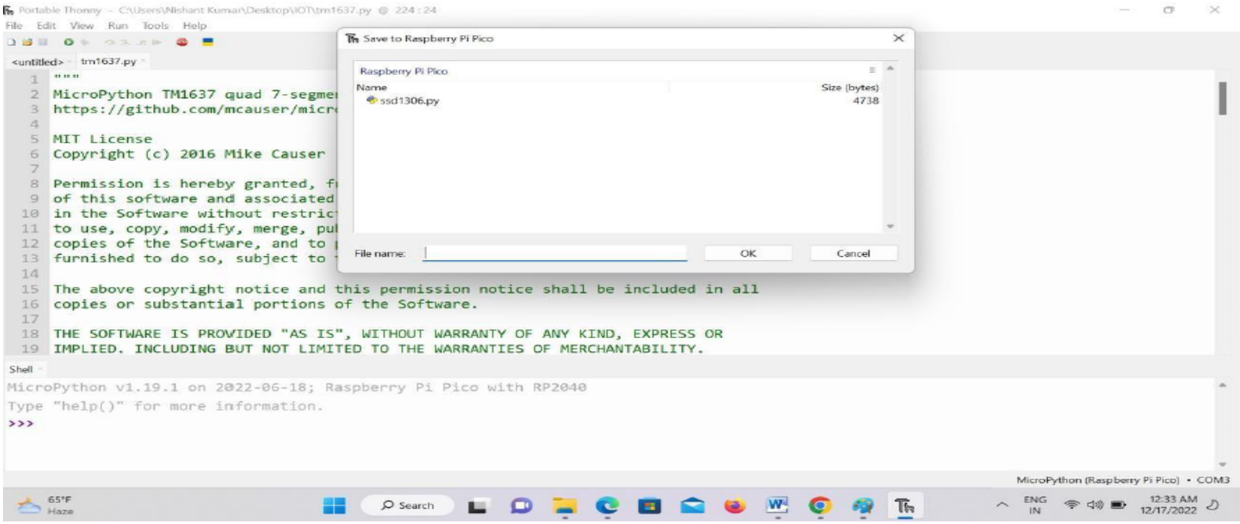
To save a file in Raspberry Pi Pico write the or open the python file on thonny then click on the file option and select Save As option.

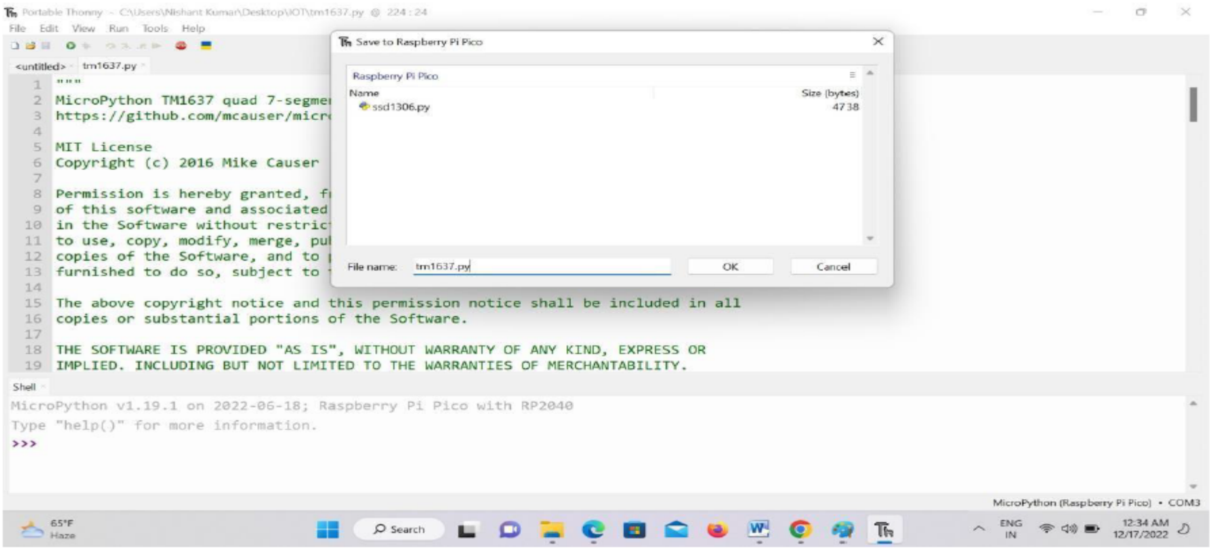



A dialog box appears select raspberry pi pico option button



A dialog box appers showing the names of the files already saved.





Write the name of the file with .py extension and click on ok button.Your file will be saved in pico.

# CHAPTER 4: PROJECT DESCRIPTION

The main purpose of this project is the sound sensor that detects the level change of the sound sensor through Raspberry Pi Pico. When the sound loudness is greater than the threshold, the sensor is triggered, and then the RGB LED is controlled to light up. Then the LED will turn off when we make noise like clap etc.

The sound sensor acts like a microphone, which is used to receive sound waves. The sensor has a built-in condenser electret microphone that is sensitive to sound. Sound waves make the electret film in the microphone vibrate, resulting in a change in capacitance and a small voltage corresponding to the change. This voltage is then converted into a 0-5V voltage, which is received by the data collector after A/D conversion and transmitted to the microcontroller.

# CHAPTER 4: ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Sound sensors are used for security systems.
- Sound sensors are easily affordable.
- Wireless sound sensors provide great freedom while speaking. Besides, it does not require cabling as compared to a wired mic.
- Sound sensors work with speech recognition software where sound or speech is converted to text. This is also used by disabled people.

RGB LED

- It occupies less area
- Small in size
- Less weight
- Greater efficiency
- Toxicity is less
- Contract and brightness of the light is better compared to other LED
- Good maintenance of Lumen.

**DISADVANTAGES:**

Sound files require more memory size.

➨Voice recognition softwares are not very accurate compare to manual typing.

Example: It is difficult to distinguish between keywords e.g. "there" and "their".

➨Often it picks up near by radio signals and hence interference cancellation microphones are needed. This increases cost of the microphone.

➨The wireless microphones have limited coverage range.

➨Operation time of wireless microphone is limited due to battery life. This is shorter compare to condenser microphone.

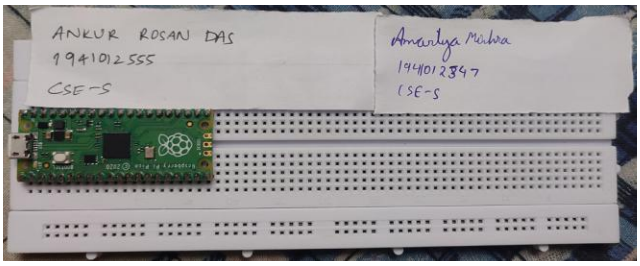
➡Often sound sensors are required to be mounted on cards for specific applications. This increases use of hardware.

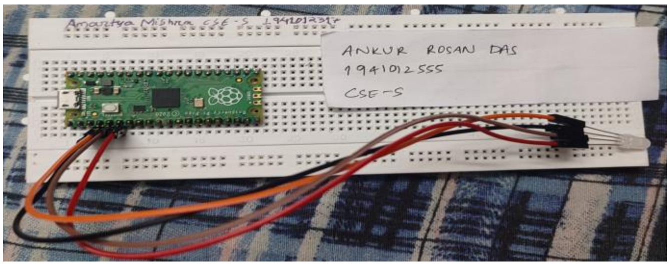
**RGB LED**

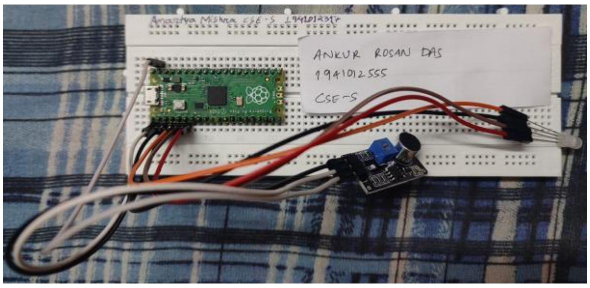
- Cost of manufacturing is high
- Dispersion of color
- The shift in color.

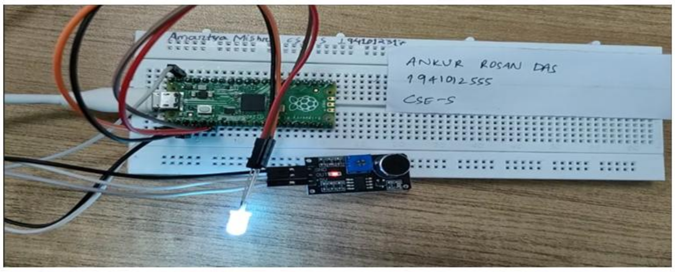
# CHAPTER 5: RESULTS

## 7.1 Results:




## 7.2 Conclusion:

The sound sensor detects the level change of the sound sensor through Raspberry Pi Pico. When the sound loudness is greater than the threshold, the sensor is triggered, and then the RGB LED is controlled to light up. Then the LED will turn off when we make noise like clap etc.

**Future Scope:**

The growth in applications of sound sensors, along with the need to produce reliable sensor equipment, are expected to fuel the progress of this market in the future. Furthermore, cameras that have inbuilt sound sensing abilities can be of greater value to the safety system, which is another factor expected to drive market growth in the upcoming years. In addition, the growth of the market can also be attributed to factors such as the ease of use of sound sensors and the advancements in sensing technologies.

# REFERENCES

The sites which were used while doing this project: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2. https://how2electronics.com

3. https://www.lighting.philips.com

4. https://robu.in/sound-sensor-basics-pin-configuration-working-applications-and-interfacing/

5. https://wiki.seeedstudio.com/Grove-Sound_Sensor/

6. https://randomnerdtutorials.com/getting-started-thonny-micropython-python-ide-esp32-esp8266/

# CHAPTER 6: TEAMWORK

## *8.1. SUMMARY OF TEAM WORK*

**Ankur Rosan Das**: "As an assembler and programmer, I developed and maintained the hardware and the codebase of the project. This involved assembling and constructing project, writing new code, fixing bugs, and refactoring existing code. Additionally, I worked with other team members to ensure that the code was properly tested and debugged before deployment. I also developed the user interface and backend logic for the system, and implemented various security measures to ensure the safety and privacy of the data. Additionally, I worked closely with the hardware and software vendors to ensure that all components were functioning correctly. Finally, I tested and monitored the system to ensure it was operating as intended."

**Amartya Mishra**: "As a researcher on an IoT project, I conducted research to identify the current challenges and opportunities of developing IoT technologies. I explored existing IoT platforms, hardware, software, and services, and evaluated the potential for new applications and solutions. I also developed a research plan to guide the development of the project, which included gathering and analyzing relevant data, developing a set of best practices for developing IoT-based applications, and evaluating the potential for integrating IoT technologies into existing systems. Additionally, I created a prototype of the proposed system and evaluated its feasibility and performance. Finally, I conducted usability tests to determine user acceptance and satisfaction with the proposed system."

### *8.1.1 ATTRIBUTES*

| | |
|---|---|
| 1 | Attends group meetings regularly and arrives on time. |
| 2 | Contributes meaningfully to group discussions. |
| 3 | Completes group assignments on time. |
| 4 | Prepares work in a quality manner. |
| 5 | Demonstrates a cooperative and supportive attitude. |
| 6 | Contributes significantly to the success of the project. |

*8.1.2 SCORE*

**1**=strongly disagree; **2**=disagree; **3**=agree; **4**=strongly agree

**Student 1:** ____________________________________

**Student 2:** ____________________________________

| Student 1 | Evaluated by | |
|---|---|---|
| | Attributes | Student 2 |
| | 1 | |
| | 2 | |
| | 3 | |
| | 4 | |
| | 5 | |
| | 6 | |
| | **Grand Total** | |

| Student 2 | Evaluated by | |
|---|---|---|
| | Attributes | Student 1 |
| | 1 | |
| | 2 | |
| | 3 | |
| | 4 | |
| | 5 | |
| | 6 | |
| | **Grand Total** | |

____________________________________
**Signature of Student 1**

____________________________________
**Signature of Student 2**

# Appendix

**Code:**

<u>main.py</u>

```
from machine import Pin,PWM

from utime import sleep_ms

sound = Pin(0, Pin.IN, Pin.PULL_DOWN)  # Port internal pull-down

Led_R = PWM(Pin(2))

Led_G = PWM(Pin(3))

Led_B = PWM(Pin(4))

Led_R.freq(2000)

Led_G.freq(2000)

Led_B.freq(2000)

memory = 0
```

```
if __name__ == '__main__':
    while True:


        if sound.value() = = 1:
            if memory = = 1:
                memory = 0
                Led_R.duty_u16(65535)
                Led_G.duty_u16(65535)
                Led_B.duty_u16(65535)
                sleep_ms(2000)
            else:
                 memory = 1
                 Led_R.duty_u16(0)
                 Led_G.duty_u16(0)
                 Led_B.duty_u16(0)
            sleep_ms(2000)
            print(“sound value  -------“, sound.value())
```