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IOT Based Sound and Air Pollution System Using Raspberry Pi Pico

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ABSTRACT:: Due to the increase of automobiles on the road today, as well as the effects of industry and urbanisation, air pollution has become one of the major problems. This increase in pollution has detrimental repercussions on prosperity. This project illustrates how an air pollution detection system is shown and used. The invention in question is a real-world implementation of the Internet of Things idea. Things. This in-depth study examines the consumption options for this invention in a world where natural safety is evolving into a real issue. With an Arduino microcontroller board, the task is finished. In this project, I'm going to build an Internet of Things-based air pollution detection and monitoring system. I'll use an ESP8266 Wi-Fi device to watch the air quality over a web server, and I'll set off an alarm when the air becomes polluted. Quality declines When harmful gases are present in the air at a certain quantity, Like CO₂, oxygen. The PPM (Parts Per Million) air condition will be displayed as "Fresh Air," "Poor," and so on. I can easily watch "Air", "Danger Air" on LCD and the website.

KEYWORDS: Raspberry-pi Pico, sound sensor, MQ135 gas sensor, Thing speak cloud.

I. INTRODUCTION

A major increase in air pollution is having grave consequences for both the environment and human health. Nitrogen dioxide, ozone, sulphur dioxide, and carbon monoxide are a few of the typical air pollutants. When it comes to human health, these pollutants increase the danger of developing conditions like asthma, respiratory illnesses, circulatory system disorders, high rates of heart problems, immune system damage, and others. The problem of air pollution has gotten worse due to the huge increase in the number of automobiles and motorcyclists on main highways in most emerging and developed cities. To lessen and stop the air pollution from growing worse, proactive measures must be adopted. The determination of the air quality is based on the estimation of a few key and indicative parameters, such as air temperature, radiation, activity level, air flow, humidity, and the presence of atmospheric particles, such as carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), volatile organic compound (VOC), and black carbon. To stop the problems with air pollution from getting worse, it is essential to check the quality of the air. Recent research has been done on several air pollution monitoring methods. IoT (Internet of Things), Kernel Models Technique, which defined the architecture of a product unit network, evolutionary learning the algorithm, and mobile system, which is a trustworthy measurement system, are a few examples of monitoring systems. Additionally, there is a LabVIEW-based air pollution tracking system that shows real-time data collection and monitoring system on the LabVIEW interface. These monitoring methods come with their own benefits and drawbacks. IoT technology has become a crucial component of many Industry 4.0 applications that aim to enhance human existence. The Internet of Things (IoT) application has progressed to the point where all networks of devices can be linked to the same cloud server for the purposes of data collection and sharing.

II.METHODOLOGY

It is becoming increasingly urgent to address the issue of air pollution brought on by vehicle exhaust gas due to the growing number of automobiles. The amount of air pollution in Europe has been determined to be dangerous for human health. The engine outflows principles have been established and developed for a long time in many developed nations to combat this issue. Also, experts have established a few more advanced measurements in gas quality or car motors. Yet, it seems that these methods won't make a significant difference in the problems of effluent pollution. The fundamental focus of the Internet of Things (IoT) is using OSI's layered architecture to link smart gadgets to the internet. To assess the concentration of air pollutants, we suggest a cluster of Air Quality Monitoring Gas Sensor MQ135 notes in the framework of this study. The interface for the Gas Sensors MQ135 is a small, established platform that has additional equipment. The Raspberry Pi Pico, an open-source development board with ESP8266-12E chips, has been the major tool we have employed. The MQ135 Gas Sensor is employed to monitor gas concentrations. This sensor data would be recorded and transmitted to the Raspberry Pi Pico for IoT-based data acquisition. The section above covered the principal elements of my project. The architecture is described here. The Raspberry Pi Pico has a Wi-Fi device and a gas sensor attached. Moreover, an LCD is linked to the Raspberry Pi Pico to show information. I use a gas sensor to monitor the air quality on a serial monitor and LCD and to sound an alarm when it drops below a specific point, which occurs when a sufficient amount of dangerous gases, such as CO2, smoking, alcohol, benzene, and NH3, are present in the atmosphere. I have used the MQ135 sensor, which is the best option for monitoring air quality because it can find and precisely quantify the majority of harmful gases. I can use a computer to remotely watch the pollution level in this Internet of Things (IoT) project. The greatest threat to living beings is noise pollution. It typically occurs as a result of the noise made by vehicles, machinery, businesses, gadgets, etc. The additional goal of our effort is to ensure the safety of the coldest regions of the atmosphere. Sensors that are sent off a Raspberry Pi Pico are used to collect the data. Analysis is done on the evaluation of the sound strength and air quality. The built-in Wi-Fi module transfers that info to the cloud.

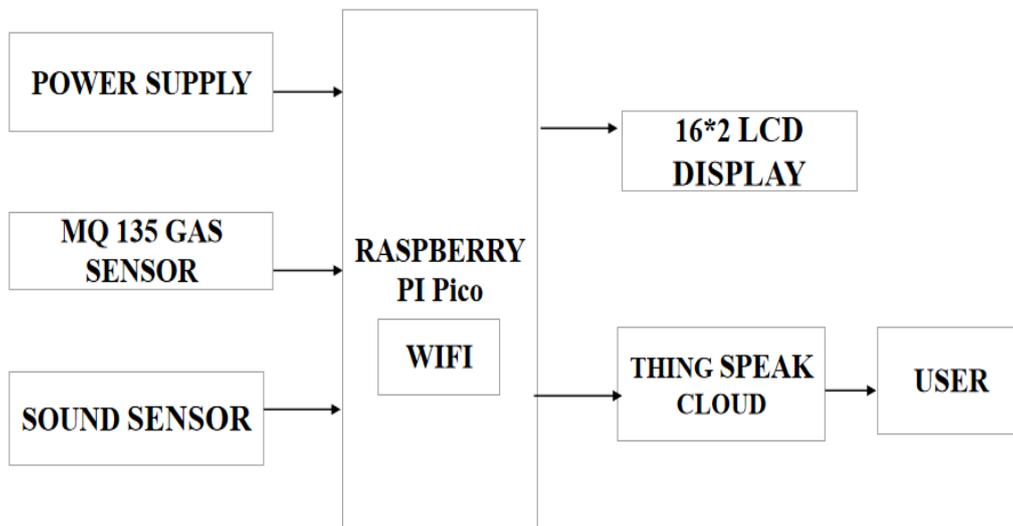


Fig.1 Block Diagram of Proposed System

III. HARDWARE REQUIREMENTS

3.1. RASPBERRY PI Pico:

A microcontroller board based on the Raspberry Pi RP2040 microcontroller chip is called the Raspberry Pi Pico. The Raspberry Pi Pico and its incredible community will accompany you every step of the way whether you want to learn the tiny Python programming language, start using physical computing, or develop a hardware project. It is capable of controlling a wide range of devices in the project, including Lights, buttons, sensors, motors, and even additional microcontrollers.

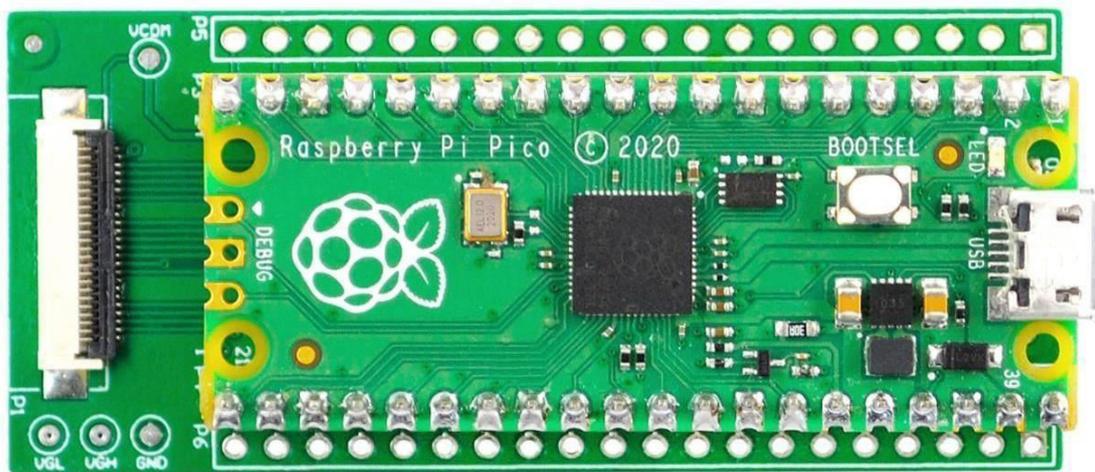


Fig.2 Raspberry Pi Pico

3.2. MQ135 GAS SENSOR:

The MQ-135 Gas Sensors are utilised in air quality control devices and are appropriate for NH₃, NO_x, alcohol, benzene, smoke, and CO₂ detection or measurement. When you simply need to detect one particular gas, the MQ-135 sensor module's built-in Digital Pin allows it to function without the aid of a microcontroller.



Fig.4. MQ135 Gas Sensor

3.3 SOUND SENSOR:

A sound sensor, sometimes known as an acoustic sensor, is a device that converts sound waves into electric impulses by measuring their depth. The sound sensor has a built-in capacitive microphone, a height detector, and an extremely sensitive sound amplifier. A sound sensor is a component that recognises sound waves by their intensity and transforms them into electrical impulses.

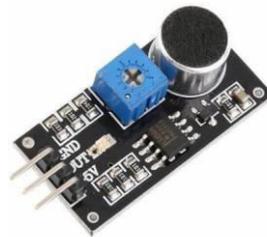


Fig.5.Sound Sensor

3.4 16*2 LCD DISPLAY:

An electronic display module called an LCD (Liquid Crystal Display) screen has several uses. A fairly basic module that is frequently used in many different devices and circuits is a 16x2 LCD display. These modules are preferred over multi-segment LEDs with seven segments and additional segments. The explanations are that LCDs are inexpensive, easily programmable, and have no restrictions on showing unusual and even customised characters, animations, and other content. On a 16x2 LCD, there are 2 lines that can each display 16 characters.

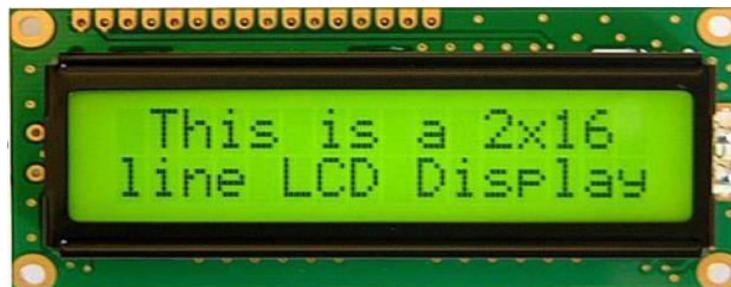


Fig.6.16*2 LCD Display

3.5 ESP8266 WI-FI MODULE:

With a complete TCP/IP stack and a microprocessor, the ESP8266 is a low-cost Wi-Fi microchip. The ESP-01 module, produced by a third-party company Ai-Thinker, originally caught the eye of Western manufacturers in August 2014 with the chip. The Espressif system created the ESP8266, a system on chip (SoC) microcontroller with Wi-Fi capabilities. It is primarily utilised for the creation of embedded Internet of Things (IoT) apps.

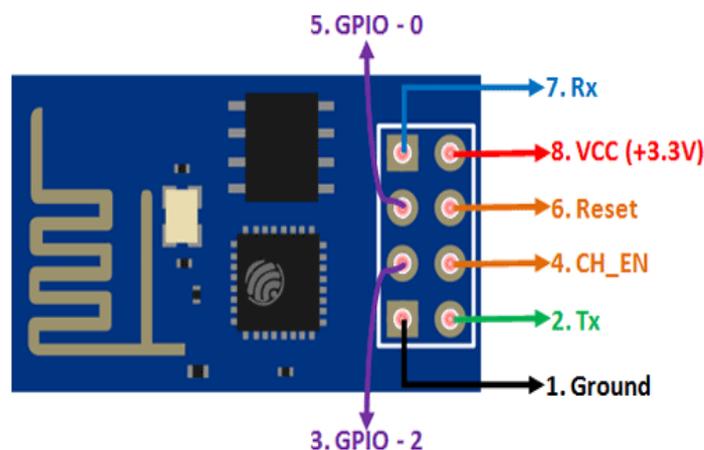


Fig.7.16*2 ESP8266 Wi-Fi Module

IV.SOFTWARE SETUP

Operating system:

Operating systems based on the Linux kernel are mainly used by the Raspberry Pi Pico. The ARM11 is built on ARM version 6, which is no longer supported by a number of widely used Linux distributions, including Bunt. RASPBIAN is the setup manager for the Raspberry Pi. RASPBIAN includes the following OS. Raspbian (recommended) - Maintained independently of the Foundation; built on ARM hard-float -Debian 7 "Wheezy" architecture port. Raspbian was compiled for the Raspberry Pi's ARMv6 instruction set, making it functional but slower than other operating systems. It offers a few freely downloadable, pre-compiled deb software programmes. A SD card of at least 2 GB in size is needed, but a card of at least 4 GB in size is preferred. A Pi Store is available for trading applications. In contrast to the standard Raspbian, which is focused on desktop computers, the "Raspbian Server Edition (RSEv2.4)" is a stripped-down version with additional software programmes bundled.

Then a code window will appear, as seen in figure.8. The Run and Run Module options should then be selected.

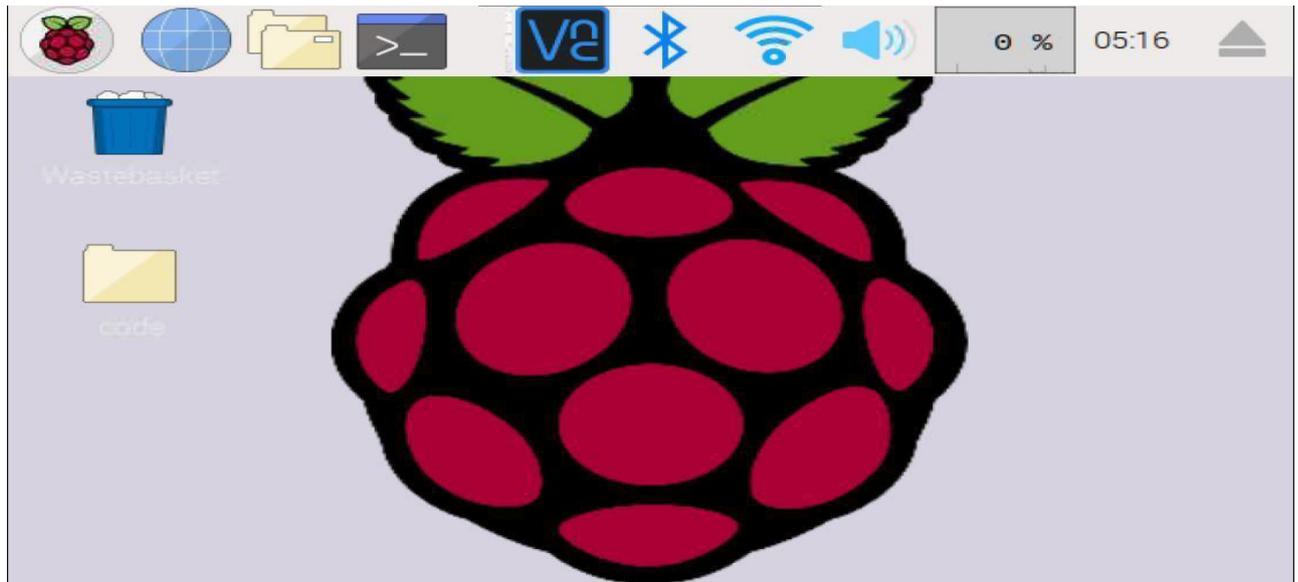


Fig.8.RaspBerrypi Pico Setup

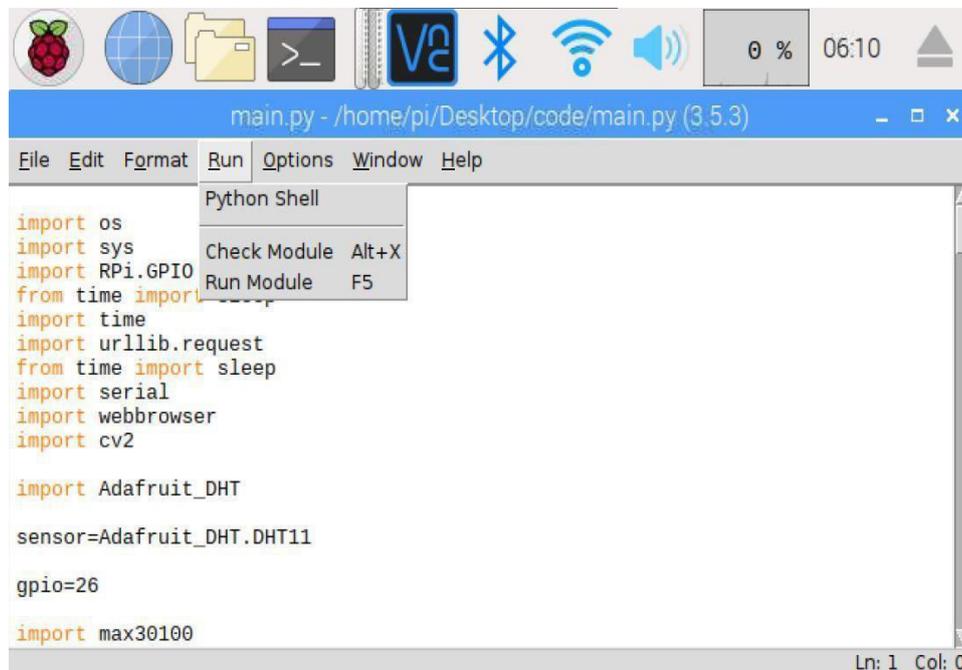


Fig.9.Code Window

Then, as seen in figure 8, a code window will popup. Next, choose the Run option, followed by the Run Module option.

V.RESULT & CONCLUSION

This test has measured the levels of CO, LPG, and smoke as well as the ambient temperature and humidity at various times at intervals of 1 minute in various traffic condition areas. Calculations are made for the average temperature, humidity, and smoke, LPG, and CO concentrations. To compare the typical levels of smoke, LPG, and carbon monoxide. The smartphone app "Air Prop" may also evaluate the average temperature and humidity as well as the levels of smoke, LPG, and carbon monoxide on a specified date. By utilising the date picker, users may also examine more detailed information about the selected date. The real-time IoT-based air quality monitoring system has been designed successfully and achieved the stated goals. The ambient air quality sensor system, which can measure temperature, humidity, and pollutant gas concentrations, has been created with an alert and warning indication. The programme has successfully been constructed and is able to track real-time measurements of temperature, humidity, and pollutant gas concentration. Moreover, a website or iOS app has been created to see historical data and track real-time environmental air quality data. The database's accessibility for subsequent analysis and monitoring purposes is this paper's primary contribution.

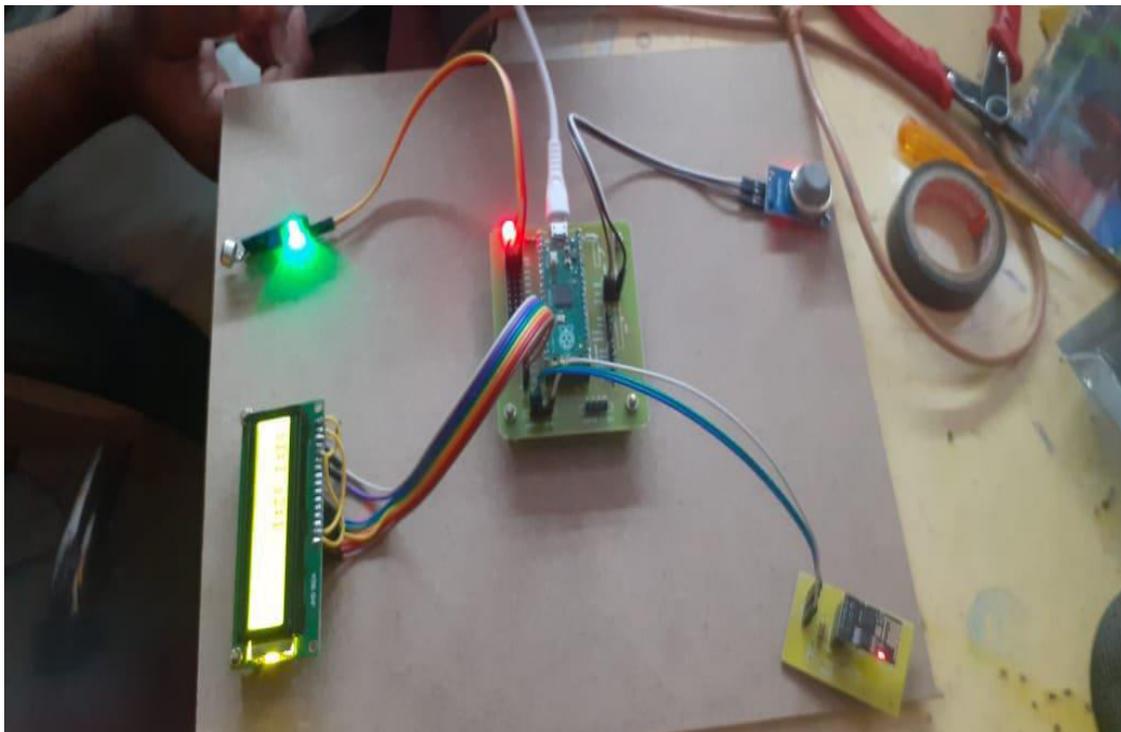


Fig.8.Final Output



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