Arduino Based Air Quality Monitoring Iot Project

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Abstract- *Air quality is a very important health factor. However, there are situations where humans are exposed to poisonous air that has a high concentration of Volatile Organic compounds (VOC), especially indoor environments such as car cabins and offices. It is important for a better health to breathe clean air that has low concentrations of VOC.*

This paper presents a design for a system that aims to notify the residents of VOC's concentration level in both indoor and outdoor environments. The system is Arduino-based, it will monitor and detect total volatile organic compounds (TVOC) and then inform the user via wireless communication system of its levels to take actions.

Keywords- Arduino UNO, MQ135 Gas sensor, 16X2 LCD, Breadboard, 10K potentiometer,1K ohm registers, 220 ohm register

I. INTRODUCTION

Air quality is a major concern for everyone. A survey conducted on 300 people from Saudi Arabia and Oman showed that 64% of people spend between 2-3 hours a day in car's cabins. However, most people do not pay attention of air quality in such places. There are many evidences supporting that the indoor environment's air can be a lot more polluted than the outdoor air even in large industrialized cities [1]. Volatile Organic Compounds (VOC) could be found in concentrated quantities indoor and outdoor. These compounds are very harmful and are easily absorbed by the skin and mucous membranes. That will cause damage to the human's organs and the metabolic system. In addition, some VOCs are related with Sick Building Syndrome (SBS). The United States Environmental Protection Agency (U.S.EPA) estimated that VOC levels in indoor air are typically 5-10 times higher than VOC levels of outdoor air [2]. According to World Health Organization (WHO), polluted air indoor is a major threat to human's health [3].

CONSTRUCTION

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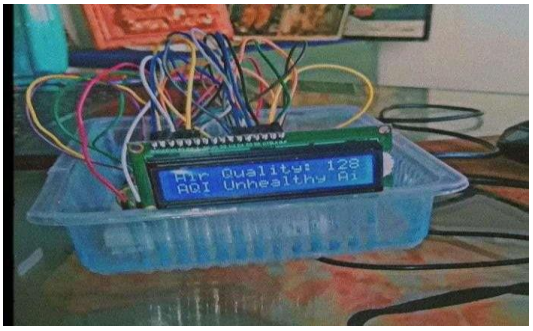


Hardware Technology:

1) Arduino:

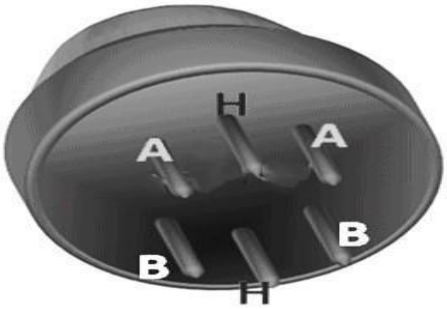
The Arduino Uno is an open-source microcontroller board designed for beginners and hobbyists. It is equipped with digital and analog input/output pins that allow users to connect various sensors and actuators to the board. This enables users to build interactive projects, like robots, temperature monitors, and light shows. The board is programmed using the user-friendly Arduino IDE software and can be powered by a USB cable or battery, making it convenient for portable projects. Released in
2010, the

Arduino Uno is the successor of the Arduino Duemilanove and remains the most popular board in the Arduino family due to its ease of use, affordability, and vast community support.

2) MQ135 Gas sensor:

A device that is used to detect or measure or monitor the gases like ammonia, benzene, sulfur, carbon dioxide, smoke, and other harmful gases are called as an air quality gas sensor. The MQ135 air quality sensor, which belongs to the series of MQ gas sensors, is widely used to detect harmful gases, and smoke in the fresh air. This article gives a brief description of how to measure and detect gases by using an MQ135 air quality sensor.

The alternatives for the MQ135 air quality sensor/detector are MQ-2 (methane, LPG, butane, and smoke), MQ-3 (alcohol, smoke, and ethanol), MQ-4 (CNG gas and methane), MQ-5 (natural gas, and LPG), MQ-6 (butane and LPG), MQ-7 (CO), MQ-8 (Hydrogen), MQ-9 (CO, and flammable gases), MQ131 (ozone), MQ136 (Hydrogen sulfide gas), MQ137 (ammonia), MQ138 (benzene, alcohol, propane, toluene, formaldehyde gas, and hydrogen), MQ214 (methane, and natural gas), MQ303A (alcohol, smoke, Ethanol), MQ306A (LPG and butane), MQ307A(CO), MQ309A(CO and flammable gas).

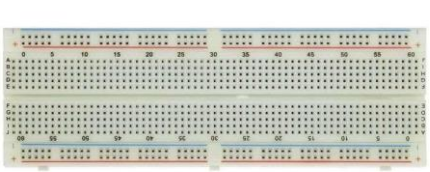


3) 16X2 LCD:

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

4) Breadboard:

Jump wires, also known as DuPont wires, are electrical wires with connectors on each end that enable the creation of circuits without soldering. They are frequently used on breadboards, which have slots specifically designed to receive these connectors. Different connector types exist, including solid tips for breadboards and crocodile clips for temporary connections to various components. Additionally, jump wires come in various sizes and colors, aiding in distinguishing different signals within a circuit.



5) 10K potentiometer:

Potentiometers have some basic working principles. A pot has two terminals as input (marked as red and green in the figure). The input voltage is applied – across the resistor. Then the output voltage is measured. It comes out as the difference between the fixed and moving contact. The wiper plays a vital role here. While optimizing the output voltage- as per the need, the wiper needs to be moved- along the resistive element. Moving the slider helps to balance the galvanometer in case of measuring the emf of a cell. Now it acts as a voltage divider as it continuously produces variable voltage. Based on this concept, a pot measures electrical emf.

6) 1K ohm registers:

The humble resistor is the lowest-cost component in our maker box, but it is also incredibly useful. Previously, we've shown how to use resistors in a project, but the focus of this guide is understanding the colored bands that wrap around the center of the resistor. These resistor color codes tell us exactly how many Ohms of current each unit handles.

How do we read a resistor color code? Why are some resistor color codes four bands and others five bands? What resistor do I need for an LED? We answer all of these questions and give you the tools to quickly calculate the correct resistor for all of your projects.

Software Technology:

1) Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog.

II. RESULT, CONCLUSION AND FUTURE SCOPE

Result:

Experiments were run on two platforms for validation purposes; on an edge device and a PC. The PC had an Intel processor Core i7 6700 @3.4 GHz quad- system will trigger an alarm to alert the driver. This could involve sounds (buzzer), vibrations (motor), or lights (LEDs).core with hyper-threading enabled alongside 16 GB of DDR4 RAM. The edge device was a Raspberry Pi 4 Model B (referred to afterwards as RP4) with 4 GB LPDDR4-3200 SDRAM. The devices were dedicated only to run the experiments with no other workloads. As stated, the input was shifted by 24 h to adapt for a time series prediction, but only for the algorithms that were not used as base models in NARX hybrid methods. The same shifted input was supplied to six methods: LSTM, RF, ET, GB, XGB, and XGBRF.

Conclusion:

An anti-sleep alarm system using an Arduino and eye sensor shows promise for detecting drowsiness and alerting drivers. While the potential to integrate vehicle control for critical situations exists, the associated safety and legal complexities require extreme caution and expert guidance.

Addressing sensor accuracy, false positives, and gradual braking mechanisms are crucial for a reliable system. Remember, prioritize safety by starting with simpler functionalities and progressing gradually with expert consultation, especially when dealing with vehicle control.

Future Scope:

A project to build an anti-sleep alarm system using Arduino has great potential to improve driver safety.
Here's a breakdown of the scope:

Main functionalities:

- Drowsiness detection: This will be the core function achieved by the eye sensor mounted on the driver's spectacles. The sensor will monitor eye blinks and detect extended closure (e.g., exceeding 3 seconds) as an indicator of drowsiness.
- Alarm triggering: When drowsiness is detected, the
- Vehicle deactivation (optional): This is a more advanced feature that involves interfacing with the vehicle's control systems. If the driver remains unresponsive to the alarm after a set time, the system could initiate actions like slowing down, activating hazard lights, or even coming to a controlled stop.

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