iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** IV **Month of publication:** April 2024

DOI: https://doi.org/10.22214/ijraset.2024.61038

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

Pollution Based Ventilation Control in Automobiles

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Abstract: ***Growing worries about air pollution have driven new approaches to confined spaces, such autos. The proposed system includes air quality sensors, ventilation control mechanisms, and data processing units inside the car. It continuously monitors the amount of CO2 and other air pollutants. It emits warning sounds and turns on automated window ventilation when thresholds are passed. Furthermore, the system proposes closing windows in high-pollution areas and detects foul odors to put on air fresheners accordingly. Alerts are sent by push notifications, sirens that sound, or dashboard lights. This innovation combines sophisticated ventilation control, real-time monitoring, and alerts to make driving safer while prioritizing both environmental sustainability and passenger safety.***

Keywords: Environmental sustainability, ventilation control techniques, air quality sensors, and air pollution.

I. INTRODUCTION

The creation of an effective air quality monitoring and control system within automobiles is required due to the negative effects of poor in-car air quality, which include health problems, drowsiness, and impaired driver decision-making. In order to address this issue, the Pollution-based Ventilation Control in Automobiles project installs an intelligent ventilation system that makes dynamic adjustments in response to current pollution levels. This cutting-edge system combines sophisticated sensor technology that is strategically positioned both inside and outside the vehicle to continuously monitor levels of various pollutants, with the primary goal of enhancing the health and comfort of vehicle occupants while also contributing to environmental sustainability. An advanced onboard computer with algorithms built in to dynamically control the vehicle's ventilation system processes real-time data from these sensors.

In addition, the initiative prioritizes user comfort and control by providing simple-to-use dashboard interfaces for monitoring and manual overrides in vehicles. The initiative intends to limit overall emissions during high pollution events by lowering the intake of polluted external air, addressing issues related to both individual health and the ecosystem as a whole. An important advancement in the development of in-car air quality management is the Pollution-based Ventilation Control in Automobiles project. Its all-encompassing strategy raises the bar for in-car air quality by integrating cutting-edge sensor technology, clever algorithms, and intuitive user interfaces. The project seeks to promote environmental responsibility and occupant well-being in order to contribute to cleaner and healthier air within cars while promoting environmentally friendly modes of transportation.

II. BLOCK DIAGRAM AND FIGURES

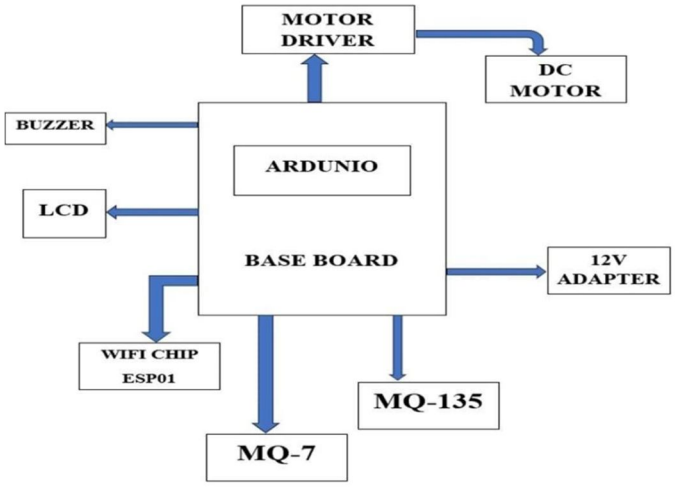


Figure 1. Block Diagram

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Figure 2. MQ-7 Sensor

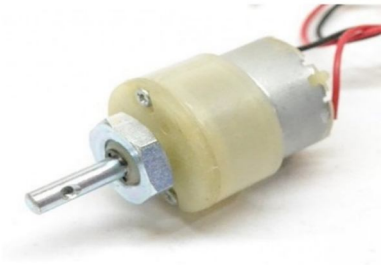


Figure 3. Geared DC Motor



Figure 4. LCD Display



Figure 5. MQ-135 Sensor



Figure 6. Relay

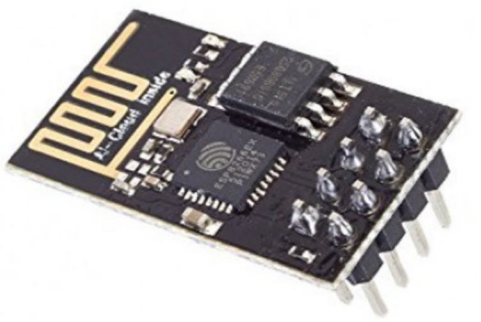


Figure 7. Wi-Fi Chip

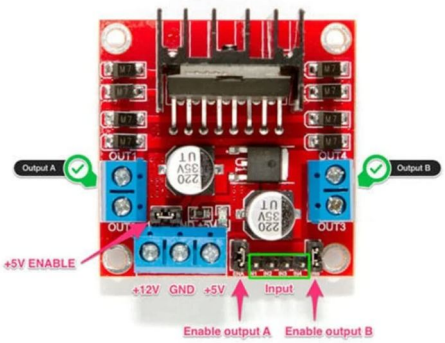


Figure 8. Motor Drive Board



Figure 9. Buzzer



Figure 10. Arduino UNO

III. PROPOSED WORK

The MQ135 and MQ7 gas sensors are the focal point of the simple yet efficient operating concept of the pollution monitoring and ventilation control system. These sensors are interfaced with an Arduino microcontroller. With an emphasis on the Air Quality Index (AQI) and carbon monoxide (CO) levels, these sensors assess a variety of air contaminants. When the system first boots up, it signals "Pollution based Ventilation Control" on a 16x2 LCD that is connected. The sensors continuously measure analog signals from the ambient air, converting them into analytically useful data and AQI and CO levels based on the analog readings.

The system has an alarm mechanism to guarantee user safety and awareness that is activated by specified threshold levels for CO and AQI. The LCD panel updates to show a hazardous air warning message and an auditory warning is activated through a buzzer when critical thresholds are exceeded. The LCD is used to regulate the system's ventilation control feature, which represents the opening and closing of a ventilation mechanism. When air quality improves and the ventilation symbol opens, it indicates a safe atmosphere. When hazardous conditions arise, the ventilation symbol closes, suggesting the need to minimize airflow.

This mechanism offers clear and quick feedback on the quality of the air. An efficient ventilation management system and pollution monitoring are enhanced by alarms, real-time monitoring, and a visual depiction of ventilation status. The system provides users with a proactive means of preserving healthy air quality in their surroundings, hence augmenting overall safety and well-being, through the integration of various components.

IV. RESULTS

Hardware and software are successfully integrated in the ventilation control and pollution monitoring system. It uses MQ135 and MQ7 gas sensors to provide precise readings and sets off alarms for dangerous air situations. In order to reduce dangers, it quickly responded during testing by turning on air fresheners, modifying airflow, and activating alarms. The system keeps running smoothly under typical circumstances, guaranteeing the comfort of the passengers. It effortlessly establishes real-time monitoring connections with external servers through a Pollution Monitoring Dashboard, providing insightful data on trends in air quality. Even though controlled testing shows promise, real-world implementation requires attention to practical issues including sensor calibration and interoperability with various vehicle models. Performance optimization and resolving deployment issues require constant improvement and user input.

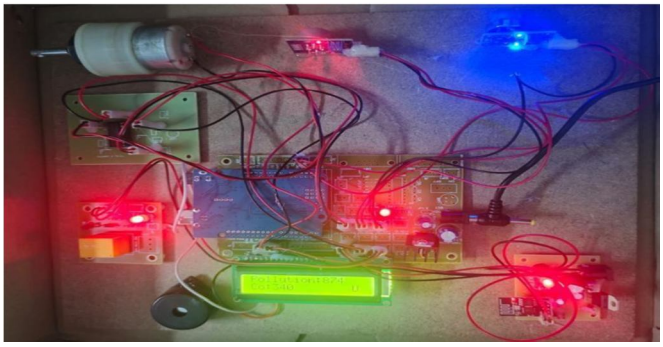


Figure 11. Display showing the hazardous condition.

As can be seen in figure 11 above, the system quickly mitigated excessive pollution levels by turning on air fresheners, changing ventilation, and activating alarms. By warning residents and lowering health risks related to extended exposure to contaminants, this proactive method guarantees better indoor air quality.



Figure 12. Display showing the safe condition.

Figure 12 shows that the system did not set off any alarms, saved energy, or made sure the windows closed while the air inside was safe.

S.No	Pollution_Mq135	CO_Mq7	Date
1	571	209	2024-03-23 11:13:19
2	528	214	2024-03-23 11:12:30
3	562	208	2024-03-23 11:10:54
4	565	104	2024-03-23 11:10:02
5	601	206	2024-03-23 11:09:27
6	588	206	2024-03-23 11:07:15
7	598	164	2024-03-23 11:06:40
8	874	340	2024-02-02 22:07:12
9	496	85	2024-02-02 15:10:11
10	509	89	2024-02-02 15:07:52
11	526	94	2024-02-02 15:05:34
12	549	101	2024-02-02 15:03:16
13	585	114	2024-02-02 15:00:57
14	618	215	2024-02-02 15:00:12
15	810	121	2024-02-02 14:59:17

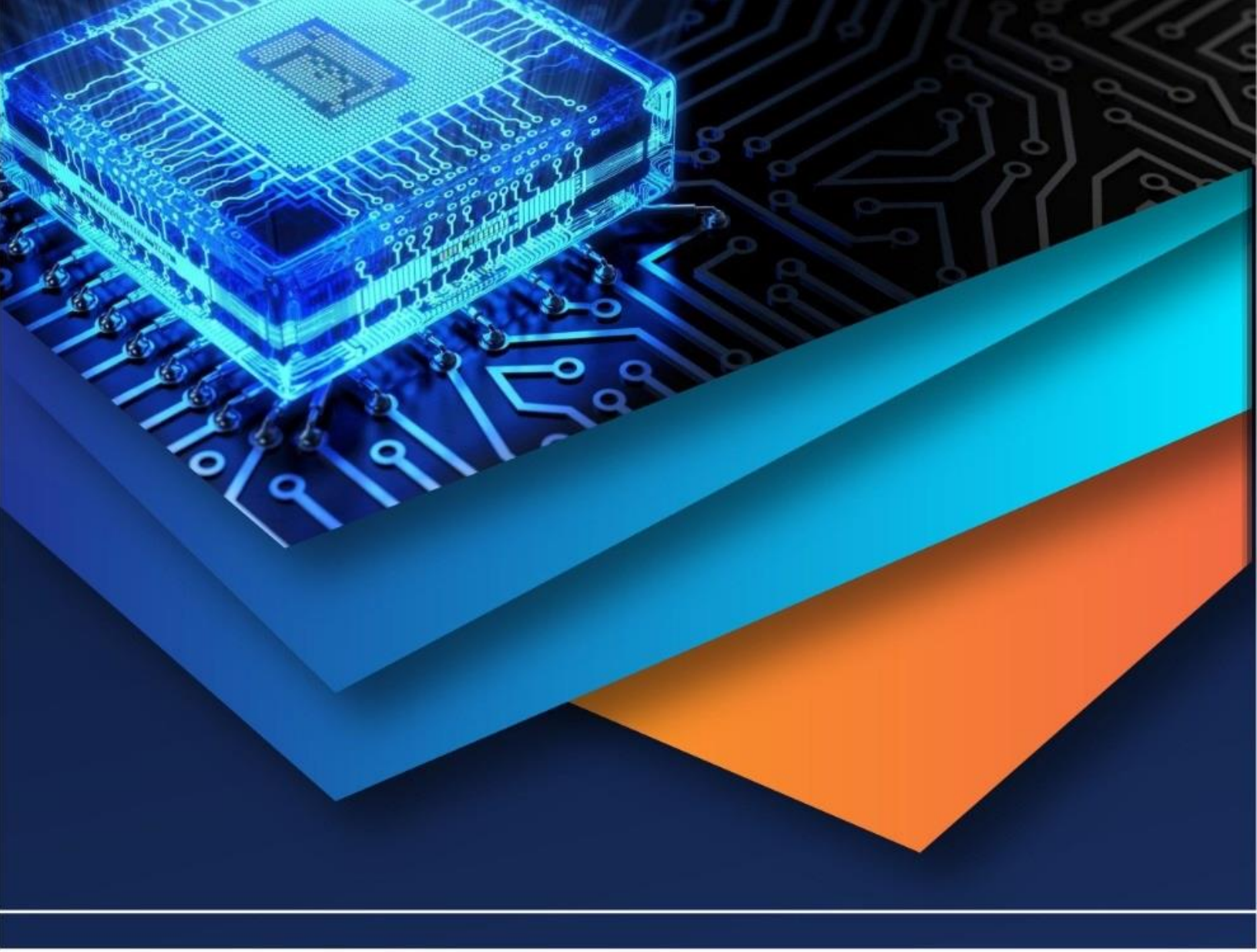
Figure 13. Pollution Monitoring Dashboard

V. CONCLUSION

In conclusion, a major development in the fight against poor in-car air quality is the vehicle ventilation control system and air quality monitoring system. The system effectively accomplishes its goals by monitoring and identifying contaminants, improving passenger comfort and health, and continuously evaluating the quality of the air. It is outfitted with accurate sensors and clever management systems that make sure that when pollution levels rise over predetermined levels, appropriate action is taken right away, guaranteeing prompt notifications and remediation. Positive user feedback and its flexibility to adapt to a variety of vehicles show that, despite some obstacles, it has the potential to be widely adopted. The system supports resilient cities and sustainable mobility by combining with current infrastructure and developing technology. Future improvements should result in increased efficacy and better air quality control, making driving safer for everyone.

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