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# Bad Odour Detector System

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**Abstract:** *This Arduino program is designed for measuring ammonia (NH3) gas concentrations using an MQ gas sensor. It reads the sensor's analog output connected to pin A0, calculates the sensor resistance (Rs) based on the voltage drop across the sensor and predefined resistor values. The program compares the sensor resistance to a reference resistance (Ro) to calculate the ratio (Rs/Ro), which is used to estimate the gas concentration. Using a formula derived from the sensor's calibration data (slope 'm' and intercept 'b'), the program calculates the ammonia concentration in parts per million (ppm).The data, including the ammonia concentration and corresponding voltage, is displayed on a 16x2 LCD screen. The program also features a safety mechanism: if the ammonia concentration exceeds a set threshold (50 ppm), a buzzer and a fan are activated as an alert system. Otherwise, the buzzer and fan remain off. This process continuously repeats, providing real-time monitoring of ammonia levels.*

**Keywords:** Ammonia (NH3), Gas Sensor, MQ Sensor, Arduino, Microcontroller

## I. INTRODUCTION

Prioritizing safety, the Ammonia Detector is designed for early detection of harmful ammonia gas. This compact device, equipped with an LCD, buzzer, CPU fan, and an Arduino microcontroller, offers reliable monitoring in various settings, from industrial facilities to agricultural operations[1-10].

Sensors within the detector continuously analyze the surrounding atmosphere for ammonia. The Arduino microcontroller processes sensor data, controlling the LCD display, buzzer, and CPU fan. The LCD provides real-time ammonia concentration levels, enabling users to quickly assess the environment[11-21].

In case of elevated ammonia levels, the buzzer sounds an alarm, prompting immediate action. The integrated CPU fan maintains optimal operating temperatures, ensuring the system's longevity. The Ammonia Detector provides a cost-effective and user-friendly solution for enhancing safety and peace of mind across diverse applications[22-32]

We've all been there – a lingering, unpleasant smell that disrupts our comfort, productivity, or even our health. From overflowing bins to industrial emissions, bad odours are more than just an annoyance; they can be a sign of underlying problems. But what if technology could step in, not just to mask the smells, but to detect and pinpoint their source? This is the promise of the emerging field of "Bad Odour Detector Systems."[33-43]

These systems are not about simply smelling better; they're about leveraging advanced sensors and data analysis to create a more informed and controlled environment. Imagine a world where leaks are identified by their unique smell before they cause major damage, or where air quality is constantly monitored for harmful pollutants. This is the vision powering the development of smart odor detection.

At their core, bad odour detection systems employ a range of sophisticated technologies:

- **Electronic Noses (e-Noses):** These devices mimic the human olfactory system, using array of chemical sensors to detect and identify different volatile organic compounds (VOCs) present in the air. Each odour has a unique "fingerprint" that can be recognized by the e-nose.
- **Gas Chromatography-Mass Spectrometry (GC-MS):** A highly precise laboratory technique that separates and identifies individual chemicals, providing a detailed understanding of the composition of even complex odours.
- **Machine Learning and AI:** These technologies are crucial for analyzing the vast amounts of data collected by sensors. AI algorithms can be trained to recognize specific odour profiles, distinguish between similar smells, and even predict the source and severity of odours.

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- **Cloud Connectivity and Data Platforms:** These allow for real-time monitoring, data logging, and remote access to information, enabling quick responses to odour events.

The potential applications of bad odour detection systems are vast and span across numerous industries and aspects of daily life:

- **Environmental Monitoring:** Detecting air and water pollution, identifying illegal dumping, and tracking sources of industrial odours[44-54].
- **Industrial Safety:** Monitoring for leaks of hazardous gases, ensuring worker safety in factories and chemical plants[55-65].
- **Food and Beverage Industry:** Identifying spoilage in food products, ensuring consistent quality, and detecting contamination[66-75].
- **Waste Management:** Optimizing waste collection routes and schedules, identifying overflowing bins and potential health hazards[11].
- **Agriculture:** Monitoring animal health through the detection of specific biomarkers in their breath and environment, optimizing fertilizer usage, and early detection of fruit ripening and spoilage[76].
- **Healthcare:** Diagnosing certain illnesses through specific breath odours, which can provide a non-invasive diagnostic tool[12-25].
- **Smart Homes and Buildings:** Monitoring indoor air quality, detecting mould growth, and identifying potential sources of unpleasant odours[50].

Despite the promising potential, several challenges remain:

- **Cost and Complexity:** Developing and deploying sophisticated odor detection systems can be expensive and require specialized expertise.
- **Sensor Sensitivity and Specificity:** Ensuring that sensors can accurately and reliably identify target odours in complex environments is crucial[77].
- **Data Analysis and Interpretation:** Processing vast amounts of sensor data requires advanced algorithms and robust data analysis infrastructure[78-82].
- **Public Perception:** Addressing concerns about privacy and potential misuse of odor data is vital for widespread adoption[83 -87].

## II. LITERATURE REVIEW: AMMONIA DETECTION SYSTEMS

This section reviews existing research on ammonia gas detection technologies:

- **Ammonia Gas Detection Technologies:** A diverse range of technologies have been explored for ammonia detection, including electrochemical, semiconductor, optical, and metal oxide sensors. Each technology exhibits unique advantages and limitations, with critical factors such as sensitivity, selectivity, response time, and cost influencing their suitability for specific applications.
- **Portable Ammonia Detectors:** Driven by the increasing demand for portable and handheld devices, research has focused on miniaturizing sensors and integrating them with electronic components. Studies have demonstrated the feasibility of developing compact systems utilizing sensor arrays and microcontrollers for real-time ammonia level monitoring in various environments.
- **Wireless Sensor Networks:** Wireless Sensor Networks (WSNs) have emerged as a promising approach for environmental monitoring, including ammonia detection. These networks facilitate real-time, remote monitoring of multiple locations, providing valuable data for environmental assessment, air quality management, and industrial safety applications.
- **Sensor Calibration and Drift Compensation:** Ensuring the accuracy and reliability of ammonia detection systems requires robust calibration techniques and effective drift compensation algorithms. By calibrating sensors against known ammonia concentrations and employing mathematical models to address sensor drift, the accuracy and longevity of detection systems can be significantly improved (Sanjeev C Mhamane et.al) [6]
- **Internet of Things (IoT) Integration:** The integration of IoT technologies with ammonia detection systems has unlocked new avenues for data collection, analysis, and decision-making. By connecting sensors to cloud-

based platforms, users can access real-time monitoring data, receive alerts, and leverage predictive analytics for proactive management of ammonia-related risks. (Sanjeev C Mhamane et.al) [7,12-35]

## III. PROBLEM IDENTIFIED

Train bathrooms frequently experience hygiene issues due to high usage and potentially inadequate cleaning schedules. Ammonia buildup can contribute to unpleasant odors and unsanitary conditions, negatively impacting the overall passenger experience.

- **Health Risks:** Ammonia accumulation in train bathrooms poses potential health risks to both passengers and staff. Exposure to elevated ammonia vapor can irritate the respiratory system and eyes, leading to discomfort and potential health complications.
- **Safety Hazards:** Ammonia leaks or high concentrations within confined train bathrooms create significant safety hazards. Without a reliable detection system, passengers and staff may remain unaware of these risks until the situation becomes critical.
- **Maintenance Efficiency:** Traditional cleaning schedules may not be sufficiently efficient or responsive to promptly address cleanliness issues. An ammonia detection system that alerts staff to the need for cleaning can significantly improve maintenance efficiency and ensure timely interventions.
- **Passenger Satisfaction:** Clean and well-maintained train facilities are paramount for passenger satisfaction and loyalty. By effectively addressing hygiene concerns, particularly in bathrooms, railway operators can enhance the overall travel experience and improve their service reputation.

## IV. SYSTEM OVERVIEW: HARDWARE AND SOFTWARE COMPONENTS AND BLOCK DIAGRAM

**Software:**

The system utilizes the Arduino IDE for programming and Proteus for simulation and circuit design.

**Hardware:**

Key hardware components include an Arduino Uno microcontroller, an MQ135 gas sensor, a 16x2 LCD display, a buzzer, a breadboard, and a GSM module for communication.

**SOFTWARE used**

1.Arduino Uno
2.Proteus

**Hardware used**

1.16 x 2 Led display
2.MQ135 Sensor
3.Arduino Uno
4.Buzzer
5. Bread Board
6. GSM Module

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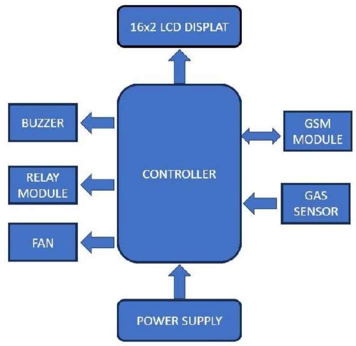


Fig.1 Block Diagram

The Fig.1 Shows the Block Diagram of this Work. This diagram illustrates a system for monitoring and controlling gas levels. A gas sensor detects gas concentrations. The sensor data is processed by a controller. The controller activates a buzzer, LCD display, and sends alerts via GSM module. It also controls a relay to activate a fan for ventilation. The system is powered by a power supply.

## V. SYSTEM DESIGN

The following Fig 2 shows the circuit connection of this Work.

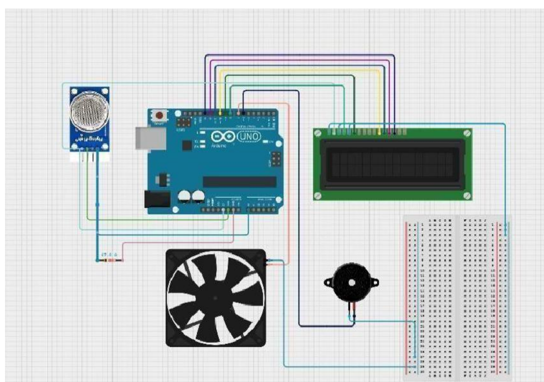

Fig.2 Circuit Diagram

**Sensor Monitoring:**

The ammonia sensor continuously monitors the air quality within the train bathroom. Strategically positioned for optimal ammonia gas detection, the sensor generates an analog output signal to the Arduino microcontroller, proportional to the ambient ammonia concentration.

**Data Processing:**

The Arduino receives and processes the analog data from the ammonia sensor. This raw data is then converted into a value representing the actual ammonia concentration. Subsequently, the Arduino compares this calculated concentration against a pre-defined threshold value.

**Threshold Detection:**

The system utilizes a pre-defined threshold value programmed into the Arduino. For instance, if the measured ammonia concentration exceeds 300 (sensor units), it is classified as "high." When the sensor detects ammonia levels surpassing this threshold, the system initiates a cleaning requirement alert.

**Alert Mechanism:**

Local Alerts: A buzzer or flashing lights are activated within the bathroom to immediately alert passengers and staff of elevated ammonia levels and the need for cleaning.

SMS Notification: Upon exceeding the threshold, the Arduino triggers the GSM module to send an SMS alert to a designated phone number (e.g., maintenance staff or control center). The SMS message typically follows this format: "ALERT: Ammonia levels high in Train Bathroom [Train No.]. Immediate cleaning required. Please attend ASAP." This SMS notification ensures that relevant personnel are promptly informed, regardless of their proximity to the train.

**LCD Display Feedback:**

An LCD display positioned outside the bathroom provides real-time status updates:

"Bathroom Clean": Displayed when ammonia levels are low, indicating a clean and safe environment.

"Needs Cleaning!": Displayed when ammonia levels exceed the threshold, signaling the need for immediate cleaning.

**Automatic Ventilation (Optional):**

In instances where high ammonia levels are detected, an optional ventilation fan can be activated. This fan assists in dispersing the ammonia gas, improving the overall air quality within the bathroom.

Example Scenarios:

**Scenario 1: Normal Conditions (Low Ammonia Levels):** The ammonia sensor continuously monitors the bathroom air. With ammonia concentration remaining below the threshold (e.g., 100), the Arduino detects no anomalies. The LCD Display shows "Bathroom Clean." No SMS alert is sent, and the ventilation fan remains inactive.

**Scenario 2: High Ammonia Levels Detected:** The ammonia sensor detects elevated ammonia levels within the bathroom (e.g., exceeding 300). The Arduino compares this sensor data to the threshold. Since the concentration surpasses the threshold, the Arduino initiates the following actions:

- Activates the Buzzer/Flashing Lights within the bathroom.
- Sends an SMS Alert via the GSM module to the designated maintenance team.
- The LCD Display outside the bathroom displays "Needs Cleaning!"
- The ventilation fan (if installed) is activated to improve air quality.

**Scenario 3: After Cleaning (Ammonia Levels Return to Normal):** Following cleaning efforts, ammonia levels within the bathroom decrease and fall below the threshold. The ammonia sensor detects this reduced concentration. The Arduino processes the new data, recognizing that the ammonia concentration is now within acceptable limits. The LCD Display updates to "Bathroom Clean." The buzzer/flashing lights and the ventilation fan (if active) are deactivated.

## VI. CONCLUSION

The system successfully integrates sensor technology, data processing, and communication modules to provide real-time monitoring of ammonia levels in train bathrooms. This approach enables proactive maintenance, improves hygiene standards, and ultimately contributes to a more comfortable and hygienic travel experience for passengers. Bad odour detector systems represent a significant step forward in our ability to understand and interact with our environment. As the technology matures and costs decrease, we can expect to see these systems become more prevalent in various sectors. From ensuring our safety and health to optimizing resource management, the ability to "smell" with precision is set to transform the way we approach a wide range of challenges, making our world a cleaner, healthier, and more pleasant place. The future isn't just about seeing and hearing; it's also about smelling with intelligence.

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