Ahsanullah University of Science and Technology
Department of Computer Science and Engineering

CSE 3118 Microprocessor and Microcontroller Lab

Spring 2024

Project Proposal

Air and Noise Pollution Detection System

Lab Group: A_2

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Submission Date: 9 March, 2025

Introduction

The Air and Noise Pollution Detection System is designed to track air quality and noise levels in real time. It uses sensors to measure pollutants and sound levels, sending the data to the Blynk app for easy monitoring. If pollution levels exceed safe limits, the system activates visual alarms (lights) to alert users. This helps raise awareness and ensures a safer and healthier environment.

1 Sustainability in multidisciplinary context

1.1 Sustainability Context

"Air and Noise Pollution Detection System" contributes to sustainability by addressing critical environmental and health challenges in urban and industrial areas:

- **Environmental Protection:** By monitoring air quality and noise levels in real time, your system helps mitigate pollution.
- **Good Health and Well-being:** Reducing exposure to harmful air pollutants and noise levels protects public health.
- **Sustainable Cities and Communities:** Promoting livable urban environments through pollution management.
- **Promoting Awareness:** Through visual alerts (blinking lights) and integration with the Blynk app, the system educates individuals and organizations about pollution levels, encouraging behavior changes for environmental stewardship.
- **Energy Efficiency:** The use of compact sensors (MQ-135 for gas detection and a sound sensor LM-393) ensures minimal energy consumption, making it a low-power solution suitable for widespread deployment.
- **Pollution Mitigation:** Early detection and alerts allow authorities and individuals to take preventive measures, such as reducing industrial emissions or controlling noise in residential areas.

1.2 Multidisciplinary Context

Computer Science Software Engineering

1. Our project involves programming (Arduino language) to control and process sensor data.
2. Knowledge of data handling, cloud computing, and app development is necessary to process and display pollution levels effectively.

Environmental Science

1. Our project focuses on detecting air and noise pollution, which are major environmental concerns.
2. Understanding pollutants, their sources, and their impact on health helps in defining sensor thresholds and interpreting data meaningfully.

Health Public Safety

1. Noise and air pollution have direct health impacts (respiratory issues, stress, hearing loss).
2. Knowledge of WHO air quality standards and noise exposure limits helps in setting meaningful thresholds for alerts.

Business Economics

1. If your system is deployed in industries or smart cities, you need to understand cost-effectiveness, feasibility, and market demand for sustainable deployment.
2. Funding, budgeting, and scalability matter when developing real-world solutions.

2 Safety Norms and Environmental Impact of Air and Noise Pollution Detection System

2.1 Safety Norms

1. **Electrical Safety:**
   Use properly insulated wiring to prevent short circuits or electrical hazards. Ensure all components, including sensors and microcontrollers, are securely mounted and protected from environmental elements like moisture or dust. Operate the system within recommended voltage and current limits to prevent overheating or equipment damage.

2. **Sensor Handling and Placement:**
   Avoid direct exposure of the MQ-135 gas sensor to corrosive gases or liquids that might damage it. Install sensors in well-ventilated areas to provide accurate readings without interference. Position the sound sensor at a safe distance from high-decibel industrial machinery to avoid overload or damage.

3. **Light Alert Safety:**
   Use LEDs or lights with safe intensity levels to prevent discomfort or harm to individuals exposed to the alerts for long durations. Ensure the alert light is mounted in a non-obstructive location to avoid visual interference.

4. **Emergency Response Readiness:**
   Set thresholds for critical pollution levels and test alert mechanisms regularly to ensure they function effectively. Include instructions for users on how to respond to alerts (e.g., evacuating areas with high pollution).

2.2 Environmental Impact :

1. **Pollution Monitoring and Mitigation:**

   By providing real-time air and noise pollution data, the system enables proactive measures to reduce harmful emissions and noise levels, improving environmental quality.

2. **Promoting Sustainable Practices:**

   Educating individuals and industries about their environmental footprint encourages actions like reducing vehicle usage or optimizing industrial processes.

3. **Reduced Public Health Risks:**

   Alerting individuals to dangerous pollution levels can reduce exposure to harmful air pollutants and excessive noise, lowering risks of respiratory, cardiovascular, and hearing-related health issues.

4. **Energy Efficiency:**

   The system's low-power components and efficient Wi-Fi integration minimize energy consumption, reducing its carbon footprint. Scalability for Green Initiatives:

   The system can be deployed in smart cities, contributing to data-driven environmental policies and urban planning.

3 Final Budget Plan

Sl. No	Component	Price (BDT)
(a)	Arduino UNO (x1)	700
(b)	ESP-01 8266 Wi-Fi module (x2)	200
(c)	Jumper Wires (as required)	120
(d)	16x2 Serial LCD Module (x1)	240
(e)	Sound Sensor LM-393 (x1)	170
(f)	Gas Sensor MQ-135 (x1)	170
(g)	LED Light (x4)	20 (BDT 5 each)
(h)	Breadboard (x4)	150
(i)	3.7V li-ion Battery (x1)	300
Total Budget (final.)		**2720**

Table 1: Component List with updated final Prices

Design :

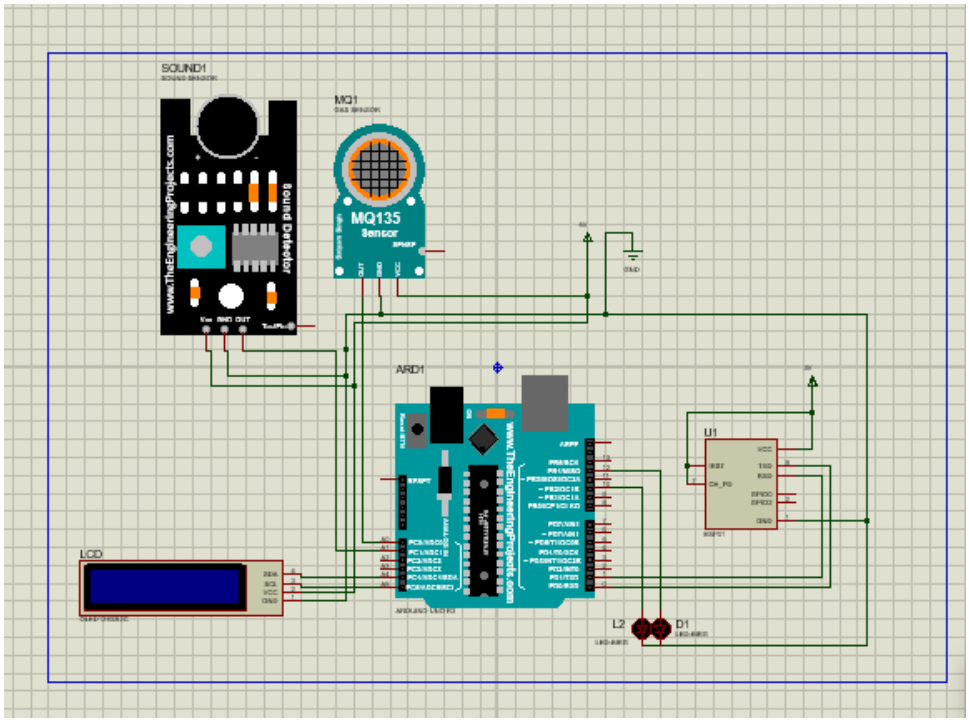

Figure 1: Final Proteus Design of our project

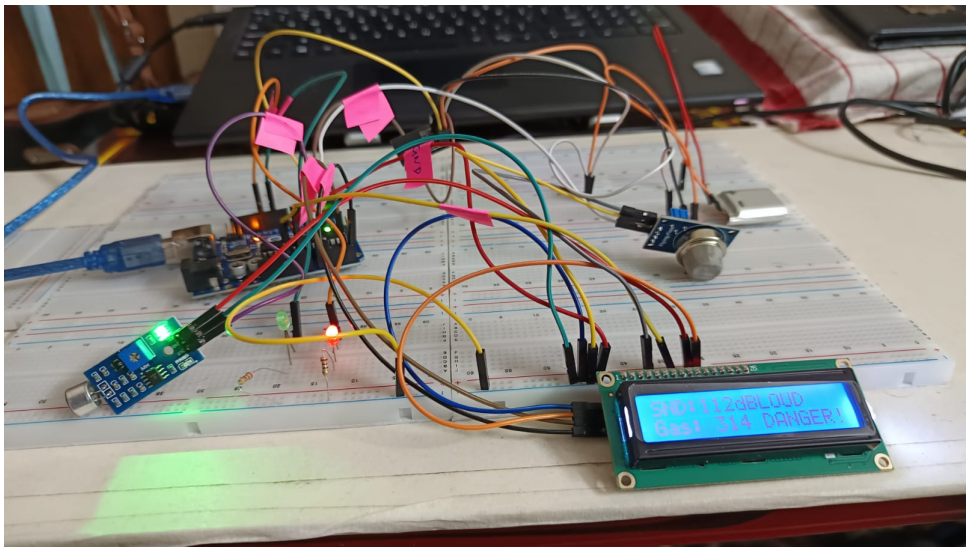

Figure 2: Final image of our project

4 Possible stakeholders or beneficiaries of the project

1. **Environmental Agencies:**

   Governmental and non-governmental organizations responsible for monitoring and managing environmental quality can use the system to track air and noise pollution levels in real-time and enforce regulations.

2. **Urban Planners:**

   City planners can leverage the data from the system to design sustainable urban layouts, such as creating low-pollution zones or optimizing traffic flow to reduce noise and emissions.

3. **Local Communities and Residents:**

Individuals living in highly polluted or industrial areas can benefit from real-time alerts about unsafe air and noise levels, enabling them to take necessary precautions.

4. **Public Health Organizations:**

   Health authorities can utilize data from the system to correlate pollution levels with health trends and plan interventions or awareness campaigns.

5. **Emergency Services:**

   Real-time alerts can help emergency response teams prioritize areas with critical pollution levels, ensuring timely action.

6. **IoT Developers and Innovators:**

   The project can inspire developers to build upon its functionality, improving IoT-based environmental monitoring systems for broader applications.

5 Social and Economical issues and mitigation strategy

5.1 Social Issues :

1. **Lack of Public Awareness:**

   Issue: Many people may not understand the importance of monitoring air and noise pollution or how it affects their health and well-being.

   Mitigation Strategy:

   Conduct awareness campaigns in local communities and schools about the effects of pollution. Provide user-friendly interfaces on mobile apps to make the data easy to understand.

2. **Resistance to Technology Adoption:**

   Issue: Some individuals or institutions may hesitate to adopt the system due to unfamiliarity with IoT-based solutions.

   Mitigation Strategy:

   Offer training sessions or demonstrations to showcase the system's benefits and usability. Provide technical support for setup and troubleshooting.

3. **Data Privacy Concerns:**

   Issue: People may be concerned about how their data (e.g., location or environmental data) is being used or shared.

   Mitigation Strategy: Implement strong data encryption and ensure compliance with privacy laws. Clearly communicate how the data will be used and ensure anonymity where possible.

4. **False Alarms and Public Panic:**

   Issue: Inaccurate readings or overly sensitive sensors may cause unnecessary alerts, leading to panic or misinformation.

   Mitigation Strategy: Regularly calibrate sensors to ensure accurate readings. Clearly communicate threshold levels and provide context for alerts to prevent overreaction.

5.2 Economic Issues :

1. **High Initial Costs:**

   Issue: The cost of sensors, microcontrollers, and other hardware might make the system unaffordable for small businesses or low-income areas.
   Mitigation Strategy: Use cost-effective components without compromising quality. Offer subsidies or incentives through government or environmental grants.

2. **Maintenance and Operational Costs:**

   Issue: Regular maintenance of sensors and components could be financially challenging for long-term operations.
   Mitigation Strategy: Design modular systems for easy replacement of parts. Use energy-efficient components to minimize operational costs.

3. **Economic Inequality:**

   Issue: The system might be accessible only to privileged communities, leaving underprivileged areas exposed to pollution without monitoring or alerts.
   Mitigation Strategy: Partner with NGOs or local governments to deploy the system in underserved areas. Provide a low-cost version of the system for broader accessibility.

4. **Impact on Businesses:**

   Issue: Businesses contributing to pollution may face financial penalties or higher operating costs due to monitored data.
   Mitigation Strategy: Collaborate with businesses to find pollution-reducing solutions. Incentivize eco-friendly practices, such as tax rebates for pollution control initiatives.

Conclusion

In conclusion, the Air and Noise Pollution Detection System successfully developed a real-time monitoring solution to address pollution challenges. By utilizing MQ-135 gas and sound sensors, along with a Wi-Fi-enabled ESP-01 module, the system effectively detects harmful air quality and excessive noise levels. It provides real-time data and alerts through the Blynk app, ensuring accessibility and timely action. Users benefit from its user-friendly interface and reliable notifications, promoting awareness and proactive responses.
Overall, the system represents a significant step forward in leveraging technology to improve environmental monitoring and public health.

Related Works

Several research studies and projects have contributed to the development of air and noise pollution detection systems. The following works highlight some significant advancements:

- **Air and Noise Pollution Monitoring System:** A project on IoT-based air and noise pollution monitoring using gas and sound sensor. Available at: Saiful Islam JNu.
- **Noise and Air Pollution Monitoring in Urban Areas:** Research focusing on real-time noise level monitoring and mitigation strategies. Read more: appliedgis.net.
- **Arduino-Based Real Time Air Quality and Pollution Monitoring System:** A project implementing energy-efficient sensors for continuous air quality monitoring. Link: ResearchGate.