EN1190 Engineering Design Project

Project progress report

DAMD Designers

ReFreshmate

(Automated air renewal and air fresher system)

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Abstract….

The proposed project, Refreshmate, aims to develop an automated air renewal and air freshener system for public toilets and washrooms. The system will be designed to improve the air quality in public bathrooms by automatically detecting and eliminating unpleasant odors. The proposed system includes a gas sensor, an exhaust fan, and an air freshener connected via a microcontrollers and powered by electricity and batteries. The system will detect and eliminate unpleasant odors quickly and effectively, while also circulating fresh air and providing a pleasant aroma. The layout procedure will involve careful selection of components, testing, and generation to ensure the most appropriate performance. Our final product will be easy to install, operate, maintain with minimal energy consumption, and be environmentally friendly.

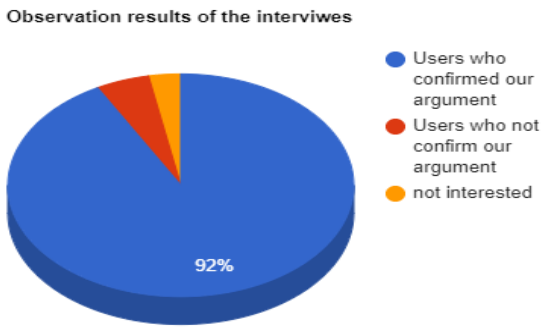
Problem Description Relevance, and Justification

Problem description and relevance:

- Public toilets are notorious for creating unpleasant odors due to the accumulation of bacteria and other pollutants. These odors not only make users uncomfortable, but also pose health risks by spreading airborne infections.
- Currently, there are few solutions to this problem. The most common method is to use mechanical air fresheners or manual deodorants. However, these solutions are often ineffective and short-lived, requiring frequent replacement and maintenance.
- Improving air quality and promoting healthy hygiene practices in public toilets and washrooms may have a positive effect on public health and well-being. By decreasing the spread of harmful bacteria and viruses, those spaces may be made safer and more welcoming for all users.

Problem justification:

Our team conducted informal interviews with users of public toilets to gather information about their experiences with air quality and odors. From these conversations, the team observed that unpleasant odors were a common problem that negatively impacted users' experiences and sometimes caused them to avoid using public washrooms altogether. Observation results can be represented in following pie chart.



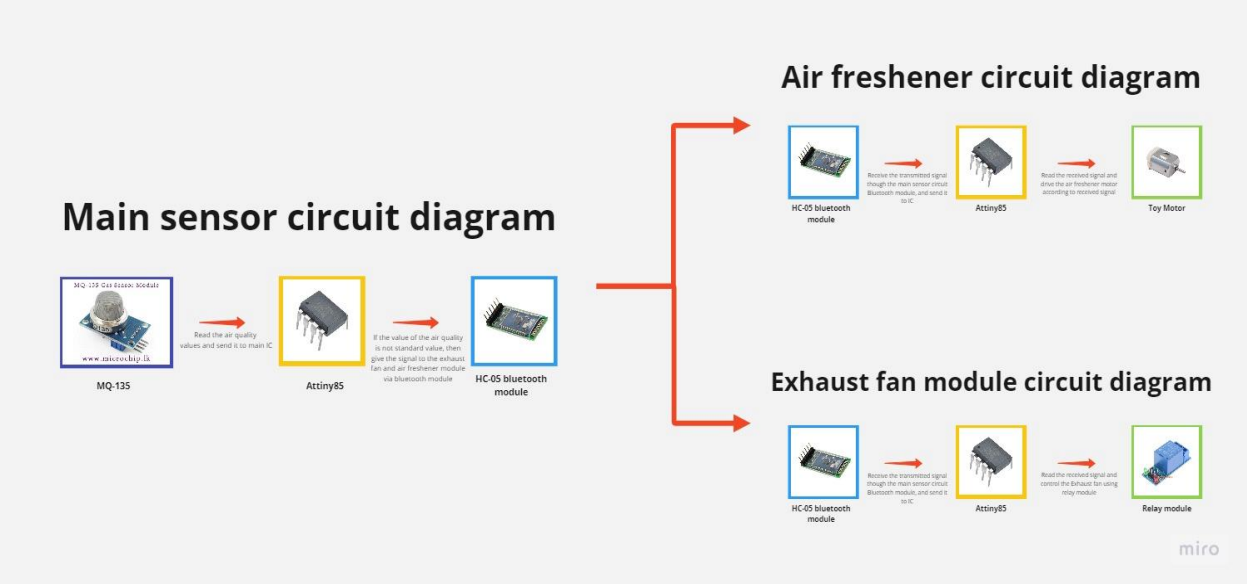
Technical Specifications

We have planned to demonstrate a scaled down version of the original application. Based on the experience of the small-scale demonstration, we can describe the practical toilet conditions that the proposed system aims to address. The following chart shows the components required for our scaled down version of the final product.

Characteristics	Specifications
Ammonia sensor	MQ135
Exhaust fan	AC Cooling fan 8025
Air freshener	Airwick Air Freshener Spray 475ml
DC power supply	9V batteries × 3
Bluetooth modules	HC-05 × 3
Enclosure box	1m × 1m × 1m cardboard box
Microcontroller	ATTiny85 × 3
Motor	130 Toy Motor
Crystal	Crystal Oscillator 16MHz
Switch	Push button switches On/Off rocket switches
Other required components	Resistors Capacitors Connecting wires Relay module Transistors Diodes LEDs

Product Architecture with Technological Viability

Block diagram of systems



Technical viability

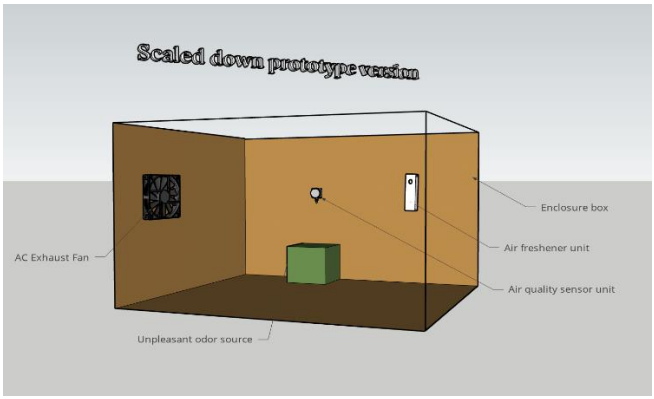
- **Main sensor circuit unit:** Our selected gas sensor (MQ135) should be able to detect common pollutants and changes quickly and accurately in air quality, triggering the exhaust fan and air purifier to maintain optimal air quality and deliver a pleasant aroma. The sensor will be able to send signals to the microcontroller block. So, if the value of the air quality is not within the standard value range, it gives a signal to the exhaust fan and the air freshener module through the Bluetooth module. This system is powered by a 9V battery.

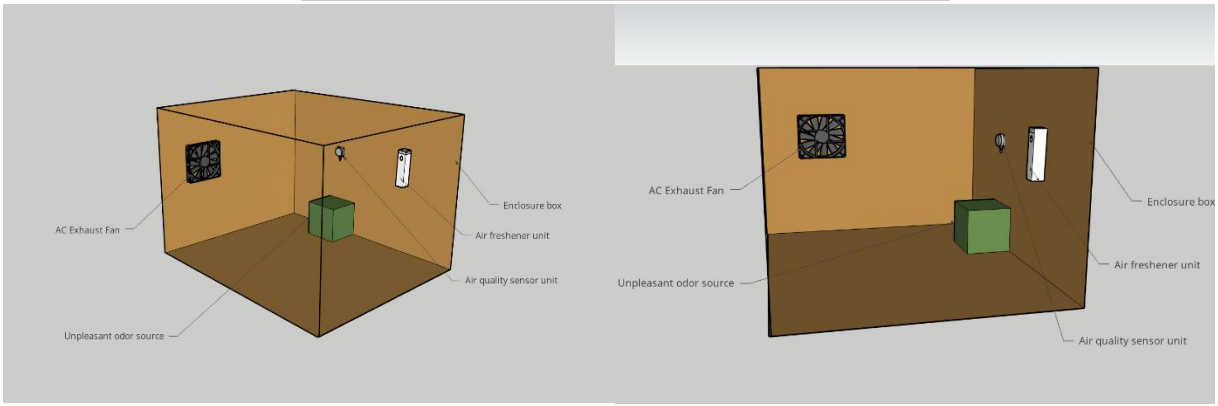
- **Use of an exhaust fan module to circulate fresh air**: The AC fan will be activated by the microcontroller using a relay module when Bluetooth module receives the transmitted signal through the main sensor circuit.

- **Air Freshener system:** This system will include an air freshener that releases a pleasant scent after the air has been refreshed by the exhaust fan. When transmitted signal received to the Bluetooth module from the main sensor and it sends that signal to an IC. The IC will read the received signal and drive the toy motor in the air freshener according to the received signal. This system is powered by a 9V battery.

Initial and Finalized Sketches of the Product.

Initial sketches





Finalized product architecture of the real application.

Marketing, Sales, and Aftercare

Marketing targets

- According to our informal interviews, the main sources of being uncomfortable for prospective customers are unpleasant odors, poor air quality, and hygiene concerns in public restrooms. Our product addresses these issues by automatically detecting and eliminating unpleasant odors and continuously circulating fresh air, providing a pleasant and hygienic restroom experience.
- Before introducing our automated air renewal and fresher system to the market, we conducted extensive market research to understand the target market and identify potential customers. Our research showed that public toilets and washrooms in high traffic areas such as shopping malls, bus and train stations, schools, universities, and hospitals are the most suitable locations for our product.

Pricing Strategy and Sales

- While taking into consideration the specific characteristics and advantages of the product, our pricing strategy is expected to stay competitive.
- Our pricing strategy is based on the cost of materials, labor, and manufacturing, as well as a competitive analysis of similar products. We will price our product competitively while still maintaining a reasonable profit margin. Because we are planning to make this product in a large-scale cost of manufacturing can be reduced by a large margin.
- We project that we can sell our product at a price point of Rs.8000/= to Rs.12000/= per unit.

Aftercare

- To ensure customer satisfaction and, we have planned to develop an after-sale service plan that includes a warranty period, technical support, and repair services. We will offer a one-year warranty on all parts and labor. If any issues arise during the warranty period, customers can contact our technical support team for assistance. If a product needs repair after the warranty period, we will offer repair services at a reasonable cost.
- To ensure the system is functioning at optimal capacity, regular maintenance check-ups are planned to be scheduled every 6 months.
- Regularly collecting and analyzing customer feedback highlights areas for development and making sure that our product's after-sale support strategy satisfies consumer needs.

Limitations, Future Works and Conclusion

Limitations and future works

- It is important to consider some limitations despite the significant potential of the proposed system. For example, the proposed system may not be suitable for very large public bathrooms without significant modifications such as installing more sensors and air freshener modules, as the unit's capacity may not be sufficient. The effectiveness of the system may be limited as it is designed to detect common pollutants like ammonia, carbon dioxide, alcohol, Benzene, smoke, and particulate matter but may not have the ability to detect all potential pollutants. Hence, further research and development may be required to expand the system's pollutant detection capabilities. Additionally, further research and development may be required to expand the system's pollutant detection capabilities.

- Expanding the proposed system to include additional features like real-time monitoring of air quality and remote-control capabilities is a potential area for future work. The system could also be integrated with smart building systems to enable even greater efficiency and control. In addition, the promotion of improved indoor air quality and hygiene could be extended to other settings such as homes and offices by adapting the proposed system.

Conclusion

The proposed system is scalable and can be installed in different types of public toilets. It will provide numerous benefits, including improved air quality, better hygiene, and enhanced user experience for public toilet users. It is cost-effective and environmentally friendly as it will consume minimal energy. The project's technical feasibility, product architecture, initial and finalized sketches of the product enclosures, marketing, sales, and after-sale service considerations, and project budget with bill of quantities have been discussed in detail. The task allocation among the group members has also been outlined.

Overall, this project has the potential to greatly benefit both individuals and communities, and we look forward to exploring its implementation in greater detail. While there may be limitations and challenges, we believe that with the right approach, this project can achieve its goals and make a positive impact on public health and hygiene. Further work will be needed to optimize the system and make it widely accessible.

Project Budget, and Task Allocation

Bill Of Quantities

Item	Quantity	Unit price Rs. /=	Total Rs/=
MQ135 Ammonia sensor	1	540	540
Exhaust fan	1	780	780
Airwick Air Freshener Spray 450ml	1	740	740
Attiny85 microcontrollers	3	835	2505
Hc-05 Bluetooth module	3	500	1500
9V Batteries	3	160	480
130 Toy Motor	1	50	50
Crystal Oscillator 16MHz	1	40	40
Relay Module	1	180	180
PCB design cost	3	500	1500
Enclosure material cost	-	1000 per 100g	1000
Resisters, Capacitors, connecting wires and other	-	-	200
Total budget			**Rs. 9515/=**

Task Allocation among group members

Roles and responsibilities of each group member. To ensure efficient and effective project execution, we have assigned specific roles and responsibilities to each group member.

L.H.H. Maduwantha	Solid works and System development
D.M.P.C. Dissanayaka	Altium and PCB Designing
U.M.Y.B. Alahakoon	Microcontroller programming and Research planning
D.M.T.K.R. Dassanayake	3D Modeling, Enclosure Designing and Market Research Management

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