AEROSAUR - SMART AIR PURIFIER WITH AIR QUALITY MONITORING SYSTEM

Software Development Proposal

Abstract

An IoT-based air purifier integrated with an air quality monitoring system that retrieves and predicts the air quality of a specific location, with real-time data collected from sensors and displayed through software platforms.

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Executive Summary

Air pollution contributes significantly to cardiovascular and respiratory complications (Bălă, 2021) and recent studies have shown that indoor environments are also affected (Bluyssen, 2013). While many air purifiers exist in the market, including smart models, most only measure PM2.5 levels. However, air quality is also influenced by PM10, VOCs, and gases such as CO_2 and NH_3 (Sá, et al, 2022). Especially, for “Smart” Air Purifier, where its “Smart” features are limited to mobile access and rigid logic systems. Furthermore, limited communication between device and user often results in unnecessary energy consumption, since users cannot accurately determine when the air is sufficiently clean.

This project, AEROSAUR, seeks to address these gaps by developing a Smart Air Purifier integrated with an Air Monitoring System, capable of reporting the Air Quality Index (AQI) and additional pollutants in real time as well as additionally powered by a much more flexible “Smart” system.

1.) Project Overview

General Objective:

To develop AEROSAUR, a IoT-based Smart Air Purifier with an integrated Air Quality Monitoring System where users can receive information related to the air quality of a venue that they are going to at a specific time using Web 3.0 as well as being able to set up a venue themselves that other users can visit.

Specific Objectives:

1.) To improve the user's indoor air quality.
2.) To inform users about the air quality related changes that the device brought as well as to monitor any abnormal readings that may be of concern to the user.
3.) To provide insights to users about how they utilize the device.
4.) To provide means for users to remotely control the device.

System Features:

1.) **Air Purifier**. The main feature of the system. Increases the air quality of the device's venue via filtering airborne particles that may be inhaled by the user.
2.) **Reading presentation.** The system's mobile application allows the user to perceive the readings of the air monitoring system as well as the changes brought by the air purifier.
3.) **Remote device control.** The users are able to control the device remotely such as fan power toggle, air monitoring toggle, smart mode etc via Wi-fi or Bluetooth.
4.) **Data Insights.** The user can see summaries of data that they might be interested in including but not limited to: timely usage, mode control, and periodical reading levels.
5.) **Single Sign O**n. Users are able to use existing accounts on supported platforms like Google and Meta to create an account and log in to the application.
6.) **Account Management**. Users are able to manage information related to their.
7.) **Device Binding.** Devices are bound to accounts.

8.) **Smart Mode.** The speed of the fan can automatically adjust based on the decisions of the flexible smart system.

2.) Statement of the Problem

Air Pollution is one of the most prevalent causes of cardiovascular and respiratory complications (Bălă et al., 2021) . Unfortunately, spaces in which citizens are supposed to rest are also not safe due to various studies proving that air pollution is also present within indoor spaces (Saini et al, 2021). Although there is already an abundance of Air Purifiers (AP) in the consumer's market, most models do not directly communicate with the user the effects that it changes in the environment. As such, the user can only assume that the device is doing something significant in purifying the air.

Surprisingly, this also includes models that are labelled as "Smart Air Purifiers" (SAP). Some popular models like the 'Xiaomi Smart Air Purifier' (Xiaomi, 2014) and the 'STARTKVIND Air Purifier Smart' (IKEA, 2021), that only communicates the current level of 'PM2.5' which is a quantity that corresponds to the levels of particulate matter that has a diameter of 2.5 micrometers which is a unit one-thousandth of a millimeter (mm). Although 'PM2.5' is also a factor that contributes to the Air Quality Index (AQI) , it is not the sole major contributor to health complications. Other factors such as 'PM10', Volatile Organic Compounds (VOC) and notable levels of gases such Carbon Dioxide (Co2) and Ammonia (NH_3) (Clougherty & Ocampo, 2023).

Another concern is energy usage. Due to the lack of communication mentioned previously, few models in the market communicate with the user whether or not the surrounding air is 'clean enough'. This implies that the user is not clear when to turn off

the purifier which either costs them more energy usage or a slight risk of being in a space with still slightly contaminated air.

Our project AEROSAUR, aims to solve these problems by retaining the baseline performance of modern air purifiers while integrating an Air Monitoring System (AMS) that can directly communicate with the user the current AQI as well as notable factors such as levels of ‘PM2.5’, ‘PM10’, as well as the presence of VOCs and gases that can impact the user’s health.

3.) Technical Obstacles

A device that can move air that has the following traits: 1.) Good free air power 2.) Passable levels of static pressure 3.) reasonable price is uncommon in the Market. Additionally, a Machine learning algorithm would be needed to implement the “Smart” features of the project.

4.) Industry and Market Risks

- The concept of smart air purifiers has already been around for some time. As such, multiple devices have already been known to be a staple. The edge of this product is its ability, functionality, and saving a lot of cost money. The functionality will be listed below the table for clear comparisons

Products	Function	Pricing	Drawbacks
Xiaomi Smart Air Purifier 4 Lite	● True HEPA H13 filtration ● PM2.5 CADR: 400 m³/h ● OLED touch display ● Smart app control ● Auto mode with sensors ● Quiet operation at	P. 7,999	● No manual control buttons ● No countdown timer ● Proprietary filter system ● Limited onboard settings ● Noisy at high speeds ● No pre-filter

	night ● Compact design ● Energy-efficient ● Child lock feature ● Filter replacement indicator		included ● Ionizer cannot be disabled manually ● Bright OLED display at night ● Limited coverage area ● No HEPA certification
STARKVIND AIR PURIFIER	● Dual Functionality. ● Smart Integration ● Multiple Fan Speeds ● Air Quality Sensing ● Quiet Operation ● Filter Options ● Portable Design ● Energy Efficient	P.8,999	● Limited Coverage: Effective for rooms up to 215 sq ft. ● No Air Quality Display: Lacks onboard air quality indicators. ● App Dependency: Requires IKEA Home smart app for full functionality. ● No HEPA Certification: ● No Fine Speed Control:. ● Additional Sensor Purchase: Air quality sensor sold separately. ● No Humidification:
DYSON Purifier Cool TP07	● Dual fan and air purifier functions ● Fully sealed to HEPA H13 standard ● Effective HEPA and activated	P 9,999	● High price point compared to many competitors ● Relatively slow Clean Air Delivery Rate (CADR) for its cost

	carbon filtration ● Built-in air quality sensors and real-time reporting ● Intelligent automatic sensing and adjustment ● Wi-Fi connectivity with the MyDyson app ● Remote control with magnetic storage ● Adjustable oscillation up to 350° ● Diffused mode for purification without cooling ● Night mode for quiet operation with a dimmed display ● Sleek and modern bladeless design ● Supports voice control with Amazon Alexa, Google Home, and Apple Siri ● Easy to set up and use		● Can be loud and disruptive at higher fan speeds ● Not a powerful whole-room air conditioner ● Small amount of activated carbon for odor removal ● Expensive, non-washable replacement filters ● Plastic waste from filter replacements ● Sensor accuracy has been inconsistent for some users ● Display does not turn off completely, even in Night mode
Briiv Pro 2.0	● Eco-/Sustainability-oriented design ● Low running power	P. 27, 116	● Expensive ● Not HEPA Certified ● Low Purification Capabilities ● Multiple device

	● Smart features & automation ● AI-Powered ● Aesthetic + design ● Multiple device setups		setup may be a drawback due to its price ● Users stated that the moss filters dry out on drier environments.

5.) Budgetary Risks

Most of the available options that users can consider are limited to concrete physical devices that do not have a dedicated supporting software that users can utilize as an interface which results in less-controlled management. Unlike our proposed system where the device can be controlled remotely as well as having information that can be presented in a more comprehensive manner and also increases management capabilities.

Technology Requirement

6.) Hardware

a. Device Requirements

Device	Role	Pricing
ESP32-38P-TYPE C-CP2102	Main Unit Microcontroller	P. 189.00
MQ135	Air Sensor	P. 72.00
DHT22	Temperature and Humidity Sensor	P 220.00
MOS/PID Sensor	VOC detector	P 130.00
PMS5003	Dust Sensor	P 795.00
Inline Duct Fan	Air Purifier Fan	P. 1840 - 2900
MERV Filter	Air Purifier Filter	P. 240.00

Activated Carbon Filter	Air Purifier Filter	P. 150.00

7.) Software

a. For Android:
    i.) Android OS 4.1 minimum. Oldest version supported by React-Native.
b. For IOS:
    i.) IOS 15.1 minimum. Oldest version supported by React-Native.

8.) Milestones and Reporting

a. Communication
b. Planning
c. Modeling
d. Construction
e. Deployment

Milestone	Tasks	Reporting	Days	Date
Communication	● Gather information to learn problem domain ● Define system requirements ● Build prototypes for discovery of requirements ● Prioritize requirements ● Generate and evaluate alternatives ● Review recommendations with management	To-be-agreed-upon	112 hours	To-be-agreed-upon
Planning	● Design and integrate the network ● Confirm hardware components. ● Estimate total pricing. ● Design the application architecture ● Design the user interfaces Design the system interfaces ● Design and integrate the database ● Prototype for design details ● Design and integrate		280 hours	

	system control ● Construct software components			
Modeling	● Verify and test ● Load limited data for sampling		112 hours	
Construction	● Convert data ● Train users and document the system ● Install the system ● Maintain system ● Small patches, repairs, and updates ● Enhance system ● Small upgrades or enhancements to expand system capabilities ● Larger enhancements may require separate development project		143 hours	
Deployment	● Personal training of users ● Support		24 hours	

9.) Deployment

The software will be distributed in the following manner/ s:

- Mobile application as a service

10.) Testing

The testing process shall be as follows:

- Beta testing on limited input
- Final testing on emulated input.

11.) Documentation

The document provided will be as follows:

- Software Development Proposal
- Project Manual

12.) Warranty

The project is inclusive of a 2 year warranty. Identified functions will be maintained for the time being.

13.) Support

The project is inclusive of 1 month support and oversees the first full implementation.

14.) Training

A total of 6 hours of training will be provided, which includes system setup, interface familiarization such as navigation of the setup and view modes, device registration, venue creation and joining, and interpretation of predictive results.

15.) Pricing

Our fee for seeing the project through from start to completion:

Concrete device: 6,500 PHP

Mobile Application: Free

16.) Payment Terms

Full payment must be paid upfront upon transaction.

17.) Contact Us

You can get in touch with us in any of the below ways:

- By Email: easientph@gmail
- By Phone: +63 951 683 1684

18.) References

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In any case please feel free to call us to discuss the quote, request more information or for any other reason.

We look forward to hearing from you soon!