AIR QUALITY IN ENCLOSED AREA

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Abstract

The project offers the ideas and functioning physical model of a smart air purifier system for a confined space such as a room, apartment, or office. The smart air purifier is controlled by a Wio Terminal microcontroller. The model is equipped with various sensors that are used to detect the quality of the air. The technology initiates the air filtering procedure automatically. The dust sensor readings are used by the air purification system to determine the quality of the air in the area and turn the air purifier on and off accordingly. The temperature of an air conditioner can be adjusted. A smartphone app that allows us to manually operate the air purifier and air conditioner.

Acknowledgement

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1 Introduction

1.1 Background

This invention is an automatic gadget that improves air quality and controls the atmosphere in particular scenarios, or it may be controlled manually with a smartphone. Dust is inescapable in homes, offices, and other enclosed areas. This air pollution can have a negative impact on people's health, causing sneezing and headaches. Worse, it can have a role in severe allergies and life-threatening asthma. To address this issue, an automatic gadget that improves air quality and controls the atmosphere in specific scenarios would make your life easier. We'd like to add sensors to the air purifier to make it smarter. Instead of turning on the air purifier all day, the use of a "microcontroller" and a "sensor" to work only if the presence of dust reaches a particular level of awareness. This might save a lot of electricity while also keeping the room, apartment, not only cleaning the air pollutants in the room but also monitoring the quality of the air purifier at any given moment. We also produce our product to adjust the temperature of an air conditioner. A smartphone app that we created allows us to manually operate the air purifier and air conditioner. Nowadays, air pollution is becoming more of an issue. It is one of the primary causes of climate change, and it has the potential to cause much more issues in the future.

1.2 Problem Statement

• Long-term health effects from air pollution

• Normal air purifier needs to open and close manually which can cost more electricity.

• No monitoring device to detect air quality

1.3 Objective

• The device can control the air quality via a sensor and link it with the air purifier for air improvement.

• The device can control temperature by controlling an air conditioner.

• Measure the air quality of indoor location and compare it to the air quality parameters and display in the smartphone application and Wio Terminal.

• Setting the atmosphere by using the smartphone as a remote controller.

1.4 Scope of Work

• Physical design

• Wireless connection

• IR connection

• Monitoring display

• Smartphone application

2 Background Theory and Related Work

2.1 Relevant Theory

Talking about the relevant theory of this project, in order to make this product, we discuss what tools we need to use. We are working on a smart air purifier that requires many things to make it smart. First is to build the foundation of the product, which we started by making the air purifier allow wireless connection by using Bluetooth and WiFi. We decided to use Bluetooth when the air purifier is offline and use WiFi when the air purifier is online.The Wio terminal works as a center to make air purifiers turn on and off and has the ability to control the temperature with an IR sensor. Users can also look at the status on the Wio terminal screen. This will give important information about air quality. With this theory, we can get the work done.

2.1.1 Bluetooth

A Bluetooth internet gateway allows applications to exchange data with Bluetooth devices from anywhere in the world and is a key component of any Internet of Things solution architecture that involves Bluetooth technology.Gateways use one or more approaches to support the interfacing of Bluetooth devices, and applications connected to a TCP/IP network. They each have their own merits, capabilities, and Your constraints and your requirements and priorities will help you appraise each. When

considering gateways, we identify several different types of Bluetooth devices, whose technical These capabilities require a different approach to be taken in order to be supported. They are They are not mutually exclusive, and a single gateway solution could support all of them at a suitable price. architecture.For a gateway to provide access to the various types of devices, the gateway The architecture must accommodate the particular capabilities of those devices somehow. In most cases,The devices themselves do not need to have any special capabilities that were designed in.In anticipation of their being accessed via a gateway.

2.1.2 WiFi

WiFi's proliferation has made it a necessity in everyday life.During the past two decades, technological advancements have enabled the industry to provide better user experiences with each WiFi generation while using a limited amount of unlicensed spectrum. WiFi's strengths of affordable performance, efficient operation in unlicensed spectrum, commitment to security, ease of use, self-deployment, and long-term compatibility provide a basis for fulfilling advanced connectivity use cases.The WiFi Alliance has created a number of certification programs to support a variety of advanced connectivity scenarios, including those requiring high bandwidth and low latency, while enabling increased performance, longer range, and power efficiency. This includes Internet of Things (IoT) environments ranging from the smart home to industrial and manufacturing plants.

2.1.3 IR Connection

The Infrared Data Association, often referred to as IrDA, is a nonprofit organization whose goal is to develop globally adopted specifications for infrared wireless communication.Many user scenarios are covered by Point and Shoot object push.Users will be able to transfer an object to another device by selecting the object and performing a simple operation (such as pressing a button).Close proximity to the other device is natural in this type of data exchange situation, as is pointing one device at another. The limited range and angle of IrDA-Data allows others to simultaneously perform a similar activity nearby without interference. The short-range and narrow angle of IrDA-Data provides a simple form of security and a natural ease of use.

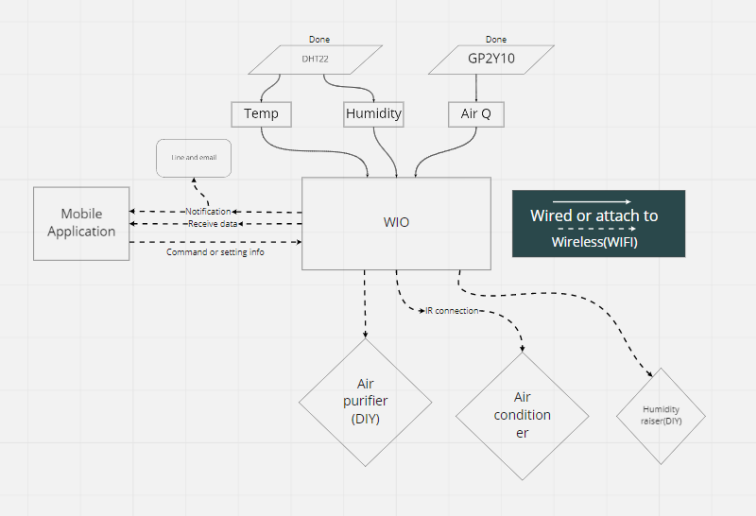

Figure 1: Structure of the device

3 Proposed work

The structure of the proposed air quality control is presented in Fig.1

3.1 Physical device

3.1.1 Wio Terminal

Our invention is intended for use in confined spaces, and the Wio Terminal serves as the primary device for displaying temperature, humidity, and air quality. We designed the Wio Terminal to be wall-mounted so that the sensor may read a constant value and produce consistent output.

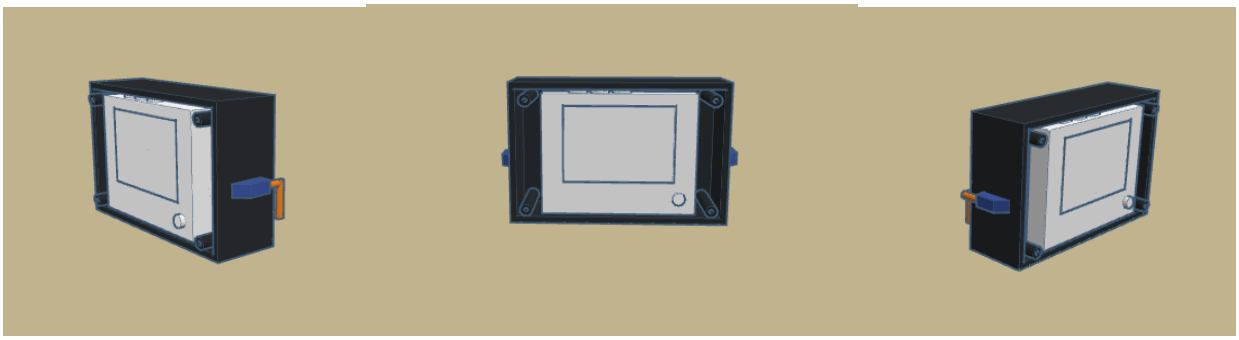

Figure 2: Visualization of the Monitoring device

3.1.2 Sensors

DHT22 / AM2302 Module Original ASAIR, all in One Humidity and Temperature Sensor Module high precision

• Sensor DHT11 Power Supply: 3-5.5V

• Measures temperature between -40 to 80 degrees Celsius +/- 0.5 degrees

• Measures air humidity between 20 - 90 • Measurement time: 2 seconds

SHARP GP2Y10 Dust Sensor PM2.5 module

An optical air quality sensor that detects dust particles This gadget contains an infrared emitting diode and a phototransistor that is placed diagonally to detect the reflected light of dust in the air. It is very effective at detecting small particles such as cigarette smoke and is widely used in air purifier systems.

The sensor consumes relatively low current (20mA max, 11mA typical). With a sensitivity of 0.5V/0.1mg/m3, the sensor's output is an analog voltage proportional to the observed dust density.

3.1.3 Air Purifier

The most efficient use of passive filters involves having airflow pass across the filter rather than being driven into its center. As a result, the filter life is extended and the air purifier's effective filtration duration is improved. In order to fulfill these two tasks, the speed and direction of the airflow must be predefined. This is achieved using a powerful fan but due to a lack of funds, we decided to construct a DIY version of the air purifier to test with the main equipment first. The intake filters and fan are the least expensive ones that could be found. The fine filter and fan are the better to catch the finer particles.

2-wire cooling fan 4x4cm 5V

- Size: 4 x 4 x 1cm
- Electrical parameters: 5V 0.25A

Dustproof Filterable 40mm Fan Filter Guard

- Size: 4.4 x 4.4 x 0.7cm

3.2 User Interface

In the user interface design, we mostly use built-in WIO Terminal functions such as the TFT LCD Library to display on LCD screen and reduce problems when we have to run a test on different devices.User interfaces have many criteria that need to be considered, such as the air quality meter, which has to display temperature, dust density, and humidity. Most importantly, we must notify the user when the danger level of dust has been reached on every page for their own safety. So we divided it all into three parts. The first is the air quality meter. The second is device setting. The third is Device Manager.The air quality meter has to display the value of temperature, dust density, and humidity.The device setting must have the functionality to adjust the temperature value and dust danger level.The Device Manager must have functionality to manually turn on or off individual external devices, such as an air conditioner or air purifier. And every page has a "leave room" button to turn everything off for the comfort of the user.

3.3 Air conditioner

Air conditioner is the procedure of removing energy and wet from the surface of the occupied area, to improve the comfort of occupants. Air conditioning may be applied in both national and technical environments. The procedure is most usually used to reach the more comfortable internal situation, typically for humans and creatures; yet, air conditioning is also

applied to cool/dehumidify areas filled with heat-producing electronic devices, such as computer servers, power amplifiers, And yet to show and keep some delicate products, such as art. Thailand is in Southeast Asia which has hot and humid environment. To solve this problem, we invented this masterpiece(mood controller) to solve this hot environment for us Thai people to enjoy our life. The air conditioner help solve this problem by producing a cool and fresh air. The word conditioner didn't come with its name only, our product helps deduce many dust particle to make the user life healthier. With all of these function and performance the mood controller can do, it is the real smart mood controller.

4 Implementation Result

4.1 Software

At first, we planned to make an application to control it directly from the user's phone, but with our limited time, we had to abandon our application project and switch to using the IoT platform. We chose the Blynk IoT platform to connect our WIO Terminal with our external equipment via wifi. We control our WIO terminal with the Blynk application on our phones.We can also control it via computer with the Blynk website.The status of the dust density, temperature, and humidity in the WIO terminal are now synced with the Blynk application.

4.2 Hardware

Using the IoT platform, we can control our external devices such as air conditioners and air purifiers. The air conditioner uses IR to transmit our device signal to the air conditioner.Our device's limit is the air conditioner brand, which for now only supports the Mitsubishi brand.But with our air purifier, we can use WiFi to connect it with our WIO Terminals.But with our high overhead costs, we have to reduce it down to a DIY demonstration of our air purifier.

4.3 Wireless connection

We can link all of our equipment via WiFi by creating a local server for our equipment and combining it with the Blynk application.We still can't connect our equipment via Bluetooth to work in offline mode.With the time we have, we decided to include it in our future plan.

5 Conclusion

5.1 Problem and Solution

The world is experiencing a pandemic right now, not only the pandemic that the world is experiencing but Thailand doesn't have a good air quality especially in places near road. We can't denied that Bangkok is one of the most traffic in the world. People living in a city with many people and cars don't really have a good environment and this can effect their health in long term. We group C9 create the smart air purifier to solve this problem. The smart air purifier itself helps filtered the air surrounding the room for a better life purpose. The smart air purifier also suits with many people life style because the user don't need to be worry that they will forget to turn on or off, the smart air purifier can turn on and off by itself depending on the air condition inside the room which this also help with the electrical fees. The smart air purifier can also be controlled with smart phone or with the built-in interface on the smart air purifier. We believe that people who use our smart air purifier will have an healthier life.

5.2 Future work

5.2.1 bluetooh

To allow the device to work in an offline mode, we usually provide a Bluetooth connection capability. so that the gadget can continue to function even if your wifi connection is dropped

5.2.2 Fan and Filter

Due to the limited budget, we used a DIY version to test the device's usability first. We will try to employ a larger fan that fits the size of the enclosed area in the future, as well as a higher-quality filter, to check the dust density and come up with the more accurate result.

5.3 IR calibrator

In order to make our product be able to connect to your choice of air conditioner we need to make the IR connection link to the choice of yours air conditioner which we must calibrate the IR connection. In the current stage of our product, the product is able to connect to air conditioner from Mitsubishi. Our future plan is to make product able to connect the air conditioner from different brand, this will make our air conditioner more full function and support many different kind of user.

5.4 Project Conclusion

Our group C9 got to something special for Engineering exploration class final project. We decide to go with hardware creation. Our group brainstorm many ideas and come up with a smart air purifier. The smart air purifier is created to do many things with either wireless and wired control. The smart air purifier can measure the temperature, dust density, and humidity, and with the word smart in its name the smart air purifier is tend to start the purify function when the surrounding air condition is poor. The smart air purifier can also control the temperature with the use of smart phone for wireless and the Wio terminal for wired control. The smart air purifier is controlled with smart phone by connecting to WiFi when it is available but when WiFi is not available, it will connect to Bluetooth. Our group C9 really put effort for this project to make this happen within the given time And plan to make it better in future

Reference

1.Wi-Fi Alliance,2021 "Discover Wi-Fi Advanced Connectivity Era"
Available at https://www.wi-fi.org/discover-wi-fi/advanced-connectivity-era

2.IrDA The Secure Wireless Link,2004 "About IrDA" Available at
http://web.archive.org/web/20040610101333/http://www.irda.org/displaycommon.cfm?an=1

3.Bryce Jeppsen,Hewlett-Packard,2000"Infrared Data Association Point and
Shoot Profile" Available at https://www.irda.org/standards/specifications

4.Martin Woolley,Bluetooth SIG,2021 "Designing and Developing Bluetooth
Internet Gateways" Availavle at https://www.bluetooth.com/bluetooth-
resources/bluetooth-internet-gateways/