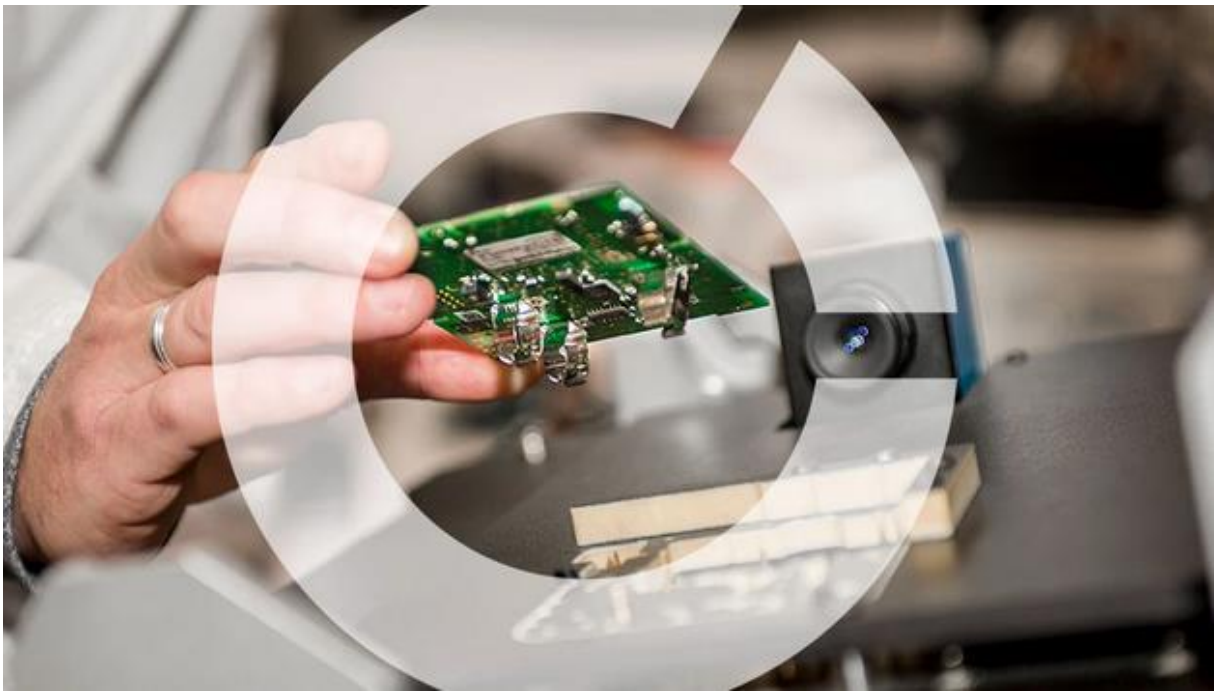

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- Farros Ramzy

Project Report Document

Indoor Climate Control

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Document history

Version	Date	Status	Author	Description	Remarks
0.1	2022-Jun-25	Draft	Victor	Creation	✓
0.2	2022-Jun-26	Draft	Farros	Adding part 2 and 3	✓
1	2022-Jun-28	Draft	Farros	Finalizing all parts for submission	✓

Terms, Abbreviations

Abbreviation	Description
Inc	Incorporated
IDE	Integrated Development Environment
UI	User Interface
MVP	Minimum Viable Product

Summary

This project has been done to the team to learn about the working product of a ventilation system by using the overall course base study in the second semester. And as for the company, this project is meant to set up a good climate control product using a wireless device as its communication control.

1. Introduction

This project is about building an indoor climate system by using some sensors that should work reliable with and without the wireless condition, both in its functionalities and also the data saving.

The reason that this project has been created is because sometimes, people demand a friendly environment to breath and live, more over when these people have to live nearby the industrial area such as the Eindhoven, or the Veldhoven city in The Netherlands. And by looking at this demand, Airios company, the custom-made electronics of residential ventilation system manufacturer, which is the joint venture company of Honeywell Inc has decided to build up some groups to do some research to create a good product for their customers in this scope.

And this project group is one of the participants of that goal for the study purposes.

And along this report, this group will explain about the project and the product that they have made inside it from a brief overview, experience, procedure, results, conclusions, and recommendations.

2. Project overview

Given the main focus by the company, this project is actually all about building a reliable air control system for a house. And some aspects that should be worked on to this air control system are:

1. This control system should be reliable to read and circulate the air of an indoor area.
2. This control system should be extendable and easy to be maintained for every program maintainers.
3. This control system should have an ability to communicate with one control app, multiple rooms, and also the internet since the data sharing for the air quality analytic purpose should happen by the maintainers any time.

Other requirements that should be applied to the product in this project is the system should be able to response an automatic and/or manual workflow that can be decided by the user, and also have the ability to keep handle the workflow of the system even when it detect an error during the process.

This project has been split into six sprints. And each sprint should take approximately 2 weeks before a progress demonstration activity. During these sprints, the project members

should do at least one task a day to make a good result on the demonstration time. And after each demonstration, the team must do a retrospective and a scrum meeting by the direction of the feedback from that demonstration to make an improvement of their product in agile way and also to be able to keep in track of their improvements until the goal of the end product achieved.

During this project, the team uses some IDE and software platforms to aid their tasks in solving and reaching the goal of the project. These supports are:

1. The Azure DevOps for the team organization and work load's repositories.
2. The GitHub for the team work load's repositories management.
3. Visual Studio for the app programming.
4. Visual Studio Code for the system programming.
5. MongoDB for the database platform.
6. Nextion IDE for the UI designing.
7. AsciiDoc for diagram designing.
8. Fritzing App for the wiring diagram designing.

And other than those support platforms, the team also use a planning document, some use-case data lists, and a system design document.

Other than that, some research documents of the air climate control system and each sensors that could be useful for it also becoming a support of this team.

2.1. About The Company

The company which has tasked this project team is called Airios. Airios is a custom-made electronics of residential ventilation systems manufacturer that was founded in 1982. This company is trading under the name of Honeywell Customized Comfort Products and has been a joint venture company of Honeywell Inc since 2002. This company is specialized in a climate controls system products. However, it also develops in other scope areas of technology.

As what the company state on their website, "We build for comfort", this group will also tasked to construct a concept of a system that would be suit their focus and goal as a company.

2.2. About The Team

This report and the project is proceeded by Group 3 of Fontys ICT Technology course semester two. The team members are supposed to be similar with the other group which is five people. However, because of some circumstances, the team only proceeds with two people until the end of the project.

In any case, these five people are:

Table 1. 1 Team members.

No.	Name	Role	Responsibilities
1.	Colvaciuc, Victor	Scrum Master	• Project Plan • System Design Document • Project Report • Daily Scrum • C# programming support • System programming support • Team Well-being • Tasks Issue
2.	Farros, Farros Ramzy	Team Member	• Project Plan • System Design Document • Project Report • C# Program • Overall System Program • Database Program • Additional Cloud Program (Weather App) • Git Issue
3.	Verkooijen, Andy	N/A	N/A
4.	Lama, Sonam	N/A	N/A
5.	Bašić, Žana	N/A	N/A

2.3. About the system

2.3.1. System Context

The system was comprised of two main parts, they are the hardware and the software. These parts are connected together with a link between them which is called as the communication link.

The communication link of this system can only work if the system have its protocol. And this protocol has written inside the system design document of this group project.

2.3.2. System Hardware

The hardware system of this project should contains:

1. Sensor module

This module consists some main air quality sensors, such as:

a) CJMCU-811 sensor for the CO2 and TVOC gas detector.
b) MQ-9 sensor for the CO gas detector.
c) DHT11 sensor for the Temperature and Humidity detector.

Each of these sensors catch the air quality of the environment as a data, then send the data to the Arduino Uno to trigger any alarm if a harm situation detected.

2. Actuator Module

This module consists a PWM mini fan as the simulation for the ventilation box of the system itself.

The fan will stays on from the lowest until the highest RPM due to the sensors' trigger, and can only off if a manual setup applied by the user from the UI.

3. Communication Module

This module consists the ESP32 sensor. This sensor is used to communicate the system to the app.

4. UI module

This module consists a touchscreen display where the user can views and controls the ventilator system manually in each room where the system is implemented.

The touchscreen display that this project group used for the system is Nextion Touch Display.

Figure 1. 1 The display touchscreen device of the system.

2.3.3. System Software

This system is a C# built app that consists a room air analytic, outdoor weather analytic, database analytic, and the ventilation box control, all in one product.

This app contains a socket server that used to catch the system as its client wirelessly.

This app built in purpose to handle multiple room ventilator control all in one without using any cable connection. This is determined to make sure that the user of the system have the

ability to keep control the room air quality without having to go to the UI system that is implemented somewhere inside each rooms.

The parts of each functionality of this app are:

a) Room analytic and control
A parts where the user can select a room, see the data of the room, and control the ventilation system manually without being inside of the room.

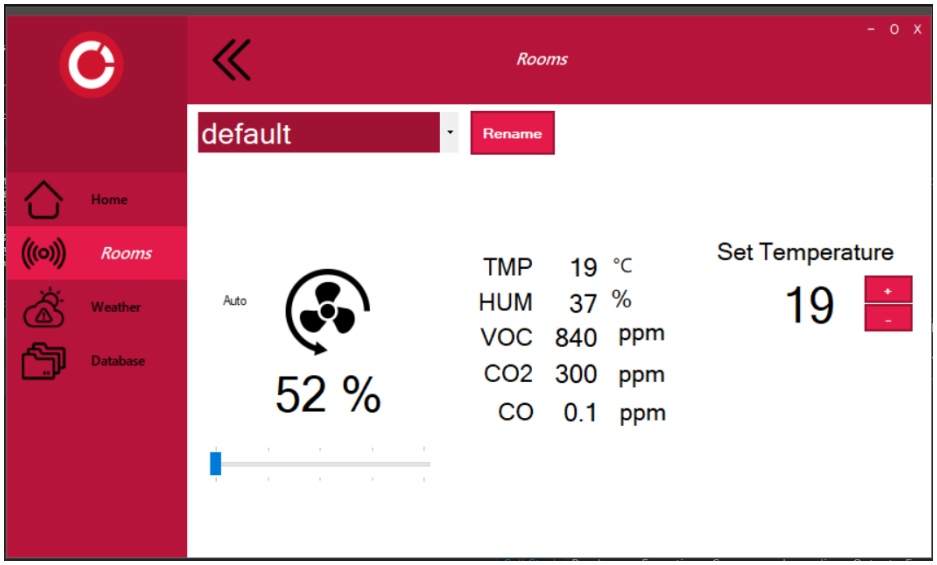


Figure 1. 2 The Room page of the app.

b) Weather analytic
A part where the users can see the weather condition of their environment.

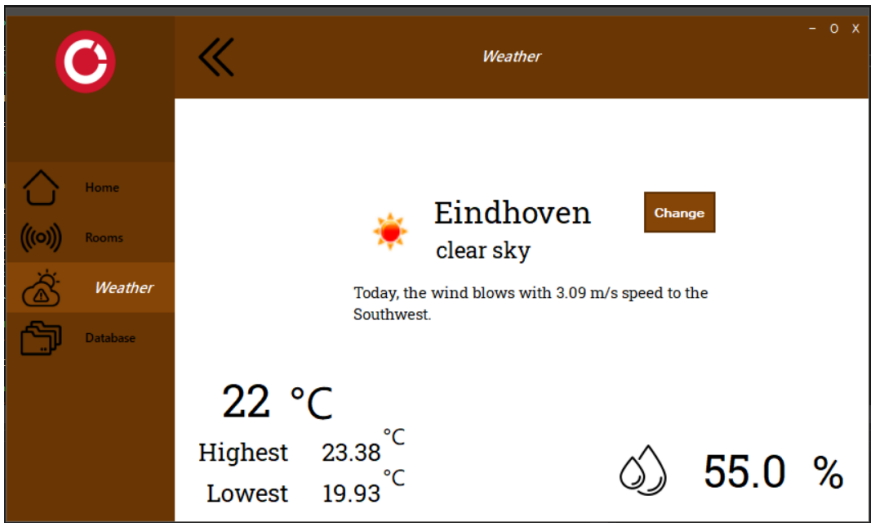


Figure 1. 3 The Weather page of the app.

c) Database analytic

A part where the user can see the read sensor data that has been stored to the internet.

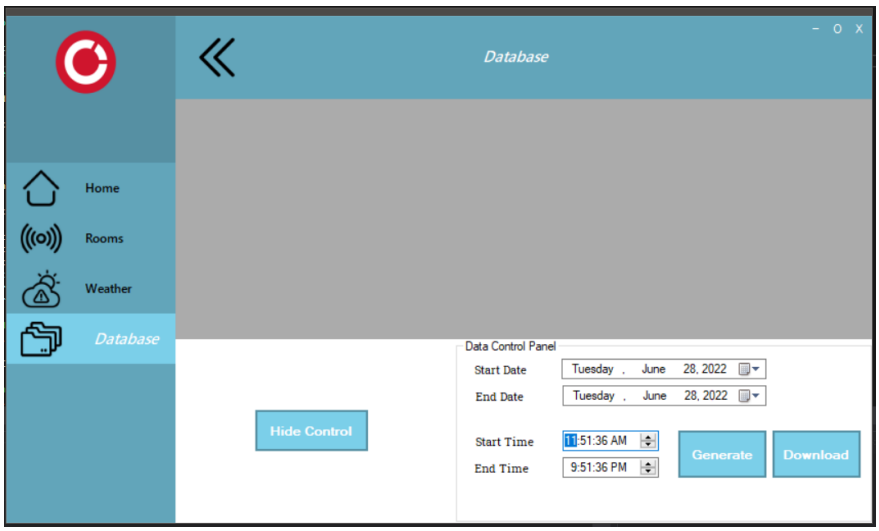


Figure 1. 4 The Database page of the app.

This app also have a home page which summarize the time and the weather condition of the environment of the house as what is shown in this figure 1.5 below.

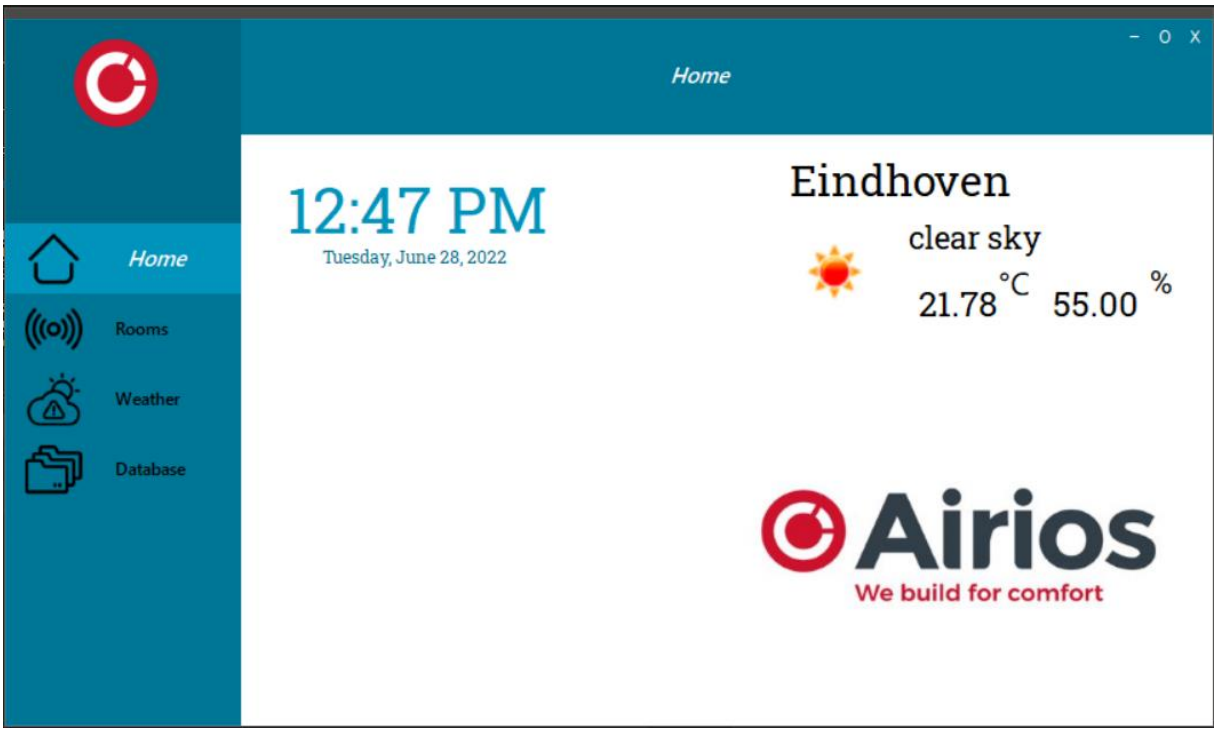


Figure 1. 5 The Home page of the app.

2.3.4. System Database Cloud

This cloud is a platform where the system can send the data of each rooms' air qualities in every minute if the system is active and connected with the internet. The data cloud that is used by this group is MongoDB database network.

This cloud will collect every data that has been sent out by the system app and only send back the data to the app when the app is asking for it.

Other than that, this cloud also can print the data as a graph, publicly to the customer and the maintainer, as long as they have a link to access it.

The data collected by the cloud will look like this figure 2.1 from the server.

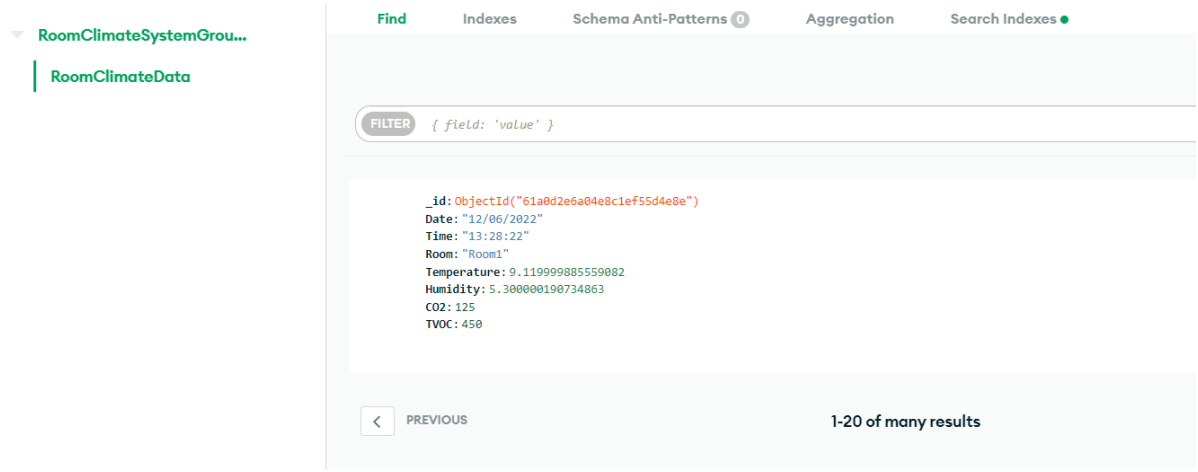


Figure 2. 1 collected data as viewed in the cloud storage.

The data collected by the cloud will look like this figure 2.2 below as the graph.

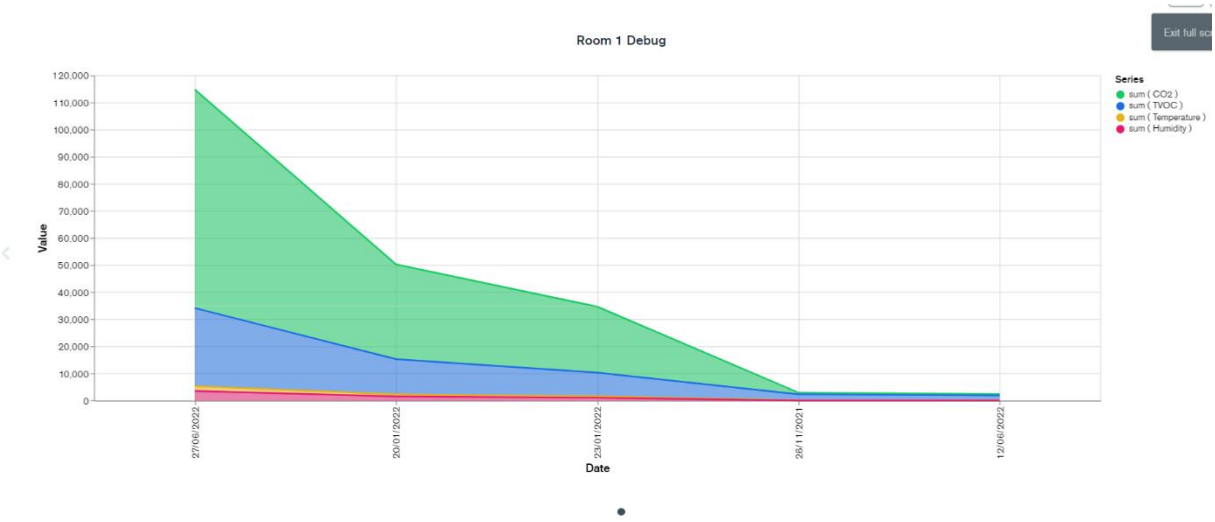
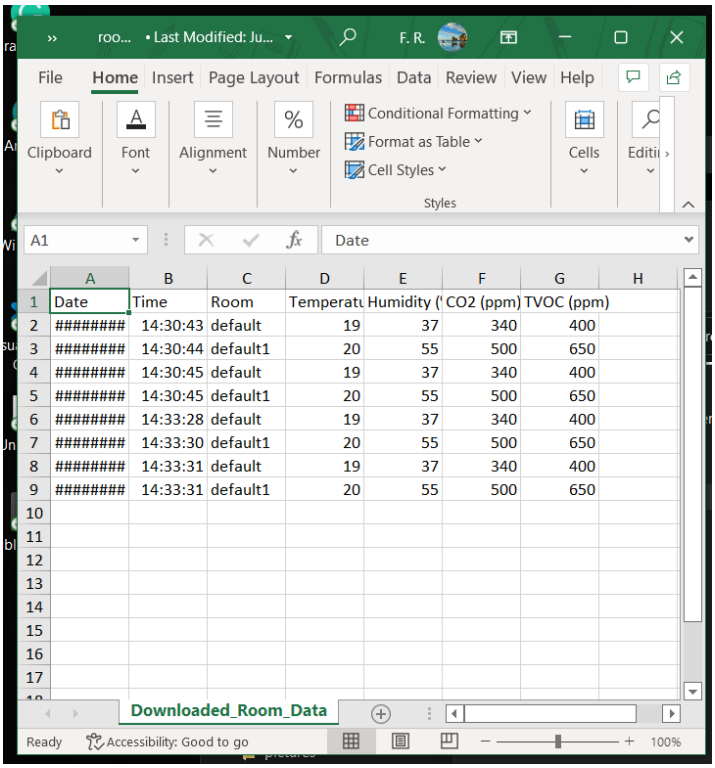


Figure 2. 2 collected data as viewed as a graph in database.

The data that was asked by the app will be printed as an excel file as this figure 2.3 below.



	A	B	C	D	E	F	G	H
1	Date	Time	Room	Temperatu	Humidity ('	CO2 (ppm)	TVOC (ppm)	
2	########	14:30:43	default	19	37	340	400	
3	########	14:30:44	default1	20	55	500	650	
4	########	14:30:45	default	19	37	340	400	
5	########	14:30:45	default1	20	55	500	650	
6	########	14:33:28	default	19	37	340	400	
7	########	14:33:30	default1	20	55	500	650	
8	########	14:33:31	default	19	37	340	400	
9	########	14:33:31	default1	20	55	500	650	
10								
11								
12								
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14								
15								
16								
17								

Figure 2. 3 collected data that was pulled by the app and printed in excell file.

The reason that this group choose MongoDB as its data cloud is because this cloud allows it users to use its platform in a free price with enough online storage data capacity for unlimited time. For any further information of the MongoDB, the link to this cloud is provided in the appendix.

2.3.5. Additional Cloud (Weather)

The additional cloud that this group used is a weather data cloud. This cloud is a platform where this group use to get the weather data of the system location. If the system location has been changed manually by the user from the app, the weather data will also be changed, following to the correct location, as long as the location is exists on earth.

The weather data cloud that this group had used is the OpenWeatherMap. The data that can be returned to the app, to be shown to the user is the XML data of this cloud as what is shown in this figure 2.4 below as example.

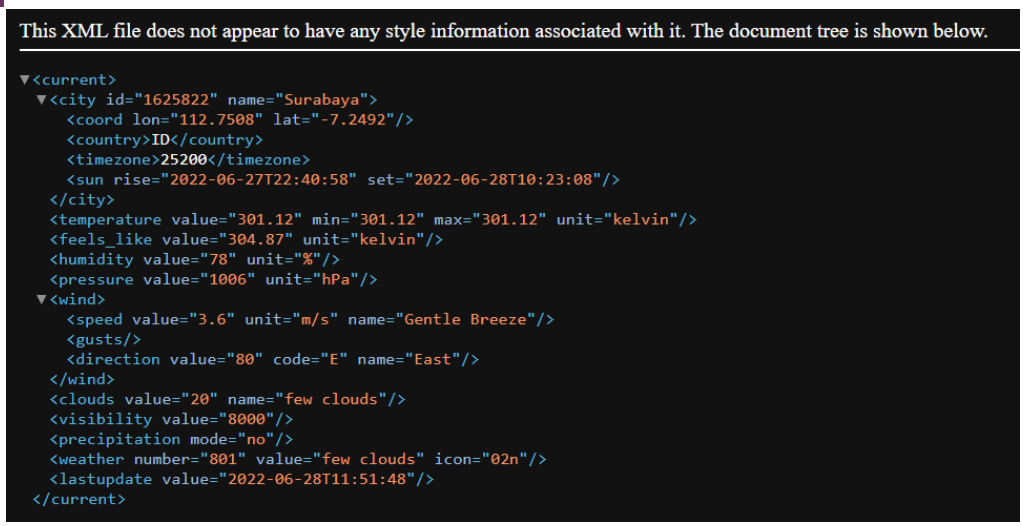

Figure 2. 4 XML data from the weather cloud.

For further information about this cloud, the link to visit this cloud is also provided in the appendix of this document.

3. Procedure and Results

3.1. Sprints

This project has been split by the company into six sprints in total. And in each sprint, the project team had to done some tasks of the project.

3.1.1. Sprint 0

Sprint 0 is an introduction sprint. During the start of this sprint, the team has been introduced to the Airios company, all about the project, the scope, the goal, and also the criteria of it. After being introduced to the project the team must proceed to do a further research about the project, the company, and also the main goal of the product.

After that, the team must decides the roles of each member and decides the tasks organization for the project.

3.1.2. Sprint 1

During this sprint, the team should know all about the use-case scenario of the product. They should understand the purpose of the project and how to manage the task divisions.

Most of the time, sprint 1 is completely about planning and documentation.

3.1.3. Sprint 2

During this sprint, each member should work on each part of the system hardware to build an MVP product. Further than that, the team must already designs the workflow of the system and the sketch of the app.

3.1.4. Sprint 3

During this sprint, the team must start to work on the app, the communication protocol, and the integration of the system. Some debug and try-app should also be done by the team in case the previous MVP product is still not work as what has been planned.

3.1.5. Sprint 4

During the sprint 4, the team must check if their product is ready. Most of the work that can be done in this sprint are the database and the additional cloud, also the implementation of the communication protocol.

Other than that, the team must apply at least one unit-test program to check if the product contains a bug. If a bug found, the team must repair the program immediately before some further addition of the system merged together.

3.1.6. Sprint 5

Sprint 5 is the final sprint. During this sprint, the team member should have finished their product. The team should keep testing the product and should not add another addition into the product because it should be ready before the final presentation. All that should be keep in mind by the team is if their product is already catch the criteria of the project or not.

3.2. Hardware System

This procedure is mostly exists during the sprint 1 until sprint 4. After the team member did their research in sprint 0, the team should divide their tasks into some smaller tasks to build the system hardware.

As it mentioned in the System Hardware, the hardware must contains at least four sensors to detect the air quality. And to show the air quality to the user, the system should have a UI.

To make this system, the team member should sketch the wiring diagram of the system, state machines, and the design of the UI itself, since the UI that is being used in this system is the touchscreen display.

After these parts are connected, the team must test if the UI shows the data of each sensors correctly.

After that, the team must proceed to add the actuator, testing the UI auto and manual control of the actuator, then preparing the communication protocol of the system so it can communicate with the app in a proper way.

3.3. Software

The software task starts wit the design of the app. The team members will decide the display of the app, what should be shown and what should be act as the input or output data to control the system, and also how to read and send the reply data due to the main system communication protocol.

After done with the designs, the team member who responsible with the app tasks should consider about the server of the communication. This is very crucial for the team and the product since the system of this project will be using the wireless communication on its protocol.

After that, the team member should add the API and XML reader for the wather, and database client to the app so it has the ability to read the weather data, and also send or receive the system data on the database cloud.

3.4. Communication

Once the system and the app is done, the team member may proceed to build the communication system.

This communication system is a bit tricky than the others. The team must known the protocol of the system and the device that is being used for the wireless system since it is not inside the scope of the semester study.

The team member must do a research to the device that they have planned to use before finalizing the product with it.

4. Conclusion(s) and Recommendation(s)

Concluding on the entire execution of the project it is to be said that best efforts were made to in order to try and achieve the end goal of the assignment. Despite the trouble that the team had by losing some members due to their incompetent and personal matters, and also some progress losses in each sprints, the two last members of the team still managed to get close and to a version of the product which resembled a final product as an MVP (Minimum Valuable Product).

For a recommendation in the next study, we would advice the director of the project and also the Airios company to explain more about the wireless communication programming in a better way, and also provide us a device that could be useful for the project as one box so we will not being dizzy to look at the other box and extra items due to a broken item and missing components.

5. References / Literature list

Report document platform, project CANVAS Fontys ICT (2022), https://fhict.instructure.com/courses/12220/assignments/198531

6. Appendix (attachment)

MongoDB database cloud site: https://cloud.mongodb.com

OpenWeatherMap site: https://openweathermap.org