CHAPTER 1
INTRODUCTION

1.1 Background

The impact of economic growth in Indonesia is parallel to the rise of CO^2 emissions, Due to the economic rise, more Indonesian people prefer a personal motorized vehicle as their method of transportation, Engine exhaust consists of several gases and particulate emissions, which in turn consist of various chemical mixtures with molecular weight, although this gas contains harmless compounds such as nitrogen (N) and water vapor. This gas also contains some chemical compounds that are toxic to the environment, like lead (Pb), and carbon monoxide (CO), This condition leads to the air quality shift being more polluted. Air pollution is a concern to public health, either from short-term or long-term exposure and can cause various illnesses. The most common is an allergic reaction, which can be handled easily. However, this allergic reaction for some people can give rise to diseases like bronchitis, pneumonia, aggravated asthma, and lung and heart diseases that can cause death[1].

The government has taken several efforts to raise awareness against air pollution. In 2019 the government conduct a free emission test around Monas tower, the result is more than 50% of cars and trucks that use diesel fuel do not pass the emission test [2]. There is another research conducted in Sleman that tested the car exhaust emissions in that area, the result is that 13 cars did not pass the emission test with 120 cars passed[3].

Based on the trend in **Figure** 1.1 between 2012 and 2015 there was a significant improvement in air quality, this was due to efforts to improve air quality by closing illegal mining and reforestation, this paper suggests educating the public by adding to the curriculum with lessons on the dangers of air pollution [4]. The research on air quality has also been carried out in Bandung, they use Node sensors to collect the data [5]. The result of the air quality research can be seen in **Figure** 1.2, we can see that CO concentration is high during work hours which makes the air unhealthy to breathe.

The air quality index (AQI) is used to measure the air quality, AQI is an effective method to tell how polluted the air is or how healthy it is, AQI is calculated
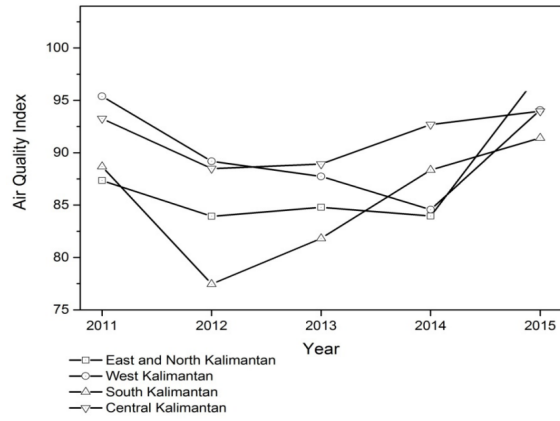
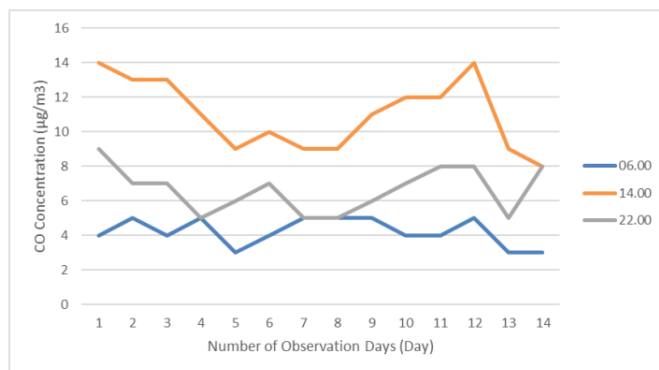**Figure 1.1** Kalimantan AQI

Figure 1.2 Result of the AQI sensor

based on the concentration of air pollutants, a high AQI detects highly concentrated pollutions appear in that area, a low AQI indicates that the area has suitable clean air, AQI data can be gained by sensors at governmental observation stations, producing an AQI map in the local area[6]. However, these sensors can only obtain a limited number of area samples in the observation area and often induce high costs. To reduce cost, a mobile platform is chosen to use along with the sensors. The sensor unit needs to be more compact and light enough, numerous paper suggests making the sensor unit with a microcontroller attached with some important gas sensors like DHT22 and MQ135. The sensor unit can be installed on any platform and be more mobile. This platform can be used as a data reference to predict near-future air quality and anticipated the future[7]. The previous research also suggested that this sensor unit can be attached to an unmanned aerial vehicle (UAV). This form made it very agile and compact which the static sensor could not be capable of, gaining the ability to gather data even in remote places. While still maintaining the ability to gather data in large area coverage, this also reduces the production costs and is effective to use in a large-scale area of operations [8]. The applications for drones open up possibilities for many functions including disaster supervision, crowd control, and agriculture[9]. This UAV does not require an excessive amount to Operate, and also This UAV is portable to do remote surveying a remote mission. Numerous paper suggests making the sensor unit with a microcontroller attached with some important gas sensors[7]. The sensor unit can be installed on any platform and be more mobile. With this task in mind, the traditional quadcopter frame would not do the task optimally. The quadcopter itself produces too much noise to the air quality index data, and the amount of air that is blown away from the trust generated from the four motors will disrupt the sensor greatly, the safety hazard that it can cause if it were deployed to populations dense area and the cost will be too high to produce and maintain. There are many types of drone frames that can prevent or ease these conditions from happening, and the singlecopter frame is the most suitable for this case of usage[10].

In this undergraduate thesis, I proposed to make Air Quality Index Mapping using a programable unicopter Drone, to survey highly polluted areas and remote places. The data is going to be stored in the cloud using Arduino-based IoT of Arduino. With this hopefully can improve the quality of life for those overall.

1.2 Problems Formulations

A government-issued static AQI sensor is not portable enough to be carried by conventional means, making it harder to survey remote locations, and because it is already installed in fixed locations, only certain areas with the static sensor already installed get the survey, it can not pinpoint the cause of the pollutions. This undergraduate thesis purpose solutions by making a swarm-drone unit that can perform autonomous missions, collect AQI data, and survey remote places. Resulting in an AQI map containing AQI values.

1.3 Objectives

Design a drone with the unicopter configurations that can stabilize itself, and can take air quality data, temperature data, and humidity data. This data will be displayed through the app or python script.

1.4 Scope of Works

Problem limitations for this undergraduate thesis are as follows:

1. Drones must have the ability to stabilize themselves while flying and take temperature, quality, and humidity data.

2. The drones must have a compact form, to perform effectively maneuver in narrow place.

3. The drones must be cost-effective to mass-produce.

4. The drones must have a lightweight frame to not be health hazard.

1.5 Statement of The Problem

There is not much reference to the unicopter method of flying, with this limited reference, we have to sort out what can be developed further. While we also tried to figure out what is the best method to take air quality measurements.

1.6 Research Method

1. Literature Study, data from several journals about related the project.

2. Model design and problem formulation.

3. Manufacturing process.

4. Testing results and performance evaluations.

5. Conclusions.

1.7   Bachelor Thesis Organizations

The rest of this thesis is organized as follows:

- Bab 2 BASIC CONCEPT
  This chapter contains an explanation of the basic theory, application, and tools.

- Bab 3 SYSTEM METHOD
  This chapter contains the flowchart, algorithm, experimental diagram and the method.

- Bab 4 TESTING RESULT AND PERFORMANCE EVALUATION
  This chapter contains work steps, test conducted, test result and analysis of the result of the test gained.

- Bab 5 CONCLUSIONS
  This chapter contains the conclusion and suggestion of this final assignment.