**A Descriptive Template for Writing Project Documentation**

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Under the supervision of Supervisor’s Name

**Disclaimer**

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the Degree of Master of Science in Applied Digital Media at Griffith College Dublin, is entirely my own work and has not been submitted for assessment for an academic purpose at this or any other academic institution other than in partial fulfilment of the requirements of that stated above.

**Signed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Acknowledgements**

We would like to express our deepest gratitude to several individuals who made this project possible.

Firstly, we extend our sincere thanks to our lecturer, Barry, for his invaluable guidance and support. His insights and assistance provided us with the right direction and essential components needed for our project. Barry's help in classes, especially when we faced challenges or had doubts, was crucial to our success.

We are also grateful to our team members for their dedication and collaboration throughout the project. Their efforts were essential in completing this project.

Finally, we thank our families for their support and understanding. Their encouragement gave us the strength to finish this project.

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# Abstract

Our project addresses the critical need for monitoring air quality, focusing on detecting various gases including carbon dioxide, methane, liquefied natural gas, butane, propane, methane, alcohol, and hydrogen in the atmosphere. With the understanding that while most atmospheric gases are beneficial, excessive levels can pose health risks, especially in enclosed spaces. We designed an air quality monitoring system capable of detecting multiple gases simultaneously, along with temperature and humidity levels.

The primary goal of our project is to provide a comprehensive solution for maintaining optimal air quality in indoor environments, particularly in spaces like classrooms where CO2 levels can quickly rise due to human respiration. We aim to create a system that not only detects harmful gas levels but also alerts users when temperature thresholds are exceeded, ensuring a comfortable and safe environment.

To achieve this, we utilized sensors capable of detecting various gases, temperature, and humidity levels. The system includes a passive buzzer to sound an alarm when the temperature surpasses predefined thresholds, along with three LEDs indicating air quality—green for good, yellow for moderate, and red for poor.

By implementing this solution, we aim to enhance awareness of air quality and empower individuals to take proactive measures to improve the environment they inhabit. Ultimately, our project contributes to promoting health and well-being by ensuring access to clean and safe air, particularly in indoor settings where people spend a significant amount of time.

The abstract should be at most one page in length, giving a very high-level overview of your project. Your abstract should state the following:

* What your project is
* Why you chose it / what are your goals
* What your project does / what problem does it address
* How you did it / what did you use
* What does it accomplish / what goals were achieved.

This guide is designed to assist you in writing your project documentation. Different chapters contain instructions regarding all aspects of your document and project. In addition, this document is formatted as a template, and can be used as a starting point for your documentation. All of the font sizes, margins, etc. are correct, and the chapter layout presented is an example of what is expected but will need to be modified to suit your specific project. You should consult your supervisor regarding this. General and overall project/documentation instructions and comments are found in most chapters below, marked with the tag “**General Material**”. Each chapter also contains chapter-specific instructions specific to that chapter. These instructions are marked with the tag “**Chapter Specific Material**”.

It is advised that you look at past project documentation in the library, however bear in mind that guidelines and regulations change over time. Thus, you should not use past documentation as anything but to get a general feel of what project documentation looks and feels like. This guide is up to date and supersedes any formatting or parameters of past documentation.

# Chapter 1. Introduction

**General Material:**

First and foremost, you must understand what your project is. **It is a major contribution to your degree.** Your project must address several important points, including your ability to:

* Understand the state-of-the-art of a specific area
  + You will need to learn, know, and adapt to the most current technologies in your area
* Learn and apply new technologies on your own
  + The ability to work under your own inertia on new/changing technologies is important
* Develop and demonstrate a productive relationship with your supervisor
  + Collaboration and working productively with others are a very important aspect of your abilities. Co-workers, colleagues, and bosses will always be there
* Demonstrate a comprehensive understanding of development lifecycle
  + You need to know what a project entails, top to bottom, start to finish

Your work should reflect on your ability to:

* + Take an idea, do background research, understand it thoroughly, and develop and demonstrate an application based on that idea
  + Describe your project in well-structured and formatted documentation so that others can understand what you achieved
  + Demonstrate a working application, simulation results, etc.
  + Discuss your project with faculty examiners, answering any questions put to you regarding your project
  + Take something you have learned and push it further – to take it beyond the classroom

Your project should be critical and analytical. Your project and especially your documentation should be focused on not just “doing” but explaining. Why are you doing this? What does it do? Why are you doing it this way? Why is it different? Why is it better? Why is it worse? Where are its strengths? Where are its weaknesses? Where is it going? Where is it not going? Notice that the word “how” has not yet been mentioned. How you complete your project is only one part of the whole. Equally important to the “hows” are these “whys” – the decisions you made along the way and the results and impacts of those decisions.

The title page, as in this template, is centered and not numbered. All other front matter (Disclaimer, Table of Contents, Acknowledgements, Abstract, etc.) each start on their own page (except for lists of equations/figures/tables if they are short) and are numbered in lower case Roman numerals (i, ii, iii, iv, v, vi, …). The Table of Contents should be automatically generated by MS Word or the word processing package you are using. The same goes for lists of equations/figures/tables. Do not forget to sign and date the Disclaimer of your final bound copy which you will turn into the faculty.

Starting on the first page of Chapter 1, page numbering should start over (from 1) and count normally (1, 2, 3, etc.). Font should be 12 pt., fully justified, with 1.5 line spacing. Standard MS Word margins are used (as they are in this document). Consistency is the key to your documentation. All headings should have the same style, all margins should be the same, etc.

The exact chapter layout of your documentation should be discussed with your supervisor and made to fit your project. A traditional layout would be the following:

1. Introduction (*Page No 1 Starts here)*
2. Background
   1. Literature Review
   2. Similar work
3. Methodology
4. System Design and Specifications
5. Implementation
6. Testing and Evaluation
7. Conclusions and Future Work

(Un-numbered) Bibliography

(Un-numbered) Appendices

From *Introduction through Conclusion and Future Work* should be between 40 and 50 pages. Lengths outside these limits need to be approved by your supervisor. The subsections of Chapters 3-6 will be specific to your project, and additional chapters may be necessary. You should discuss this further with your supervisor. Remember that the 40-50 page guideline does not include front matter, references, or appendices. Chapters should always start on their own fresh page, never on a page where another chapter ends.

**Chapter Specific Material:**

This chapter is all about your project as a whole, not specifics. It is intended to give the reader a brief summary of the “what”, and the “why”, with a very high-level “how”. Technical details and procedures will be discussed in later chapters.

## 1.1 “Your area”, (or specific field of expertise, problem name, etc.)

In this subsection you briefly state what your project is. A good rule of thumb is to use about 3-4 paragraphs, expanding on what the “what” part of your abstract.

---------

Our project focuses on monitoring air quality using a variety of gas sensors. The primary sensor, the MH-Z19B by ICQUANZX, measures CO2 levels in the current atmosphere. This sensor is known for its high accuracy and reliability in detecting carbon dioxide concentrations.

In addition to the MH-Z19B, we have integrated an MQ-2 gas sensor. The MQ-2 is versatile and capable of detecting several gases, including smoke, liquefied natural gas (LNG), butane, propane, methane, alcohol, and hydrogen. This wide detection range allows for comprehensive monitoring of potential air contaminants

For calculating temperature and humidity, we worked with KY-015 DHT 11 by Generic.This sensor measures temperature and humidity, essential parameters that can influence gas concentrations and sensor readings.

For user feedback and alert mechanisms, we have implemented a passive buzzer. This buzzer is programmed to activate when temperature levels exceed a predetermined threshold, providing an immediate audible warning of poor air quality.

Furthermore, we have incorporated a visual alert system using three LEDs of different colours:

* Green LED: Indicates good air quality.
* Yellow LED: Indicates moderate air quality.
* Red LED: Indicates poor air quality.

This multi-sensor approach, coupled with both visual and auditory alerts, aims to provide a comprehensive and user-friendly air quality monitoring system.

This multi-sensor approach uses a combination of different sensors to monitor air quality. It then combines visual alerts, like readings you can see, and auditory alerts, like sounds, to give you a complete and easy-to-understand picture of your air quality.

## 1.2 “Goals” (or something similar)

In this subsection you expand again on your abstract but explaining in more detail why you did this project, what you want to achieve, what your goals are, who will benefit from your work and why.

-----

The reason we did this project is that, as a team, we decided to come up with an original proposal without taking any project ideas from the internet. We were inspired by a similar setup in our classrooms, where many already have CO2 monitor devices installed with LEDs indicating the current air quality. We took this idea into account and used it as inspiration for our project.

Since air quality is crucial for every living being on Earth, especially for students in classrooms, we aimed to address this need. Our goal is to develop a robust Raspberry Pi project that provides users with both auditory and visual alerts about the air quality. It includes all the necessary gas sensors to give real-time updates about the air quality.

From this project, students and teachers in classrooms will benefit significantly. By providing real-time monitoring of CO2 levels and other air quality indicators, the system will alert them when the air quality deteriorates, prompting them to open windows and doors to improve ventilation. This will help maintain a healthier and more comfortable learning environment, enhancing overall well-being and productivity.

## “Overview of Approach” (or something similar)

In this subsection you briefly describe how you achieved your goals and accomplished your work. This should be done at an abstract level at this point. You can name the technologies involved and why you chose them, etc., but the details are for later.

-----

We encountered many bugs and errors during the development of the project. Our lecturer, Barry, helped us on multiple occasions whenever we needed help. Overall, we used GitHub to share necessary information among team members, and we regularly met on campus to work on the project and ensure we met the deadline.

Even though our schedules were different, we stayed persistent and managed to complete the project by the deadline.

In our project, we used different technologies and software’s.

We chose Python because it's the main language for building Raspberry Pi projects. Python has many useful libraries and is easy to use. It's versatile and widely used, making it a good choice for our project.

## “Document Structure”, “Document Layout” (or something similar)

Chapter 2: Provides background literature review, compares project to related works, and cites sources consistently.  
Chapter 3: Outlines methodology including design decisions (technology, sensors, algorithms), development approach, progress tracking methods, and solutions to challenges faced.  
Chapter 4: Overviews technologies used like Python, sensor libraries, ThingSpeak library. Presents system architecture with Data Acquisition and Data Transmission layers. Addresses data/process modelling and compatibility considerations.  
Chapter 5: Describes development of air quality monitoring system using Raspberry Pi and Python. Covers software installation, transitioning to RealVNC, and consolidating sensor code into one script.  
Chapter 6: Focuses on testing sensor functionality, ThingSpeak integration, and overall system performance. Highlights results, challenges faced, and refinements made.  
Chapter 7: Discusses air quality system development process - researching components, learning Raspberry Pi, integrating sensors. Mentions challenges like sensor inaccuracies and future plans.

The rest of this document is as follows. Chapter Two consists of provides a literature review of the area of <your topic area> and the sources consulted in accomplishing my project, in addition to related work. Chapter Three describes the methodology and high–level design of my project structure. In Chapter Four, I discuss the system design, and requirements/specifications including any hardware and software used. Chapter Five provides the implementation details of my project/system/etc. In Chapter Six, details of the working prototype of my project/system/etc are provided, including my testing and evaluation technique. I also discuss results including any revisions to the overall design and implementation that were deemed necessary. Finally, Chapter Seven presents conclusions and future work.”

# Chapter 2. Background

**Chapter Specific Material:**

This chapter will acquaint the reader to the existing literature in your project area and to related work that has been done. This chapter should contain about 50% of your references.

## 2.1 Literature Review

In this section you present the findings of a review of up-to-the-date literature on your project *topic area and related areas*. This chapter will have many references to some (preferably all) of several of the following: scholarly journals, conference proceedings, books (textbooks or expert volumes), whitepapers / technical reports, software (including software documentation), etc.

For example, if your project was on parallel computing, you may refer to some of the following:

* Scholarly Journals
  + IEEE Transactions on Parallel and Distributed Systems (IEEE)
  + Journal of Parallel and Distributed Computing (Elsevier)
  + International Journal of Parallel Programming (Springer)
* Conference Proceedings
  + (Similar publishers to Scholarly Journals, above)
* Books
  + University-level texts
  + Other expert volumes
* Software Documentation
  + Product, Company, Version, Authors, etc
  + Only up-to-date, official documentation
* Online Material
  + Only *terminal references,* from official/reputable sources
  + No Wikipedia, random/unknown/un-reputable sites
  + Treated as endnotes, not a reference (more later)

## 2.2 Related Work

In this section you present the findings of a review of *specific works closely related to your project.* You should discuss the similarities and differences between your project and others like it that have been done before. A pointed and convincing argument should be presented as to *why* your approach/technique/etc. is an improvement/extension/etc upon previous work. You do not need to go into the specific details on *how* this is achieved here. This will be explained throughout the coming chapters. For now, your job is to bring your reader up-to-speed with the current state-of-the-art, how your project fits into that, and why yours is better!

In this section, we discuss about the

**General Material:**

References are a very important part of your work and must be done carefully and correctly. References are how readers of your work will connect and relate your work to the work of others and your topic area in general. Without proper referencing your documentation would only be a description of work, not a piece of work on its own, that is related to your field.

**Bibliography Style:**

* The Bibliography (or References) must contain a list of books, journal and conference articles and all other material cited in the main body of text (except websites).
* Entries in the bibliography must contain: author(s), title, conference/journal, publisher, date of publication and possibly other reference-specific information. Consult your supervisor.
* Each entry in the bibliography is numbered consecutively in order of appearance, such as [1], [2], etc. These citation numbers are included in the main body of text in square brackets.
* All bibliographical information is exclusively included in the list of “References” section at the end of the document, next to the respective citation number.
* Please see the following example.

**Bibliography Example:**

**Main body of text:**

“A prefix labelling technique presented in [1] seems to be appropriate for topologies similar to a Tree structure. Our research focuses on developing a prefix labelling technique of B-Tree topology [2]. Once a network is organized as a B-Tree the prefix can be calculated using a distributed process as suggested in [1]. The ultimate aim is to achieve load balancing for distributed systems [3], [4] organized as a B-Tree topology.”

**Bibliography (or References) (placed at end of documentation):**

1. C. Li and T.W. Ling. An Improved Prefix Labeling Scheme: A Binary String Approach for Dynamic Ordered XML. *10th International Conference on Database Systems for Advanced Applications, DASFAA 2005*, Beijing. Volume 3453*/*2005 , April 2005, pp.125 *−* 137.
2. D. Comer. Ubiquitous B-Tree. *ACM Computing Surveys (CSUR)*,Volume 11, Issue 2, June 1979, pp. 121*−*137.
3. Ka-Po Chow, Yu-Kwong Kwok. On Load Balancing for Distributed Multi-agent Computing. *IEEE Trans. on Parallel and Distributed Systems*, Volume 13, No 8, 2002. pp. 787 *−* 801.
4. M. H. Willebeek-LeMair, A. P. Reeves. Strategies for Load Balancing on Highly Parallel Computers. *IEEE Trans. on parallel and distributed systems,* Volume 4, No 10, Sep 1993.

**End of Example**

All referenced websites must be *terminal references*. A terminal reference is the “root” reference for a specific idea/theory/concept/product/technology/etc. For instance, *no* Wikipedia pages are terminal references. All Wikipedia pages have references to other (possibly terminal) references! Another way to view a terminal reference is as the reference where the “chain of reference” stops. A chain of reference is (for example) when someone discussing *concept A* refers to a website, which refers to a Wikipedia site on concept A, which refers to another website, which refers to a book, which refers to another book, which then refers to a scholarly journal article, which presented concept A for the first authoritative time. That journal article is the terminal reference for concept A. In some cases, websites may be terminal references, however this is rare. Another time that a website may be referenced is when the website is the official website or portal to a specific tool/technology/etc.

Websites *are not* included in the bibliography/references section. They are included as footnotes.

**Example:**

“Although the number of proteins with known structure continues to grow, the number of proteins with known sequence, but unknown structure is growing faster. Thus the gap between the number of proteins of known structure and the number of proteins of known sequence is growing. As protein structure dictates protein function, and proteins of similar sequences often have similar structure and therefore function, databases of protein sequence and structure information such as UniProt[[1]](#footnote-1) have become increasingly useful to both those who are sequencing proteins, and those that are predicting protein structure.”

**Note the footnote at the bottom of this page, corresponding to the 1 above. This is how websites should be cited.**

**End of Example**

All references other than websites should be added in MS Word as a “citation” – usually Insert > Citation, or something similar. This will give you options on how to present your references, and allow you to automatically generate your bibliography, similar to your table of contents.

# Chapter 3. Methodology

**Chapter Specific Material:**

This chapter *begins* to explain how you accomplished your project and your objectives. Explain here what was needed to implement your project, both in technology and effort. Discuss the high-level decisions you made. These are your design decisions. Why did you choose technology x instead of technology y? Why did you choose a top-down approach instead of a bottom-up? If you chose a divide-and-conquer paradigm to a specific problem, why did you, and why did you not choose a brute-force or greedy approach? The subsections of this chapter will be specific to your project and should be discussed with your supervisor.

This chapter does not need specific details *about* your chosen technologies. For example, you do not need to explain what java is or what cloud computing is. What you do need to discuss is *why* you chose java, or *why* you chose a cloud platform. If you did choose java over C#, why? If you did choose cloud computing, why did you choose PaaS instead of SaaS or IaaS?

**General Material:**

The role of your supervisor includes the following:

* Guiding you in the right direction relating to your project idea
* Identifying and suggesting the technologies that might be useful to implement your idea
* Identifying and setting up project milestones and deadlines
* Monitoring progress, milestones and deadlines

Remember that you were told about your project almost a year ago, at the start of your Research Methods module. This is when your project started! The summer period is for implementing, not starting your project idea! You should check with the faculty and your supervisor regarding the demonstration and documentation submission dates. You should aim to be done well before these deadlines. You will find that once you are “done” and have removed some pressure from yourself, you will go back and make many important changes that you wouldn’t if you were rushing to meet the deadline. You will also give a much better presentation if your finished project has had some time to mature.

You are highly advised to keep a “progress log” while you are working on your implementation. This will be an invaluable help when you begin your documentation proper. Document everything! Document the bad decisions, the mistakes, the things that didn’t work, as well as those that did. They will all contribute to your documentation and help you answer and explain the big questions, what, why, how.

# Chapter 4. System Design and Specifications

**Chapter Specific Material:**

This is the first chapter where you can describe specifics. What technologies did you use? What vendor/version/etc.? What features of these technologies made you decide to use them? How were they helpful? How were they difficult? What might have been better? Did you have compatibility issues? Did you have any other issues?

You will also need to discuss and present *your* system architecture/model. How did you use your different technologies/platforms and how did they work together? Did your architecture use a tiered system? How many tiers? How are they separated both logically and in implementation?

In this chapter you can use architecture diagrams, code snippets, UML diagrams, formal diagrams, etc. All of these can be included as figures (see Chapter 5).

A note on code snippets: Code snippets should be just that – snippets. Snippets are small, core pieces of code that are integral and unique to your project. Typically a snippet is 10-15 lines of code. *Long segments of code, general structure, headers, etc. should not be included in documentation*.

You can also describe your process modelling (software) and data modelling here. Data modelling can include the type of input/information your system needs, the use and processing of that information, and what your system generates (output).

**General Material:**

Assessment and Evaluation:

*The project will be evaluated on its quality of thought, interpretation and insight as well as the contribution it makes to the field of study and the writer’s own professional development. An essential ingredient will be the student’s ability to master a technical body of knowledge and apply it to a given problem domain. The ability to think and reason with the material at issue is crucial. The design, layout, quality of expression, structure and coherence of all documentation will be taken into account when grading the finished work. The ability of the student to present and defend the material is also of significant importance.*

Marking:

Your project is marked according to Table 4.1.

# Chapter 5. Implementation

**Chapter Specific Material:**

This chapter discusses specifically how you implemented the working version of your system. The specifics of this chapter should be discussed with your supervisor. Screen shots *may* be appropriate in certain circumstances in this chapter and subsequent chapters. See the note on screen shots in General Material, below.

**General Material:**

A note on Screenshots: Screenshots should be used carefully and sparingly. Only use those that are very explanatory in nature. A good rule of thumb is that if it would take many lines of text (with a footprint larger than that of the screenshot, caption, and brief text explanation combined) to explain what you want, use the screenshot/caption/brief text explanation. Otherwise just describe in text.

Tables, figures, and equations may appear throughout your documentation. All tables and figures should be centered and have captions. Captions should be inserted in MS Word with “Caption…” after selecting or right clicking the table/figure. This will allow you to generate a list of tables and/or figures for your front-matter if desired, similar to your table of contents. For an example, see Figure 5.1.



**Figure 5.1** An example figure.

Equations may also appear throughout your documentation. If you refer back to a particular equation in your documentation more than once, you should center and number the equation, allowing you to refer to it by number, and to allow you to generate a list of equations, similar to your lists of tables/figures.

**Example:**

Einstein’s famous mass-energy equivalence is given by Equation (3.1),

 **3.1**

Where *E* is energy, *m* is mass, and *c* is the speed of light. Equation 3.1 can be rearranged to an expression for the speed of light as in Equation 3.2.

 **3.2**

Equations 3.1 and 3.2 are unit independent and dimensionally consistent.

**End of Example**

Equations should be inserted into word with: (Insert > Equation, or Insert > Object > Microsoft Equation 3.0), depending on your version of Word.

We developed an air quality monitoring system to measure the co2 levels, humidity, temperature and other external gasses like smoke, methane etc.

For this project, we utilized the Raspberry Pi 3 Model B as the main computing unit to integrate all the sensors and components. The Raspberry Pi provided a powerful yet compact platform with support for Python, which was our chosen programming language for the project.

First, we made sure that the Python and pip were correctly installed on Raspberry Pi using the following command in bash:

sudo apt-get install python3 python3-pip

Next, we installed the ‘RPi.GPIO’ library to work with the GPIO pins. This library allowed us to interact with the pins programmatically, enabling us to read input from sensors and send output signals to actuators. The installation command is:

sudo apt-get install python3-rpi.gpio

The primary sensor used for CO2 detection was the MH-Z19B. We used the ‘mh-z19b’ library to interface with the MH-Z19B sensor.

pip install mh-z19

For detecting external gases, we used the MQ-2 sensor. This sensor communicates with the Raspberry Pi through analog and digital pins, and we interfaced it accordingly.

To monitor temperature and humidity, we integrated the DHT11 sensor from Generic.

This sensor uses a single-wire protocol to communicate with the Raspberry Pi. We utilized the ‘Adafruit\_DHT’ library for Python to work with the DHT11 sensor and retrieve temperature and humidity readings.

pip install Adafruit\_DHT

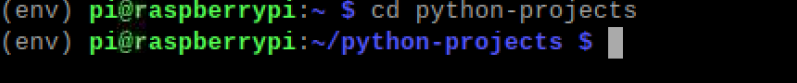
Initially, we used PuTTY to interact with Raspberry Pi. However, it frequently asked for credentials, which was time-consuming. Consequently, we switched to RealVNC Viewer, which allowed us to remotely interact with, control, and access the desktop environment of the Raspberry Pi from our device, significantly improving our development workflow.

We were keeping separate files for every sensor but later we incorporated every files into one file called airqualitydetector.py

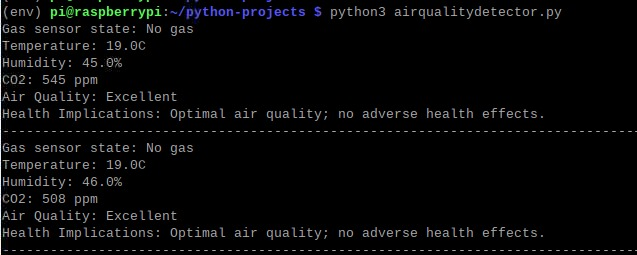
The following steps demonstrate how to run the project, as depicted in the following screenshots.

First, we change the default environment to a virtual environment



Next, we navigate to the 'python-projects' directory where the project files are stored.

Lastly, we execute our main Python file named ‘airqualitydetector.py’.”



# Chapter 6. Testing and Evaluation

**Chapter Specific Material:**

This chapter should include a description of the process or processes you used to test and evaluate your system. You can use things such as user experience reports, attempts by yourself or others to break your own code, graphs/charts of outputs or performance, etc. Include discussions of why things work, and why and when they don’t work. You can also include any refinements made to your implementation as a result of your testing.

**General Material:**

Your project demonstration will occur at the end of the project period. Check with your supervisor for the exact date. You will be examined by two teams, each consisting of two faculty members. You should prepare 5-8 slides briefly outlining your project idea. You do not need to go into implementation specifics in your slides. It should take no longer than 3-4 minutes to go through your slides (approx. 30 seconds per slide).

Your first slide should contain the following information for the examiners:

* Name
* Student Number
* Project Title
* Supervisor Name

After your slides, you should answer any questions the examiners may have for you, and then show them your project in action. This is when you should walk through your application from a user’s point of view. After this you should be ready to have the examiners ask you to see code, explain how certain functionalities are implemented, etc. Your entire demonstration should be no longer than 20 minutes, including examiner questions. **A good recommendation for the timeline of your demonstration is the following: 5 minutes – Intro/Slides, 5 minutes – Demonstration from user’s point of view, 10 minutes – Questions from examiners, TOTAL – 20 minutes.**

# Chapter 7. Conclusions and Future Work

**Chapter Specific Material:**

Conclusion-

Our project was completed on a course of 3 months. First few weeks were utilized in researching for the proposal and gathering the bills of materials. Following weeks were spent in researching about the components we had ordered and learning about raspberry pi and its GPIO pins usage.

One of our primary goals was to develop an accurate and reliable air quality monitoring system. We accomplished this by integrating various gas sensors such as the MH-Z19B for CO2 detection and the MQ-2 for detecting other gases. Additionally, we incorporated environmental sensors like the KY-015 DHT11 for temperature and humidity measurements. Through rigorous testing and calibration, we ensured that our system provided real-time updates on air quality, providing users the information they needed to make wise decisions.

A major success of our project lies in the implementation of an effective alert mechanism. By utilizing LEDs and a passive buzzer, we provided both visual and auditory alerts when air quality exceeded predefined thresholds. This feature enhances user awareness and promotes proactive measures to maintain a healthy environment.

However, it's important to acknowledge the limitations of our system. While our sensors provide valuable data, they are not immune to inaccuracies and calibration drift over time. Also, because our system relies on Raspberry Pi for processing, there can be delays in transmitting data, which might affect how quickly we can respond to changes.

Secondly, we faced internet issues, and thus we couldn’t install many libraries and packages from home as the system required the college internet.

Thirdly, we didn’t order an ADC (Analog-to-Digital Converter), so we couldn’t accurately measure the percentages of different gases detected by the MQ-2 sensor.

Future Work-

In the future, we want to make our system even better. To achieve this, we'll incorporate Adafruit libraries, which simplify reading data from sensors and converting that data into usable, readable information. For instance, the libraries for the MQ-2 sensor are particularly helpful. The MQ-2 outputs a raw analog signal corresponding to the concentration of gases detected. Converting this raw data into meaningful ratios of specific gases involves complex calculations and calibrations, which can be challenging.

Adafruit's sensors and libraries assist in this conversion process by providing pre-calibrated sensors and well-documented libraries that handle data conversion. These libraries include functions to interpret raw analog readings and convert them into gas concentration levels, usually measured in parts per million (ppm). Additionally, Adafruit's documentation and community support offer guidance on fine-tuning sensor readings for more accurate gas ratio calculations.

By integrating Adafruit sensors and leveraging their extensive resources, we can enhance the accuracy and reliability of our air quality measurements, making our system more effective and user-friendly. We also plan to improve the overall GUI of the application to further enhance user experience.

If we had more time, we would have improved the overall GUI of the application to further enhance user experience. To achieve this, we will aim to incorporate React and CSS into the backend, creating a dynamic, responsive, and user-friendly interface. This will surely enhance the look, making our application more effective and visually appealing to users.

# References

This section should list your references as outlined in Chapter 2, General Material. The references section should be page-numbered but is not a chapter and therefore should not have a number itself. It should be listed in your table of contents and be the last thing in your document unless you have appendices.

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General Material:

**Do not forget, the last things you need to do:**

1. **Spell/grammar check**
2. **Update Table of Contents, all lists, etc. (Right click on TOC or list and select “update field”, then select “update entire table”**
3. **Sign and date your declaration**
4. **Get two copies bound at a bookbinder – one hard bound and one soft bound. These are for the faculty. You can order more for yourself if you wish**
5. **Burn all documentation, code, etc. to a CD/DVD and turn this in to the faculty or supervisor with one hard bound and one soft bound copy at your demonstration.**

# Appendix I

One or more appendices may be necessary but should be approved by your supervisor. Appendices should be used for material you would like to refer to such as figures/diagrams/code/etc, but are deemed too large and bulky for the main text, or outside the “flow” of any particular chapter. Appendices should be page-numbered, and numbered with capital Roman numerals (I, II, III, …). This is not a place for large pieces of code. (There is no place for large pieces of code!) Appendices are the last section(s) in your document.

1. http://www.uniprot.org [↑](#footnote-ref-1)