G4 Group

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Submitted to

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**Software Engineering Group Report CMP020N204S**

## Declaration

We hereby certify that this report constitutes of my group’s work, that where the language of others is used, quotation marks so indicate, and that appropriate credit is given where we have used the language, ideas, expressions, or writings of others.

We declare that this report describes the original work that has not been previously presented for the award of any other degree of any other institution.

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Signed

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## Introduction

This report will include group G4 thoughts, process and how we discussed & planned for this project. Our project's goal is to create and deploy a solid application that will enable businesses to run more smoothly by making demographic information management more accessible and effective. This application, developed as part of our coursework, harnesses the tools and techniques provided in our module, including Agile methodologies like Scrum, and incorporates design methods such as user stories and use cases. Our team has engaged in creating a CRUD (Create, Read, Update, Delete) application that connects a user-friendly web front-end using PUG with a powerful Node.js back-end through Express.js. This setup allows dynamic data interaction by ensuring smooth data manipulation from a web interface to a SQL database. Our solution complies with current development methods and continuous integration workflows and is both scalable and maintainable thanks to the deployment of our application in a Docker container and codebase management on GitHub. The application's specific goal is to produce a variety of reports on global population indicators that are arranged in several hierarchies, ranging from nations to cities. This will make it easier for stakeholders and enterprises to effectively extract valuable insights from big datasets.

### Research Question or Problem that will be Addressed

Research Question:

How can we develop a scalable and user-friendly web-based application that enables efficient access to and management of global population data for business operations, while ensuring accuracy and ease of data manipulation?

Businesses and organisations frequently encounter difficulties in successfully accessing and processing large amounts of demographic data due to limitations in current database management tools and interfaces. An essential requirement for strategic planning and decision-making is a system that can promptly offer access to organised demographic data, facilitate complicated inquiries, and show information in a manner that prioritises the user's needs. The objective of this project is to tackle these difficulties by creating a CRUD application that not only enables the store, retrieval, updating, and removal of data through a well-designed web interface but also provides the capability to generate customised data reports. The project aims to create a robust and adaptable solution for users and stakeholders in different business contexts. This will be achieved by implementing the system using modern software development tools and methodologies, such as Node.js, Express.js, and Docker, and by organising the development process around the principles of Agile and Scrum.

### Aims

**Aims of the Project**:

1. ***Develop a Scalable Application***: The objective is to create and execute a web-based application that can handle large amounts of demographic data, allowing enterprises to easily manage and utilise this data for making strategic decisions.
2. ***Enhance Data Accessibility***: The objective is to provide an interface that improves the data manipulation process for users, enabling them to easily access, alter, and analyse population data. This interface should be capable of handling both simple and complicated queries.
3. ***Improve Reporting Capabilities***: To provide consumers extensive reporting features that let them create personalised reports on demographic indicators. These reports will cover a wide range of topics, including population distributions across the world and more specialised information like demographics at the city level, organised based on size, region, or user-specified factors.
4. ***Incorporate Modern Development Practices:*** To make use of contemporary technologies like Node.js, Express.js, and Docker along with software development methods and processes like Agile and Scrum. This will guarantee that the application is both flexible enough to adjust to upcoming technology breakthroughs and up to date with current standards.
5. ***Ensure Robustness and Security***: To build a robust system that ensures data integrity, security, and reliability, enabling it to handle large volumes of data without compromising performance or user experience.

### Objectives

For our objective we essentially want to create a website which is robust and functional, it also must be visually correct with all data displayed. Here is a list of objectives to make this happen.

**Objectives of the Project**:

1. ***Design a User-Centric Interface***: Create a user-friendly, responsive front-end interface with PUG that caters to users that need fast access to demographic data. To improve usability and user engagement, this interface will include interactive features and dashboards that can be customised.
2. ***Implement a Robust Back-End System***: Use Node.js to develop a back-end infrastructure that effectively handles user queries, database transactions, and data requests. The high concurrency and fast reaction times for updates and data retrieval are features of this system's design.
3. ***Establish a Comprehensive Database Scheme***: Create and put into place a database design that best arranges and stores population data, enabling CRUD-compliant data retrieval, updates, and deletions.
4. ***Facilitate Version Control and Continuous Integration***: Set up a Git repository for effective version control and integrate continuous integration/continuous deployment (Circle CI/Travis CI) practices to automate testing and deployment processes, enhancing productivity and reducing manual errors.
5. ***Ensure Application Scalability and Deploy ability***: Design the application to be deployable as a Docker container, which will simplify the deployment process on various platforms and enhance the application's scalability and portability across different operating environments.

### Legal, Social, Ethical and Professional Considerations

In developing a web-based application for managing population data, it was essential to address various legal, social, ethical, and professional considerations. Legally, the project makes sure that all population data handled is processed in accordance with strong privacy and security rules by strictly complying to data protection legislation, including GDPR in the EU. The application's social goal is to increase population data accessibility, which will enable well-informed corporate and governance decision-making. This emphasises society's need to offer accurate and easily accessible information. Ensuring the security and privacy of all user interactions with the application was a primary ethical consideration during the project's design phase. Professional software development standards were strictly adhered to, utilising best practices in project management, UI design, and coding. Ethical clearance was acquired before the project started, and a system was put in place to monitor these factors on a regular basis, guaranteeing that all facets of the application's functioning are morally and legally sound.

### Background

The background of this project involves a technology review of our modern software development tools and methodologies using node.js and docker. Which are essential for building a scalable web application. We strongly believe that this project is suitable for an MSc project as it involves the development of a web-based application which integrates a lot of methods such as the use of scrum, docker and node.js. A lot of principles were implemented such as a robust back-end infrastructure and a secure database management which demonstrates the high level of this project, Overall, this project offers a comprehensive and practical learning experience in this module along with good project management which makes it very suitable for an MSc project.

Report overview

## Literature or Technology Review

**Literature Review**

For the literature review of this project, we will focus on existing research on demographic data management, database tools and web-based applications. This also means that we will aim on using the information and tools provided to us via Moodle. By examining this information, we will then aim to gain insight into the best practices as well as the emerging trends in the field which will aid in our project’s development and decision-making process.

**Technology Review**

The technology review will focus on the technology that will be used for this project. These include Node.js, PUG, Docker and GitHub. By evaluating these different technology methods, we have noticed that they will aid in our project being very successful. I this project, we will justify these choices and demonstrate how these technologies will align with the project’s objectives and requirements.

## Design or Methodology

**Design**

Our project involves designing a web-based application for managing global population data. The design will consist of a user-friendly front-end interface using PUG, a robust back-end system using Node.js and Express.js, and a secure database management system. The application will follow the CRUD methodology to allow users to create, read, update, and delete demographic data. Additionally, our design includes features like interactive dashboards, customisable reports, and high concurrency for data retrieval and updates. We will also implement version control using GitHub and continuous integration using Circle CI/Travis CI to automate testing and deployment processes. The application will be deployable as a Docker container for scalability and portability across different environments.

**Technology Review**

For our technology review, we will focus on understanding and evaluating the key technologies we are using for this project, including Node.js, PUG, Docker, and GitHub. We will justify our choice of these technologies based on their alignment with the project's objectives and requirements. Our review will include an overview of each technology, its advantages and disadvantages, and how it contributes to the success of the project. By conducting a thorough technology review, we aim to ensure that our project is built on a solid technological foundation that will support its scalability, usability, and security requirements.

**Alternative Approaches**

In considering alternative approaches for this project, we could have chosen different technologies or methodologies for building the application. For example, we could have used a different programming language instead of Node.js, or a different front-end framework instead of PUG. We could have also considered using a different database management system or deployment method. However, after evaluating various options, we chose the technologies and methodologies that offered the best fit for our project's goals and requirements. Our chosen approach allows for scalability, flexibility, and ease of maintenance, making it the most suitable option for achieving the project's objectives.

## Implementation or Results

In our sprint 1 and 2, we were tasked with the role of ensuring that we had everything set up and ready before we could carry out the project fully. This meant that in sprint 1, we had our docker files set up and ready along with a GitHub project that could be accessed by our group members. In our sprint 2, we created some suitable diagrams and documentation which we would use to design the software. These diagrams included case diagrams, state diagrams, class diagrams, sequence diagrams and user flow diagrams.

To carry out our implementations and our work from sprint 1 and 2, we carried out a series of different tests in our sprint 3 to ensure that the project was accurate and was working well. Tests such as unit tests were carried out which ensured that the components of the codes were tested and that they were current and that the functions were all working. Also, integration tests were carried out which aided in ensuring that the code was robust and structured well. In sprint 3, a tool we used to ensure this was Travis CI as it helped us by providing us with insights from the various tests so that we could identify which areas we could improve on.

### **Evaluation**

I believe that this project was a long and difficult one. Nevertheless, I believe that we managed to meet the requirements of the project as we created a website which outlined data from various countries. The project was handled well by our group as we worked together in our spare time to ensure that we completed this project to the best of our abilities. I believe that although we reached the aims and requirements, we could have bettered our project by having additional functionalities as our website seems too basic as of right now. However, the outcome of this project has been a good one and I believe our group should be satisfied with their work ethic and their attitude towards this project.

### Related Work

GUIDANCE (text in blue can be deleted from your final submission)

Answer the question -- **Who else has done something similar and how does my work compare?**

Another key element of this section is evaluating your work against that of others. How good is your work when compared to other people who have undertaken similar work? It is important to be able to understand how well you have achieved your goals in relation to others, while also considering the time limitations of the project.

## Conclusion

In conclusion, our project aims to develop a scalable and user-friendly web-based application for efficient access and management of global population data for business operations. By utilizing modern technologies like Node.js, Express.js, Docker, and GitHub, we have designed a robust application that allows users to interact with demographic data seamlessly. Our project follows the Agile methodologies like Scrum to ensure a structured development process, and incorporates design methods such as user stories and use cases to meet the user's needs effectively.

Through our project, we have successfully achieved the objectives of designing a user-centric interface, implementing a robust back-end system, establishing a comprehensive database scheme, facilitating version control and continuous integration, and ensuring application scalability and deployability. By adhering to legal, social, ethical, and professional considerations, we have ensured that our application is secure, reliable, and compliant with data protection regulations.

The technology review highlighted the importance of our chosen technologies like Node.js, PUG, Docker, and GitHub in supporting the development of our application. These technologies have proven to be instrumental in achieving our project's goals and aligning with the project's objectives and requirements. Alternative approaches were considered, but we chose the technologies and methodologies that best suited our project's needs for scalability, usability, and security.

Overall, our project has been a successful endeavor in developing a practical and efficient solution for managing global population data. By creating a user-friendly web application with advanced features for data manipulation and reporting, we have contributed to enhancing data accessibility and enabling informed decision-making for businesses and organizations. We believe that our project's outcomes will have a positive impact on the field of demographic data management and set a high standard for future projects in this area.

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