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***A Comprehensive Health Advisory Application: Tracking and Preventing Infectious Diseases in Malaysia***

**By**

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A report submitted in partial fulfillment of the requirements for the degree of

Bachelor of Science (Hons) in Software Engineering

at Asia Pacific University of Technology and Innovation.

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**2024**

# Acknowledgement

First and foremost, I would like to express my gratefulness to my supervisor, Dr. Kesava Pillai, for his consistent guidance throughout my entire project. I have received his advice and feedback during our discussions which are important in directing my research.

I would also like to thank my family for their unwavering support, either emotionally or financially. Their encouragement has been my strength and motivation during this project.

I appreciate all the participants who contributed their time to my questionnaire. This project would not have been possible without their contributions.

Lastly, I would like to acknowledge the resources provided by Asia Pacific University of Technology and Innovation.

# Abstract

This project aims to develop a comprehensive health advisory website to track and prevent infectious diseases in Malaysia. The research addresses the problem of inadequate real-time information on disease trends and preventive measures, which hinders effective public health responses. Using a mixed-methods approach, data will be collected through online surveys and interviews with healthcare professionals. Preliminary results suggest significant gaps in public awareness and preventive practices. The developed website will integrate data from multiple sources to provide real-time updates, educational content, and guidelines for disease prevention. This project is expected to enhance public health knowledge, improve disease management, and facilitate timely responses to outbreaks.

*Keywords: health advisory, infectious diseases, public health, Malaysia, real-time data, disease prevention*

**SDG 3: Ensure healthy lives and promote well-being for all at all ages**

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# 1.0 Introduction

## Introduction to the project

Infectious diseases have long been a significant public health challenge in Malaysia, contributing to a considerable burden on the healthcare system and affecting the well-being of the population. Diseases such as dengue fever, COVID-19, and influenza are prevalent, leading to severe health complications and, in some cases, death. The tropical climate and high population density in urban areas further exacerbate the spread of these infectious diseases, making effective management and prevention crucial ([Ministry of Health Malaysia, 2020](https://www.moh.gov.my/moh/modules_resources/bookshelf/MOH_Annual_Report_2020_min/index.html)).

Despite the efforts of public health authorities, there are persistent gaps in the availability and accessibility of real-time information on infectious diseases. Traditional methods of disseminating health information, such as public announcements and printed materials, are often slow and unable to reach a broad audience promptly. This delay in information dissemination can hinder timely public health responses and reduce the effectiveness of preventive measures. Moreover, the general public's awareness and understanding of disease prevention practices remain limited, further complicating efforts to control disease outbreaks ([World Health Organization, 2020](https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation)).

The rapid advancement of technology offers new opportunities to address these challenges. By leveraging digital platforms, it is possible to provide real-time updates and comprehensive information on infectious diseases to a wide audience. This project aims to develop a comprehensive health advisory website specifically designed to track and prevent infectious diseases in Malaysia. The website will integrate data from various reliable sources to provide timely updates on disease trends, offer educational content to enhance public health knowledge, and deliver guidelines for effective disease prevention. By making this information readily accessible, the project seeks to empower individuals and communities to take proactive measures in safeguarding their health ([Leveraging Technology for Public Health Awareness, 2021](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8075350/)).

The proposed health advisory website will utilize modern web technologies to ensure a user-friendly and interactive experience. It will feature real-time data visualization tools, educational articles, preventive guidelines, and a platform for users to provide feedback and receive personalized health advice. The goal of this project is to bridge the information gap, improve public awareness, and enhance the overall effectiveness of disease management strategies in Malaysia. By doing so, it aims to contribute to a healthier and more informed society, better equipped to handle the challenges posed by infectious diseases ([Effective Health Care Program, 2021](https://effectivehealthcare.ahrq.gov/products/medical-evidence-communication/research-protocol)).

## Problem Statements

The management of infectious diseases in Malaysia faces several critical challenges that hinder effective disease control and prevention efforts. These challenges are multifaceted and require a comprehensive approach to address them effectively.

### Problem 1: Underreporting and Data Gaps

Inaccurate or incomplete reporting of infectious disease cases is a significant issue. This problem stems from insufficient infrastructure for real-time data collection and reporting, leading to gaps in surveillance data. Without accurate data, it is challenging to track disease trends and predict outbreaks, which hampers effective response strategies. The current systems often rely on delayed reporting methods, which can result in missing critical early warning signs of potential outbreaks. Accurate and timely data is essential for effective disease management and response planning. ([Ministry of Health Malaysia, 2020](https://www.moh.gov.my/moh/modules_resources/bookshelf/MOH_Annual_Report_2020_min/index.html))

### Problem 2: Limited Public Awareness

Public knowledge about infectious diseases and their prevention remains inadequate. Despite information campaigns, many individuals lack access to real-time, accurate information about disease trends and prevention measures. This gap can lead to poor compliance with preventive practices and increased disease transmission. Misinformation and a lack of understanding about the severity and transmission methods of infectious diseases can exacerbate the spread, especially in rural and underserved communities. Effective public health education must be continuous and adaptive to address emerging threats and changing public perceptions. ([World Health Organization, 2020](https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation))

### Problem 3: Resource Allocation

The efficient allocation of healthcare resources is critical in managing infectious diseases. However, without real-time data, it is difficult to identify areas most in need of medical supplies, vaccines, and healthcare personnel. This inefficiency can lead to overburdened healthcare facilities in high-incidence areas, negatively impacting patient care. The unequal distribution of resources can result in some regions facing shortages while others have excess supplies. A data-driven approach is necessary to optimize the distribution of resources, ensuring that high-risk areas receive adequate support promptly. ([BMJ Global Health, 2021](https://www.researchgate.net/publication/323283626_Productive_disruption_Opportunities_and_challenges_for_innovation_in_infectious_disease_surveillance))

### 1.1.4 Technological Barriers

While there are advancements in technology, many existing platforms do not integrate real-time data effectively. For example, applications like MySejahtera focus primarily on contact tracing and vaccination status but may not provide comprehensive data on disease prevalence and healthcare resource availability. Additionally, not all platforms are user-friendly, which can limit their effectiveness in disseminating information to a broad audience. The lack of interoperability between different health information systems further complicates data sharing and integration, which is crucial for comprehensive disease monitoring and management. ([Journal of Public Health Research, 2021](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8075350/))

## Aims

The primary aim of this project is to develop a comprehensive health advisory application designed to track and prevent infectious diseases in Malaysia. This interactive web application, built using R and Shiny, will provide real-time updates on disease trends, offer educational content on disease prevention, and deliver personalized health recommendations. By integrating data from various reliable sources and utilizing advanced data visualization techniques, the project seeks to enhance public health knowledge, improve disease management practices, and facilitate timely responses to outbreaks. The goal is to empower individuals and communities to make informed health decisions, thereby contributing to better public health outcomes in Malaysia.

## Objectives

1. **To develop a user-friendly web application:**

Create a platform using R and Shiny that integrates multiple data sources to provide real-time information on infectious diseases in Malaysia, ensuring ease of use and accessibility for the public.

1. **To implement data aggregation and visualization:**

Design algorithms for aggregating and processing data in real-time, and develop interactive visualizations to display disease trends, prevalence, and locations of healthcare facilities, enabling users to easily interpret and act on the information.

1. **To enhance public health awareness:**

Curate and present up-to-date preventive measures and healthcare resources through the application, providing educational content to improve public understanding of infectious diseases and their management.

1. **To ensure the platform's scalability and sustainability:**

Implement scalable data processing and storage solutions to handle increasing data volumes, and plan for long-term maintenance and updates to keep the platform relevant and effective.

## Scope

The scope of this project outlines the specific deliverables, boundaries, and limitations to ensure a focused and effective development process.

### Deliverables

1. **User Registration and Authentication System:**

Implement a secure user registration and login system to manage user access to the application, ensuring data privacy and security.

1. **Real-Time Data Integration and Visualization:**

Develop algorithms to aggregate and process real-time data from multiple sources, including government health records, epidemiological studies, and real-time reporting systems. Create dynamic visualizations to display disease trends, prevalence in specific areas, and locations of nearby healthcare facilities.

1. **Informational Dashboard:**

Design a comprehensive dashboard that provides users with up-to-date information on infectious diseases, including preventive guidelines and relevant statistics. This dashboard will serve as the central interface for users to access all the features of the application.

1. **Educational Content:**

Curate and integrate educational resources such as articles, videos, and infographics to inform users about preventive measures and healthcare resources. This content will help raise public awareness and educate users on how to protect themselves from infectious diseases.

1. **Feedback Mechanism and User Support:**

Implement a system for users to provide feedback on the platform, report issues, and suggest improvements. This mechanism will ensure continuous improvement of the platform based on user input and enhance user satisfaction.

### Within Scope

1. Development of web applications using R and Shiny.
2. Integration of data from reliable sources for real-time updates on infectious diseases.
3. Creation of interactive visualizations and educational content.
4. User testing to ensure the platform meets user needs and is user-friendly.
5. Continuous maintenance and updates based on user feedback and new data.
6. Secure user registration and authentication system.
7. Development of algorithms for data aggregation and real-time processing.
8. Design and implementation of an informational dashboard.
9. Integration of a feedback mechanism for user support.
10. Implementation of scalable data processing and storage solutions.

### Outside Scope

1. The development of mobile applications (although future expansion may include this).
2. Real-time integration with healthcare providers' databases without prior agreements.
3. Handling of sensitive personal health data beyond basic user registration information.
4. Implementation of advanced AI algorithms for predictive modeling, which could be considered for future phases of the project.
5. Direct collaboration with healthcare professionals for real-time updates.
6. Inclusion of features specific to other regions or countries.
7. Development of offline features for web applications.
8. Integration with wearable health devices.
9. Real-time user health monitoring.
10. Providing personalized medical advice based on user data.

## Potential Benefits

The development and implementation of a comprehensive health advisory application for tracking and preventing infectious diseases in Malaysia offer several tangible and intangible benefits to various stakeholders.

### Tangible Benefits

1. Improved Disease Surveillance
2. Resource Optimization
3. Reduction in Disease Transmission
4. Cost Savings
5. Accessibility to Information

### Intangible Benefits

1. Increased Public Trust
2. Empowerment of Individuals
3. Community Engagement
4. Innovation in Public Health
5. Crisis Preparedness

### Target Users

**General Public**: Individuals seeking information on infectious diseases, preventive measures, and nearby healthcare facilities.

**Healthcare Professionals**: Medical practitioners and public health officials who need real-time data for disease management and resource allocation.

**Policy Makers**: Government and public health officials responsible for developing and implementing health policies.

**Researchers and Academics**: Individuals conducting research on infectious diseases and public health interventions.

**Non-Governmental Organizations (NGOs)**: Organizations involved in public health awareness campaigns and disease prevention initiatives.

## Overview

This Investigation Report is structured into four main chapters. Chapter 1 introduces the project, covering the background, problem statement, project aim, objectives, scope, and potential benefits. Chapter 2 presents a comprehensive literature review, examining existing research, technologies, and methodologies related to infectious disease tracking and prevention. Chapter 3 details the research methodology, including data collection methods, analysis techniques, and tools used. Finally, Chapter 4 discusses the findings, interpreting the data, and highlighting key insights and implications for public health strategies in Malaysia.

## Project Plan

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Task ID** | **Task Name** | **Duration** | **Start Date** | **End Date** | **Status** |
| 1 | Project Proposal Form | 13 Days | 19/05/2024 | 31/05/2024 | Completed |
| 2 | Acknowledgement | 1 Hour | 1/6/2024 | 1/6/2024 | Completed |
| 3 | Chapter 1 | 7 Days | 2/6/2024 | 8/6/2024 | Completed |
| 4 | 1.1 Introduction | 1 Day | 2/6/2024 | 2/6/2024 | Completed |
| 5 | 1.2 Problem Statement | 1 Day | 3/6/2024 | 3/6/2024 | Completed |
| 6 | 1.3 Project Aim | 1 Hour | 4/6/2024 | 4/6/2024 | Completed |
| 7 | 1.4 Objectives | 1 Day | 5/6/2024 | 5/6/2024 | Completed |
| 8 | 1.5 Scope | 1 Day | 6/6/2024 | 6/6/2024 | Completed |
| 9 | 1.6 Potential Benefits | 1 Day | 7/6/2024 | 7/6/2024 | Completed |
| 10 | 1.7 Overview of the IR | 1 Hour | 8/6/2024 | 8/6/2024 | Completed |
| 11 | 1.8 Project Plan | 1 Hour | 8/6/2024 | 8/6/2024 | Completed |
| 12 | Chapter 2 | 9 Days | 9/6/2024 | 17/06/2024 | Completed |
| 13 | 2.1 Introduction | 1 Day | 9/6/2024 | 9/6/2024 | Completed |
| 14 | 2.2 Domain Research | 3 Days | 10/6/2024 | 12/6/2024 | Completed |
| 15 | 2.3 Similar Systems | 3 Days | 13/06/2024 | 15/06/2024 | Completed |
| 16 | 2.4 Technical Research | 1 Day | 16/06/2024 | 16/06/2024 | Completed |
| 17 | 2.5 Summary | 1 Day | 17/06/2024 | 17/06/2024 | Completed |
| 18 | Chapter 3 | 22 Days | 18/06/2024 | 9/7/2024 | Completed |
| 19 | 3.1 Introduction | 1 Day | 18/06/2024 | 18/06/2024 | Completed |
| 20 | 3.2 System Development Methodology | 3 Days | 19/06/2024 | 21/06/2024 | Completed |
| 21 | 3.3 Data Gathering Design | 14 Days | 22/06/2024 | 5/7/2024 | Completed |
| 22 | 3.4 Analysis Survey Result | 3 Days | 6/7/2024 | 8/7/2024 | Completed |
| 23 | 3.5 Summary | 1 Day | 9/7/2024 | 9/7/2024 | Completed |
| 24 | Chapter 4 | 3 Days | 10/7/2024 | 12/7/2024 | Completed |
| 25 | 4.1 Discuss Achievements | 1 Day | 10/7/2024 | 10/7/2024 | Completed |
| 26 | 4.2 Justify Investigation | 1 Day | 11/7/2024 | 11/7/2024 | Completed |
| 27 | 4.3 Gaps and Future Improvements | 1 Day | 12/7/2024 | 12/7/2024 | Completed |
| 28 | Final Report Compilation | 5 Days | 13/07/2024 | 17/07/2024 | Completed |
| 29 | Project Presentation Preparation | 3 Days | 18/07/2024 | 20/07/2024 | Completed |
| 30 | Project Presentation | 1 Day | 21/07/2024 | 21/07/2024 | Completed |
| 31 | Submission | 1 Day | 22/07/2024 | 22/07/2024 | Completed |
| 32 | Final Review and Adjustments | 5 Days | 23/07/2024 | 27/07/2024 | Completed |
| 33 | Final IR Submission | 1 Day | 7/8/2024 | 7/8/2024 | Completed |

Table 1: Project Plan

# 2.0 Literature Review

## 2.1 Introduction

The literature review aims to provide a comprehensive understanding of the current state of research and technology in the field of infectious disease tracking and prevention. By examining relevant theories, technologies, and methodologies, this chapter establishes a foundation for the project, highlighting the significance of real-time data analysis, technological integration, and predictive modeling in managing infectious diseases. The review will help identify gaps and opportunities for innovation, guiding the development of a comprehensive health advisory application for tracking and preventing infectious diseases in Malaysia.

The study of epidemiology and public health surveillance is crucial for understanding the spread and control of infectious diseases. Epidemiology involves the analysis of disease incidence, prevalence, and transmission dynamics, which are essential for identifying risk factors and evaluating the effectiveness of intervention measures. Public health surveillance, on the other hand, focuses on the continuous and systematic collection, analysis, and interpretation of health-related data. Effective surveillance systems can detect outbreaks early, monitor disease control programs, and provide data for informed decision-making ([CDC, 2012](https://archive.cdc.gov/#/details?url=https://www.cdc.gov/csels/dsepd/ss1978/index.html)).

Technological advancements have significantly enhanced the ability to track and prevent infectious diseases. Geographic Information Systems (GIS) enable the mapping of disease spread, providing insights into the geographic patterns of infections. Real-time data analytics tools allow for the processing and analysis of large volumes of data, enabling quick identification of trends and anomalies ([Ginsberg et al., 2009](https://www.nature.com/articles/nature07634)). Machine learning algorithms and predictive modeling play a crucial role in forecasting disease outbreaks and informing public health interventions ([Chen & Asch, 2017](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5953825/)). However, it is essential to ensure that these models are fair and unbiased, as they can inadvertently perpetuate existing disparities if not carefully designed and validated ([Lazer et al., 2014](https://gking.harvard.edu/files/gking/files/0314policyforumff.pdf)).

By reviewing existing systems and technical research, this chapter aims to identify best practices and areas for improvement that can inform the development of the new health advisory application. The review will cover domain research, similar systems, and technical research, providing a detailed analysis of the current state of the field and highlighting the potential benefits of integrating advanced technologies into public health initiatives.

## 2.2 Domain Research

### 2.2.1 Public Health Advisory Systems

Public health advisory systems play a crucial role in disseminating information and guidelines to the public to prevent the spread of infectious diseases. These systems leverage various technologies and methodologies to ensure timely and accurate information delivery. Effective public health advisory systems are essential for managing pandemics and other health crises by promoting healthy behaviors and mitigating the harm from misinformation and disinformation. Public health advisory systems typically include various components, such as communication strategies, data collection and analysis, and the dissemination of health information through different channels.

Historically, public health advisory systems have relied on traditional media, such as television, radio, and newspapers, to reach the public. These methods, while effective to some extent, have limitations in terms of reach and speed. With the advent of digital technology, the scope and efficiency of public health advisory systems have improved significantly. Digital platforms, including social media, websites, and mobile applications, have become essential tools for public health communication. They allow health authorities to provide real-time updates and engage with the public more interactively.

Public health advisory systems also involve collaboration between various stakeholders, including government agencies, healthcare providers, and the public. Effective communication and coordination among these stakeholders are vital to ensure that accurate information is disseminated and that public health interventions are implemented effectively.



Figure 1: Early public health advisories in urban areas

### 2.2.2 Historical Development of Health Advisory Systems

Health advisory systems have evolved significantly over the years, with advancements in technology enhancing their efficiency and reach. Initially, these systems relied on traditional media, such as television and newspapers, to disseminate information. However, with the advent of digital technologies, public health advisory systems have transitioned to online platforms, social media, and mobile applications. This shift has enabled real-time updates and interactive features, making health information more accessible to the public ([Leveraging Technology for Public Health Awareness, 2021](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8075350/)).

A diagram of a process

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Figure 2: Conceptual model of public health preparedness

The historical development of health advisory systems can be traced back to the early days of public health, where printed pamphlets and posters were used to educate the public about disease prevention and health promotion. With the invention of radio and television, health authorities could reach a broader audience more quickly. Public service announcements and health campaigns on these platforms played a crucial role in raising awareness about various health issues.

In recent years, the internet and mobile technology have revolutionized public health advisory systems. Websites and social media platforms allow health authorities to provide timely and accurate information to the public. Mobile applications, such as MySejahtera in Malaysia, enable individuals to access health information, report symptoms, and receive alerts about potential health threats in their area. These technologies have made health information more accessible and have empowered individuals to take proactive measures to protect their health.

The evolution of health advisory systems reflects the continuous efforts to improve public health communication and response. By leveraging modern technologies, public health authorities can reach more people, provide accurate information, and promote healthy behaviors more effectively.

### 2.2.3 Role of Technology in Public Health Advisory Systems

Modern public health advisory systems utilize various technologies to improve their effectiveness. Machine learning and artificial intelligence (AI) are increasingly being used to analyze large datasets and provide personalized health recommendations. For instance, AI-powered systems can predict disease outbreaks based on data trends and provide targeted advice to individuals at higher risk ([Managing the COVID-19 infodemic, 2020](https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation)). Additionally, mobile applications have become a vital tool for health advisory systems, offering features such as symptom tracking, vaccination reminders, and real-time alerts.

A diagram of data processing

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Figure 3: A basic Geographic Information System (GIS) concept

Technology plays a critical role in enhancing the capabilities of public health advisory systems. Geographic Information Systems (GIS) are used to map disease spread and identify hotspots, facilitating targeted interventions. GIS technology allows health authorities to visualize data spatially, enabling them to understand the geographic distribution of diseases and allocate resources more effectively.

Real-time data analytics is another essential technology in public health advisory systems. By analyzing data from various sources, such as social media, electronic health records, and mobile applications, health authorities can detect early signs of disease outbreaks and respond promptly. Real-time data analysis enables timely decision-making and helps prevent the spread of infectious diseases.

AI and machine learning algorithms are used to develop predictive models that can forecast disease outbreaks and identify high-risk populations. These models analyze historical data and identify patterns that can predict future disease trends. By using AI and machine learning, public health advisory systems can provide personalized recommendations and interventions based on individual risk profiles.

Overall, technology enhances the ability of public health advisory systems to monitor, predict, and respond to infectious diseases. By leveraging advanced technologies, public health authorities can improve the accuracy and timeliness of health information, ultimately protecting public health and preventing the spread of diseases.

### 2.2.4 Challenges and Ethical Considerations in Health Advisory Systems

While the advancements in technology have significantly improved health advisory systems, several challenges remain. Data privacy and security are major concerns, as these systems handle sensitive health information. Ensuring the accuracy and reliability of health information is also critical to prevent the spread of misinformation. However, the opportunities presented by technology in public health advisory systems are vast. The potential to reach a broader audience, provide personalized health advice, and improve public health outcomes makes these systems a vital component of modern healthcare ([Communication and Dissemination Strategies, 2021](https://effectivehealthcare.ahrq.gov/products/medical-evidence-communication/research-protocol)).

One of the primary challenges in health advisory systems is ensuring the privacy and security of health data. Public health advisory systems collect and store sensitive information, such as individuals' health status, symptoms, and location data. Protecting this data from unauthorized access and breaches is crucial to maintaining public trust and compliance with health guidelines.

Another challenge is addressing misinformation and disinformation. Inaccurate health information can spread quickly, leading to confusion and potentially harmful behaviors. Public health advisory systems must ensure that the information they provide is accurate, reliable, and based on scientific evidence. Effective communication strategies and collaboration with trusted sources are essential to combat misinformation.

Ethical considerations also play a significant role in the development and implementation of health advisory systems. Ensuring that these systems do not perpetuate existing health disparities is crucial. Efforts must be made to provide equitable access to health information and resources, particularly for marginalized and underserved communities.

Despite these challenges, the opportunities for improving public health advisory systems are significant. Technology enables health authorities to reach a broader audience and provide personalized health advice. By leveraging digital platforms, such as social media and mobile applications, public health advisory systems can engage with individuals and communities more effectively.

Furthermore, technology allows for the integration of real-time data analysis and predictive modeling, enhancing the ability to monitor and respond to health threats. By using advanced technologies, public health advisory systems can improve the accuracy and timeliness of health information, ultimately protecting public health and preventing the spread of diseases.

### 2.2.5 Future Trends in Health Advisory Systems

The future of health advisory systems lies in the continuous integration of emerging technologies and the adoption of innovative approaches to public health communication. One promising trend is the use of blockchain technology to enhance data security and privacy. Blockchain can provide a decentralized and transparent method for managing health data, ensuring that information is secure and tamper-proof ([Yue et al., 2016](https://link.springer.com/article/10.1007/s10916-016-0574-6)).

Another emerging trend is the use of wearable devices and the Internet of Things (IoT) in health advisory systems. Wearable devices can continuously monitor health parameters, such as heart rate, temperature, and activity levels, providing real-time data to health advisory systems. This data can be used to provide personalized health advice and detect early signs of potential health issues ([Patel et al., 2012](https://pubmed.ncbi.nlm.nih.gov/22520559/)).

Telemedicine and remote health monitoring are also expected to play a significant role in the future of health advisory systems. These technologies enable individuals to access health information and services from the comfort of their homes, reducing the need for in-person visits and minimizing the risk of disease transmission ([Dorsey & Topol, 2016](https://www.nejm.org/doi/full/10.1056/NEJMra1601705)).

The integration of advanced data analytics and machine learning algorithms will continue to enhance the predictive capabilities of health advisory systems. By analyzing large datasets from various sources, these systems can identify patterns and trends that predict disease outbreaks and inform public health interventions ([Raghupathi & Raghupathi, 2014](https://link.springer.com/article/10.1186/2047-2501-2-3)).

Overall, the future of health advisory systems is promising, with the potential to improve public health outcomes significantly. By embracing new technologies and innovative approaches, public health authorities can enhance the effectiveness of health advisory systems, ensuring that they continue to protect and promote public health in an ever-changing landscape.

## 2.3 Similar System



Table 2: Similar System comparison

The analysis of similar health advisory systems provides valuable insights into the features, strengths, and weaknesses of existing solutions. From the review, it is evident that a successful health advisory application should include comprehensive features such as real-time updates, contact tracing, health alerts, and vaccination status tracking. The integration with national health systems and government backing significantly enhances user adoption and trust, as seen in the cases of MySejahtera and TraceTogether.

However, privacy and data security remain critical concerns across all systems. Ensuring strong privacy measures and transparent data handling practices is essential to maintaining user trust. The feedback from users indicates that while features and functionalities are important, the usability and reliability of the application are equally crucial.

Figure 4 & 5: The logo of MySejahtera and TraceTogether

## 2.4 Technical Research

### 2.4.1 Hardware Requirements

For the development and deployment of the health advisory application, robust hardware is essential to ensure efficient performance. High-performance development workstations with at least 16GB of RAM, multi-core processors (e.g., Intel i7), and SSD storage are necessary to handle intensive coding, testing, and debugging tasks. Cloud-based servers, such as AWS EC2 instances, will be used for real-time data processing and storage, offering scalable resources to meet the application's demands. Various mobile devices, including both iOS and Android smartphones and tablets, will be utilized for testing to ensure compatibility across different platforms. A reliable high-speed internet connection is crucial for seamless communication and data transfer between development teams and servers. Additionally, peripheral devices like external hard drives for backups, network switches for connectivity, and monitors will support the development environment by enhancing productivity and ensuring data security​ ([Career Karma, 2020](https://careerkarma.com/blog/computer-specs-for-programming/))​.

### 2.4.2 Software Requirements

The software environment for this project includes essential tools and platforms to support development, testing, and deployment. Development workstations will run on Windows 10/11 for compatibility with a wide range of development tools, while servers will use Linux (Ubuntu) for its robustness and security. Integrated Development Environments (IDEs) such as RStudio will be used for their extensive support for the R programming language, specifically for developing with R Shiny. Version control will be managed using Git, with repositories hosted on GitHub to facilitate efficient collaboration and code management among team members. MySQL was selected as the database management system due to its reliability and strong community support. The primary programming language will be R with R Shiny for developing the web application. Testing and deployment tools will ensure quality and efficiency in the development process, supported by relevant R packages and libraries for data analysis and visualization.

### 2.4.3 Language Selection

Figure 6 & 7 : The founder, Joe Cheng, and logo of R Shiny programming language

The programming language selected for the development of the health advisory application is R, specifically utilizing the R Shiny framework. R Shiny is an open-source web application framework for R that allows developers to create interactive web applications directly from R scripts. It is designed to facilitate the building of data-driven applications without requiring extensive knowledge of web development. This framework is particularly well-suited for applications involving data analysis and visualization, making it an excellent choice for a health advisory application that needs to present health data effectively.

### 2.4.4 Justification for R Shiny

R Shiny offers several advantages that make it an ideal choice for developing a health advisory application. The primary reason for choosing R Shiny is its unparalleled capability for interactive data visualization. The ability to create dynamic, interactive charts, graphs, and maps is crucial for a health advisory application that aims to present complex health data in an accessible and understandable manner. Users can explore data interactively, gaining insights into health trends, risks, and preventive measures, which is essential for informed decision-making. ([Programming Historian, 2020](https://programminghistorian.org/en/lessons/shiny-leaflet-newspaper-map-tutorial))

Another significant advantage of R Shiny is its seamless integration with the R programming language. R is a leading language for statistical computing and data analysis, widely used by data scientists and statisticians. By leveraging R's extensive libraries and tools, the application can perform sophisticated statistical analyses and implement advanced machine learning models. This integration ensures that the health advisory application can provide robust data processing and generate insightful visualizations, enhancing the overall user experience. ([Gupta, 2023](https://connectjaya.com/r-vs-r-shiny/))

R Shiny also simplifies the web application development process, allowing for rapid prototyping and deployment. The framework abstracts much of the underlying complexity of web development, enabling developers to focus on the application logic and user interface design. This efficiency is particularly beneficial for projects with tight timelines, such as a final year project, where quick iteration based on user feedback is necessary to refine and improve the application.

Furthermore, R Shiny provides extensive customization options. Developers can use HTML, CSS, and JavaScript to tailor the application's user interface to specific requirements. This flexibility allows for the creation of highly customized and responsive interfaces, ensuring that the application meets diverse user needs and provides a user-friendly experience. Customization is particularly important for a health advisory application, which must cater to different user groups, including healthcare professionals and the public. ([Zacks, 2022](https://zacks.one/r-shiny/))

The robust community support for R and R Shiny is another key factor in their selection. The vibrant and active communities offer a wealth of resources, tutorials, and packages that facilitate problem-solving and continuous improvement of the application. Access to such a robust support network is invaluable for developers, providing guidance and tools that can accelerate development and enhance the application's functionality.

Additionally, R Shiny applications can be deployed on various platforms, including Shiny Server, RStudio Connect, and cloud services such as AWS. This flexibility in deployment options ensures that the application can be scaled and maintained efficiently, accommodating growing user bases and evolving requirements. The ability to deploy on different platforms also enhances the accessibility and reliability of the application, ensuring that it always remains available to users.

In conclusion, R Shiny's strengths in data visualization, integration with R, ease of development, customization capabilities, community support, and flexible deployment options make it the ideal choice for developing a comprehensive health advisory application. These features ensure that the application will be effective in presenting health data, providing valuable insights, and supporting informed decision-making.

### 2.4.5 Integrated Development Environment (IDE) Selection

Figure 8 & 9 : The founder, JJ Allaire, and logo of R Studio

For the development of the health advisory application using R Shiny, the Integrated Development Environment (IDE) selected is RStudio. RStudio is a powerful and versatile IDE specifically designed for R programming, making it an excellent choice for this project.

### 2.4.6 Justification for Selected IDE

RStudio is the chosen Integrated Development Environment (IDE) for developing the health advisory application, primarily because of its numerous advantages that align perfectly with the project requirements.

Firstly, RStudio is specifically designed for R programming, which is the core language used in this project. This ensures that all tools and functionalities within RStudio are optimized for R, providing a seamless development experience. The IDE supports various tasks such as coding, debugging, and data visualization, all within a single environment. This integration enhances productivity by allowing developers to perform multiple tasks without needing to switch between different tools.

Another significant advantage of RStudio is its user-friendly interface, which simplifies the development process for both beginners and experienced developers. Features such as syntax highlighting, code completion, and an integrated console streamline the coding process and reduce the likelihood of errors. These features are crucial for maintaining high coding standards and ensuring the application runs smoothly​.

The seamless integration with R Shiny is a key factor in the selection of RStudio. It includes built-in support for creating Shiny web applications, with templates and tools that simplify the development process. This makes it easy to build interactive web applications directly from R scripts, which is essential for this health advisory application that relies heavily on data visualization and interactivity.

RStudio also supports a wide range of R packages, including those necessary for data analysis, visualization, and web development. This extensive package support ensures that developers can leverage the full capabilities of R and R Shiny in their applications. The IDE's support for version control systems like Git and GitHub facilitates collaborative development and version tracking, allowing multiple developers to work on the project simultaneously and ensuring efficient management of changes​​.

Cross-platform compatibility is another advantage of RStudio. It is available for Windows, macOS, and Linux, providing flexibility in the development environment. This ensures that developers can work on their preferred operating system without compatibility issues, making the development process more efficient and adaptable to different workflows​.

Furthermore, the robust community support and extensive documentation available for RStudio significantly enhance its utility. The active community forums and comprehensive guides help developers troubleshoot issues and improve their skills, ensuring that they can quickly resolve any challenges that arise during the development process​​.

In summary, RStudio's comprehensive toolset, user-friendly interface, seamless integration with R Shiny, extensive package support, version control integration, cross-platform compatibility, and strong community support make it the ideal IDE for developing the health advisory application.

### 2.4.7 Database Selection

A person talking to another person

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Figure 10 & 11 : The founders, David Axmark and Michael Widenius, and logo of MySQL

For the health advisory application, MySQL has been selected as the database management system (DBMS). MySQL is a widely used, open-source relational database management system known for its reliability, performance, and ease of use. It is suitable for handling large volumes of data, which is essential for a health advisory application that needs to manage and analyze extensive health data.

### 2.4.8 Justification for MySQL

MySQL has been selected as the database management system for the health advisory application due to its numerous benefits that align well with the project requirements.

MySQL is renowned for its robust performance and reliability, making it a preferred choice for applications that require handling large volumes of data and numerous concurrent transactions. This ensures that the health advisory application can manage extensive health data efficiently without compromising on speed or performance.

Scalability is another key strength of MySQL. It can accommodate the growing data and user base of the application, ensuring that the system remains efficient and responsive as the application expands. This is crucial for a health advisory application that aims to serve many users with real-time data updates ([MySQL Scalability](https://www.mysql.com/products/enterprise/scalability.html)).

Security is a paramount concern for any application dealing with sensitive health data. MySQL provides robust security features, including data encryption, user authentication, and access control mechanisms, which help protect data integrity and confidentiality. These security measures are essential for maintaining the trust of users and ensuring compliance with data protection regulations ([MySQL Security](https://dev.mysql.com/doc/refman/8.0/en/security.html)).

Ease of use is another significant advantage of MySQL. The database management system has a straightforward installation and configuration process, along with comprehensive management tools that facilitate database administration and maintenance. This user-friendliness is beneficial for developers and database administrators working on the health advisory application.

The compatibility of MySQL with R Shiny is another important factor. The RMySQL package allows seamless integration, enabling efficient data querying, manipulation, and analysis directly from R Shiny applications. This integration is vital for the smooth functioning of the health advisory application, ensuring that data flows seamlessly between the database and the web application ([RMySQL Package](https://cran.r-project.org/web/packages/RMySQL/RMySQL.pdf)).

As an open-source database management system, MySQL is a cost-effective solution. It offers extensive features and capabilities without the need for expensive licensing fees, making it a financially viable option for the project. This cost-effectiveness ensures that budget constraints do not hinder the application’s development.

Finally, MySQL boasts a large and active community, providing extensive documentation, tutorials, and forums. This support network is invaluable for troubleshooting issues and continuously improving the application. The availability of community resources ensures that developers can find solutions to problems quickly and enhance the application’s functionality efficiently.

In summary, MySQL’s performance, scalability, security, ease of use, integration capabilities with R Shiny, cost-effectiveness, and strong community support make it the ideal database management system for the health advisory application. These features ensure that the application can handle large volumes of health data securely and efficiently, providing a reliable and scalable solution for users.

### 2.4.9 Tools and Libraries

**1. RStudio:**

RStudio is the primary integrated development environment (IDE) used for R programming and R Shiny development. It offers a comprehensive suite of tools for coding, debugging, and data visualization, which are essential for building health advisory web applications. Its seamless integration with R Shiny facilitates the creation of interactive web applications.

**2. R Packages:**

**shiny:** This package is the core of R Shiny, allowing the creation of interactive web applications directly from R.

**shinydashboard:** Provides a framework for creating dashboards in R Shiny, helping to organize and present data in a user-friendly manner.

**dplyr:** A package for data manipulation, providing a set of functions to perform data cleaning and transformation tasks efficiently.

**ggplot2:** Used for data visualization, enabling the creation of high-quality and customizable plots and charts.

**plotly:** Adds interactivity to ggplot2 visualizations, allowing users to interact with the data through zooming, panning, and hovering.

**DT:** Used for rendering interactive data tables in R Shiny applications, making it easier to display and explore tabular data.

**3. Version Control:**

**Git:** A distributed version control system used to track changes in the source code and collaborate with other developers.

**GitHub:** A web-based platform for hosting and managing Git repositories, facilitating version control and collaborative development.

4. Database Management

**MySQL:** The chosen database management system for storing and managing the application's data. The RMySQL package will be used to connect and interact with MySQL databases from within R.

5. Testing and Deployment:

**shinytest:** A package for testing Shiny applications, ensuring that the app functions correctly and meets the specified requirements.

**shinyapps.io:** A platform for deploying R Shiny applications, making them accessible to users via the web.

### 2.4.10 Algorithms

**1. Descriptive Statistics:**

Basic statistical measures such as mean, median, mode, standard deviation, and variance will be used to summarize and describe the health data.

**2. Predictive Modeling:**

Machine learning algorithms like linear regression, logistic regression, and decision trees will be used to predict health trends and potential outbreaks based on historical data.

**3. Clustering:**

Clustering algorithms such as k-means and hierarchical clustering will be employed to identify patterns and group similar data points, helping to uncover insights from the health data.

**4. Time Series Analysis:**

Time series analysis techniques will be used to analyze temporal data, identifying trends, seasonal patterns, and anomalies in health data over time.

### 2.4.11 Browser Selection

For the development and deployment of the health advisory application, Google Chrome is selected due to its performance, compatibility, and robust developer tools. Chrome efficiently handles JavaScript-heavy applications, supports modern web technologies, and offers comprehensive debugging capabilities through Chrome DevTools. Additionally, Chrome's built-in security features, such as sandboxing and automatic updates, provide strong protection for sensitive health data. Its large market share ensures broad accessibility for users ([Browser Market Share, 2023](https://gs.statcounter.com/browser-market-share)). Compatibility with other major browsers like Mozilla Firefox, Microsoft Edge, and Safari will also be ensured.

### 2.4.12 Operating System Selection

For the development and deployment of the health advisory application, **Windows 10/11** has been chosen as the operating system for both development workstations and servers.

Windows 10/11 was selected due to its widespread use, user-friendly interface, and compatibility with a broad range of development tools, including RStudio. It supports numerous software applications required for development and testing, ensuring a smooth and efficient workflow. Additionally, Windows provides strong security features, regular updates, and extensive support, making it a reliable choice for managing and deploying the application ([TechRadar, 2023](https://www.techradar.com/news/windows-11-home-and-pro)).

# 3.0 Methodology

This chapter will describe the overall approach and framework chosen for the research and system development of the health advisory application. It includes the system development methodology, data gathering design, and analysis of the collected data. By outlining the methods and techniques used during the design and implementation phases, this chapter aims to provide a comprehensive understanding of the process involved in developing the application. Each section justifies the choice of methods and approaches, ensuring that the project is built on a solid foundation.

## 3.1 System Development Methodology

The methodology chapter outlines the overall approach and framework chosen for the research and system development of the health advisory application. The primary objective is to ensure a structured and systematic approach to project development, enabling the efficient and effective realization of project goals. The chosen methodology provides a clear roadmap for the project, detailing each phase of development, from planning to maintenance.

System development methodologies are crucial in guiding the development process, ensuring that the project is well-organized and that each phase is executed with precision. These methodologies offer a standardized approach, reducing the likelihood of errors and improving the quality of the final product. By following a defined methodology, the development team can better manage resources, time, and risks, leading to a more successful project outcome.

In this project, the **Software Development Life Cycle (SDLC)** has been selected as the development methodology. SDLC is a well-established framework that breaks down the project into distinct phases, each with specific deliverables and milestones. This methodology is particularly suited for health advisory web applications, as it provides a comprehensive structure for developing a robust and reliable system.

The following sections will delve into the chosen methodology, its justification, and the detailed activities and processes involved in each phase of the SDLC.

### 3.1.1 Methodology Choice and Justification

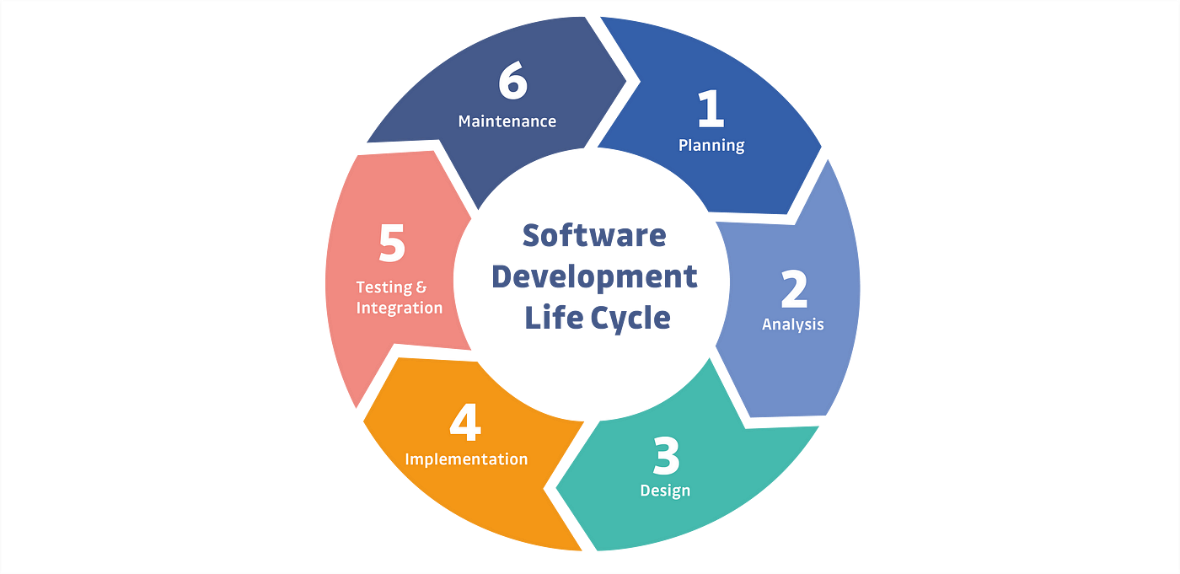


Figure 12: Software Development Life Cycle’s phases

For the development of the health advisory application, the **Software Development Life Cycle (SDLC)** has been chosen as the methodology. The SDLC framework is a well-established, structured approach that guides the development of information systems through a series of phases, each with specific objectives and deliverables.

The SDLC framework is composed of the following phases:

**Planning:** This initial phase involves defining the project's scope, objectives, and feasibility. It includes resource allocation, project scheduling, and risk assessment.

**Analysis:** In this phase, the requirements of the system are gathered and analyzed. This involves understanding the needs of the stakeholders and documenting the system requirements.

**Design:** The design phase involves creating the architecture of the system. This includes designing the user interface, database structures, and system interfaces.

**Implementation:** During this phase, the actual development and coding of the system take place. The design specifications are transformed into a working system.

**Testing and Integration:** This phase involves testing the system to ensure it meets the specified requirements. It includes unit testing, integration testing, and system testing.

**Maintenance:** After the system is deployed, the maintenance phase ensures that the system operates smoothly. This involves performing updates, fixing bugs, and making improvements as needed.

The SDLC methodology has been chosen for this project due to several key reasons:

1. **Structured Approach:** SDLC provides a clear, structured approach to system development, ensuring that each phase is thoroughly planned and executed. This structured approach reduces the risk of errors and omissions, leading to a more reliable and high-quality system ([GeeksforGeeks, 2024](https://www.geeksforgeeks.org/software-development-life-cycle-sdlc/)).
2. **Comprehensive Documentation:** The SDLC framework emphasizes detailed documentation at each phase of development. This documentation is crucial for maintaining project clarity, facilitating communication among team members, and providing a reference for future maintenance and updates ([Guru99, 2023](https://www.guru99.com/software-development-life-cycle-tutorial.html)).
3. **Defined Phases:** The clear division of the development process into distinct phases allows for better project management and resource allocation. Each phase has specific deliverables and milestones, making it easier to track progress and ensure that the project stays on schedule ([Blake Jonathan, 2004](https://www.pmi.org/learning/library/project-managing-sdlc-8232)).
4. **Stakeholder Involvement:** SDLC encourages active involvement of stakeholders throughout the development process. This ensures that the system meets the actual needs of the users and that any issues are identified and addressed early in the development cycle ([TestFyra, 2024](https://testfyrablog.medium.com/collaboration-with-stakeholders-in-testing-maximizing-quality-and-alignment-db53b2ed1643)).
5. **Risk Management:** The SDLC framework includes risk assessment and mitigation strategies, which are essential for managing potential risks associated with system development. This proactive approach helps in identifying and addressing risks before they become critical issues ([UpTop, 2023](https://uptopcorp.com/blog/risk-management-in-software-development-the-2023-guide/)).
6. **Flexibility and Scalability:** SDLC is flexible and can be adapted to projects of different sizes and complexities. It provides a scalable framework that can accommodate changes and expansions in the project scope without compromising the development process ([MoldStud, 2024](https://moldstud.com/articles/p-the-importance-of-scalability-and-flexibility-in-software-architecture)).

By adopting the SDLC methodology, the development of the health advisory application will benefit from a well-organized, systematic approach that ensures the delivery of a high-quality, reliable, and user-centered system. The structured phases, comprehensive documentation, and active stakeholder involvement will contribute to the successful implementation and maintenance of the application.

### 3.1.2 Description of Activities and Processes

The Software Development Life Cycle (SDLC) methodology adopted for this project follows a structured approach divided into six key phases: Planning, Analysis, Design, Implementation, Testing and Integration, and Maintenance. Each phase includes specific activities and deliverables that contribute to the development of the health advisory application. The SDLC methodology ensures a comprehensive and systematic approach to software development, facilitating project management and quality assurance.

### Phase 1: Planning

**Activities:**

* **Define the Project Scope and Objectives:**
  + Establish clear goals and objectives for the project. Define the boundaries of what the project will achieve and the deliverables that will be produced.
  + Example: Determining that the health advisory web application will track and provide information on infectious diseases in Malaysia, offer preventive measures, and suggest nearby healthcare facilities.
* **Conduct Feasibility Studies:**
  + Assess the technical, economic, and operational feasibility of the project. Identify the resources required and determine if the project is viable.
  + Example: Evaluating if the current technology stack (R Shiny and MySQL) is suitable for developing the application and if the budget allocated is sufficient.
* **Develop a Project Plan:**
  + Create a detailed project plan that includes tasks, timelines, resource allocation, and milestones. Use project management tools to schedule and track progress.
  + Example: Using Gantt charts to map out the development timeline, from requirement gathering to deployment and maintenance.
* **Identify Potential Risks and Develop Mitigation Strategies:**
  + Identify risks that could impact the project and develop strategies to mitigate them. Document these in a risk management plan.
  + Example: Identifying potential delays in data gathering and developing a contingency plan to source data from alternative sources.

**Deliverables:**

* Project Scope Document
* Project Plan
* Risk Management Plan

A chart with colorful squares

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Table 3: A Risk Management Plan table

In the planning phase, it is crucial to assess potential risks and develop a comprehensive risk management plan. The risk management plan helps in identifying, evaluating, and mitigating risks that could impact the project’s success. Above is an illustration of a risk management plan chart that categorizes risks based on their severity and probability.

In the context of developing the health advisory application, the risk management plan chart helps in categorizing and prioritizing risks. For instance, a catastrophic risk with a high probability, such as a critical data breach, would require immediate attention and robust mitigation strategies. Conversely, a minor risk with a rare probability, like a minor software bug, would be less critical and managed accordingly.

### Phase 2: Analysis

**Activities:**

* **Gather Detailed Requirements:**
  + Collect comprehensive requirements from stakeholders through surveys, interviews, and observations.
  + Example: Conducting surveys to understand user needs and preferences for the health advisory application.
* **Document Functional and Non-Functional Requirements:**
  + Clearly define what the system should do (functional requirements) and the quality attributes (non-functional requirements) it should have.
  + Example: Specifying that the application should provide real-time updates on infectious diseases (functional) and be user-friendly and responsive (non-functional).
* **Analyze Requirements to Identify System Functionalities and Constraints:**
  + Evaluate the gathered requirements to identify necessary system functionalities and any constraints.
  + Example: Determining that the application needs a real-time data feed and considering constraints like data privacy regulations.

**Deliverables:**

* Requirements Gathering Report
* Functional Requirements Document (FRD)
* Non-Functional Requirements Document (NFRD)

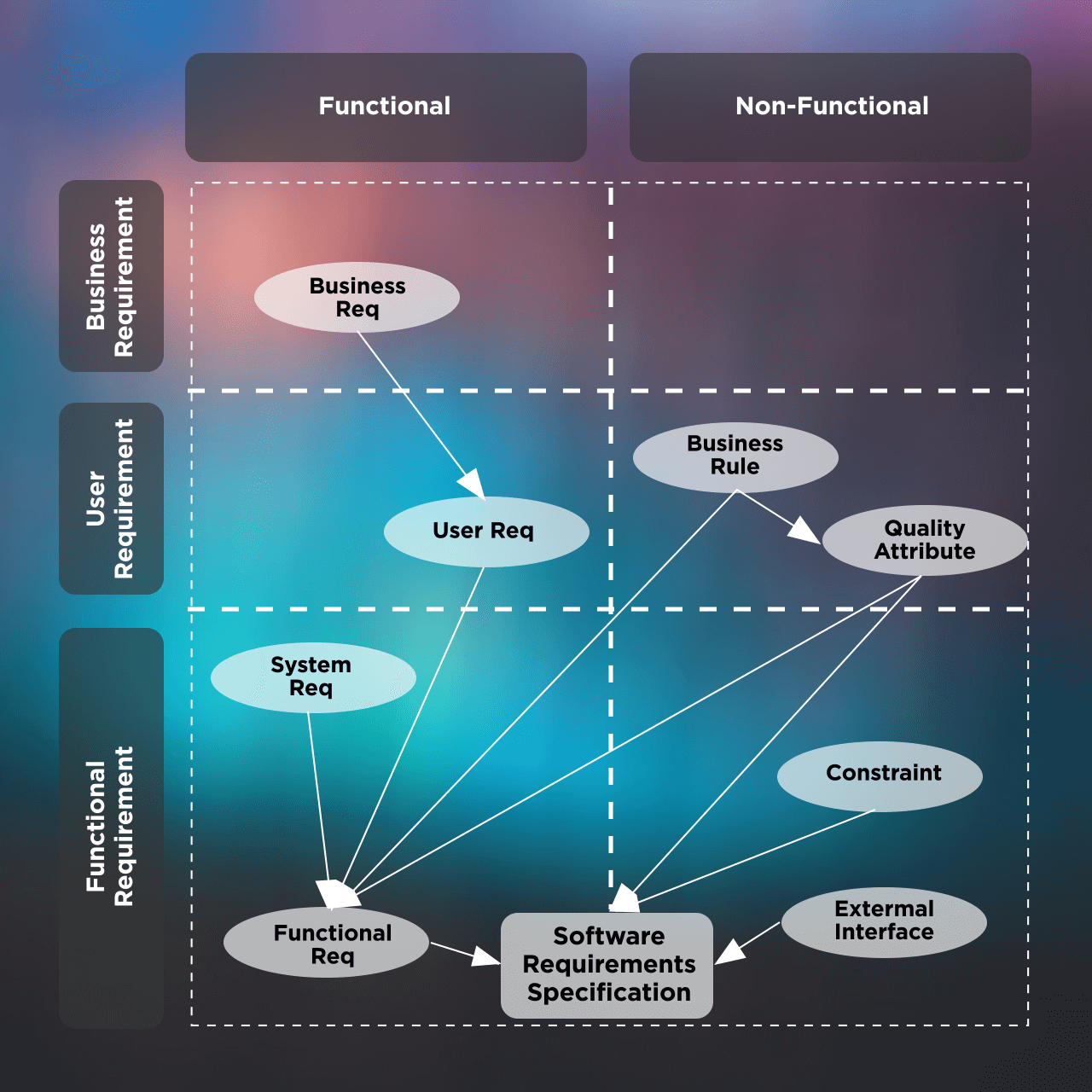


Figure 13: Relationships between functional requirements and non-functional requirements

In the analysis phase, it is crucial to distinguish between functional and non-functional requirements and understand their interrelationships. The image above illustrates how business, user, and functional requirements interact with both functional and non-functional aspects of the system.

Business requirements are broken down into user requirements to ensure that the system meets the specific needs of the users. Example: A business requirement for improving public health awareness translates into a user requirement for real-time health updates.

User requirements are further detailed into functional and non-functional requirements to provide a complete specification for the system. Example: The need for real-time updates (user requirement) translates into a functional requirement for real-time data feeds and a non-functional requirement for system responsiveness.

In the context of developing the health advisory application, the functional requirements ensure that the system provides the necessary functionalities, such as real-time updates and preventive measures. Non-functional requirements ensure that the system delivers these functionalities with the desired quality attributes, such as performance and usability.

### Phase 3: Design

**Activities:**

* **Create the System Architecture:**
  + Design the overall system architecture, including the database design, application architecture, and user interface design.
  + Example: Designing a multi-tier architecture that separates the user interface, business logic, and data storage layers.
* **Develop Detailed Design Specifications:**
  + Provide detailed specifications for each component of the system, including data models, algorithms, and interface designs.
  + Example: Specifying the database schema, including tables, relationships, and constraints.
* **Design Data Flow Diagrams:**
  + Create diagrams to represent data flows, entity relationships, and user interface layouts.
  + Example: Developing data flow diagrams (DFDs) to represent the flow of data in the system.

**Deliverables:**

* Detailed Design Specifications
* Data Flow Diagrams (DFDs)

A diagram of a computer system

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Figure 14: The example of system architecture diagram of the web application

The system architecture for the health advisory application includes different layers that manage user interactions, application logic, services, and resources. The figure above illustrates a typical system architecture diagram for a web application.

* Users: Agents can be health professionals, while browsers can be the public accessing the health advisory application.
* Delivery Mechanism: Users access the health advisory application through internet browsers on various devices.
* Application: The Booking System in the figure is analogous to the health advisory application that processes user requests and provides health information.
* Services: Services in the health advisory application might include user authentication and real-time data validation.
* Resources: The health advisory application would use a database to store and retrieve health data and user information.

In the context of developing the health advisory application, the system architecture ensures a clear separation of concerns. Each layer handles a specific aspect of the system, making it easier to manage, maintain, and scale. The architecture supports robust and efficient interactions between the user interface, application logic, services, and data resources.

By designing a well-structured system architecture, the development process becomes more streamlined, and the application can handle complex requirements while maintaining high performance and reliability.

### Phase 4: Implementation

**Activities:**

* **Develop the Application:**
  + Write code based on the design specifications using R Shiny and MySQL. Ensure adherence to coding standards and best practices.
  + Example: Implementing the user interface using R Shiny and setting up the database using MySQL.
* **Write and Test Code for Each Module:**
  + Develop and test individual modules to ensure they function correctly and meet the specified requirements.
  + Example: Writing and testing the module for user authentication and authorization.
* **Conduct Peer Reviews and Code Inspections:**
  + Perform code reviews and inspections to ensure code quality and identify any potential issues.
  + Example: Conducting peer code reviews to check for adherence to coding standards and identifying areas for improvement.

**Deliverables:**

* Source Code
* Module Integration Plan
* Code Review Reports

A screenshot of a checklist

Description automatically generated

Figure 15: Code review checklist

In the context of developing the health advisory application, using a comprehensive code review checklist ensures that the codebase remains clean, efficient, and maintainable. By addressing each point in the checklist, developers can identify and resolve potential issues early, leading to a more stable and reliable application. ([GitHub, 2020](https://github.com/mgreiler/code-review-checklist))

### Phase 5: Testing and Integration

**Activities:**

* **Develop Test Plans and Test Cases:**
  + Create comprehensive test plans and test cases to validate the system's functionalities.
  + Example: Developing test cases for user login, data retrieval, and data visualization functionalities.
* **Conduct Unit Testing, Integration Testing, System Testing, and User Acceptance Testing (UAT):**
  + Perform different levels of testing to ensure the system works as intended and meets user requirements.
  + Example: Conducting unit tests for individual components, integration tests for combined modules, and UAT with end-users.
* **Identify and Fix Defects and Bugs:**
  + Track and resolve any issues or bugs identified during testing.
  + Example: Using a bug tracking system to document and fix issues found during testing.
* **Ensure the System Meets All Specified Requirements:**
  + Verify that the system meets all functional and non-functional requirements before deployment.
  + Example: Performing final verification to ensure the system is ready for production deployment.

**Deliverables:**

* Test Plans and Test Cases
* Test Reports
* Bug Fix Reports

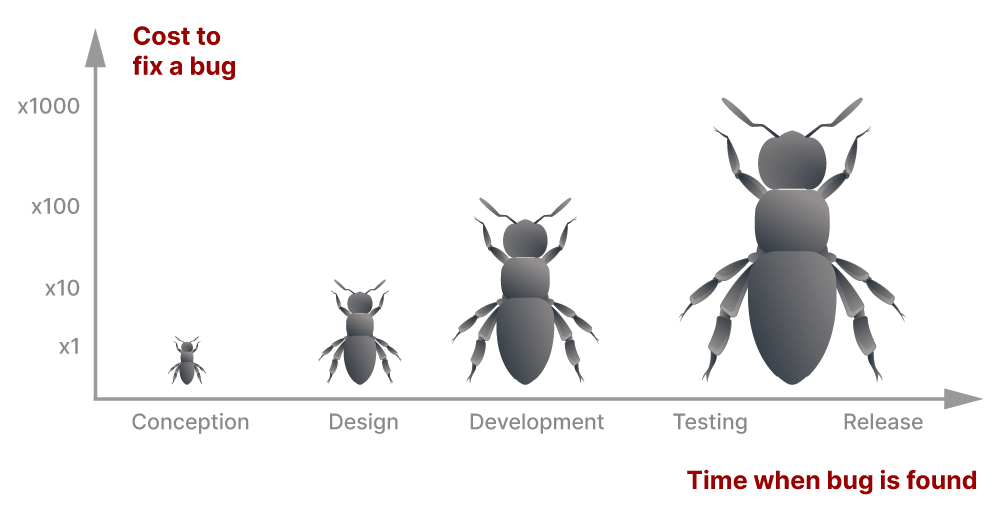


Figure 16: The importance of fixing bugs in time

The cost of fixing bugs increases significantly as the software development lifecycle progresses. The figure above illustrates how the cost to fix a bug escalates from conception to release.

**Conception:** Bugs identified during the conception phase are the least costly to fix. These bugs are usually related to initial requirements and design and can be addressed with minimal effort. Example: Identifying a missing requirement for the health advisory application early on can be resolved by updating the requirements document.

**Design:** Bugs found during the design phase are more expensive to fix than those found during conception. Design-related issues may require reworking the architecture or system design. Example: Discovering an issue with the database schema design may require adjustments to the database design, which could impact other parts of the system.

**Development:** Bugs identified during development are costlier to fix as they may require changes to the codebase, which can be time-consuming and affect other components. Example: Fixing a bug in the data processing logic of the health advisory application during development may involve significant code changes.

**Testing:** Bugs found during testing are even more expensive to fix, as they may require thorough retesting and validation of the affected components. Example: Discovering a critical issue during system testing may necessitate extensive retesting to ensure all functionalities are working correctly.

**Release:** Bugs identified after the application is released are the costliest to fix. These bugs can impact user experience and may require emergency patches or updates. Example: Fixing a major security vulnerability found post-release can be very expensive due to the need for immediate patches and possible damage control.

In the context of developing the health advisory application, conducting thorough testing during the development lifecycle is crucial to identify and fix bugs early. This helps to minimize the cost and effort required to address defects and ensures a higher quality product.

### Phase 6: Maintenance

**Activities:**

* **Monitor the System for Performance and Reliability:**
  + Continuously monitor the system to ensure it performs well and remains reliable.
  + Example: Using monitoring tools to track system performance and uptime.
* **Perform Regular Updates and Maintenance Tasks:**
  + Keep the system updated with regular maintenance tasks, including software updates and performance tuning.
  + Example: Applying security patches and optimizing database queries.
* **Address User Feedback and Fix Issues Post-Deployment:**
  + Collect and address user feedback to improve the system and fix any issues that arise.
  + Example: Implementing user-suggested enhancements and resolving reported bugs.
* **Plan for System Enhancements and Future Upgrades:**
  + Develop plans for future enhancements and upgrades to keep the system relevant and efficient.
  + Example: Planning for the integration of new features based on emerging technologies and user needs.

**Deliverables:**

* Maintenance Plan
* Performance Monitoring Reports
* Issue and Resolution Reports
* Enhancement Plans

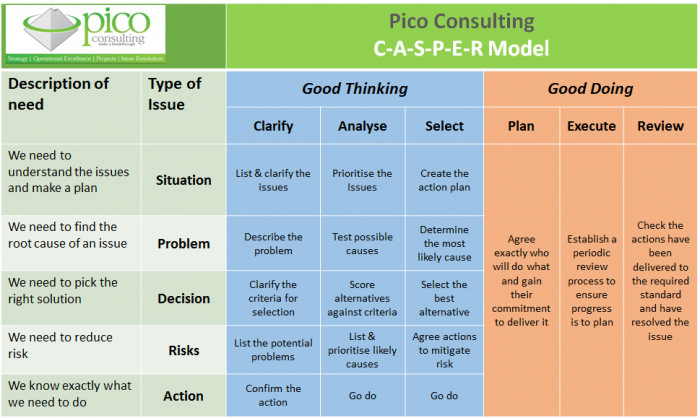


Table 4: Issues and Resolution Report

The issues and resolution report is a structured approach to problem-solving and issue resolution. It includes five key steps: Clarify, Analyze, Select, Plan, Execute, and Review. The following table illustrates how this model can be applied during the deployment and maintenance phase.

In the context of developing and maintaining the health advisory application, the model provides a structured approach to address various challenges. By following this model, the development team can ensure that deployment and maintenance activities are carried out efficiently and effectively, leading to a reliable and robust application.

## 3.2 Data Gathering Design

### 3.2.1 Data Gathering Techniques

The primary data gathering technique used in this project is a survey conducted through Google Forms. Surveys are an effective method for collecting quantitative and qualitative data from many respondents efficiently. This approach is particularly suitable for gathering data on public awareness, preventive measures, and the use of health advisory platforms related to infectious diseases in Malaysia.

### 3.2.2 Questionnaire Design

### Section 1: Introduction

A screenshot of a computer

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Figure 17: Section 1 of the survey

This introductory section ensured that participants were well-informed about the study's purpose, procedures, and their rights as respondents, thereby promoting transparency and ethical research practices.

### Section 2: Demographic Information

A screenshot of a survey

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Figure 18 & 19: Section 2 of the survey

This section was designed to collect demographic data from the participants to ensure a diverse and representative sample. The demographic information helps in understanding the background of the respondents, which is crucial for analyzing and interpreting the survey results accurately.

Each question in this section was carefully selected to provide a comprehensive demographic profile of the participants. This information is vital for segmenting the data during analysis and understanding how different demographic factors might influence awareness, practices, and experiences related to infectious diseases and health advisory platforms.

### Section 3: Awareness and Prevention of Infectious Diseases

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Figure 20 & 21: Section 3 of the survey

In this section, respondents are asked about their awareness and preventive measures regarding infectious diseases. This section is crucial for understanding the public's current knowledge level and their habits in preventing the spread of infectious diseases. The questions are designed to gauge the respondents' awareness, the sources from which they receive information, the diseases they are familiar with, and the preventive measures they practice.

### Section 4: Use of Health Advisory Platforms

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Figure 22: Section 4 of the survey

This section focuses on the respondents' use of online platforms or applications for tracking infectious diseases and their perceived usefulness. This information is essential to determine the existing engagement with digital health tools and identify any gaps or areas for improvement in current health advisory platforms.

### Section 5: Feedback and Suggestions

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Figure 23: Section 5 of the survey

This section is designed to gather open-ended feedback and suggestions from respondents about health advisory applications. The insights from this section will be valuable in understanding user needs and improving the design and functionality of the proposed health advisory application.

### Section 6: Closing

A person with his hand up

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This section is to express thanks to all the participants.

### 3.2.3 Participants and Data Collection

**Participants:**

The participants for this survey were selected to gather diverse insights on infectious diseases and preventive measures in Malaysia. The target group includes individuals from various demographics to ensure a comprehensive understanding of public awareness and behavior regarding health advisories.

**Demographic Overview:**

Gender: Participants include both male and female respondents.

Age: The age groups of the participants range from 18 to 65+ years.

Nationality: The majority are Malaysians, with a few from other nationalities.

Education Level: Participants' education levels range from primary school to doctorate degrees.

Duration of Stay in Malaysia: The respondents have been living in Malaysia for varying periods, from less than 1 year to more than 5 years.

**Data Collection Process:**

Data was collected using an online survey distributed through various channels to reach a broad audience. The survey was designed to be completed in approximately 5-7 minutes, ensuring that it was accessible and convenient for participants.

**Distribution:**

The survey was shared via email, social media, and other online platforms to ensure wide reach.

Participants were encouraged to share the survey with their networks to increase the sample size.

**Data Handling:**

Responses were collected and stored securely, ensuring confidentiality and anonymity.

The collected data was then imported into a spreadsheet for analysis.



Table 5: All 61 responses from the survey (\*double click to open)

## 3.3 Analysis

### 3.3.1 Data Analysis

|  |  |
| --- | --- |
| Section 1: Introduction |  |
| Forms response chart. Question title: Gender. Number of responses: 61 responses. | The survey responses show that most participants are male, comprising 88.5% of the total respondents, while females make up the remaining 11.5%. This indicates a significant gender imbalance among the participants. |
| Forms response chart. Question title: Age. Number of responses: 61 responses. | The age distribution reveals that 68.9% of respondents are aged between 18-24 years. This is followed by 19.7% in the 25-34 age group. Smaller proportions of respondents fall into the 35-44 (6.6%), 45-54 (3.3%), and 55-64 (1.6%) age groups. There were no respondents in the 65+ category, highlighting a younger demographic overall. |
| Forms response chart. Question title: What is your nationality?. Number of responses: 61 responses. | A vast majority of 95.1% of the respondents are Malaysian, with a few participants identifying as Yemeni, Indian, or Pakistani. This indicates that the survey predominantly captures the perspectives of Malaysian nationals. |
| Forms response chart. Question title: What is your highest level of education?. Number of responses: 61 responses. | Most respondents (63.9%) have a bachelor’s degree, followed by 23% with a Diploma, and 9.8% have completed secondary school. A small number have achieved a master’s degree (1.6%) or other qualifications such as "Sijil Reka Bentuk Grafi" (1.6%). |
| Forms response chart. Question title: How long have you been living in Malaysia?. Number of responses: 61 responses. | An overwhelming majority of respondents (95.1%) have lived in Malaysia for more than five years. This suggests that most participants have a long-term residency in the country, providing a stable context for understanding local health advisory applications. |

Table 6: Data Analysis of Section 1

|  |  |
| --- | --- |
| Section 2: Awareness and Prevention of Infectious Diseases |  |
| Forms response chart. Question title: Are you aware of the common infectious diseases in Malaysia?   . Number of responses: 61 responses. | **Summary**: A significant portion of respondents, 60.7%, are aware of common infectious diseases in Malaysia. However, 27.9% are uncertain, and 11.5% are unaware.  **Insight**: This indicates that while a majority are informed, a notable percentage of the population could benefit from increased awareness efforts. |
| Forms response chart. Question title: How do you usually receive information about infectious diseases? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: Social media is the most common source of information (88.5%), followed by radio/television (50.8%), and newspapers (42.6%). Government websites (36.1%) and healthcare providers (36.1%) are less frequently used.  **Insight**: Social media plays a crucial role in disseminating information about infectious diseases. Efforts to enhance the reliability of information on these platforms could be beneficial. |
| Forms response chart. Question title: Which of the following infectious diseases are you familiar with? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: COVID-19 (93.4%) and Dengue Fever (85.2%) are the most recognized diseases, followed by Influenza (80.3%). Diseases like Malaria (34.4%) and Tuberculosis (29.5%) have lower awareness.  **Insight**: Public health campaigns have effectively increased awareness of COVID-19 and Dengue Fever. There is a need for more educational efforts on other infectious diseases. |
| Forms response chart. Question title: How often do you practice preventive measures against infectious diseases?   . Number of responses: 61 responses. | **Summary**: Preventive measures are practiced to varying degrees, with the majority practicing them sometimes (39.3%) or often (29.5%). Only 4.9% always practice preventive measures.  **Insight**: While many individuals practice preventive measures occasionally or often, there is room to encourage consistent and regular preventive behaviors. |
| Forms response chart. Question title: Which preventive measures do you practice regularly? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: The most common measures are washing hands frequently (85.2%) and wearing masks (65.6%). Using insect repellent (37.7%) and avoiding crowded places (60.7%) are less common.  **Insight**: Emphasizing the importance of less commonly practiced preventive measures, such as using insect repellent, could enhance overall health and safety. Areas where public health messaging could be strengthened. |

Table 7: Data Analysis of Section 2

|  |  |
| --- | --- |
| Section C: Use of Health Advisory Platforms |  |
| Forms response chart. Question title: Have you used any online platform or application to track infectious diseases?   . Number of responses: 61 responses. | **Summary**: 45.9% of respondents have used online platforms or applications to track infectious diseases, while 42.6% have not, and 11.5% are unsure.  **Insight**: There is a moderate usage of online platforms for tracking infectious diseases, suggesting potential for increased adoption. |
| Forms response chart. Question title: How useful do you think these platforms in managing your health?   . Number of responses: 61 responses. | **Summary**: The usefulness of these platforms varies, with 31.1% rating them as moderately useful (3), 26.2% as useful (4), and 14.8% as very useful (5). However, 6.6% find them not useful at all.  **Insight**: While many users find these platforms moderately useful, there is potential for improvement to increase their perceived value. |
| Forms response chart. Question title: What additional features would you like to see in a health advisory application? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: The top desired features are real-time disease tracking (77%), preventive guidelines (75.4%), and notifications and alerts (65.6%). Educational content and nearby healthcare facilities are also highly valued.  **Insight**: To meet user needs, health advisory applications should prioritize features like real-time tracking, preventive guidelines, and timely alerts. |
| Forms response chart. Question title: How satisfied are you with the current health advisory platforms in the market?   . Number of responses: 61 responses. | **Summary**: Satisfaction levels vary, with 41% rating their satisfaction as moderate (3), 24.6% as somewhat satisfied (4), and 6.6% as very satisfied (5). A notable percentage (23%) are somewhat dissatisfied (2).  **Insight**: There is room for improvement in health advisory platforms to better meet user expectations and enhance satisfaction. |

Table 8: Data Analysis of Section 3

|  |  |
| --- | --- |
| Section D: Feedback and Suggestions |  |
| Forms response chart. Question title: What challenges do you think will face in accessing accurate health information? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: The most significant challenges are misinformation (70.5%) and lack of trust in sources (62.3%). Information overload (52.5%) and language barriers (45.9%) are also notable concerns.  **Insight**: Addressing misinformation and building trust in information sources are critical steps to improve access to accurate health information. |
| Forms response chart. Question title: What motivates you to use health advisory applications? (Select all that apply)   . Number of responses: 61 responses. | **Summary**: Concern for personal health (82%) and staying informed about outbreaks (73.8%) are the primary motivators. Family health management (62.3%) and convenience (50.8%) also play significant roles.  **Insight**: Health advisory applications should emphasize their role in personal and family health management, as well as their convenience in staying informed about outbreaks. |

Table 9: Data Analysis of Section 4



Table 10: The responses of the for Section 4(1)

The feedback provided by respondents offers valuable insights into how health advisory applications can be improved. Key areas of focus include real-time updates and notifications, user interface enhancements, personalization, and ensuring the accuracy and reliability of information. Additionally, respondents suggested the integration of features such as printable doctor's notes, AI chatbots, and symptom checkers to increase the application's utility. These insights will be instrumental in guiding the development of a more effective and user-friendly health advisory application.



Table 11: The responses of the for Section 4(2)

The feedback provided by respondents offers valuable insights into how healthcare providers and public health authorities can better support health information needs. Key areas of focus include utilizing digital platforms for dissemination, enhancing accessibility and transparency, ensuring timely and accurate updates, increasing health education and awareness, delivering personalized and engaging content, and making health information convenient and easily accessible. These insights will be instrumental in guiding the development of more effective health information strategies and platforms.

### 3.3.2 User Requirements

Based on the analysis of the survey responses, the following user requirements have been identified for the development of a comprehensive health advisory application aimed at tracking and preventing infectious diseases in Malaysia. These requirements encompass various aspects of the application, including its features, functionality, and user interface design.

### Functional Requirements

1. **Real-Time Disease Tracking**
   * **Description**: The application should provide real-time updates on the status of infectious diseases in different regions.
   * **Source**: "Real-time update the infectious diseases status" (Survey response).
2. **Personalized Health Alerts and Notifications**
   * **Description**: Users should receive personalized alerts and notifications based on their location, health status, and preferences.
   * **Source**: "Real-time update alerts and notifications" (Survey response).
3. **Interactive and User-Friendly Interface**
   * **Description**: The application should have an easy-to-use interface, catering to users of all age groups, including the elderly.
   * **Source**: "Have an easy user interface for eldest group" (Survey response).
4. **Educational Content and Resources**
   * **Description**: The application should provide educational content on infectious diseases, preventive measures, and self-assessment tips.
   * **Source**: "Provide more awareness, education on infectious disease, preventive measures to take and self-assessing tips" (Survey response).
5. **Integration with Wearable Devices**
   * **Description**: The application should support integration with wearable devices to track health metrics and provide personalized recommendations.
   * **Source**: "Integration with wearable devices, and ensuring reliable, evidence-based information" (Survey response).
6. **Multilingual Support**
   * **Description**: The application should offer support in multiple languages to cater to a diverse user base.
   * **Source**: "Translate information into multiple languages and ensuring it is understandable to people with varying levels of health literacy" (Survey response).
7. **AI-Driven Health Recommendations**
   * **Description**: Implement AI algorithms to provide personalized health advice based on user data such as health records and lifestyle.
   * **Source**: "Implement AI-driven algorithms that tailor advice based on user data, such as health records, lifestyle and preferences" (Survey response).
8. **Access to Nearby Healthcare Facilities**
   * **Description**: Users should be able to locate and access nearby healthcare facilities through the application.
   * **Source**: "Provide more awareness, education on infectious disease, preventive measures to take and self-assessing tips" (Survey response).

### Non-Functional Requirements

1. **Performance and Reliability**
   * **Description**: The application should provide timely and accurate information without any downtime or delays.
   * **Source**: "Ensure real-time updates and personalized alerts for local disease risks" (Survey response).
2. **Security and Privacy**
   * **Description**: The application must ensure the security and privacy of user data, adhering to relevant data protection regulations.
   * **Source**: "Ensure easy access to reliable, up-to-date information through digital platforms" (Survey response).
3. **Scalability**
   * **Description**: The application should be scalable to handle an increasing number of users and expanding data sets.
   * **Source**: General best practice for health advisory applications.
4. **Accessibility**
   * **Description**: The application should be accessible to users with varying levels of digital literacy and physical abilities.
   * **Source**: "Ensure it is understandable to people with varying levels of health literacy" (Survey response).
5. **Maintainability**
   * **Description**: The application should be designed for easy maintenance and updates to incorporate new health information and features.
   * **Source**: General best practice for software applications.
6. **Usability**
   * **Description**: The application should provide an intuitive user experience, minimizing the learning curve for new users.
   * **Source**: "Clear and simple UI will help with the convey of information" (Survey response).

The identified user requirements will guide the development of the health advisory application, ensuring it meets the needs and preferences of its users. These requirements emphasize real-time information, personalization, user-friendliness, educational content, and integration with modern technologies, making the application a valuable tool for tracking and preventing infectious diseases in Malaysia.

### 3.3.3 Summary of Findings

The survey results offer key insights into the needs and preferences of potential users for a health advisory application focused on tracking and preventing infectious diseases in Malaysia.

Most respondents were young, educated males (88.5% male, 68.9% aged 18-24, 63.9% with a bachelor’s degree). Most were Malaysian nationals (95.1%). 60.7% of respondents were aware of common infectious diseases. Social media (88.5%) and radio/television (50.8%) were the main sources of information, indicating the need to leverage these platforms for health communication. High familiarity was noted for COVID-19 (93.4%), dengue fever (85.2%), and influenza (80.3%). The application should focus on these diseases while also covering fewer familiar ones. Frequent handwashing (85.2%), wearing masks (65.6%), and getting vaccinated (68.9%) were common practices. The application can support these behaviors with additional guidelines and information. Only 45.9% had used an online health advisory platform, suggesting a significant opportunity. Existing platforms were rated moderately useful, highlighting room for improvement. Users wanted real-time disease tracking (77%), preventive guidelines (75.4%), and notifications/alerts (65.6%). Educational content (59%) and symptom checkers (67.2%) were also important. Major challenges included misinformation (70.5%) and lack of trust in sources (62.3%). Primary motivations were personal health concerns (82%), staying informed about outbreaks (73.8%), and family health management (62.3%). Recommendations included AI-driven advice, personalized alerts, better user interfaces, and real-time updates. These emphasize the need for advanced technology and user-centric design. Suggestions for better support included using multiple communication channels, providing timely updates, promoting health literacy, and ensuring transparency.

In conclusion, the survey highlights the need for a comprehensive, user-friendly health advisory application with real-time updates, personalized recommendations, and educational content. By addressing the identified challenges and incorporating desired features, the application can enhance public health awareness and disease management in Malaysia, meeting the specific needs of its target audience.

# 4.0 Conclusion

The first part of this project, focused on developing a comprehensive health advisory application for tracking and preventing infectious diseases in Malaysia, has made significant strides towards its objectives. The chosen project title reflects the critical need for accessible, real-time health information in the context of infectious diseases, particularly in a post-pandemic world. The decision to use the R Shiny programming language was driven by its robust capabilities in data visualization and interactivity, which are essential for creating an effective and user-friendly health advisory application.

Throughout the investigation and research phases, extensive efforts were made to gather relevant data and insights. This included conducting a comprehensive literature review to understand the current landscape of health advisory applications, identifying key functional and non-functional requirements, and designing a detailed survey to collect user feedback. The responses from 61 participants provided valuable information on user demographics, awareness of infectious diseases, preventive measures, and preferences for health advisory platforms. This data has been crucial in shaping the design and functionality of the proposed application.

Despite the progress made, there are areas that warrant further exploration and improvement. One gap identified is the need for more detailed research on integrating advanced features such as AI-driven personalized recommendations and real-time data analytics. Additionally, while the survey provided a good overview of user needs, a larger and more diverse sample size could offer deeper insights and help in fine-tuning the application’s features. Future research could also explore the technical feasibility and implementation strategies for incorporating multilingual support and accessibility features to cater to a broader audience.

In conclusion, the initial phase of this project has successfully laid the groundwork for developing a comprehensive health advisory application. By addressing the identified gaps and continuing to refine the design based on user feedback and technological advancements, the project can achieve its goal of enhancing public health awareness and disease management in Malaysia.

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# 6.0 Appendices

# Appendix A: Proposal Form

A close-up of a form

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A close-up of a book

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## Appendix B: Fast Track Ethics Form

A close-up of a form

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## A close-up of a document Description automatically generated

## Appendix C: Log SheetsA document with text and a note Description automatically generated with medium confidence A document with text and images Description automatically generated with medium confidence A document with text and images Description automatically generated with medium confidence

## Appendix D: Gantt Chart

A screenshot of a computer

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## Appendix E: Respondence Demographic Profile



## 