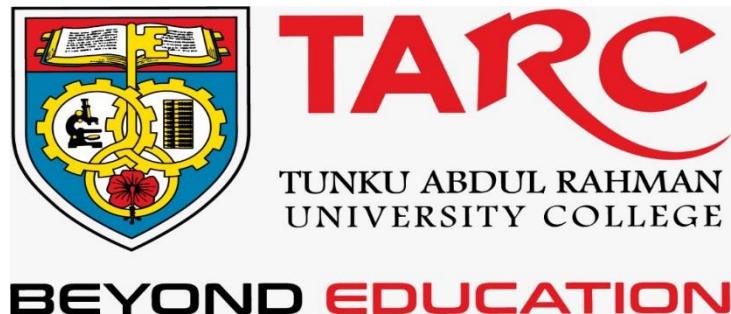


Traco COVID-19 Tracking System (Citizen, Location, Messaging and enquiry, and Vaccine setup)

By

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**FACULTY OF COMPUTING AND
INFORMATION TECHNOLOGY**

**TUNKU ABDUL RAHMAN UNIVERSITY COLLEGE
KUALA LUMPUR**

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2021/22**

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Supervisor: Miss GAN LAY KEE

A project report submitted to the
Faculty of Computing and Information Technology
in partial fulfillment of the requirement for the
Bachelor of Information Technology (Honours)

Department of Information and Communication Technology
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Abstract

The Traco COVID-19 Tracking System is a COVID-19 tracking system developed by the author and his partner to solve the problems of the existing system. The existing systems have some problems such as time-consuming and ineffective processes, user dissatisfaction, and poor management. The problems must be solved as soon as possible as these problems might delay the process of defending against the COVID-19 pandemic. The proposed system aims to remove time-consuming processes and provide greater management to reduce the workload of the MoH staff and reduce the cases of COVID-19. The author in this project is in charge of the citizen management, location module, messaging and enquiry module and vaccine management.

The author and his partner have used the waterfall methodology to develop the proposed system. They also used the questionnaire to gather the user requirements. The system design is shown by using diagrams such as use case diagrams, activity diagrams, and more. The proposed system is developed by using Visual Studio 2019 and the framework used is ASP.Net with Visual Basic. Google Chrome, Notepad++, and Microsoft Word also have been used in this project. Black box testing, module testing and system testing are performed to assure the quality of the system.

The outcomes of the proposed system are to speed up the tracking processes, reduce the word load of MOH staff, and provide better user experience. The strengths of the proposed system are it has responsive design which provides flexibility of access to the system by mobile devices or PC devices via internet and provide automation processes in some functions which help the MOH staff to save more time. The weaknesses of the proposed system are the system is not tested in the real-work environment and it cannot support IOS and Linux devices.

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Chapter 1

Introduction

1 Introduction

The Traco COVID-19 Tracking System is a disease (COVID-19) tracking system proposed by the author and his partner, LEE KOK KEN, in their Final Year Project. Currently, the cases of COVID-19 in Malaysia are still unstable, and the current system like MySejahtera is not good enough to manage the citizens during the pandemic. In the middle of March, cases of COVID-19 were reduced and controlled in a range of 1000 to 2000, but it was controlled due to the restriction of the SOP in CMCO and not the contribution of the current system. Once the SOP of CMCO is ended or removed, the cases of COVID-19 might increase again due to the current system having poor management. To avoid this situation from happening again, the author and his partner investigate the current system to discover what problems cause poor management and solve it in the proposed system.

The author and his partner find out that the current system like MySejahtera has lousy management on the citizens. The health status of citizens is decided by filling the survey that is provided by the system. The citizens might fill in the questionnaire dishonestly and fake their health status. Besides that, there are only two health statuses in the system that are “low risk” and “high risk”. Having only two health statuses will confuse the staff about whether the citizen is infected with COVID-19 or suspected infected with COVID-19. Next, the high-risk citizens won’t get any warning if they go out during the quarantine period and scan the QR code somewhere. Other than that, the current system like MySejahtera has many inefficient processes. For example, the staff needs to manually check the suspended citizens who went places that have positive cases in the past 14 days and notify them one by one to do a PCR test. Apart from that, most of the current system has no messaging function. The citizens have to contact the staff by using the hotline provided on the website. The call might be missed and the citizens are required to call again until the staff accepts the call. Furthermore, some of the current systems like LivePhoto and COVID-19 Malaysia only provide the news and statistics of COVID-19 only and do not offer any other functions. Moreover, some of the current systems have a poor layout which makes the contents hard to read by the citizens.

To solve the problem above, the author and his partner provide better management and automate most of the processes in the proposed system. First, there are three types of statuses: “Safe”, “Suspected” and “Infected” which clearly indicate the health status of the citizens. The status of citizens can be automatically managed by the proposed system or manually by the staff so that the citizens cannot fake their status. Besides that, once there is a citizen’s status updated to “infected”, the proposed system will search the location history of that person in the past 14 days and automatically notify the citizens that went to those locations in the past 14 days as well as set these citizens’ status to “Suspected”. The automated process has helped the staff to save more time and

can take more time to do other stuff. Apart from that, the proposed system will send warnings to the suspended citizens if they went somewhere during the quarantine period and scan the QR code of a specific location. Then, the proposed system will send the information of the suspended citizen to the staff and the staff can consider taking action to punish this suspended citizen. Moreover, the proposed system will also warn the citizens if they scan the QR code of a high-risk location. The system will ask the citizens whether they want to continue to proceed to the high-risk location and record the location history if the user chooses to proceed. Other than that, the proposed system will include the messaging function for the citizens and staff. The citizens can message the staff by using the proposed system for any enquiry. The messages are kept and the citizens just need to wait for the reply of the staff. Aside from that, the proposed system will provide a more friendly user interface to increase users' satisfaction and users are more likely to use the system.

The target users of the proposed system will be Malaysia citizens, the Ministry of Health (MoH) staff, and the government hospital staff. The Malaysia citizens will use the proposed system to record their location history, check their health status, contact the staff, register to vaccinate applications, etc. Next, the MoH staff will use the proposed system to check the citizens' details, keep track of citizens' location history, manage vaccines, make announcements, and more. Lastly, the hospital staff will use the proposed system to record the citizens' PCR results and update the citizens' health status.

1.1 Objective

a. Provide better management

One of the aims of the proposed system is to provide better management than the current system to reduce the cases of COVID-19 as much as possible. For example:

- A warning message will be sent to the suspended citizen if that person went somewhere and scan the QR code of a specific location during the quarantine period.
- The staff can check which suspended citizens have gone out before during the quarantine period and consider taking action on these citizens.
- The citizens will receive a warning message when they scan the QR code of the high-risk location and the proposed system will ask the citizens either want to continue to proceed to the area.

b. Eliminate inefficient process

The proposed system is developed to eliminate time-consuming processes and automate some processes to save more time for users. For example:

- The proposed system eliminates the phone call process by implementing the messaging function for the users.
- The warning message is sent automatically by the proposed system to the suspected citizen if they have gone somewhere and scan the QR code of a specific location. The staff can save more time on other stuff as they do not need to warn the citizens one by one manually.

c. Provide comprehensive function

The proposed system had combined essential functions from other existing systems to provide comprehensive functionalities for the users. The proposed system contains:

- Messaging function for the citizen to send a message to the staff for any enquiry.
- Location tracking function that allows the citizens to record their location histories.

d. Increase user satisfaction

The proposed system provides a friendly user interface to make the user more willing to use the proposed system. For example:

- The webpages of the proposed system had proper alignment to arrange the contents tidily.
- Adding more margin between the contents of the webpages to increase the readability of the contents.

1.2 Background

Coronavirus disease 2019 (COVID-19) is a kind of virus that would affect the respiratory system of the infected person and it is hard to detect as the symptoms of the disease might appear after a few days of infecting the COVID-19. The first COVID-19 case was found in Malaysia on 25th January 2020, which is 3 Malaysians who had contacted an infected person in Singapore. Since then, the cases of COVID-19 have kept increasing every day and the government decided to implement the Movement Control Order (MCO) to restrict the activities of citizens. At first, the cases of COVID-19 were decreased and the government decided to ease the restrictions of MCO. This let the situation of COVID-19 become worse and the daily cases of COVID-19 are higher than before. Later on, the government also implemented the Conditional Movement Control Order (CMCO) but it is too late as the virus is already spreading around Malaysia. In mid-March 2021, there were over 320,000 cumulative COVID-19 cases in Malaysia and the daily cases of COVID-19 were around 1000 to 2000. Currently, the cases of COVID-19 are under control but no one can guarantee that the cases of COVID-19 will rise again after the CMCO is ended.

The Ministry of Health (MoH) Malaysia is the ministry of government Malaysia that manages kinds of stuff related to health such as health management, public health, health promotion, and more in Malaysia. During the COVID-19 pandemic, the MoH is responsible for controlling the spread of COVID-19 by implementing different measurements as well as guidelines for the citizens and industries in Malaysia. The MoH had developed MCO, CMCO, and RMCO to control the spread of COVID-19 in Malaysia. Furthermore, the MoH will broadcast the news and statistics of COVID-19 to the public through social media. Next, MoH had developed the COVID-19 Malaysia website to provide information about COVID-19 to the citizens and developed MySejahtera with NSC, MAMPU, MCMC, and MOSTI to keep track of the citizens' locations history as well as the health status of the citizens. Recently, MoH has imported vaccines from different countries and open vaccine registration for the citizens.

The government hospital in Malaysia is responsible for taking care of the infected COVID-19 patients that stay in the hospital. Besides that, the government hospital also provides the PCR test for the suspected citizens to check whether they are infected with the COVID-19. Next, each government hospital will report the death cases of COVID-19 in the hospital to the MoH to calculate the total death cases of COVID-19 in Malaysia. Recently, the government hospital also received vaccines from MoH and performed vaccination for the frontliners first.

MCO - Movement Control Order

CMCO - Conditional Movement Control Order

RMCO - Recovery Movement Control Order

NSC - National Security Council

MAMPU - Malaysian Administrative Modernisation and Management Planning Unit

MCMC - Malaysian Communications and Multimedia Commission

MOSTI - Ministry of Science, Technology and Innovation

1.3 Advantages and Contributions

a. Removes time-consuming processes

The proposed system includes online message features that allow the citizens to send messages to the staff for any inquiry. The current system like COVID-19 Malaysia only provides a list of hotlines for the citizens, the citizens only can contact the staff with phone calls and the staff need to answer the call one by one. There is also a chance that the call is missed and the citizens are required to call the hotline again. Unlike the current system, the citizens can directly send the message to the staff using the proposed system even if the staff is busy with other stuff, the messages will be kept and the staff will reply once they see the message.

b. Provide greater control

The proposed system will send a warning message to the suspected citizen when he/she went to a location and scan the QR code, the system will also send a message to inform the staff that this person had gone out during the quarantine period. All the suspected citizens' information will be sent to the staff and the staff can consider taking action on those citizens. The current system like MySejahtera will just display high risk on the screen after the suspected citizen scans the location's QR code and the staff didn't know that the suspected citizen had gone out before. Besides that, the proposed system will warn the citizens who scan the high-risk location's QR code and ask whether they want to enter the high-risk location. The location history only will be recorded if the citizen chooses yes in the selection. The current system like MySejahtera won't warn the citizens when scanning the QR code of high-risk location and the high-risk status will only be shown after citizens finish scanning the QR code.

c. Better user experience and interface

The proposed system will provide more friendly-user interfaces to users compared to the current system like COVID-19 Malaysia. The contents of websites will have proper alignment and enough margin between each content to let the webpage be comfortable to see and read. Besides that, the website won't show too much information at once like the COVID-19 Malaysia, all the information will be divided and placed into meaningful categories. With a cleaner and tidier website, the user will be more willing to use the website more.

Contribution to the society:

The proposed system can help to reduce the cases of COVID-19 in Malaysia. The proposed system will warn the suspected citizens when they go out somewhere and scan the QR code during the quarantine period. The suspected citizen's information will be sent to staff and the system will show that this person went out during the quarantine period. The staff can take action to punish the citizen and deter the general public from committing the crime by punishing those who do offend. The suspected citizens will be scared to get punishment and start to quarantine at home obediently. This can be useful in reducing the cases of COVID-19 as currently, some Malaysia citizens are still going out even though they are suspected of infecting the COVID-19 and the police cannot investigate the citizens one by one.

1.4 Project Plan

1.4.1 Project Scope

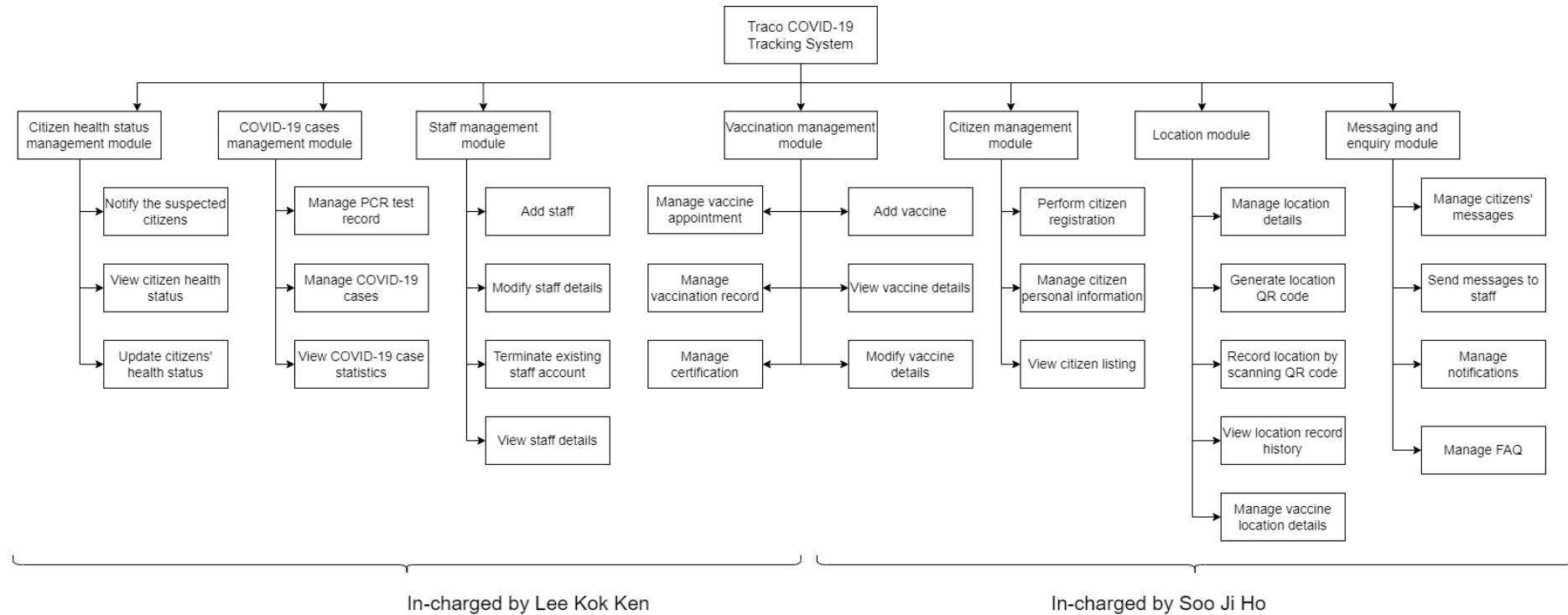


Figure 1.1: Project hierarchical chart

1.4.2 Functional and non-functional

Functional requirements

There are seven modules in the proposed system. There are two sites in the proposed system that are the citizen site and the admin site. The Malaysia citizens use the citizen site and the admin site is used by the staff of MoH and the government hospital. Each module provides different functions for each user. The author is in charge of the citizen management module, location module, message module and vaccine setup in the vaccine management module.

1) Citizen Management module

The citizen management module provides the functions to the users of the system to manage the citizen account.

Citizen site

- **Register account**

The first-time citizen would need to register an account to use the system. The citizen will provide the information needed such as the full name, NRIC, occupation, current address, phone number, email address and more. If the information is correct. The system will send a confirmation link to the citizen's email address. The citizen will click the link in the email address to complete the registration process.

- **Manage personal details**

The module also allows the citizens to manage their account details.

Admin site

- **View citizen listing**

The staff can use the system to view the list of registered citizens and check the details of a specific registered citizen.

2) Location module

The location module provides the functions that help the users to manage the locations and keep track of their location histories.

Citizen site

- **Generate location QR code**

The citizens can apply and generate a QR code for their company or shop.

- **Track location history**

The citizens can scan the QR code and record the location record.

- **View own location histories**

The citizens can view their location histories.

- **Warn suspected citizen of going out**

The suspected citizens will receive a warning message when they go out and scan a specific location's QR code during the quarantine period. The information of that suspected citizen will be sent to the staff.

- **Warn citizens of high-risk location**

When the citizens scan the QR code for the location with a "High" risk status, the system will warn the citizens that they are going to a high-risk place. The location would only be recorded if the citizens know the risks and want to continue to record the location.

Admin site

- **Manage resisted location**

The staff can manage the QR code generated for the location, such as editing the location details, activating or deactivating the location's QR code. Besides that, the staff can update the location's risk status to "Low" after the staff is notified that the location is sanitized.

- **View citizens' location details**

The staff can view all the locations' history of registered citizens. Besides that, the staff can view the suspected citizen who gone out during the quarantine period.

- **Update location status**

If there is a confirmed case of COVID-19 recorded into the system, the system will update the risk status of the locations the patient had been to as “High”. The staff can update the risk status of a location to “Low” after the staff is notified that the location is sanitized.

3) **Messaging and enquiry module**

- The messaging and enquiry module enables citizens to search enquiries by messaging the staff or checking through the FAQ.

Citizen site

- **Check FAQ**

The citizens can view the available FAQ. Before the citizen sends a message to staff for any enquiry, the module will ask the citizens to check the FAQ first before sending a message to the staff.

- **Send message**

If the FAQ didn't have the question that the citizen seeks for, the citizens can send messages to the staff to ask the question.

Admin site

- **Send notifications**

The staff can send any notifications about news of COVID-19 pandemic to the citizens.

- **Reply Citizens' Message**

The staff can view the message sent by the citizen and reply to the message.

- **Manage FAQ**

- 1) Add new FAQ

The staff are able to add new FAQ to the system.

- 2) Update FAQ

The staff are able to update the existing FAQs details.

- 3) View FAQ lists

The staff are able to view the FAQs lists and details of each FAQ.

- 4) Delete FAQ

The staff are able to delete existing FAQs in the system.

4) Vaccine management and application module (Author focus on vaccine setup)

The vaccine management and application module allow the staff to manage the vaccines.

Admin site**Manage vaccine****1) Add vaccine**

The staff can add new vaccines into the system.

2) View vaccine details

The staff can view the list of vaccines as well as the details of each vaccine.

3) Modify vaccine detail

The staff can update the vaccines' information.

Mange vaccine location**1) Add vaccine location**

The staff can add the vaccine location.

2) View vaccine location

The staff can view lists of vaccine locations.

3) Modify vaccine location

The staff can update the vaccine location details.

Non-functional requirements

a. Security

Security is the degree to ensure all the information is well-protected from unauthorized access and modification. Security is essential for the proposed system as it is a health care system that will contain most of Malaysia citizens' personal information. The leak of citizens' information will bring unpredictable harm to the citizens and the country. Besides that, the proposed system is implemented online, the system might have a chance of facing problems such as Distributed Denial of Service attacks (DDoS), phishing attacks, SQL injection and more. Being attacked by the cyber-attacks will bring financial loss to the company and might cause the loss of users as they think the system is not safe to use.

Target goal

- Provide authentication and level of authorization to ensure the right person uses the system's resources. As there are two sites for the proposed system, the citizen site and staff site, each user only can access each respective site. The user must also enter the correct username and password to log in to the system to ensure that his account is not used by others. Next, the proposed system will require the user to have a strong password with a minimum of 8 characters and a combination of 1 Upper-Case letter, 1 Lower-Case letter, and 1 number to avoid brute force attack.
- To protect citizens' privacy, the proposed system only allows authorized staff and citizens to view their personal details.
- To protect the proposed system from cyber-attacks, security measures such as Firewall, Intrusion Detection System (IDS), Secure Socket Layers (SSL) and more should be implemented to the system.

b. Reliability

Reliability is the system's degree of performing a specific function correctly under a particular circumstance without any failure in a period. A high-reliability system won't be easy to break down and the tasks are ably performed smoothly for the users. As the proposed system contains automated processes on the critical tasks, the system breaks up will highly affect the system's overall performance. Next, high recoverability is required for the proposed system when encountering any errors.

Target goal

- The proposed system will have a low rate of downtime to ensure high reliability of the system. The proposed should have around 99.5% of uptime which is 4 and a half hours of downtime per year.
- The proposed system should have a fast recovery speed to recover from any encountered errors to provide high reliability. The proposed system will have a Mean Time To Recovery (MTTR) of around 10 to 15 minute per recovery.

c. Usability

Usability measures how easy the user interfaces are for the users to use and understand. A high usability system can let users more quickly learn in using the system. As the proposed system might contain novice users who use the system recently and expert users who use the system for some time. The proposed system should have high usability to concern the two types of users.

Target goal

- Guidelines and instructions are clearly shown to the users so that the users know what to do when performing a specific task. The proposed system will also send feedback like the successful message and error message to tell the users that they are doing the task wrongly or correctly.
- The steps of performing a specific task are simplified as much as possible so that the novice users can easily learn how to use the system and the expert user can perform the tasks faster. Most of the functions in the proposed system have no more than 5 to 6 steps to complete the tasks.
- The proposed system should have an easy-understand and consistent user interface so that the users can recognize how to use it instead of recall. The proposed system should follow the design of most of the existing website so that the users can use their previous experience of using other systems. For example, a proceed button is placed below the form so that the user knows he/she needs to press the proceed button after filling the form.

1.4.3 Milestone

Table 1.1: Project Milestone

Milestone	Milestone Goal	Deadline
Concept approval	The feasibility studies and the system concepts are approved.	12/4/2021
Requirement review	The requirements are complete, correct after the checking and is available for input to the system design.	25/6/2021
Preliminary design review	The overall architectural design fulfils the requirements, is approved and can be input into the following design process.	5/7/2021
User interface review	The design of the system's user interface is approved and can be input into the critical design process.	19/7/2021
Critical design review	The detailed system design fully implements the architectural design, is approved and can be input into the code development.	3/8/2021
System review	The modules in the system are fully functional and fully integrated into the system.	27/10/2021
Test plan review	The test plan fully covers the requirements, is approved and can be input into the system test review.	9/11/2021
System test review	The system has passed the system testing and can be input into acceptance testing.	15/11/2021
Operation readiness review	The system has passed the acceptance testing and can be launched to the market.	26/11/2021
Submission of Draft FYP Report	The draft of the FYP report which includes the previous reports and test reviews are submitted.	28/11/2021
Submission of Final FYP Report	The draft of the FYP report is arranged and finalized. After finalized, the FYP report is submitted.	4/12/2021

		Task Mode	Task Name	Type	Duration	Start	Finish	Predecessors
1			Traco Covid-19 Tracking System	Fixed Duration	150 days	Mon 3/5/21	Fri 26/11/21	
2			Requirement Gathering And Analysis	Fixed Duration	40 days	Mon 3/5/21	Fri 25/6/21	
3			Define fact gathering techniques	Fixed Units	5 days	Mon 3/5/21	Fri 7/5/21	
4			Perform requirements gathering on the system's user	Fixed Units	20 days	Mon 10/5/21	Fri 4/6/21	3
5			Analyze requirements collected	Fixed Units	5 days	Mon 7/6/21	Fri 11/6/21	4
6			Create system requirement specification (SRS)	Fixed Units	10 days	Mon 14/6/21	Fri 25/6/21	5
7			System Design	Fixed Duration	21 days	Mon 28/6/21	Mon 26/7/21	2
8			Design the overall architectural design	Fixed Units	4 days	Mon 28/6/21	Thu 1/7/21	
9			Design the new database design for the system	Fixed Units	4 days	Fri 2/7/21	Wed 7/7/21	8
10			Design the new UI for the system's website	Fixed Units	13 days	Thu 8/7/21	Mon 26/7/21	9
11			System Implementation	Fixed Duration	67 days	Tue 27/7/21	Wed 27/10/21	7
12			Create the system's database with appropriate tables	Fixed Units	4 days	Tue 27/7/21	Fri 30/7/21	
13			Develop the functions of the module	Fixed Units	54 days	Mon 2/8/21	Thu 14/10/21	12
14			Develop the UI of the website	Fixed Units	9 days	Fri 15/10/21	Wed 27/10/21	13
15			System Testing	Fixed Duration	13 days	Thu 28/10/21	Mon 15/11/21	11
16			Perform initial testing and database testing	Fixed Units	1 day	Thu 28/10/21	Thu 28/10/21	
17			Perform cross function, cross platform testing	Fixed Units	2 days	Fri 29/10/21	Mon 1/11/21	16
18			Perform overall system testing	Fixed Units	3 days	Tue 2/11/21	Thu 4/11/21	17
19			Gather feedback from tester	Fixed Units	3 days	Fri 5/11/21	Tue 9/11/21	18
20			Fix existing error and bug	Fixed Units	7 days	Fri 5/11/21	Mon 15/11/21	18
21			System Deployment	Fixed Duration	5 days	Tue 16/11/21	Mon 22/11/21	15
22			Install the initial version of the system	Fixed Units	2 days	Tue 16/11/21	Wed 17/11/21	
23			Gather feedback from the user	Fixed Units	3 days	Thu 18/11/21	Mon 22/11/21	22
24			System Maintenance	Fixed Duration	4 days	Tue 23/11/21	Fri 26/11/21	21
25			Perform maintenance on the system based on users feedback	Fixed Units	2 days	Tue 23/11/21	Wed 24/11/21	
26			Update the system with the new patch	Fixed Units	2 days	Thu 25/11/21	Fri 26/11/21	25

Figure 1.2: Project Gantt chart

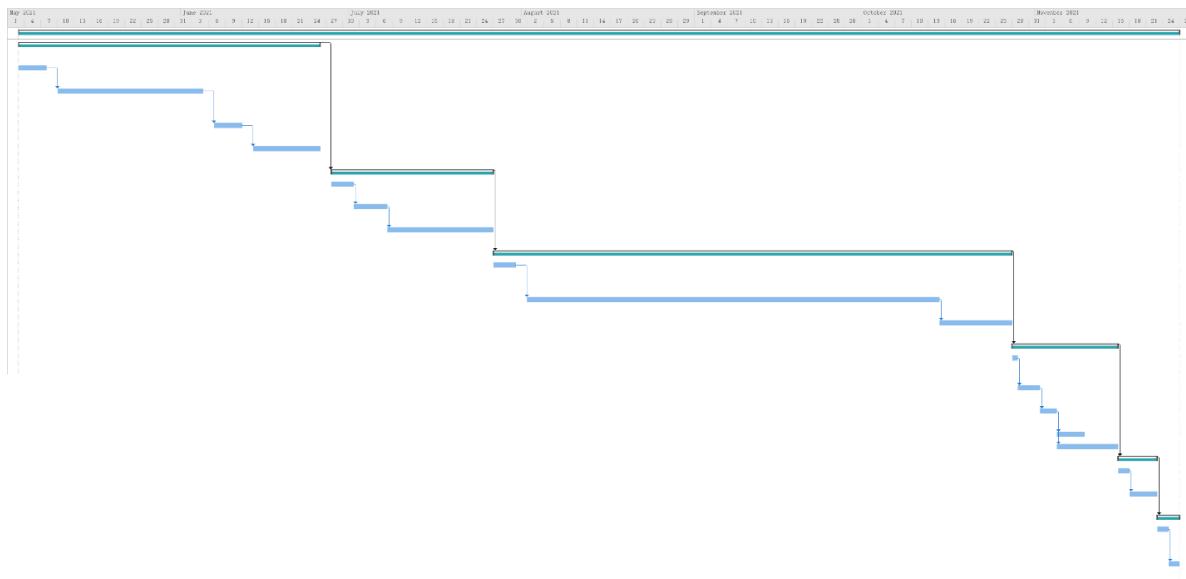


Figure 1.3: Project Gantt chart progress line

1.4.4 System Development Life Cycle

Waterfall model

The author and his partner decided to use the waterfall methodology to develop the proposed system. The author and his partner use the waterfall methodology because the requirement of the proposed system is well-defined and won't frequently change in the future. Next, the proposed system is given enough time to develop which is suitable for waterfall model software. Moreover, each software development stage is clearly defined in the milestone for the author and his partner to follow. Furthermore, waterfall methodology ensures each stage of software developing is completed when proceeding to the next stages.

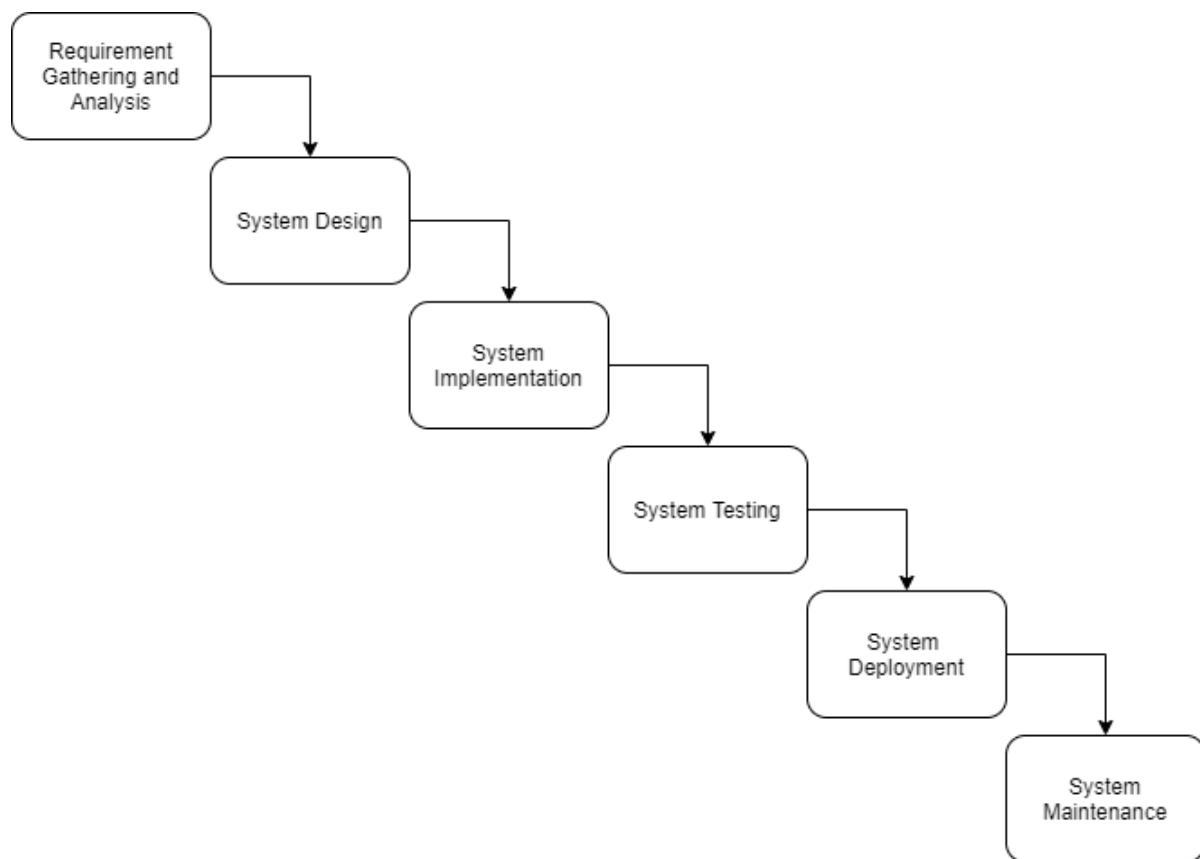


Figure 1.4: Waterfall model diagram

1.5 Project Team and Organization

There are 7 modules in the proposed system. The following table shows the sub-system distributions of the two members of the team.

Table 1.2: Project Team and Organization table

Sub-systems	SOO JI HO	LEE KOK KEN
Citizen management module	✓	
Staff management module		✓
Location module	✓	
Citizen health status management module		✓
COVID-19 cases management module		✓
Messaging and enquiry module	✓	
Vaccine management and appointment module		
Vaccine management	✓	
Vaccine appointment		✓

1.6 Chapter Summary and Evaluation

In a nutshell, the current cases of COVID-19 in Malaysia are under control but the author and his partner think that the cases of COVID-19 will increase again after CMCO and RMCO are ended due to the current system is not good enough. The author and his partner find out that some of the current system has problems such as limited function provided, poor management, poor layout and more. Then, the author and his partner had proposed the Traco COVID-19 tracking system that has comprehensive functionalities, better management and a better user interface. The proposed system aims to provide greater control on the COVID-19's cases, remove time-consuming processes and a friendly user interface. There are 7 modules in the proposed system and the proposed system is developed with waterfall methodology.

The problem faced in this chapter is the author's partner is advised to add in the vaccine application functions into the system to manage citizens' vaccine application. The author's partner decided to add in the function and create the vaccine management and application module. The task is reallocated and the author is in charge of the vaccine management function, which focuses on managing the vaccines used in Malaysia.

Chapter 2

Literature Review

2 Literature Review

In this chapter, the author has done some background research on the COVID-19, the existing COVID-19 Tracking systems, and the users of the COVID-19 Tracking Users. Then, the author also done a literature review based on some articles found. Lastly, the author had performed a feasibility study to check whether the proposed system is feasible to develop.

2.1 Project Background

Currently, COVID-19 cases in Malaysia are still unstable after the COVID-19 pandemic has already existed for 1 year. From the start of the COVID-19 case in January 2020 to the end of August 2020, the daily cases of COVID-19 are under 100. But starting from September 2020, the cases start increasing rapidly and the peak of daily COVID-19 cases reach 5725 in January 2021. Currently, the cases of COVID-19 are unstable and the daily COVID-19 cases are maintained above 1000 which is ten times more compared to last year. To control the COVID-19 cases in Malaysia, the author and his partner propose the Traco COVID-19 Tracking System. The proposed system is a web-based application that aims to manage the COVID-19 outbreak in Malaysia. The proposed system also provides more comprehensive functionalities for the users.

The reason why Traco COVID-19 Tracking System is proposed is that the existing systems like MySejahtera, COVID-19 MALAYSIA, and more are not good enough to control the COVID-19 pandemic. Poor management is one of the main problems of the existing system like MySejahtera. Although MySejahtera is the best COVID-19 tracking system in Malaysia, it has poor management. For example, the health status is decided based on the answer chosen by the citizens in the survey and the citizens might fake their health status. Besides that, there are no warning messages sent to the suspected citizen if they went somewhere and scan the location's QR code. Furthermore, the existing systems have incomprehensive functionalities. For example, MySejahtera has no messaging and enquiry functions for the citizens and staff to communicate with each other. Next, the COVID-19 MALAYSIA and LivePhotos have the tracking function and notification function. Moreover, some of the existing systems have poor layout and make the contents hard to see for the users. The proposed system will help to solve the above problems of the existing system. First, the health status of citizens is decided by the system automation or staff so that the citizens cannot fake their health status. Besides that, we combine the core functions of the existing systems and add some new functions to create a more comprehensive COVID-19 tracking system. Lastly, the proposed system will have a friendly user interface for the users.

The targeted users of the system are Malaysia citizens around the age of 12 - 80 that have smartphones. The Malaysian citizens will use the citizen's site of the website to manage their personal information, track location histories, apply locations' QR codes, check the latest COVID-19 information, messaging the staff, check the FAQs, and register vaccine applications. The second targeted user is the MoH staff. The MoH staff will use the staff site of the website to manage the health status of citizens, manage locations, manage vaccines, send announcements, reply to the citizens' message, manage FAQ, manage PCR test results, and more.

2.2 Literature Review

The needs of COVID-19 Tracking System (Rai and Innovation, 2020)

The COVID-19 has already spread to every corner of the world, the countries' economies and society are highly affected by COVID-19. The COVID-19 has a high spread rate and the symptoms might only be discovered after being infected a few days so that it is hard to keep track of the infected or suspected citizens manually with manpower. The crisis has revealed the urgent need to develop and deploy surveillance innovations which will provide real-time information for proactive decision-making at the local, state, and national levels of public health systems.

Consideration of developing the COVID-19 Tracking System

Technology design

The COVID-19 Tracking System can be run on the centralized data model that the data is controlled by the government or health agencies; or the decentralized data model that data is stored on the users' devices.

Digital inequality

The COVID-19 Tracking system won't be able to keep track of all the citizens' contact history as not all the citizens have mobile devices or poor network access in the rural areas. If this group of citizens are infected with COVID-19, the government is not able to track the contact history and who is suspected to be infected with COVID-19. The 5G mobile infrastructure might help to provide network access to the rural areas but the cost, disadvantages, times, resources and more need to be considered before implementing it.

Data governance

The COVID-19 pandemic has caused the emergence of surveillance and tracking users' personal data. So, it is important to recognize key data governance issues such as risks of misuse of the data, authorization access of data, and sunset clauses on collecting and using such data.

Consideration of contact tracing methods (Peng et al., 2021)

The main use of the COVID-19 tracking system is to keep track of the citizens activities. Existing approaches for contact tracing utilize various technologies, such as GPS, GSM, Bluetooth, and QR code, to decide a person's absolute and relative location with others. There are also a combination of two or more methods used by some countries to keep track of the citizens' activities. The contact tracing methods must ensure the privacy protection, system intelligence and get user permission of using the personal information.

Choice of contact tracing method (Hoffman et al., 2020)

The QR code method is more preferred to keep track of the citizens' activities as using Bluetooth and GPS methods are required to turn on the signal all the time. Besides that, Bluetooth and GPS are more passive methods as the phone will automatically track the citizens' activities and the user might forget to turn on or accidentally turn off the Bluetooth and GPS. The QR code method required the user to scan manually with the system which ensured the location was recorded and it just required mobile broadband.

Overview of ASP.NET application (Panvelkar and Dhande, 2017)

The ASP.NET is flexible as it can support programming languages like VB.net as well as C# and it works well with MYSQL, JavaScript, and CSS. The ASP .Net handles all the main work on the web server, SQL Server manages all the data, and the combination of CSS and JavaScript looks after web page presentation. The ASP.NET is a semi open-source system and it is free to use.

Architecture of ASP.NET (Komal, 2015)

The ASP.NET page contains two sites that are client-side and server-side in order to create dynamic web pages. The browser will submit a web form to the web server and the server returns a full markup page or HTML page in response. All client-side user activities are forwarded to the server for stateful processing, the server processes the output of the client actions and triggers the reactions. The .Net framework also includes versions for mobile or embedded devices to use.

2.3 Feasibility Study

Technical feasibility

As technology is rapidly advancing, most current devices such as laptops, desktops, and mobile devices are able to support the system. Mobile devices are required for the users to scan the QR codes of a specific location. The proposed system is developed using ASP.Net with VB and it is a web-based application. As long as the user has an internet connection, the user can access the system through the browsers like Google Chrome or Microsoft Edge using any device. .Net has two frameworks that are .Net Framework and .Net Core. Currently, .Net Core is better but we will select .Net Framework as the .Net Core does not support web applications with VB language and we are familiar with the VB language.

Economical feasibility

The cost of developing a new system will be high but it will bring long-term benefits and the cost of development might be cheaper than the existing system. The system is developed by using open-source software and the system can be open through the browser, the additional software cost will be saved. Moreover, the proposed system will bring more comprehensive functionality to improve the management and tracking of COVID-19. This helps to reduce the COVID-19 cases in Malaysia, the operations can slowly return to the normal state as before and the SOP restriction can be removed. Besides that, the proposed system also increases the work efficiency of the MoH staff by providing automation processes to help the staff to save more time and be able to focus on other stuff.

Schedule feasibility

To complete the proposed system in time is extremely important as if the author and his partner fail to develop the proposed system in time, their system might lose trust and be doubted by the public. As the deadline of the system is at the end of November, they have about 7 months to develop the system which is sufficient to complete the whole system. Next, the proposed system already has a clear requirement so that the expansion of project scope has a low chance of happening in the future and the schedule won't be delayed. Besides that, they also have created a gantt chart to indicate the time of the developing system in different steps. They also disturb more time in system design, system implementation and system testing to ensure the quality of the system.

Operational feasibility

The proposed system had helped to solve the problems of the existing systems. First, the proposed system provides messaging and enquiry functions for the users. The citizens can send messages to the staff or search the FAQs with the system. It is more convenient and efficient compared to the existing system that only provides hotlines and the citizens are required to contact the staff with phones. Besides that, the proposed system will warn the users after scanning the high-risk location's QR code and inform the users that they are entering a high-risk location. The users will know that they are entering a high-risk area and they might choose to leave or act cautiously in the area. Moreover, the proposed system will warn the suspected users who went out and scan a location's QR code during the quarantine period and then it will inform the MoH staff that this person went out during his quarantine period. The MoH staff can punish the suspected citizens and deter the public from not committing the same crime.

Social/Legal feasibility

The proposed system is a health care system so it is required to collect the personal details of the users. The proposed system should follow the Acts regulated by the Malaysia government to ensure the user's data is protected and used in a good way. The proposed system should follow the Personal Data Protection Act (PDPA) which helps to protect the privacy of personal data for commercial uses. The proposed system will ask the users to agree to the term and conditions or privacy policy before using the system to ensure the users are providing the details by their own will.

2.4 Chapter Summary and Evaluation

In a nutshell, the author and his partner have read through some of the articles to find out any information related to the COVID-19 Tracking system and what we should care about during developing the system. Information to develop the system such as the architecture of the ASP.NET, needs of the COVID-19 Tracking system, and technologies to keep track of the citizens' location are listed in the literature review. Besides that, the author and his partner also perform the feasibility study for the proposed system to ensure the system is suitable to develop in different aspects. The problem that the author faced in this chapter is the articles are quite hard to find. Not all the articles are free and we don't have any funds to purchase the articles. The author only can select the articles that are free to use. The solution to solve the problem is that the author takes more time to search for articles that are free to use and related to the COVID-19 Tracking system.

Chapter 3

Methodology and Requirements Analysis

3 Methodology and Requirements Analysis

This chapter shows the software development methodologies used by the author and his partner. Then, the chapter talks about the fact-gathering and fact recording methods used by them. They also show the analysis results in the chapter and show the project scope. The author lists the functional requirements of the modules that he is in charge of by using use case diagrams and use case descriptions. The author also lists out the non-functional requirements that are needed in the proposed system. Lastly, the author and his partner also prepared the development and operation environment of the system.

3.1 Software Development Methodologies

In this project, the author and his partner decided to use the waterfall methodology to develop the proposed system. The Waterfall methodology is one of the most famous and simple software development lifecycle methodology. The waterfall methodology divided the development process into phases. The phases are fixed and follow in the sequence of requirements gathering and analysis, system design, system implementation, system deployment, and system maintenance. Each phase in the waterfall methodology must be completed before moving on to the next phase and there is no overlapping in the phases.

The reason that the author and his partners selected the waterfall model is that the project has clear requirements. The waterfall methodology is suitable when the project requirements are well-defined to avoid project scope being increased and mess up development processes. The author and his partner can also have more time on writing the code and testing the system as they don't need to work with the users to determine the requirements. Besides that, the proposed system is given a quite long time to develop. It is good to use the waterfall methodology when a long time is given to developing the system because it is time-consuming as each phase in the waterfall methodology must be completed before entering the next phase. The author and his partner also prepare a Gantt chart to ensure that the time is distributed well in each phase to ensure system quality.

3.2 Requirement Gathering Techniques

3.2.1 Fact Gathering

The author and his partner decided to use questionnaires to gather the users' requirements. The reason for using the questionnaire is because the questionnaire is costless and flexible. By using the Google Form, the author and his partner can create a questionnaire without any cost, and to distribute the questionnaire, they just need to share the link to social media. Moreover, the COVID-19 pandemic is not over in Malaysia, fact-gathering techniques such as interview and observation are not safe for the team and the users. Using the questionnaire, the team is still able to collect the requirement without physically contacting the users.

The questionnaire contains 20 questions for the respondents. Most of the questions are closed-ended and ask about the rating of the existing system and any new features that they wish to include.

3.2.2 Fact Recording

For fact recording, the author and his partner used Google Form to arrange and list the response into graphs and charts which helps the team to save a lot of time without analyzing the response manually. The team will check which selection has the highest number of responses and consider that the selection is the requirement that is desired by most of the users.

3.3 Requirements Analysis

3.3.1 Analysis Results

Result 1:

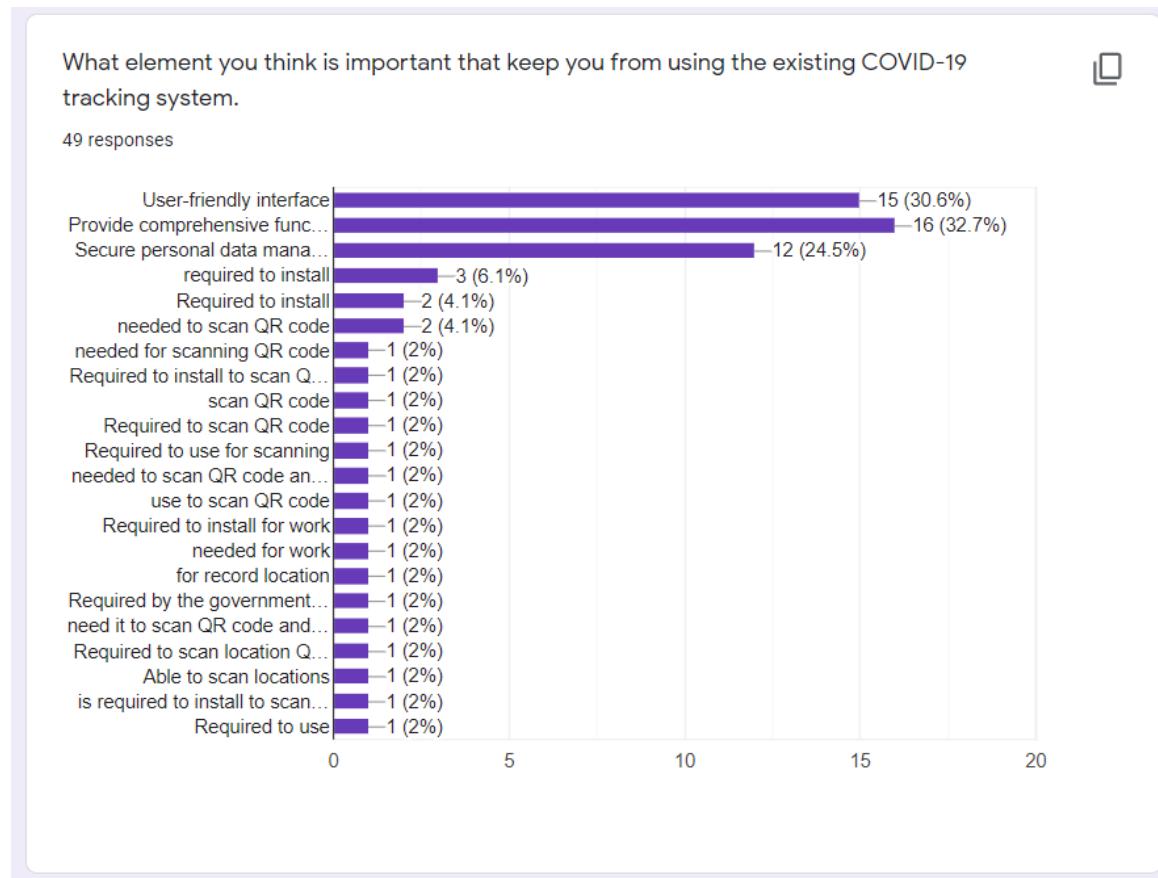


Figure 3.1: Bar chart representing the responses of Question 5

From figure 3.1, the team finds out the elements that keep the most respondents to use the existing system is because it is required to install for scanning the location QR code. There are quite a few respondents who continue to use the existing system because of its user-friendly interface, provide comprehensive function, and secure personal data management. Based on the result, the team can find out that it is necessary to maintain the contact tracing method to QR code as the change of contact tracing method might delay the current tracing process and the users might not be familiar with the new contact tracing method. Moreover, we can include some functions that already exist in the existing system as there are quite many respondents who think the existing system has comprehensive functions.

Result 2:

Do you think the existing COVID-19 tracking system can help in provide information of the current situation?

49 responses

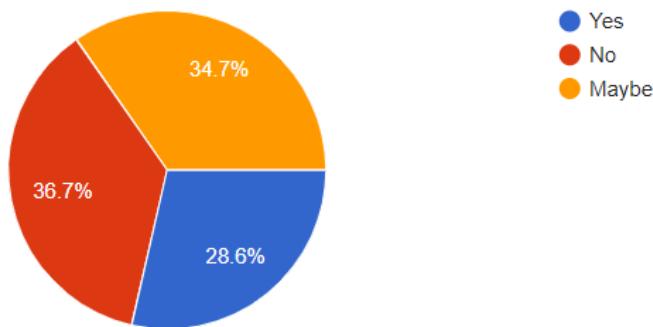


Figure 3.3: Pie chart representing the responses of Question 7

From figure 3.3, the team has found out that about 37% of the respondents think that the existing system cannot control and relieve the COVID-19 pandemic. About 35% of respondents are not sure that it will help to control and relieve the pandemic and around 29% of respondents think it can help to control and relieve the pandemic. From the result, the team can consider that most of the citizens think that the existing system is not good enough to control and relieve the COVID-19 pandemic. The team will analyze the existing system and include any insufficient of the existing system to the proposed system.

Result 3:

What is the purpose of using the existing tracking system?

49 responses

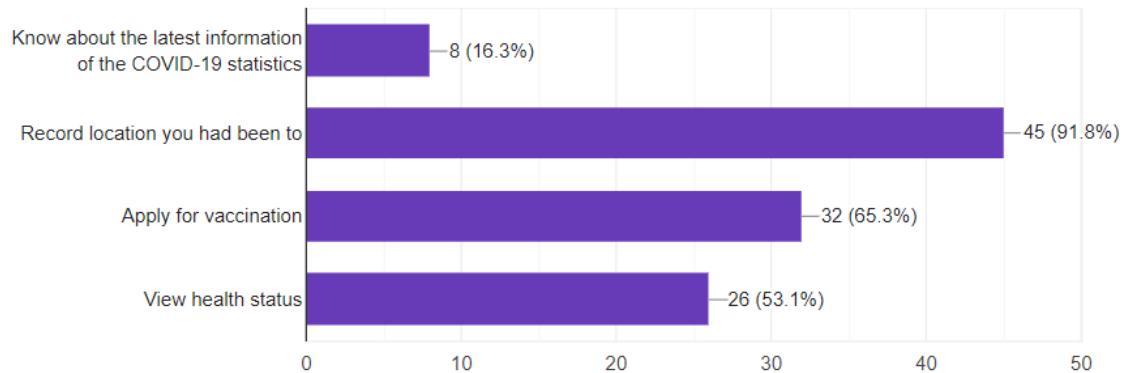


Figure 3.2: Bar chart representing the responses of Question 8

Based on figure 3.2, the team finds out that most of the respondents use the existing tracking system to record the location that they have been. There are also quite many responses in the “apply for vaccination” and “view health status”. Based on the responses, the team had marked the “record location”, “apply for vaccination”, and “view health status” as top priority for the proposed system.

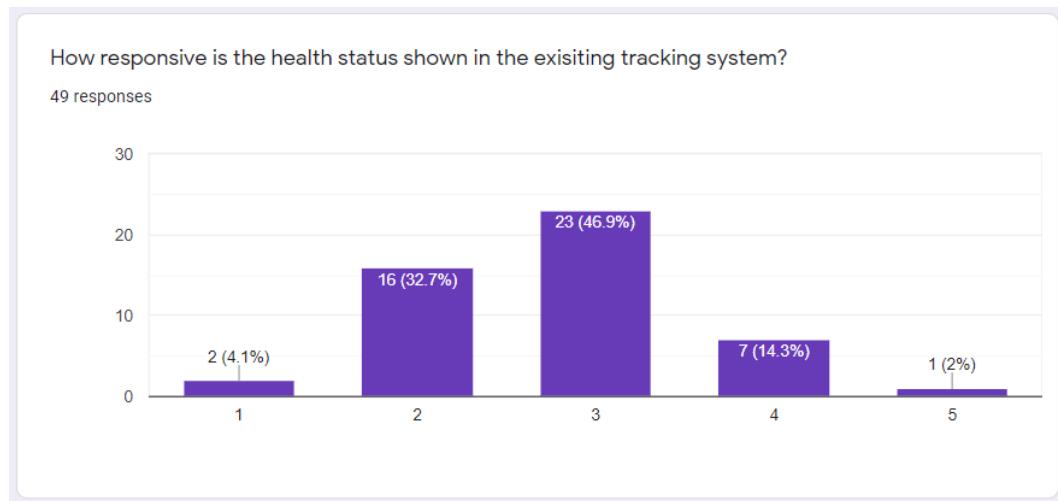
Result 4:

Figure 3.4: Bar chart representing the responses of Question 9

From figure 3.4, the team finds out that most of the respondents think that the health status is not responsive. This might be caused by the health status of the existing system like MySejahtera is decided by answering the survey. The citizens might fake their health status by answering the survey not honestly. The team has decided to make the health status of the proposed system not decided by the citizens.

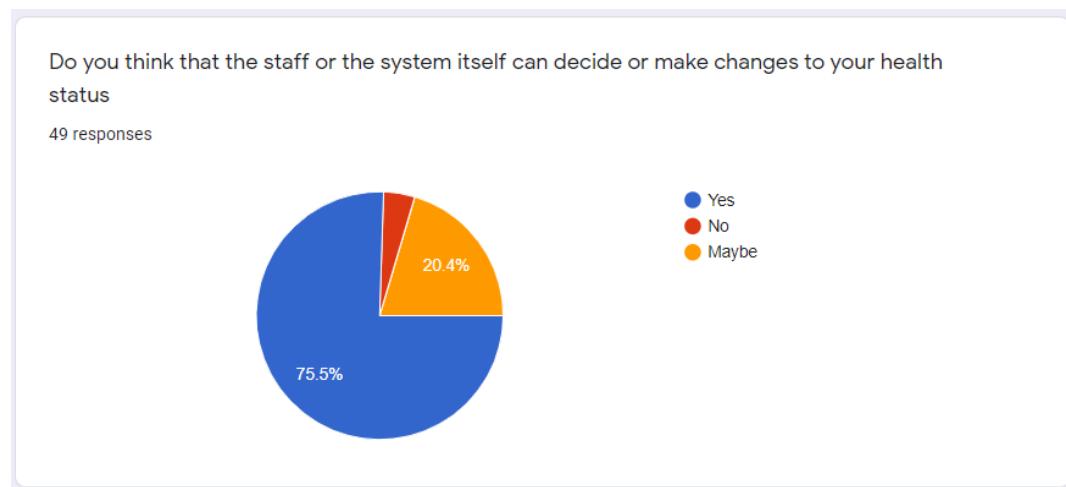
Result 5:

Figure 3.5: Pie chart representing the responses of Question 12

Based on figure 3.5, the result shows that the majority of the respondents accept that the health status can be decided by the MoH staff and system. To make the health status more responsive, the team will let the MoH staff and system decide the citizen's health status.

Result 6:

Do existing COVID-19 tracking systems notify you before entering high risk locations?

49 responses

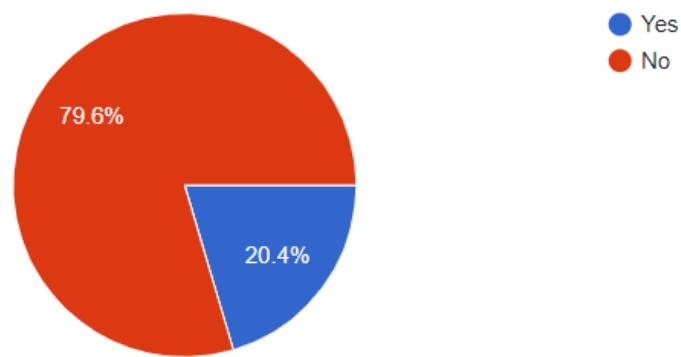


Figure 3.6: Pie chart representing the responses of Question 13

From figure 3.6, the team finds out most of the existing systems didn't notify the respondents before entering a high-risk location. The team records this problem of the existing system and finds a way to solve this problem.

Result 7:

Do you prefer the COVID-19 tracking system to send you a notification before entering high risk locations?

49 responses

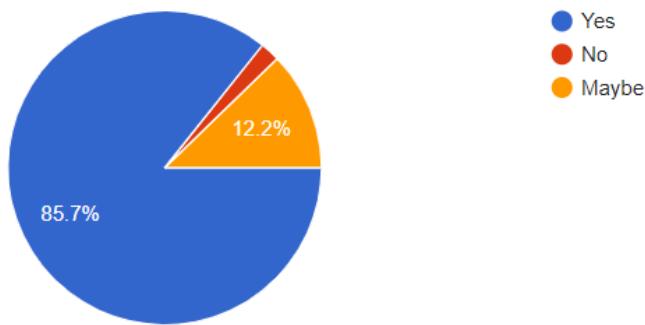


Figure 3.7: Pie chart representing the responses of Question 14

Figure 3.7 shows that the most respondents want a notification sent before they are entering a high-risk location. The team will include the warning notification to the scanning location QR code function.

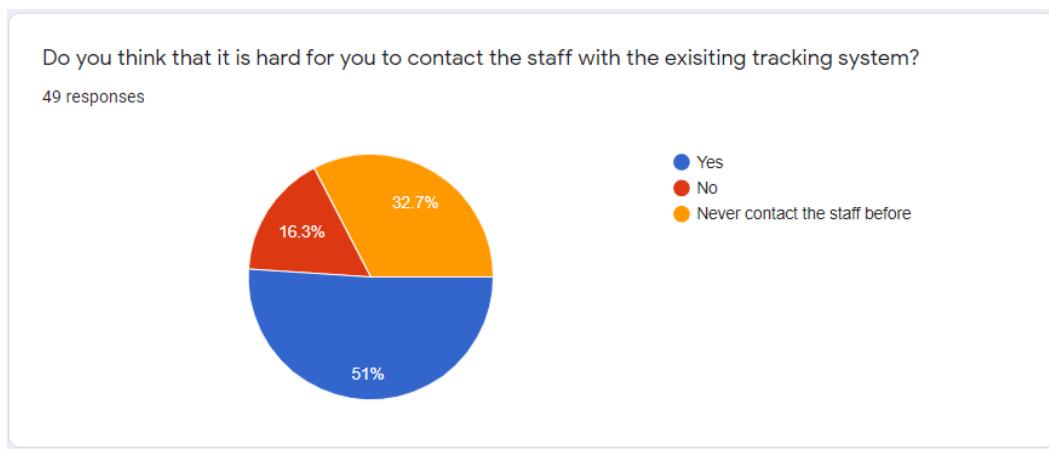
Result 8:

Figure 3.8: Pie chart representing the responses of Question 15

From figure 3.8, the responses show that about half of the respondents think that it is hard to contact the staff using the existing tracking system. The team has recorded this problem and plans to improve it in the proposed system.

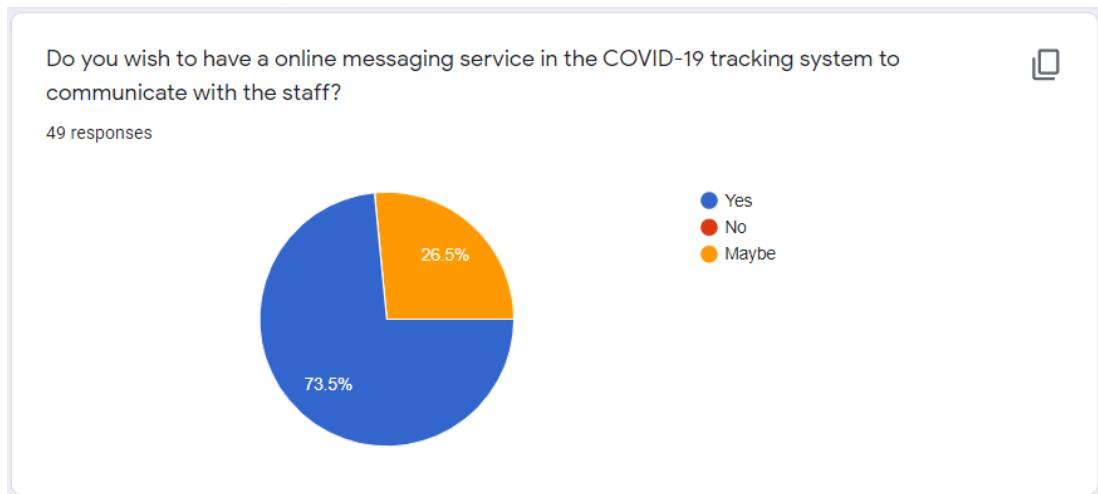
Result 9:

Figure 3.9: Pie chart representing the responses of Question 16

In figure 3.9, the team finds out that most of the respondents want an online messaging service in the system. The team will include a messaging and enquiry module into the proposed system to solve the ineffective communication that above question mentions.

Result 10:

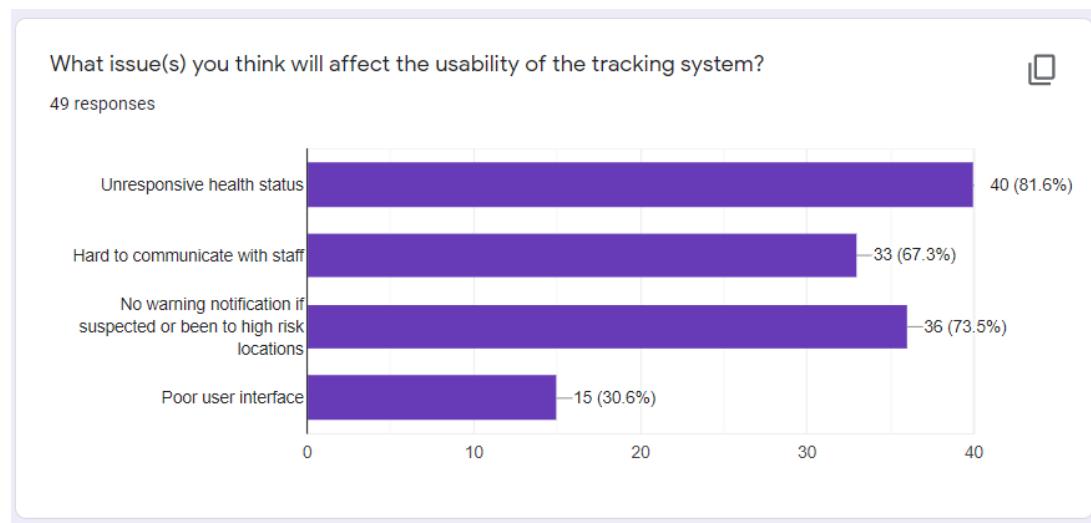


Figure 3.10: Bar chart representing the responses of Question 19

In figure 3.10, the responses show that there are quite many respondents who think that “Unresponsive health status”, “hard to communicate with staff”, “No warning notification if suspected or been to high-risk locations” will affect the usability of the tracking system. The team has recorded the results and marked these as top priorities to increase the usability of the proposed system.

3.3.2 Project Scope

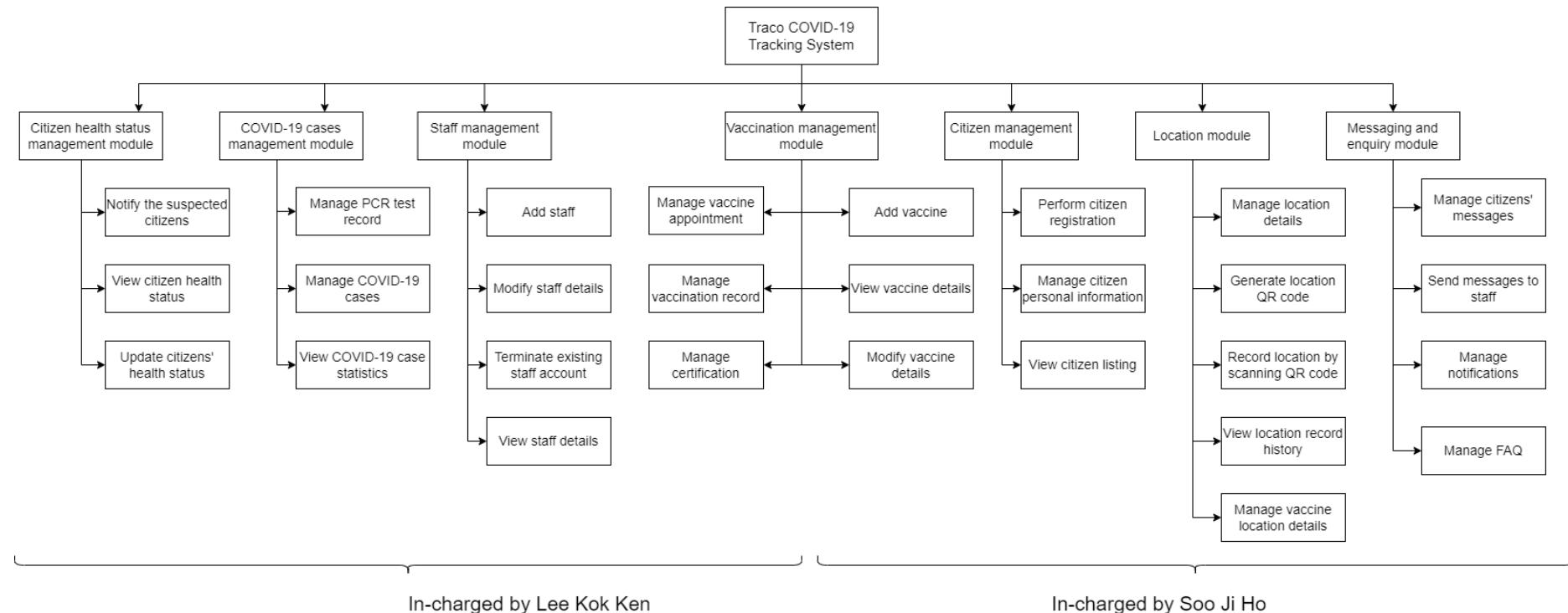


Figure 3.11: Project hierarchical chart

Modules in charge

1. Citizen management module

The citizen management module manages the registered citizens and allows citizens to become a user of the proposed system.

Perform citizen registration

The module allows the Malaysia citizens to register and become the user of the system. The citizen is required to enter personal information such as name, age, NRIC, email address, phone number and address in order to become a user. After finishing the registration, the user is able to login to the system. Furthermore, the module also provides authentication and authorization to ensure the citizen can only enter the citizen site and the citizen is accessing his/her own page.

Manage citizen personal information

The citizens are able to change personal details with the module if there are any changes or corrections.

View citizen listing

The staff of the proposed system are able to view the list of all registered citizens. The staff are able to search specific citizens and check full details of that citizen.

2. Location module

The location module helps to manage the location tracking of the users and registered location details.

Record location by scanning QR code

The citizens can scan the QR code of a specific location and record the location record. The module will also warn the citizens that they are going to a high-risk location if they scan the QR code of a high-risk location. Suspected citizens who go out and scan the location's QR code will get a warning message and their information will be sent to the staff.

View location record history

The citizens can view their location histories and are able to check the check-in details such as check-in time, location details, and more. The staff is also able to view the location histories of the registered citizen for checking purposes.

Generate location QR code

The citizens can apply and generate QR codes for their company or shop by using the proposed system. The citizen is required to enter the business name, contact number and address of the company to generate the QR code.

Manage location details

The module will automatically update the status of the location to "high" if the infected person went to the place before. Furthermore, the module also allows the MoH staff to manage registered locations by updating the location details, activating or deactivating the QR code.

3. Messaging and enquiry module

The module provides communication between the citizen and MoH staff, and also helps the citizen to answer any enquiries. The module has two ways for the citizens to search enquiries, the first way is to check the FAQs and the second way is to directly send messages to the MoH staff.

Send messages to staff

The module will recommend the citizens check through the FAQs to reduce the questions that need to be answered by the staff. If the FAQs do not have the question the citizen needed, the citizen can send a message to the MoH staff for the question. After getting the answer needed, the citizen can choose to end the chat.

Manage citizens' message

On the other side, the MoH staff can reply to any message that the citizens send. After replying to the message, the staff can choose to end the chat.

Manage FAQs

The MoH staff can manage the FAQs. To add a FAQs, the staff is required to enter the title of the question and the answer. If the SOP changes or there are any corrections in the FAQs, the staff can modify the existing FAQs. Moreover, the staff can view the list of FAQs and check the details of a specific FAQ. Lastly, the staff can delete any unwanted FAQ.

Manage notifications

The module also allows the MoH staff to send notifications regarding the COVID-19 pandemic to the citizens. The notification can be sent to all registered citizens. The MOH Staff also can choose specific citizens to send notifications.

4. Vaccine management and appointment module (Author focus on vaccine setup)

The module allows the MoH staff to manage the vaccines in the proposed system.

Manage Vaccine

1. Add vaccine

The MoH staff can add new vaccines by entering the vaccine's name, description, number of stock and number of injections.

2. Modify vaccine details

The MoH staff is able to modify the existing vaccine's details by updating the stock, description or number of injections.

3. View vaccine details

The MoH staff is able to view the list of vaccines that are registered in the system and check the details of a specific vaccine.

4. Delete existing vaccine

The module allows the MoH staff to delete the vaccine's details if the vaccine is no longer available.

Manage vaccine location

1. Add vaccine location

The MoH staff can add the vaccine location for the citizen to perform vaccination by adding the vaccine location details.

2. View Vaccine location

The MoH staff can view the existing vaccine locations in the system.

3. Modify vaccine location

The MoH staff can modify the details of existing vaccine locations in the system.

3.3.3 Functional Requirements

Overview use case diagram

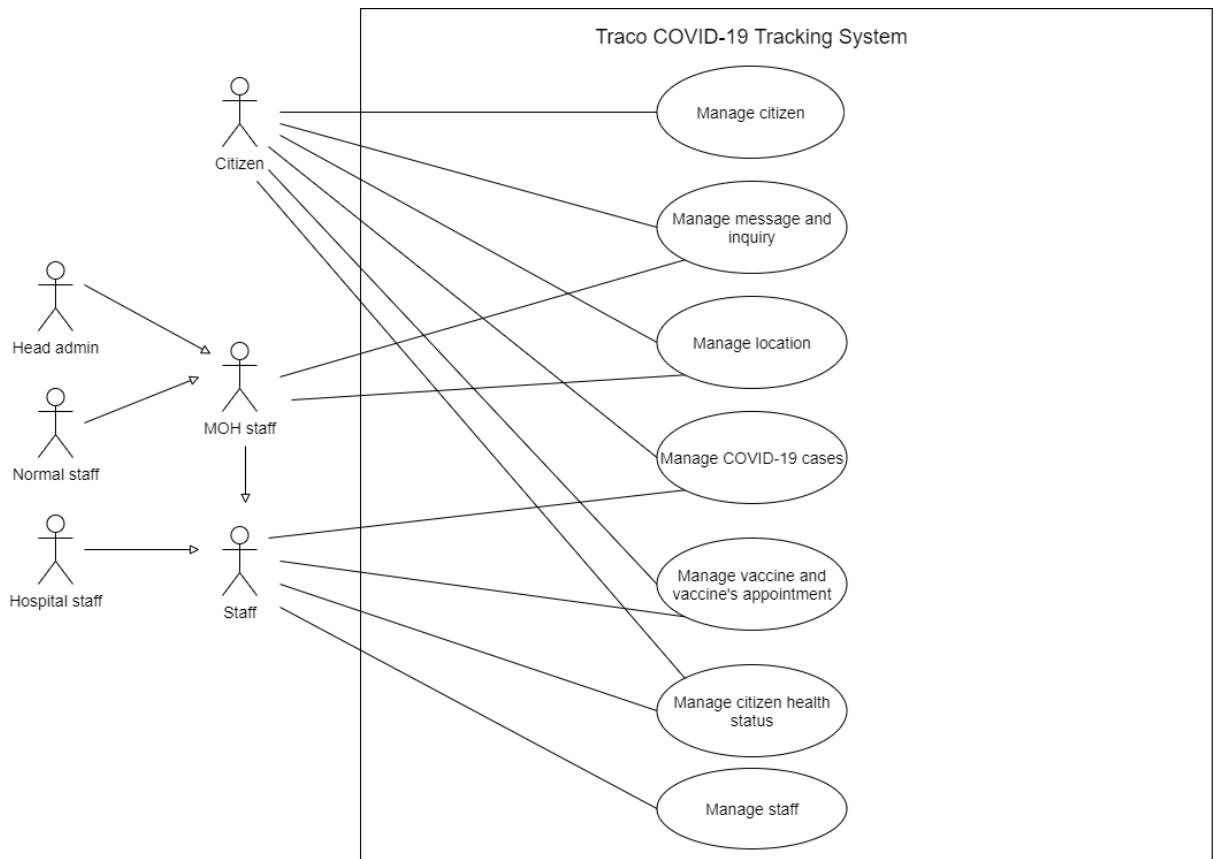


Figure 3.12: Overview use case diagram

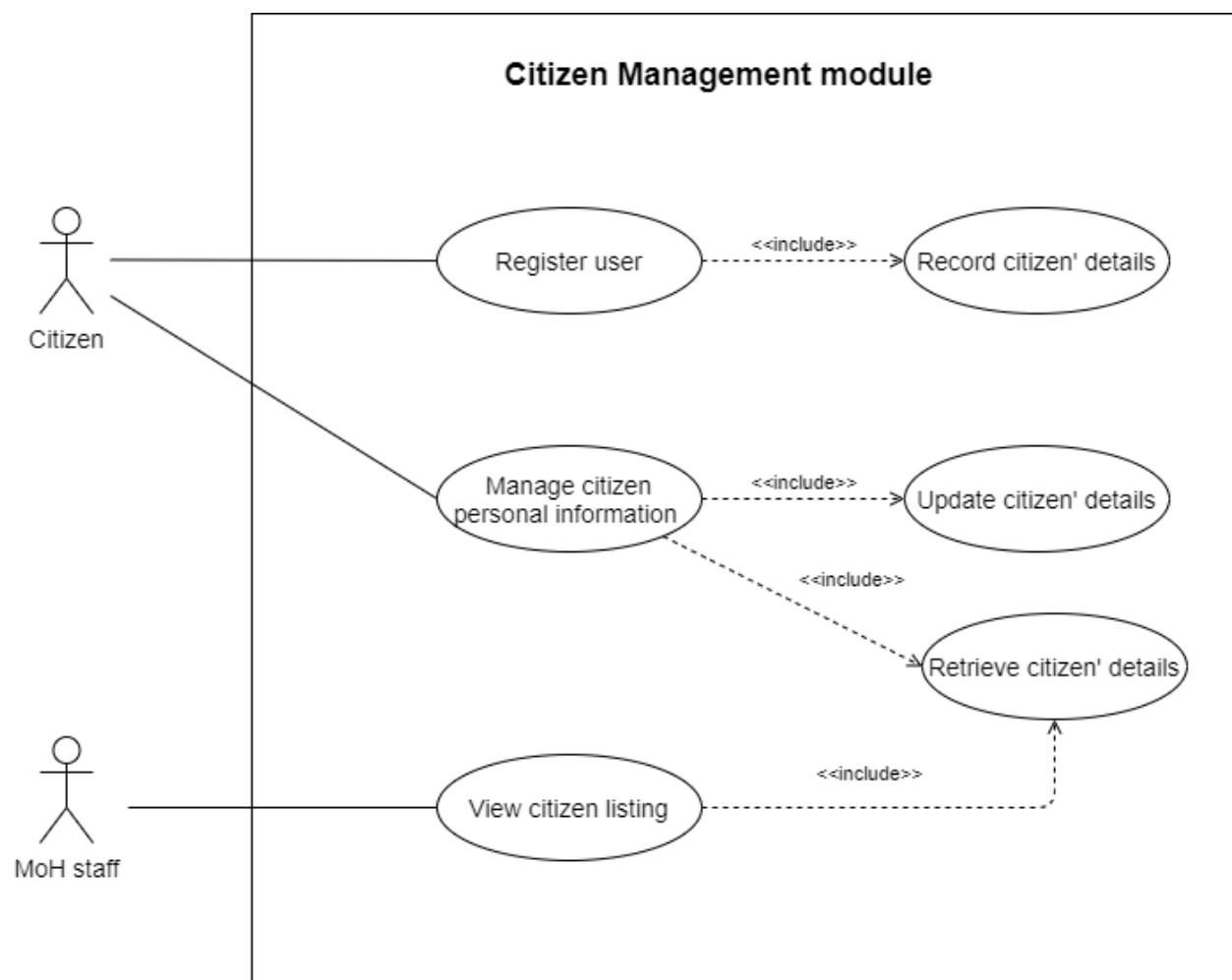
Detailed use case diagram**Citizen management module**

Figure 3.13: Detailed use case diagram for citizen management module

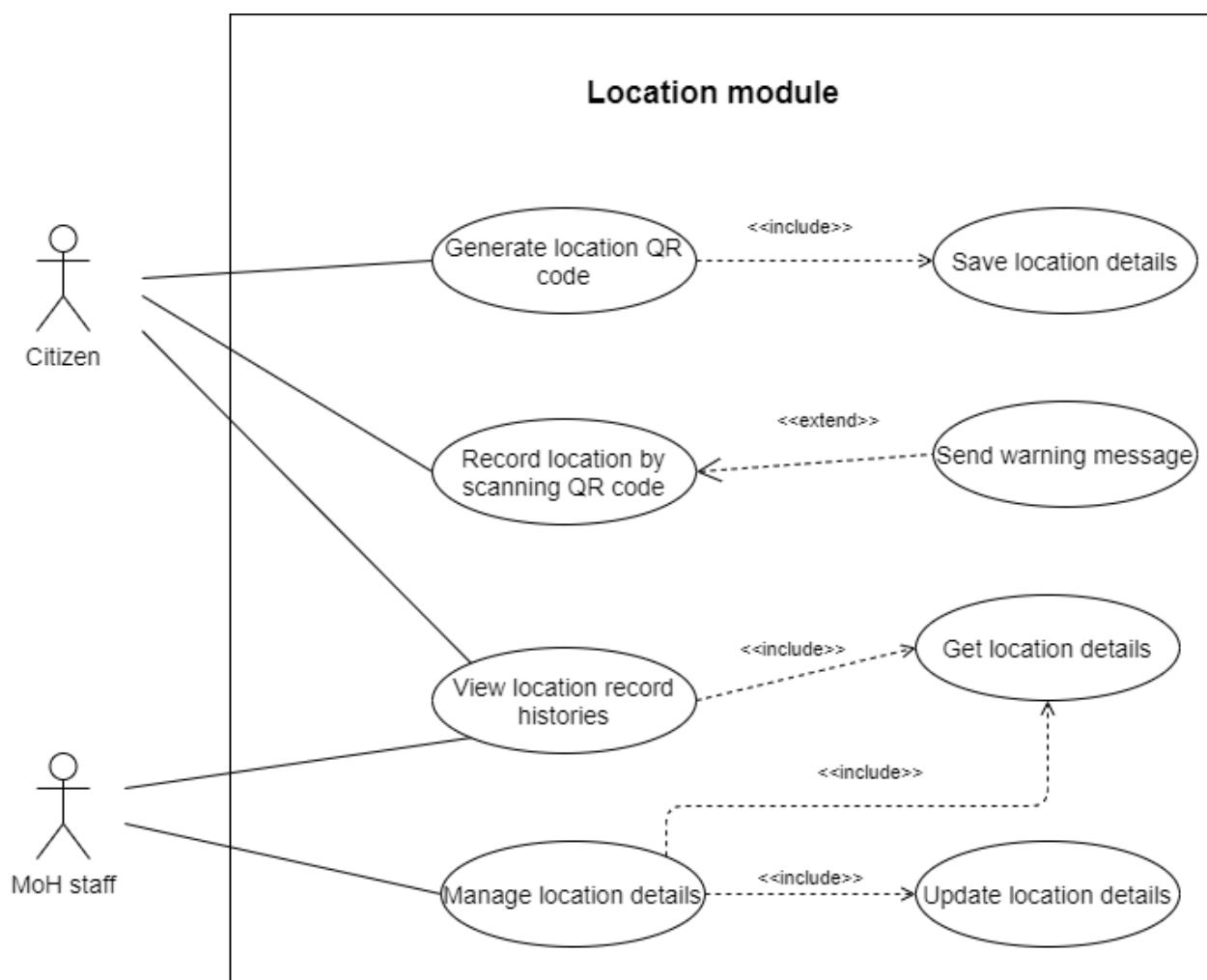
Location module

Figure 3.14: Detailed use case diagram for location module

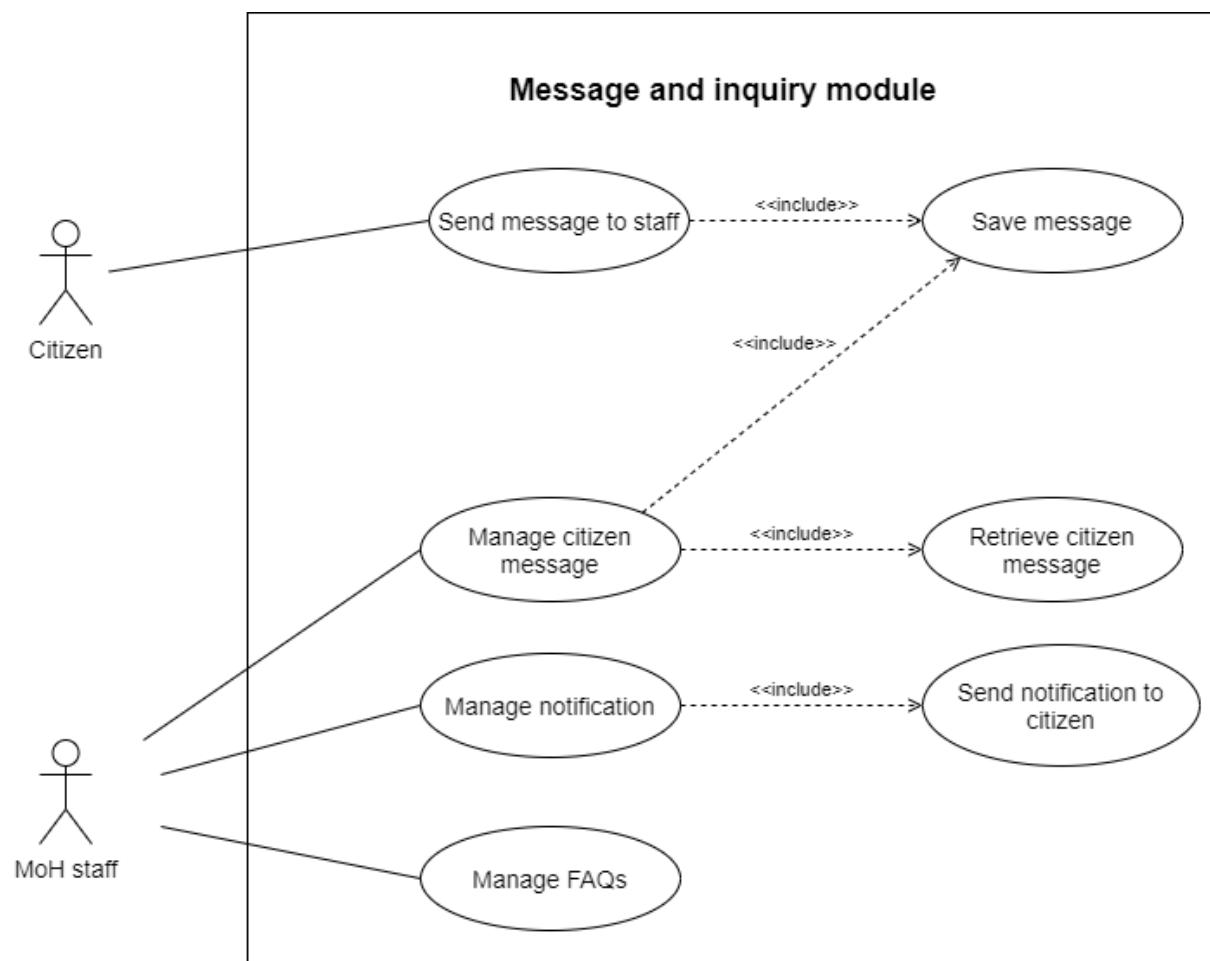
Message and enquiry module

Figure 3.15: Detailed use case diagram for messaging and enquiry module

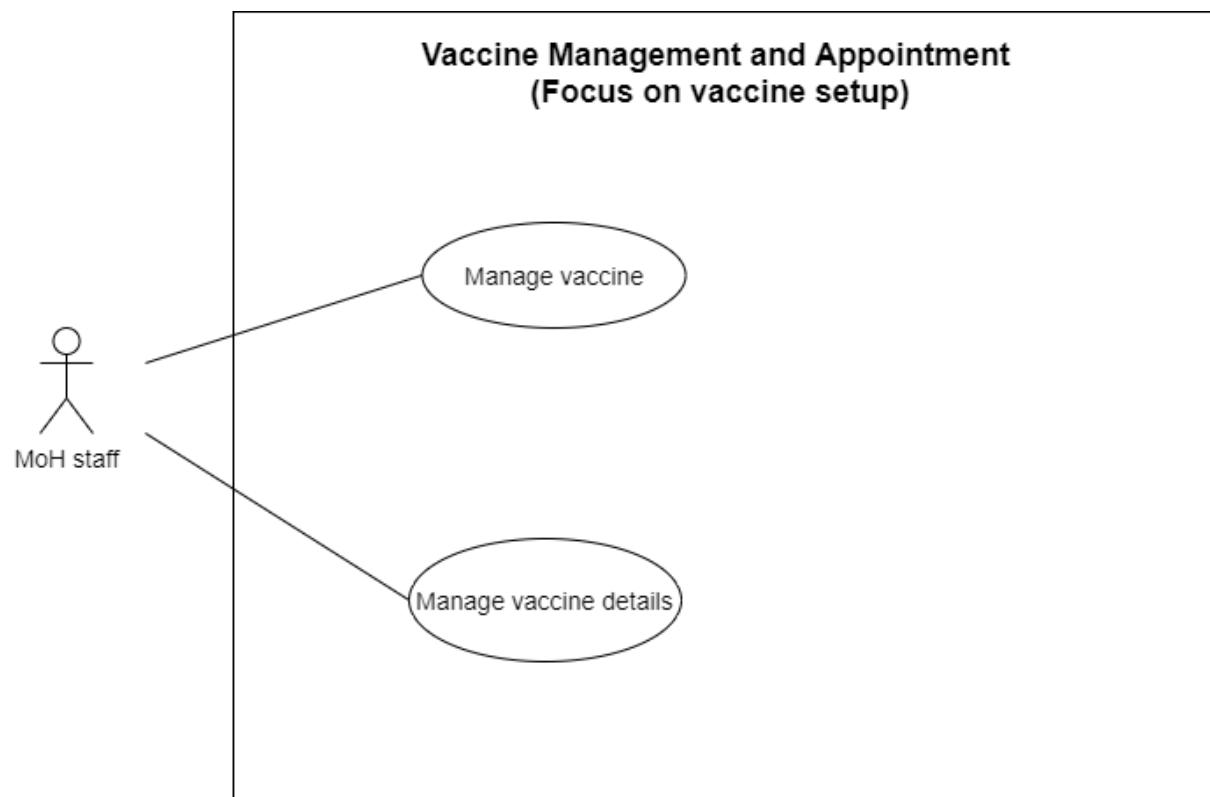
Vaccine Management and Appointment module (Author focus on vaccine setup)

Figure 3.16: Detailed use case diagram for vaccine management and appointment module

Use Case Description

Citizen management module

Table 3.1: Use case description for perform citizen registration

<p>1. User case name: Perform citizen registration</p> <p>2. Actor: Citizen</p> <p>3. Brief description: This use case allows the citizen to register to become a user of the proposed system.</p> <p>4. Precondition: The citizen needs to access the system website through a browser and choose to register.</p> <p>5. Main flow</p>	<table border="1"> <thead> <tr> <th>Actor action</th><th>System response</th></tr> </thead> <tbody> <tr> <td> <p>2. The citizen fills up the forms by entering his/her details.</p> <p>3. The citizen selects either the submit or cancel option.</p> </td><td> <p>1. The system shows the registration form to the citizen.</p> <p>4. If the option selected is “submit”, then the system will validate the details entered by the citizen.</p> <p>5. If all the details are correct, the system saves the citizen’s details to the database.</p> <p>6. The system will show a successful message.</p> </td></tr> </tbody> </table> <p>6. Alternative flow:</p> <p>A1: Step 4 If the option selected is the cancel option, then the system will redirect the citizen back to the homepage.</p> <p>A2: Step 5 If the values entered are incorrect or empty, the system will prompt an error message.</p> <p>7. Post condition The system will redirect the citizen to the homepage and the citizen is able to login to the system.</p>	Actor action	System response	<p>2. The citizen fills up the forms by entering his/her details.</p> <p>3. The citizen selects either the submit or cancel option.</p>	<p>1. The system shows the registration form to the citizen.</p> <p>4. If the option selected is “submit”, then the system will validate the details entered by the citizen.</p> <p>5. If all the details are correct, the system saves the citizen’s details to the database.</p> <p>6. The system will show a successful message.</p>
Actor action	System response				
<p>2. The citizen fills up the forms by entering his/her details.</p> <p>3. The citizen selects either the submit or cancel option.</p>	<p>1. The system shows the registration form to the citizen.</p> <p>4. If the option selected is “submit”, then the system will validate the details entered by the citizen.</p> <p>5. If all the details are correct, the system saves the citizen’s details to the database.</p> <p>6. The system will show a successful message.</p>				

Table 3.2: Use case description for manage citizen personal information

- 1. User case name:** Manage citizen personal information
- 2. Actor:** Citizen
- 3. Brief description:** This use case allows the citizen to view and update his/her personal details.
- 4. Precondition:** The citizen needs to log in to the system successfully.
- 5. Main flow**

Actor action	System response
<ol style="list-style-type: none"> 2. The citizen selects the “view personal information” option. 5. The citizen can view his/her personal information. 6. The citizen can select either the back or update option. 8. The citizen changes his/her personal information. 9. The citizen selects either the submit or cancel option. 	<ol style="list-style-type: none"> 1. The system shows the main menu. 3. The system will find the citizen record from the database. 4. The system will show the citizen’s personal details. 7. If the option selected is “update”, then the system will enable the textbox for the citizen to edit. 10. If the option selected is “submit”, then the system will validate the details entered by the citizen. 11. If all the details entered are correct, the system will update the citizen’ details at the database. 12. The system will show a successful message.

6. Alternative flow:

A1: Step 7

If the option selected is the back option, then the system will redirect the citizen back to the homepage.

A2: Step 10

If the option selected is cancel option, then the system will return update mode to view mode.

A3: Step 11

If the values entered are incorrect or empty, the system will prompt an error message.

7. Post condition

The system will redirect the citizen back to view mode.

Table 3.3: Use case description for view citizen listing

1. User case name: View citizen listing	
2. Actor: MoH staff	
3. Brief description: This use case allows the MoH staff to view the citizens' details.	
4. Precondition: The MoH staff needs to log in to the system successfully.	
5. Main flow	
Actor action	System response
2. The MoH staff selects the “view citizen listing” option.	1. The system shows the main menu. 3. The system will find all the citizen records from the database. 4. The system will show all the citizens in a list.
5. The MoH staff can search a specific citizen by filter.	6. The system will search the citizens based on the filter. 7. If the system finds the records, it will show a new list.
8. The MoH staff select a citizen.	9. The system will show further information of the selected citizen.
6. Alternative flow:	
<u>A1: Step 7</u>	If the system didn't find the record, it will show a “not found” message.
7. Post condition	The MoH staff choose to return to another page.

Location module

Table 3.4: Use case description for generate location QR code

- 1. User case name:** Generate location QR code
- 2. Actor:** Citizen
- 3. Brief description:** This use case allows the citizen to create location QR code for his/her company or business.
- 4. Precondition:** The citizen needs to log in to the system successfully.
- 5. Main flow**

Actor action	System response
<p>2. The citizen selects the “generate location QR code” option.</p> <p>4. The citizen fills up the form by entering the location details.</p> <p>5. The citizen either selects the submit or cancel option.</p>	<p>1. The system shows the main menu.</p> <p>3. The system shows a location form to the citizen.</p> <p>6. If the option selected is “submit”, then the system will verify the details entered.</p> <p>7. If all the details are correct, the system will save the location details to the database.</p> <p>8. The system will show a successful message.</p>

- 6. Alternative flow:**

A1: Step 6

If the option selected is the cancel option, then the system will redirect the citizen back to the homepage.

A2: Step 7

If the values entered are incorrect or empty, the system will prompt an error message.

- 7. Post condition**

The system will redirect the citizen to the homepage.

Table 3.5: Use case description for record location by scanning QR code

- 1. User case name:** Record location by scanning QR code
- 2. Actor:** Citizen
- 3. Brief description:** This use case allows the citizen record location by scanning the location's QR code.
- 4. Precondition:** The citizen opens a QR code scanner.
- 5. Main flow**

Actor action	System response
1. The citizens scan the location QR code.	<p>2. The system will check the citizen's health status.</p> <p>3. If the citizens' health status is not "infected" or "Suspected", then the system will search the location details based on the QR code.</p> <p>4. If the system finds the location details, then it will check the location status.</p> <p>5. If the location status is not "high-risk", then the system will save the location record for the citizen.</p> <p>6. The system shows the successful message and location details to the citizen.</p>

6. Alternative flow:

A1: Step 3

If the citizens' health status is "infected" or "Suspected", then the system will send a warning message to the citizen and send the citizen information to the staff.

A2: Step 4

If the location is not found from the database, then the system will show a "location not found" message.

A3: Step 5

If the location status is "high-risk", then the system will inform the citizen that he/she is entering a high-risk location and ask whether the citizen wants to continue to proceed.

7. Post condition

The citizens close the page.

Table 3.6: Use case description for view location record histories

- 1. User case name:** View location record histories
- 2. Actor:** Citizen/ MoH staff
- 3. Brief description:** This use case allows the citizen to check his/her location history. The MoH staff can view all the citizen location history.
- 4. Precondition:** The user needs to successfully login to the system.
- 5. Main flow**

Actor action	System response
<p>2. The user chooses the “view location history” option.</p> <p>6. The user searches a location record by filter.</p> <p>9. The user click a specific location record.</p>	<p>1. The system shows the main menu.</p> <p>3. The system will check the user type.</p> <p>4. If the user is a staff, then the system will retrieve all citizen location record.</p> <p>5. The system will display the location records in list.</p> <p>7. The system will search the location record based on the filter.</p> <p>8. If the system found the location records, it will display it in a new list.</p> <p>10. The system will show further information of the selected location record.</p>

6. Alternative flow:

A1: Step 4

If the user is a citizen, then the system will only retrieve the citizen’s location records.

A2: Step 8

If the location history is not found from the database, then the system will show a “location history not found” message.

7. Post condition

The user leaves the page.

Table 3.7: Use case description for manage location details

- 1. User case name:** Manage location details
- 2. Actor:** MoH staff
- 3. Brief description:** This use case allows the MoH staff to manage registered locations.
- 4. Precondition:** The user needs to successfully login to the system.
- 5. Main flow**

Actor action	System response
<p>2. The MoH staff chooses the “manage location” option.</p> <p>5. The MoH staff searches a specific location by filter.</p> <p>8. The MoH staff click the specific location.</p> <p>10. The MoH selects either the update or back option.</p> <p>12. The MoH modified the details.</p> <p>13. The MoH staff selects either cancel or submit option.</p>	<p>1. The system shows the main menu.</p> <p>3. The system will retrieve all the registered locations from the database.</p> <p>4. The system displays the location in the list.</p> <p>6. The system searches the location based on the filter.</p> <p>7. If the system finds the location, then it will display the location.</p> <p>9. The system shows further information of the specific location.</p> <p>11. If the option selected is “update”, the system enables the control for the MoH staff to edit.</p> <p>14. If the option selected is “submit”, the system will verify the details entered.</p> <p>15. If the details entered are correct, the system will update the location details at the database.</p> <p>16. The system will show a successful message.</p>

6. Alternative flow:

A1: Step 7

If the location is not found from the database, then the system will show a “location not found”

message.

A2: Step 11

If the option selected is “back”, then the system will redirect the MoH staff back to view mode.

A3: Step 14

If the option selected is “cancel”, then the system will redirect the MoH staff back to view mode.

A4: Step 15

If the values entered are incorrect or empty, the system will prompt an error message.

7. Post condition

The system will redirect the MoH staff back to view mode.

Message and enquiry module

Table 3.8: Use case description for send message to staff

1. User case name: Send message to staff				
2. Actor: Citizen				
3. Brief description: This use case allows the citizen to send messages to the MoH staff.				
4. Precondition: The citizen needs to successfully login to the system.				
5. Main flow				
<table border="1"> <thead> <tr> <th>Actor action</th> <th>System response</th> </tr> </thead> <tbody> <tr> <td> 2. The citizen enters the help center pages. 3. The citizen choose “chat with the staff” option. 5. The citizen enters the message. 6. The citizen clicks the send icon. </td> <td> 1. The system shows the main menu. 4. The system will show the chat layout. 7. The system will save the chat details to the database. 8. The system will save the message to the database. 9. The system show a successful message and tell the citizen wait for reply. </td> </tr> </tbody> </table>	Actor action	System response	2. The citizen enters the help center pages. 3. The citizen choose “chat with the staff” option. 5. The citizen enters the message. 6. The citizen clicks the send icon.	1. The system shows the main menu. 4. The system will show the chat layout. 7. The system will save the chat details to the database. 8. The system will save the message to the database. 9. The system show a successful message and tell the citizen wait for reply.
Actor action	System response			
2. The citizen enters the help center pages. 3. The citizen choose “chat with the staff” option. 5. The citizen enters the message. 6. The citizen clicks the send icon.	1. The system shows the main menu. 4. The system will show the chat layout. 7. The system will save the chat details to the database. 8. The system will save the message to the database. 9. The system show a successful message and tell the citizen wait for reply.			
6. Post condition				
The citizen waits for the MoH staff to reply. After finishing the chat, the citizen can choose to end the chat.				

Table 3.9: Use case description for manage citizen message

1. User case name: Manage citizen message				
2. Actor: MoH staff				
3. Brief description: This use case allows the MoH staff to reply to the message sent by the citizen.				
4. Precondition: The MoH staff needs to successfully login to the system.				
5. Main flow				
<table border="1"> <thead> <tr> <th>Actor action</th> <th>System response</th> </tr> </thead> <tbody> <tr> <td> 2. The MoH staff chooses the “reply citizen’s messages” option. 5. The MoH staff chooses a specific chat to view. 8. The staff press the “enter chat” button. 10. The MoH staff enters the message. 11. The MoH staff clicks the send icon. </td> <td> 1. The system shows the main menu. 3. The system retrieves available chat from the database. 4. If there are available chats, the system shows the available chat list. 6. The system will retrieve the message details of the specific chat. 7. The system show the chat layout with message. 9. The system will update the chat details. 12. The system will save the message to the database. </td> </tr> </tbody> </table>	Actor action	System response	2. The MoH staff chooses the “reply citizen’s messages” option. 5. The MoH staff chooses a specific chat to view. 8. The staff press the “enter chat” button. 10. The MoH staff enters the message. 11. The MoH staff clicks the send icon.	1. The system shows the main menu. 3. The system retrieves available chat from the database. 4. If there are available chats, the system shows the available chat list. 6. The system will retrieve the message details of the specific chat. 7. The system show the chat layout with message. 9. The system will update the chat details. 12. The system will save the message to the database.
Actor action	System response			
2. The MoH staff chooses the “reply citizen’s messages” option. 5. The MoH staff chooses a specific chat to view. 8. The staff press the “enter chat” button. 10. The MoH staff enters the message. 11. The MoH staff clicks the send icon.	1. The system shows the main menu. 3. The system retrieves available chat from the database. 4. If there are available chats, the system shows the available chat list. 6. The system will retrieve the message details of the specific chat. 7. The system show the chat layout with message. 9. The system will update the chat details. 12. The system will save the message to the database.			
6. Alternative flow				
<u>A1: Step 4</u> If there are no available chats, then the system will show a “no chat found” message.				
7. Post condition				
The MoH staff waits for further replies or ends the chat.				

Table 3.10: Use case description for manage notifications

1. User case name: Manage notification				
2. Actor: MoH staff				
3. Brief description: This use case allows the MoH staff to send notifications to the citizens.				
4. Precondition: The MoH staff needs to successfully login to the system.				
5. Main flow				
<table border="1"> <thead> <tr> <th>Actor action</th> <th>System response</th> </tr> </thead> <tbody> <tr> <td> 2. The MoH staff chooses the send notification option. 4. The MoH staff fill up the form by entering the details. 5. The MoH staff selects either the submit or cancel option. </td> <td> 1. The system shows the main menu. 3. The system will show the form. 6. If the option selected is “submit”, then the system will verify the details entered. 7. If all the details entered are correct, the system will save the notification details to the database. 8. The system sends the notification to the citizens. 9. The system shows a successful message. </td> </tr> </tbody> </table>	Actor action	System response	2. The MoH staff chooses the send notification option. 4. The MoH staff fill up the form by entering the details. 5. The MoH staff selects either the submit or cancel option.	1. The system shows the main menu. 3. The system will show the form. 6. If the option selected is “submit”, then the system will verify the details entered. 7. If all the details entered are correct, the system will save the notification details to the database. 8. The system sends the notification to the citizens. 9. The system shows a successful message.
Actor action	System response			
2. The MoH staff chooses the send notification option. 4. The MoH staff fill up the form by entering the details. 5. The MoH staff selects either the submit or cancel option.	1. The system shows the main menu. 3. The system will show the form. 6. If the option selected is “submit”, then the system will verify the details entered. 7. If all the details entered are correct, the system will save the notification details to the database. 8. The system sends the notification to the citizens. 9. The system shows a successful message.			
6. Alternative flow:				
<u>A1: Step 6</u> If the option selected is “cancel”, the system will redirect the MoH staff to the homepage. <u>A2: Step 7</u> If the values entered are incorrect or empty, the system will prompt an error message.				
7. Post condition				
the system will redirect the MoH staff to the homepage.				

Table 3.11: Use case description for manage FAQs

- 1. User case name:** Manage FAQs
- 2. Actor:** MoH staff
- 3. Brief description:** This use case allows the MoH staff to manage FAQs.
- 4. Precondition:** The MoH staff needs to successfully login to the system.
- 5. Main flow**

Actor action	System response
<p>2. The MoH staff chooses the “manage FAQs” option.</p> <p>5. The MoH staff can search a specific FAQ by the filter.</p> <p>8. The MoH staff can click a specific FAQ for further viewing or update, or click the “add new FAQ” button.</p> <p>10. The MoH selects either the update or delete or back option.</p> <p>12. The MoH staff modifies the details.</p> <p>13. The MoH staff selects either cancel or submit option.</p>	<p>1. The system shows the main menu.</p> <p>3. The system will retrieve all the FAQs details from the database.</p> <p>4. The system will show the FAQs in the list.</p> <p>6. The system searches the FAQ based on the filter.</p> <p>7. If the system finds the FAQ, then it will display the FAQ.</p> <p>9. If the MoH staff click a specific FAQ, the system will show further information.</p> <p>11. If the option selected is “update”, the system enables the control for the MoH staff to edit.</p> <p>14. If the option selected is “submit”, the system will verify the details entered.</p> <p>15. If the details entered are correct, the system will update the FAQ details at the database.</p> <p>16. The system will show a successful message.</p>

6. Alternative flow:

A1: Step 7

If the system didn't find the FAQ from the database, it will show "FAQ not found" message.

A2: Step 9

If the MoH staff clicks the "add new FAQ" button, the system will show a form to the MoH staff to add a new FAQ.

A3: Step 11

If the option selected is "back", the system will redirect the MoH staff to view mode. If the option selected is "delete", the system will show a confirmation to the MoH staff.

A4: Step 14

If the option selected is "cancel", then the system will redirect the MoH staff back to view mode.

A5: Step 15

If the values entered are incorrect or empty, the system will prompt an error message.

7. Post condition

The system will redirect the MoH staff back to view mode.

Vaccine management and appointment (Author Focus on vaccine setup)

Table 3.12: Use case description for manage vaccine

1. User case name: Manage vaccine	
2. Actor: MoH staff	
3. Brief description: This use case allows the MoH staff to manage the vaccine.	
4. Precondition: The MoH staff needs to successfully login to the system.	
5. Main flow	
Actor action	System response
2. The MoH staff chooses the “manage vaccine” option.	1. The system shows the main menu. 3. The system will retrieve all the vaccines details from the database. 4. The system will show the vaccines in the list.
5. The MoH staff can search a specific vaccine by the filter.	6. The system searches the vaccines based on the filter. 7. If the system finds vaccine, then it will display the vaccines.
8. The MoH staff can click a specific vaccine for further viewing or update, or click the “add new vaccine” button.	9. If the MoH staff click a specific vaccine, the system will show further information.
10. The MoH selects either the update or delete or back option.	11. If the option selected is “update”, the system enables the control for the MoH staff to edit.
12. The MoH staff modifies the details.	
13. The MoH staff selects either cancel or submit option.	14. If the option selected is “submit”, the system will verify the details entered. 15. If the details entered are correct, the system will update the vaccine details at the database. 16. The system will show a successful message.

6. Alternative flow:A1: Step 7

If the system didn't find the vaccine from the database, it will show "vaccine not found" message.

A2: Step 9

If the MoH staff clicks the "add new vaccine" button, the system will show a form to the MoH staff to add a new vaccine.

A3: Step 11

If the option selected is "back", the system will redirect the MoH staff to view mode. If the option selected is "delete", the system will show a confirmation to the MoH staff.

A4: Step 14

If the option selected is "cancel", then the system will redirect the MoH staff back to view mode.

A5: Step 15

If the values entered are incorrect or empty, the system will prompt an error message.

7. Post condition

The system will redirect the MoH staff back to view mode.

Table 3.13: Use case description for manage vaccine location

1. User case name: Manage vaccine location	
2. Actor: MoH staff	
3. Brief description: This use case allows the MoH staff to manage the vaccine location.	
4. Precondition: The MoH staff needs to successfully login to the system.	
5. Main flow	
Actor action	System response
2. The MoH staff chooses the “manage vaccine location” option.	1. The system shows the main menu. 3. The system will retrieve all the vaccine location details from the database. 4. The system will show the vaccine location in the list.
5. The MoH staff can search a specific vaccine location by the filter.	6. The system searches the vaccine location based on the filter. 7. If the system finds vaccine location, then it will display the vaccines.
8. The MoH staff can click a specific vaccine location for further viewing or update, or click the “add new vaccine location” button.	
10. The MoH selects either the update or back option.	9. If the MoH staff click a specific vaccine location, the system will show further information. 11. If the option selected is “update”, the system enables the control for the MoH staff to edit.
12. The MoH staff modifies the details.	
13. The MoH staff selects either cancel or submit option.	14. If the option selected is “submit”, the system will verify the details entered. 15. If the details entered are correct, the system will update the vaccine details at the database. 16. The system will show a successful message.

6. Alternative flow:**A1: Step 7**

If the system didn't find the vaccine from the database, it will show "vaccine location not found" message.

A2: Step 9

If the MoH staff clicks the "add new vaccine location" button, the system will show a form to the MoH staff to add a new vaccine location.

A3: Step 11

If the option selected is "back", the system will redirect the MoH staff to view mode.

A4: Step 14

If the option selected is "cancel", then the system will redirect the MoH staff back to view mode.

A5: Step 15

If the values entered are incorrect or empty, the system will prompt an error message.

7. Post condition

The system will redirect the MoH staff back to view mode.

3.3.4 Non-functional Requirements

a) Security

Security is one of the most important non-functional requirements for the proposed system. The proposed system is a health care system so it will store sensitive information of the citizens such as NRIC, phone number, health information, location histories, and more. The proposed system must have strong security to ensure the citizens' information is protected and not easily hacked by the black hat hacker. If the information gets leaked and hacked, the hacker can sell the personal information for money. The citizens will lose trust in the system as they think the system is not safe to use and it will also cause a bad reputation to the company. Moreover, the proposed system is run on the browser, the system might face attacks such as Distributed Denial of Service attacks (DDoS), Domain Name Hijacking, SQL injection. Strong security is required to ensure the safety of the system and avoid any financial loss to the company.

The proposed system will provide authentication and levels of authorization to ensure the right person is using the resources. The proposed system has two sites, the citizen site, and the admin site, the admin site even has three types of users that are the head admin, normal MoH staff, and hospital staff. Each user only can access each respective site and each of the staff can access different functionality. The proposed system must ensure the functionality can only be accessed by the right person to avoid other staff misuses of the system. The user of the proposed system is required to enter the correct username and password in order to log in to the system to ensure the user account is not used by others. During the registration process, the user has also required a strong password that has a minimum of 8 characters and a combination of 1 UpperCase, 1 Lower-Case, and 1 number to avoid password attack. Besides that, the proposed system also needs to ensure only the authorized staff can view the citizens' personal information to protect the citizens' privacy and the citizens agree with privacy policies to share their personal information. Furthermore, security measures such as Firewall, Intrusion Detection System (IDS), Secure Socket Layers (SSL) and more should be implemented to the proposed system to avoid any cyber-attacks.

b) Reliability

Reliability is also an important element for the proposed system to ensure the system can perform the functions correctly without failure. As the proposed system is a health care system, there are many critical tasks such as record location history, inform suspected citizens, apply for vaccines, and more. Some of the tasks are even automatically processed by the system. If the system fails during the operation, it will cause delay as well as inconvenience to the staff and the staff might need to perform the task manually as the system is not reliable. So, a high-reliability system is needed to ensure the tasks can perform smoothly for the users without any failure. The proposed system should also have high recoverability to recover the system when encountering any errors.

The proposed system should have a low rate of downtime to ensure the high reliability of the system. It should have around 99.5% of uptime which is 4 and a half hours of downtime per year. With such a low rate of downtime, the user can trust that the proposed system can perform the tasks smoothly as well as increase user satisfaction. Other than that, the proposed system should have a high recovery speed when it encounters any errors. The Mean Time To Recovery (MTTR) should be around 10 to 15 minutes per recovery to let users use it back more quickly and not to cause further delay to the operation of defending COVID-19.

c) Usability

Usability is also extremely important for the proposed system as it measures how easily the system can be understood and used by the user. The proposed system should be easy to use as there will be novice users using the system. A high usability system can ensure the novice user can learn faster to use the system and avoid the loss of user cause of complexity as well as the difficulty of the system. There might be expert users in the proposed system so that the system should concern the two types of users.

The proposed system should provide guidelines and instructions to the user when the user is performing a specific task. So, the user can understand how to perform the task and learn to use the system. The proposed system will also give feedback like sending a successful message and error message to the user so that the user will know that he/she is doing correctly or wrongly in the task. Error messages also can let the user not repeat the same error and make corrections to the wrong part. Moreover, the steps of performing the tasks should be simplified as much as possible. This helps the novice user more easily to learn how to use the system as it has few steps and the expert user can use his/her experience to perform the task faster. This will highly increase the satisfaction of both users and they will be more willing to use the proposed system. Lastly, the proposed system needs to have an easy-understand and consistent user interface for the user. The user interface should follow the existing system so that the user can learn to use the proposed system faster as he/she already has experience in using the previous system. For example, the navigation of the website is always on the top and the proceed button or back button is always at the bottom of the form.

3.3.5 Development Environment

In this project, the author and his partner are using the ASP.Net to develop the proposed system. The reasons of using the ASP.Net are:

More experience in using ASP.Net with Visual Basic

The ASP.Net is language independent which means the developer can choose one of the available programming languages to develop the system. The ASP.Net has two common programming languages for the server site that are C# and Visual Basic. C# is more popular among the programming languages but the author and his partner decided to use Visual Basic as they have more experience in VB. The author and his partner have gained knowledge and experience during their internship and they are more confident to develop the proposed system with VB language.

Support extra packages and features

The ASP.Net is an open-source program, the developers can develop their features and share them with others. Currently, there are over 100,000 contributions in GitHub. Moreover, ASP.Net is also supported by NuGet. The NuGet is a Microsoft-supported mechanism for sharing code and the developer can install the packages in the NuGet package manager. The author and his partner can find useful packages or features in GitHub and NuGet package manager for the proposed system.

Develop dynamic web pages

The Asp.Net has two sides that are client-side and the server-side. The web pages can become dynamic by running the functions on both sides. The client-side can retrieve the data of the server site by using JavaScript and the client-side can pass the data to the server site with JQuery. This helps the author and his partner to have more ideas in developing the proposed system and more choices in writing the codes.

Code efficiency

The ASP.Net application is compiled before running the program which means the whole code is translated into object code before executed. This method is more efficient and faster compared to other websites that use interpreted methods such as PHP. The author and his partner can run and test their program faster.

Hardware environment

Table 3.14: Hardware requirements for developing the proposed system

Code development device	
Laptop (Lenovo Y520-151KBM)	<p>The author uses the Lenovo Y520 laptop that was developed by the Lenovo company to develop the proposed system. The author's laptop has a fast speed CPUs and large memory which can help the author run the program faster and smoother.</p> <p>Overall laptop specification:</p> <ul style="list-style-type: none"> - Intel Core i7-7700HQ CPU (Quad-core 2.8 GHz) - 16 GB DDR4 RAM (Memory speed of 2400 MHz) - 1 TB HDD, 128 GB SSD - Windows 10 Home - NVIDIA GeForce GTX 1060 3GB - WiFi + Bluetooth

Software environment

Table 3.15: Software requirements for developing the proposed system

Integrated development environment Software	
Microsoft Studio 2019	<p>Visual Community</p> <p>Microsoft Visual Studio is an integrated development environment (IDE) from microsoft. It can be used to develop computer programs such as web sites, mobile apps, games and more. It also supports multiple programming languages such as C++, C#, Python, Visual Basic, F# and more.</p> <p>Reasons of using:</p> <ul style="list-style-type: none"> - Visual Studio Community 2019 is free and powerful. It also provides many features even though it is free. As the software is free, it also helps the developer to reduce the development cost. - The software also provides useful features which can increase productivity in developing the proposed system. For example, the squiggles and quick action feature will underline the error code and provide solutions for the developer. Besides that, the IntelliSense feature provides information of a specific command in a small window to help developer to understand the usage of the specific command, and the developer no need to look for the information elsewhere. - The software also provides functions such as NuGet package manager to help developers easily install extra packages for the project. The developer is not required to search the packages elsewhere and include the file manually as everything will be managed by the software. <p>System requirements for Visual Studio community 2019:</p> <ul style="list-style-type: none"> - Supported OS: <ul style="list-style-type: none"> - Windows 10 - Windows 8 - Windows 7 - Windows Server 2019 - Windows Server 2016 - Hardware: <ul style="list-style-type: none"> - Quad-core or better x64 processor with CPU speed of 1.8 GHz

	<p>or above (AMD or Intel)</p> <ul style="list-style-type: none"> - 2 GB of RAM or above - Minimum 800 MB to 210 GB of storage based on the features installed - Screen resolution of 720p (1280 x 720) or higher - Language: <ul style="list-style-type: none"> - English - Chinese (Simplified and traditional) - French - German - Italian - Czech - Japanese - Korean - Polish - Portuguese - Russian - Spanish - Turkish - Additional requirements: <ul style="list-style-type: none"> - Installation should be run as administrator - .NET Framework version is 4.5.2 or above to run - C# and VB language should be installed at the installer before starting to develop the application.
SQL Server database	
Microsoft SQL server (MSSQL)	<p>MSSQL is a relational database management system developed by Microsoft. It allows the developer to write SQL scripts to perform functions such as storing, upgrading, retrieving and deleting data.</p> <p>Reasons of using:</p> <ul style="list-style-type: none"> - The main reason of the MSSQL is because it integrates well with visual studio and it also providing some features in visual studio such as: <ul style="list-style-type: none"> ● table designer which helps the developer to manage tables without writing SQL scripts.

	<ul style="list-style-type: none">● The database data is able to view and edit in visual studio and the developer is not required to switch programs to manage the data. <p>System requirements for SQL Server 2019:</p> <ul style="list-style-type: none">- Supported OS:<ul style="list-style-type: none">- Windows 10 or above- Windows Server 2016 and above- Hardware:<ul style="list-style-type: none">- x64 processor with CPU speed of 1.4 GHz and above (AMD or Intel)- Hard-disk space of 6 GB or above- Screen resolution of 800 x 600 and above- Internet connectivity is required if using internet features- 512 MB of RAM and above- Additional requirements:<ul style="list-style-type: none">- Requires .NET framework to be installed
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3.3.6 Operation Environment

Target market

The proposed system is developed for Malaysia citizens, MoH staff, and hospital staff. The users can access the proposed system through the browser with internet connection. The main users of the proposed system are the citizens. The citizens can use the proposed system to check health status, scan location QR codes, send messages to staff, apply vaccines, and more. The MoH staff will use the proposed system to manage the citizen, location, message, and more. The hospital staff only use some functions such as uploading PCR test records, managing vaccine appointment, and others.

Hardware requirements

Table 3.16: Hardware requirements for operating the proposed system

Desktop device	
PC/Laptop	<p>Minimum requirement of devices:</p> <ul style="list-style-type: none"> - 1.9 gigahertz (GHz) x86- or x64-bit dual core processor with SSE2 instruction set - 2 GB RAM - Super VGA with a resolution of 1024 x 768 - 1 GB - 2GB free storage for browser - WIFI supported
Mobile device	
Tablet/smartphone	<p>Minimum requirement of devices:</p> <ul style="list-style-type: none"> - 2 GB RAM - Camera supported for scanning QR code - WIFI and Mobile data supported
Network	
WiFi/Cellular network	<p>Minimum requirements of network:</p> <ul style="list-style-type: none"> - 50 KBps (400 kbps) or above - 150 ms or below

Software requirement

Table 3.17: Software requirements for operating the proposed system

Operating system
<u>Desktop device:</u> Window 7 Window 8 Window 8.1 Window 10
<u>Android device:</u> Android 4.0 or above
<u>IOS device:</u> IOS 6 or above
Browser
Browsers supported are: Mozilla Firefox Google Chrome Safari Microsoft Edge

3.4 Chapter Summary and Evaluation

In conclusion, the author and his partner have defined the requirements of the Traco COVID-19 Tracking System in this chapter. First, they choose the waterfall methodologies to develop the proposed system as it is suitable for the project condition. Then, they have designed an online questionnaire using Google Form and distribute it to gather users' requirements. Next, they analyze the results and list out the functional and non-functional of the proposed system. They also develop the use case diagrams and use case descriptions for the proposed system. After that, they start to select what programming language to develop the proposed system and they decided to use VB.Net as they can gain more benefits from this programming language. Lastly, they list out the hardware and software requirements of the operation and development environments.

The problems faced by the author in this chapter is it is hard to find the minimum requirement to run the VB.net application. The author had taken some time to search for the requirement from the websites.

Chapter 4

System Design

4 System Design

In this chapter, the author had shown the processes of the module that was in charge by him with an activity diagram. Then, the author and his partner also prepared the class diagram, data dictionary, and deployment diagram in this chapter. Lastly, the author also shows some UI designs of the proposed system and algorithms used in the proposed system.

4.1 Processes

4.1.1 Activity diagram

Citizen management module

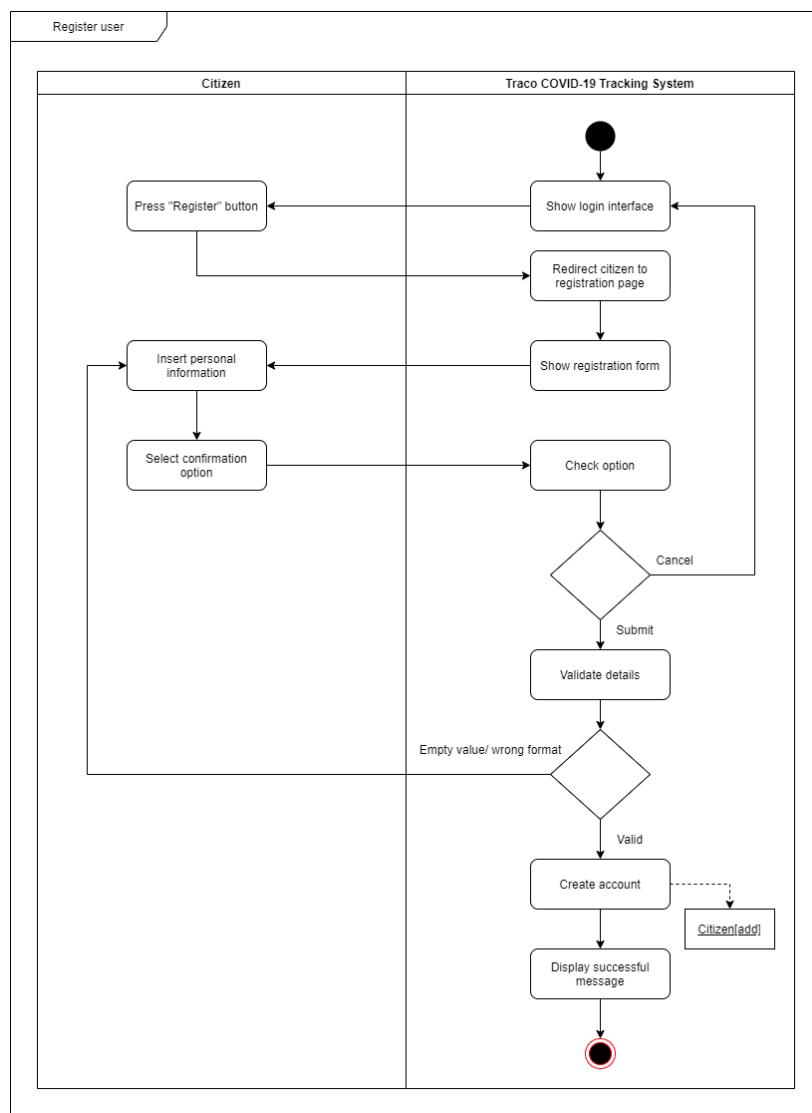


Figure 4.1: Register user activity diagram

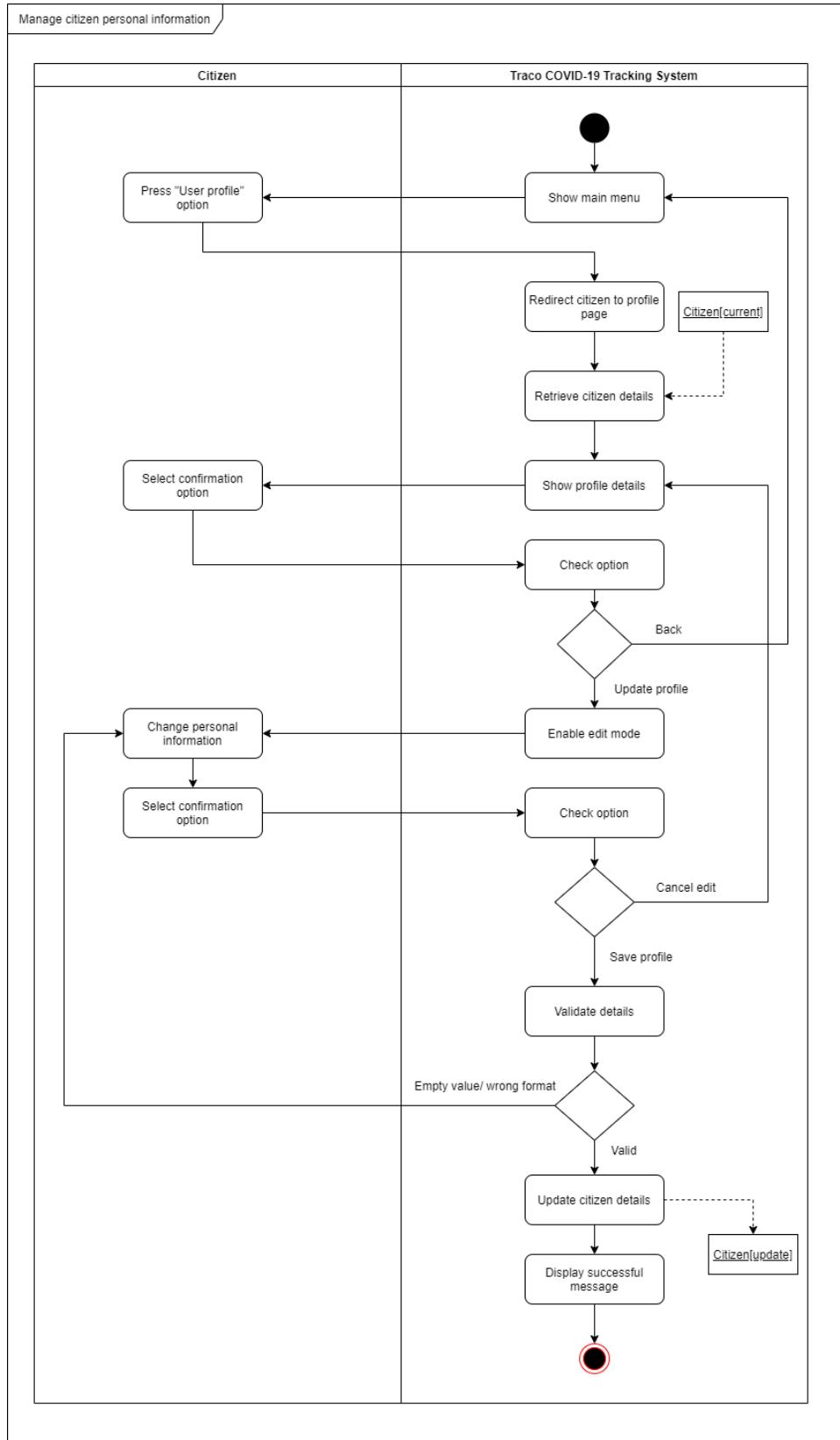


Figure 4.2: Manage citizen personal information activity diagram

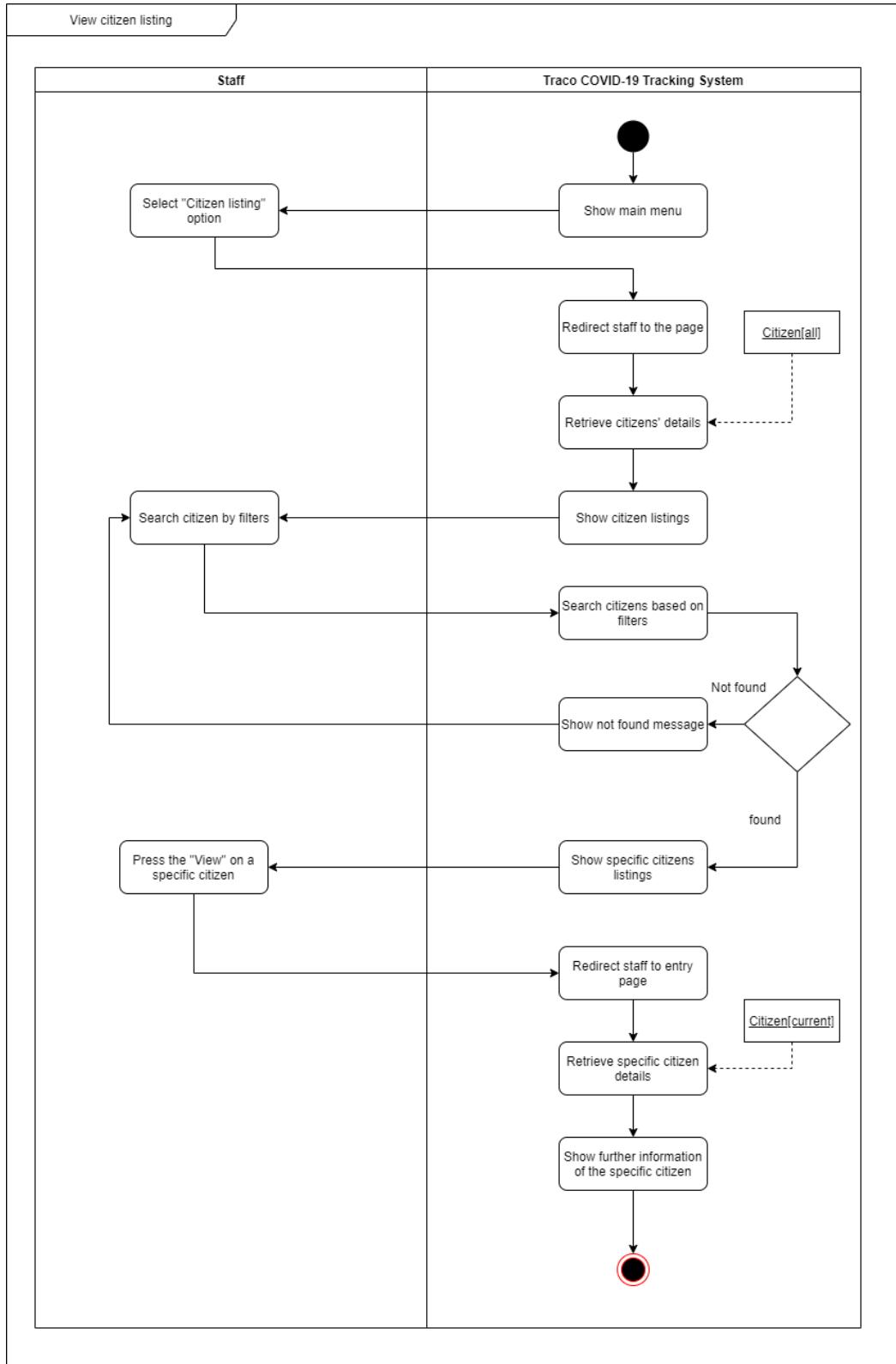


Figure 4.3: View citizen listing activity diagram

Location module

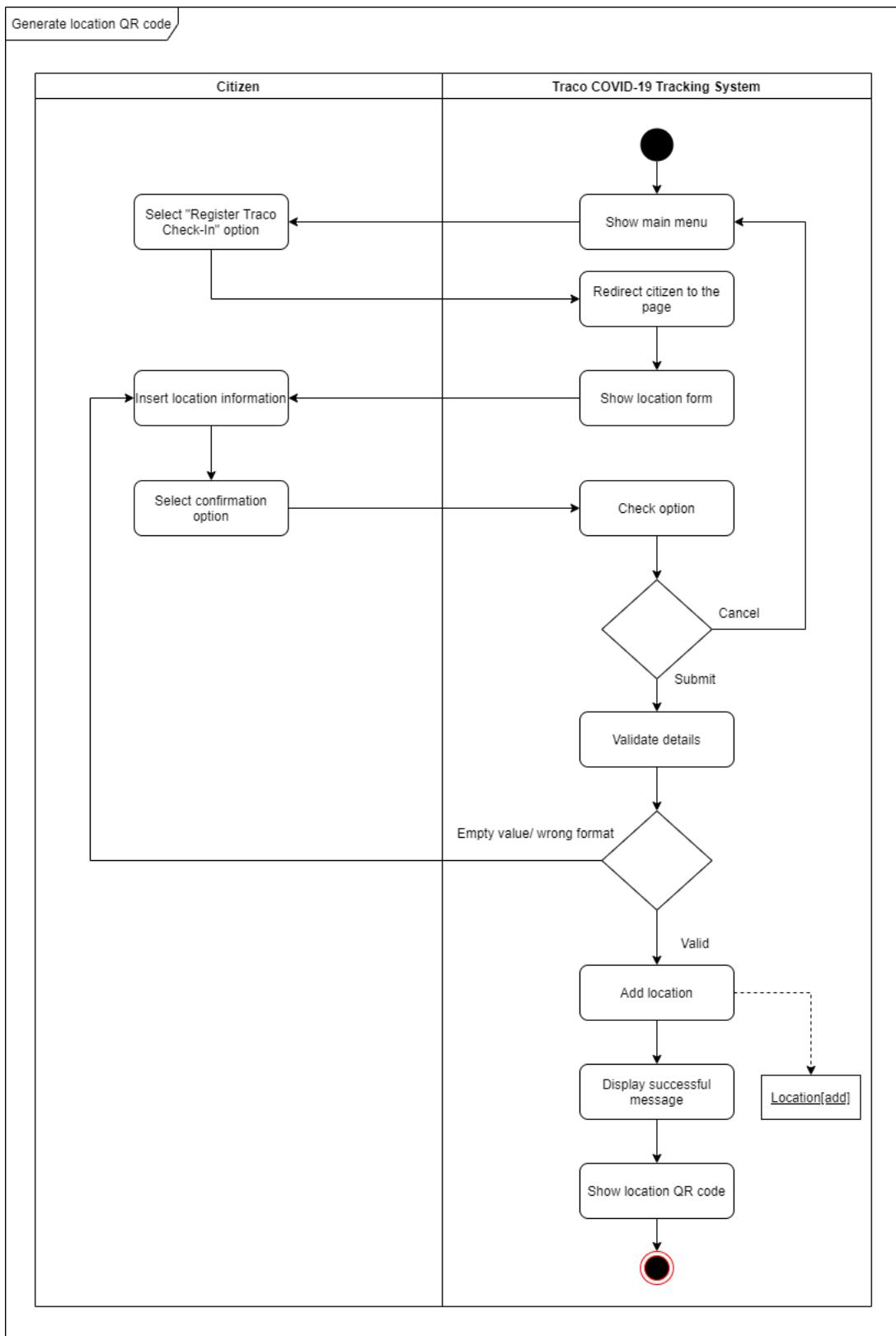


Figure 4.4: Generate location QR code activity diagram

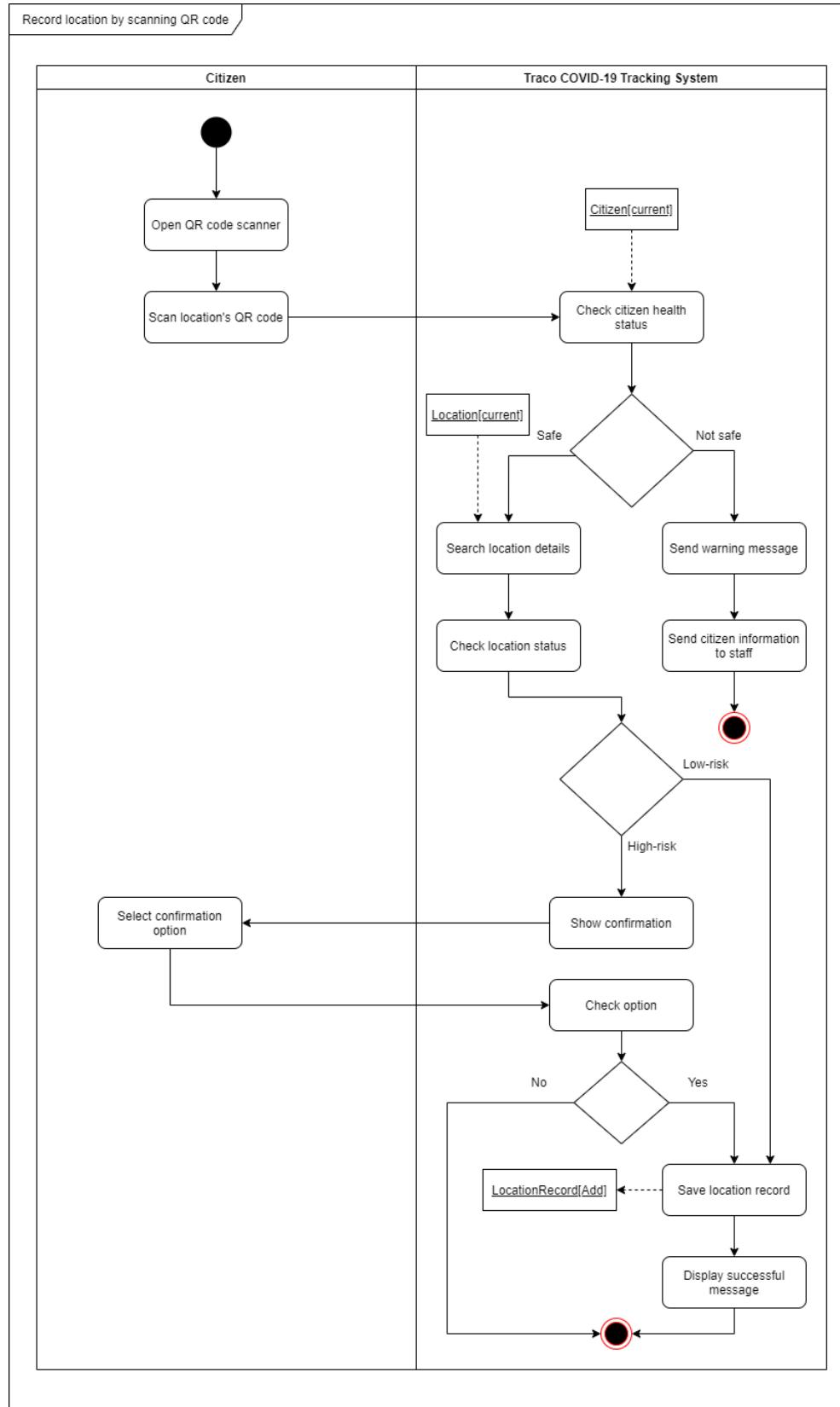


Figure 4.5: Record location by scanning QR code activity diagram

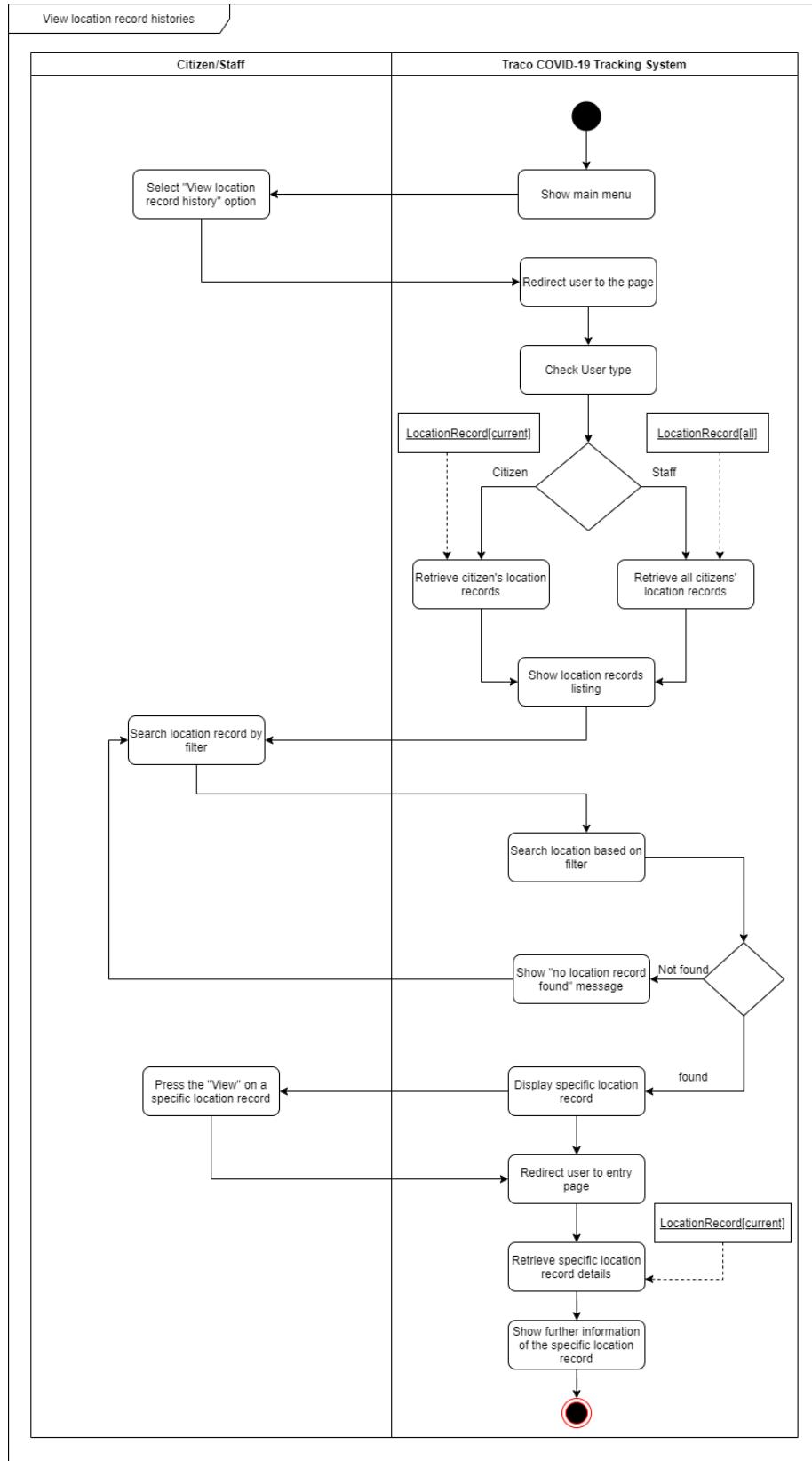


Figure 4.6: View location record histories activity diagram

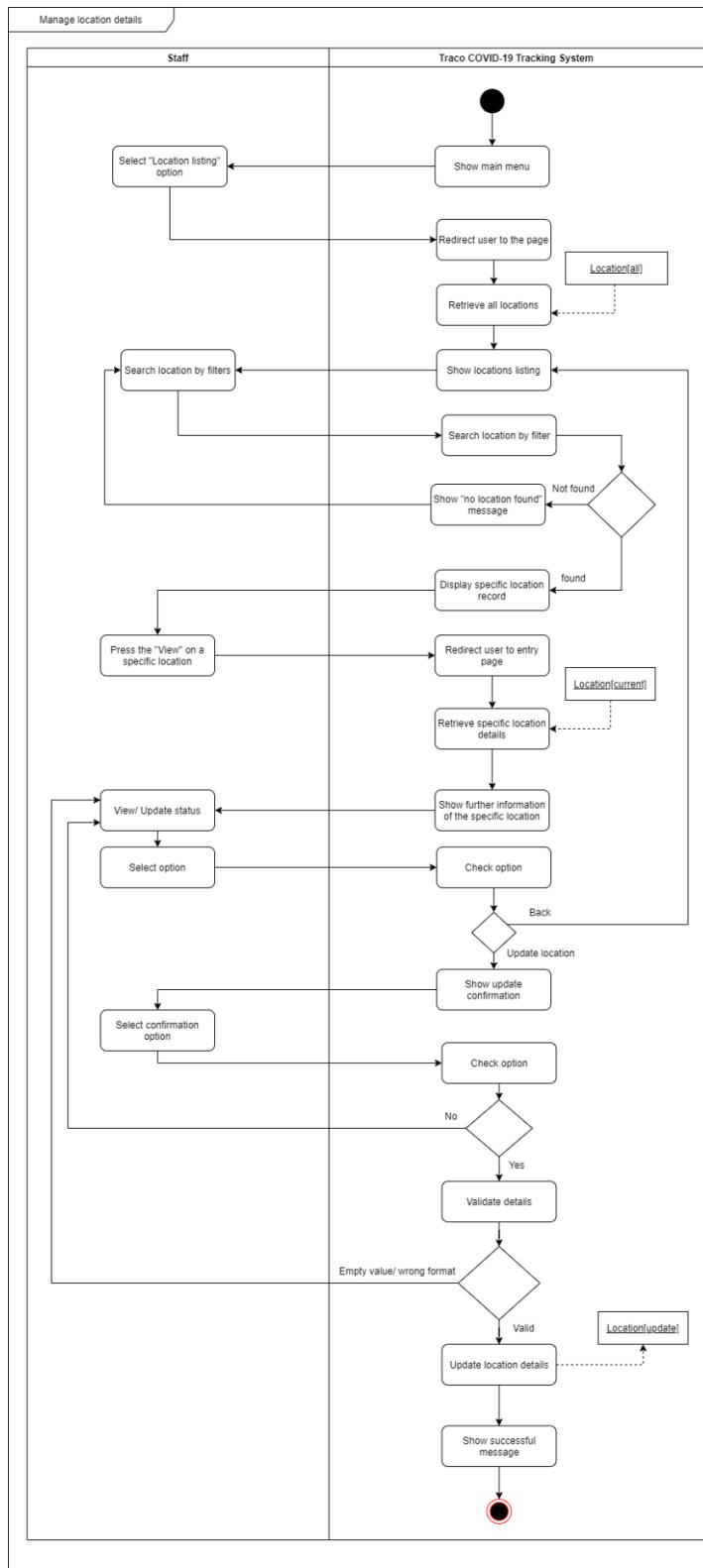


Figure 4.7: Manage location details activity diagram

Messaging and enquiry module

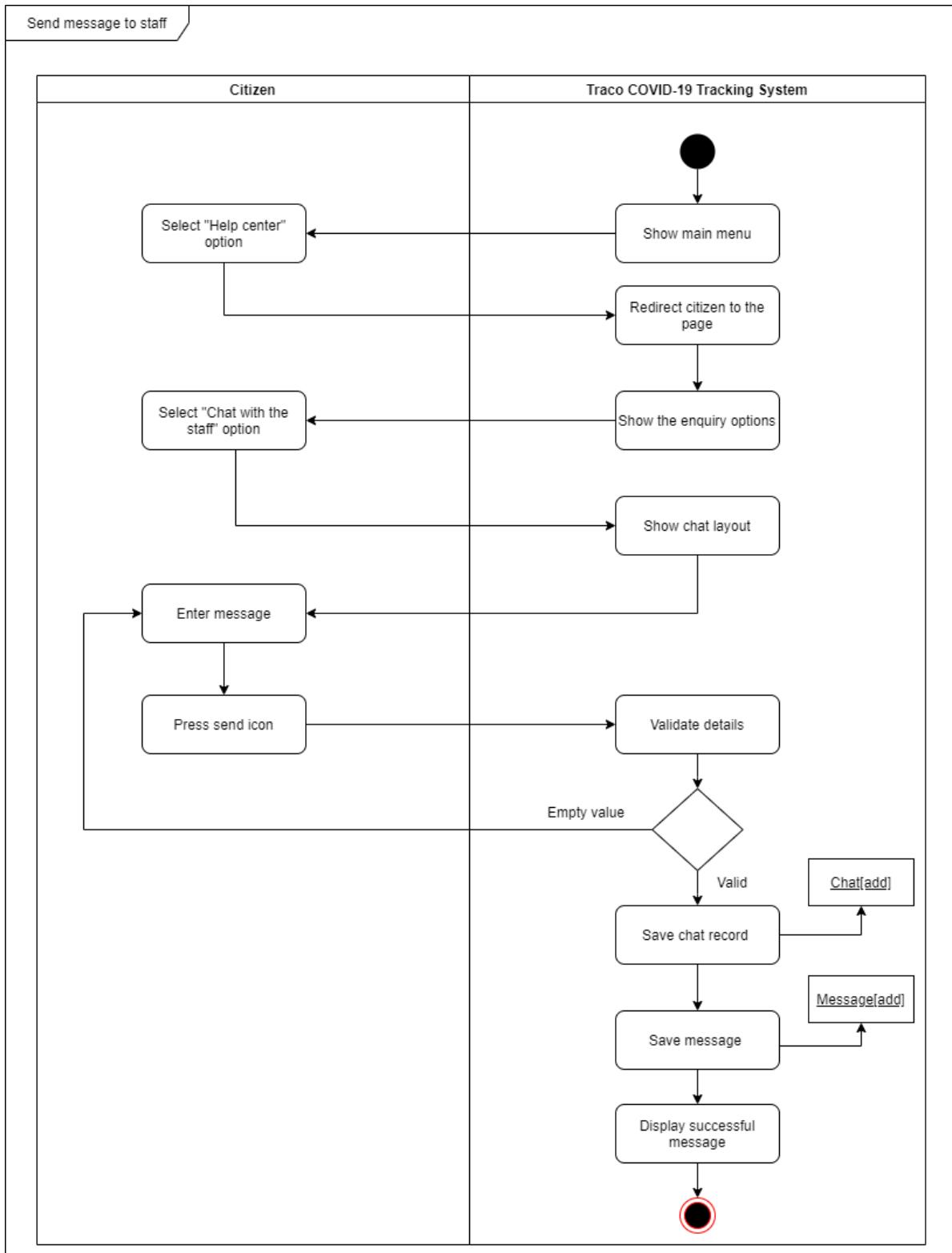


Figure 4.8: Send message to staff activity diagram

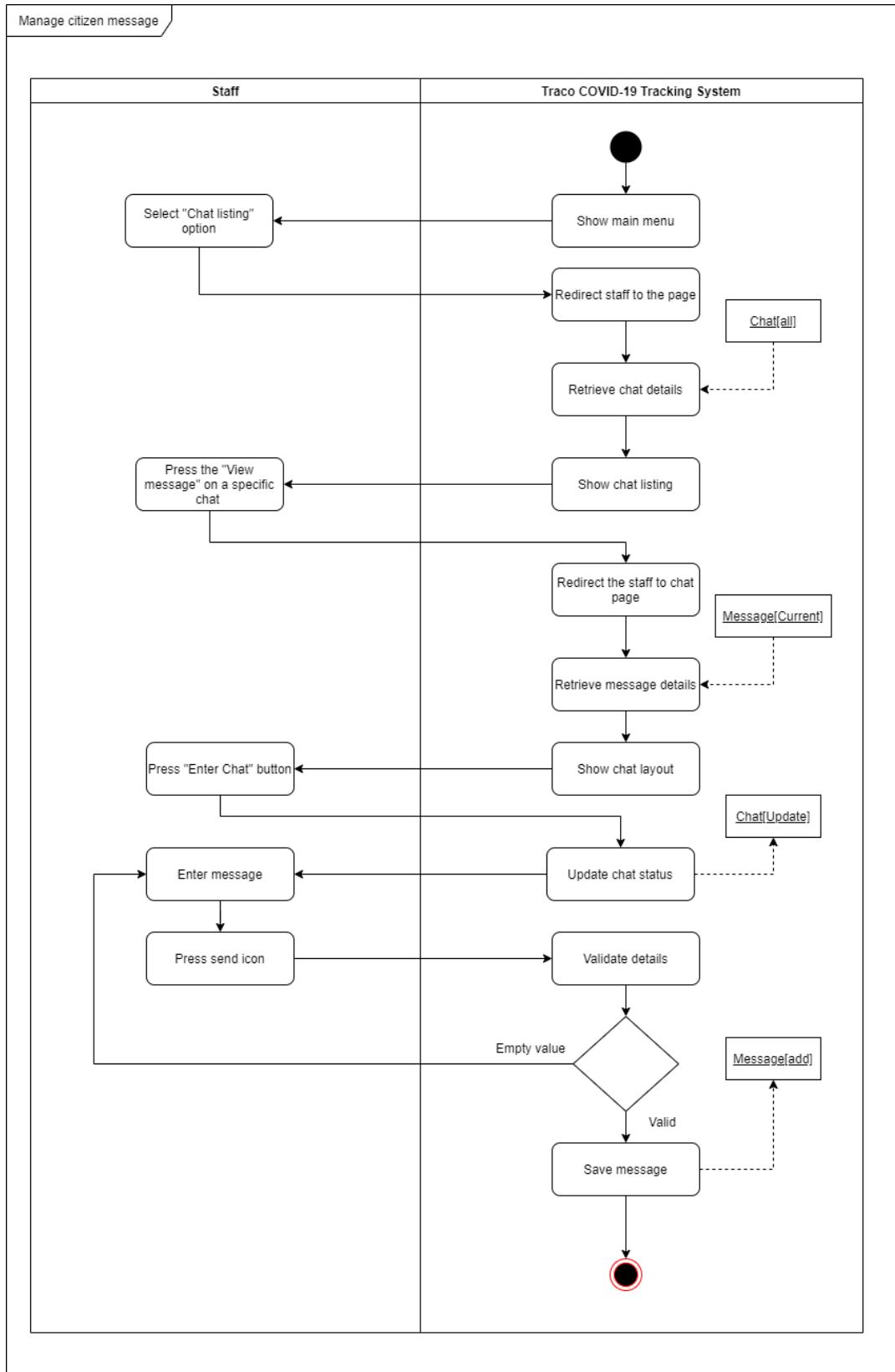


Figure 4.9: Manage citizen message activity diagram

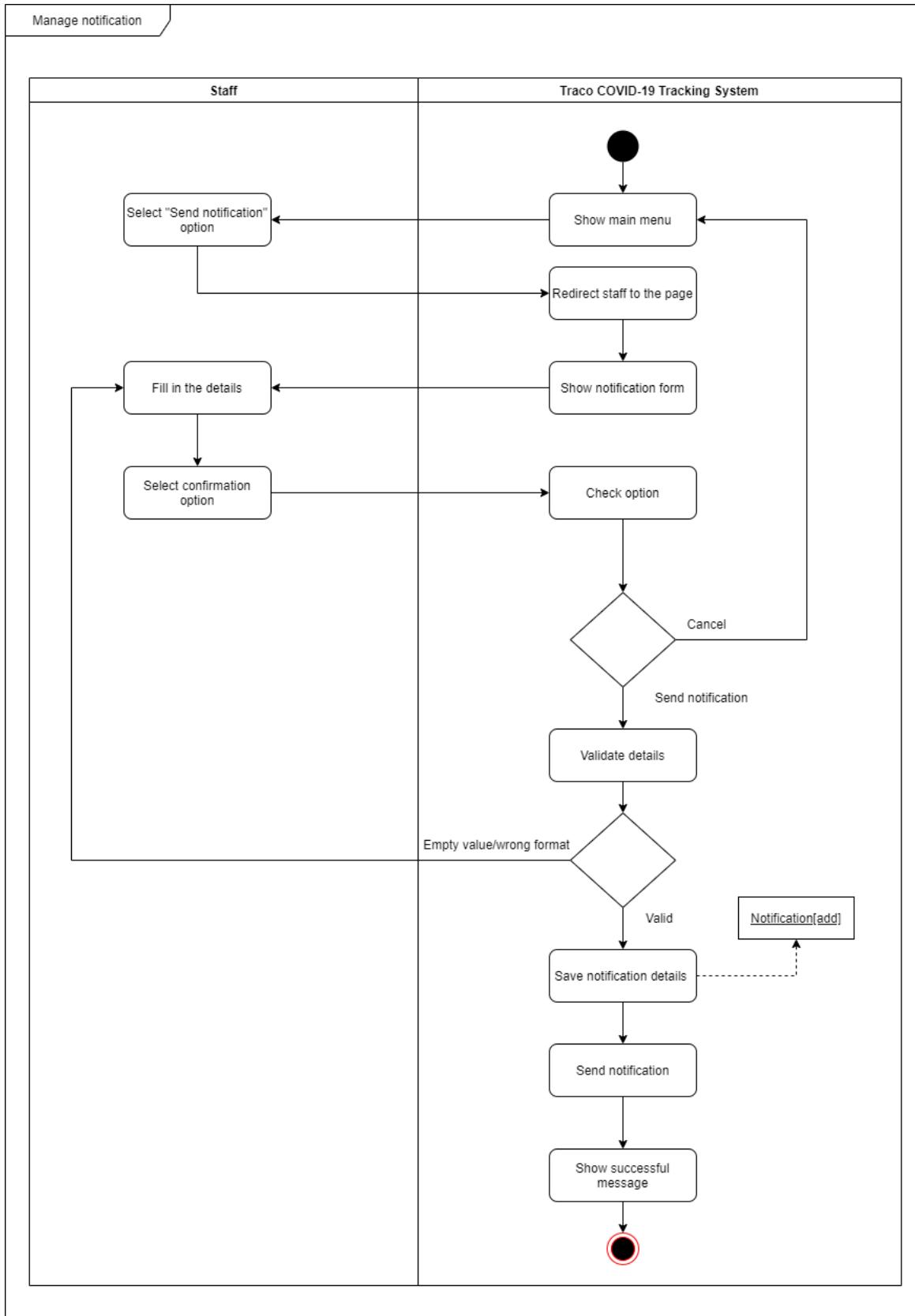


Figure 4.10: Manage notification activity diagram

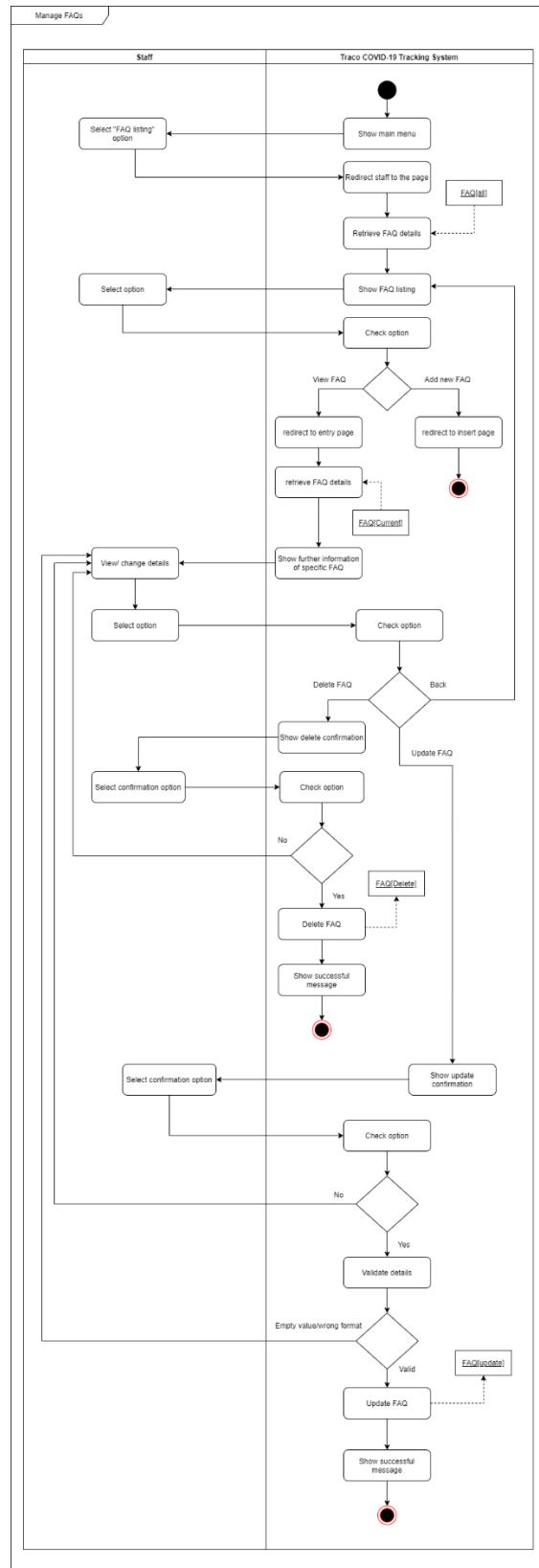


Figure 4.11: Manage FAQ activity diagram

Vaccine management and application module (Autor focus on vaccine setup)

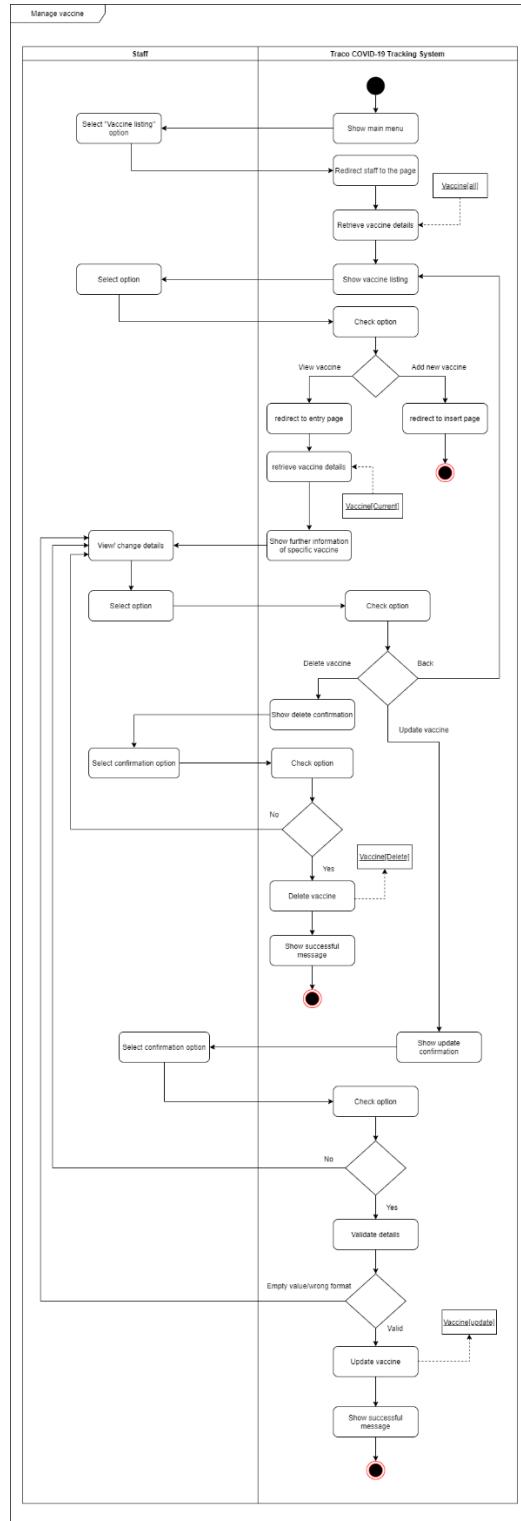


Figure 4.12: Manage vaccine activity diagram

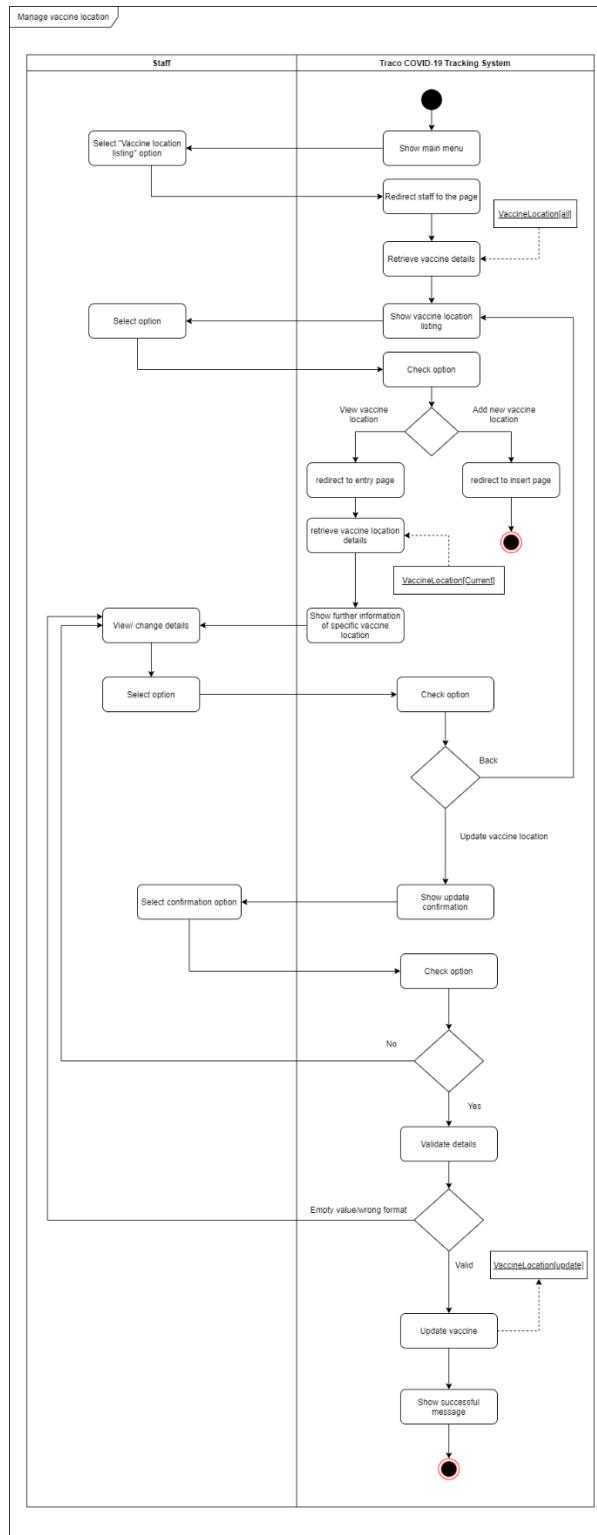


Figure 4.13: Manage vaccine location activity diagram

4.2 Databases and data dictionary

4.2.1 UML class diagram

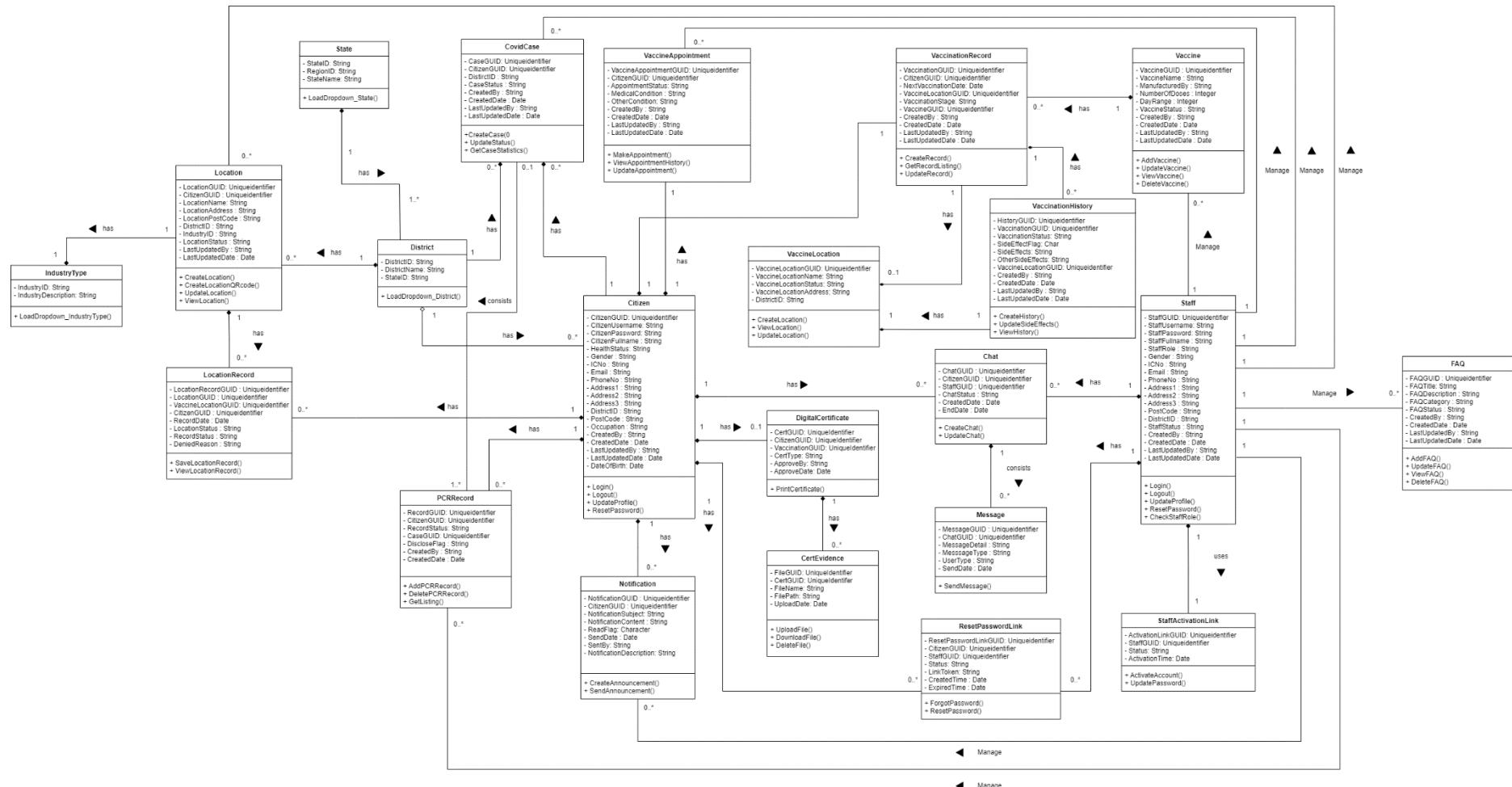


Figure 4.14: Class diagram of Traco COVID-19 Tracking System

4.2.2 Data dictionary

Citizen table

Table 4.1: Citizen Table

Attributes	Data Type	Field Length	Description	Format (Example)
CitizenGUID (PK)	UNIQUEIDENTIFIER	-	The GUID for the citizen.	Format: 32 hexadecimal characters divided with “-”
CitizenUsername	VARCHAR	30	The username of the citizen.	Format: 8 to 20 characters, both numeric and alphabetical
CitizenPassword	VARCHAR	50	The encrypted password of the citizen used to authenticate the citizen's identity	Format: 8 to 20 characters, both numeric, alphabetical and special characters encrypted using AES (Advanced Encryption Standard)
CitizenFullscreen	VARCHAR	50	The full name of the citizen.	Format: All alphabetical character
HealthStatus	VARCHAR	20	The health status of the citizen.	Example:

				Safe, Suspected, Infected
DateOfBirth	Date	-	The date of birth of the citizen	For example: 28/10/2000
Gender	VARCHAR	10	The gender of the citizen.	Format: Male, Female and Others
ICNo	VARCHAR	13	The Malaysian IC number of the citizen.	Format: 12 digits without dashes For example: 001020101111
Email	VARCHAR	50	The email of the citizen.	Format: Valid email format = example@mail.com Example: Jiho123@gmail.com

PhoneNo	VARCHAR	11	The phone number of the citizen.	Format: Malaysian phone number format without spaces and dashes, start with 01 and around 10 to 11 digits Example: 0191234567
Address1	VARCHAR	100	The line 1 of the citizen's current address	Example: No 12, Jalan Pinang
Address2	VARCHAR	100	The line 2 of the citizen's current address	Example: Taman Kepong
Address3	VARCHAR	100	The line 3 of the citizen's current address	Example: Setapak
DistrictID (FK)	CHAR	6	The ID used to identify the districts in the states of Malaysia which the citizen lives in.	Format: DT-XXX Example:

				DT-001 = Batu Pahat District
PostCode	VARCHAR	5	The postal code of the citizen's current address.	Format: 5 digits Example: 53200
Occupation	VARCHAR	100	The occupation of the citizen.	For example: Chef, Programmer
CreatedBy	VARCHAR	50	The user that created the citizen record.	For example: Jiho
CreatedDate	DATETIME	-	The date that the citizen record was created.	For example: 24/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the citizen record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the citizen record was updated.	For example: 25/6/2021 2:12:55 PM

Staff table

Table 4.2: Staff Table

Attributes	Data Type	Field Length	Description	Format (Example)
StaffGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the staff in the system	Format: 32 hexadecimal characters divided with “-”
StaffUsername	VARCHAR	20	The username of the staff used to authenticate the staff's identity	Format: 8 to 20 characters, both numeric and alphabetical
StaffPassword	VARCHAR	50	The encrypted password of the staff used to authenticate the staff's identity	Format: 8 to 20 characters, both numeric, alphabetical and special characters encrypted using AES (Advanced Encryption Standard)
StaffFullname	VARCHAR	50	The full name of the staff	Format: All alphabetical character
StaffRole	VARCHAR	20	The role for the staff which determines the privileges the staff can have in using the system	Format: HeadAdmin, MOHStaff, and HospitalStaff

Gender	VARCHAR	10	The gender of the staff	Format: Male, Female and Others
ICNo	CHAR	12	The Malaysian IC number of the staff	Format: 12 digits without dashes Follows the format of the Malaysian IC number
Email	VARCHAR	50	The email for the staff which is used to send account activation links and other notifications to the staff	Format: Valid email format = example@mail.com Example: lkk@gmail.com
PhoneNo	VARCHAR	12	The phone number of the staff	Format: Malaysian phone number format without spaces and dashes, start with 01 and around 10 to 11 digits Example: 0191234567

Address1	VARCHAR	100	The line 1 of the staff's current address	Example: No 123, Jalan Bunga Raya
Address2	VARCHAR	100	The line 2 of the staff's current address	Example: Taman Cempedak
Address3	VARCHAR	100	The line 3 of the staff's current address	Example: Setapak
PostCode	CHAR	5	The postal code of the staff's current address	Format: 5 digits Example: 53200
DistrictID (FK)	CHAR	6	The ID of the district used to identify which district the staff lives in	Format: DTXXXX Example: DT0002 = Johor Bahru District
StaffStatus	VARCHAR	20	The status of the staff's account	Format: Inactive, active and terminated

CreatedBy	VARCHAR	50	The user that created the staff record.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the staff record was created.	For example: 24/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the staff record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the staff record was updated.	For example: 25/6/2021 2:12:55 PM

Reset password link table

Table 4.3: ResetPasswordLink

Attributes	Data Type	Field Length	Description	Format (Example)
ResetPasswordLink GUID (PK)	UNIQUEIDENTIFIER	-	The GUID for the reset password link.	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the citizen that requested to reset the password.	Format: 32 hexadecimal characters divided with “-”
StaffGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the staff that requested to reset the password.	Format: 32 hexadecimal characters divided with “-”
Status	VARCHAR	20	The status of the reset password link.	Format: Pending, Completed
LinkToken	VARCHAR	6	A unique code for the reset password link.	For example: 123567
CreatedTime	DATETIME	-	The date and time that the reset password link was created.	For example: 27/6/2021 5:15:25 PM
ExpiredTime	DATETIME	-	The expired date and time of the reset password link.	For example: 27/6/2021 5:30:25 PM

Staff activation link table

Table 4.4: StaffActivationLink Table

Attributes	Data Type	Field Length	Description	Format (Example)
ActivationLinkGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the staff activation link	Format: 32 hexadecimal characters divided with “-”
StaffGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the staff who the link belongs to	Format: 32 hexadecimal characters divided with “-”
Status	VARCHAR	10	The status of the staff activation link	Format: Active, Expired
ActivationDate	DATETIME	-	The activation time of the staff activation link	For example: 22/6/2021 2:10:49 PM
CreatedDate	DATETIME		The date that this link is created, used to allow only one email is send to that user every 24 hours.	For example: 19/6/2021 2:10:49 PM

State table

Table 4.5: State Table

Attributes	Data Type	Field Length	Description	Format (Example)
StateID (PK)	CHAR	3	The ID that is used to identify the states in Malaysia.	<p>Format: Abbreviation of states in Malaysia</p> <p>For example: SLG for selangor</p>
RegionID	CHAR	5	The ID of ISO 3166-2:MY entry used in the Google Geochart to identify the states in Malaysia.	<p>Format: MY-XX, where 01-13 is for the states and 14-16 is for the federal territories</p> <p>For example: MY-14 = Wilayah Persekutuan Kuala Lumpur</p>
StateName	VARCHAR	30	The name of the states in Malaysia	<p>For example: Selangor</p>

District table

Table 4.6: District Table

Attributes	Data Type	Field Length	Description	Format (Example)
DistrictID (PK)	CHAR	6	The ID used to identify the districts in the states of Malaysia	Format: DTXXXX Example: DT0001 = Batu Pahat District
DistrictName	VARCHAR	30	The name of the districts in Malaysia	For example: Ulu Selangor
StateID (FK)	CHAR	3	The ID of the state used to identify which state the district is in	Format: Abbreviation of states in Malaysia For example: SLG for selangor

Location table

Table 4.7: Location Table

Attributes	Data Type	Field Length	Description	Format (Example)
LocationGUID (PK)	UNIQUEIDENT IFIER	-	The GUID for the registered location.	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENT IFIER	-	The GUID of the citizen that registered the location.	Format: 32 hexadecimal characters divided with “-”
LocationName	VARCHAR	50	The name of the registered location.	For example: Jiho Japanese Restaurant
LocationAddress	VARCHAR	100	The address of the registered location.	For example: 63, block 2, Jalan Pinang
LocationPostCode	CHAR	5	The postcode of the registered location.	For example: 52100

DistrictID (FK)	CHAR	6	The ID of the district for the registered location.	Format: DT-XXX Example: DT-001 = Batu Pahat District
IndustryID (FK)	CHAR	4	The ID of the industry type of the registered location.	Format: ITXX Example: IT01 = Accounting
LocationStatus	VARCHAR	20	The status of the registered location.	Format: Low-Risk, High-Risk
LastUpdatedBy	VARCHAR	50	The latest user that updates the location record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the location record was updated.	For example: 30/6/2021 2:12:55 PM

Location record table

Table 4.8: LocationRecord Table

Attributes	Data Type	Field Length	Description	Format (Example)
LocationRecordGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the location record.	Format: 32 hexadecimal characters divided with “-”
LocationGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the location that was recorded.	Format: 32 hexadecimal characters divided with “-”
VaccineLocationGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the vaccine location that was recorded.	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the citizen that records the location.	Format: 32 hexadecimal characters divided with “-”
LocationStatus	VARCHAR	20	The status of the location during the record date	Format: Low-Risk, High-Risk
RecordDate	DATETIME	-	The date of the user records the location.	For example: 26/6/2021 3:15:25 PM

RecordStatus	VARCHAR	20	The status of the location record	Format: “Accepted”, “Denied”
DeniedReason	VARCHAR	200	The reason where the citizen is denied from check in a location.	For example: Went out when is infected COVID-19

Modules table

Table 4.9: Modules Table

Attributes	Data Type	Field Length	Description	Format (Example)
ModuleID (PK)	VARCHAR	50	The unique ID for the modules in the system	Format: UserSite_ModuleName Example: Staff_StaffManagement
UserSite	VARCHAR	20	The site the module is used in the system	Format: Staff, Citizen
ModuleName	VARCHAR	50	The name for the module, ID of the HTML component	Example: StaffManagement
ModuleTitle	VARCHAR	50	The title for the module, name of the HTML component	Example: Staff management
ModuleIcon	VARCHAR	50	The icon for the module, identifies Font Awesome icons	Example: fa fa-user

CreatedBy	VARCHAR	50	The user that created the module.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the module was created.	For example: 24/5/2021 1:14:37 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the module.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the module was updated.	For example: 27/6/2021 2:12:55 PM

Function pages table

Table 4.10: FunctionPages Table

Attributes	Data Type	Field Length	Description	Format (Example)
FunctionGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the functions in the system modules	Format: 32 hexadecimal characters divided with “-”
UserRole	VARCHAR	20	The role of the users who can access this function	Format: Citizen, HeadAdmin, MOHStaff, HospitalStaff
PageLink	VARCHAR	200	The link of the function page	Example: CitizenChatList.aspx
PageName	VARCHAR	50	The name of the function page, name of the HTML component	Example: CitizenChatList
PageTitle	VARCHAR	50	The title of the function page	Example: Citizen Chat List
PageStatus	VARCHAR	10	The status of the function page	Format: Active, Inactive

ShowFlag	CHAR	1	The flag that determines whether the page is shown in the menu	Format: Y, N
ModuleID (FK)	VARCHAR	50	The unique ID for the modules in the system	Format: UserSite_ModuleName Example: Citizen_SupportManagement
CreatedBy	VARCHAR	50	The user that created the functions page.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the function page was created.	For example: 17/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the function page.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the function page was updated.	For example: 25/6/2021 2:12:55 PM

Notification table

Table 4.11: Notification Table

Attributes	Data Type	Field Length	Description	Format (Example)
NotificationGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the notification.	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the citizen that received the notification.	Format: 32 hexadecimal characters divided with “-”
NotificationSubject	VARCHAR	50	The notification's subject, shown as header of the notification.	For example: Suspected notification, PCR record notification
NotificationContent	VARCHAR	500	The notification's contents.	For example: Hello, you have been...
ReadFlag	CHAR	1	The flag that determines if the notification is read or not.	Format: Y, N
SendDate	DATETIME	-	The date of the staff sends the notification.	For example: 27/6/2021 5:15:25 PM

SentBy	VARCHAR	50	The staff who sends the notification, stores null value if sent by the system	For example: Staff 1
NotificationDescription	VARCHAR	300	The description of the notification shown to the MoH staff so that they know whether the target of the notification.	Format: Sent to all Sent to citizen1, citizen2, citizen3 Sent to citizen 4

Chat table

Table 4.12: Chat Table

Attributes	Data Type	Field Length	Description	Format (Example)
ChatGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the chat.	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the citizen that created the chat.	Format: 32 hexadecimal characters divided with “-”
StaffGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the staff that entered the chat.	Format: 32 hexadecimal characters divided with “-”
ChatStatus	VARCHAR	30	The status of the chat.	Format: Pending, In Progress, Ended
CreatedDate	DATETIME	-	The date that the chat was created.	For example: 24/6/2021 1:14:35 PM
EndDate	DATETIME	-	The date that the chat ended.	For example: 25/6/2021 2:12:55 PM

Message table

Table 4.13: Message Table

Attributes	Data Type	Field Length	Description	Format (Example)
MessageGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the message.	Format: 32 hexadecimal characters divided with “-”
ChatGUID (FK)	UNIQUEIDENTIFIER	-	The GUID of the chat that the user sent the message.	Format: 32 hexadecimal characters divided with “-”
MessageDetail	VARCHAR	300	The details of the message.	For example: Hello
MessageType	VARCHAR	30	The type of message.	For example: Text, Image, File
UserType	VARCHAR	30	The type of user that sent the message.	Format: Citizen, Staff
SendDate	DATETIME	-	The date that the message was sent.	For example: 24/6/2021 1:14:35 PM

FAQ table

Table 4.14: FAQ Table

Attributes	Data Type	Field Length	Description	Format (Example)
FAQGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the FAQ.	Format: 32 hexadecimal characters divided with “-”
FAQTitle	VARCHAR	300	The title of the FAQ.	For example: What is COVID-19
FAQDescription	VARCHAR	800	The details of the FAQ.	For example: The COVID-19 is...
FAQCategory	VARCHAR	50	The category of the FAQ.	For example: About COVID-19
FAQStatus	VARCHAR	20	The status of the FAQ.	For example: Active, Inactive
CreatedBy	VARCHAR	50	The user that created the FAQ.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the FAQ was created.	For example: 24/6/2021 1:14:35 PM

LastUpdatedBy	VARCHAR	50	The latest staff that updates the FAQ.	For example: Pin Jian
LastUpdatedDate	DATETIME	-	The date that the FAQ was updated.	For example: 25/6/2021 2:12:55 PM

PCR record table

Table 4.15: PCRRecord Table

Attributes	Data Type	Field Length	Description	Format (Example)
RecordGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the PCR record	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the citizen who took the PCR test	Format: 32 hexadecimal characters divided with “-”
RecordStatus	VARCHAR	10	The status of the PCR test	Format: Positive, Negative
CaseGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the COVID-19 case record where the test refers to	Format: 32 hexadecimal characters divided with “-”
DiscloseFlag	CHAR	1	The flag that identifies whether the citizen has fully recovered from the COVID-19.	Format: Y, N
CreatedBy	VARCHAR	50	The user that created the PCR record.	For example: Kok Ken

CreatedDate	DATETIME	-	The date that the PCR record was created.	For example: 2/7/2021 1:28:35 PM
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Covid case table

Table 4.16: CovidCase Table

Attributes	Data Type	Field Length	Description	Format (Example)
CaseGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the COVID-19 case record	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the citizen who was infected by COVID-19	Format: 32 hexadecimal characters divided with “-”
DistrictID (PK)	CHAR	6	The ID used to identify the districts in the states of Malaysia where the COVID-19 case occurs	Format: DT-XXX Example: DT-001 = Batu Pahat District
CaseStatus	VARCHAR	10	The status of the patient who was infected by the COVID-19	Format: Active, Recovered, Death
CreatedBy	VARCHAR	50	The user that created the COVID-19 case record.	For example: Kok Ken

CreatedDate	DATETIME	-	The date that the COVID-19 case record was created.	For example: 24/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the COVID-19 case record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the COVID-19 case record was updated.	For example: 25/6/2021 5:12:55 PM

Vaccine table

Table 4.17: Vaccine Table

Attributes	Data Type	Field Length	Description	Format (Example)
VaccineGUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the vaccine.	Format: 32 hexadecimal characters divided with “-”
VaccineName	VARCHAR	50	The name of the vaccine.	For example: Sinovac
ManufacturedBy	VARCHAR	50	The manufacturer of the vaccine.	For example: Sinovac Biotech Ltd.
NumberOfDoses	INTEGER	1,0	The number of doses of the vaccine.	For example: 1, 2
DayRange	INTEGER	3	The days between the first and second dose	For example: 21 days
VaccineStatus	VARCHAR	20	The status of the vaccine.	Format: Active, Inactive
CreatedBy	VARCHAR	50	The user that created the vaccine.	For example: Kok Ken

CreatedDate	DATETIME	-	The date that the vaccine was created.	For example: 24/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest staff that updates the vaccine.	For example: Pin Jian
LastUpdatedDate	DATETIME	-	The date that the vaccine was updated.	For example: 25/6/2021 2:12:55 PM

Vaccine location table

Table 4.17: VaccineLocation Table

Attributes	Data Type	Field Length	Description	Format (Example)
VaccineLocation GUID (PK)	UNIQUEIDENTIFIER	-	The GUID of the vaccine location record.	Format: 32 hexadecimal characters divided with “-”
VaccineLocation Name	VARCHAR	50	The name of the vaccine location.	For example: Hospital Sungai Buloh
VaccineLocationS tatus	VARCHAR	20	The status of the vaccine location.	Format: Active, Inactive
VaccineLocation Address	VARCHAR	50	The address of the vaccine location.	For example: A32, Jalan Keramat 1 Taman Bukit Bujang 53200 Kuala Lumpur

Vaccine appointment table

Table 4.19: VaccineAppointment Table

Attributes	Data Type	Field Length	Description	Format (Example)
VaccineAppointmentGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the vaccine appointment	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the citizen who made this vaccine appointment	Format: 32 hexadecimal characters divided with “-”
AppointmentStatus	VARCHAR	20	The status of the vaccine appointment	Format: Pending, Accepted, Rejected
MedicalCondition	VARCHAR	500	The medical condition the citizen had	Format: “Condition1”, “Condition2” Example: “Diabetes”, “Pregnancy”
OtherCondition	VARCHAR	500	Stores other medical conditions such as medication histories, allergies	Example: Allergy to dairy products

CreatedBy	VARCHAR	50	The user that created the vaccine appointment record.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the vaccine appointment record was created.	For example: 24/6/2021 1:14:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the vaccine appointment record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the vaccine appointment record was updated.	For example: 25/6/2021 2:12:55 PM

Vaccination record table

Table 4.20: VaccinationRecord Table

Attributes	Data Type	Field Length	Description	Format (Example)
VaccinationGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the vaccination	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the citizen who takes the vaccination	Format: 32 hexadecimal characters divided with “-”
NextVaccination Date	DATETIME	-	The next vaccination date of the citizen	Format: 25/6/2021 2:02:55 PM
VaccineLocation GUID	UNIQUEIDENTIFIER	36	The GUID of the next vaccine location.	Format: 32 hexadecimal characters divided with “-”
VaccineGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the vaccine the citizen would take	Format: 32 hexadecimal characters divided with “-”
CreatedBy	VARCHAR	50	The user that created the vaccination record.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the vaccination record was created.	For example: 24/6/2021 7:24:35 PM

LastUpdatedBy	VARCHAR	50	The latest user that updates the vaccination record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the vaccination record was updated.	For example: 25/4/2021 2:12:47 PM

Vaccination history table

Table 4.21: VaccinationHistory Table

Attributes	Data Type	Field Length	Description	Format (Example)
HistoryGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the vaccination effects	Format: 32 hexadecimal characters divided with “-”
VaccinationGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the vaccination this effect record related to	Format: 32 hexadecimal characters divided with “-”
VaccinationStage	VARCHAR	20	The current stage of the vaccination	Format: 1, 2, 3, ...
VaccineLocation GUID	UNIQUEIDENTIFIER	36	The GUID of the vaccine location where the citizen takes the vaccine	Format: 32 hexadecimal characters divided with “-”
SideEffectFlag	CHAR	1	The flag representing if the citizen has side effects after vaccination	Format: Y, N

SideEffects	VARCHAR	500	The side effects of the vaccination	Format: “SideEffect1”, “SideEffect2” Example: “Fever”, “Headache”
OtherSideEffects	VARCHAR	500	Other side effects if have	Example: Hand hurts...
CreatedBy	VARCHAR	50	The user that created the vaccination effect record.	For example: Kok Ken
CreatedDate	DATETIME	-	The date that the vaccination effect record was created.	For example: 24/6/2021 7:24:35 PM
LastUpdatedBy	VARCHAR	50	The latest user that updates the vaccination effect record.	For example: Kok Ken
LastUpdatedDate	DATETIME	-	The date that the vaccination effect record was updated.	For example: 25/4/2021 2:12:47 PM

Digital certificate table

Table 4.21: DigitalCertificate Table

Attributes	Data Type	Field Length	Description	Format (Example)
CertGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the digital certificate	Format: 32 hexadecimal characters divided with “-”
CitizenGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the citizen who owns this certificate	Format: 32 hexadecimal characters divided with “-”
VaccinationGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the vaccination record for this certificate	Format: 32 hexadecimal characters divided with “-”
CertType	VARCHAR	20	The type of certificate indicating whether the citizen is fully vaccinated or in special cases.	Format: FullyVaccinated, SpecialCases
ApproveBy	VARCHAR	50	The staff name who approved that the citizen is fully vaccinated.	For example: Kok Ken
ApproveDate	DATETIME	-	The date that the citizen is proven to be fully vaccinated	For example: 05/07/2021 3:12:23 PM

Certificate evidence table

Table 4.21: CertEvidence Table

Attributes	Data Type	Field Length	Description	Format (Example)
FileGUID (PK)	UNIQUEIDENTIFIER	36	The GUID for the evidence's file	Format: 32 hexadecimal characters divided with “-”
CertGUID (FK)	UNIQUEIDENTIFIER	36	The GUID for the digital certificate that the file is associated with	Format: 32 hexadecimal characters divided with “.”
FileName (FK)	VARCHAR	500	The name of the file and used as the file name when file is downloaded.	Format: Evidence_[citizen name]_[random 5 characters].[file extension] For example: Evidence_Citizen1_W23UD.pdf
FilePath	VARCHAR	500	The file path where the file is stored	Format: C:\Users\User\Traco\Traco\Evidence\245a 093b-9f04-4b33-873a- fef9e7f1acee\Evidence_Citizen 6_A426M.pdf

UploadDate	DATETIME	-	The date that the file is uploaded.	For example: 06/07/2021 3:12:23 PM
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Industry type table

Table 4.22: IndustryType Table

Attributes	Data Type	Field Length	Description	Format (Example)
IndustryID (PK)	CHAR	4	The ID of the industry type.	Format: ITXX Example: IT01 = Accounting
IndustryDescription	VARCHAR	50	The description of the industry	Example: Accounting, Restaurant, Art

4.3 Screens

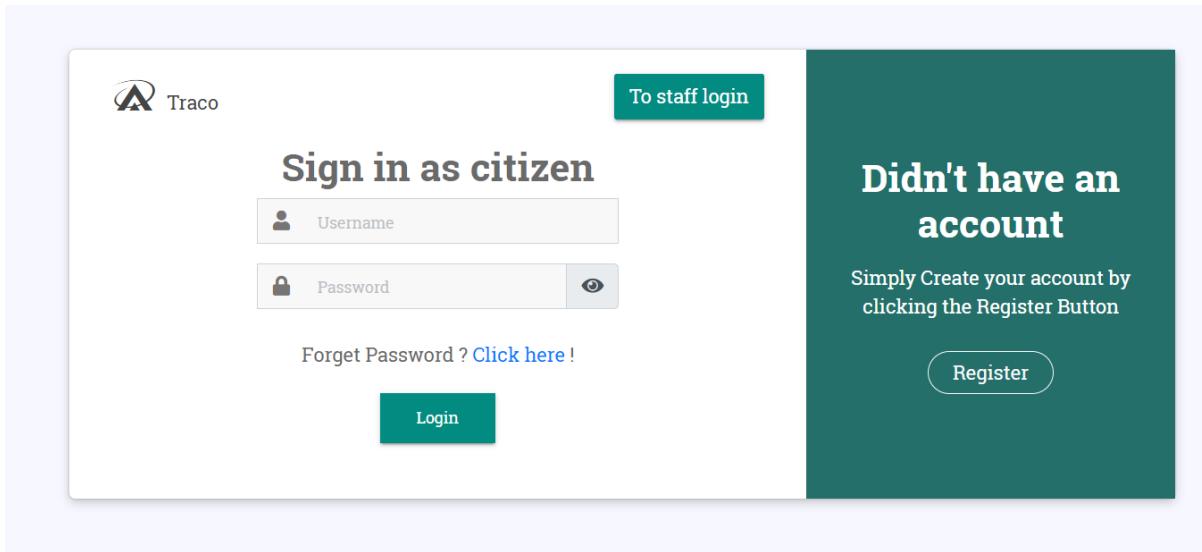


Figure 4.15: Login page screen interface 1

The login page will display the citizen login interface first. The citizen is required to enter the correct username and password to log in to the citizen site of the system. The citizen also can create an account by clicking the register button on the right side. If the user is a staff, the user can click the “Login as staff” button to switch to the staff login.

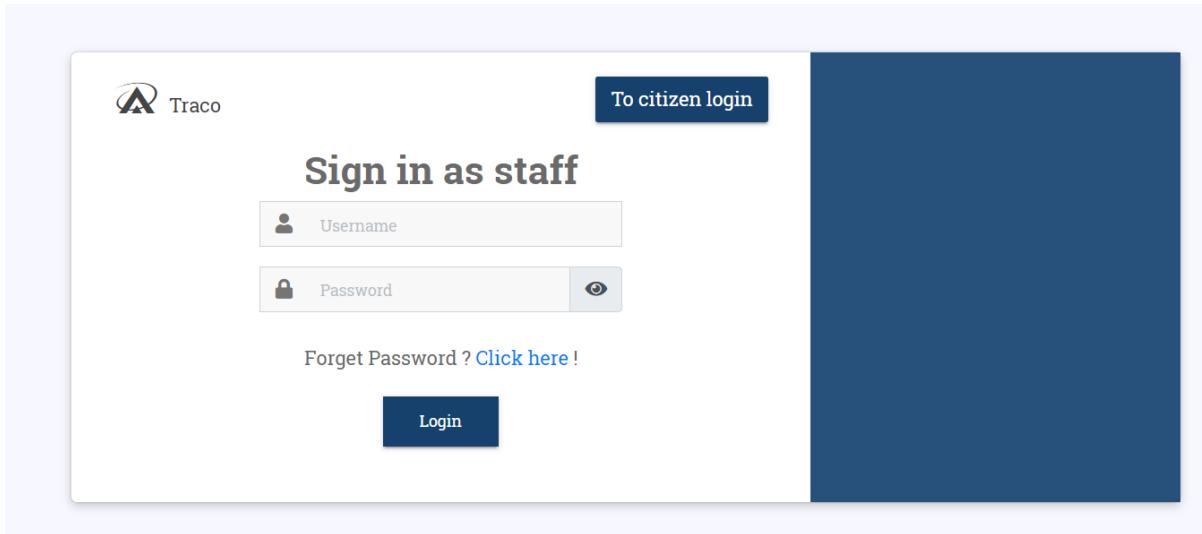


Figure 4.16: Login page screen interface 2

The staff login interface will require the staff to enter the correct username and password to login to the staff site of the system. If a citizen accidentally enters the staff login interface, the citizen can go back to the citizen login interface by clicking the “Login as Citizen” on the right side.

The image shows the top half of a registration form titled "Create an account". It features a section for "Personal information" with three input fields: "FullName:" (with a red asterisk), "UserName:" (with a red asterisk), and "Password:" (with a red asterisk). Each field has a corresponding empty text input box.

Figure 4.17: Registration page top screen interface

The image shows the bottom half of the registration form. It includes a "Postcode :" field with a red asterisk and an empty text input box. Below it is a checkbox labeled "I understand and agree with the Terms & Conditions". A large teal "Register" button is centered at the bottom. At the very bottom, there is a link "Have already an account, [login here !](#)".

Figure 4.18: Registration page bottom screen interface

The registration page allows the citizen to create an account. The citizen is required to enter his/her personal information, address information and agrees with the term and conditions to register an account.

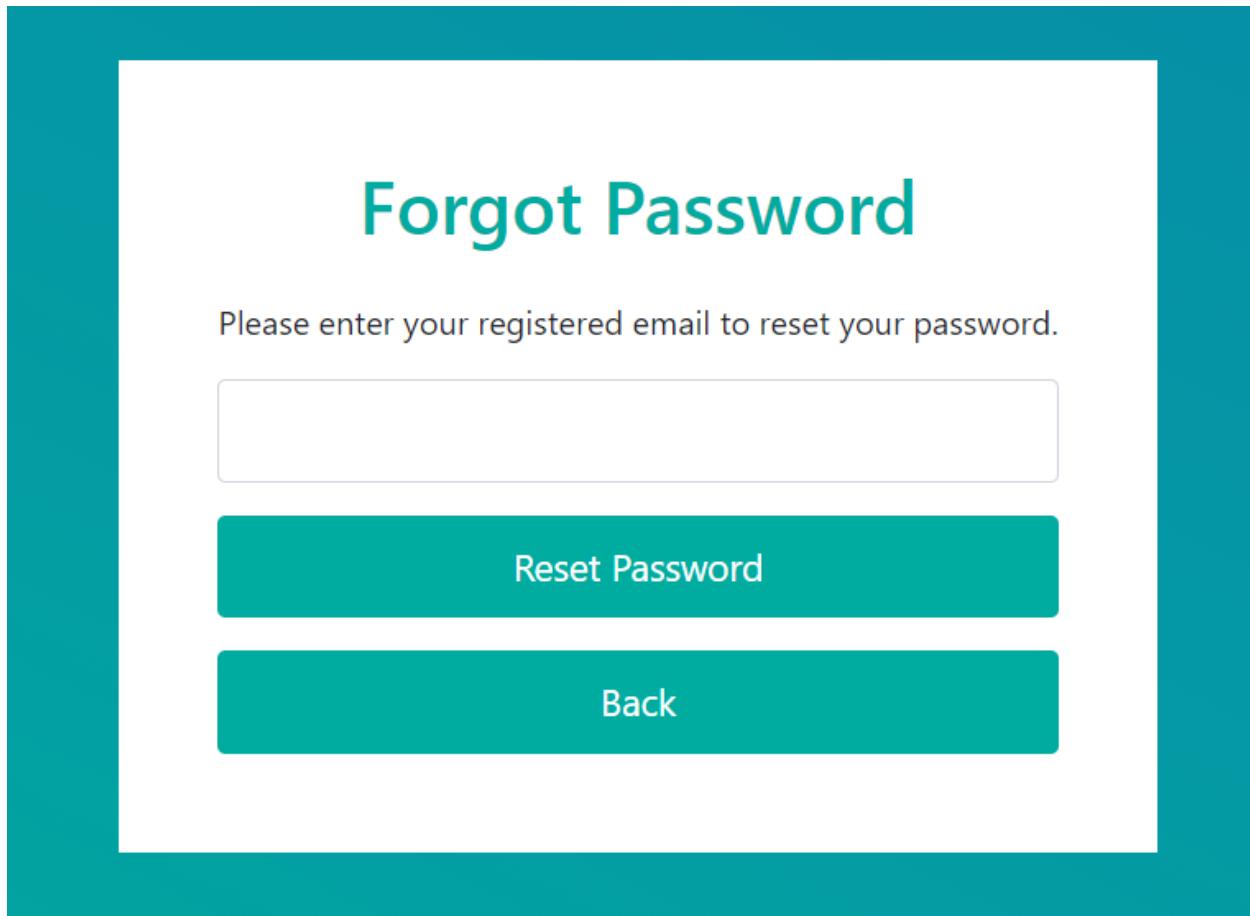


Figure 4.19: Forgot password page (citizen view) screen interface

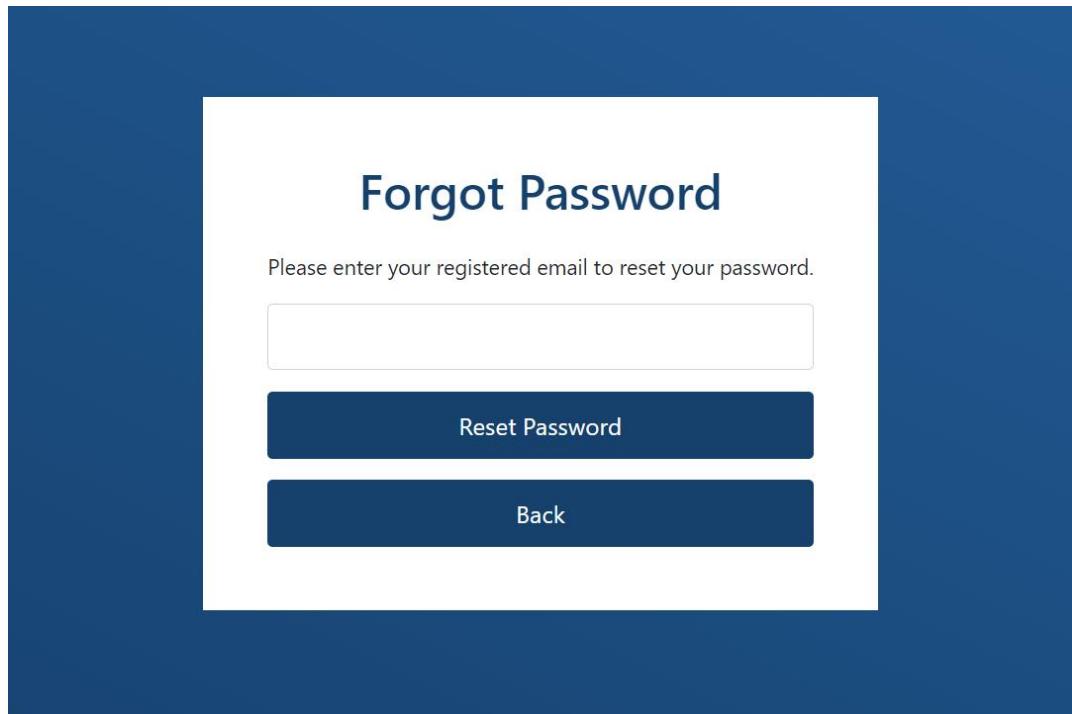


Figure 4.20: Forgot password page (staff view) screen interface

The forgot password page allows the staff and citizen to recover their password if they forgot their password. The staff and citizens need to enter their registered email to reset the password. An email will be sent to their account for resetting their password.

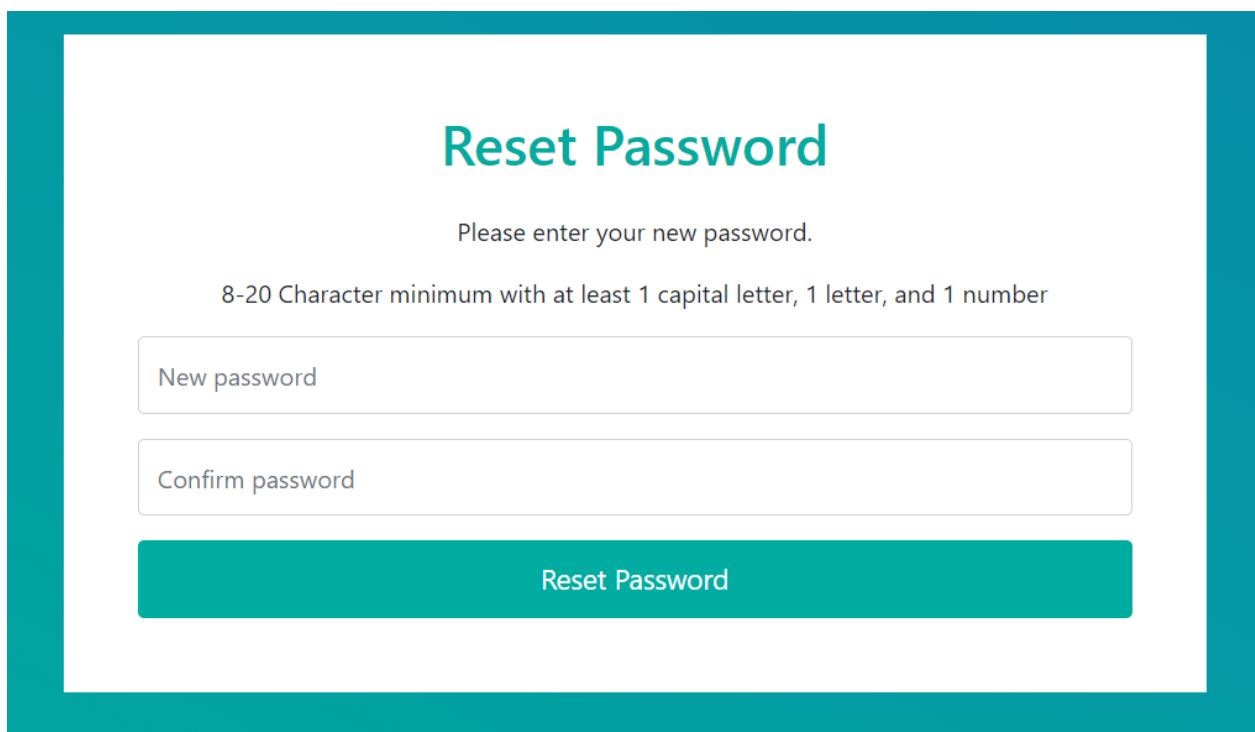


Figure 4.21: Reset password page (citizen view) screen interface

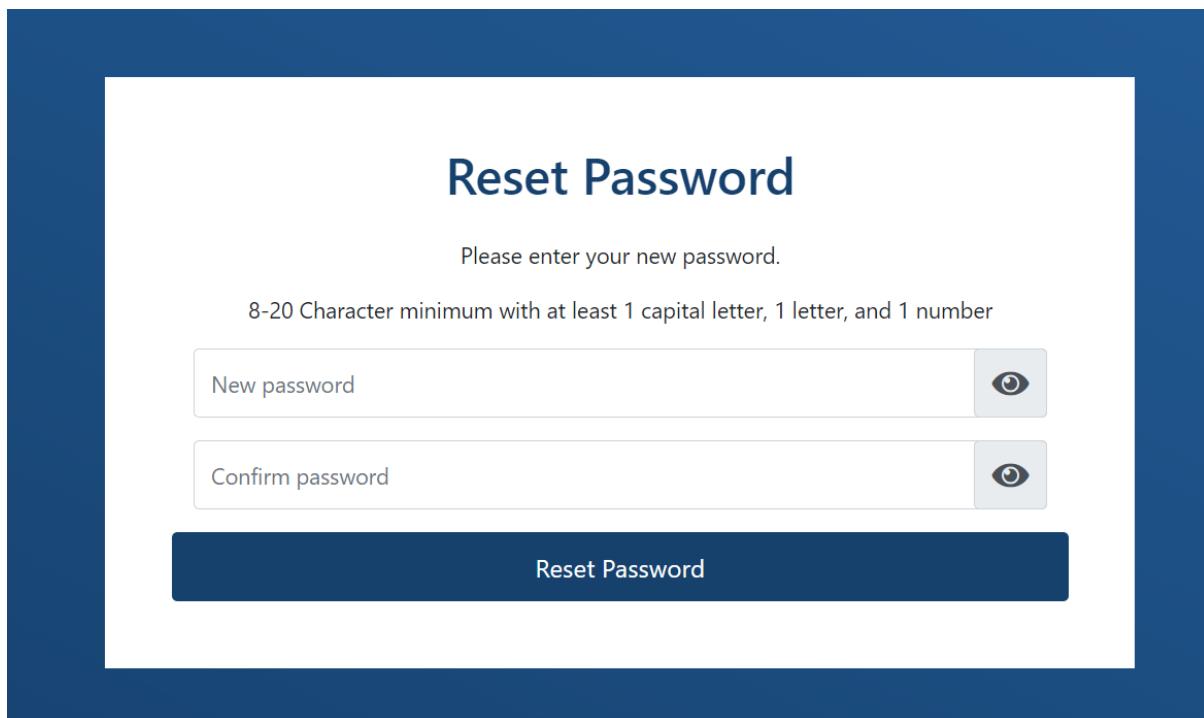


Figure 4.22: Reset password page (staff view) screen interface

The reset password page allows the citizen and staff to reset their password. The page will only be shown if the user presses the reset password link that is sent to his/her email account. The user needs to enter the new password and confirm password to reset his/her password.

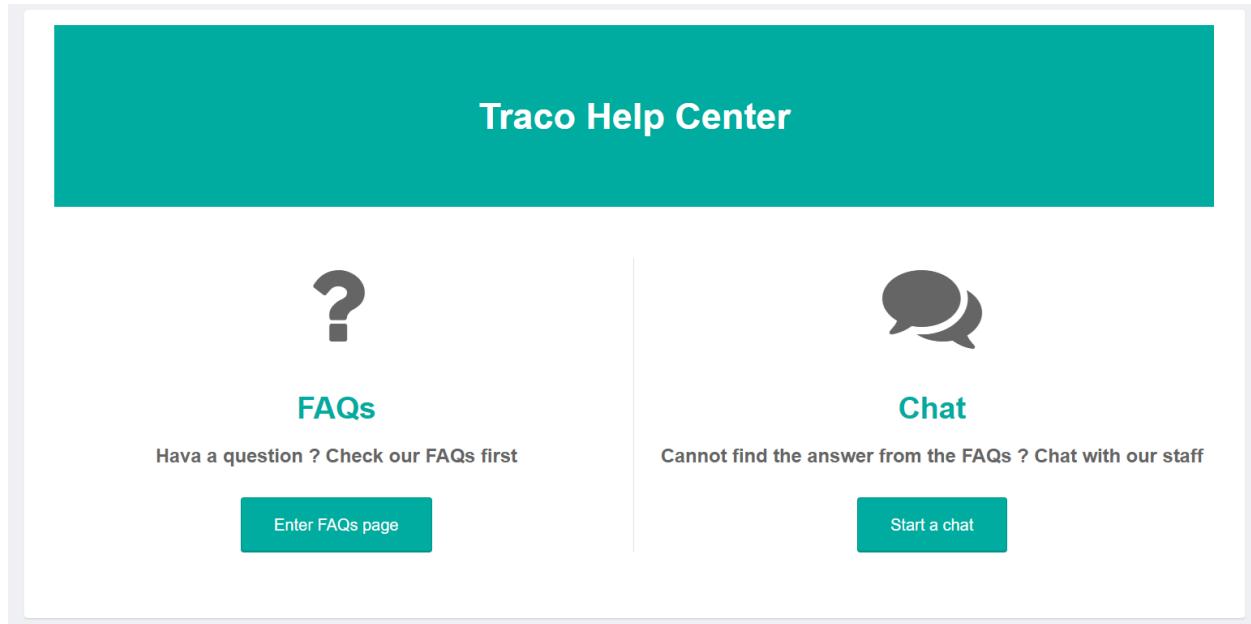


Figure 4.23: Help center page screen interface

The helper center page will allow the citizen to search for any enquiries. The citizen can click the “Enter FAQs page” button to enter the FAQ page or click the “Start a chat” button to chat with the staff.

The screenshot shows the 'Traco FAQs' page. On the left, there's a sidebar with a 'Category' header and three items: 'About Contact Tracing' (1), 'About COVID-19' (2, highlighted in blue), and 'About Vaccine' (1). The main content area has a header 'About COVID-19'. Below it is a question '⊖ What is COVID-19?' followed by a detailed answer about the disease. At the bottom of this section is the text 'Updated on: June 30, 2021'. Another question, '⊕ Why is the disease being called coronavirus disease 2019, COVID-19?', is partially visible below.

Figure 4.24: Traco FAQ page screen interface

The Traco FAQ page allows the citizen to search any FAQs on this page. The citizen can click the title of a FAQ to show the details of the FAQ. Moreover, the citizen can also switch categories by clicking other categories on the left side.

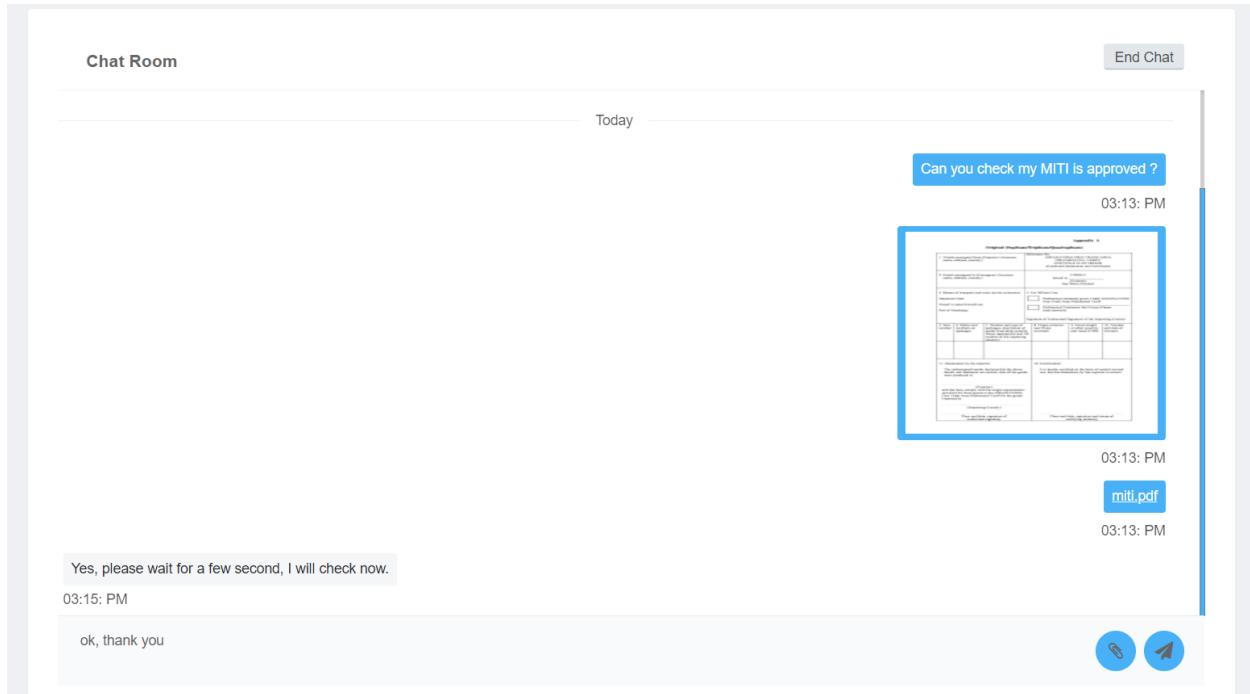


Figure 4.25: Chat page screen interface

The chat page allows the citizen to send messages to the staff and let the staff reply to any messages. The user is allowed to send text messages, image files, and pdf files. Both of the users can end the chat by clicking the “End Chat button” on the top right side.

The screenshot shows a "Your Chat Lists" section. It includes a "Chat Status:" dropdown with "Current Chat" selected (indicated by a checked radio button) and "Chat History" (indicated by an unchecked radio button). Below this is a table with the following data:

	Chat Status	Replied By	Sent Date	End Date
Enter Chat	In Progress	staff1	30-06-2021 10:39 PM	-
	View Message			

Figure 4.26: Citizen chat list screen interface

The citizen list page allows the citizen to view and enter any existing chat. The citizen also can view his/her chat histories by ticking the “chat history” at the top.

The screenshot shows a table titled "Citizen Chat Lists" with two rows of data. The columns are labeled "Send By", "Chat Status", "Sent Date", and "End Date". The first row shows "Tang Kok Hou" as the sender, "Pending" as the status, "21-10-2021 08:21 PM" as the sent date, and "-" as the end date. The second row shows "LEE KOK KEN" as the sender, "Pending" as the status, "30-10-2021 03:30 PM" as the sent date, and "-" as the end date.

Send By	Chat Status	Sent Date	End Date
Tang Kok Hou	Pending	21-10-2021 08:21 PM	-
LEE KOK KEN	Pending	30-10-2021 03:30 PM	-

Figure 4.27: Staff chat list screen interface

The staff chat list page has a list of chat status on the top for the staff to view different chat based on the status. Tick the “Pending (All)” will allow the staff to view any pending chat from citizens. Next, tick the “In Progress” will show the current chat that is managed by the staff. Lastly, ticking the “Ended” will show the ended chat that is managed by the staff.

FAQs Listing

The screenshot shows a search interface with fields for "FAQ Title", "Category" (set to "All"), "FAQ status" (set to "Active"), and buttons for "Search" and "Add new FAQ". Below the search area is a table listing four FAQs. The columns are "Title", "Category", and "Status".

Title	Category	Status
What is COVID-19	About COVID-19	Active
How does the virus spread?	About COVID-19	Active
How Can I Protect myself ?	Prevention	Active
How many person can go out during FMCO	About MCO	Active

Figure 4.28: FAQ listing screen interface

The FAQ listing page will allow the staff to view any existing FAQ. The staff can search any specific FAQ by entering some text in the title, category, or status. If the staff wants to add a new FAQ, the staff can click the “Add new FAQ” button. The staff also can view further information of the FAQ by clicking the “view” of a specific FAQ.

FAQ Entry

FAQ Title*

Category* Use existing category
 Add new category

FAQ status*

FAQ Description*

Figure 4.29: FAQ entry screen interface 1

This is the insert mode of the FAQ entry page. The staff can insert the FAQ details to add a new FAQ.

The screenshot shows the 'FAQ Entry' page. It includes fields for 'FAQ Title*' (What is COVID-19), 'Category*' (selected 'Use existing category' with 'About COVID-19' in the dropdown), 'FAQ status*' (Active), and a large 'FAQ Description*' text area containing information about COVID-19. At the bottom are three buttons: 'Cancel', 'Update', and 'Delete'.

Figure 4.30: FAQ entry screen interface 2

This is the edit mode of the FAQ entry page, the staff can view the full details of the FAQ, update the FAQ, or delete the FAQ.

Overall UI evaluation

The author and his partner have followed some user-interface design guidelines to ensure the UI of the proposed system meets the requirements. The colors used in the system are not flashy and too bright that harms the users' eyes and they choose the color that is soft and comfortable to see. Moreover, each element in the system has enough margin and padding to make the content shown more nicely and neatly. The strength of the UI design in the proposed system is the system UI is consistent, user-friendly, and easy to use for the users. The weakness of the UI design in the proposed system is there are quite many CSS files in the proposed system as the author and his partner make many styling to the elements in the proposed system. This may cause the proposed system to use extra storage for the CSS file and make the system loading process longer.

4.4 Algorithms

```
Private Function Encrypt(clearText As String) As String
    Dim EncryptionKey As String = ConfigurationManager.AppSettings.Get("EncryptionKey")
    Dim clearBytes As Byte() = Encoding.Unicode.GetBytes(clearText)
    Using encryptor As Aes = Aes.Create()
        Dim pdb As New Rfc2898DeriveBytes(EncryptionKey, New Byte() {&H49, &H76, &H61, &H6E, &H20, &H4D,
            &H65, &H64, &H76, &H65, &H64, &H65,
            &H76})
        encryptor.Key = pdb.GetBytes(32)
        encryptor.IV = pdb.GetBytes(16)
        Using ms As New MemoryStream()
            Using cs As New CryptoStream(ms, encryptor.CreateEncryptor(), CryptoStreamMode.Write)
                cs.Write(clearBytes, 0, clearBytes.Length)
                cs.Close()
            End Using
            clearText = Convert.ToBase64String(ms.ToArray())
        End Using
    End Using
    Return clearText
End Function
```

Figure 4.31: Algorithm for password encryption

These algorithms are used to encrypt a user's password. First, the algorithm gets the encryption key. Then, the algorithm will create a derived key by using the Rfc2898DeriveBytes class with the combination of the encryption key, new byte for key salt, and iterations. Next, the algorithm will use Aes to perform encryption and the algorithm will need to generate the key and IV with the derived key. Later on, the algorithm will use the MemoryStream and CryptoStream to fully encrypt the password and the password will be written into the byte array. Lastly, the algorithm will convert the byte array into a string using the ToBase64String class for returning the encrypted password in string.

```
-----  
Private Function Decrypt(cipherText As String) As String  
    Dim EncryptionKey As String = ConfigurationManager.AppSettings.Get("EncryptionKey")  
    Dim cipherBytes As Byte() = Convert.FromBase64String(cipherText)  
    Using encryptor As Aes = Aes.Create()  
        Dim pdb As New Rfc2898DeriveBytes(EncryptionKey, New Byte() {&H49, &H76, &H61, &H6E, &H20, &H4D,  
        &H65, &H64, &H76, &H65, &H64, &H65,  
        &H76})  
        encryptor.Key = pdb.GetBytes(32)  
        encryptor.IV = pdb.GetBytes(16)  
        Using ms As New MemoryStream()  
            Using cs As New CryptoStream(ms, encryptor.CreateDecryptor(), CryptoStreamMode.Write)  
                cs.Write(cipherBytes, 0, cipherBytes.Length)  
                cs.Close()  
            End Using  
            cipherText = Encoding.Unicode.GetString(ms.ToArray())  
        End Using  
    End Using  
    Return cipherText  
End Function
```

Figure 4.32: Algorithm for password decryption

These algorithms are used to decrypt a user's encrypted password. First, the algorithm will get the key that is the same as the encryption key. Next, the algorithm will convert the encrypted password into byte for decrypt purposes. Then, the algorithm will use the Rfc2898DeriveBytes class to create a derived key that is the same when performing encryption. Later on, the algorithm will use Aes to create a decryptor to get the key and VI from the derived key. Afterward, the algorithm will use the MemoryStream and CryptoStream to fully decrypt the password and the password will be written into the byte array. Lastly, the algorithm will convert the byte array into a string using an encoding class for returning the decrypted password in string.

4.5 Overall system architecture

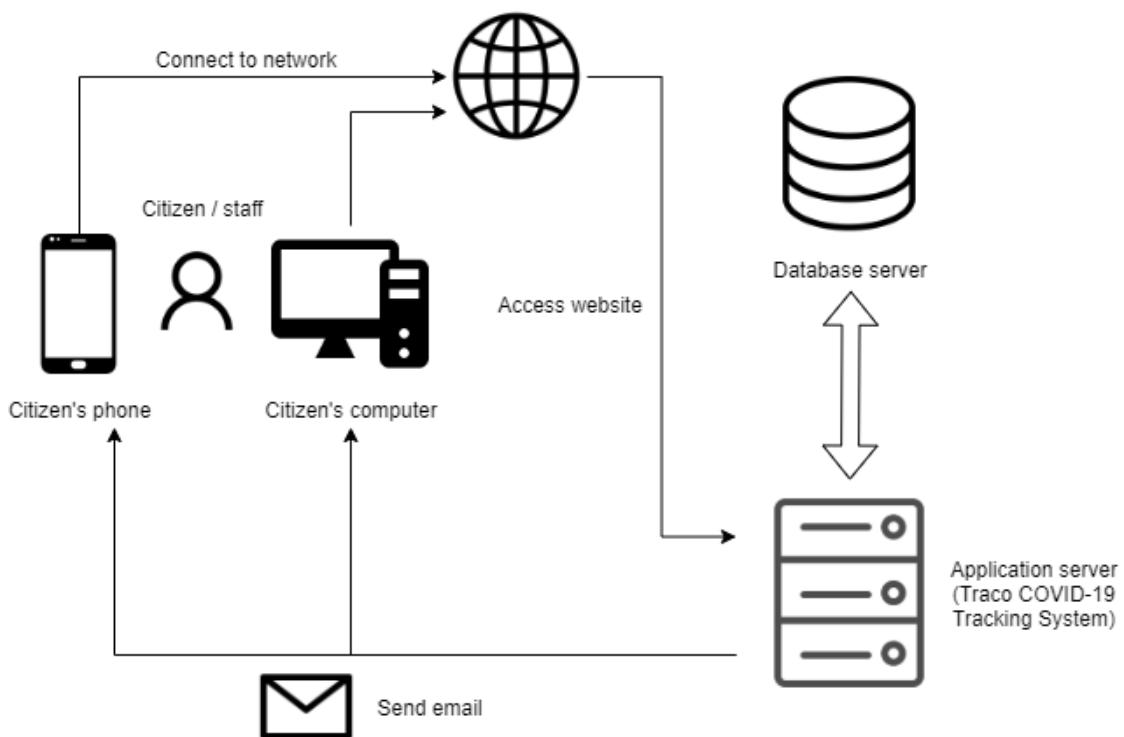


Figure 4.33: Overall system architecture of Traco COVID-19 Tracking System

4.6 Chapter Summary and Evaluation

In this chapter, the author and his partner have drawn the processes of their respective module into activity diagrams. Next, they design the database of the proposed system by drawing the class diagram and the data dictionary. Then, they show some UI designs of some web pages in the prosed system and descript how these web pages work. Later on, they also show the algorithms of some functions in the proposed system and explain how the codes work. Lastly, they prepared a deployment diagram for the proposed system together.

The problems faced by the author in this chapter is struggle in designing the database of the proposed system. The author and his partner have taken some time to design database and have changed the database few times. The author and his partner have solved this problem by testing the database in Visual Studio multiple times to ensure it can perform well.

Chapter 5

Implementation and Testing

5.1 Implementation

5.1.1 Hardware implementation

Table 5.1: Hardware requirements

For system deployment	
All-in-one server	<p>The server is used to run the Traco COVID-19 Tracking System and also used to store the database of the system. The server would need higher hardware requirements to ensure good performance and user experience as the server would need to host the web app and operate the database 24 hour.</p> <p>Recommended requirements:</p> <ul style="list-style-type: none"> • Processor: x64 or x84 processor with the speed 1.6 GHz and quad-core and above (Intel or AMD) • Memory: 128 GB and above • Storage: At least 40 GB for the software to run the system, and then 1 TB and above for the database storage. • Network: Network card with at least 1 Gigabit (1,000 Mbps) speed)
For using the system (For staff and citizens)	
Desktop devices	<p>The Traco COVID-19 Tracking System is mainly developed for desktop users. The users can use a laptop or pc to access the system through a browser and use the functionality of the system smoothly under the recommended requirements.</p> <p>Recommended requirements:</p> <ul style="list-style-type: none"> • X64 or x86 dual-core processor with 1.9 GHz and above • 2 GB of memory and above • Display with a resolution of 1024 x 768 and above • 100 MB of free storage for installable web resources and

	<ul style="list-style-type: none"> • web browser (like location QR code, chat image and pdf) • WIFI supported (access browser)
Mobile devices	<p>The Traco COVID-19 Tracking System also can be used with mobile devices with the dynamic display provided by the Bootstrap CSS. The user also needs to use the mobile devices to scan the location QR code. As long as the mobile devices have the recommended requirements and internet connection, the system can run smoothly without any problem.</p> <p>Recommended requirements:</p> <ul style="list-style-type: none"> • 2 GB of memory and above • 100 MB of free storage for installable web resources and web browser (like location QR code, chat image and pdf) • Camera supported for scanning the location QR code • WIFI or cellular network supported
Network	<p>The network is required for the user's device to connect the system through the browser and manage the database. The user can either use WIFI or cellular network to access the system.</p> <p>Recommended requirements:</p> <ul style="list-style-type: none"> - 125 KBps (1 Mbps) of network bandwidth - 3G cellular network and above

5.1.2 Software implementation

Table 5.2: Software requirements

For system deployment	
Operating system	<p>Windows Server is an operating system from Microsoft for system servers. Windows server is one of the best operating systems for servers and it provides multiple services and supports for the server.</p> <p>Operating system: Windows Server 2012 and above</p>
.NET Framework	<p>.NET framework is a software developed by Microsoft. It includes a large library class which is required to develop the ASP.NET webpages which the author and his partner are currently using to develop the Traco COVID-19 Tracking System.</p> <p>.NET Framework: .NET Framework 4.6 and above</p>
RDBMS	<p>Microsoft SQL Server is a relational database management system developed by Microsoft. Visual Studio 2019 that was used by the author and his partner to develop the system had already included the Microsoft SQL server which helped the author and his partner to save more time without finding additional databases.</p> <p>Database server: Microsoft SQL server 2016 and above</p>
For using the system (For staff and citizens)	
Operating system	Any devices that have a standard operating system can access the

	<p>system without any problem.</p> <p>Desktop device: Window 7,8,8.1,10,11</p> <p>Android device: Android 4.0 or above</p> <p>IOS Device: IOS 6 or above</p>
Browser	<p>Browsers that can support the HTML5, latest Bootstrap CSS or JQuery are suitable for the system.</p> <p>Browser supported are:</p> <ul style="list-style-type: none"> Mozilla Firefox Google Chrome Safari Microsoft Edge
Other software	Software like QR code scanner is required for the system to scan location QR code to record the check-in details.

5.2 Code Snippet

1. Real time chat

```
4 0 references
5  Public Class ChatHub
6    Inherits Hub
7
8    0 references
9    Public Sub Send(CurrentUserGUID As String, userType As String, message As String, ChatGUID As String, newChat As String, MessageType As String)
10   Dim SendTimeDB As DateTime = DateTime.Now
11   Dim SendTimeStr As String = SendTimeDB.ToString("hh:mm tt")
12
13   ManageMessageDB(CurrentUserGUID, userType, message, ChatGUID, newChat, MessageType, SendTimeDB)
14   Clients.Group(ChatGUID).broadcastMessage(userType, message, MessageType, SendTimeStr)
15 End Sub
16
17 0 references
18  Public Sub Join(groupName As String)
19    Groups.Add(Context.ConnectionId, groupName)
20  End Sub
21
22 0 references
23  Public Sub IsTyping(ChatGUID As String, userType As String)
24    Clients.Group(ChatGUID).whoIsTyping(userType)
25  End Sub
26
27 0 references
28  Public Sub alertEndChatMsg(ChatGUID As String, userType As String, message As String)
29    Clients.Group(ChatGUID).alertEndChat(userType, message)
30  End Sub
31
32 1 reference
33  Private Sub ManageMessageDB(CurrentUserGUID As String, userType As String, message As String, ChatGUID As String, newChat As String, MessageType As String, SendDate As DateTime)
34
35   If newChat = "True" Then
36     InsertChat(CurrentUserGUID, ChatGUID)
37   End If
38
39   InsertMessage(userType, message, ChatGUID, MessageType, SendDate)
40
41 End Sub
42
43 1 reference
44  Private Sub InsertChat(CurrentUserGUID As String, ChatGUID As String)
45
46   Try
47
48     Dim con As New SqlConnection(ConfigurationManager.ConnectionStrings("TracoDB").ConnectionString)
49     con.Open()
50
51     Dim InsertCommand As New SqlCommand("INSERT INTO Chat VALUES(@ChatGUID,@CitizenGUID,@StaffGUID,@ChatStatus,@CreatedDate,@EndDate)", con)
52
53     InsertCommand.Parameters.AddWithValue("@ChatGUID", Guid.Parse(ChatGUID.ToString()))
54     InsertCommand.Parameters.AddWithValue("@CitizenGUID", Guid.Parse(CurrentUserGUID.ToString()))
55     InsertCommand.Parameters.AddWithValue("@StaffGUID", DBNull.Value)
56     InsertCommand.Parameters.AddWithValue("@ChatStatus", "Pending")
57     InsertCommand.Parameters.AddWithValue("@CreatedDate", DateTime.Now.ToString("yyyy-MM-dd HH:mm:ss"))
58     InsertCommand.Parameters.AddWithValue("@EndDate", DBNull.Value)
59
60     InsertCommand.ExecuteNonQuery()
61
62     con.Close()
63
64
65
```

Figure 5.1: Chathub backend code

```

function AddMessage(userType, message, messageType, sendTime) {
    var divChat = '';
    var linkColor;
    var checkDate = new Date($('#hdCheckDate.ClientID').val());
    var todaysDate = new Date();

    if (checkDate.setHours(0, 0, 0, 0) != todaysDate.setHours(0, 0, 0, 0)) {
        divChat += '<div class="row col-lg-12 p0">';
        divChat += '<div class="media media-meta-day">Today</div>';
        divChat += '</div>';
        $('#hdCheckDate.ClientID').val(todaysDate.toDateString())
    }

    divChat += '<div class="row col-lg-12 p0">';

    if (userType == $('#hdUserType.ClientID').val()) {
        linkColor = "pdfLinkWhite";
        clearMsgAfterSend();
        keyPressCount = 0
        $('#sendDiv').slideUp(500);
        divChat += '<div class="media media-chat media-chat-reverse mediaPadding">';
    } else {
        linkColor = "pdfLinkBlack";
    }
}

```

Figure 5.2: Some JavaScript code of the chat

```

function ShowTyping(userType) {
    if (userType != $('#hdUserType.ClientID').val()) {
        if ($('#divIsTyping').is(":hidden")) {
            $("#divIsTyping").slideDown(500);

            ScrollToBottom();
        }
    }
}

window.setInterval(function () {
    if ($('#divIsTyping').is(":visible")) {
        $("#divIsTyping").slideUp(500);
    }
}, 8000);

```

Figure 5.3: Some JavaScript code of the chat

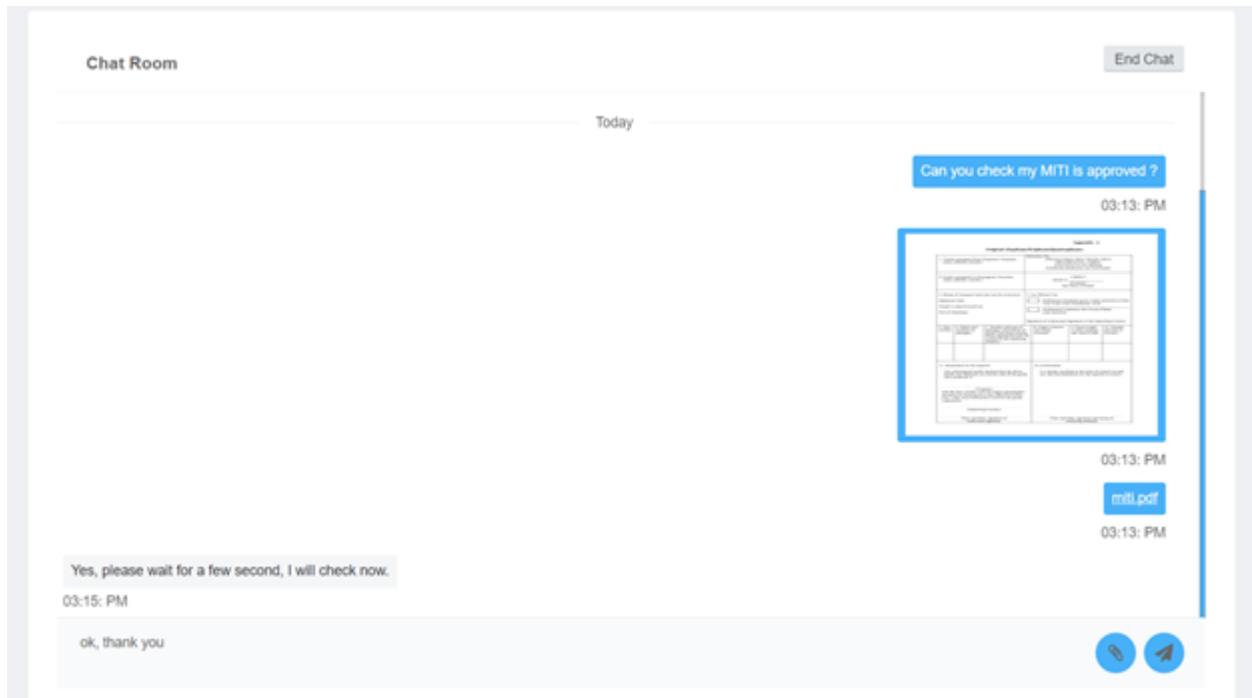


Figure 5.4: Sample output of the chat

In order to make a real time chat, the author had to use the SignalR library which allows the server code to send asynchronous notifications to the clients site. The author first created a server hub for the chat (figure 5.1) and created a group based on the chat GUID when there is a citizen request to send a message to the staff to ensure there are no other users who can join the chat room. When the user sends a message, the system will send asynchronous notifications to client sites of the staff chat and the citizen chat as well as store the chat details into the database. Then, the client site (figure 5.2 and figure 5.3) of both citizens and staff will receive the details of the chat and generate html code for both sides. Later on, the system will display the chat details to both sides and this makes the chat real time. The message sent by the sender will be highlighted in blue and the message sent by the recipient will be highlighted in grey (figure 5.4).

The JavaScript also contains other functions such as play audio if there are any new messages, change tab title if there are new messages, send image and pdf, show typing and more.

2. Location check-in

```

123
124 |     ElseIf dtLocation.Rows(0).Item("LocationStatus") = "High-Risk" And denied = False Then
125 |
126 |         Page.ClientScript.RegisterStartupScript(Me.GetType(), "openconfirmjs", "<script>highRiskConfirm();</script>")
127 |
128 End If

```

Figure 5.5: Call JavaScript in backend to ask confirmation about entering high-risk location

```

7   <script type="text/javascript">
8
9     function highRiskConfirm() {
10    if (confirm('You are entering a high-risk location, are sure you want to enter ?')) {
11      $('#btnConfirmEnter.ClientID').click();
12    }
13  }
14
15
16
17 </script>

```

Figure 5.6: JavaScript code to ask confirmation about entering high-risk location

```

If RecordStatus = "Accepted" Then
    lblCheckInHeader.Text = "Check-In Successful"
    lblIcon.Text = "done"
    lblDesc.Text = "Show this ticket to the guard/frontliner if required"
    headerDiv.Attributes.Add("class", headerDiv.Attributes("class") + " acceptBackgroundColor")
    iconDiv.Attributes.Add("class", iconDiv.Attributes("class") + " acceptBackgroundColor")

Else
    lblCheckInHeader.Text = "Check-In Denied"
    lblIcon.Text = "clear"
    headerDiv.Attributes.Add("class", headerDiv.Attributes("class") + " deniedBackgroundColor")
    iconDiv.Attributes.Add("class", iconDiv.Attributes("class") + " deniedBackgroundColor")

If dtCitizen.Rows(0).Item("HealthStatus") = "Suspected" Then
    lblDesc.Text = "You should not went out when you are suspected of infected COVID-19"
Else
    lblDesc.Text = "You should not went out when you are infected COVID-19"
End If

End If

```

Figure 5.7: Change CSS in backend code based on check-in status

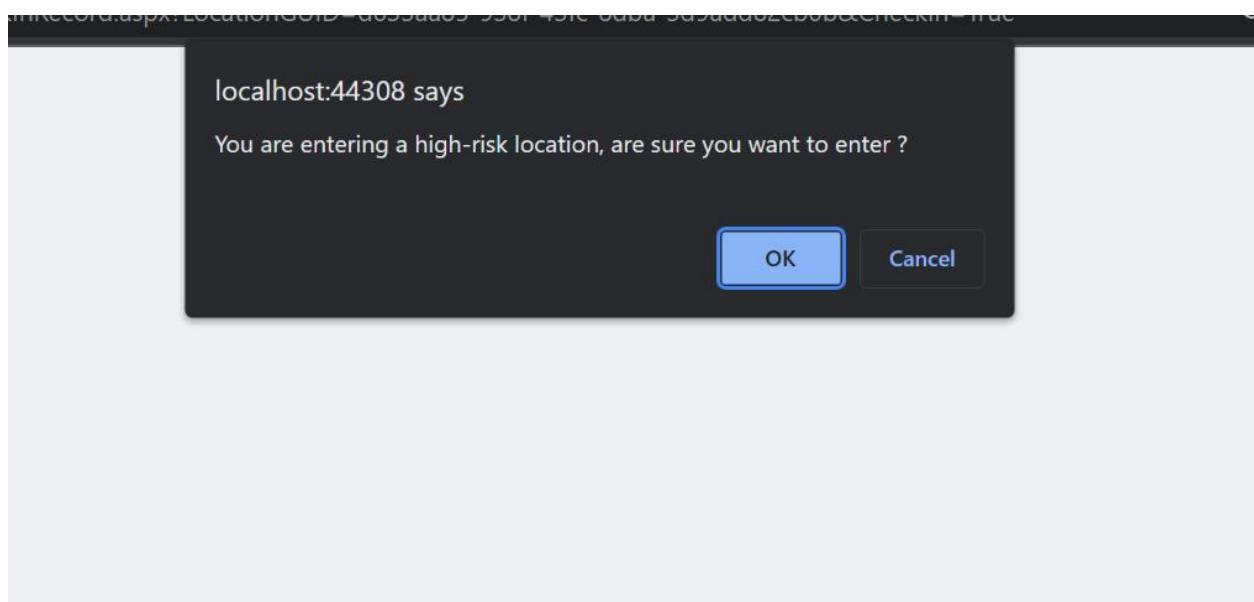


Figure 5.8: Sample output of ask confirmation when entering high-risk location

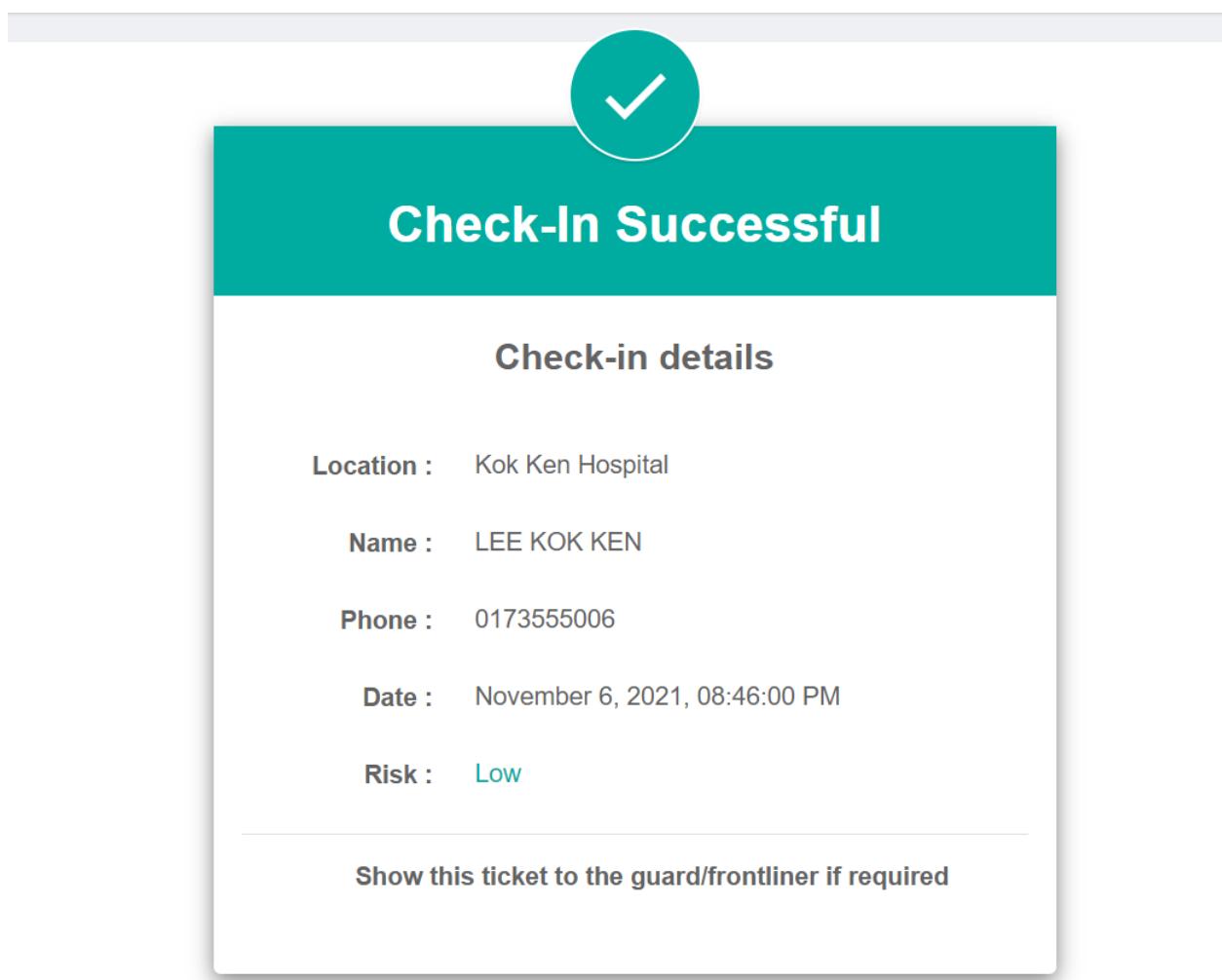


Figure 5.9: Sample output of check-in accepted

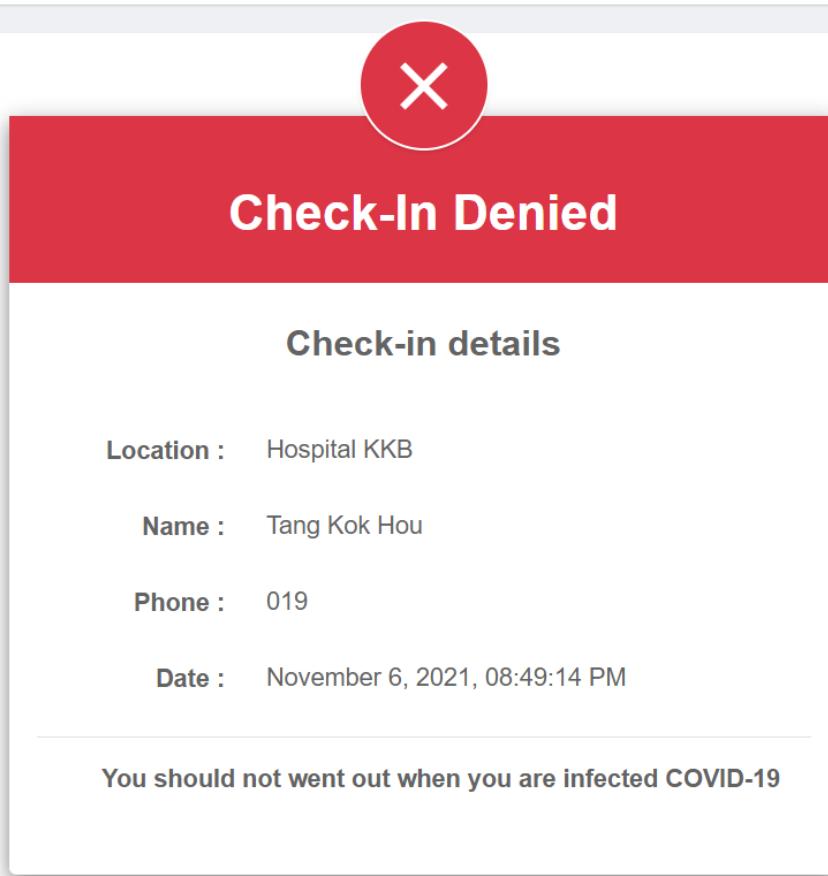


Figure 5.10: Sample output of check-in denied

To record a citizen check-in record, the system will first check the health status of the citizen. If the citizen's health status is infected or suspected, the system will deny the check-in. If the infected or suspected citizen check-in location with industry type of “Hospital/Health Care” and “Hospitality”, the check-in will be accepted. If the citizen’s health status is safe, then the system will check the location status. If the location status is high-risk, the system will call the JavaScript function through the backend for asking confirmation (figure 5.5), if the citizen selects yes then the system will trigger a hidden button and the system will continue to run the backend code and save the location check-in record. If the check-in record is accepted, then the system will add the CSS of the accepted theme to the check-in record card (figure 5.9), else it will add the CSS of the denied theme to the check-in record card (figure 5.10).

3. Update location status to high-risk where the infected citizen went in last three day

```

1 If InfectedFlag = "Y" Then
2     'Update the location where the citizen went before in past three day to high-risk
3     Dim UpdateLocationCommand As New SqlCommand()
4     UpdateLocationCommand.Connection = con
5     UpdateLocationCommand.CommandText = "NSP_UpdateLocationRisk"
6     UpdateLocationCommand.CommandType = CommandType.StoredProcedure
7     UpdateLocationCommand.Parameters.AddWithValue("@CitizenGUID", CitizenGUID)
8     UpdateLocationCommand.ExecuteNonQuery()
9
10    UpdateLocationCommand.Dispose()

```

Figure 5.11: backend code to run the stored procedure of the update location status where the infected citizen went past three days

```

1 CREATE PROCEDURE [dbo].[NSP_UpdateLocationRisk](
2     @CitizenGUID UNIQUEIDENTIFIER
3 )
4 AS
5 BEGIN
6
7     DECLARE @CurrentLocationGUID UNIQUEIDENTIFIER
8
9     --Get the locations the infected user has been to in these 3 days
10    SELECT B.LocationGUID
11    INTO #SuspectedLocation
12    FROM PCRRecord A
13    LEFT JOIN LocationRecord B
14    ON A.CitizenGUID = B.CitizenGUID
15    WHERE A.CitizenGUID = @CitizenGUID
16    AND A.RecordStatus = 'Positive'
17    AND b.RecordDate BETWEEN DATEADD(DAY, -3, GETDATE()) AND GETDATE()
18    GROUP BY B.LocationGUID
19
20
21    IF (EXISTS (SELECT TOP 1 * FROM #SuspectedLocation))
22    BEGIN
23
24        DECLARE location_cursor CURSOR FOR
25        SELECT *
26        FROM #SuspectedLocation
27
28        OPEN location_cursor
29        FETCH NEXT FROM location_cursor INTO @CurrentLocationGUID
30        WHILE @@FETCH_STATUS = 0
31        BEGIN
32            --Update location to high-risk one by one
33            UPDATE [Location] SET LocationStatus = 'High-Risk' WHERE LocationGUID = @CurrentLocationGUID
34            FETCH NEXT FROM location_cursor INTO @CurrentLocationGUID
35        END
36
37        CLOSE location_cursor
38        DEALLOCATE location_cursor
39
40    END
41
42    DROP TABLE #SuspectedLocation
43
44 END

```

Figure 5.12: Stored procedure to update location status where the infected citizen went past three days

If an infected citizen PCR record is inserted, the system will run a stored procedure (figure 5.12) to update location status where the infected citizen went past three days. First, the system will check which locations that the infected citizen went to before and store the location details to a cursor. Then, the system will use the cursor to update the location status to high-risk one by one using a loop.

4. Send notification

```

sqlQuery += "INSERT INTO Notification(NotificationGUID,CitizenGUID,NotificationSubject,NotificationContent,ReadFlag,SentDate,SentBy,NotificationDescription) "
sqlQuery += "SELECT newid(),CitizenGUID,@Subject,@Content,'N',@SendDate,@SendBy,@NotificationDesc "
sqlQuery += "FROM Citizen C "
sqlQuery += "LEFT JOIN District D ON "
sqlQuery += "C.DistrictID = D.DistrictID "
sqlQuery += "LEFT JOIN State S ON "
sqlQuery += "D.StateID = S.StateID "
sqlQuery += "WHERE C.HealthStatus != 'Death'"
```

Figure 5.13: SQL command and backend code of sending notification to all citizen

```

If ddlHealthStatus.SelectedValue <> "All" Then
    sqlQuery += " AND C.HealthStatus = '" + ddlHealthStatus.SelectedValue + "'"
    NotificationDesc += ddlHealthStatus.SelectedValue.ToLower + " "
    countSelection += 1
End If

If ddlGender.SelectedValue <> "All" Then
    sqlQuery += " AND C.Gender = '" + ddlGender.SelectedValue + "'"
    NotificationDesc += ddlGender.SelectedValue.ToLower + " "
    countSelection += 1
End If

NotificationDesc += "citizen "

If txtStartAge.Text <> "0" Or txtEndAge.Text <> "100" Then
    sqlQuery += " AND CONVERT(int,DATEDIFF(DAY,C.DateOfBirth,GETDATE())/365.25) BETWEEN " + txtStartAge.Text + " AND " + txtEndAge.Text + ""
    NotificationDesc += "age between " + txtStartAge.Text + " - " + txtEndAge.Text + " "
    countSelection += 1
End If

If ddlState.SelectedValue <> "All" Then
    sqlQuery += " AND S.StateID = '" + ddlState.SelectedValue + "'"
    NotificationDesc += "from " + ddlState.SelectedItem.Text + " "
    countSelection += 1
End If
```

Figure 5.14: SQL command and backend code of sending notification based on category

```

sqlQuery = "INSERT INTO Notification(NotificationGUID,CitizenGUID,NotificationSubject,NotificationContent,ReadFlag,SentDate,SentBy,NotificationDescription) VALUES "

For Each row As GridViewRow In gvSelectedCitizen.Rows
    sqlQuery += "(newid()," + row.Cells(1).Text + ",@Subject,@Content,'N',@SendDate,@SendBy,@NotificationDesc)"

    NotificationDesc += row.Cells(2).Text

    If countRow <> gvSelectedCitizen.Rows.Count Then
        sqlQuery += ","
        NotificationDesc += ","
    Else
        sqlQuery += ";"
    End If

    countRow += 1
Next

Session("dtCitizenNotification") = Nothing

End If
```

Figure 5.15: SQL command and backend code of sending notification to specific citizens

The staff is able to select to send notifications to all citizens, citizens based on category like male, female; or send to specific citizens. If the staff selects send based on category, the system will add the SQL query dynamically based on the selection of the staff. If the staff select send to specific citizens, then the system will get the citizens in the selected grid view and use a for loop to write the SQL command.

5.3 Test Plan and Result

Project Details			
Student's Name	SOO JI HO	Programme:	RSD3S1
Project Title	Traco COVID-19 Tracking System	Test Case No.	1
Module:	Citizen management module	Reference No. (diagram)	
Actor(s)	Staff (Head admin and MoH staff) and citizen		
Pre-requisites^{1:}	1. The MOH staff need to login to use the functionality of the citizen management module.		
	2. The citizen needs to register an account and login to view or update his/her details.		
Dependencies^{2:}	1. Location management module		
	2. Messaging and enquiry module		

Test Case (Citizen site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	Input testing when a citizen performs registration.	<p>Insert all details correctly and click the register button.</p> <p>Input: Fullscreen: Soo Ji Ho Username: Jiho1273 Password: Jiho1273 Confirm password: Jiho1273 Gender: Male Date of birth: 28/10/2000 Occupation:</p>	Show “Account created successfully.” message and redirect the citizen to the registration successful page. The citizen record is added to the database.	Show “Account created successfully.” message and redirect the citizen to the registration successful page. The citizen record is added to the database.	Pass	

	<p>Student</p> <p>NRIC:</p> <p>001028140969</p> <p>Phone number:</p> <p>0173555006</p> <p>Email:</p> <p>soojiho127@gmail.com</p> <p>Address 1:</p> <p>No 10, Jalan ABC</p> <p>Address 2:</p> <p>Taman Cempedak</p> <p>Address 3:</p> <p>-</p> <p>State:</p> <p>Sabah</p> <p>District:</p> <p>Telupid</p> <p>Post Code:</p> <p>53200</p> <p>Term and condition:</p>			
--	--	--	--	--

	checked			
	<p>Leave required fields blank while entering citizen details.</p> <p>Input:</p> <p>Fullscreen:</p> <ul style="list-style-type: none"> - <p>(Same for other required fields)</p>	Show “Please enter full name” message.	Show “Please enter full name” message.	Pass
	<p>Enter citizen details with invalid format (Fullscreen).</p> <p>Input:</p> <p>Fullscreen (Contain digit):</p> <p>SOO JI HO 123</p>	Show “Fullscreen should not have number” message.	Show “Fullscreen should not have number” message.	Pass
	<p>Enter citizen details with invalid format (Username).</p>	Show “Username should have at least 8 characters !” message.	Show “Username should have at least 8 characters !” message.	Pass

	<p>Input: Username (less than 8 character): ABC123 OR Username (Duplicate): Kokhou123</p>	OR Show “Duplicate Username, please use another username !” message.		
	<p>Enter citizen details with invalid format (Password).</p> <p>Input: Password (less than 8 character and with digit only): 123456</p>	Show “Passwords should have 8 - 20 characters with at least 1 uppercase, 1 lowercase, 1 number !” message.	Show “Passwords should have 8 - 20 characters with at least 1 uppercase, 1 lowercase, 1 number !” message.	Pass
	<p>The password is not the same as the confirmed password.</p> <p>Input:</p>	Show “Password is not the same as the confirmed password !” message.	Show “Password is not the same as the confirmed password !” message.	Pass

	<p>Password: Jiho1273</p> <p>Confirm password: Jiho1256</p>			
	<p>Enter citizen details with invalid format (NRIC).</p> <p>Input:</p> <p>NRIC (Not 12 digits): 0123</p> <p>Or</p> <p>NRIC (Duplicate): 123412345678</p>	<p>Show “Wrong NRIC format !” message.</p> <p>Or</p> <p>Show “Duplicate NRIC detected !” message.</p>	<p>Show “Wrong NRIC format !” message.</p> <p>Or</p> <p>Show “Duplicate NRIC detected !” message.</p>	<p>Pass</p>
	<p>Enter citizen details with invalid format (Email).</p>	<p>Show “Invalid email format” message.</p> <p>Or</p>	<p>Show “Invalid email format” message.</p> <p>Or</p>	

	<p>Input:</p> <p>Email (Invalid email format): soojiho5</p> <p>Or</p> <p>Input:</p> <p>Email (Duplicate): leekokken16@gmail.com</p>	<p>Show “This email has been used, please use another email !” message.</p>	<p>Show “This email has been used, please use another email !” message.</p>		
	<p>Enter citizen details with invalid format (Phone number).</p> <p>Input:</p> <p>Phone number (with character): qwer</p>	<p>Show “Wrong phone number format !” message.</p>	<p>Show “Wrong phone number format !” message.</p>	<p>Pass</p>	

	<p>Enter citizen details with invalid format (Post code).</p> <p>Input:</p> <p>Post Code (With only 3 digit):</p> <p>123</p>	Show “Wrong postcode format !” message.	Show “Wrong postcode format !” message.	Pass	
	<p>Didn’t check the terms and conditions.</p> <p>Input:</p> <p>Term and condition (unchecked):</p> <p>unchecked</p>	Show “Please agree to our terms and conditions !” message.	Show “Please agree to our terms and conditions !” message.	Pass	
	<p>Input testing when a citizen updates their details.</p>	<p>Insert all details correctly and click the save profile button.</p> <p>Input:</p> <p>Fullscreen:</p> <p>Soo Ji Ho</p>	Show “Profile updated success.” message. The citizen record is updated in the database.	Show “Profile updated success.” message. The citizen record is updated in the database.	Pass

	<p>Username: Jiho1273</p> <p>Gender: Male</p> <p>NRIC: 001028140969</p> <p>Phone number: 0173555006</p> <p>Email: soojiho127@gmail.com</p> <p>Address 1: No 10, Jalan ABC</p> <p>Address 2: Taman Cempedak</p> <p>Address 3: -</p> <p>State: Sabah</p> <p>District: Telupid</p>			
--	---	--	--	--

	Post Code: 53200			
	<p>Leave required fields blank while entering citizen details.</p> <p>Input:</p> <p>Fullscreen:</p> <p>-</p> <p>(Same for other required fields)</p>	Show “Please enter full name” message.	Show “Please enter full name” message.	Pass
	<p>Enter citizen details with invalid format (Fullscreen).</p> <p>Input:</p> <p>Fullscreen (Contain digit):</p> <p>SOO JI HO 123</p>	Show “Fullscreen should not have number” message.	Show “Fullscreen should not have number” message.	Pass

	<p>Enter citizen details with invalid format (Username).</p> <p>Input:</p> <p>Username (less than 8 character): ABC123</p> <p>OR</p> <p>Username (Duplicate): Kokhou123</p>	<p>Show “Username should have at least 8 characters !” message.</p> <p>OR</p> <p>Show “Duplicate Username, please use another username !” message.</p>	<p>Show “Username should have at least 8 characters !” message.</p> <p>OR</p> <p>Show “Duplicate Username, please use another username !” message.</p>	Pass	
	<p>Enter citizen details with invalid format (Email).</p> <p>Input:</p> <p>Email (Invalid email format):</p>	<p>Show “Invalid email format” message.</p> <p>Or</p> <p>Show “This email has been used, please use</p>	<p>Show “Invalid email format” message.</p> <p>Or</p> <p>Show “This email has been used, please use</p>	Pass	

		<p>soojiho5</p> <p>Or</p> <p>Input:</p> <p>Email (Duplicate):</p> <p>leekokken16@gmail.com</p>	<p>another email !” message.</p>	<p>another email !” message.</p>		
		<p>Enter citizen details with invalid format (Phone number).</p> <p>Input:</p> <p>Phone number (with character):</p> <p>qwer</p>	<p>Show “Wrong phone number format !” message.</p>	<p>Show “Wrong phone number format !” message.</p>	Pass	
		<p>Enter citizen details with invalid format (Post code).</p> <p>Input:</p>	<p>Show “Wrong postcode format !” message.</p>	<p>Show “Wrong postcode format !” message.</p>	Pass	

		Post Code (With only 3 digit): 123			
	Perform checking when a citizen forgets password.	<p>Enter the correct email and apply for the forget password for the first time.</p> <p>Input: Email: soojiho127@gmail.com</p>	<p>A link will be sent to the email that was entered by the citizen. The reset password details will be saved into the database.</p>	<p>A link will be sent to the email that was entered by the citizen. The reset password details will be saved into the database.</p>	Pass
	The citizen applies for the forget password the second time after the expiry date of the first link.		<p>A new link will be sent to the email that was entered by the citizen. The reset password details will be updated in the database.</p>	<p>A new link will be sent to the email that was entered by the citizen. The reset password details will be updated in the database.</p>	Pass
		<p>Enter a wrong or invalid email.</p> <p>Input: Email:</p>	Show “Email not found” message.	Show “Email not found” message.	Pass

	Jiho12234.com				
	The citizen applies for the forget password the second time before the expiry date of the first link.	Show “an email has been sent to your account. Please check your mail account to reset your password.” message.	Show “an email has been sent to your account. Please check your mail account to reset your password.” message.	Pass	
Perform checking when citizens reset the password.	Enter the correct details. Input: Password: Jiho1273 Confirm password: Jiho1273	Show a successful message.	Show a successful message.	Pass	
	Leave required fields blank while entering password. Input:	Show “Please enter the password !” message.	Show “Please enter the password !” message.	Pass	

	Password: - (Same for other required fields)			
	Enter the password in the incorrect format. Input: Password: ABC123	Show “Passwords should have 8 - 20 characters with at least 1 uppercase, 1 lowercase, 1 number !” message.	Show “Passwords should have 8 - 20 characters with at least 1 uppercase, 1 lowercase, 1 number !” message.	Pass
	The password is not the same as the confirmed password. Input: Password: Jiho1273 Confirm password: Jiho1256	Show “Password is not the same as the confirmed password !” message.	Show “Password is not the same as the confirmed password !” message.	Pass

		After resetting the password the citizen presses the reset password link again.	Show “This link is already used to reset the password.” message.	Show “This link is already used to reset the password.” message.	Pass	
	Change password for existing citizens.	<p>Login to the account, go to the user profile page (Top right corner of the page), click the “Update profile” button and click the “Change password” button.</p> <p>Enter the correct details and click the “Change password” button to change the password.</p> <p>Input:</p> <p>Current password: Asdf1234</p> <p>New password:</p>	Show “Password changed success” message. The password is updated to the new password.	Show “Password changed success” message. The password is updated to the new password.	Pass	

		Asdf12345 Confirm password: Asdf12345			
		Blank the current password and click the “Change password” button. Input: Current password: -	Show “Please enter your current password” message.	Show “Please enter your current password” message.	Pass
		Enter an incorrect password and click the “Change password” button. Input: Current password: asdf123456	Show “Current password does not match, please try again” message.	Show “Current password does not match, please try again” message.	Pass

	<p>Blank the new password and confirm password and click the “Change password” button.</p> <p>Input:</p> <p>Current password: Asdf1234</p> <p>New password: -</p> <p>Confirm password: -</p>	<p>Show “Please enter the new password and confirm your password” message.</p>	<p>Show “Please enter the new password and confirm your password” message.</p>	Pass	
	<p>Enter the new password but with incorrect format and click the “Change password” button. (Invalid format: 8 to 20 characters, at least one upper alphabetic, one lower alphabetic and one numeric character.)</p>	<p>Show “Invalid password format” message.</p>	<p>Show “Invalid password format” message.</p>	Pass	

		<p>Input:</p> <p>Current password:</p> <p>Asdf1234</p> <p>New password:</p> <p>asdf12345</p> <p>Confirm password:</p> <p>asdf12345</p>			
--	--	--	--	--	--

Test Case (Staff site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	The MOH staff searched for citizens in the citizen listing.	Click the search button without providing criteria.	Show all the available citizen records.	Show all the available citizen records.	Pass	
		<p>Find existing citizens using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Citizen Name: SOO JI HO</p> <p>Occupation: -</p> <p>Gender: All</p> <p>Health status: All</p> <p>State: All</p> <p>District:</p>	Show the citizen record that matches the criteria.	Show the citizen record that matches the criteria.	Pass	

		All Age: 1 - 100				
		Find non-existing citizens using specific criteria and click the “Search” button. Input: Citizen Name: JI JI HO Occupation: - Gender: All Health status: All State: All District: All	Show a “No citizen record found” label instead of showing the table	Show a “No citizen record found” label instead of showing the table	Pass	

		Age: 1 - 100				
--	--	------------------------	--	--	--	--

Project Details			
Student's Name	SOO JI HO	Programme:	RSD3S1
Project Title	Traco COVID-19 Tracking System	Test Case No.	2
Module:	Location management module	Reference No. (diagram)	
Actor(s)	Staff (Head admin and MoH staff) and citizen		
Pre-requisites¹:	1. The citizen needs to login to use the functionality of the location management module.		
	2. The MOH Staff needs to login to use the functionality of the location management module.		
Dependencies²:	1. Vaccine management and application module		
	2.		

Test Case (Citizen site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	The Citizen registers QR Code for a specific location.	<p>Insert all details correctly and click the submit button.</p> <p>Input:</p> <p>Location name: KOK KEN Restaurant</p> <p>Location address: Block 56, Jalan Helang</p> <p>State: Kuala Lumpur</p> <p>District: Kuala Lumpur</p> <p>PostCode: 52100</p> <p>Industry type: Restaurant</p>	Show “Location QR code created successfully!” message and save location details to the database.	Show “Location QR code created successfully!” message and save location details to the database.	Pass	

	<p>Leave required fields blank while entering location details.</p> <p>Input:</p> <p>Location name:</p> <p>-</p> <p>(Same for other required fields)</p>	Show “Please enter location name” message.	Show “Please enter location name” message.	Pass	
	<p>Enter the wrong postcode format</p> <p>Input:</p> <p>Postcode (Contain character):</p> <p>ABC123</p>	Show “Wrong postcode format !”message	Show “Wrong postcode format !”message	Pass	
	The citizen updates the details of the registered location.	Same as the location register part but click with the update button.	Display “Location updated successfully !” message	Display “Location updated successfully !” message	Pass

	The citizen terminates the registered location.	Click the terminate button.	Display “Location terminated successfully !” message	Display “Location terminated successfully !” message	Pass	
The citizens search for their registered locations in the location listing.	Click the search button without providing criteria.	Show all the available location records.	Show all the available location records.	Pass		
		Find existing Locations using specific criteria and click the “Search” button. Input: Location name: KOK KEN Restaurant	Show the location record that matches the criteria.	Show the location record that matches the criteria.	Pass	
	Find non-existing locations using specific criteria and click the “Search” button. Input: Location name: Kin Lam Restaurant	Show a “No location record found” label instead of showing the table	Show a “No location record found” label instead of showing the table	Pass		

	The citizens scan the location or vaccine location QR code and perform check-in.	If the citizen's health status is safe and the location is low-risk.	Display check-in accepted and low-risk location. Save check-in details to the database.	Display check-in accepted and low-risk location. Save check-in details to the database.	Pass	
		If the citizen's health status is safe and the location is high-risk.	Display check-in accepted and high-risk location. Save check-in details to the database.	Display check-in accepted and high-risk location. Save check-in details to the database.	Pass	
		If the citizen's health is suspected or infected.	Display check-in denied. Save check-in details to the database.	Display check-in denied. Save check-in details to the database.	Pass	
	The citizens search for their location check-in record in the location record listing.	Find an existing Location check-in record using specific criteria and click the “Search” button. Input: Start date:	Show the location check-in details record that matches the criteria.	Show the location check-in details record that matches the criteria.	Pass	

		01/10/2021 End Date: 31/10/2021 Risk: All			
	Find non-existing location check-in records using specific criteria and click the “Search” button. Input: Start date: 01/01/2022 End Date: 31/10/2022 Risk: All	Show a “No location record found” label instead of showing the table	Show a “No location record found” label instead of showing the table	Pass	

Test Case (Staff site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	The MOH Staff registers QR Code for a vaccine location.	<p>Insert all details correctly and click the submit button.</p> <p>Input:</p> <p>Location name: KOK KEN Restaurant</p> <p>Location address: Block 56, Jalan Helang</p> <p>State: Kuala Lumpur</p> <p>District: Kuala Lumpur</p> <p>PostCode: 52100</p> <p>Status: Active</p>	Show “Vaccine location QR code created successfully !”message and save vaccine location details to the database.	Show “Vaccine location QR code created successfully !”message and save vaccine location details to the database.	Pass	

	The MOH Staff updates the details of the registered location.	Same as the vaccine location register part but click with the update button.	Display “vaccine location updated successfully !” message	Display “vaccine location updated successfully !” message	Pass	
	The MOH Staff searches for vaccine location in the vaccine location listing.	Click the search button without providing criteria. Find existing vaccine Locations using specific criteria and click the “Search” button. Input: Vaccine location name: KOK KEN Hospital State: - District: - Status: Active	Show all the available vaccine location records. Show the vaccine location record that matches the criteria.	Show all the available vaccine location records. Show the vaccine location record that matches the criteria.	Pass	

	<p>Find non-existing vaccine locations using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Vaccine location name: Kin lam Hospital</p> <p>State: -</p> <p>District: -</p> <p>Status: Active</p>	<p>Show a “No vaccine location record found” label instead of showing the table</p>	<p>Show a “No vaccine location record found” label instead of showing the table</p>	Pass	
	The MOH Staff searches for citizens registered locations in the location	Click the search button without providing criteria.	Show all the available location records.	Show all the available location records.	Pass

	<p>listing.</p> <p>Find existing locations using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Location name: KOK KEN Restaurant</p> <p>State: -</p> <p>District: -</p> <p>Status: Low-risk</p> <p>Industry type: -</p>	<p>Show the location record that matches the criteria.</p>	<p>Show the location record that matches the criteria.</p>	<p>Pass</p>	
	<p>Find non-existing locations using specific criteria and click the “Search” button.</p>	<p>Show a “No location record found” label instead of showing the table</p>	<p>Show a “No location record found” label instead of showing the table</p>	<p>Pass</p>	

	<p>Input:</p> <p>Location name: KOK KEN Shop</p> <p>State: -</p> <p>District: -</p> <p>Status: Low-risk</p> <p>Industry type: Restaurant</p>			
	The MOH Staff updates the location status of a specific location that is registered by a citizen.	Change the location status and click the update button.	Display “Location updated successfully !” message	Display “Location updated successfully !” message Pass

	<p>The MOH Staff searches for citizen check-in records in the citizen check-in listing.</p> <p>Input:</p> <p>Citizen name: -</p> <p>Start date: 01/10/2021</p> <p>End Date: 31/10/2021</p> <p>Risk: All</p>	<p>Find an existing citizen location check-in record using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Citizen name:</p>	<p>Show the citizen location check-in details record that matches the criteria.</p> <p>Show the citizen location check-in details record that matches the criteria.</p>	<p>Pass</p>	
	<p>Find non-existing location check-in records using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Citizen name:</p>	<p>Show a “No location record found” label instead of showing the table</p>	<p>Show a “No location record found” label instead of showing the table</p>	<p>Pass</p>	

		<p>SOO JI JI</p> <p>Start date: 01/01/2022</p> <p>End Date: 31/10/2022</p> <p>Risk: All</p>			
	The MOH Staff searches for citizen check-in records that are denied in the warning listing.	<p>Find an existing citizen location check-in record using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Citizen name: -</p> <p>Start date: 01/10/2021</p> <p>End Date: 31/10/2021</p>	<p>Show the citizen location check-in details record that matches the criteria.</p>	<p>Show the citizen location check-in details record that matches the criteria.</p>	Pass

		<p>Find non-existing location check-in records using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Citizen name: SOO JI JI</p> <p>Start date: 01/01/2022</p> <p>End Date: 31/10/2022</p>	<p>Show a “No location record found” label instead of showing the table</p>	<p>Show a “No location record found” label instead of showing the table</p>	Pass	
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Project Details			
Student's Name	SOO JI HO	Programme:	RSD3S1
Project Title	Traco COVID-19 Tracking System	Test Case No.	3
Module:	Messaging and enquiry module	Reference No. (diagram)	
Actor(s)	Staff (Head admin and MoH staff) and citizen		
Pre-requisites^{1:}	1. The citizen needs to login to use the functionality of the messaging and enquiry management module.		
	2. The MOH Staff needs to login to use the functionality of the messaging and enquiry management module.		
Dependencies^{2:}	1. -		
	2. -		

Test Case (Citizen site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	The Citizen start a chat with the staff	Click the start a chat button without an existing chat.	Enter the chat room.	Enter the chat room.	Pass	
		Click the start a chat button with an existing chat.	Display “You already have a chat pending to reply or already in progress. If you want to start a new chat please end the previous chat.” message.	Display “You already have a chat pending to reply or already in progress. If you want to start a new chat please end the previous chat.” message.	Pass	
	The citizen sends a message to the staff.	Type text and press the send icon. Input: Message field: Hello	Display “Hello” and if it is a first message will display “Your message has successfully been sent to the staff. You can choose to wait for the reply here or leave the page and check it	Display “Hello” and if it is a first message will display “Your message has successfully been sent to the staff. You can choose to wait for the reply here or leave the	Pass	

		later on the Chat List” message. Message will save into the database.	page and check it later on the Chat List” message. Message will save into the database.		
	Press the upload icon and upload an image or pdf.	Display the image or pdf uploaded. The image or pdf details will save into the system folder and database.	Display the image or pdf uploaded. The image or pdf details will save into the system folder and database.	Pass	
	Didn't type anything and send the message. (send icon will show once there are keys in but if you the user spamming the backspace, it will show.) Input: Message field: -	Display “Please enter message” message.	Display “Please enter message” message.	Pass	

		Press the upload button and upload a file which is not a pdf or image.	Display “Only allow image and pdf file.” message.	Display “Only allow image and pdf file.” message.	Pass	
	The citizens end the chat.	Press the end chat button and click yes in the confirmation.	Display “Chat ended successfully” message. The system will update the chat status to “ended”.	Display “Chat ended successfully” message. The system will update the chat status to “ended”.	Pass	
		Press the end chat button in an empty chat (new chat room).	Display “You cannot end an empty chat !” message.	Display “You cannot end an empty chat !” message.	Pass	

Test Case (Staff site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	The MOH staff enter a pending chat.	Select a pending chat and press enter chat.	Display the message typed by the citizen.	Display the message typed by the citizen.	Pass	
		Select a pending chat and press enter chat but the chat is already handled by other staff. (maybe will occur if staff enter same time)	Display “This chat is already handled by other staff” message.	Display “This chat is already handled by other staff” message.	Pass	
	The MOH staff sends a message to the citizens.	Type text and press the send icon. Input: Message field: Yes, how can I help you	Display “Yes, how can I help you” message. Message will save into the database.	Display “Yes, how can I help you” message. Message will save into the database.	Pass	
		Press the upload icon and upload an image or pdf.	Display the image or pdf uploaded. The image or pdf details will save into the	Display the image or pdf uploaded. The image or pdf details will save into the	Pass	

		system folder and database.	system folder and database.		
	<p>Didn't type anything and send the message. (send icon will show once there are keys in but if you the user spamming the backspace, it will show.)</p> <p>Input:</p> <p>Message field:</p> <ul style="list-style-type: none"> - 	Display “Please enter message” message.	Display “Please enter message” message.	Pass	
	<p>Press the upload button and upload a file which is not a pdf or image.</p>	Display “Only allow image and pdf file.” message.	Display “Only allow image and pdf file.” message.	Pass	
	<p>Input testing when the MOH staff try to create a FAQ.</p>	<p>Insert all required fields correctly and press the save button.</p> <p>Input:</p> <p>FAQ Title:</p>	Display “FAQ added successfully !” message.	Display “FAQ added successfully !” message.	Pass

		<p>What is COVID-19</p> <p>FAQ Category:</p> <p>About COVID-19</p> <p>FAQ Description:</p> <p>COVID-19 is</p> <p>Status:</p> <p>Active</p>			
		<p>Leave required fields blank while entering citizen details.</p> <p>FAQ Title:</p> <p>-</p> <p>(Same for other required fields)</p>	<p>Display ““Please enter the FAQ Title” message.</p>	<p>Display ““Please enter the FAQ Title” message.</p>	<p>Pass</p>
	<p>The MOH staff searched for FAQ in the FAQ listing.</p>	<p>Click the search button without providing criteria.</p>	<p>Show all the available FAQ records.</p>	<p>Show all the available FAQ records.</p>	<p>Pass</p>

	<p>Find existing FAQs using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>FAQ Title:</p> <p>What is COVID-19</p> <p>Category:</p> <p>-</p> <p>Status:</p> <p>Active</p>	<p>Show the FAQ record that matches the criteria.</p>	<p>Show the FAQ record that matches the criteria.</p>	<p>Pass</p>	
	<p>Find non-existing FAQs using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>FAQ Title:</p> <p>What is COVID-20</p> <p>Category:</p> <p>-</p>	<p>Show a “No FAQ record found” label instead of showing the table</p>	<p>Show a “No FAQ record found” label instead of showing the table</p>	<p>Pass</p>	

		Status: Active			
	<p>Input testing when the MOH staff send notification to the all citizens</p> <p>Input: Notification subject: Free COVID-19 Test Notification content: There will be a free....</p>	<p>Select the “All” radio button and insert all details correctly and click the send button.</p> <p>Input: Notification subject: Free COVID-19 Test Notification content: There will be a free....</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to all citizens and the details will be saved into the database.</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to all citizens and the details will be saved into the database.</p>	Pass
	<p>Leave required fields blank while entering notification details.</p> <p>Input: Notification subject: - (Same for other required fields)</p>	<p>Show “Please enter the notification subject !” message.</p>	<p>Show “Please enter the notification subject !” message.</p>	Pass	

	<p>Input testing when the MOH staff send notification to the citizens based on category (example: Male, female)</p> <p>Input: Select the “Category” radio button , select the category, insert all details correctly and click the send button.</p> <p>Gender: Female</p> <p>Health Status: All</p> <p>State: All</p> <p>Age 1 - 100</p> <p>Notification subject: Free COVID-19 test for female</p> <p>Notification content: There will be a free....</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to female citizens and the details will be saved into the database.</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to female citizens and the details will be saved into the database.</p>	<p>Pass</p>	
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		<p>Leave required fields blank while entering notification details.</p> <p>Input:</p> <p>Notification subject:</p> <p>-</p> <p>(Same for other required fields)</p>	<p>Show “Please enter the notification subject !” message.</p>	<p>Show “Please enter the notification subject !” message.</p>	Pass	
	<p>Input testing when the MOH staff send notification to specific citizens.</p>	<p>Select the “Personal” radio button , select the citizen in the gridview, insert all details correctly and click the send button.</p> <p>Input:</p> <p>Selected citizen:</p> <p>LEE KOK KEN, SOO JI HO</p> <p>Notification subject:</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to the specific citizens and the details will be saved into the database.</p>	<p>Display “Notification Sent successfully !” message. The notification will be sent to the specific citizens and the details will be saved into the database.</p>	Pass	

		<p>Free COVID-19 test for female</p> <p>Notification content:</p> <p>There will be a free....</p>			
		<p>Leave required fields blank while entering notification details.</p> <p>Input:</p> <p>Selected citizen:</p> <p>-</p> <p>(Same for other required fields)</p>	Show “Please enter the notification subject !” message.	Show “Please enter the notification subject !” message.	Pass
		Select the citizen again which is already in the selected citizens list.	Display “This citizen has been selected !” message.	Display “This citizen has been selected !” message.	Pass
	The MOH Staff searches for notification in the notification listing.	Find existing notifications using specific criteria and click the “Search” button.	Show the notification that matches the criteria.	Show the notification that matches the criteria.	Pass

	<p>Input: Subject: Free COVID-19 Test Start Date: 01/10/2021 End Date: 31/10/2021</p>				
	<p>Find non-existing notifications using specific criteria and click the “Search” button.</p> <p>Input: Subject: Free COVID-12 Test Start Date: 01/10/2022 End Date: 31/10/2022</p>	<p>Show a “No notification record found” label instead of showing the table</p>	<p>Show a “No notification record found” label instead of showing the table</p>	<p>Pass</p>	

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Project Details			
Student's Name	SOO JI HO	Programme:	RSD3S1
Project Title	Traco COVID-19 Tracking System	Test Case No.	4
Module:	Vaccine management and application (author focus on vaccine management)	Reference No. (diagram)	
Actor(s)	Staff (Head admin and MoH staff)		
Pre-requisites¹:	1. The MOH staff needs to login to use the functionality of the messaging and vaccine management and application module. 2.		
Dependencies²:	1. - 2. -		

Test Case (Staff site)

ID	Test Description	Test Actions/Inputs	Expected Results	Actual Results	Pass/Fail	Remarks
	Input testing when a MOH staff insert a vaccine.	<p>Insert all details correctly and click the save button.</p> <p>Input:</p> <p>Vaccine name: Sinovac</p> <p>Manufactured by: Sinovac Sdn Bhd</p> <p>Number of dose: 2</p> <p>Day of range: 14</p> <p>Status: Active</p>	Show “Vaccine details inserted successfully !.” message. The vaccine record is added to the database.	Show “Vaccine details inserted successfully !.” message. The vaccine record is added to the database.	Pass	
	Leave required fields blank while entering citizen details.	<p>Input:</p>	Show “Please enter the vaccine name !” message.	Show “Please enter the vaccine name !” message.	Pass	

		Vaccine name: - (Same for other required fields)				
	Input testing when updating existing vaccine	Same as the adding part	Same as the adding part	Same as the adding part	Pass	
	The MOH staff searched for vaccines in the vaccine listing.	Click the search button without providing criteria. Find existing vaccines using specific criteria and click the “Search” button. Input: Vaccine name: Sinovac Manufactured by: - Number of dose: - Day of range:	Show all the available vaccine records. Show the vaccine record that matches the criteria.	Show all the available vaccine records. Show the vaccine record that matches the criteria.	Pass	

	<p>-</p> <p>Status:</p> <p>Active</p>				
	<p>Find non-existing vaccines using specific criteria and click the “Search” button.</p> <p>Input:</p> <p>Vaccine name:</p> <p>Pinovac</p> <p>Manufactured by:</p> <p>-</p> <p>Number of dose:</p> <p>10</p> <p>Day of range:</p> <p>-</p> <p>Status:</p> <p>Active</p>	<p>Show a “No vaccine record found” label instead of showing the table</p>	<p>Show a “No vaccine record found” label instead of showing the table</p>	<p>Pass</p>	

5.4 Chapter summary and evaluation

In this chapter, the author and his partner have performed the implementation of the system. The author and his partner also check the software and hardware requirements needed by the system. Next, the author also listed out the code snippets which are complex and explain it in this chapter. Lastly, the author performs testing to the system to ensure the system is error free.

The problem faced by the author in this chapter is that some testing is unable to perform due to some circumstances. The system is run on the localhost and not tested in the real-world environment so the author cannot guarantee the system is 100% error free. To solve the problem, the author performs multiple tests to make sure the system is error free and able to work in the real-world environment.

Chapter 6

Discussions and Conclusion

6.1 Summary

The COVID-19 pandemic has brought large losses and damages to Malaysia. To overcome the losses and damages, some organizations have developed the COVID-19 tracking system to manage the COVID-19 pandemic in Malaysia. MySejahtera, a mobile application developed by the collaborations of multiple ministries in Malaysia has been used daily for the Malaysian to check-in location, get notifications, register for vaccines and more. There are also some websites like Livephotos, COVID-19 Malaysia and more that provide up-to-date news about COVID-19 pandemic and statistics for the Malaysians.

Although these systems have developed to overcome the COVID-19 pandemic, the author and his partner find out there are some problems in these existing systems. For MySejahtera, the app has limited functionality and time-consuming process. For example, the staff needs to send notification manually, no online messaging and FAQ function, and more. Moreover, the Sejahtera app has poor management on the COVID-19 pandemic. For example, the health status can be decided by the citizen by completing a survey manually. If the citizen is not honest and fakes the result then the health status of the citizen will always be “Low”. Next, there is no warning before the citizen enters a high-risk location when the citizen is scanning the location QR code. The citizen will only know he/she is entering a high-risk location after he/she scans the location QR code and the check-in details are recorded. Furthermore, there is no deny check-in if an infected or suspected citizen scans the location QR code and enters a specific location. For websites like Livephotos and COVID-19 Malaysia only provide information of COVID-19 pandemic and have no other functionality. Besides that, there are some poor layouts in these websites which increase the dissatisfaction of users and make the content harder to read.

To solve the problem stated above, the author and his partner have come up with a different solution and plan to develop a new COVID-19 tracking system which is the Traco COVID-19 tracking system. The proposed system has kept the core functions of the existing system and added new functionalities which can solve the existing problems.

First, the proposed system has automated most of the notification process efficiently and effectively. If a PCR record of an infected citizen is recorded in the proposed system, the proposed system will automatically send the notification to the infected citizen to notify the citizen is infected of COVID-19 and also find the suspected citizen who went to the places where the infected citizen went in the past three days and sent a notification automated to them to tell them about they are suspected to be infected of COVID-19. The automation process has reduced the workload of the staff and avoided the problem of human-error such as forget to send or send missed.

Moreover, the proposed system provides better management. For example, the proposed system will ask confirmation if the citizen scans a high-risk location QR code. The citizen can know that he/she is entering a high-risk location and decide he/she wants to continue to proceed to the high-risk location. The check-in record will be recorded if the citizen chooses to proceed to the high-risk location. Next, there will be a deny check-in if there are any infected or suspected citizen scan the location QR code which is not industry type of “Hospital/Health Care” and “Hospitality”. The staff also can view and search the citizens who are suspected and infected in the proposed system and decide to make some punishment. Furthermore, the health status of the citizen is decided by the proposed system and the staff. The proposed system will automatically change the health status of the citizen to “Infected” if the citizen PCR record is positive and find all the suspected citizens and change their health status to “Suspected”. The staff also can manually change the health status of the citizen if there are any special cases or situations. This can ensure the health status of citizens is always accurate and avoid the citizens changing their health status by themselves.

Lastly, the proposed system provides a user-friendly interface for the users. The author and his partner have used soft colour and provide sufficient spaces for each content for the proposed system to ensure the system is comfortable to use and read for the users. The design of the web pages also follows the design of most web pages in the internet to ensure consistency and make the proposed system easier to learn and use by the users.

6.1.1 Justification of the choices of tools used

Google Chrome

Google Chrome is a popular web browser in the world. Based on some research, Google Chrome is the most used web browser in the world and 65.27% of web users are using chrome (OBERLO, 2021). The author and his partner mostly test and view the proposed system on Google Chrome as most of the web users are using it. Besides that, the author and his partner also used Google Chrome to gather information of COVID-19, existing tracking system, type of contact tracing and more. Furthermore, the author also used Google Chrome to find ideas and solutions to solve the bugs of the system, add new functionalities, code improvements and more during the development stage. Next, the inspect mode of Google Chrome also brings huge help to the author as the author can check the CSS and JavaScript code through there if there are any problems.

Microsoft Visual Studio 2019

Microsoft Visual Studio 2019 is an integrated development environment (IDE) from Microsoft. It can be used to develop computer programs, web applications, mobile applications and more. It also support multiple programming languages such as C#, Visual Basic, Python and more. The reason that author is using it is because it is free and provides multiple features. It already included database features which help the author don't need to find extra database tools and the NuGet package features have listed up-to-date packages or API which helped the author to save more time without searching the extra package on the internet and install the packages manually.

NotePad++

NotePad++ is a popular source code and text editor. It supports a large number of file types and programming languages. The NotePad++ is free and it requires less processing power and storage. The author had used it to inspect CSS file, SQL file, and the VB file without opening it with Visual Studio as inspecting code using NotePad++ is faster and more convenient. NotePad++ also supports tabbed editing which allows the author to open multiple files for checking and editing.

Microsoft Word 2019

Microsoft Word 2019 is a popular word processing software developed by Microsoft. The author had used it to write up all the system documents. The reasons for using it are the author is familiar with this software and it provides multiple features.

6.1.2 Techniques and methodologies

Stored procedures

Stored procedure is a set of SQL statements with an assigned name and can be runned by calling the assigned name. The author had used the stored procedure to write complex SQL queries for the system. Stored procedures have helped to reduce complexity of writing complex SQL queries and it is easier to view the SQL queries.

6.2 Achievements

6.2.1 Project achievement

The Traco COVID-19 tracking system had achieved the objectives set during the introduction of the project. (Refer to 1.1 at Chapter 1: Introduction)

Firstly, the proposed system provides better management over the COVID-19 pandemic. The proposed system has provided functionalities that help to manage the COVID-19 for the citizen and staff for example, the location tracking, personal health status, check-in location, notification, enquiries and more. The citizens can have better knowledge about the COVID-19 through reading the FAQs from our proposed system and start to be aware of how to avoid infection of COVID-19. The personal health status will always show in the homepage, the citizen can always view their personal health status anytime and check that he/she is safe, suspected or infected. The personal health status is managed by the staff or the proposed system automatically to make the health status accurate and avoid any fake and dishonest result. Next, a confirmation will be displayed to the citizens if they are entering a high-risk location. This helps the citizens to be aware that they are entering a high-risk location, they can choose to not continue to proceed and if proceed, they can be more cautious as they already know that the entering location is a high-risk location. Besides that, there will be a deny check-in for the suspected or infected citizen who scans the location QR code. The details of the suspected or infected citizen who try to perform location check-in will be sent to the staff and the staff can try to do some action.

Next, the proposed system eliminates inefficient processes. Some of the tasks have been automated or systematic to reduce the workload of the staff. The proposed system will automatically send notification to the infected citizen if there is a positive PCR record uploaded to the system. The staff doesn't need to call the infected citizens by phone to notify them, everything will be done by the proposed system. Next, the chat and FAQs function have helped to eliminate the hotline calling process. The citizens find the answer through the FAQs or chat with the staff to get their answer or solution through the proposed without calling the hotline provided in the website. This helps the citizen to save more time as calling the hotline there might be a chance of a missed call and the citizens are required to call again.

Furthermore, the proposed system provides a better user experience and interface. The proposed system has combined the core functionalities of the existing systems which make the proposed system familiar to the users and the users can learn to use the proposed system faster. Other than that, the proposed system also follows the design of most websites on the internet to ensure consistency to make the proposed system easier to use for the users. For example, the notification and profile icon are on the top and the navigation are on the left. Lastly, each content of the web pages have sufficient spaces and soft colour and make the content comfortable to read for the users.

6.2.2 Strength of the system

The strength of the proposed system is it provides automation processes but keeps some of the manual processes. As there will always be special cases in which the automation processes cannot do the task, keeping the manual processes can help the staff perform the task in the way they wish. For example, the notification to notify suspected or infected citizens will be sent automatically, if there are some specific notifications that the staff want to send, the staff can manually write the notification and choose which type of citizens to send.

The next strength of the proposed system is a web application. As long as the users' devices have a web browser and internet connection then the users are able to access the system. The Bootstrap CSS provides dynamic display for the laptop users and mobile users. The users are able access the system through mobile devices or PC devices which bring convenience to the users and provide flexibility.

6.3 Contributions

The contribution of the proposed system is to help reduce the cases of COVID-19 in Malaysia. As the proposed system will ask confirmation after the citizen scans a high-risk location QR code, this will help to create an awareness to the citizen that he/she is entering a high-risk location. If the citizen is too dangerous to enter then he/she can choose to leave else the citizen can proceed to the location cautiously. Next, there will be a deny check-in for the infected or suspected citizen who scans the location QR code. This can help to avoid the spread of the virus in the specific area as the frontliner or guard will not allow these citizens to enter as the check-in is denied. The details of citizens who have been denied check-in will be sent to the staff and the staff can check the record and put some punishment on these citizens. This helps to deter the general public from committing the crime and the public will start to follow the rules properly.

Next, the proposed system helped to reduce the workload of the MOH staff and hospital staff. The proposed system automates most of the time-consuming processes which make the staff have more time to focus on other important tasks such as increasing the number of PCR tests, taking care of the infected citizen, organizing more PCR test events. The automation process also can help to reduce human error as the system will run everything correctly based on the procedure, unlike humans who will sometimes get distracted and perform the task incorrectly.

Besides that, the proposed system provides accurate health status and increases health quality for the citizens. The health status of the citizens now is decided by the system automatically and the staff can change it if there are special cases, the citizens are not able to change the health status by themselves and make the health status of the citizen more accurate. The citizens also can view their health status anytime in the homepage of the proposed system. Once a positive PCR record is uploaded to the system, the system will immediately update the status of the infected citizen as well as the health status of the suspected citizen. After that, the system will send a notification to inform these citizens that their health status has changed. The citizens are able to know their change of health status in a short time and go to the hospital immediately for treatment or perform a PCR test.

Other than that, the proposed system has comprehensive functions. The proposed system has combined the core functionalities of different existing systems such as vaccination, record check-in, view COVID-19 statistics, etc, and added new functionalities such as online chat, deny check-in, FAQs and more. The author and his partner believe that the proposed system will more likely be used by the citizens as the existing systems have limited functionalities and the citizens need to switch systems to use the core functionalities of different existing systems. For example, for check-in location purposes, the citizens will use MySejahtera, for viewing COVID-19 statistics, the citizens will use LivePhoto. Using the proposed system, the citizens can use all the functionalities mentioned above with the system without switching one to another.

6.4 Limitations and future improvements

6.4.1 Limitations

There are some limitations in the proposed system. Functions like location check-in works in theory but can't be fully tested as it requires mobile phones to scan the QR code to check-in into the locations. Currently the author and his partner manually enter the link in which the QR code is representing to simulate the check-in process. Next, the proposed system is only tested in localhost but not tested in the real work environment. The author and his partner cannot guarantee that the proposed system can work well in the real-world environment.

The second limitations of the proposed system is the system cannot support IOS and Linux devices as the proposed system is developed with .NET framework which only supports Windows devices. This problem can be solved using the newest .NET Core but the .NET Core only supports C# and the author and his partner are not familiar with C# and didn't know how the .NET Core worked.

6.4.2 Future improvements

There are some additional functions that the author wishes to add to the proposed system but due to issues like time constraints.

The improvements that can be made in the future are:

1. Location check-out

The MySejahtera application has made some improvements since last the author analysed it. One of the improvements is that it had added location check-out for the system. But the location check-out of MySejahtera is quite imperfect as the citizens always forget to perform check-out after check-in the location. The author wishes to add a location check-out function that will show confirmation to ask the citizen to perform check-out for the previous location after the citizen scans a new location QR code. Next, the system will inform the citizen that there are locations that haven't been checked-out every 2 hours.

2. Check-in setting

Currently, the check-in function is not dynamic as the check-in procedure is coded in the backend. The author wishes to add a check-in setting for the staff which can let the staff to set the setting for the check-in. The default setting will allow all citizens that are not infected and suspected to perform check-in for the location and the staff can change the check-in setting based on industry type. For example, industry types of restaurants only allow citizens who perform 2-dose vaccination to perform check-in.

3. Search and show location status with Google Map

The proposed system currently only allows the staff to check location status and the location details are shown in text-form without a Map. The author wishes to add a Google Map which allows the citizen and staff to search for location and display the location status in the Map.

6.5 Problems and solutions

6.5.1 Problems faced during the planning stage

The problem that the author faced during the planning stage is finding system requirements. There are quite less of COVID-19 tracking systems in Malaysia, which made it harder for the author to find the requirements of the systems at that time.

6.5.2 Solutions for problem faced during the planning stage

The solution that the author had taken is researching COVID-19 tracking systems of other countries. The author can compare the COVID-19 tracking system of different countries and find out what are core requirements needed and what functionality that the COVID-19 tracking system in Malaysia lacks.

6.5.3 Problems faced during the literature review

The problem that the author faced during the literature review is there are quite less articles about the COVID-19 tracking system. The COVID-19 tracking system only developed recently to face the COVID-19 pandemic, many researchers are still researching the COVID-19 tracking system. Next, not all the related articles are free and the author is not planning to purchase any articles due to lack of financial support.

6.5.4 Solutions for the problems faced during the literature review

The solution to solve the problem is for the author to take more extra time to search for the research papers and try to search for any related articles from different sources such as ResearchGate, Google Scholar and more.

6.5.5 Problems faced during the analysis stage

The problem that the author faced during the analysis stage is designing the questionnaire to gather the requirements from the Malaysia citizens. The author and his partner have to make sure the questionnaire is not too long and it is simple to understand to make sure to increase the response rates.

6.5.6 Solutions of the problems faced during the analysis stage

The solution to solve the problem is the author and his partner insert more close ended questions as these types of questions are quite easy to answer and ensure the questions asked are able to gain useful information for the analysis stage.

6.5.7 Problems faced during the design stage

The problem that the author faced during the design stage is designing the class diagram of the proposed system. The author and his partner needed to define the entity of the proposed system at that time and they revealed that they missed some of the entities during the coding stage.

6.5.8 Solutions for the problems faced during the design stage

The solution to solve the problem is the author and his partner discuss together and keep changing the class diagram until it is correct.

6.5.9 Problems faced during the coding stage

The problem that the author faced during the coding stage is that the author is not good at designing UI. As the author is better at doing the back-end which makes designing web pages quite difficult for the author.

The next problem is developing the real time chat function. The author has never developed a real time chat function before and needs to do a lot of research on this function. After some research, the author finds out the references are provided in C# and the author needs to analyse the code and convert it into Visual Basic one by one. The chat function also uses JavaScript which the author is not familiar with and the author has to take time to learn it.

Besides that, the next problem faced is combining the modules of the author and his partner. As the author and his partner are developing the modules separately and database details are not the same. The author and his partner combine the file by uploading their own file to each other and cause some issues such as missing CSS and VB files, missing database details, files getting replaced and more.

6.5.10 Solutions for the problems faced during the coding stage.

The solution to solve the problem of designing the UI of the system is the author finds some UI templates as reference and tries to implement it to the proposed system. The author also used CSS provided by the Bootstrap which makes designing the UI become easier as there are already different styles defined in the Bootstrap CSS and the author doesn't need to create some styles.

The solution to solve the problem of developing the chat function is the author used extra time to do a lot of research and implement it step by step. The author also finds solutions from coding forums like Stack Overflow and follows the guidelines provided by the senior programmer to implement the chat function. Besides that, to convert the backend code from

C# to Visual Basic, the author used some code converters on the internet, these code converters are not 100% accurate but still very helpful to the author.

To solve the problem of combining the modules, the author will always keep a backup of his own files. If the system is combined and some files are replaced or missed, the author can get back his files from the backup folder and change it.

6.5.11 Problems faced during the testing stage

The problem that the author faced during the testing stage is that some testing cannot be performed due to the project being only deployed on localhost and with the ASP.NET form authentication. ASP.NET form authentication only allows one user to login to one device. This causes some problems when the author is testing the real time chat as ASP.NET form authentication only allows one login user in one device, switching account in a new tab will replace the previous account information.

6.5.12 Solutions for problems during the testing stage

To solve the problem, the author needs to temporarily disabled the ASP.NET form authentication and login with multiple users in one device to check if the real time chat is working. After testing finishes, the author will reactivate the ASP.NET form authentication.

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8. Appendices

8.1 Questionnaire

Questionnaire for COVID-19 tracking system

We are students from the Bachelor of Software System Development in TARUC. We are developing a COVID-19 tracking system for our Final Year Project.

This questionnaire is used to gather requirements and information regarding the COVID-19 tracking system from the respondents.

There are 20 questions and respondents will only take around 5 minutes to complete the form.

* Required

Have you used any COVID-19 tracking system (MySejahtera) before? *

- Yes
- No

[Next](#)

Figure 8.1: Questions in questionnaire (Q1)

Questionnaire for COVID-19 tracking system

Rate your satisfaction in using the existing COVID-19 tracking system? *

1 2 3 4 5

Very unsatisfied Very satisfied

What features you would want to have in the COVID-19 tracking system. *

Communication with staff
 Vaccination application
 Location recording
 Notification if suspected or been to high risk places
 Other: _____

Figure 8.2: Questions in questionnaire (Q2, Q3)

What features you would want to have in the COVID-19 tracking system.*

- Communication with staff
- Vaccination application
- Location recording
- Notification if suspected or been to high risk places
- Other: _____

What element you think is important that keep you from using the existing COVID-19 tracking system.*

- User-friendly interface
- Provide comprehensive functions
- Secure personal data management
- Other: _____

Figure 8.3: Questions in questionnaire (Q4, Q5)

Do you feel safe about your personal data being collected by the existing COVID-19 tracking system? *

1 2 3 4 5

Very unsafe

Very safe

Do you think the existing COVID-19 tracking system can help in provide information of the current situation? *

Yes

No

Maybe

Figure 8.4: Questions in questionnaire (Q6, Q7)

What is the purpose of using the existing tracking system? *

Know about the latest information of the COVID-19 statistics
 Record location you had been to
 Apply for vaccination
 View health status
 Other: _____

How responsive is the health status shown in the existing tracking system? *

1 2 3 4 5

Very unresponsive Very responsive

Where do you usually get the latest COVID-19 statistics from? *

COVID-19 tracking systems (MySejahtera)
 Websites (Livephotos)
 Social media (Facebook)
 Messaging apps (Whatsapp)
 Other: _____

Figure 8.5: Questions in questionnaire (Q8, Q9, Q10)

Rate the understandability COVID-19 statistics shown in the existing tracking system.*

1 2 3 4 5

Very hard to understand Very easy to understand

Do you think that the staff or the system itself can decide or make changes to your health status *

Yes

No

Maybe

Do existing COVID-19 tracking systems notify you before entering high risk locations? *

Yes

No

Figure 8.6: Questions in questionnaire (Q11, Q12, Q13)

Do you prefer the COVID-19 tracking system to send you a notification before entering high risk locations? *

- Yes
- No
- Maybe

Do you think that it is hard for you to contact the staff with the existing tracking system? *

- Yes
- No
- Never contact the staff before

Do you wish to have an online messaging service in the COVID-19 tracking system to communicate with the staff? *

- Yes
- No
- Maybe

Figure 8.7: Questions in questionnaire (Q14, Q15, Q16)

Rate the reliability of the existing tracking system *

1	2	3	4	5	
Very unstable	<input type="radio"/> Very stable				

Is the health status shown in the existing tracking system useful for you? *

1	2	3	4	5	
Very useless	<input type="radio"/> Very useful				

What issue(s) you think will affect the usability of the tracking system? *

- Unresponsive health status
- Hard to communicate with staff
- No warning notification if suspected or been to high risk locations
- Poor user interface
- Other: _____

Any suggestions for us to develop a new COVID-19 tracking system?

Your answer

Figure 8.8: Questions in questionnaire (Q17, Q18, Q19, Q20)

8.2 User guide

8.2.1 Hardware and software requirements

The hardware requirement for the users' devices won't be too high. As long as it has normal equipment, camera support and browser, the system will work fine.

For the software requirements, the users need to have a standard operating system such as Windows, Android, and IOS and the version of operating systems cannot be too low to run the system. Besides that, any web browser can support HTML 5, latest Bootstrap CSS and JavaScript can be used for the system. Lastly, any software that can be used to scan QR code can be used for the system.

Table 8.1: Hardware requirements for client device

Hardware	Requirements
Processor	x64 or x86 dual-core processor with 1.9 GHz and above
Memory	2 GB of memory and above
Display	Display with a resolution of 1024 x 768 and above
Graphics	Processor integrated graphics and above
Storage	100 MB of free storage for installable web resources and web browser (like digital certificates, reports)
Network	Support WiFi or cellular network
Other components	(For mobile device) Camera for scanning location QR code when check-in

Table 8.2: Software requirements for client device

Software	Requirements
Operating system	<p>Desktop devices:</p> <ul style="list-style-type: none"> - Windows 7 and above <p>Mobile devices:</p> <ul style="list-style-type: none"> - Android 4.0 and above <p>IOS devices:</p> <ul style="list-style-type: none"> - IOS 6 and above
Web browser	<p>(Web browser which supports HTML5)</p> <ul style="list-style-type: none"> - Google Chrome - Microsoft Edge - Opera - Mozilla Firefox - Safari
Other software	QR scanner for scanning the location QR code when check-in.

8.2.2 Installation

No installation is needed for the Traco COVID-19 Tracking system. As long as the users have a browser and internet connection, they are able to access the system.

8.2.3 Operation document

Sample data:

Staff username: staff1234

Staff password: Asdf1234

Staff full name: staff1

Staff email: staff1@gmail.com

Citizen management module

Citizen site

1. Register

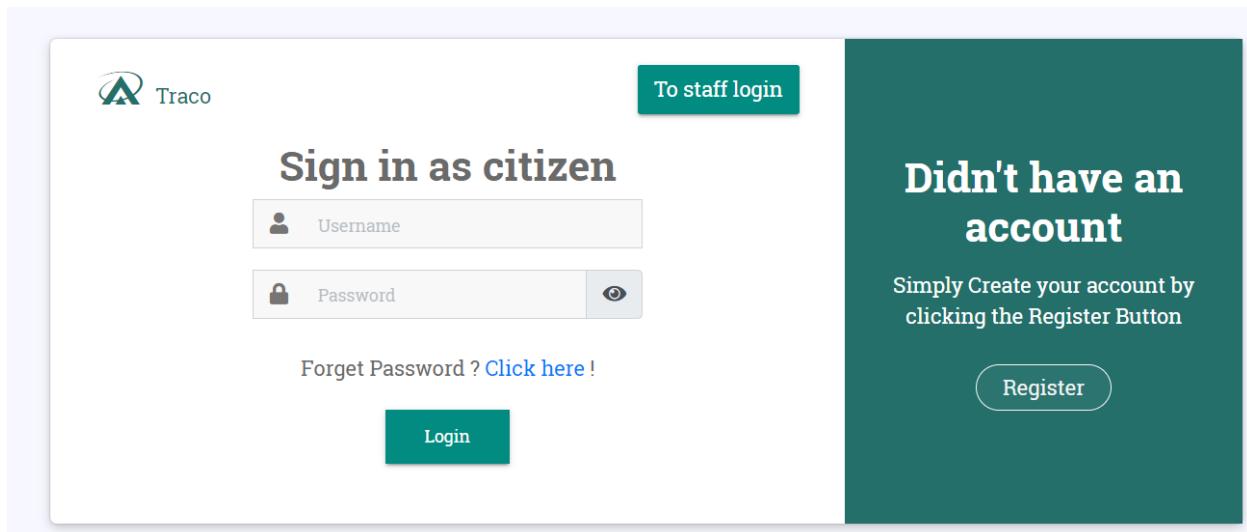


Figure 8.9: register guideline 1

If the citizens want to use the Traco COVID-19 tracking system, they need to register an account. To register an account, press the “Register” button on the right side.

The screenshot shows a registration form titled "Create an account". The form is divided into sections by horizontal lines. The first section is labeled "Personal information". It contains five input fields: "FullName:" with a red asterisk, "UserName:" with a red asterisk, "Password:" with a red asterisk, "Confirm Password:" with a red asterisk, and "Gender:" with a red asterisk. Below the "Gender:" label are three radio buttons: "Male" (selected), "Female", and "Others". The entire form is set against a teal background.

Create an account

Personal information

FullName: *

UserName: *

Password: *

Confirm Password: *

Gender: *

Male Female Others

Figure 8.10: register guideline 2

After the citizens click the register button, the registration form will pop up, the citizens are required to fill in the required fields which have a red asterisk at the fields.

The screenshot shows a registration form on a white background with a teal header and footer. At the top, it says "Traco COVID-19 Tracking System" and "Appendices". The form has three dropdown menus: "State : *" (set to "Kelantan"), "District : *" (set to "Kota Bharu"), and "Postcode : *" (set to "34978"). Below these is a checkbox labeled "I understand and agree with the Terms & Conditions" which is checked. A large teal button at the bottom is labeled "Register". At the bottom of the page, there is a link "Have already an account, login here !".

State : *

Kelantan

District : *

Kota Bharu

Postcode : *

34978

I understand and agree with the [Terms & Conditions](#)

Register

Have already an account, [login here !](#)

Figure 8.11: register guideline 3

After filling out all the required fields, the citizens need to agree to the system terms and conditions and click the “Register” button.

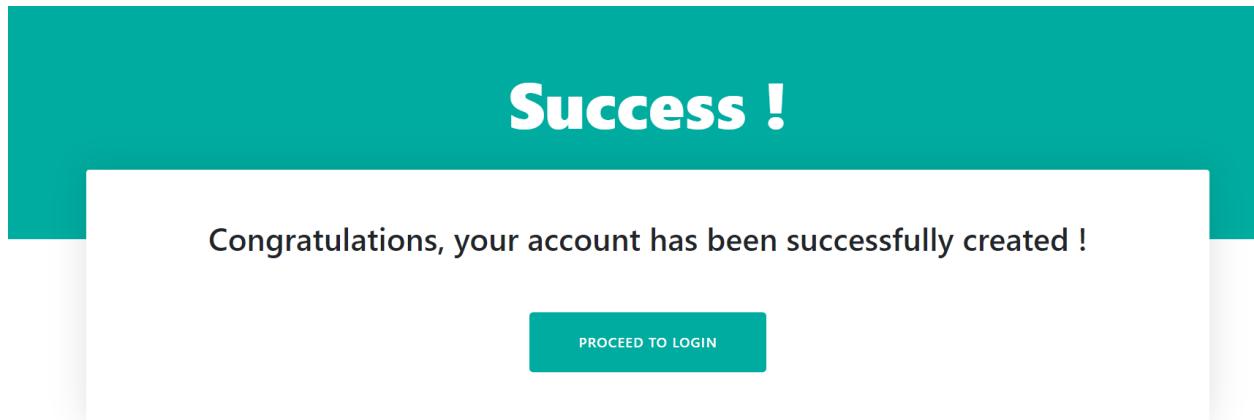


Figure 8.12: register guideline 4

If all the details entered are correct, the system will show a successful message to the citizens and the citizens can proceed to the login.

2. Login

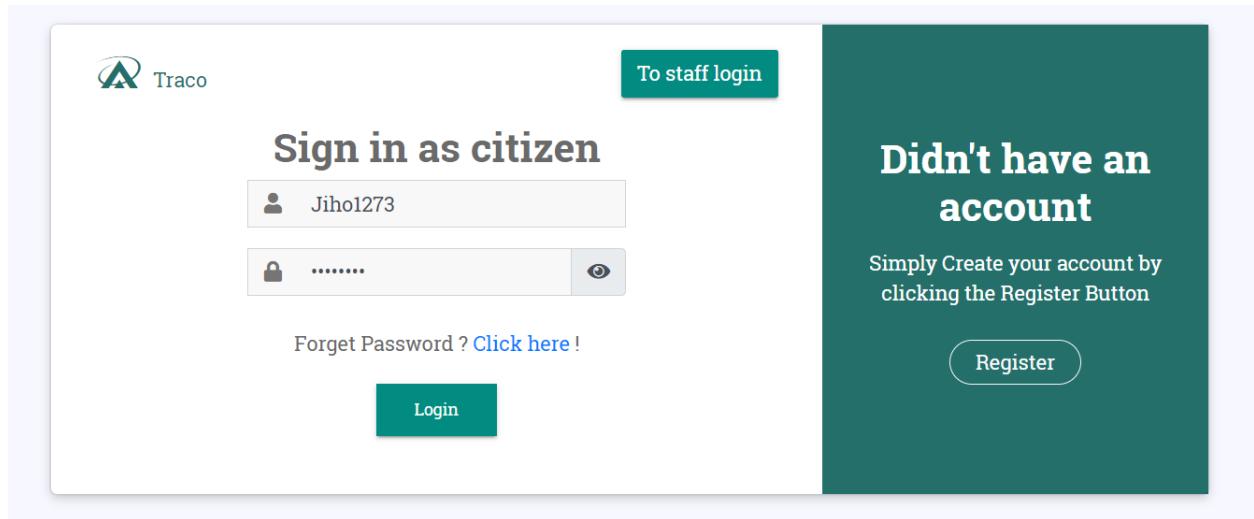


Figure 8.13: login guideline 1

To login to the system as a citizen, the citizens need to login at the citizen login. The citizens need to enter the correct username and password to login into the system. After filling in all the details, the citizens need to press the “Login” button.

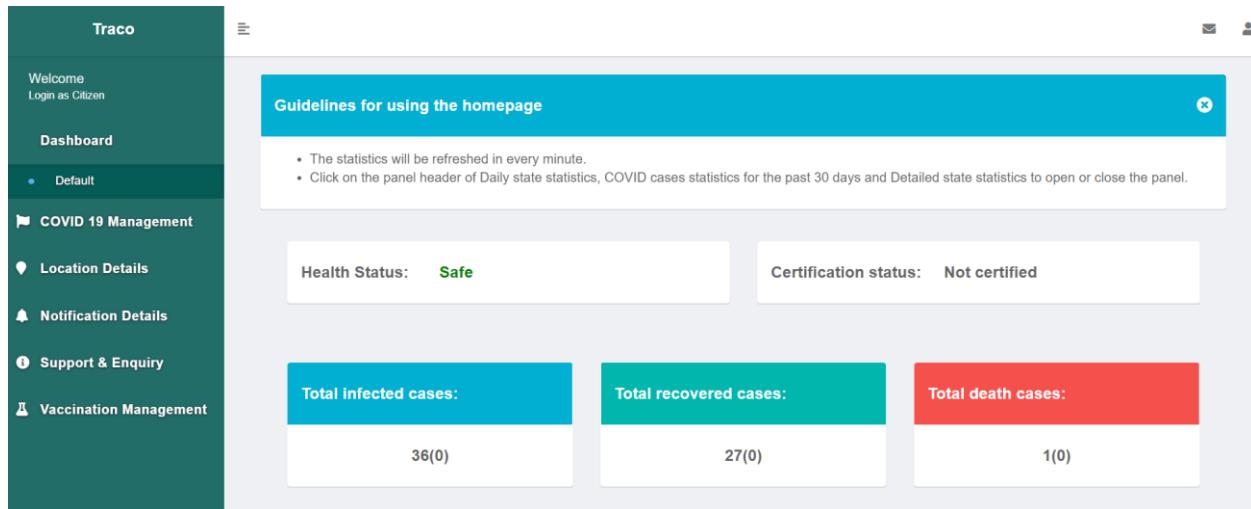


Figure 8.14: login guideline 2

If the login details are correct, the citizens will successfully login to the system and the citizens can start to use the system.

3. Forget password

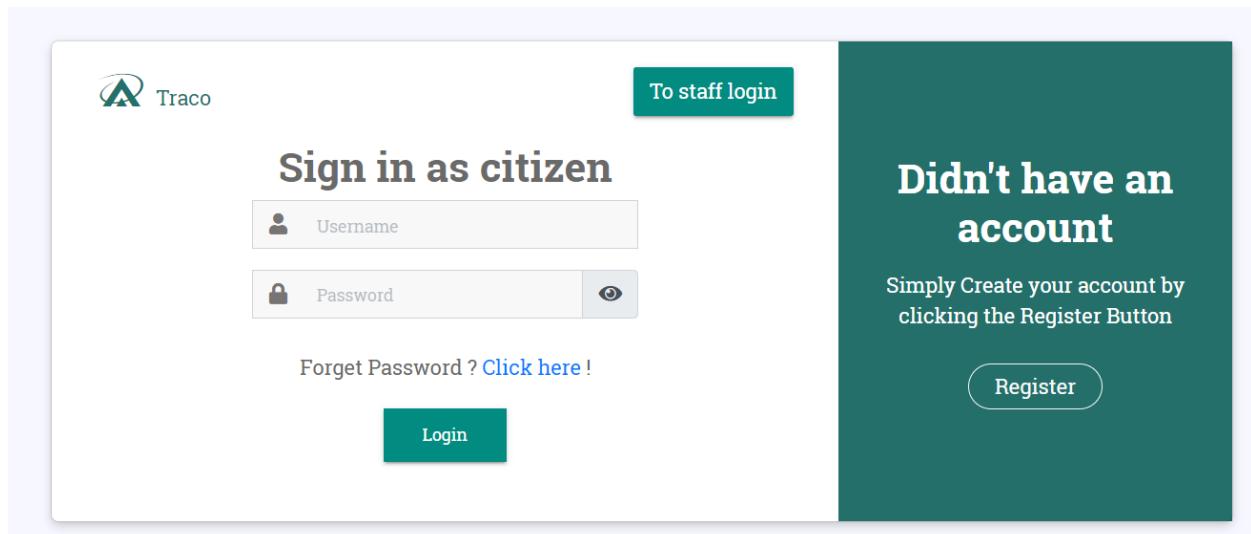


Figure 8.15: forget password guideline 1

If the citizens forget their password, they can click the “Click here” which is located at the top of the “Login” button.

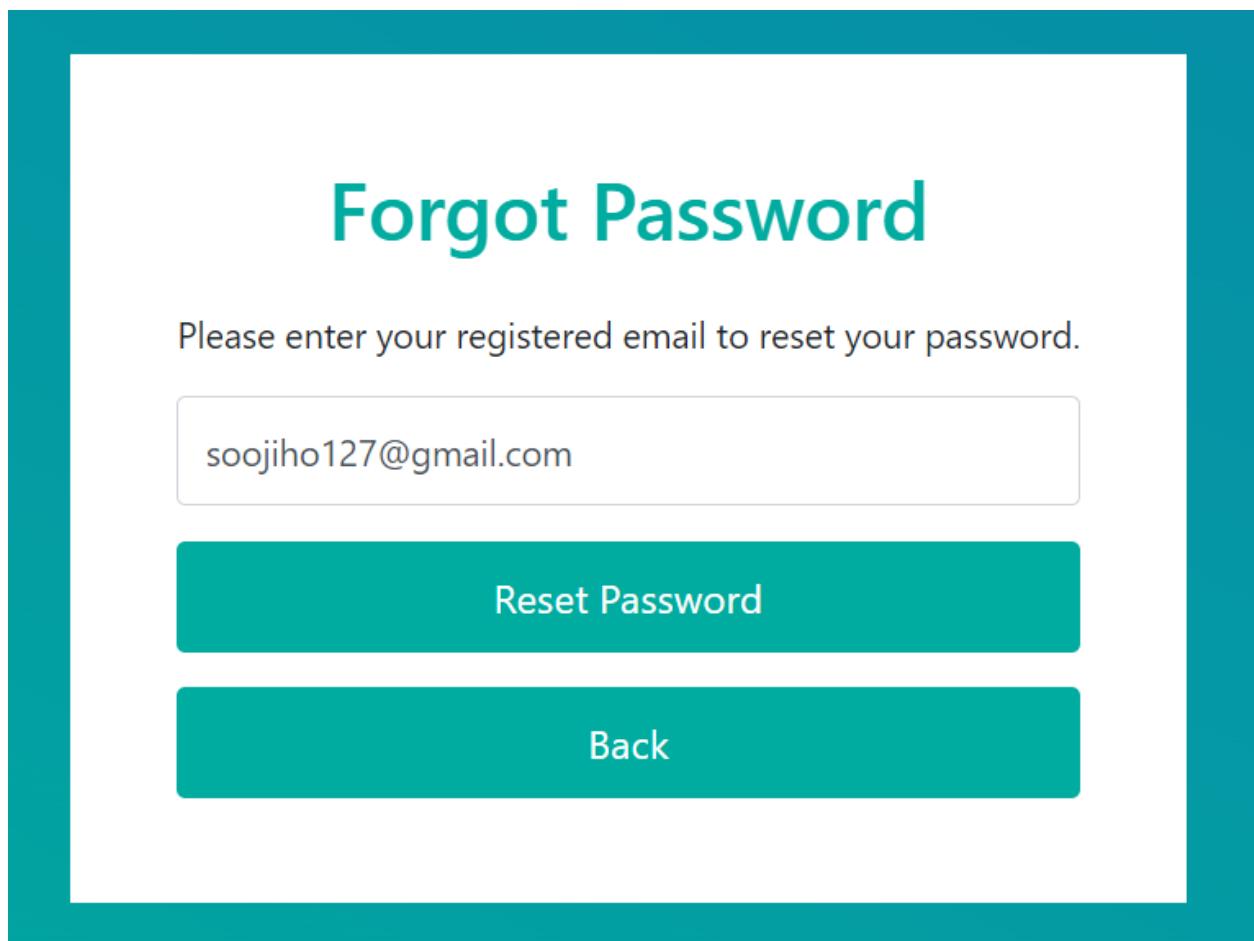


Figure 8.16: forget password guideline 2

The citizens will see the forget password form, the citizens need to write their registered email to reset the password.

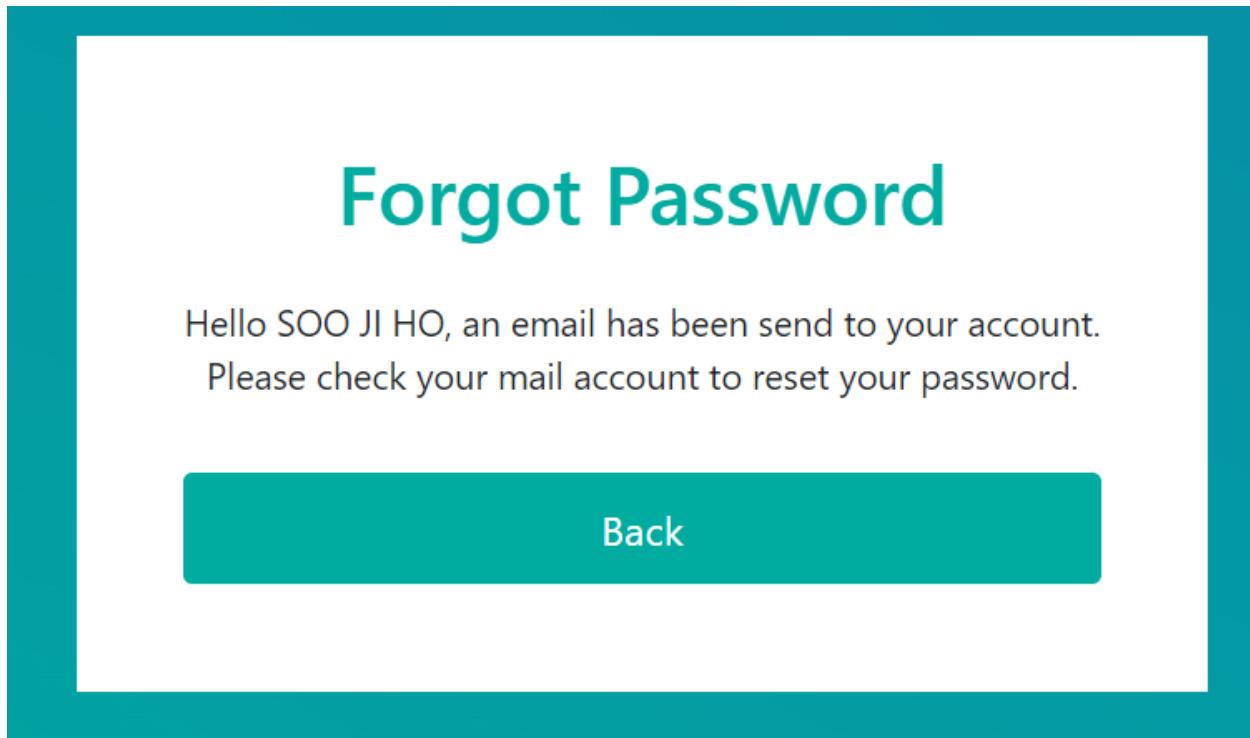


Figure 8.17: forget password guideline 3

If the entered email is correct, the system will send an email to the citizens' email account and the citizens need to check their email account for the link.

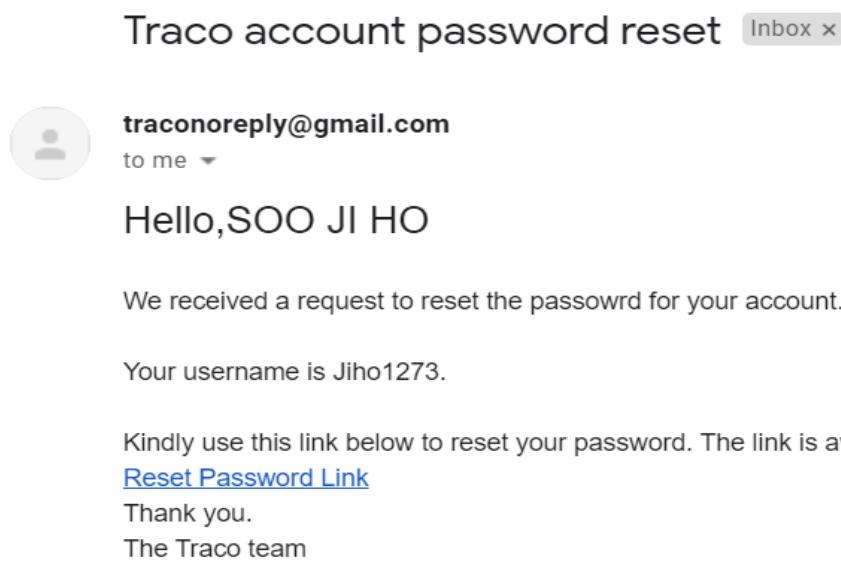


Figure 8.18: forget password guideline 4

In the email message, the citizens need to click the “Reset Password Link” to reset the password.

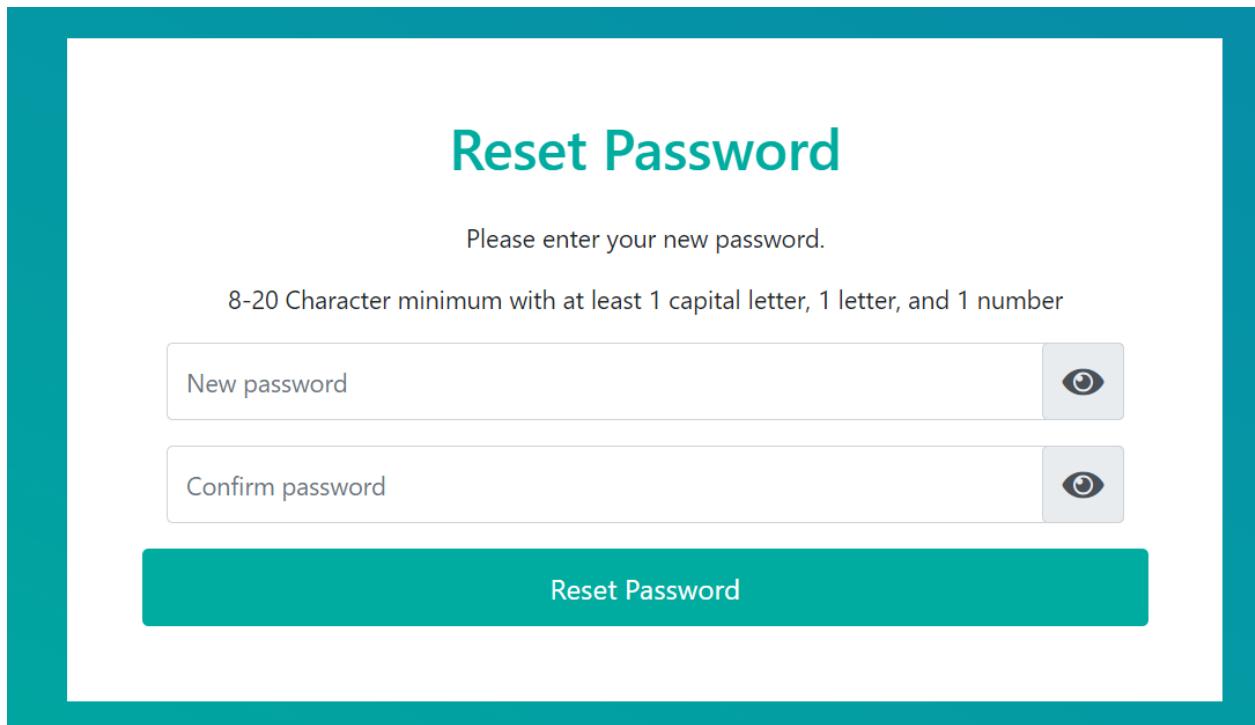


Figure 8.19: forget password guideline 5

After clicking the link, a reset password form will pop up and the citizens are required to enter the new password details to reset the password. After entering the new password and confirm password, the citizens need to click the “Reset Password” button.

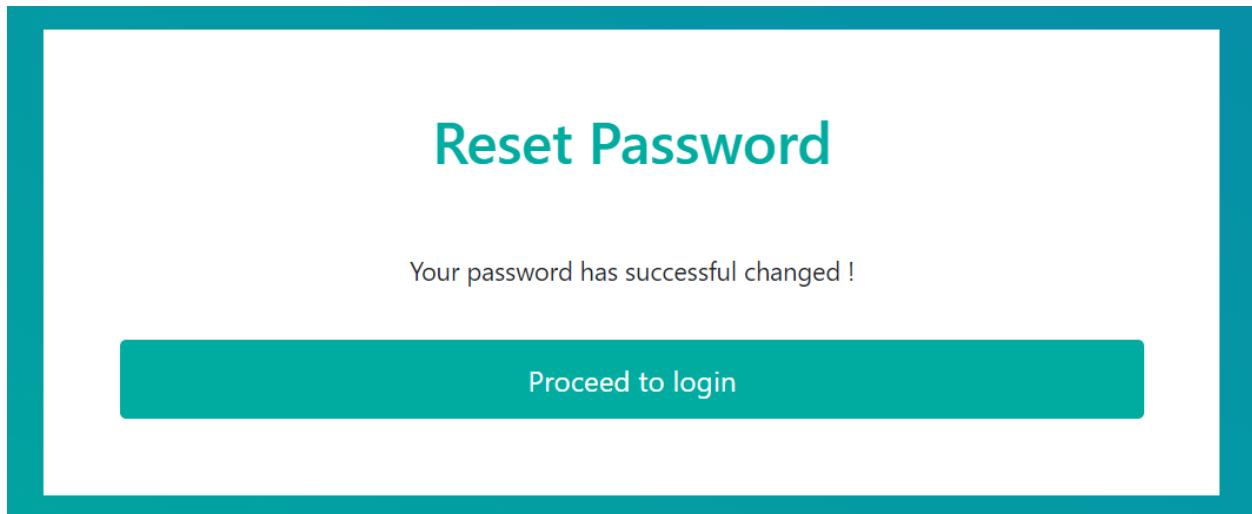


Figure 8.20: forget password guideline 6

If all the details are correct, a successful message will show to the citizens and citizens can proceed to login.

4. View profile

A screenshot of the Traco COVID-19 Tracking System's homepage. On the left is a dark green sidebar menu with options like "Welcome", "Login as Citizen", "Dashboard", "COVID 19 Management", "Location Details", "Notification Details", "Support & Enquiry", and "Vaccination Management". The main content area has a teal header bar with the text "Guidelines for using the homepage". Below this is a section with two status indicators: "Health Status: Safe" and "Certification status: Not certified". At the bottom are three colored boxes showing statistics: "Total Infected cases: 36(0)", "Total recovered cases: 27(0)", and "Total death cases: 1(0)". A small user icon and "Profile" link are visible in the top right corner of the main content area.

Figure 8.21: view profile guideline 1

If the citizens want to view their profile details, they must successfully login to the system and click the small user icon on the right top and click the “Profile” selection.

The screenshot shows the 'User Profile' section of the Traco COVID-19 Tracking System. It displays the following user information:

Health Status	Safe
Fullname	SOO JI HO
Username	Jiho1273
IC No.	001028147689
Email	soojiho127@gmail.com
Gender	Male
Phone No.	0173555006

Current Address

Address Line 1	53, Jalan Helang
----------------	-------------------------

Figure 8.22: view profile guideline 2

The user profile will show to the citizens and the citizens can view their details here.

5. Update profile

The screenshot shows the 'Update profile' section of the Traco COVID-19 Tracking System. It displays the following address information:

Address Line 1	53, Jalan Helang
Address Line 2	
Address Line 3	
Post Code	34978
State	Kelantan
District	Kota Bharu

Update profile

Figure 8.23: update profile guideline 1

If the citizens want to update their profile, they need to click the “Update profile” button which is located at the bottom of the user profile.

The screenshot shows the 'User Profile' section of the Traco COVID-19 Tracking System. At the top, it displays the health status as 'Safe'. Below this are input fields for 'Fullname*' (SOO JI HO), 'Username*' (Jiho1273), and a 'Change password' button. Further down are fields for 'IC No.*' (001028147689) and 'Email*' (soojiho127@gmail.com). A 'Gender*' section includes radio buttons for 'Male' (selected), 'Female', and 'Others'.

Figure 8.24: update profile guideline 2

After clicking the “Update profile” button, the system allows the citizens to edit their existing details.

The screenshot shows the 'Current Address' section of the profile update page. It includes fields for 'Address Line 1' (55, Jalan Helang), 'Address Line 2', 'Address Line 3', 'Post Code' (34978), 'State' (Kelantan), and 'District' (Kota Bharu). At the bottom are 'Save profile' and 'Cancel edit' buttons.

Figure 8.25: update profile guideline 3

After the citizens have finished changing the details, the citizens can click the “Save profile” button or “Cancel edit” button.

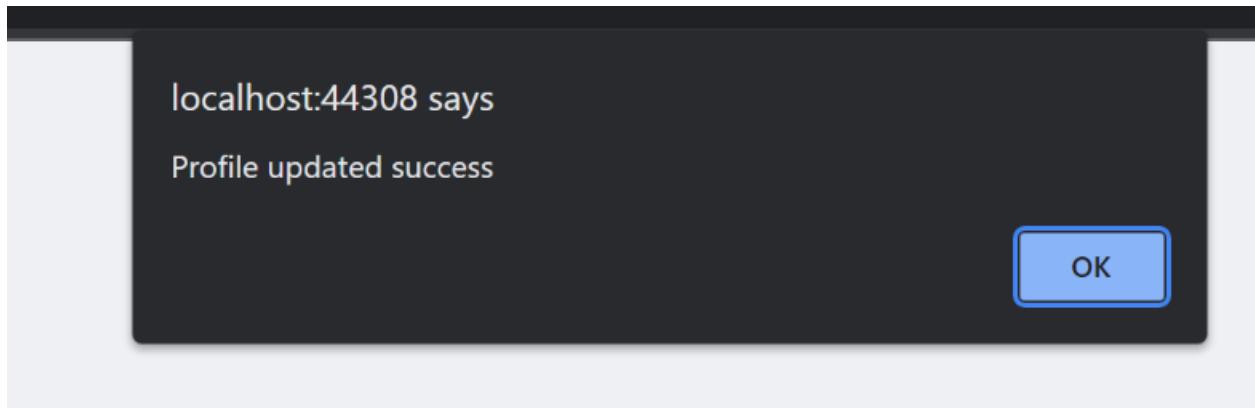


Figure 8.26: update profile guideline 4

If the citizens click the “Save profile” button and all the details entered are correct, the system will show a successful message and the profile details will be changed.

A screenshot of a web-based user profile page titled "User Profile". The page displays various personal information in a tabular format. The data is as follows:

Health Status	Safe
Fullname	SOO JI HAO
Username	Jiho1273
IC No.	001028147689
Email	soojiho127@gmail.com
Gender	Male
Phone No.	0173555006

Below this section, there is a heading "Current Address" followed by the address "Address Line 1: 55, Jalan Helang".

Figure 8.27: update profile guideline 5

The citizens can check that their profile is successfully updated.

6. Change password

The screenshot shows a 'User Profile' section. It includes fields for Health Status (set to 'Safe'), Fullname (SOO JI HAO), Username (Jiho1273), and several other personal details like IC No. and Email. A prominent teal-colored 'Change password' button is centered below the main profile information.

Figure 8.28: change password guideline 1

If the citizens want to change their password, they can change the password at the update profile page. In the update profile form, the citizens need to press the “Change password” button.

The screenshot shows a 'Change password' page. It features three password input fields: 'Current password*', 'New password*', and 'Confirm password*'. Each field has an accompanying eye icon for password visibility. Below the fields, a note states: 'Password should be more than 8 characters, with the mix of alphabetic, numeric characters and no special characters'. A teal-colored 'Change password' button is located at the bottom of the form.

Figure 8.29: change password guideline 2

A change password form will show to the citizens, the citizens need to enter the current password, new password and confirm password to change their password. After entering all the details, press the “Change password” button.

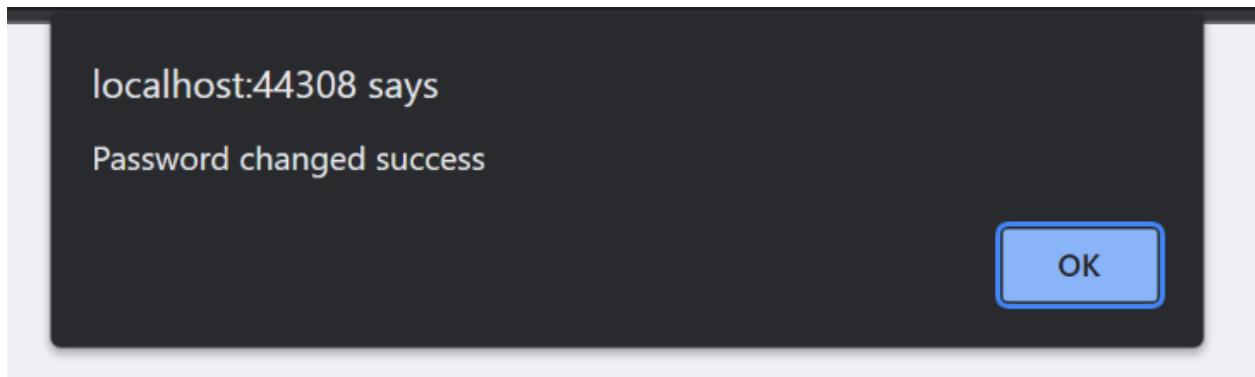


Figure 8.30: change password guideline 3

If all the details are correct, a successful message will show the citizens and the password will be changed.

Staff site

1. View citizen listing

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0

Figure 8.31: view citizen listing guideline 1

The staff need to login successfully to the system and click the “Citizen Management” at the left side of the system. Next, the staff click the “Citizen listing”.

Citizen Listing

Citizen Name	<input type="text"/>		
Occupation	<input type="text"/>		
Gender	<input type="text" value="All"/>	Health status	<input type="text" value="All"/>
Age Between	<input type="text" value="0"/>	-	<input type="text" value="100"/>
Search			

	Full Name	Phone No	Email	Gender	Age	Health Status
View	Citizen 1	0122344567	citizen1@gmail.com	Male	21	Safe
View	Citizen 10	0144742567	citizen10@gmail.com	Male	21	Infected
View	Citizen 11	0144742567	citizen11@mail.com	Female	21	Infected

Figure 8.32: view citizen listing guideline 2

The citizen listing will be shown, the staff can view the citizen listing.

Citizen Listing

Citizen Name	<input type="text"/>		
Occupation	<input type="text"/>		
Gender	<input type="text" value="Male"/>	Health status	<input type="text" value="Suspected"/>
Age Between	<input type="text" value="0"/>	-	<input type="text" value="100"/>
Search			

Figure 8.33: view citizen listing guideline 3

The staff can search for specific citizens, by entering and selecting the criteria. After that, the staff need to click the “Search button”.

The screenshot shows a search interface for citizens. At the top, there are dropdown menus for 'Gender' (Male) and 'Health status' (Suspected). Below these are input fields for 'Age Between' (0 to 100). A 'Search' button is located below the age range inputs. The results table has columns: Full Name, Phone No, Email, Gender, Age, and Health Status. One result is shown: Citizen 9, 0144742567, citizen9@gmail.com, Male, 21, Suspected. There is a 'View' link next to the name.

	Full Name	Phone No	Email	Gender	Age	Health Status
View	Citizen 9	0144742567	citizen9@gmail.com	Male	21	Suspected

Figure 8.34: view citizen listing guideline 4

After clicking the button, the citizens who match the criteria will show in the citizen listing.

2. View citizen details

The screenshot shows the details for Citizen 9. The table has columns: Full Name, Phone No, Email, Gender, Age, and Health Status. The data is: Citizen 9, 0144742567, citizen9@gmail.com, Male, 21, Suspected. There is a 'View' link next to the name.

	Full Name	Phone No	Email	Gender	Age	Health Status
View	Citizen 9	0144742567	citizen9@gmail.com	Male	21	Suspected

Figure 8.35: view citizen details guideline 1

In the citizen listing, the staff need to click the view of a specific citizen.

Citizen Profile

User Name	citizen9
Full name	Citizen 9
IC NO	081078102368
Email	citizen9@gmail.com
Phone No	0144742567
Age	22
Gender	Male

Figure 8.36: view citizen details guideline 2

Then, the full details of the specific citizen will be shown and the staff is able to view it only.

Location module

Citizen site

1. Register location and generate location QR code

The screenshot shows the citizen interface of the Traco COVID-19 Tracking System. On the left, a dark sidebar lists various modules: Welcome, Dashboard, COVID 19 Management, Location Details, Notification Details, Support & Enquiry, and Vaccination Management. The 'COVID 19 Management' section is expanded, showing 'Location Details' as the active item. The main content area has a teal header 'Guidelines for using the homepage'. Below it, a box indicates 'Health Status: Safe' and 'Certification status: Not certified'. At the bottom, three boxes show statistics: 'Total Infected cases: 36(0)', 'Total recovered cases: 27(0)', and 'Total death cases: 1(0)'. The overall design is clean with a white background and blue/teal accents.

Figure 8.37: register location and generate location QR code guideline 1

The citizens need to successfully login first. Then, click the “Location Details” at the left side and click the “Location registration” selection.

The screenshot shows a 'Location Profile' form. It consists of several input fields with red asterisks indicating they are required:

- Location Name*
- Location Address*
- State : *
- District : *
- Postcode*

The form is presented in a light gray box with a white background, and each field has a corresponding input box to its right.

Figure 8.38: register location and generate location QR code guideline 2

A location form will pop up and the citizens need to enter the required fields.

The screenshot shows a registration form for a location. It includes fields for State (selected as Melaka), District (selected as Alor Gajah), Postcode (34221), and Industry Type (selected as Restaurants). Below the form are two buttons: 'Cancel' and 'Submit'.

State :	Melaka
District :	Alor Gajah
Postcode*	34221
Industry Type : *	Restaurants

Cancel Submit

Figure 8.39: register location and generate location QR code guideline 3

After filling in all the details, the citizens can choose to click the “Cancel” button or “Submit” button.

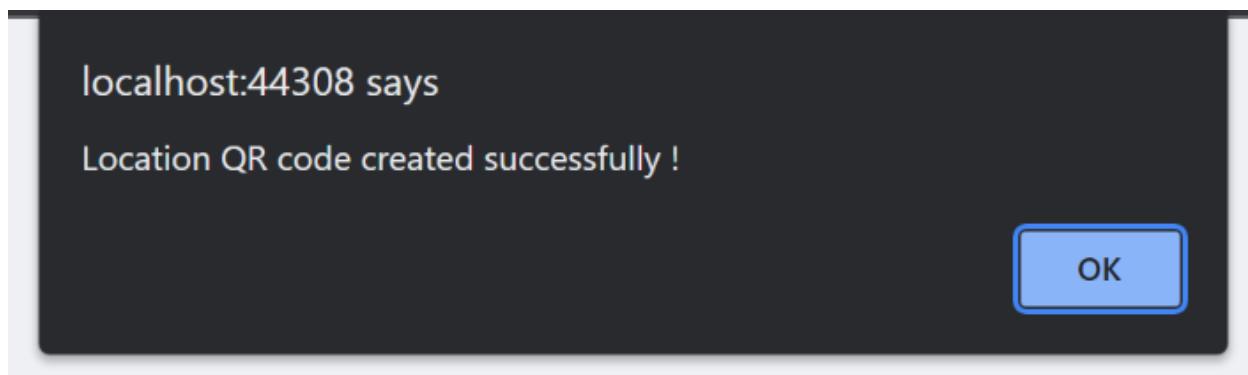


Figure 8.40: register location and generate location QR code guideline 4

If the citizens click the “Submit” button and all the details are correct, the system will send a successful message to the citizens.

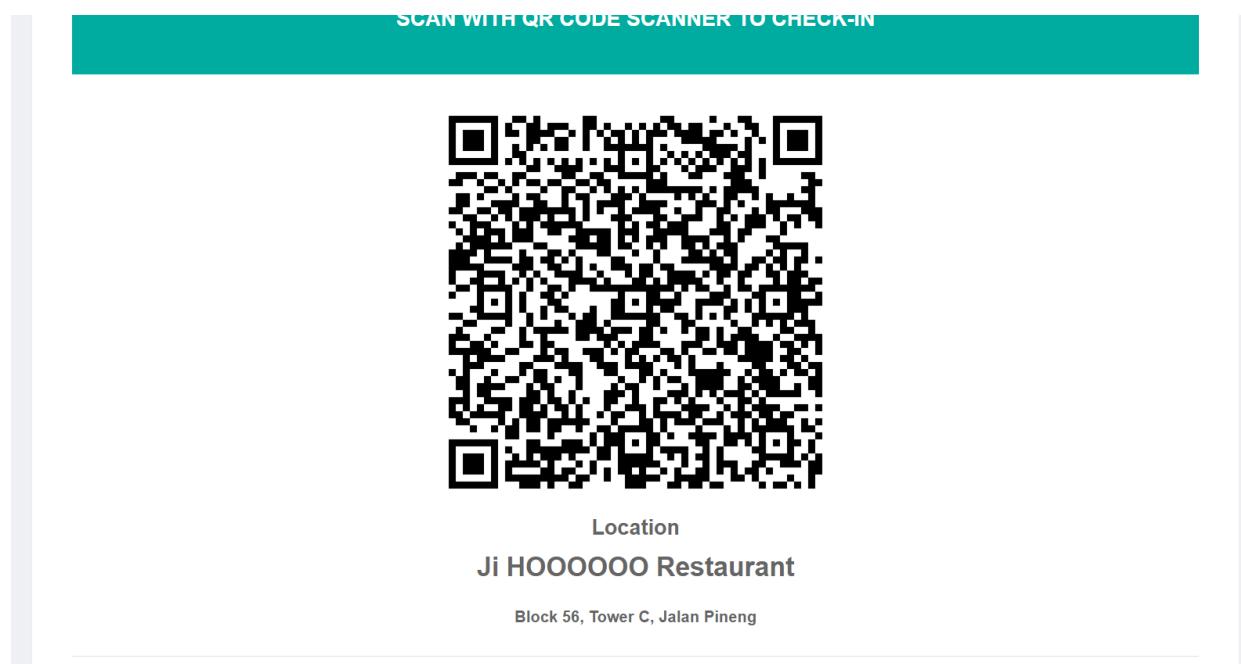


Figure 8.41: register location and generate location QR code guideline 5

Next, the system will show the location QR code to the citizens.

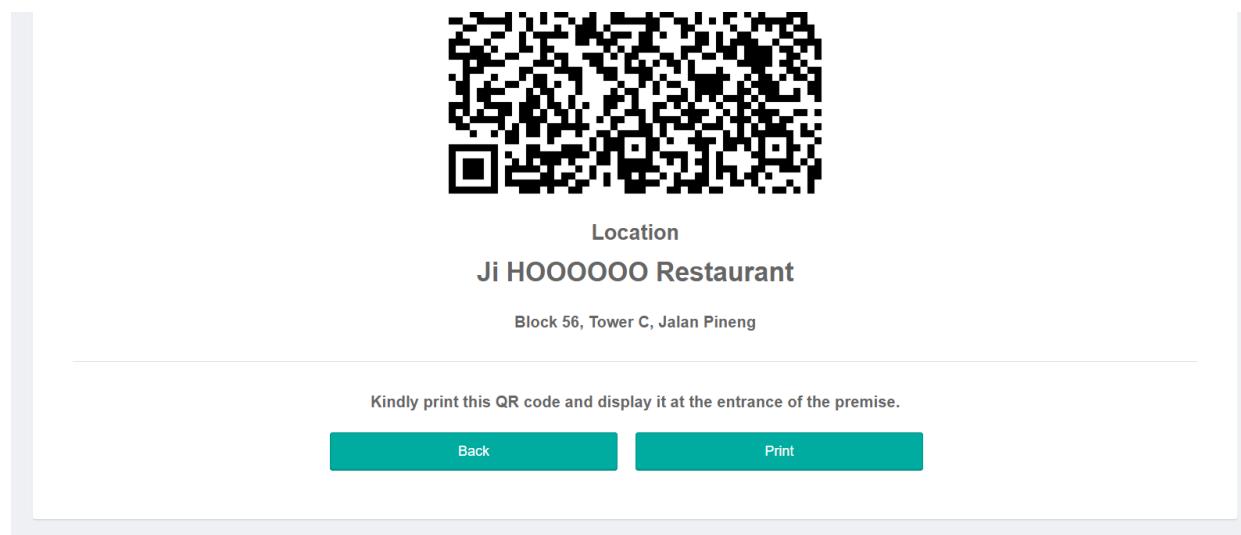


Figure 8.42: register location and generate location QR code guideline 6

The citizens can choose to print the location QR code by clicking the “Print” button on the bottom of the location QR code.

2. View registered location

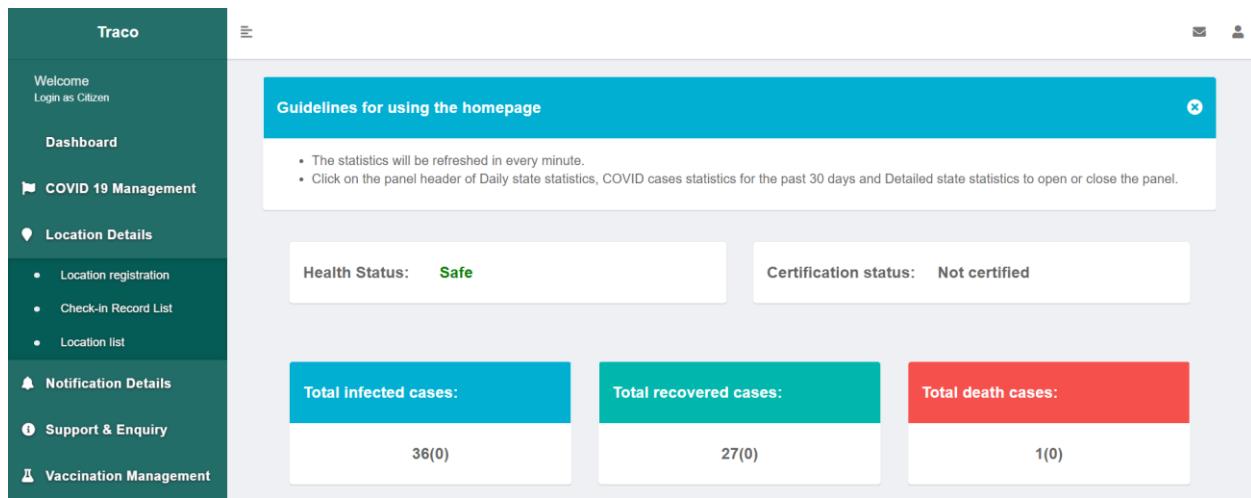


Figure 8.43: view registered location guideline 1

The citizens need to successfully login first. Then, click the “Location Details” at the left side and click the “Location list” selection.

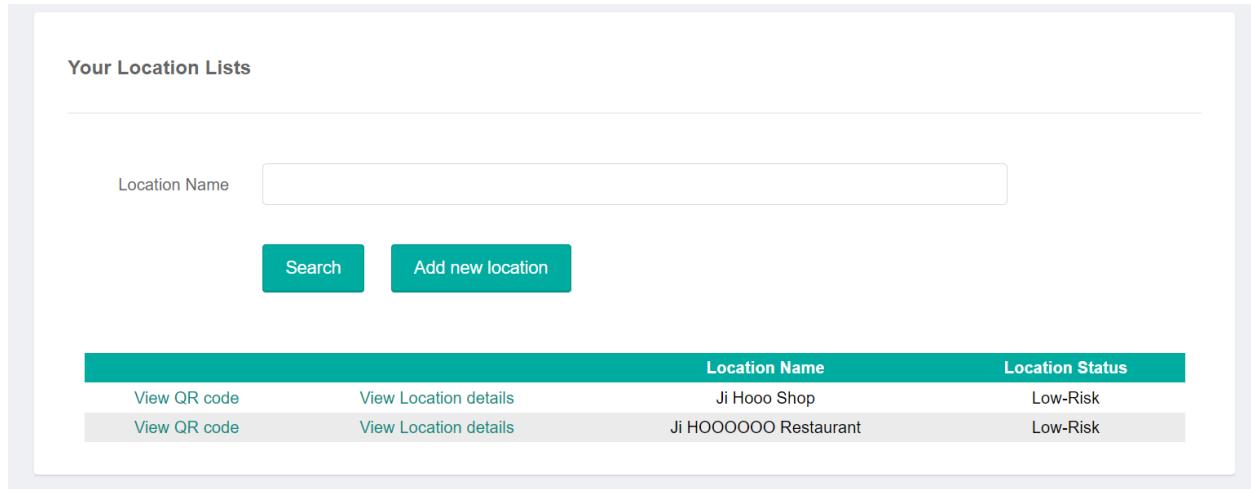


Figure 8.44: view registered location guideline 2

A location listing will show to the citizens and the citizens can view all of their registered locations. If the citizens want to add a new location, they can press the “Add new location” button.

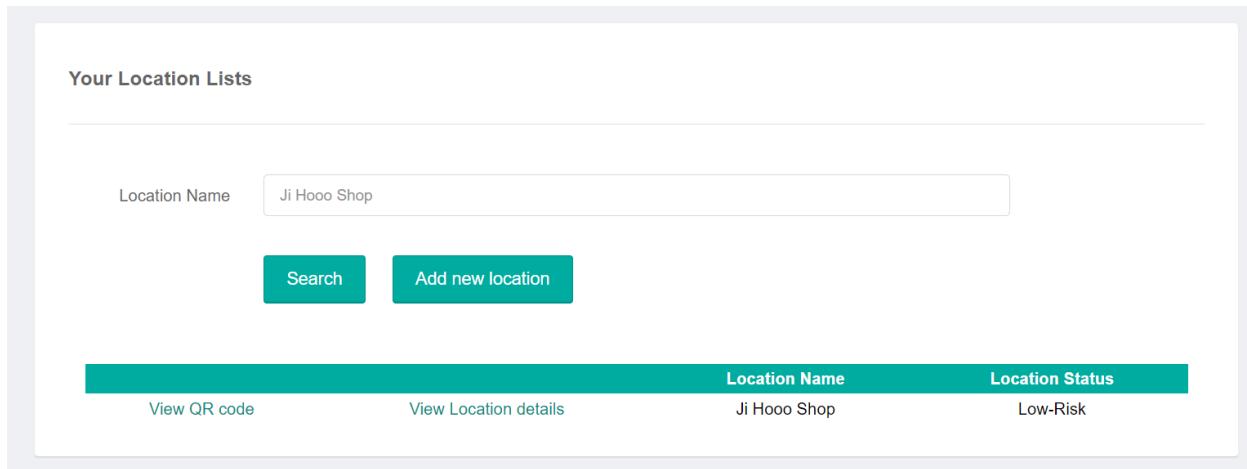


Figure 8.45: view registered location guideline 3

The citizens can search a specific location by entering the location name and press the “Search” button. Then, the system will find the specific location for the citizens.

3. Update registered location details

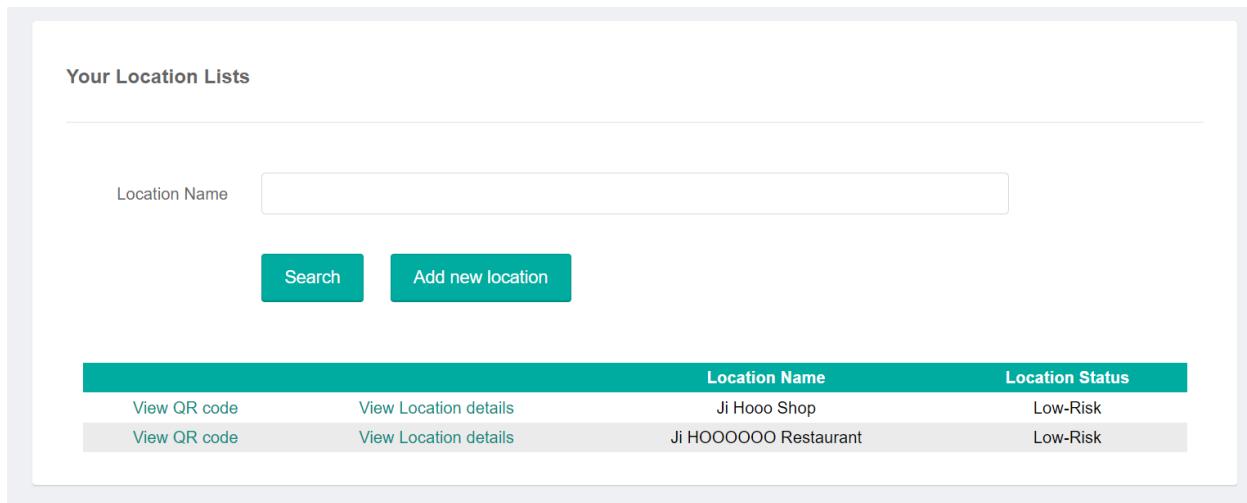


Figure 8.46: update registered location details guideline 1

First, the citizens need to go to the registered location listing, then click the “View Location details” of the specified location.

The screenshot shows a 'Location Profile' update form. It includes fields for Location Name (Ji Hooo Shop), Location Address (53,Jalan Helang,Kepong Baru, 52100 Kuala Lumpur), State (Kuala Lumpur), District (Kuala Lumpur), and Postcode (52100). The form has a light gray background with white input fields.

Figure 8.47: update registered location details guideline 2

Then, the details of the location chosen will be shown in a form and the citizens can change any details except the location status.

The screenshot shows a continuation of the 'Location Profile' update form. It includes fields for Industry Type (Wholesale) and Risk Status (Low-Risk). At the bottom, there are three buttons: 'Cancel', 'Update', and 'Terminate'. The form has a light gray background with white input fields.

Figure 8.48: update registered location details guideline 3

After changing all the details, the citizens need to click the “Update” button at the bottom of the form.

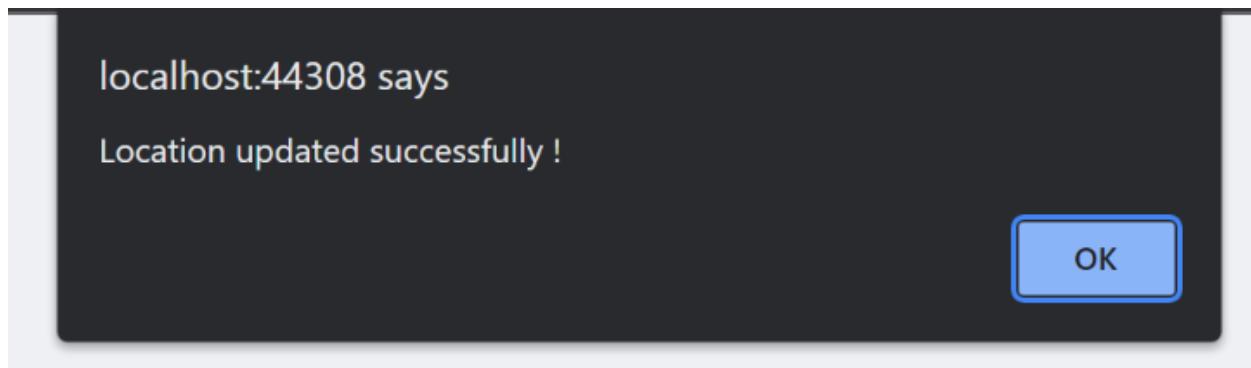


Figure 8.49: update registered location details guideline 4

If all the details entered are correct, then the system will show a successful message to the citizens.

A screenshot of a web-based form titled "Location Profile". It contains three input fields: "Location Name*" with the value "Ji Hooo and Jerry Shop", "Location Address*" with the value "55,Jalan Helang,Kepong Baru, 52100 Kuala Lumpur", and "State : *" with the value "Kuala Lumpur".

Figure 8.50: update registered location details guideline 5

The citizens can see that the location details are successfully updated.

4. Terminate registered location

The screenshot shows a user interface titled "Your Location Lists". At the top, there is a search bar labeled "Location Name" with a placeholder "Search" and a button "Add new location". Below the search bar is a table with two rows of data. The table has three columns: "Location Name" and "Location Status".

	Location Name	Location Status
View QR code	Ji Hooo and Jerry Shop	Low-Risk
View QR code	Ji HOOOOOO Restaurant	Low-Risk

Figure 8.51: terminate registered location guideline 1

To terminate a registered location, the citizens need to click the “View Location details” of a specific location.

The screenshot shows a "location form" with three input fields: "Postcode*" (52100), "Industry Type : *" (Wholesale), and "Risk Status :" (Low-Risk). Below the form are three buttons: "Cancel", "Update", and "Terminate".

Figure 8.52: terminate registered location guideline 2

In the location form, scroll to the bottom and click the “Terminate” button.

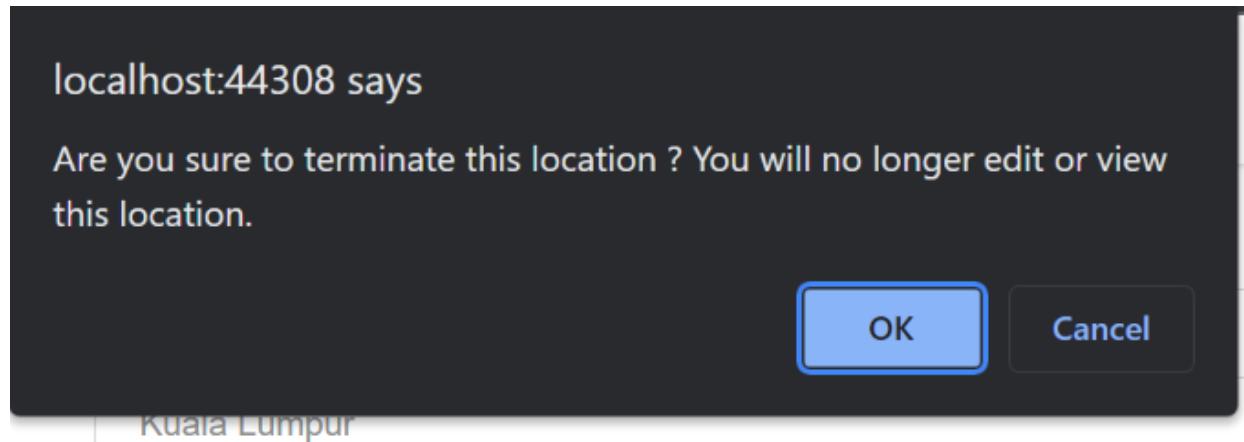


Figure 8.53: terminate registered location guideline 3

A confirmation will pop up and the citizens can choose “OK” to terminate the locations and choose “Cancel” to abort the action.

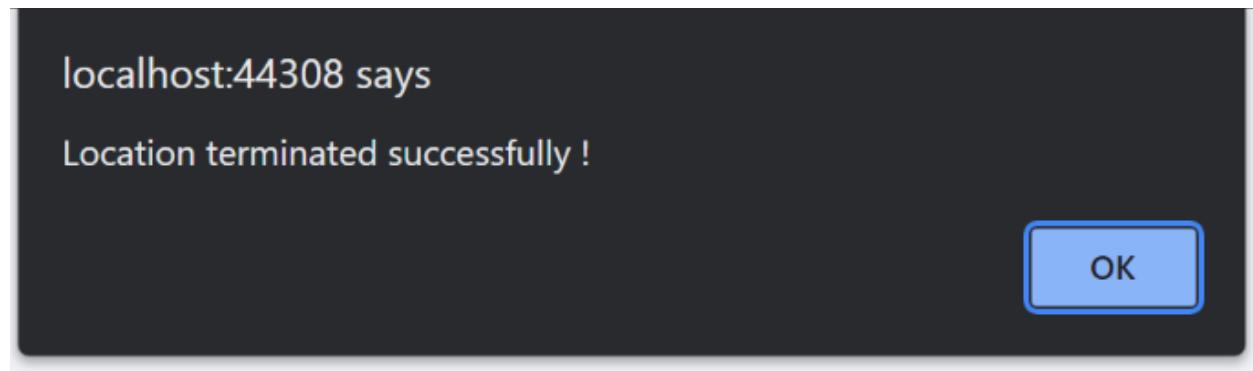


Figure 8.54: terminate registered location guideline 4

If the citizens choose “OK” at the confirmation and the location is successfully terminated, the system will show a successful message.

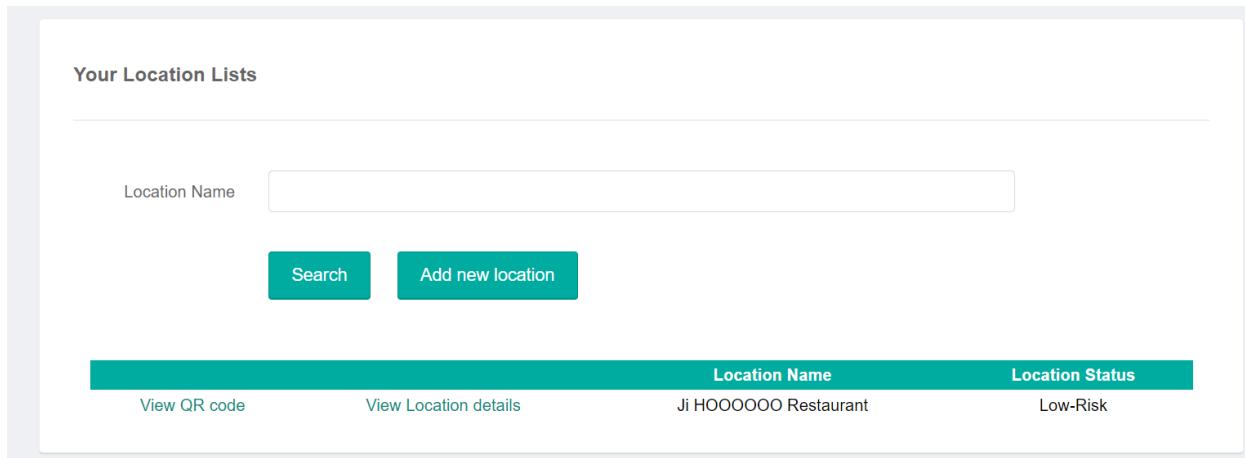


Figure 8.55: terminate registered location guideline 5

The citizens can check that the terminated location no longer exists in the registered location list.

5. Check-in location

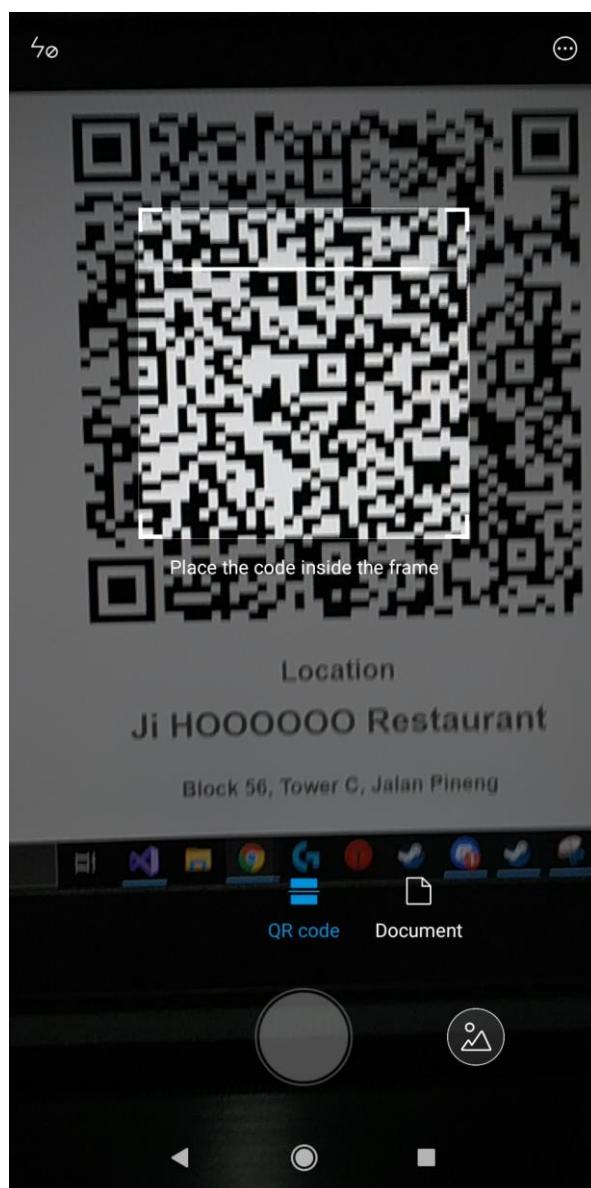


Figure 8.56: check-in location guideline 1

To check-in a location, the citizens need to use a QR code scanner to scan the location QR code.

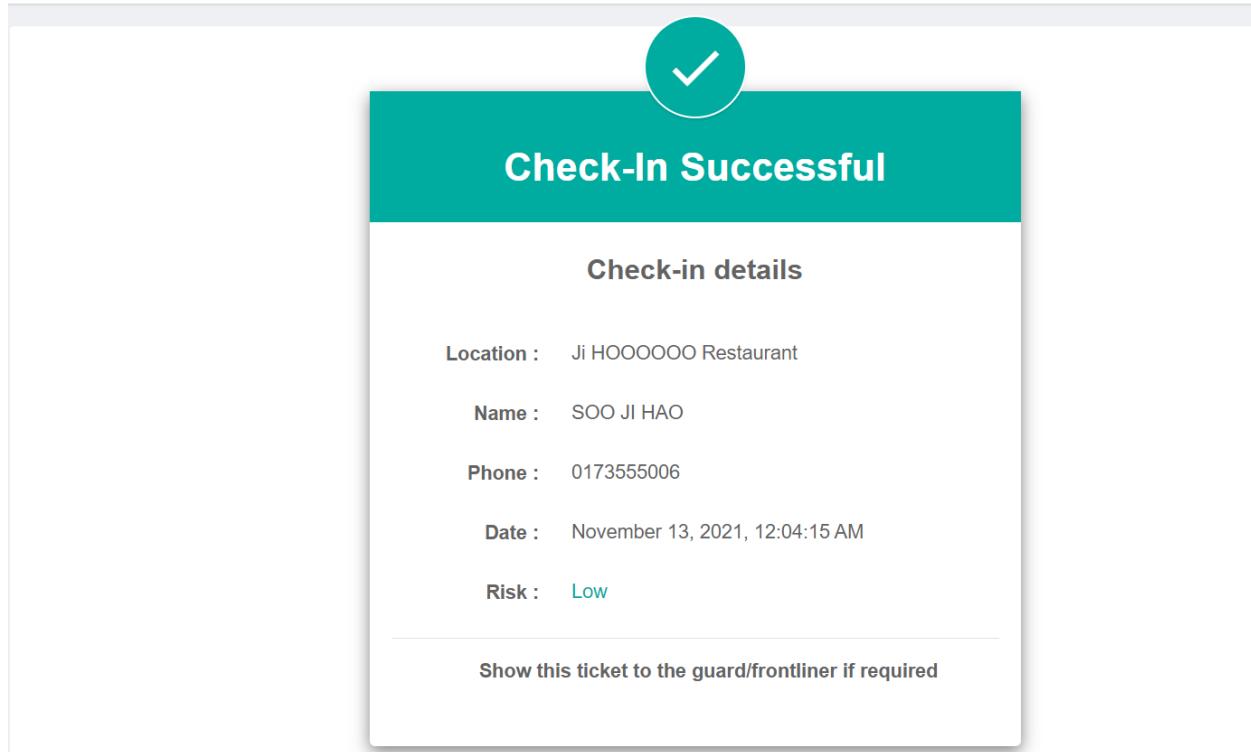


Figure 8.57: check-in location guideline 2

After scanning the QR code, the check-in details will be accepted and recorded if the citizen is safe to enter the location.

6. View check-in record

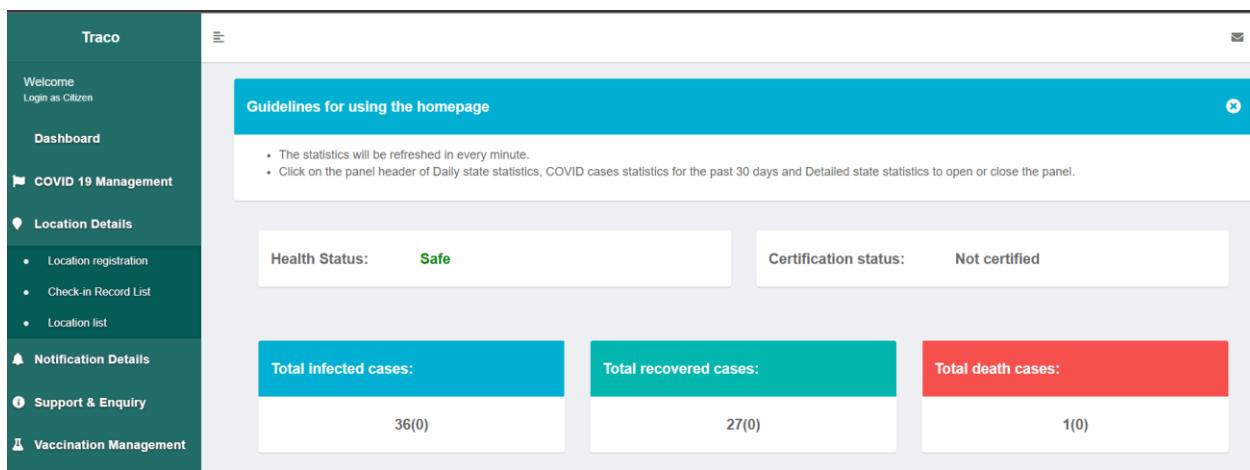


Figure 8.58: view check-in record guideline 1

The citizens need to successfully login first. Then, click the “Location Details” at the left side and click the “Check-in Record List” selection.

Your Check-in Record Lists												
Start Date	01/11/2021	End Date	14/11/2021									
Risk	All											
Search												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Location Name</th> <th style="text-align: center;">Location Status</th> <th style="text-align: center;">Record Date</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">View Record KOK HOU SHOP</td><td style="text-align: center;">Low-Risk</td><td style="text-align: center;">13-11-2021 12:09:37 AM</td></tr> <tr> <td style="text-align: center;">View Record Ji HOOOOOO Restaurant</td><td style="text-align: center;">Low-Risk</td><td style="text-align: center;">10-11-2021 12:04:15 AM</td></tr> </tbody> </table>				Location Name	Location Status	Record Date	View Record KOK HOU SHOP	Low-Risk	13-11-2021 12:09:37 AM	View Record Ji HOOOOOO Restaurant	Low-Risk	10-11-2021 12:04:15 AM
Location Name	Location Status	Record Date										
View Record KOK HOU SHOP	Low-Risk	13-11-2021 12:09:37 AM										
View Record Ji HOOOOOO Restaurant	Low-Risk	10-11-2021 12:04:15 AM										

Figure 8.59: view check-in record guideline 2

Then, all of the location check-in details of the citizens will be shown in the check-in record listing.

The screenshot shows a user interface for searching check-in records. At the top, there is a header "Your Check-in Record Lists". Below the header are three input fields: "Start Date" (11/11/2021), "End Date" (14/11/2021), and "Risk" (All). A teal-colored "Search" button is located below these fields. Below the search area is a table with four columns: "Location Name", "Location Status", and "Record Date". The first row of the table contains the following data: "View Record", "KOK HOU SHOP", "Low-Risk", and "13-11-2021 12:09:37 AM".

	Location Name	Location Status	Record Date
View Record	KOK HOU SHOP	Low-Risk	13-11-2021 12:09:37 AM

Figure 8.60: view check-in record guideline 3

The citizens can search specific check-in records by changing the start date, end date and the risk of the location during the date of check-in. If the citizens want to view the full details of the location check-in record, they can click the “View Record” on the specific location check-in record.

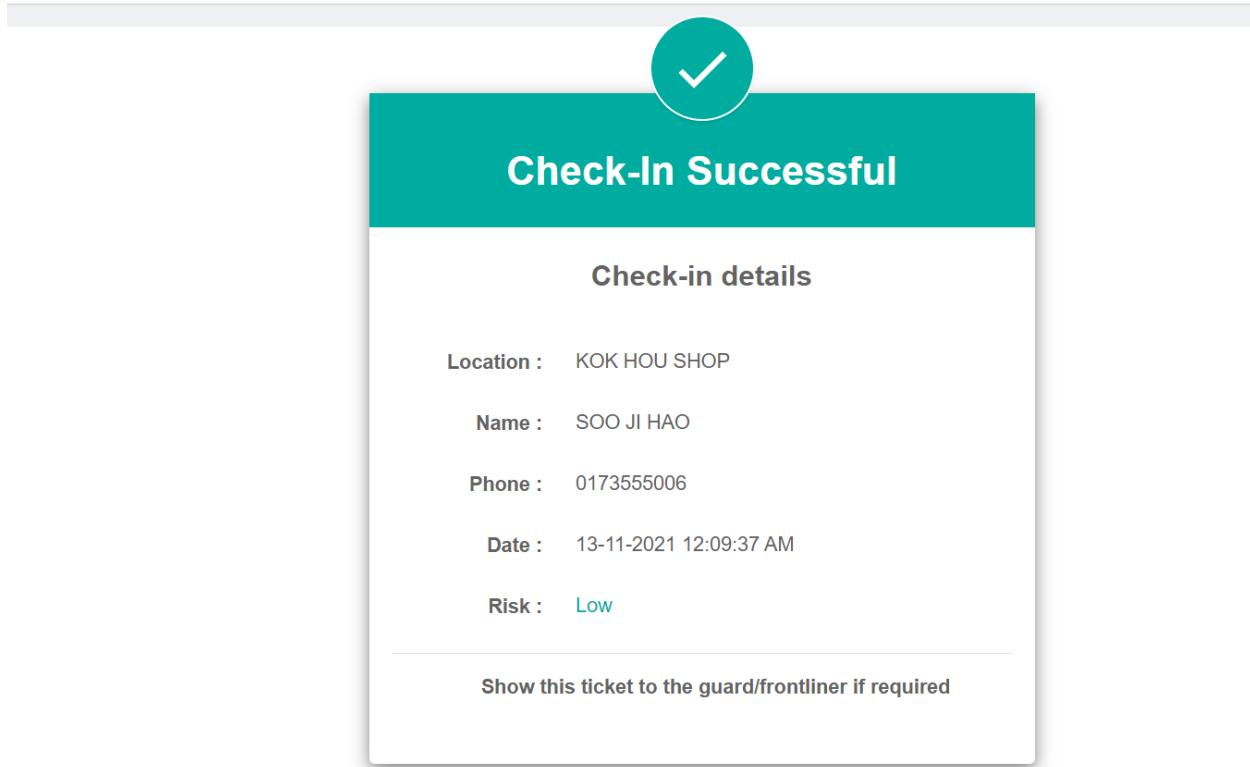


Figure 8.61: view check-in record guideline 4

The full details of the location check-in record will be shown to the citizens.

Staff site

1. Register vaccine location and generate vaccine location QR code

The screenshot shows the Traco COVID-19 Tracking System homepage. On the left, there is a sidebar with the following navigation:

- Welcome
- Login as HeadAdmin
- Dashboard**
- Citizen Management**
- COVID 19 Management**
- Enquiry Management**
- Health Status Management**
- Location Management**
 - Location listing
 - Vaccine location entry
 - Warning listing
 - Location record listing
 - Vaccine location listing
- Notification Management**

The main content area displays the following information:

- Guidelines for using the homepage**: A tooltip with instructions: "The statistics will be refreshed in every minute." and "Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel."
- Total infected cases:** 36(0)
- Total recovered cases:** 27(0)
- Total death cases:** 1(0)
- Daily state statistics (Date: 13/11/2021)**: A chart titled "Daily cases for each state" with values 1.0 and 0.5. Below it is a table:

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.62: register vaccine location and generate vaccine location QR code guideline 1

The staff need to successfully login first. Then, click the “Location Management” at the left side and click the “Vaccine location entry” selection.

The screenshot shows the “Vaccine Location Profile” form. It contains the following fields:

- Vaccine Location Name*: An input field.
- Vaccine Location Address*: An input field.
- State : *: A dropdown menu.
- District : *: A dropdown menu.
- Status : *: A dropdown menu with the option “Active” selected.

At the bottom of the form are two buttons: “Back” and “Submit”.

Figure 8.63: register vaccine location and generate vaccine location QR code guideline 2

A vaccine location form will pop up, the staff need to fill in all details.

The screenshot shows a web-based form for registering a vaccine location. It consists of three dropdown menus and two buttons. The first dropdown under 'State : *' has 'Kedah' selected. The second dropdown under 'District : *' has 'Langkawi' selected. The third dropdown under 'Status : *' has 'Active' selected. Below the form are two dark blue buttons labeled 'Back' and 'Submit'.

Figure 8.64: register vaccine location and generate vaccine location QR code guideline 3

After filling all the details, the staff can choose to press the “Back” button or “Submit” button.

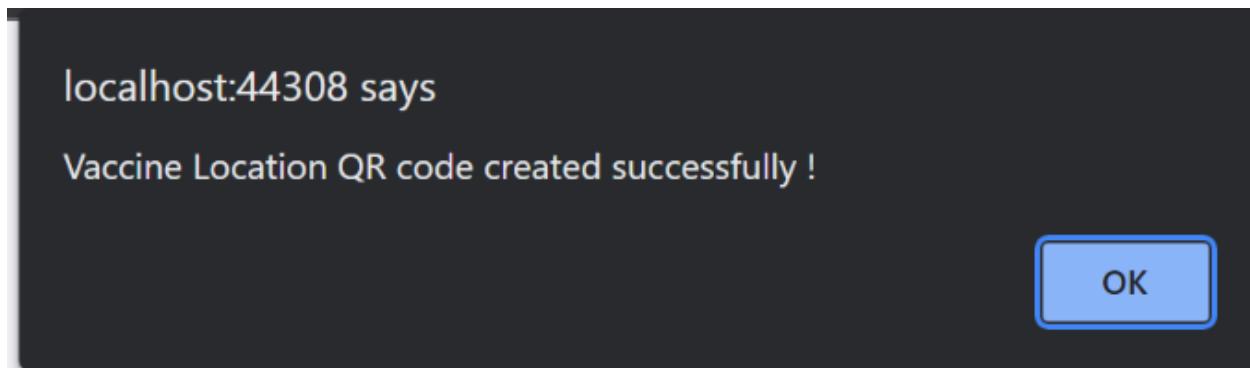


Figure 8.65: register vaccine location and generate vaccine location QR code guideline 4

If the staff selects the “Submit” button and all the details entered are correct, the system will show a successful message to the staff.

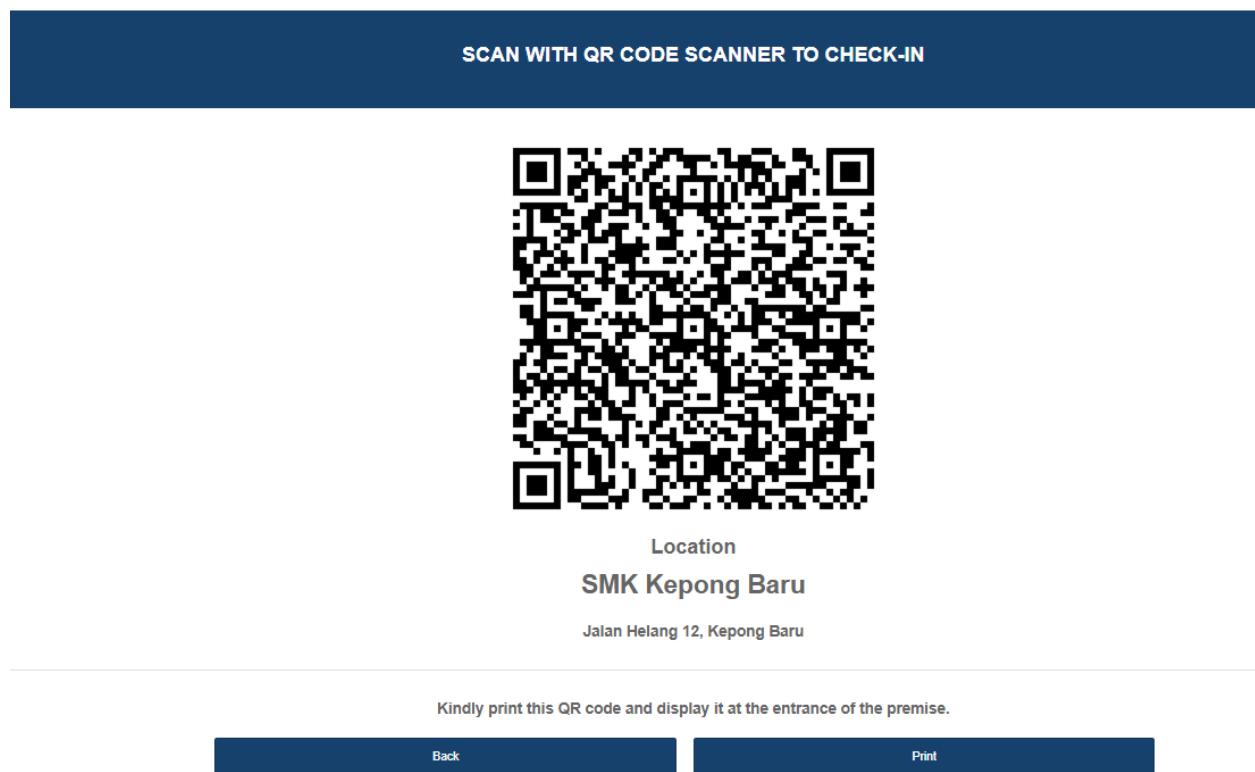


Figure 8.66: register vaccine location and generate vaccine location QR code guideline 5

Then, the QR code of the vaccine location will be shown and the staff can print it by clicking the “Print” button at the bottom.

2. View vaccine location lists

The screenshot shows the Traco COVID-19 Tracking System homepage. On the left, there is a dark sidebar with the following navigation options:

- Welcome
- Login as HeadAdmin
- Dashboard**
- Citizen Management**
- COVID 19 Management**
- Enquiry Management**
- Health Status Management**
- Location Management**
 - Location listing
 - Vaccine location entry
 - Warning listing
 - Location record listing
 - Vaccine location listing
- Notification Management**

The main content area has a teal header bar titled "Guidelines for using the homepage". Below it, there are three colored boxes: a blue box for "Total infected cases" (36(0)), a green box for "Total recovered cases" (27(0)), and a red box for "Total death cases" (1(0)). Further down, there is a section titled "Daily state statistics (Date: 13/11/2021)" with a chart showing daily cases for each state (1.0 and 0.5) and a table of state names and infected cases.

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.67: view vaccine location lists guideline 1

The staff need to successfully login first. Then, click the “Location Management” at the left side and click the “Vaccine location listing” selection.

The screenshot shows the "Vaccine Location Lists" page. At the top, there are search filters for "Vaccine Location Name", "District", "State", and "Status" (Active). Below the filters are two buttons: "Search" and "Add new vaccine location". The main area displays a table of vaccine locations with columns for "Vaccine Location Name" and "Status".

Vaccine Location Name	Status
Dewan Komuniti Serendah	Active
Hospital KKB	Active
Hospital Sungai Buloh	Active
SMK Kepong Baru	Active
VaccineLocationTest	Active

Figure 8.68: view vaccine location lists guideline 2

All of the vaccine locations will show to the staff in the vaccine location listing.

Vaccine Location Lists

Vaccine Location Name	Status
Hospital KKB	Active
Hospital Sungai Buloh	Active

Figure 8.69: view vaccine location lists guideline 3

The staff can search for specific vaccine locations by entering the vaccine location name, selecting the district, selecting the state or the status to find specific vaccine location. If the staff wish to add a new vaccine location, the staff can press the “Add new vaccine location” button.

3. Update vaccine location

Vaccine Location Lists

Vaccine Location Name	Status
Dewan Komuniti Serendah	Active
Hospital KKB	Active
Hospital Sungai Buloh	Active
SMK Kepong Baru	Active
VaccineLocationTest	Active

Figure 8.70: update vaccine locations guideline 1

To update a vaccine location, the staff need to go to the vaccine location listing and press the “View Vaccine Location details” of a specific vaccine location.

Vaccine Location Profile

Vaccine Location Name*

Vaccine Location Address*

State : *

District : *

Status : *

Figure 8.71: update vaccine locations guideline 2

Then, the vaccine location form will show to the staff and the staff can change the details of the vaccine location. After changing the details, the staff can choose to select the “Back” button or “Update” button.

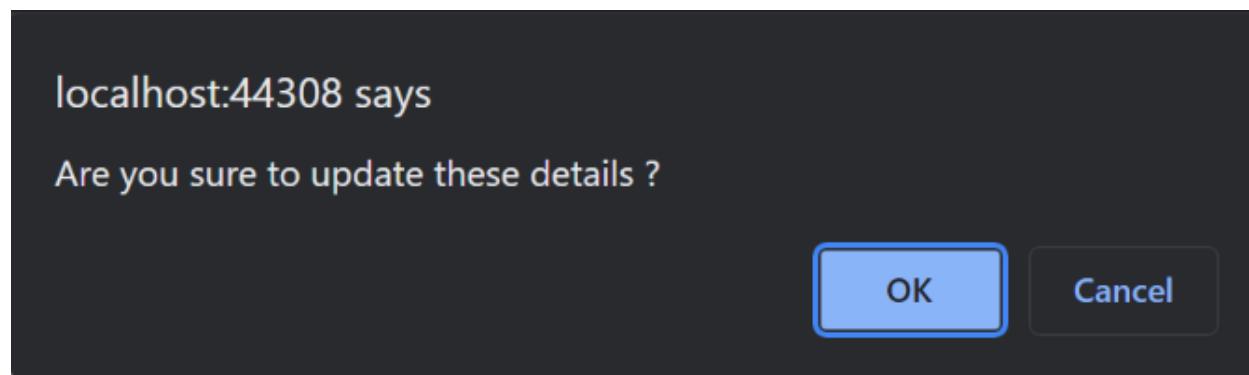


Figure 8.72: update vaccine locations guideline 3

A confirmation message will show to the staff, the staff can choose “OK” or “Cancel”.

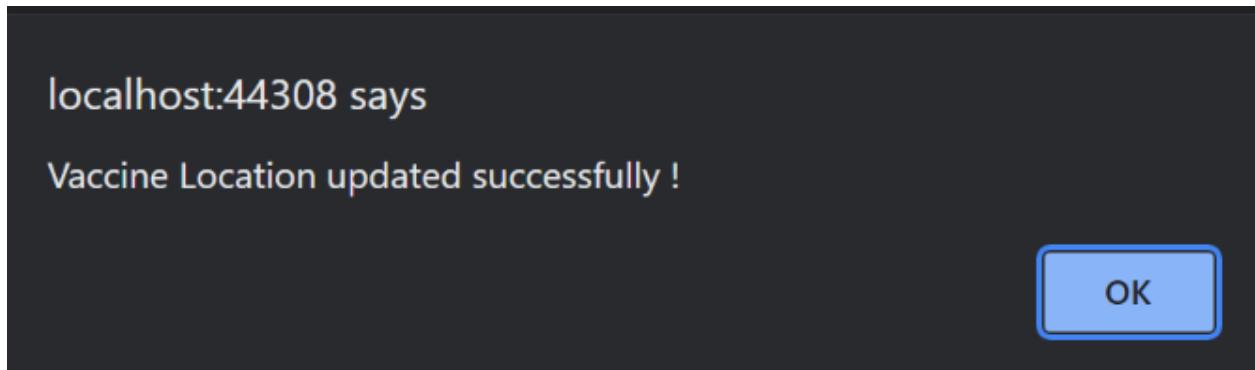


Figure 8.73: update vaccine locations guideline 4

If the staff chooses “OK” in the confirmation message and all details entered are correct, the system will show a successful message to the staff.

A screenshot of a web-based form titled "Vaccine Location Profile". The form contains five input fields: "Vaccine Location Name*" with value "Hospital KKBK", "Vaccine Location Address*" with value "zxcvdsd", "State : *" with value "Selangor", "District : *" with value "Hulu Selangor", and "Status : *" with value "Active". At the bottom are two buttons: "Back" and "Update".

Figure 8.74: update vaccine locations guideline 5

The staff can see that the vaccine location details are changed.

4. View citizens' location details and update location risk

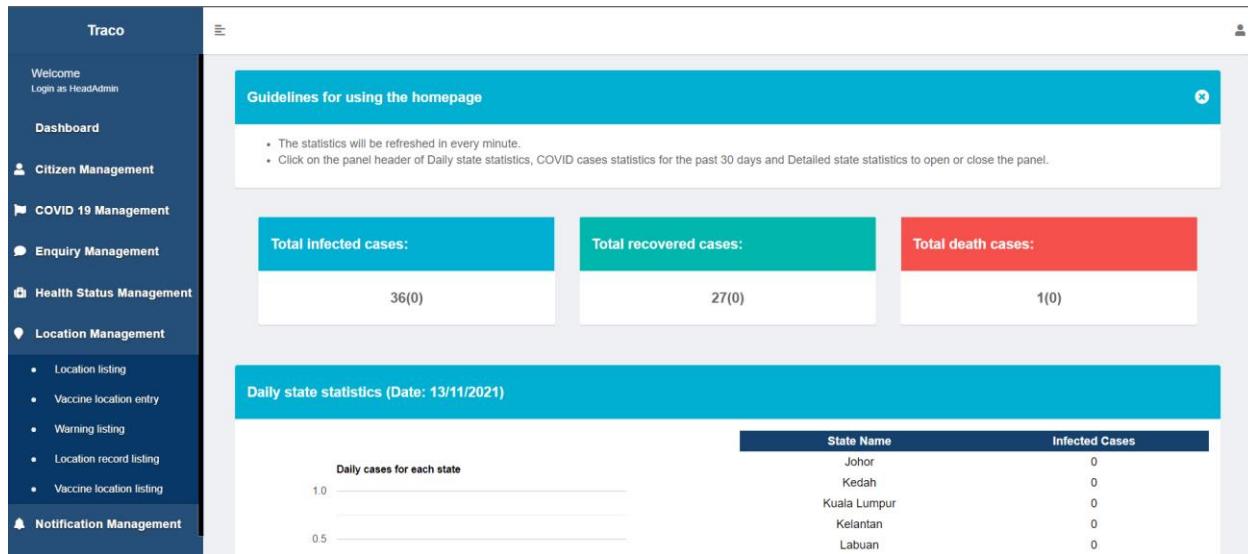


Figure 8.75: view citizens' location details and update location risk guideline 1

The staff need to successfully login first. Then, click the “Location Management” at the left side and click the “Location listing” selection.

The screenshot shows the 'Location Listing' page. At the top, there are search filters: 'Location Name' (input field), 'District' (dropdown), 'State' (dropdown), 'Industry Type' (dropdown), 'Risk' (dropdown set to 'All'), and a 'Search' button. Below the filters is a table with columns: Location Name, Industry Description, District Name, State Name, and Status. Two rows of data are shown: JI HOOOOOO Restaurant (Status: Low-Risk) and KOK HOU SHOP (Status: Low-Risk).

	Location Name	Industry Description	District Name	State Name	Status
View	JI HOOOOOO Restaurant	Restaurants	Alor Gajah	Melaka	Low-Risk
View	KOK HOU SHOP	Sporting Goods	Northeast Penang Island	Pulau Pinang	Low-Risk

Figure 8.76: view citizens' location details and update location risk guideline 2

The staff can view all the citizens' locations in the location listing.

The screenshot shows a search interface for locations. At the top, there are four input fields: 'Location Name' (KOK HOU SHOP), 'District' (dropdown), 'State' (dropdown), 'Industry Type' (dropdown), and 'Risk' (dropdown set to 'All'). Below these is a 'Search' button. Underneath the search bar is a table with the following data:

	Location Name	Industry Description	District Name	State Name	Status
View	KOK HOU SHOP	Sporting Goods	Northeast Penang Island	Pulau Pinang	Low-Risk

Figure 8.77: view citizens' location details and update location risk guideline 3

The staff can search for specific locations by entering the location name, selecting district, state, industry type and the risk. If the staff want to view the full details of the location or update the location status, the staff can press the “View” in the specific location.

The screenshot shows a detailed view of a location profile. The form includes the following fields:

- Location Name: KOK HOU SHOP
- Location Address: BLOCK 87, Jalan Binang
- State: Pulau Pinang
- District: Northeast Penang Island
- Postcode: 32456
- Industry Type: Sporting Goods
- Risk Status: Low-Risk

At the bottom are two buttons: 'Back' and 'Update'.

Figure 8.78: view citizens' location details and update location risk guideline 4

The staff is able to view the full details of the specific location and able to change the risk status of the location. If the staff wants to update the location status, the staff can press the “Update” button.

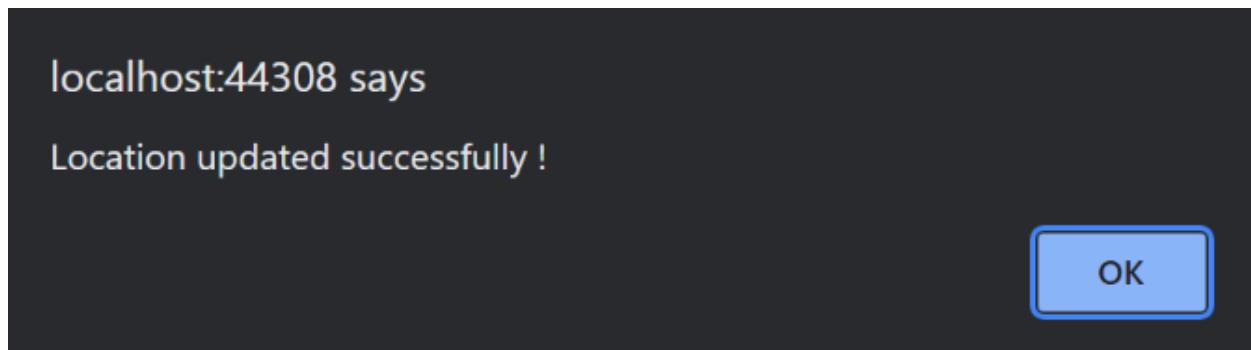


Figure 8.79: view citizens' location details and update location risk guideline 5

A successful message will show to the staff if the update is successful.

A screenshot of a web-based application titled "Location Listing". The interface includes search filters for "Location Name" (set to "KOK HOU SHOP"), "District" (dropdown), "State" (dropdown), "Industry Type" (dropdown), and "Risk" (dropdown set to "All"). A "Search" button is located below the filters. Below the search area is a table with the following data:

	Location Name	Industry Description	District Name	State Name	Status
View	KOK HOU SHOP	Sporting Goods	Northeast Penang Island	Pulau Pinang	High-Risk

Figure 8.80: view citizens' location details and update location risk guideline 6

The staff can check that the location is updated successfully.

5. View citizens' location check-in details

The screenshot shows the Traco COVID-19 Tracking System homepage. On the left, a dark sidebar lists various management modules: Welcome, Dashboard, Citizen Management, COVID 19 Management, Enquiry Management, Health Status Management, Location Management (selected), and Notification Management. The main content area has a teal header "Guidelines for using the homepage". Below it, three colored boxes show statistics: Total Infected cases (36(0) in blue), Total recovered cases (27(0) in green), and Total death cases (1(0) in red). A section titled "Daily state statistics (Date: 13/11/2021)" displays a chart of daily cases for each state (Johor, Kedah, Kuala Lumpur, Kelantan, Labuan) with values 0, 0, 0, 0, and 0 respectively, and a table of state names and infected cases.

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.81: view citizens' location check-in details guideline 1

The staff need to successfully login first. Then, click the “Location Management” at the left side and click the “Location record listing” selection.

The screenshot shows the "Location Record Listing" page. At the top, there are search filters: Citizen Name (input field), Start Date (01/11/2021) and End Date (14/11/2021) with calendar icons, and a Risk dropdown set to "All". Below these are "Search" and "Reset" buttons. The main area contains a table of location records:

Check-in Date	Citizen Name	Location Name	Status
13-11-2021 04:43 PM	Citizen 1	JI HOOOOOO Restaurant	Low-Risk
13-11-2021 12:09 AM	SOO JI HAO	KOK HOU SHOP	Low-Risk
10-11-2021 12:04 AM	SOO JI HAO	JI HOOOOOO Restaurant	Low-Risk

Figure 8.82: view citizens' location check-in details guideline 2

The system will show all the details of citizens location check-in in the location record listing.

Location Record Listing

Citizen Name: SOO JI HAO

Start Date: 11/11/2021 End Date: 14/11/2021

Risk: All

Search

Check-in Date	Citizen Name	Location Name	Status
13-11-2021 12:09 AM	SOO JI HAO	KOK HOU SHOP	Low-Risk

Figure 8.83: view citizens' location check-in details guideline 3

The staff can search for specific location check-in details by entering the citizen name, selecting the start date, end date and the risk.

6. View citizens' location check-in denied list (warning list)

Traco

- Welcome
- Login as HeadAdmin
- Dashboard**
- Citizen Management**
- COVID 19 Management**
- Enquiry Management
- Health Status Management
- Location Management
 - Location listing
 - Vaccine location entry
 - Warning listing
 - Location record listing
 - Vaccine location listing
- Notification Management

Guidelines for using the homepage

- The statistics will be refreshed in every minute.
- Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel.

Total Infected cases: 36(0) Total recovered cases: 27(0) Total death cases: 1(0)

Daily state statistics (Date: 13/11/2021)

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.84: view citizens' location check-in denied list guideline 1

The staff need to successfully login first. Then, click the “Location Management” at the left side and click the “Warning listing” selection.

The screenshot shows a search interface for denied location check-ins. At the top, there is a header 'Warning Listing'. Below it, there are input fields for 'Citizen Name' (with a placeholder 'Citizen Name'), 'Start Date' (set to 01/11/2021), and 'End Date' (set to 14/11/2021). A 'Search' button is located below these fields. The results section has a header row with columns: 'Check-in Date', 'Full Name', and 'Denied Reason'. Two rows of data are listed:

	Check-in Date	Full Name	Denied Reason
View	13/11/2021 4:54:41 PM	Citizen 11	Went out when is infected COVID-19
View	13/11/2021 4:54:14 PM	Citizen 10	Went out when is infected COVID-19

Figure 8.85: view citizens' location check-in denied list guideline 2

The system will show all the citizens location check-in denied details in the warning listing.

This screenshot shows the same search interface as Figure 8.85, but with a specific citizen name entered in the 'Citizen Name' field: 'Citizen 11'. The search results table shows one record for Citizen 11:

	Check-in Date	Full Name	Denied Reason
View	13/11/2021 4:54:41 PM	Citizen 11	Went out when is infected COVID-19

Figure 8.86: view citizens' location check-in denied list guideline 3

The staff can search for specific check-in denied records by entering the citizen's name, selecting the start date and end date. Press the "View" of a specific record, the staff is able to view the full details of the citizen.

The screenshot shows a 'Citizen Profile' form with the following data:

Field	Value
User Name	citizen11
Full name	Citizen 11
IC NO	230562103681
Email	citizen11@gmail.com
Phone No	0144742567
Age	22
Gender	Female

Figure 8.87: view citizens' location check-in denied list guideline 4

After pressing the “View” of a specific record, the system shows the full details of the citizen.

Messaging and enquiry module

Citizen site

1. View FAQs

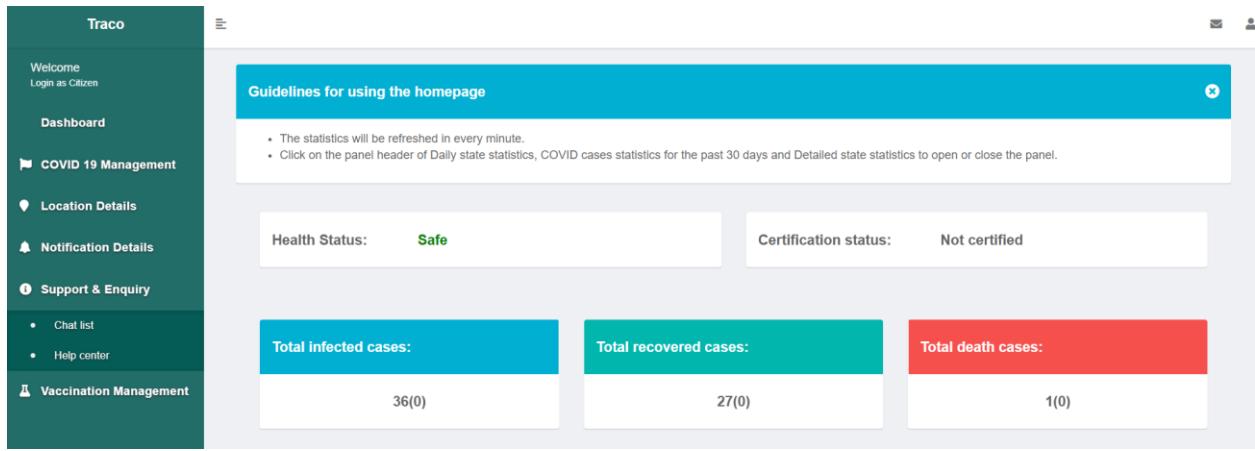


Figure 8.88: view FAQs guideline 1

The citizens need to successfully login first. Then, click the “Support & Enquiry” at the left side and click the “Help center” selection.

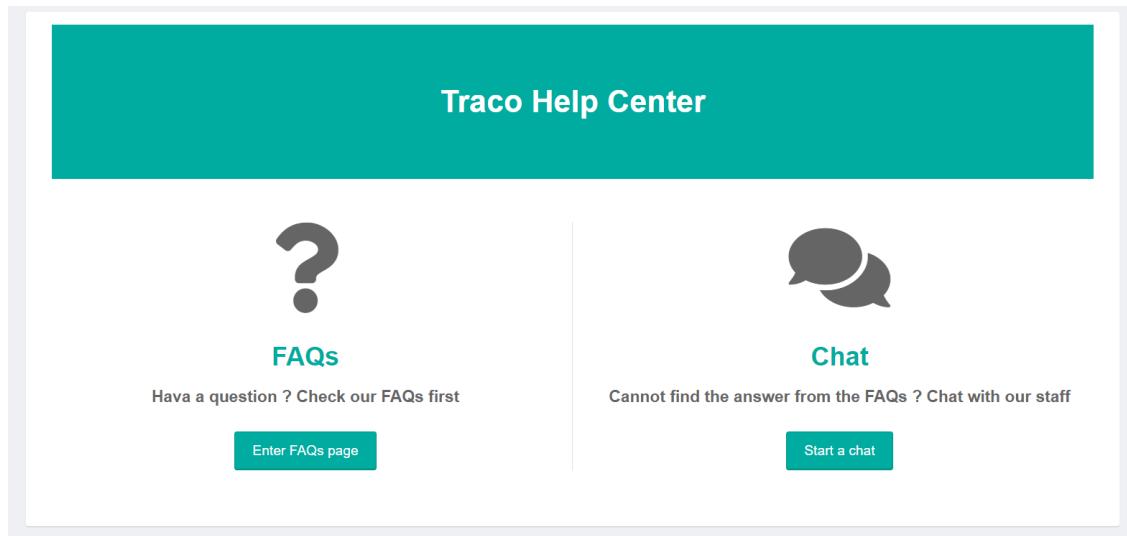


Figure 8.89: view FAQs guideline 2

The system will show the help center to the citizens. There are two choices for the citizens: view the FAQs or start a chat with staff. To view the FAQs, the citizens need to click the “Enter FAQs page” button.

The screenshot shows the 'Traco FAQs' page. At the top, there is a teal header bar with the text 'Traco FAQs'. Below the header, the page is divided into two main sections. On the left, there is a sidebar with a 'Category' heading. It contains two items: 'About COVID-19' (with a count of 2) and 'About MCO' (with a count of 1). Both items are in a light gray box. On the right, there is a main content area with a section titled 'About COVID-19'. It contains two expandable items: 'How does the virus spread?' (marked with a minus sign) and 'What is COVID-19' (marked with a plus sign). The 'How does the virus spread?' item has a detailed description below it. At the bottom of the content area, there is a note that says 'Updated on: November 13, 2021'.

Figure 8.90: view FAQs guideline 3

The system will show the FAQs page to the citizens, the citizens can view the existing FAQs here.

2. Start a chat with staff

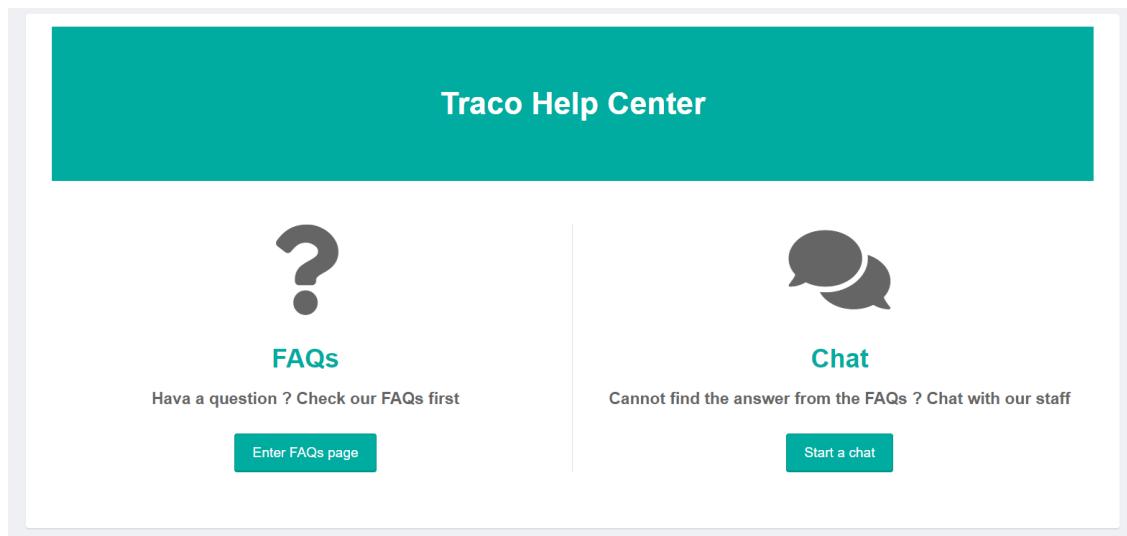


Figure 8.91: start a chat with staff guideline 1

In the help center, the citizens need to click the “Start a chat” button to start a chat.

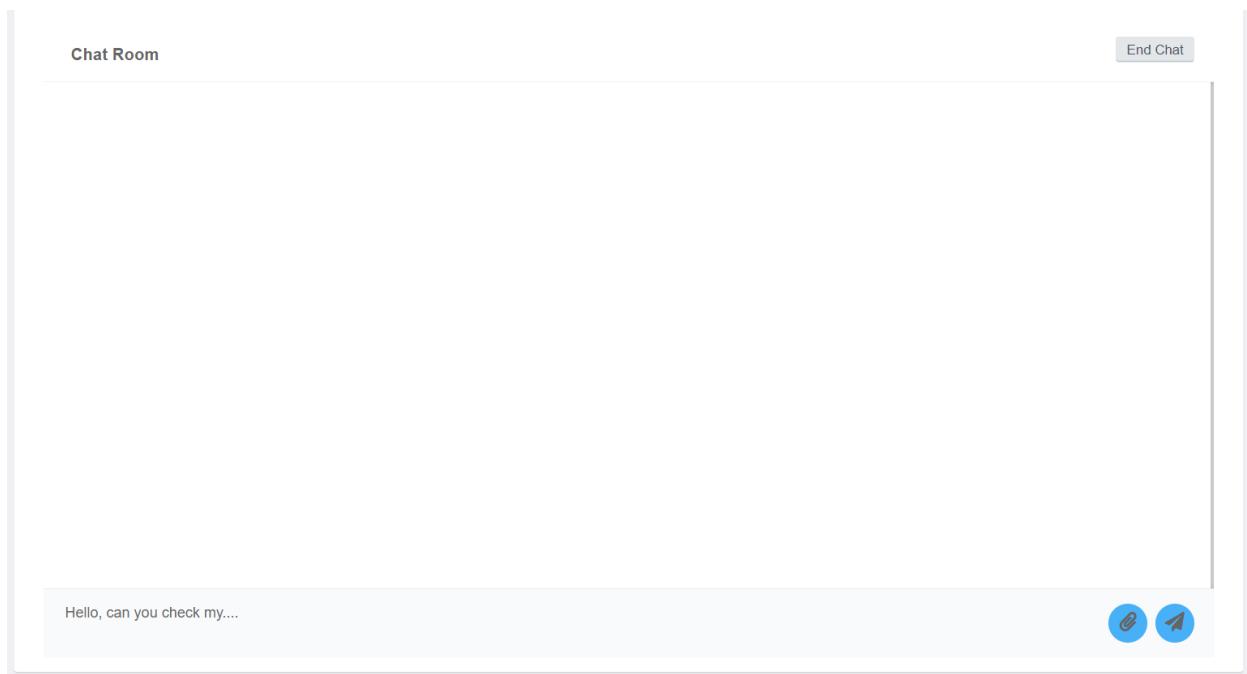


Figure 8.92: start a chat with staff guideline 2

The citizens will enter the chat room. The citizens can try to enter the message and press the send icon.

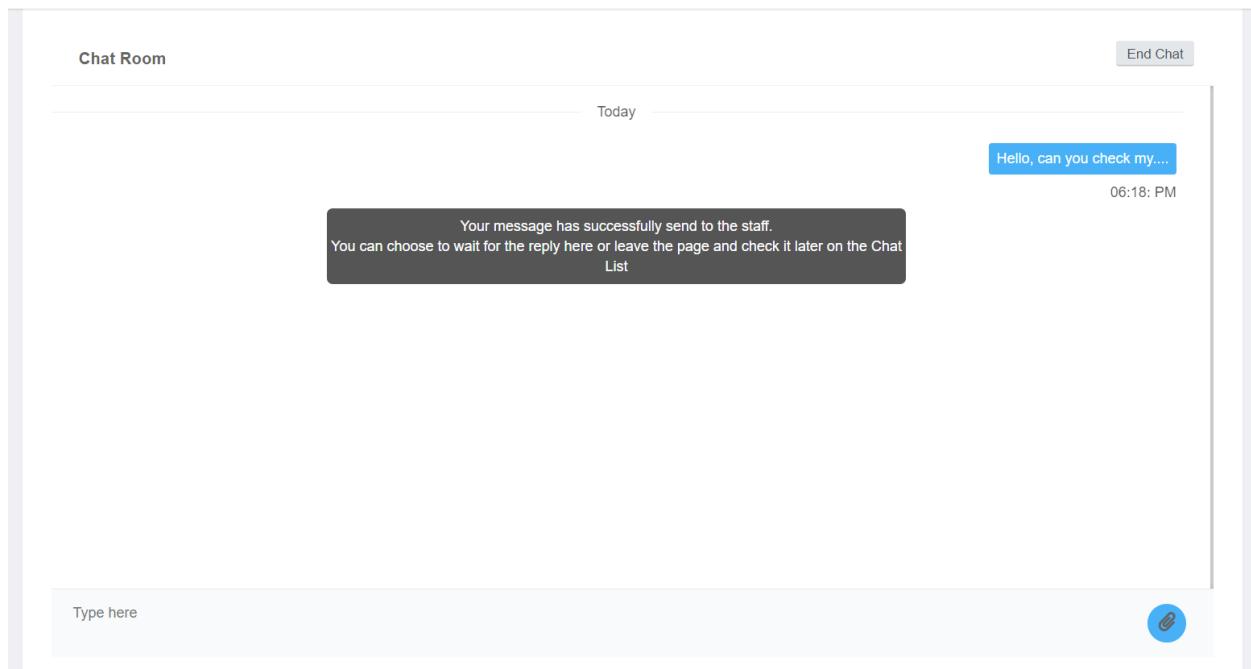


Figure 8.93: start a chat with staff guideline 3

After a message is successfully sent, the system will pop up a successful message to the citizens and the entered message will be displayed.

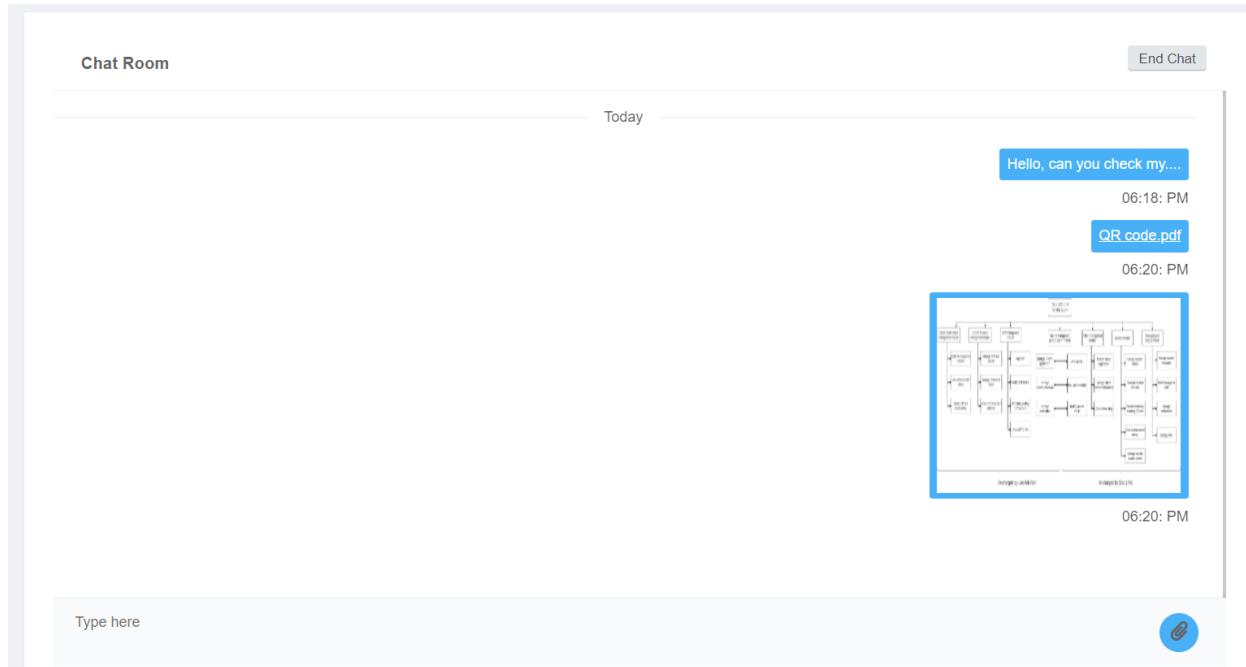


Figure 8.94: start a chat with staff guideline 4

The citizens also can send a pdf file and image file to the staff by clicking the attach icon and selecting the file to send. If the citizens want to end a chat, they can press the “End Chat” button to end the chat.

3. View existing chat and chat history

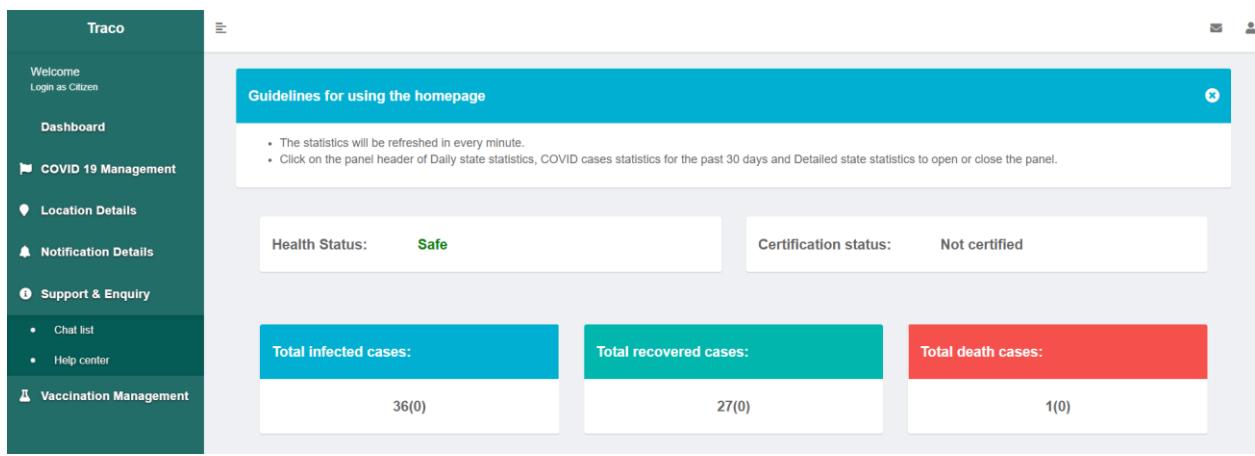


Figure 8.95: view existing chat and chat history guideline 1

The citizens need to successfully login first. Then, click the “Support & Enquiry” at the left side and click the “Chat list” selection.

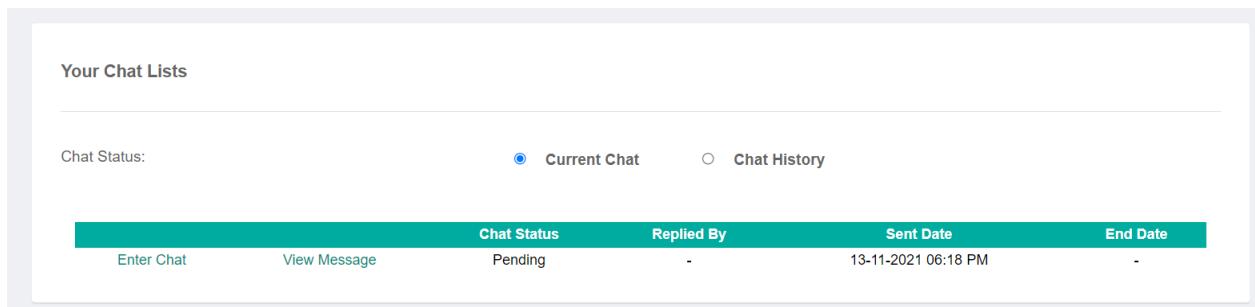


Figure 8.96: view existing chat and chat history guideline 2

The system will show the chat lists in the chat listing, the citizens can view the existing chat in the “Current Chat” and view the chat histories at the “Chat History”.

4. View existing chat message and enter chat

The screenshot shows a user interface titled "Your Chat Lists". At the top, there is a "Chat Status" section with two radio buttons: "Current Chat" (selected) and "Chat History". Below this is a table with the following data:

	Chat Status	Replied By	Sent Date	End Date
Enter Chat	View Message	Pending	-	13-11-2021 06:18 PM

Figure 8.97: view existing chat message and enter chat guideline 1

In the chat listing, the citizens can select the “View Message” to only view the message of the chat or select the “Enter Chat” to enter back to the chat room to send a new message.

The screenshot shows a "Chat Room" interface. At the top right is an "Enter Chat" button. Below it is a timestamp "Today". The message history is as follows:

- 06:18: PM: Hello, can you check my... (blue message box)
- 06:20: PM: QR code.pdf (blue message box)
- 06:20: PM: 

Figure 8.98: view existing chat message and enter chat guideline 2

If the citizens select the “View Message”, they are able to view the current message of the chat and if they want to enter the chat, they can click the “Enter Chat” button on the top right of the chat room.

5. View notifications

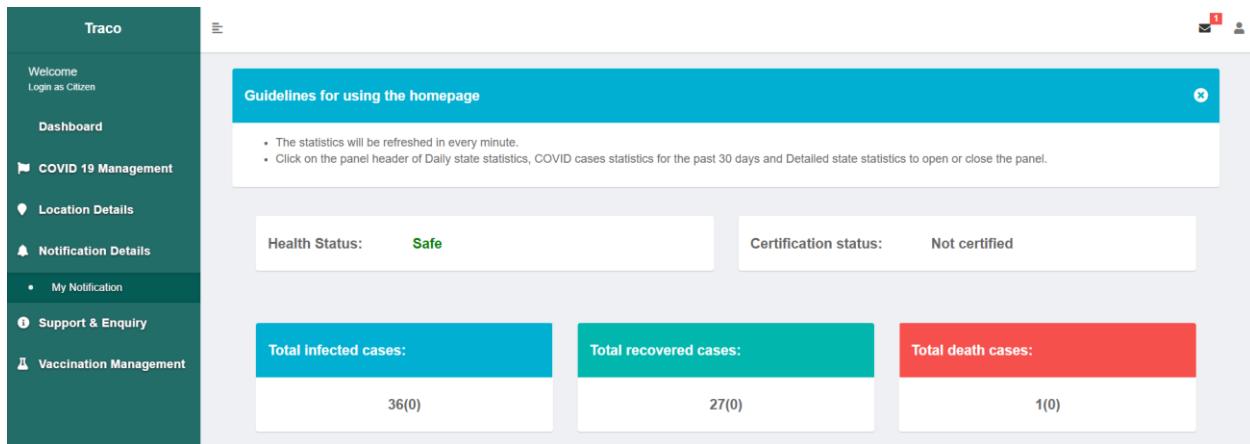


Figure 8.99: view notifications guideline 1

The citizens need to successfully login first. Then, click the “Notification Details” at the left side and click the “My Notification” selection.

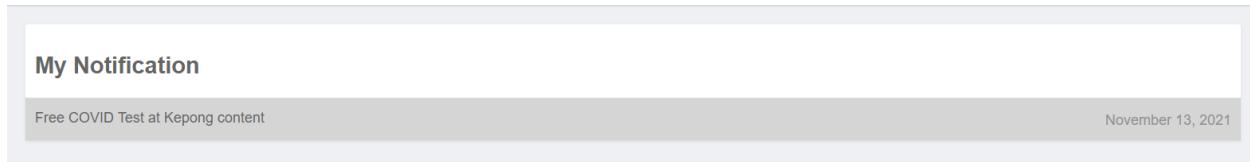


Figure 8.100: view notifications guideline 2

The citizens can check their existing notifications here and click a notification to view the full details of the notification.

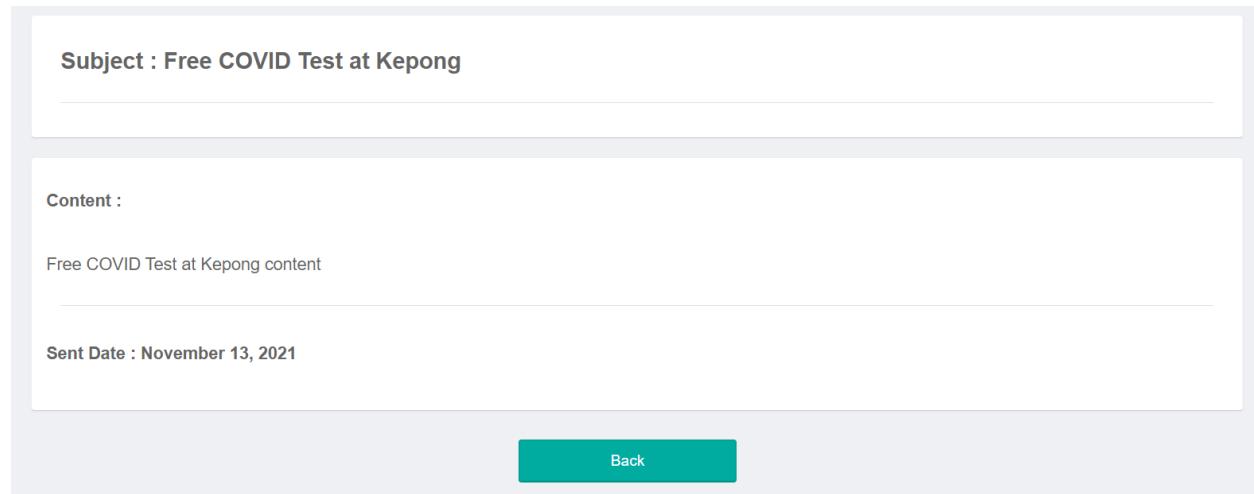


Figure 8.101: view notifications guideline 3

The citizens can view the full details of the notification after clicking one of the notifications in the My Notification.

Staff site

1. Create FAQ

The screenshot shows the staff dashboard. On the left is a sidebar with "Traco" at the top, followed by "Welcome" and "Login as HeadAdmin". Below that is a "Dashboard" section with "Citizen Management", "COVID 19 Management", "Enquiry Management" (which is expanded to show "FAQ Entry", "Citizen chat list", and "FAQ Listing"), "Health Status Management", "Location Management", and "Notification Management". The main content area has a header "Guidelines for using the homepage" with instructions about statistics refresh and panel controls. It features three summary boxes: "Total infected cases: 36(0)", "Total recovered cases: 27(0)", and "Total death cases: 1(0)". Below is a section titled "Daily state statistics (Date: 13/11/2021)" with a table:

State Name	Infected Cases
Johor	0
Kedah	0

Figure 8.102: create FAQ guideline 1

The staff need to successfully login first. Then, click the “Enquiry Management” at the left side and click the “FAQ Entry” selection.

FAQ Entry

FAQ Title*

Category* Use existing category
 Add new category

FAQ status*

FAQ Description*

Figure 8.103: create FAQ guideline 2

A FAQ form will pop up and the staff need to fill in all the fields. After filling the fields, the staff can click the “Cancel” button or “Save” button.



Figure 8.104: create FAQ guideline 3

If the staff clicks the “Save” button and all the details entered are correct, a successful message will be sent to the staff.

FAQs Listing

FAQ Title:

Category: All Active

FAQ status: Active Active

Search Add new FAQ

Title	Category	Status
View What is COVID-19	About COVID-19	Active
View How does the virus spread?	About COVID-19	Active
View How many person can go out during FMCO	About MCO	Active
View Can I eat at the restaurant during FMCO	About MCO	Active

Figure 8.105: create FAQ guideline 4

The staff can check that the new FAQ is added to the system.

2. View existing FAQs

Traco

Welcome
Login as HeadAdmin

Dashboard

Citizen Management

COVID 19 Management

Enquiry Management

- FAQ Entry
- Citizen chat list
- FAQ Listing

Health Status Management

Location Management

Notification Management

Guidelines for using the homepage

- The statistics will be refreshed in every minute.
- Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel.

Total Infected cases: 36(0)

Total recovered cases: 27(0)

Total death cases: 1(0)

Daily state statistics (Date: 13/11/2021)

State Name	Infected Cases
Johor	0
Kedah	0

Figure 8.106: view existing FAQs guideline 1

The staff need to successfully login first. Then, click the “Enquiry Management” at the left side and click the “FAQ Listing” selection.

The screenshot shows a user interface for managing FAQs. At the top, there is a header "FAQs Listing". Below it is a search bar with fields for "FAQ Title" and "Category" (set to "All") and dropdowns for "FAQ status" (set to "Active"). There are also "Search" and "Add new FAQ" buttons. Below the search bar is a table displaying four FAQ entries:

	Title	Category	Status
View	What is COVID-19	About COVID-19	Active
View	How does the virus spread?	About COVID-19	Active
View	How many person can go out during FMCO	About MCO	Active
View	Can I eat at the restaurant during FMCO	About MCO	Active

Figure 8.107: view existing FAQs guideline 2

The system will show all the existing FAQs to the staff in the FAQ listing.

The screenshot shows a user interface for managing FAQs. At the top, there is a header "FAQs Listing". Below it is a search bar with fields for "FAQ Title" (containing "How many person") and "Category" (set to "All") and dropdowns for "FAQ status" (set to "Active"). There are also "Search" and "Add new FAQ" buttons. Below the search bar is a table displaying one FAQ entry:

	Title	Category	Status
View	How many person can go out during FMCO	About MCO	Active

Figure 8.108: view existing FAQs guideline 3

The staff can search for a specific FAQ by entering the title, selecting the category or the FAQ status. If the staff want to view the full details of the FAQ, the staff can click the “View” on a specific FAQ.

The screenshot shows the 'FAQ Entry' page of the Traco COVID-19 Tracking System. The page displays a single FAQ record with the following details:

- FAQ Title***: How many person can go out during FMCO
- Category***: Use existing category (selected) - About MCO
- FAQ status***: Active
- FAQ Description***: 3 person

At the bottom of the form, there are three buttons: Cancel, Update, and Delete.

Figure 8.109: view existing FAQs guideline 4

The full details of the specific FAQ will be shown to the staff.

3. Update FAQ

The screenshot shows a 'FAQ Entry' form. It includes fields for 'FAQ Title*' (How many person can go out during FMCO), 'Category*' (radio buttons for 'Use existing category' (About MCO) and 'Add new category'), 'FAQ status*' (Active dropdown), and 'FAQ Description*' (3 person text area). At the bottom are buttons for 'Cancel', 'Update', and 'Delete'.

Figure 8.110: Update FAQ guideline 1

The staff needs to click the “View” of a specific FAQ at the FAQ listing and enter the FAQ form to update the details.

The screenshot shows the same 'FAQ Entry' form as Figure 8.110, but with updated information. The 'FAQ Title*' field now contains 'How many person can go out during MCO'. The 'FAQ Description*' field now contains '6 person'. The other fields remain the same: 'Category*' (Use existing category, About MCO), 'FAQ status*' (Active), and the bottom buttons ('Cancel', 'Update', 'Delete').

Figure 8.111: Update FAQ guideline 2

After changing the details, the staff need to click the “Update” button.

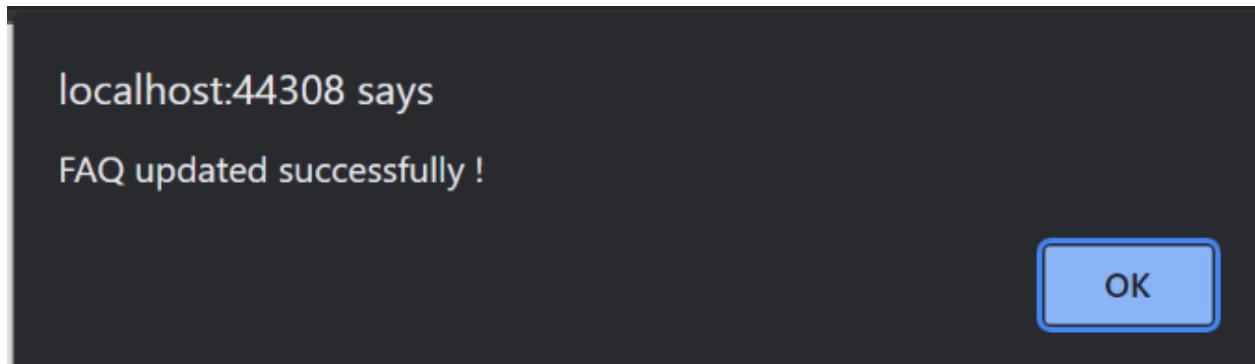


Figure 8.112: Update FAQ guideline 3

If all the details entered are correct, the system will send a successful message to the staff.

	Title	Category	Status
View	What is COVID-19	About COVID-19	Active
View	How does the virus spread?	About COVID-19	Active
View	How many person can go out during MCO	About MCO	Active
View	Can I eat at the restaurant during FMCO	About MCO	Active

Figure 8.113: Update FAQ guideline 4

The staff can check that the FAQ is updated successfully.

4. Delete FAQ

The form is titled "FAQ Entry". It contains the following fields:

- FAQ Title***: A text input field containing "How many person can go out during MCO".
- Category***: A radio button group where "Use existing category" is selected (indicated by a blue dot) and "About MCO" is chosen from a dropdown menu.
- FAQ status***: A dropdown menu showing "Active".
- FAQ Description***: A text area containing "6 person".

At the bottom are three buttons: "Cancel", "Update", and "Delete".

Figure 8.114: Delete FAQ guideline 1

The staff needs to click the “View” of a specific FAQ at the FAQ listing and enter the FAQ form to delete the FAQ. Then the staff need to press the delete button on the bottom.

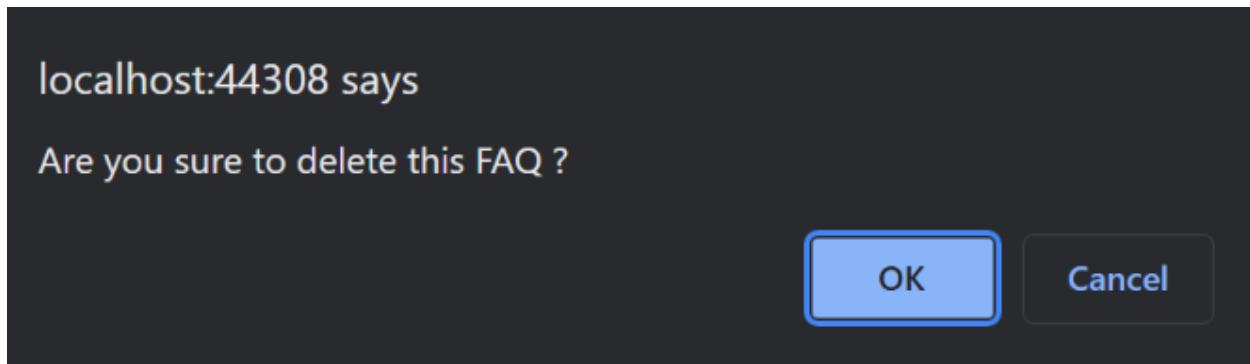


Figure 8.115: Delete FAQ guideline 2

A confirmation message will pop up to the staff. The staff can select “OK” to delete the FAQ.

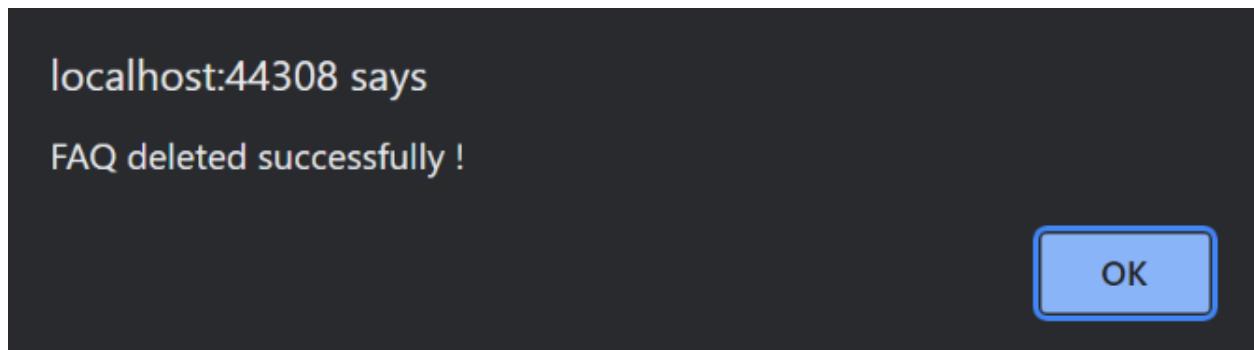


Figure 8.116: Delete FAQ guideline 3

A successful message will be sent to the staff if the FAQ is successfully deleted.

A screenshot of a web-based application titled "FAQs Listing". The interface includes search filters for "FAQ Title", "Category" (set to "All"), and "FAQ status" (set to "Active"). There are two buttons at the top: "Search" and "Add new FAQ". Below the filters is a table displaying three FAQ entries. The table has columns for "Title", "Category", and "Status".

	Title	Category	Status
View	What is COVID-19	About COVID-19	Active
View	How does the virus spread?	About COVID-19	Active
View	Can I eat at the restaurant during FMCO	About MCO	Active

Figure 8.117: Delete FAQ guideline 4

The staff can check that the FAQ is deleted successfully.

5. View citizens' chats

The screenshot shows the Traco COVID-19 Tracking System homepage. On the left, there is a sidebar with various management options: Welcome, Dashboard, Citizen Management, COVID 19 Management, Enquiry Management (selected), FAQ Listing, Health Status Management, Location Management, and Notification Management. The main content area has a teal header "Guidelines for using the homepage" with instructions: "The statistics will be refreshed in every minute." and "Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel." Below this are three boxes: "Total infected cases: 36(0)", "Total recovered cases: 27(0)", and "Total death cases: 1(0)". A section titled "Daily state statistics (Date: 13/11/2021)" shows a table with one row:

State Name	Infected Cases
Johor	0
Kedah	0

Figure 8.118: View citizens' chats guideline 1

The staff need to successfully login first. Then, click the “Enquiry Management” at the left side and click the “Citizen chat list” selection.

The screenshot shows the "Citizen Chat Lists" page. At the top, there is a filter for "Chat Status": Pending (All) In Progress Ended. Below this is a table with the following data:

Enter Chat	Send By	Chat Status	Sent Date	End Date
	SOO JI HAO	Pending	13-11-2021 06:18 PM	-

Figure 8.119: View citizens' chats guideline 2

The system will show all the pending chats in the “Pending (All)” selection, show the in-progress chat that is handled by the staff in the “In Progress” selection and the chats that are ended and handled by the staff in the “Ended” selection.

6. Enter chat and sent message to citizens

The screenshot shows a user interface titled "Citizen Chat Lists". At the top, there are three radio buttons for "Chat Status": "Pending (All)" (selected), "In Progress", and "Ended". Below this is a table with the following data:

	Send By	Chat Status	Sent Date	End Date
Enter Chat	SOO JI HAO	Pending	13-11-2021 06:18 PM	-
View Message				

Figure 8.120: enter chat and sent message to citizens guideline 1

In the citizen chat lists, the staff need to press the “Enter Chat” of a specific chat.

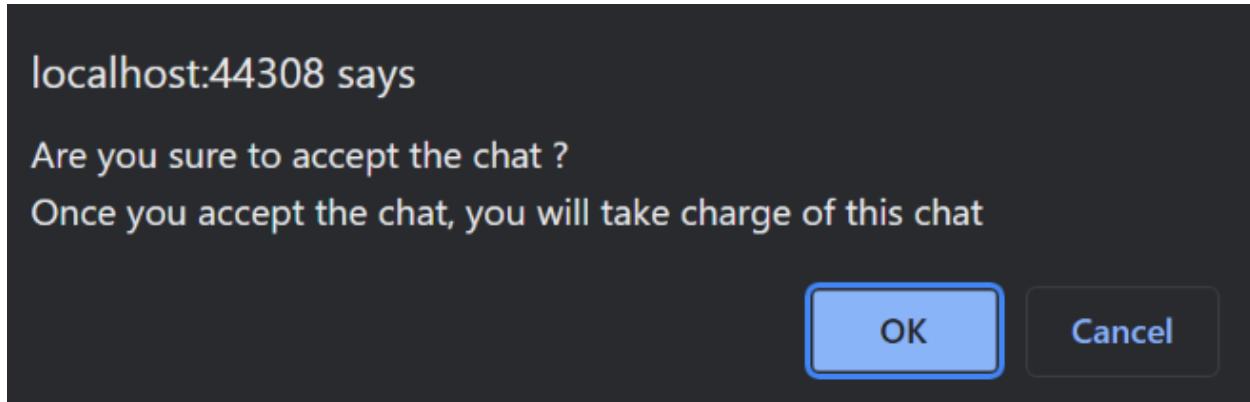


Figure 8.121: enter chat and sent message to citizens guideline 2

A confirmation message will be sent to the staff, the staff need to press “OK” to enter the chat room.

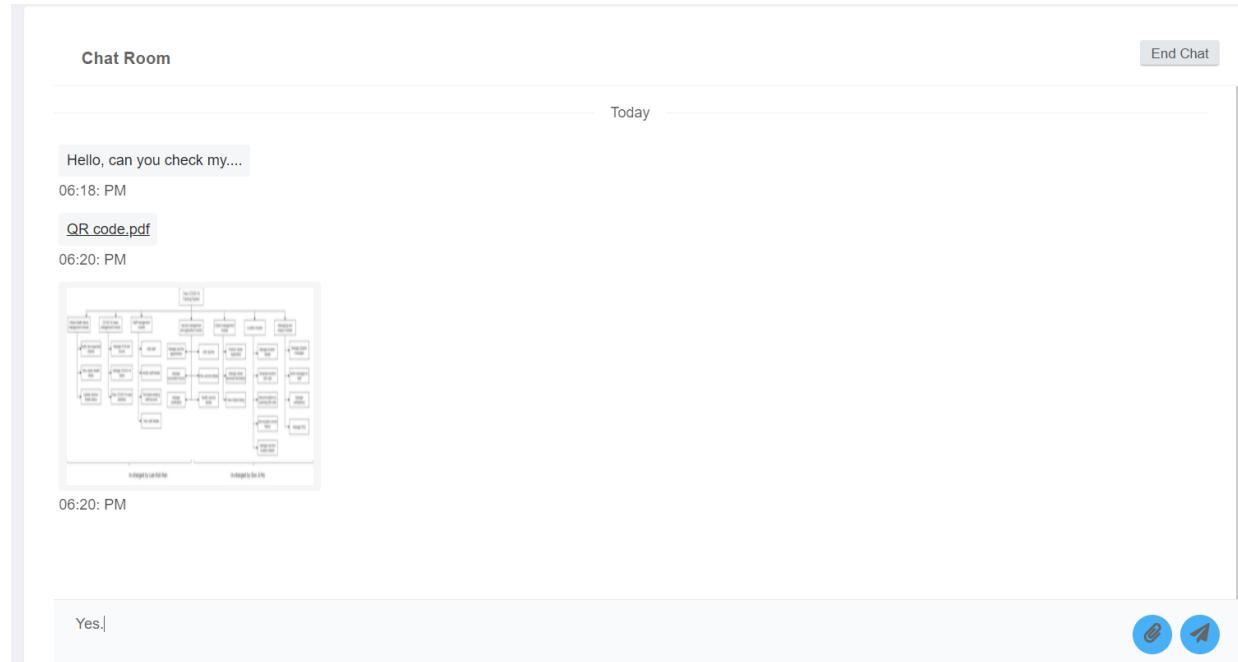


Figure 8.122: enter chat and sent message to citizens guideline 3

The staff will enter the chat room. The staff can enter a message and click the send icon to send a message. If the staff wants to end the chat, the staff can click the “End Chat” on the right top.

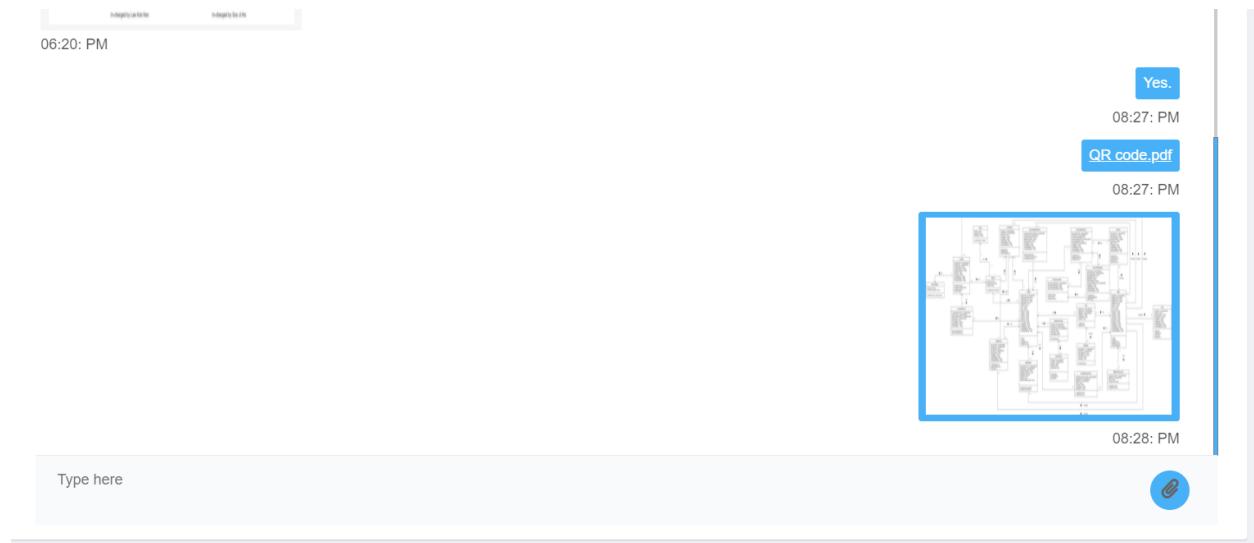


Figure 8.123: enter chat and sent message to citizens guideline 4

The staff also can send a pdf file and image file to the citizens if needed by clicking the attach icon.

7. Send notification

The screenshot shows the Traco COVID-19 Tracking System homepage. On the left sidebar, under 'Notification Management', there are two options: 'Notification listing' and 'Send notification'. The main content area displays 'Guidelines for using the homepage' with instructions about statistics refreshment and panel headers. Below this are three summary boxes: 'Total infected cases:' (36(0)), 'Total recovered cases:' (27(0)), and 'Total death cases:' (1(0)). At the bottom, a table titled 'Daily state statistics (Date: 13/11/2021)' shows data for Johor, with one row: State Name (Johor) and Infected Cases (0).

Figure 8.124: send notification guideline 1

The staff need to successfully login first. Then, click the “Notification Management” at the left side and click the “Send notification” selection.

7.1 Send notification to all citizen

The screenshot shows the 'Send Notification' dialog box. It has a 'Notification type:' section with radio buttons for 'All' (selected), 'Category', and 'Personal'. Below this are fields for 'Subject*' (Free COVID Test at Selayang) and 'Content*' (Free COVID Test at Selayang content). At the bottom are 'Cancel' and 'Send' buttons.

Figure 8.125: send notification to all citizen guideline 1

The staff need to enter the subject and content and click the “Send” button to send the notification to all citizens.

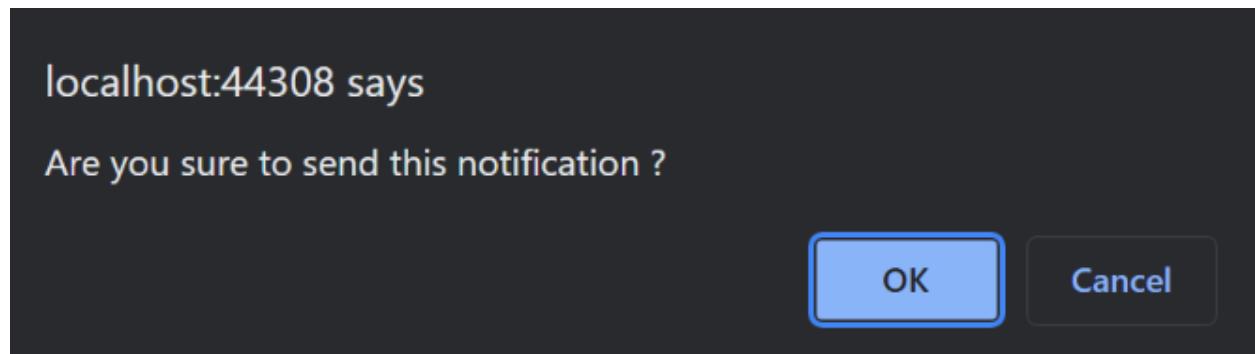


Figure 8.126: send notification to all citizen guideline 2

A confirmation message will be shown to the staff, the staff need to choose “OK” to send the notification.

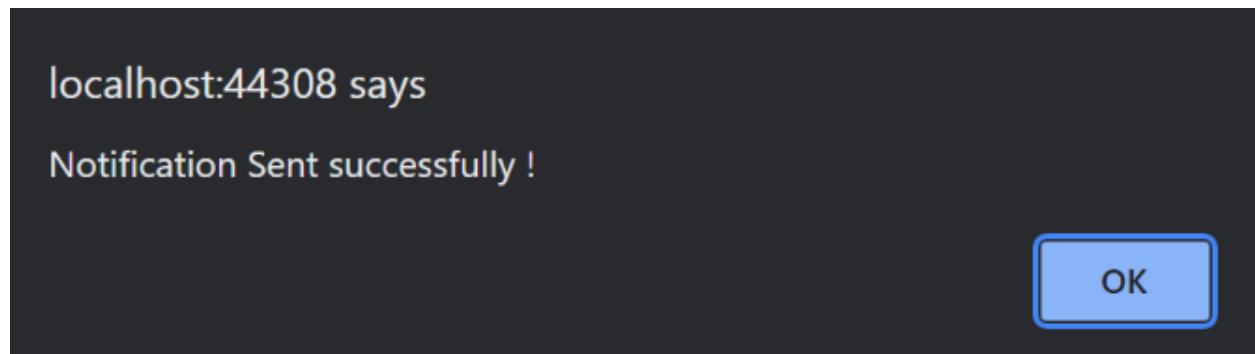


Figure 8.127: send notification to all citizen guideline 3

A successful message will show to staff if the notification is successfully sent.

7.2 Send notification based on category

The screenshot shows a user interface for sending notifications. At the top, there is a radio button group for 'Notification type' with three options: 'All' (unchecked), 'Category' (checked), and 'Personal' (unchecked). Below this, there are several input fields: 'Gender' dropdown set to 'Male', 'Health status' dropdown set to 'Infected', 'Age Between' range from 0 to 100, 'State' dropdown set to 'All', 'Subject' text input 'Free cure open for infected male', and a large 'Content' text area containing 'Free cure open for infected male content'. At the bottom are two buttons: 'Cancel' and 'Send'.

Figure 8.128: send notification based on category guideline 1

The staff need to select the notification type to “Category”, then select the type of citizens that they want to send for example male, female, infected, suspected and more for the figure above will send to infected male citizens. Next, enter the subject and content and click the “Send” button to send the notification.

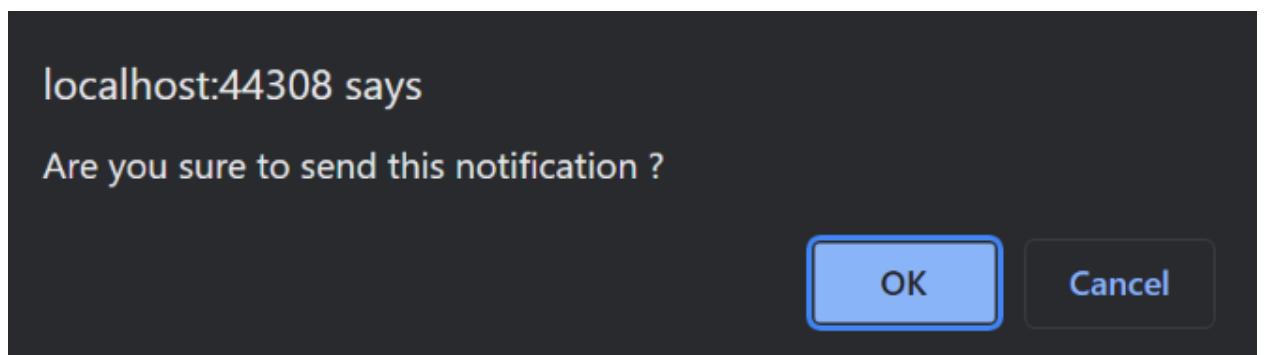


Figure 8.129: send notification based on category guideline 2

A confirmation message will be shown to the staff, the staff need to choose “OK” to send the notification.

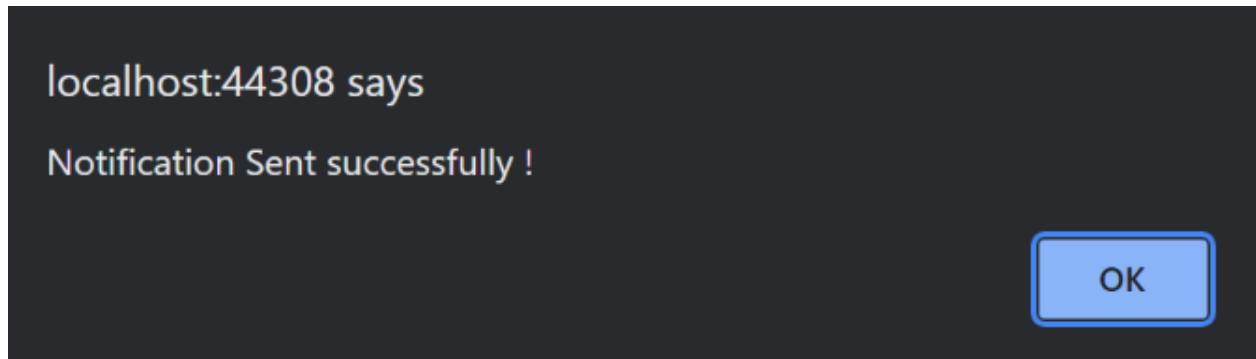


Figure 8.130: send notification based on category guideline 3

A successful message will show to staff if the notification is successfully sent.

7.2 Send notification to specific citizens

The screenshot shows a search interface for finding specific citizens. At the top, there is a label "Notification type:" followed by three radio buttons: "All", "Category", and "Personal", with "Personal" being selected. Below this are four input fields: "Citizen Name" (empty), "IC" (empty), "Gender" (dropdown menu showing "All"), and "Health status" (dropdown menu showing "All"). Underneath these are two input fields for age: "Age Between" with values "0" and "100", and a "Search" button. At the bottom, there is a section titled "Citizen List" containing a table with three rows of citizen data:

	Full Name	IC No	Gender	Age	Health Status
Add	Citizen 1	200938102013	Male	21	Safe
Add	Citizen 10	070358109055	Male	21	Infected
Add	Citizen 11	230562103681	Female	21	Infected

Figure 8.131: send notification to specific citizens guideline 1

The staff need to select the notification type to “Personal”. The staff can search for citizens and press the “Add” in the citizen lists to add the citizens that want to send notification.

Selected Citizen List

	Full Name	IC No	Gender	Age	Health Status
Remove	Citizen 1	200938102013	Male	21	Safe
Remove	Citizen 10	070358109055	Male	21	Infected

Subject*

Content*

Figure 8.132: send notification to specific citizens guideline 2

The added citizens will add into the selected citizen list and the staff can remove the selected citizen by clicking the “Remove” on a specific citizen. The staff also needs to enter the subject and content and click the “Send” button to send the notification.

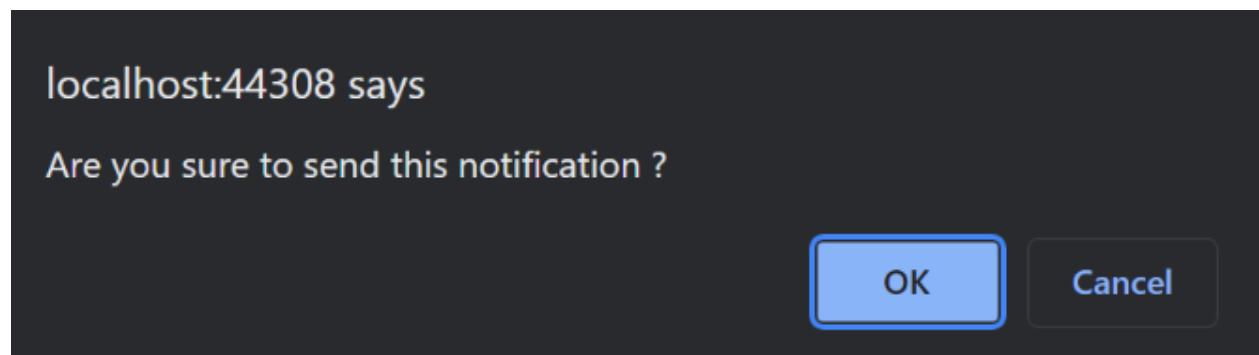


Figure 8.133: send notification to specific citizens guideline 3

A confirmation message will be shown to the staff, the staff need to choose “OK” to send the notification.

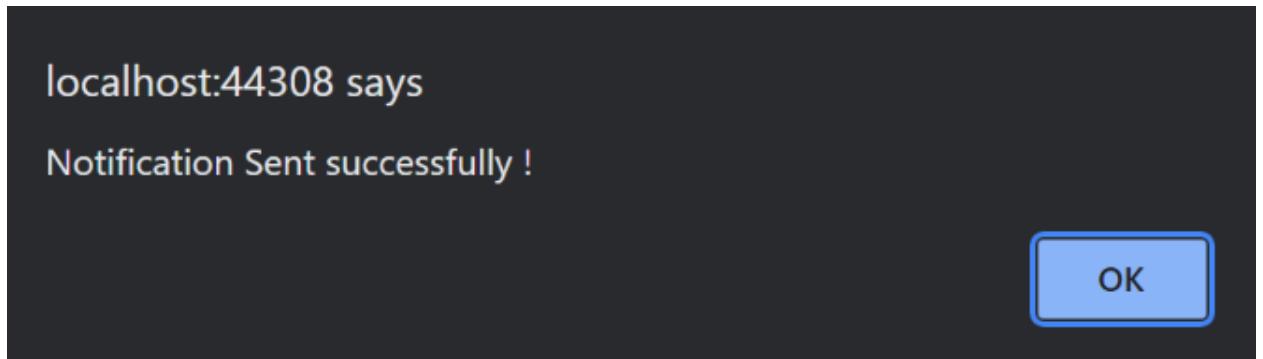


Figure 8.134: send notification to specific citizens guideline 4

A successful message will show to staff if the notification is successfully sent.

8. View notifications

A screenshot of the Traco COVID-19 Tracking System homepage. On the left is a dark sidebar with the Traco logo at the top, followed by "Welcome" and "Login as HeadAdmin". Below these are several menu items: "Dashboard", "Citizen Management", "COVID 19 Management", "Enquiry Management", "Health Status Management", "Location Management", "Notification Management" (which is currently selected, indicated by a blue background), and "Notification listing". The main content area has a teal header bar with the text "Guidelines for using the homepage". Below this is a list of instructions: "The statistics will be refreshed in every minute." and "Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel.". Underneath is a section titled "Daily state statistics (Date: 13/11/2021)". It contains three cards: "Total infected cases: 36(0)", "Total recovered cases: 27(0)", and "Total death cases: 1(0)". At the bottom of this section is a table with one row, showing "State Name: Johor" and "Infected Cases: 0".

Figure 8.135: view notifications guideline 1

The staff need to successfully login first. Then, click the “Notification Management” at the left side and click the “Notification listing” selection.

Notification Listing

Subject:

Start Date:

End Date:

Search

	Subject	Sent Date	Sent By
View	You are selected to get a free lucky draw	13/11/2021 10:11:41 PM	staff1234
View	Free cure open for infected male	13/11/2021 9:29:33 PM	staff1234
View	Free COVID Test at Selangor	13/11/2021 8:51:58 PM	staff1234
View	Free COVID Test at Kepong	13/11/2021 8:39:12 PM	staff1234

Figure 8.136: view notifications guideline 2

The system will show all the notification details that are manually sent by the staff in the notification listing.

Notification Listing

Subject:

Start Date:

End Date:

Search

	Subject	Sent Date	Sent By
View	Free cure open for infected male	13/11/2021 9:29:33 PM	staff1234

Figure 8.137: view notifications guideline 3

The staff can search for specific notification by entering the subject, selecting start date or end date. The staff can press the “View” of a specific notification to view the full details of the notification.

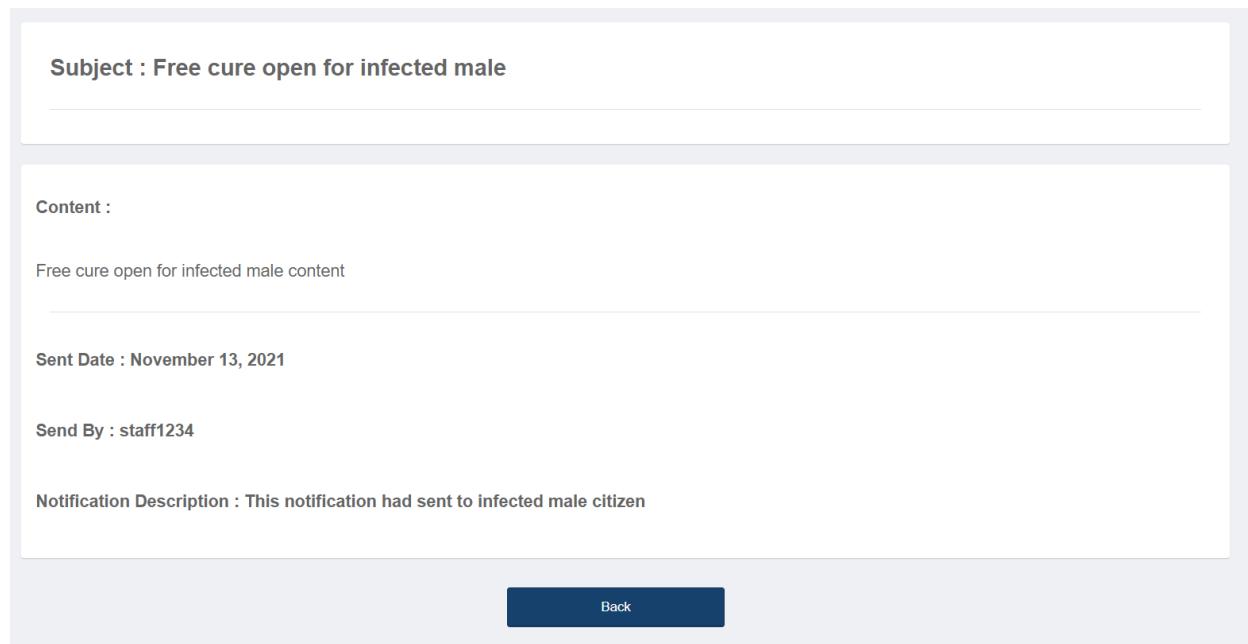


Figure 8.138: view notifications guideline 4

After clicking the “View” of a specific notification in the notification listing, the staff can view the full details of the notification.

Vaccine management and application module (Author focus on vaccine management)

1. Add new vaccine

The screenshot shows the Traco COVID-19 Tracking System interface. On the left, a vertical sidebar menu lists various management modules: Enquiry Management, Health Status Management, Location Management, Notification Management, Staff Management, and Vaccination Management. Under Vaccination Management, there is a list of sub-options: Vaccine listing, Vaccine appointment listing, Vaccinated certificate listing, Special cases listing, Export vaccination statistics, Vaccine entry, Special cases entry, and Vaccination record listing. The main content area displays a teal header titled 'Guidelines for using the homepage'. Below this, three summary boxes show: 'Total infected cases: 36(0)', 'Total recovered cases: 27(0)', and 'Total death cases: 1(0)'. A section titled 'Daily state statistics (Date: 14/11/2021)' follows, featuring a chart titled 'Daily cases for each state' with two horizontal bars at 1.0 and 0.5. To the right is a table with columns 'State Name' and 'Infected Cases', showing data for Johor, Kedah, Kuala Lumpur, Kelantan, and Labuan, all with 0 cases.

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.139: add new vaccine guideline 1

The staff need to successfully login first. Then, click the “Vaccination Management” at the left side and click the “Vaccine entry” selection.

The screenshot shows a 'Vaccine Profile' form. It contains five input fields: 'Vaccine Name*' with value 'COVAC', 'Manufactured by*' with value 'COVAC SDN BHD', 'Number Of Dose*' with value '2', 'Day Range*' with value '14', and a dropdown 'Status*' with value 'Active'. Below the form are two buttons: 'Back' and 'Save'.

Figure 8.140: add new vaccine guideline 2

A vaccine form will show to the staff, the staff needs to enter all the fields and click the “Save” button.

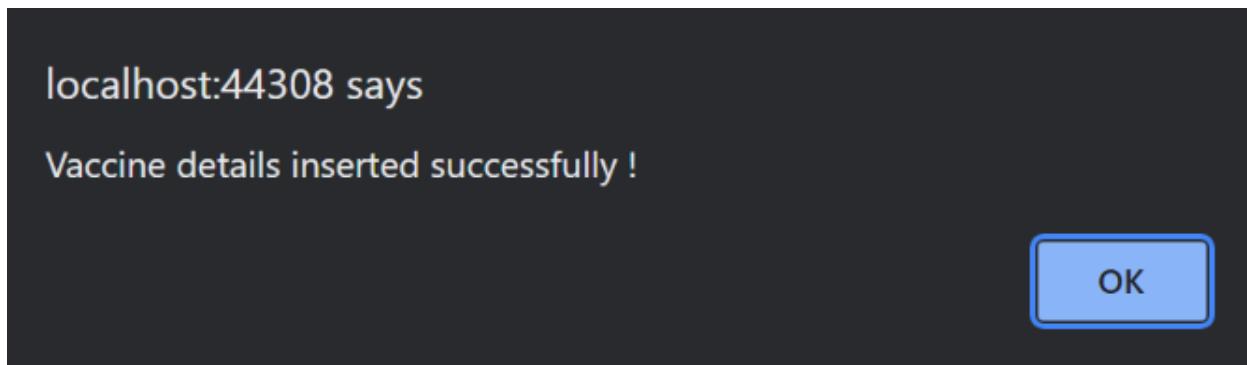


Figure 8.141: add new vaccine guideline 3

If all the details entered are correct, the system will send a successful message to the staff.

Vaccine Listing

Vaccine Name:

Manufactured By:

Number Of Doses: Status:

Search **Add new vaccine**

	Vaccine Name	Manufactured By	Day Range	Vaccine Status
View	Pfizer	miao2	21	Active
View	COVAC	COVAC SDN BHD	14	Active
View	Jerry Vaccine	Jerry Sdn Bhd	15	Active
View	AZ	miao	60	Active
View	Sinovac	miao3	14	Active

Figure 8.142: add new vaccine guideline 4

The staff can check that the new vaccine is added.

2. View existing vaccine

Traco

- Enquiry Management
- Health Status Management
- Location Management
- Notification Management
- Staff Management
- Vaccination Management**
 - Vaccine listing
 - Vaccine appointment listing
 - Vaccinated certificate listing
 - Special cases listing
 - Export vaccination statistics
 - Vaccine entry
 - Special cases entry
 - Vaccination record listing

Guidelines for using the homepage

- The statistics will be refreshed in every minute.
- Click on the panel header of Daily state statistics, COVID cases statistics for the past 30 days and Detailed state statistics to open or close the panel.
- Click on a specific state in the Detailed State Statistics to show the district statistics of the selected state.

Total infected cases:	Total recovered cases:	Total death cases:
36(0)	27(0)	1(0)

Daily state statistics (Date: 14/11/2021)

State Name	Infected Cases
Johor	0
Kedah	0
Kuala Lumpur	0
Kelantan	0
Labuan	0

Figure 8.143: view existing vaccine guideline 1

The staff need to successfully login first. Then, click the “Vaccination Management” at the left side and click the “Vaccine listing” selection.

Vaccine Listing

Vaccine Name

Manufactured By

Number Of Doses Status Active

	Vaccine Name	Manufactured By	Day Range	Vaccine Status
View	Pfizer	miao2	21	Active
View	COVAC	COVAC SDN BHD	14	Active
View	Jerry Vaccine	Jerry Sdn Bhd	15	Active
View	AZ	miao	60	Active
View	Sinovac	miao3	14	Active

Figure 8.144: view existing vaccine guideline 2

The system will show all the details of the vaccine in the vaccine listing.

Vaccine Listing

Vaccine Name: COVAC

Manufactured By:

Number Of Doses: 1

Status: Active

Search **Add new vaccine**

	Vaccine Name	Manufactured By	Day Range	Vaccine Status
View	COVAC	COVAC SDN BHD	14	Active

Figure 8.145: view existing vaccine guideline 3

The staff can search for specific vaccines by entering the name, manufactured by, selecting the number of dose or the status. If the staff want to view the full details of the vaccine, the staff can press the “View” of a specific vaccine. If the staff wants to add a new vaccine, the staff can click the “Add new vaccine” button.

Vaccine Profile

Vaccine Name*: COVAC

Manufactured by*: COVAC SDN BHD

Number Of Dose*: 2

Day Range*: 14

Status*: Active

Back **Update**

Figure 8.146: view existing vaccine guideline 4

After clicking the “View” of the specific vaccine in the vaccine listing, the staff can view the full details of the vaccine.

3. Update existing vaccine

Vaccine Listing

Vaccine Name:

Manufactured By:

Number Of Doses: Status: Active

Search Add new vaccine

	Vaccine Name	Manufactured By	Day Range	Vaccine Status
View	Pfizer	miao2	21	Active
View	COVAC	COVAC SDN BHD	14	Active
View	Jerry Vaccine	Jerry Sdn Bhd	15	Active
View	AZ	miao	60	Active
View	Sinovac	miao3	14	Active

Figure 8.147: update existing vaccine guideline 1

To update an existing vaccine, the staff need to click the “View” of a specific vaccine in the vaccine listing.

The screenshot shows a 'Vaccine Profile' update form. It contains five input fields: 'Vaccine Name*' with value 'COVACCINE', 'Manufactured by*' with value 'COVAC SDN BHD', 'Number Of Dose*' with value '2', 'Day Range*' with value '21', and a dropdown 'Status*' set to 'Active'. Below the form are two buttons: 'Back' and 'Update'.

Figure 8.148: update existing vaccine guideline 2

The system will show the vaccine form to the staff, the staff can change the details of the vaccine in the form and click the “Update” button after finishing changing the details.

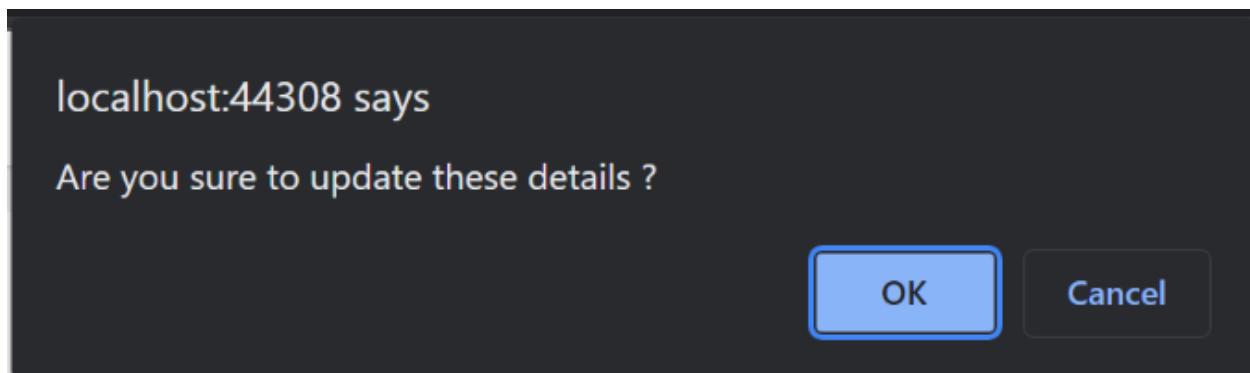


Figure 8.149: update existing vaccine guideline 3

A confirmation message will show to the staff, the staff can click “OK” to update the vaccine details.

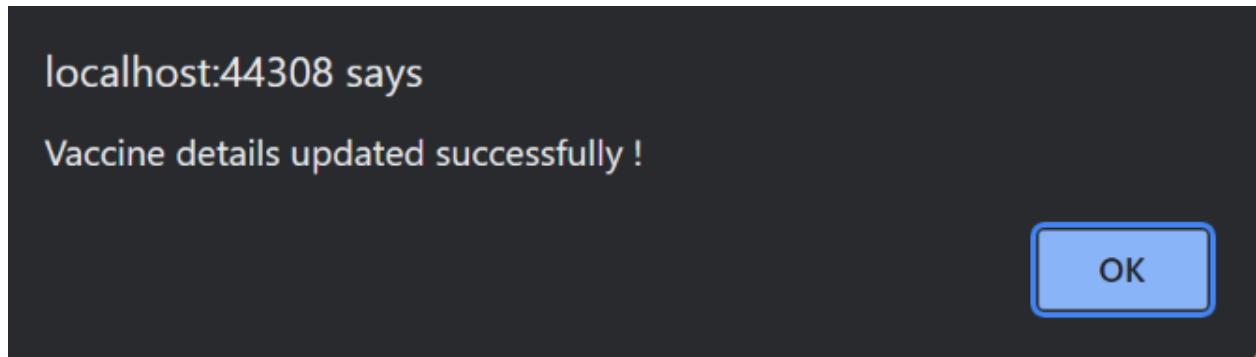


Figure 8.150: update existing vaccine guideline 4

If all the details entered are correct, the system sends a successful message to the staff.

Vaccine Listing

Vaccine Name

Manufactured By

Number Of Doses Status Active

	Vaccine Name	Manufactured By	Day Range	Vaccine Status
View	Pfizer	miao2	21	Active
View	COVACCINE	COVAC SDN BHD	21	Active
View	Jerry Vaccine	Jerry Sdn Bhd	15	Active
View	AZ	miao	60	Active
View	Sinovac	miao3	14	Active

Figure 8.151: update existing vaccine guideline 5

The staff can check that the vaccine is updated successfully.