Project Background

Topic

Influenced all aspects of economic and social life: The COVID-19 virus had a big impact on all of these things. When the COVID-19 pandemic was at its worst, digital technology showed how important it is to use digital technology to prevent and control epidemics, as well as to run society. Despite the best efforts of medical workers on the front lines, the sickness in Vietnam has kept people from socializing for a long time. The 4-Tech team is made up of people who love technology and want to help doctors and nurses. To help people in Vietnam and all over the world fight this disease, our team chose this project to work on.

Aims and Goals

Covid 19 has wreaked devastation around the globe, most notably in Vietnam. Due to the disease's complexity and quick development, individuals are compelled to retreat socially. As can be seen, this activity has a direct influence on the economic growth and human lives of a large number of countries. A surge of new cases has put the health systems of various countries in jeopardy. Vaccination efforts have sprung up in response to prior calamities in the intention of developing herd immunity and quickly reestablishing normalcy. Additionally, a challenge for the information technology industry is offering statistical solutions or identifying individuals who have had all necessary vaccinations and medical records for patients infected with Covid 19. This is why our team set out to strengthen the country's capacity for epidemic prevention and management.

The face recognition technology will identify Covid 19 data, such as vaccination records and medical information. Our team designed and manufactured devices to assist the anti-epidemic effort in limiting virus transmission, reducing health-care expenses, and restoring normal social life as early as feasible. As a result, the 4-Tech team established three primary objectives for our involvement in this project:

- **Rapid return to the new normal:** Every organization, school, and company needs face recognition to maintain a safe working environment—and to adhere to regulatory norms for live operating situations. One of the primary objectives of this project is to develop a phone application capable of detecting faces and retrieving personal information connected with covid 19.
- **Reduce exposure, enhance safety:** This initiative also provides companies and schools with a tool to assist in identifying individuals who are suited for direct participation in activities, employment, and study that do not need human contact. Face recognition and Covid-19 medical data records will be used to alert staff about potentially dangerous entrances. This is necessary to prevent direct human-to-human contact, which may result in the transmission of covid 19.

- **Immediate action and long-term development:** Identifying the epidemiology of individuals who test positive for covid 19 may aid in the prevention of disease outbreaks. The Covid 19 face recognition project satisfies the Vietnamese health care system's need for rapid answers and continued growth of digital technology in life and health.

Scope

At the beginning, we made a mistake of underestimating what needed to be done in this project and overestimated our own ability. We had to fix a lot of our scope midway of the project but eventually still kept the concept and our aim for the project. As we progress further, there are many times when we have to reconsider our scope and work together to define our final product. Finally, we managed to follow what we set out to do from the progress report. Even though the outcome is not as complete as what we expected, the ending product still achieved its purpose and worked properly. Nevertheless, there are still some small changes in the scope related to the work that we did not think achievable by the time we have to deliver the demo.

The table below show the priority of the feature that we will be working on for this project:

	Features for admin		
	Priority	Features	Description
In Scope	High	Face recognition module	The module that will be able to recognize the face of the person that is trained through data already
	Medium	UI/UX	The UI/UX design of the mobile application
		Frontend	The frontend of the mobile application
		Sync the main function with the application	The mobile application and the face recognition module can exchange data
		Add User	Allow the admin to add a new user to the database.
		Take picture	The application will be able to take the picture of the user and work with it
	Low	Login admin	Login to the admin account
		Logout	Logout of the admin account
		Get the face recognition result	The application will be able to take the picture captured by the user and send the picture to the face recognition function to send the result back for the application

		Update data	Update the data for users in the database.
		Check database	Allow the admin to access to all of the user in the database
		Request function	The notification that someone want to change the data in the database so that the admin can change it manually
		Request website	Contain the form that the user will put in data and state the reason what they want to change in the database for the admin to review and change.
		Signup admin	Sign up as the admin to use the function of the application.
Out of scope		message	The ability to have a conversation with other users. All the request should go through the request function
		Recognize face not in database	If the face recognition does not recognize the face in the database, options such as add user or check for data in the database will show up
		Security	Security to protect student data from being leaked out to the other user

For the 3 outcomes that we have setted out in the progress report, we managed to finish the first outcome as we expected and finish a part of outcome 2 and outcome 3. For the first outcome that we finish, it is the frontend for the mobile application and the face recognition module but they are not connected or have any function. This is the one that we know that we can definitely deliver for the demo. However, there are some slight changes in outcome 2 and outcome 3 when we are working on the project. At first, we expected to finish the outcome 2 first which is the backend and subfunction for the mobile application first before connecting the application to the face recognition function. After that, we will work on combining them together. However, what we did was to combine both of them since what we achieved was a function that connected with the face recognition module. We managed to create the add user function since that is the function that suited best with the mobile application that can work with the face recognition module. With this function, we managed to add users through the mobile application with their picture so that they can be recognized by the face recognition module. We work on this instead of following the roadmap because we want to deliver the full demo experience and if we follow the roadmap and manage to finish outcome 2, our application will not be able to show what it's purpose in the demo which is why we focus on

one function that can connect both of them. After considering our option, we decided to finish the add user function because it demonstrates our application the best.

The final outcome:

The outcome that we managed to achieve when we started working on this product is the basic frontend of the mobile application and the face recognition module. Other than that, we also have the add user function so that the module can recognize them after being added and show the result to a website.

Future Direction

In this section I would assume that the project would have 3 important phases: next three months, next one year and next 5 years.

Next three months:

Non-technical aspect:
- My team keeps the same team members and continues to complete our main feature.
- We would spend 8 hours a week for every member on the project and 10 minutes every day for updating our process via Team meeting.

Technical aspect:
- Display result after predict user on the application
- Build a data pipeline system to store and manage user databases.

The rationale and what requirements:

We have to arrange our timetable to have enough energy and time for continuing the project. We also

need a mentor for supporting us when we have some advanced or domain questions. Building a database system is very important and moreover our system runs primarily based on databases.

Next one year:

Non-technical aspect:
- My team keeps the need to have more team members (about 2 members who are strong about back-end) and a supervisor and continues to complete our main database feature.
- We also need more budget to build the back-end section because there are many clouds such as AWS or Azure that are not free for big data.

Technical aspect:
- We need more testing phase to make sure our AI work well
- Design architect the data model and work flow of the database.

The rationale and what requirements:

After one year hard-working and focused, we can say that our main feature applications are quite completed. We need to find investment and people who are interested in our project. The budget is very important because no one can live without eating and a project as well.

Next five year:

Non-technical aspect:
- We need a team of finance and marketing for our product

- The finance team will manage the money flow and the marketing will help people know about our product.
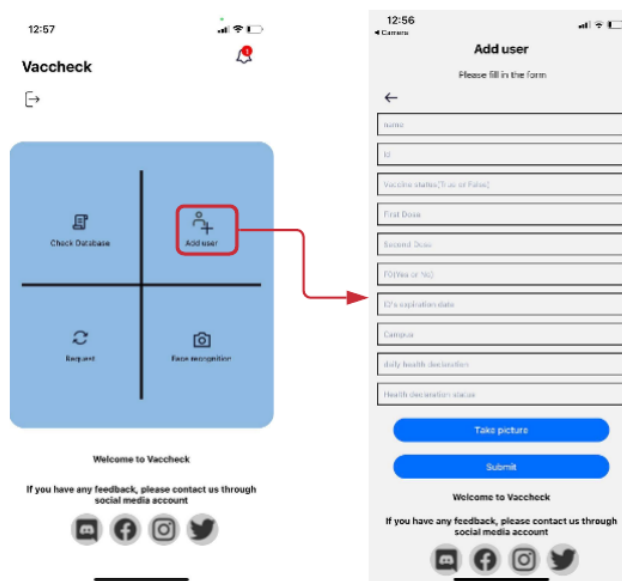
Technical aspect:
- We need more testing phase to make sure our AI work well
- Maintain our data security.

Key features

Three key features of our product is Registration (add user), Predicting (Face Recognition), Result (return personal information - they had provided)

Registration - Add user

Figure 1: Homepage and The Registration form.

Registration form: Users have to provide their information and health status, more important is that they have to provide their "face" picture for the AI to train.

The purpose of this step is to set-up data for the model to predict. If a person does not have information in the database, AI will return unknown information.

The way to register is also simple and quick, users just need to prove correctly and adequate information.

Predicting - Face Recognition
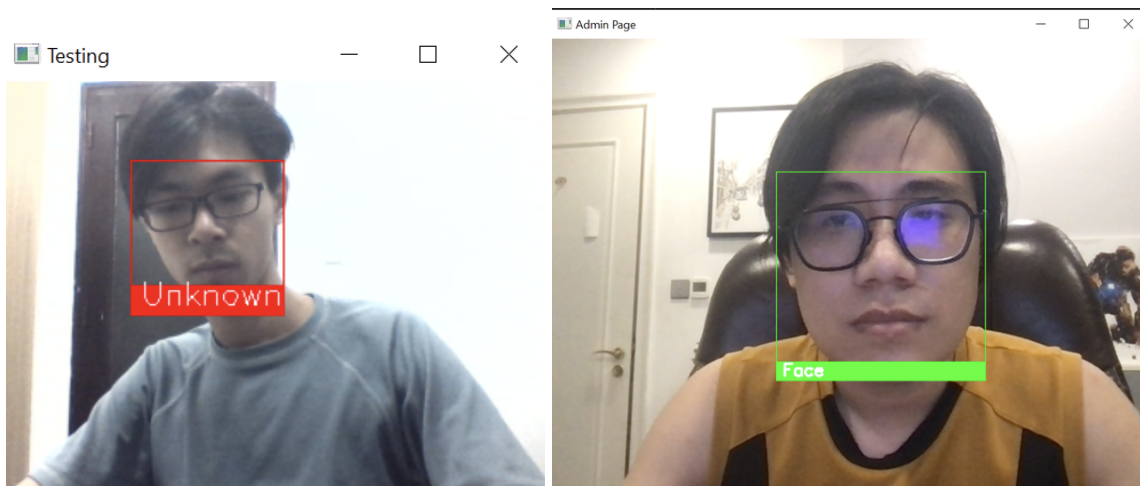
Figure 2: Camera and Face Recognition.

When a user moves their face to the camera monitor, if they have registered yet, the AI model can recognize their face (right picture), if not, the AI displays unknown (left picture).

The purpose of this step is straightforward, just to validate who had registered and who not, in more detail, which person who is successfully recognized by the system, their provided information is queried and extracted to the Result page.

The way to execute this step is also simple, users only need to move their face to the camera monitor.

Return Result - Face Recognition

Figure 3: Personal information.

The result would be like this, it shows adequate information for the security that they can approve or reject a student to enter campus.

To execute this step, users only need to complete all two steps below and click button load.

Project Progress

Description

During our first team meeting, everyone had the opportunity to express their opinions on a variety of IT-related topics that they had in mind. As a consequence of the country's social isolation, Vietnamese healthcare workers have been subjected to appalling working conditions for the last six months. Medical professionals face several challenges on a daily basis, and some members of the 4-IT team are tech enthusiasts who want to bring attention to these difficulties. Listening to the contrasting opinions of different IT professionals, including web developers, security specialists, and data scientists on a wide range of subjects is fascinating. A guide for observing what is going on Face recognition has immense potential and is a crucial component of any approach intended at combatting the Covid-19 outbreak, despite the fact that it may seem counterproductive in the face of the epidemic. We have decided to proceed with this face recognition project as a result of the precise information and expertise that has been gathered. This will allow us to devote all of our efforts to bringing about positive change in Vietnam and around the world, as well as providing assistance to those affected by the epidemic in the shortest amount of time possible.

Over the course of the project, our 4-Tech team achieved a number of important goals in the next steps following the phases mentioned in previous progress report from week 8, including:

- Phase 4: Building main systems (week 9)
- Phase 5: Combining face recognition system to mobile application (week 10)
- Phase 6: Finalising and testing product (week 11)

Scope

Compared to the scope that we developed in the progress report, the scope has not changed much. We prioritize the add users function over the function of recognizing the user based on the picture being taken by the mobile application and receiving the result from the module. We also split the take picture function from before to 2 functions which are taking pictures and get the face recognition result since the take picture from the progress report includes getting the result from the module too. We split them because the add user also uses the camera so we split them so that the scope is more correct and closely related to our project. Even though there are times when we are experiencing scope creep and want to reduce our work, in the end, we decided to go back to what we intended and finish it. Eventually, we managed to produce a proper demo and there are not much changes to the scope compared to what we set out in the progress report.

Progress

Week 9 - Building main systems: The workload this week is quite heavy. This week is our initial phase for building the back-end of our system. As discussed and shared, all the team

members do not have any experience in building back-end. We start to execute the build server and get & post method.

Week 10 - Combining face recognition system to mobile application: This week the post and get method were done, but we found one problem : our own mobile phone cannot connect to the local server due to some reasons related to different API. We discussed many hours and agreed to build a website for back-up in case our mobile phone broke and cannot connect to the server. The webpage receives images from the camera and returns the results via the result page.

Week 11 - Finalising and testing product: This week my team is at the end of the process to complete our system. We can take a picture via phone camera and send it to the system for the "registration" step. The AI receives the picture and information of the user for training then predicts. The result is returned when we access the webpage (we do not have enough time to display the result via application . But I believe it was not a difficult task because it was a "reverse" process with registration.)

Week 12 - Presentation and Reflection: The week to sum up what we had done in all the semester, what is good, what is bad and how to improve. We also list down every challenges and how to overcome them.

Testing

During the testing phase, we define several requirements for each section in order to fix the bugs efficiently. In detail, there are 3 main sections, which are Mobile, Website, and AI model. In each section, we split into categories for managing easily, such as UI/UX and Server. Each of the testcase, we require input control, output for debugging, a developer and the result. The detailed testing is shown in figure 1.

Category	Test Case Name	Input	Expected Output	Date	Result
Mobile UI	Take picture	A click	Picture being capture	3/1/2021	✔
	Navigation	A click	Navigate between pages	29/1/2021	✔
	Receive data from user	Input data from user	Get data ready to be send	3/1/2021	✔
Mobile Back-end	Camera connection	Camera	Receive mobile camera	19/12/2021	✔
	Send picture	Picture being captured	Flask received the picture	3/1/2021	✔
	Send basic data	Data being sent	Flask received the data	3/1/2021	✔
Website UI	Live Video	✘	Display a live video	20/12/2021	✔
	Display Image	A single Image	Show a person image	23/12/2021	✔
	Result content	✘	Display personal information	29/12/2021	✔

	Resize browser	✘	Display content correctly	23/12/2021	✘
	Read JSON file	A JSON file	Return a dictionary in Javascript	22/12/2021	✔
Website Back-end	Host local server	✘	Run a web page with Flask	19/12/2021	✔
	Camera connection	Camera	Receive external camera	19/12/2021	✔
	Device connection	Devices	Multiple devices can connect	23/12/2021	✔
	Embedding AI model	✘	Can run the AI model with Flask	19/12/2021	✔
AI model	Face detection	Front face only	Return coordinate points	10/12/2021	✔
		Half face, etc.		11/12/2021	✘
	Face recognition	Exist in the dataset	Return a correct person	11/12/2021	✔
		Not exist in dataset		✘	✘
	Performance	A single image	Return result less than 1s	1012/2021	✔
	Accuracy	Training dataset	More than 80%	21/12/2021	✔
		Validation dataset	More than 80%	22/12/2021	✘
Data	Write JSON file	Predictions from AI model	Write result to json file correctly	22/12/2021	✔
	Labels pre-processing	✘	Labels for images correctly	812/2021	✔
	Image pre-processing	✘	Images in the same format	8/12/2021	✔
Web Security	Any Methodology	✘	✘	✘	✘

Figure 1

Tools and Technologies

Hardware
1. Laptop: Require for coding, hosting server
   - Camera: Require for real-time image processing
2. Mobile: Require for registration
   - Iphone: Interacting with the server

All team members are familiar.

Programming Language

- Python (3.8): AI project is Python-based

All team members are familiar.

Framework
- React Native (0.66): Require for developing the mobile application
- Expo (44.0.0): A framework and platform to develop React projects.

Only Vanh Anh and Minh are familiar.

Integrated Development Environment (IDE)
- Pycharm Community Edition (2021.2): Easy for writing code without setup too much

Library and Framework
- Pytorch (1.10.0): Library to write AI code
- OpenCV (4.2.0.34): Library support real-time computer vision
- Dlib (19.18.0): API for AI model

Only Nguyen and Dung are familiar with OpenCV, Pytorch and Dlib. Nguyen is familiar with Albumentation.

Communication and Collaboration
- Facebook Messenger: Every team member uses this application to communicate between members, including meetings online.
- Github: All of the source code of the project will be posted and managed here.
- Trello: Useful for assigning tasks
- Microsoft Teams: All of the meetings, discussions during the Covid period will take place here.
- Outlook: Controlling members' calendars.
- Google Drive: Managing essential documents for the project as well as the report.
- Grammarly: Tools for checking grammar group reports.

All team members are familiar.

Project Outcomes

During the development phases, we have finished many features which will be used in the final product. On the other hand, some features have been neglected due to limited time and lacking knowledge. In detail, there are two separate sections for the final product, which are mobile application and AI application, where each of those sections will have completely different functional outcomes.

Regarding mobile applications, we successfully developed friendly user interfaces and server connections. Initially, mobile UI/UX for registration is fully functional, albeit a little unappealing design. A user can register a personal account with personal information such as name, identification number and images. An admin user can view the result retrieved from the AI model. However, functions for distinguishing a student and an admin is under development. Also, the login page can not authenticate the valid account due to the limitation of developers and time. By default, everyone can log in as either an admin or an ordinary user. Therefore, this feature is also under development.

On the other hand, mobile connections are developed adequately with many essential functionalities. First, multiple mobile devices can connect to the mobile server for transmitting their data directly to other servers via a local network. Second, we authorise users to connect to the webpage operated by the Python server for viewing the result. The reason is that a display page on a mobile application is deprecated due to heavy workload and lacking time.

Relating to the AI section, the AI model is operated under the back-end of a website - Python server. The model can receive a video as an input to the model and return the result correctly. However, the connection with the mobile application is the one-way method, in which only the mobile can transfer the data to the Python server, not in reverse.

For the design, we did some simple demonstrations on how our project works, particularly the network connection.
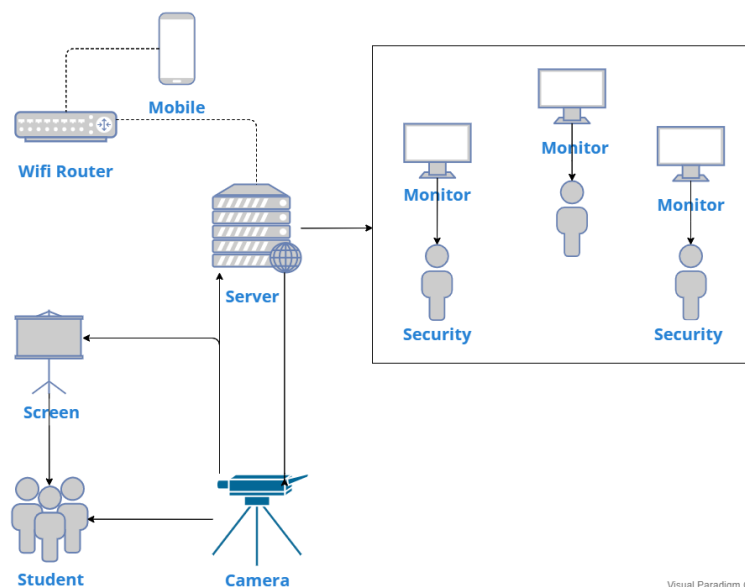
All of the parts in the diagram have been finished in the project. However, it only works with 1 station for the security for verification. For multiple stations with the AI model, problems with Python server knowledge prevents the project being expanded and widespread conveniently. Therefore, extending the existing project requires solving connection problems.

In terms of the project, there are several crucial parts of the project. Regarding the mobile application, it is vital for submitting and editing data for the AI model to learn. The displaying page is also necessary as it shows the result adequately for the admin to authenticate. As the AI section is our most crucial part, the project is useless without the AI model. Because of the aforementioned problems of the Python server and the mobile, the design for mobile applications is one-way only and must be improved in the future. Website, therefore, is our new modification for the scope as the communication from the Python server to the mobile server is challenging.

In conclusion, from low priority features defined to lower in the scope section, almost all features are dropped or implemented in some parts. We have some designs such that they can be extended and developed in the future.

Marketing Pitch

Having close contact during the pandemic is not a reasonable decision, especially granting permission to the entrance by the safeguard. Tedious with traditional conventions? We, RMIT students, are producing a product that utilises AI technology to solve this problem not only during the pandemic but also for the future. Our product allowed customers to utilise advanced technology, experiencing robust AI systems by authenticating stranger identification by the face through a camera or controlling your devices by face recognition.

Desiring low-price products with adequate quality? If you are using it for personal purposes, with only 19$, you can have an accuracy of 95% for 5 people and control your devices perfectly. For enterprise purposes, we can provide the system for managing more than 150 staff with an accuracy of 88% and more. Prices are relying on enterprise needs. Furthermore, you can expand your AI system according to your demands because it is simple enough to extend and maintain.