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**COVID-19 Apps in Viet Nam**

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# Abstract - Covid-19 is a very dangerous infectious disease. Covid-19 can spread quickly. Patients Covid-19 can become extremely dangerous, especially with current new variants. Therefore, measures to trace and medically isolate infected patients are extremely important. The State has introduced measures and policies such as social isolation, wearing masks when in contact with others, ... and indispensable applications to help trace infected cases for timely medical search and isolation. Applications are based on basic technologies available on all platforms such as Bluetooth, QR. The following article will compare current COVID-19 patient tracing applications in Vietnam.

# Keywords - COVID-19, Application, Viet Nam, Bluetooth, QR Code, Digital Health Book, PC-Covid

# 1. Introduction

Coronaviruses are a group of viruses that cause respiratory illness in humans that can lead to serious illness. It was first discovered in 2019 in Wuhan, China. The first cases in Vietnam appeared from January 23 to March 19, 2020. This virus can spread from the mouth or nose of an infected person in the form of droplets when coughing or sneezing, etc. You can become infected by inhaling the virus or touching a surface that has the virus on it, then touching your hands, eyes, nose, or mouth. The virus is more contagious in homes and in crowded places, so it greatly affects the daily life of each person. Implement 5K recommendation of The Ministry of Health is a good solution during the epidemic period, but it is an indispensable solution for applying science and technology to find and trace patients. The current new strain can infect very quickly, especially patients who can no symptoms such as cough, fever, etc. Therefore, contact tracing and storing personal data including names, addresses, individuals who have contact is extremely necessary. Protecting information during use is extremely important. Many tracking applications have been developed to identify people who have been in contact with sick people over a period of time. These applications use different techniques such as Bluetooth, QR, etc. This article will analyze some applications in Vietnam which is helping much in defending COVID-19 waves. They are PC-Covid and Digital Health Book. The second part of the report will present Bluetooth and QR technologies. In the third part, we evaluate Covid-related applications in Vietnam about the strengths and weaknesses of each application. Finally, the general conclusion.

# 2. Background work

## 2.1. Bluetooth

Currently, many applications use Bluetooth technologies. Bluetooth-based contact-tracing apps use a wireless technique to detect the smartphones of nearby positive diagnosed cases that have Bluetooth activated in their apps. When Bluetooth tracing is enabled, it works by transmitting a random, private, and secure ID. It’s like your phone is interacting with other phones in close proximity. Bluetooth tracing logs how long your phone and other phones are around each other. Bluetooth tracing on nearby phones must also be enabled for it to work.

This means that whenever someone is tested positive for COVID-19, they can send an anonymous message containing all of the IDs that their phone has transmitted in the last 14 days. If your phone can identify those IDs, then you were close and long enough to the sick person that you could get infected and you will be alerted. The alert will advise you on what to do to keep yourself and your family safe.

* **Advantages**
* Bluetooth is built-in on smartphones, allowing short-distance tracking between Bluetooth enabled smartphones.
* Bluetooth logs "contacts" between smartphones, rather than their location, more consistently and accurately .
* Using a bit-string instead of the user’s personal information helps to protect their privacy. This feature isn’t capable of sharing your location, name, or anything else about you. Bluetooth tracing doesn’t record where you’ve been or who’s been around you.
* Bluetooth tracing doesn’t use mobile data (no network consumption), and doesn’t drain your battery because it’s Bluetooth energy saving (Bluetooth Low Energy).
* **Disadvantages**
* For privacy reasons and to improve battery life, not everyone has Bluetooth enabled on their device.
* High false-positive and negative rates. Obstacles between two smartphones can reduce the strength of the received signal and, therefore, increase the calculated distance. COVID-19 can be spread through exhalation, speaking, shouting, or singing. People often stand face-to-face while talking, keeping their phones in their back pockets.
* Man-in-the-middle attacks could happen (including phishing attacks).
* Unethical wireless device tracking, using the BLE information broadcast by the tracing app.

## 2.2. QR Code

In this time of Covid pandemic, many programs such as NZ COVID tracer (New Zealand), Druk Trace (Bhutan), and the Alipay app which are integrated health code function have recently used as a feature to restrict and prevent the spread of the pandemic and its damages. QR code approaches for contact tracing are divided into two types: location-coupled QR contact tracing and symptom-based QR health code, and there are numerous concepts for incorporating QR health code techniques into contact-tracing programs. The symptom-based QR health codes, which have been published by health officials, use two colors to indicate an individual’s health state. As shown in the Figure 1, the green code shows that the person is not affected, whereas the red code indicates that the person is either infected or has a high likelihood of getting infected.

Qr code

Description automatically generated

Figure 1: QR code’s color

When compared to human operation, the information in the code is automatically read and evaluated using QR scanners, which lowers mistakes, enhances data trustworthiness, and boosts processing speed. The design's fundamental aim is to protect users' privacy by preventing the retrieval of their location data. Contact tracing, exposure risk, self-triage, health status self-updating, health care appointments, contact-free psychiatric consultation, and QR codes for other family members are all important components of the symptom-based QR health code.

QR health codes are now legally acknowledged as digital certifications of a person's health condition. China is one of the most noteworthy countries that use this notion. To access into public places, individuals must demonstrate that they have not had contact with a confirmed case of COVID-19 by displaying green health codes on their smartphones. A big data system is used to follow an individual's journey based on these records. This approach uses movement in busy public locations to determine if people are healthy or diseased. To stop the spread of the virus, a government can use traceability to swiftly identify possibly afflicted persons and take appropriate steps. Oxford University conducted a coronavirus simulation of one million inhabitants in a metropolis. It revealed that a digital contact-tracing software has the potential to significantly lower the number of coronavirus cases if around 60% of the population utilizes the app. The use of a QR code approach was efficient in restricting and slowing the transmission of the pandemic in China, where the total number of positive COVID-19 cases was limited to 363 cases, with 361 (99.4 percent) recovered by July 12, 2020. A strong centralized control method was used to achieve effective containment.

* **Advantages**
* When compared to manual operation, this strategy lowers mistakes, enhances data trustworthiness, and boosts processing speed due to QR automated scanning of code information.
* When treating highly contagious illnesses, the integration of features on one identical platform in a centralized manner, rather than the personal self-reporting that is often utilized in a decentralized approach, helps address data sharing delays.
* It helps to balance the demand on overcrowded health care systems by allowing people to self-triage and institutions to self-schedule.
* Because of its trustworthiness, traceability, and interoperability, it plays a vital role in combating COVID-19.
* It correctly detects those who were in close touch with an infected person.
* It protects users' privacy by not accessing their location data.
* **Disadvantages**
* Acceptance of this technique by the public: Due to concerns about privacy, some people do not trust or rely on QR code-based applications, resulting in a decline in the number of people who download the app.
* According to studies, unauthorized and unlawful use of healthcare information is harmful, resulting in an average financial loss of roughly $9.23 million worldwide in 2021. Furthermore, it has the potential to harm service providers' reputations as well as patients' confidence and health, resulting in lower population adoption rates. As a result, preventing harmful or illegal use of QR data is critical.

# 3. COVID-19 Apps in Viet Nam

Before the release of “PC-Covid”, there were 12 applications which helped in preventing COVID-19 pandemic. Thus, civilians had to install quite many applications in their phones, which made them feel uncomfortable. It also caused difficulty in government’s management. Furthermore, along with wide usage of QR Codes in public places, the need of unifying those applications became more and more urgent. As a result, on 30th September, 2021, PC-Covid was born and became the only application to serve COVID-19 prevention in Vietnam.

Basically, PC-Covid has some notable functions such as:

* + Providing and managing personal QR Code and QR Code at public places;
  + Scanning QR Code;
  + Health declaration;
  + Domestic move declaration;
  + Collecting reports from civilians;
  + Storing vaccinating/ testing information; etc.

“Digital Health Book” is an application of the Ministry of Health. It operates on the mobile application platform, and helps Vietnamese people easily manage their health information, not only COVID-19 but also other healthcare providers. Each resident will have a digital medical record book containing his/her health information, medical examination and treatment history, vaccinations, etc. Those will help management agencies understand people's health status, so local health centers can give appropriate instructions to each specific individual.

There are some main utilities of “Digital Health Book” such as:

* + Registering Covid-19 vaccinations;
  + Online Health Declaration;
  + Certification of COVID-19 vaccinations;
  + Advising F0 (F0 is someone who is infected with Covid-19);
  + Book an appointment at a Medical Facility;
  + Telemedicine consultation;
  + Managing health records;
  + Medical handbook; etc.

“PC-Covid” and “Digital Health Book” has been connected with each other since October 20th, 2021 to serve the prevention of the pandemic, as well as people’s living.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| App Name | | | | PC-Covid | Digital Health Book |
| Age Rating | | | Google Play | 3+ | 3+ |
| App Store | 4+ | 4+ |
| Developed By | | | | Vietnam’s Ministry of Information and Communications | Vietnam’s Ministry of Health |
| Access Date | | | | 25/12/2021 | 25/12/2021 |
| Release Date | | | | 30/9/2021 | 26/2/2021 |
| Rating(ouf of 5) | | Google Play | | 3,8 | 3,2 |
| App Store | | 3,3 | 2,4 |
| Number of Downloads | | Google Play | | Over 10 millions | Over 10 millions |
| App Store | | No data | No data |
| Compatibility | **Android** | | | Android 5.1 and up | Android 5.0 and up |
| **Iphone** | | | Requires iOS 9.0 or later | Requires iOS 12.0 or later |

Table 1: Android and IOS-based contact-tracing apps

|  |  |  |
| --- | --- | --- |
| Application Name | Advantages | Disadvantages |
| Icon  Description automatically generated  PC-Covid | - Easy in health declaration  - Travel controlling by QR code  - Support in returning test results online.  - Support in tracing and isolation management  - Communicating with "Digital Health Book" to easily get vaccination information  - Detecting close contact with people infected with Covid-19 via bluetooth for timely handling  - Recording information of people who have been in contact  - Data security: Only save data on the device without transferring it to the system  - No location collecting  - Anonymity from others (only competent health authorities know infected and suspected infected people) | - Users must turn on Bluetooth to detect contacts  - Fast battery drain  - Many bugs in the application  - Linking information with "Digital Health Book" still has some errors such as: not updating full vaccination information or having fault in editing phone numbers |
| Logo, company name  Description automatically generated  Digital Health Book | - Online COVID-19 vaccination registration  - Providing medical information about health status and symptoms that occur after being vaccinated with COVID-19 vaccine  - Certification of COVID-19 vaccination  - Booking an appointment at a medical facility  - Information about personal health records  - Advising F0  - Connecting with “**PC-Covid**” | - Due to the large amount of vaccination data, there may be delays and errors in vaccination information  - Many system errors such as: unable to login, slow loading, etc.  - Cannot edit phone number |

Table 2: Advantages and disadvantages Covid-19 Apps in Viet Nam

# 4. Conclusion

Currently, the COVID-19 pandemic is still developing very complicatedly around the world. New variants of the COVID strain are spreading faster and more dangerously, threatening human health. Therefore, building and developing applications such as Digital Health Book, PC-Covid, ... is very necessary. It greatly contributes to health monitoring, tracing and locating the source of the disease. Applications are reviewed and evaluated on many aspects, such as good traceability, accuracy, reliability, and security of user information, ... On the basis of evaluating applications, we see the advantages and disadvantages of each technology solution: Bluetooth and QR Code. The use of QR Code can be a good solution. Users will need to scan the code at the points of passage. However, the scanning of the code will depend on the honesty of the user. Sometimes, scanning the code requires intervention from external factors such as prompts and requests. Not only that, with the Digital Health Book and PC-COVID applications, the use of QR Code requires the support of the Internet. Tracking will be difficult because it is not possible to guarantee an Internet access point for everyone. In Vietnam, scanning QR Code is widely used in the whole society. As for Bluetooth, it's simpler than QR Code. Users only need to turn on Bluetooth on the mobile display device. No Internet required, no need to scan or do anything else. However, it causes battery drain during use. Each technology solution has its own advantages and disadvantages. The application of reasonable technology solutions will produce a good application. Besides, the application of many technology solutions will help the application better monitor and ensure the health of users and the community.

# Author contributions

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| 20194331 | Tran Duc Minh | COVID-19 Apps in Viet nam (3) |
| 20205033 | Nguyen Huu Tien | Bluetooth (2.1) |

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