Mobile application to track people in covid19 monitoring and patients under covid19 supervision

A Chrysler¹, H L H S Warnars², W H Utomo³

¹Computer Science Department, School of Computer Science, Bina Nusantara University, Jakarta, Indonesia 11480
²Computer Science Department, BINUS Graduate Program – Doctor of Computer Science, Bina Nusantara University, Jakarta, Indonesia 11480
³Department of Magister Science of Information Technology, Faculty of Computing, President University, Bekasi, Indonesia 17550

Email: ¹audrey.chrysler@binus.ac.id, ²spits.hendric@binus.ac.id,
³Wiranto.herry@president.ac.id

Abstract. It is crucial for the community including the government and health workers to collaborate to halt the spread of Covid-19. The idea of developing the mobile application surfaced from the previous findings. Previous researches have implemented and developed different features to better the application. The development of a mobile application to provide a platform that will assist people with information regarding patients that are around the perimeter of users to help notify them. With the help of the notification, users will be able to avoid the chances of them being in contact with the people (ODP), patients that are under surveillance (PDP) confirmed patients. All patients including ODP and PDP are required to have the application therefore, the Minister of Health will be able to track the geolocation of patients. Moreover, people will be able to be aware of patients that are around their perimeter. Therefore, with the help of the application, it will be able to help assist the community for them to be aware of and to be able to avoid being in contact with the infected patients.

1. Introduction
In December 2019, an outbreak of novel contagious pneumonia was first identified in Wuhan, China, which has subsequently spread quickly nationwide and surely become pandemic. With the outbreak of the novel Covid-19 which was first linked from the local fish market and a wild animal market in Wuhan, China where spread from person to person through droplets of bodily fluids. Therefore, there is a high transmission rate due to how asymptomatic patients have a higher possibility chance of transmitting the virus through the incubation period. It has been identified as a zoonotic disease known as a coronavirus (COVID-19) which is similar to the SARS and MERS coronavirus [9] and as human to human virus transmission [17]. COVID-19 or recognized as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a virus that belongs to the Coronaviridae family and identified as a man-made virus.

There are some rumors regarding who is patient zero and where is he or she came from? Some said it was from a Chinese lab and some said it was the US army who brought the epidemic to Wuhan, China. The allegation of Covid19 from the USA is when the US army brought the epidemic in Military World Games held in Wuhan Last October 2019 and include competitors from more than 100 countries. This is as Chinese foreign ministry spokesman, Lijian Zhao said to refer to articles from
Canada based conspiracy websites. Moreover, there is another rumor where more than 100 people most from abroad gathered for a business conference in Grand Hyatt hotel in Singapore in January 2020 where one of them as covid19 patient zero, and this story is the same as the SARS outbreak started from hotel’s international meeting.

Patients infected with Covid-19 presented symptoms of severe pneumonia which include fever, dry cough, fatigue, and respiratory strain [1], [6]. Early studies of the disease stated a link between a single local fish market as well as a wild animal market where it suggested the possible animal-to-human transmission through droplets or direct contact. Since most patients in Wuhan, China visited the local fish market and the wild animal market, where the markets sold live animals such as bats, poultry, and snakes [8][10]. Moreover, there is also evidence that indicates the possibility of transmission during the incubation period in asymptomatic patients [6]. Also, the advancement of global travel has enhanced the worldwide spread that exhibits a high transmission rate. Covid-19 can also be deadly, with a 2% fatality rate however, with severe disease may result in death due to respiratory failure and alveolar damage [15]. As of the 30th of January 2020, the World Health Organization stated Covid-19 as an international sixth public health emergency [1] and had officially named as covid19 to avoid stigmatization [7]. Therefore, the community including health workers and the government need to collaborate globally to prevent the spread of Covid-19.

The governments right now have given the health department directors the authority that imposed a law enforcing people to self-quarantine. The people who have posed a threat to public health. The problem emerged when patients refuse to self-quarantine themselves. Which lead to a various way to try to enforce self-quarantine for public health, in the United States, people defying the self-quarantine they could face fines and even criminal charges [2]. The co-director of St. Louis Country Department of Health states that if they defy the law of self-isolation, they are going to be placed in an isolation unit and can also be jailed [2]. Other countries such as Italy and the United Kingdom (UK) also has enforced the law for people to self-isolate. Authorities in Italy have warned people who avoided quarantine when they have shown symptoms such as coughing, fever, and other signs that could risk being charged with attempted murder [18]. Italy has been on lockdown and the citizens are not allowed to travel unless it is concerning their health. People who disregard the authorities order infected other people they could face three to seven years in prison. Authorities have stated that if citizens try to bypass the restrictions by lying to travel, they will be charged with false attestation to public officials which will cause them to be jailed for one to six years if found guilty [5]. As for the UK, the police are given the authority to issue fines to people who refuse to be tested where the fines can be up to £1,000 as well as having the authorities to close down premises [16].

For Indonesia, where a lockdown is not implemented, the doctors are given the authority to order the patients for self-quarantine [19]. However, it is not effective nor efficient there was a patient who refuses to be quarantined at the hospital and requested to be quarantined at his own home. Where it is reported that the patient did not conduct a self-isolation and could risk other people to be infected with Covid-19 [4]. Therefore, a system needs to be implemented to monitor patients that require self-isolation to maintain the safety of the public. There are some cases where health workers were infected where the infected covid19 patients had manipulated their covid19 infection. In Cirebon West Java, 21 health workers in Ciremai hospital such as 18 nurses and 3 specialist medics were infected by decease covid19 patients, where the family was dishonest that the decease as a patient under surveillance (PDP) which had contacted with Covid19’s patient.

2. Related works

An idea of using electronic wristband for Covid-19 patients is considered by the Korean government to resolve the problem of people violating the order to self-quarantine. Yoon Tae-Ho the Ministry of Health and Welfare stated that the government is considering using electronic wristband to enforce the quarantine. As the numbers of people who violated the quarantine rises and some of the people who violated quarantine have been investigated due to violating the country’s health laws. The government
is also considering to implement measures such as conducting random visits and routine calls. The Korean government launched an application that provides information regarding the availability status of face masks in nearby pharmacies, letting people know the information about the queues and if there are shortages of masks [13].

An e-health mobile application developed by the Lyon company that specializes in remote monitoring. Covidom allows suspected carriers to benefit from the medical monitoring from home to limit the travel to the hospitals which are already overwhelmed[20]. Covidom is used to ensure the status of patients that does not require hospitalization in order to help hospitals to focus on patients that are in critical need. The application has been operational since the 9th of March, 2020 in two Paris hospitals. The application sends questionnaires once to several times a day to the user in which the patient can respond regarding their current health conditions. If the users’ responses are worrying an alert will be sent from the application to the medical monitoring center. If it is an emergency, the patient will be asked to contact the emergency services [12].

Indonesia developed a mobile application to help protect people from Covid-19. PeduliLindungi is an application to trace, track and it is a part of the government’s effort to provide a reliable application to protect the public from Covid-19. Johnny Gerard Plate, Communication and Information Technology Minister stated that the application will have an alert that notifies the user if there is the person that is under surveillance (ODP), patients that are under surveillance (PDP) or even the confirmed Covid-19 patient within the radius of 2 to 5 meters from the user. Where all the ODP, PDP, and confirmed Covid-19 patients have installed the application on their mobile phones therefore, their movements will constantly be monitored[21]. The application can also track patients’ movements by using their mobile phone numbers, where they can backtrack and list where places patients visited as well as people, they interact with in the past 14 days[22]. Warning the people that have interacted with the patient in the past 14 days to isolate themselves. PeduliLindungi will also be able to detect large crowds and will notify the National Police. It has also the ability to monitor foreign nationals as well as citizens who are entering the country’s borders where the data will be archived and converted into QR codes that will be sent to the Health Minister [11].
Europe has a system that is to be developed and implemented across Europe where now the idea is being explored which is the application of cross-border phone tracking to tackle the current pandemic[23]. The program will first be launched in Germany, Dubbed Pan-European Privacy-Preserving Proximity Tracing (PEPP-PT)[24]. The idea for the application is based on Singapore’s application TraceTogether which is the application that enables the sharing of information with other users. Where the phone will calculate the approximate distance between users (via Bluetooth). This enables the government to find people that have been in contact with confirmed patients and directly contact people that are potentially exposed to the risk [3], [14].

3. Proposed idea

Per 21 April 2020, due to outbreak covid19 there are 6,760 positive, 747 recovered and 590 deaths patients covid19 in Indonesia (www.covid19.go.id). The Indonesian government divides covid19 victims into People under monitoring (ODP) and Patient Under Supervision (PDP), where ODP is a person who has a fever $\geq 380$ Celcius or upper respiratory Tract infection (URTI) without pneumonia and had a historical trip to infected areas covid19. Meanwhile, PDP is a person who has a fever $>380$ Celcius, URTI, and light to severe pneumonia and had a historical trip to covid19's infected areas or had a face to face conversation with covid19's infected. The increase in the number of covid19 patients is caused by the covid19 virus being easily transmitted through the air and the virus surviving in conditions of quite a long time and easily infecting people in poor health, especially the elderly.

![Application Scenario](image)

**Figure 2.** The Application Scenario

Today, having an application that will be able to assist and tackle the pandemic is very crucial. From the related works in the second section, appear the idea to develop an application that will be
able to send alerts and information regarding patients with suspected novel Covid-19, patients that are under surveillance, and confirmed patients within the radius of 5 meters. Where are patients whether they are an ODP, PDP, or confirmed patients, they are obliged to have the application and to always check-in therefore, they will be able to be constantly monitored?

The application will work as the diagram above has stated:

1. The process that is proposed where once the user has installed and log-in on the application their information will be stored in the database.
2. After logging-in on the application, the application will show the guideline.
3. In this stage, after logging-in, the application will require the users to turn on their GPS where every time they access the application it will automatically update users’ geolocation.
4. The system will receive information regarding patients’ status whether it is ODP, PDP, or confirmed patients from all hospitals.
5. Geolocation of all patients will be sent to the server of the health Minister and be monitored
6. The application will alert people within the radius of 5 meters if there are patients in their location as well as giving the update to the user that has not logged in within the hour.

Figure 3. Use Case Diagram of the Application

The use case diagram above is explaining all the listed use cases that can be accessed by the user, Minister of Health, and the admin. The user should log in to the application to access all the
information in the application as well as giving the application access to users’ geolocation. Once the user has successfully logged in to the application, the user will be given instructions that will notify the users that they are required to update their geolocation by opening the application per hour. The system will track and send alerts to users that are within radius with other ODP, PDP, and confirmed patients. The application will also send a notification if users have now updated their location within the hour. The admin has a role to manage the application.

4. Conclusion
With the recent pandemic outbreak of the novel Covid-19, which will cause infected people to have a fever, dry cough, fatigue, and respiratory infections. Covid-19 spreads from person to person through droplets of bodily fluids. After the WHO announced Covid-19 as the public health emergency of international concern. The community needs to collaborate globally to prevent the spread of Covid-19. The governments have given the health department directors the authority that imposed a law enforcing people to self-quarantine. However, this law has been broken by people that refused to be in self-quarantine, which will jeopardize the public’s health. The application proposed will provide the platform for the community to access the information and be notified if there are patients within the users’ proximity. By combining the features that are originally separated, the application will be able to give more access and benefits for the users to aid the community to prevent further spread of the pandemic.

References
[1] Bai Y, Yao L and Wei T 2020 JAMA Article. Presumed Asymptomatic Carrier Transmission of COVID-19. DOI: 10.1001/jama.2020.2565
[2] Chen E 2020 Can Local Governments Enforce Quarantines? Should They? Retrieved on April 5 2020 from https://www.npr.org/2020/03/18/816630364/can-local-governments-enforce-quarantines-should-they
[3] Doffman Z 2020 COVID-19's New Reality-These Smartphone Apps Track Infected People Nearby Retrieved on April 8 2020 from https://www.forbes.com/sites/zakdoffman/2020/04/07/covid-19s-new-normal-yes-your-phone-will-track-infected-people-nearby/#15e7d0d
[4] Dwianto A R 2020 Viral! Cerita Miris Dokter yang Lihat PDP Keluyuran Tak Isolasi Mandiri. Detik Health Retrieved on 3 April 2020 from https://health.detik.com/berita/viral-cerita-miris-dokter-yang-lihat-pdp-keluyuran-tak-isolasi-mandiri?tag_from=wp_nhl_3&_ga=2.1999324073.62166761.1586144751-1281896895.15880825120
[5] Hockaday J 2020 Coronavirus patients who refuse to self-isolate face murder charges in Italy Read more: https://metro.co.uk/2020/03/12/people-coronavirus-italy-refuse-self-isolate-face-murder-charges-12385790/?ito=cbshare Retrieved on March 13 2020 from https://metro.co.uk/2020/03/12/people-coronavirus-italy-refuse-self-isolate-face-murder-charges-12385790/
[6] Kooraki S, Hosseiny M, Myers L and Gholamrezaneshad A 2020 Coronavirus (COVID-19) Outbreak: What the Department of Radiology Should Know J. of the American College of Radiology 17 4 447-451 doi: 10.1016/j.jacr.2020.02.008
[7] Lai C C, Shih T P, Ko S C, Tang H J and Hsueh P R 2020 Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Coronavirus Disease-2019 (COVID-19) The Epidemic and the Challenges Int. J. of Antimicrobial Agents 55 3 1–9 doi: https://doi.org/10.1016/j.ijantimicag.2020.105924
[8] Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y and Feng Z 2020 Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia New England J. of Medicine 382 13 1199–1207 doi: 10.1056/nejmoa2001316
[9] Liu Y, Gayle A A, Smith W A and Rocklöv J 2020 The Reproductive Number of COVID-19 Is Higher Compared to SARS Coronavirus J. of Travel Medicine 27 2 1–4 doi: doi.org/10.1093/jtm/taaa021
[10] Lu H, Stratton C W and Tang Y W 2020 Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle J. of Medical Virology 92 4 401–402 doi: 10.1002/jmv.25678
[11] Marchelin T 2020 Minister Encourages Indonesians to Install Covid-19 Surveillance App. Jakarta Globe. Retrieved on March 27 2020 from https://jakartaglobe.id/news/minister-encourages-indonesians-to-install-covid19-surveillance-app
[12] Martinetti I 2020 App developed in record time to help monitor French Covid-19 cases. RFI Health News Retrieved on March 26 2020 from http://www.rfi.fr/en/france/20200327-covidom-app-developed-in-record-time-to-help-monitor-french-covid-19-cases-coronavirus-e-health

[13] Mu-Hyun C 2020 South Korea considers electronic wristband to enforce COVID-19 quarantine Retrieved on April 8, 2020, from https://www.zdnet.com/article/south-korea-considers-electronic-wristband-to-enforce-covid-19-quarantine/

[14] Bai Y, Yao L and Wei T 2020 Presumed Asymptomatic Carrier Transmission of COVID-19 JAMA Network 323 14 1406-1407 doi:10.1001/jama.2020.2565

[15] Shu Z, Shi L, Wang Y, Ying J, Huang L and Zhang C 2020 Pathological Findings of COVID-19 Associated with Acute Respiratory Distress Syndrome The Lancet Respiratory Medicine 8 4 420-422 doi: https://doi.org/10.1016/S2213-2600(20)30076-X

[16] Payne A 2020 A British man has been arrested for refusing to quarantine himself under tough new laws designed to tackle the coronavirus. Business Insider Singapore Retrieved on March 18 2020 from https://www.businessinsider.sg/coronavirus-british-man-arrested-after-failing-to-self-isolate-2020-3?r=US&IR=T

[17] Liu Z, Bing X and Zhi X Z 2020 The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) in China Chinese Center Disease Control and Prevention 41 2 145-151 doi: 10.3766/cma.j.issn.0254-6450.2020.02.003

[18] Sasaki and Egawa S 2018 Integrated health education in disaster risk reduction: Lesson learned from disease outbreak following natural disasters in Indonesia Int. J. of Disaster Risk Reduction 29 94-102.

[19] Remuzzi A and Remuzzi G 2020 COVID-19 and Italy: what next? Lancet 395 1225-1228.

[20] Kaur H, Sawhney R S and Komal N 2012 Wireless Sensor Networks for Disaster Management Int. J. of Advanced Research in Computer Engineering & Technology 1 5.

[21] Wenham C, Smith J and Morgan R 2020 COVID-19: the gendered impacts of the outbreak Lancet 395 10227 846-848. https://doi.org/10.1016/S0140-6736(20)30526-2

[22] Tosepu R, Gunawan J, Effendi D S, Ahmad L O A I, Lestari H, Bahar H and Asfian P 2020 Correlation between weather and Covid-19 Pandemic in Jakarta, Indonesia Science of total Environment 725 138436 https://doi.org/10.1016/j.scitotenv.2020.138436

[23] Wachter J, Babeyko A, Fleischer J, Haner R, Hammitzsch M, Kloth A and Lendholt M 2012 Development of tsunami early warning systems and future challenges Natural Hazards and Earth System Sciences 12 1923-1935.

[24] Goda K, Petrone C, Risi C D and Rossetto T 2017 Stochastic Coupled Simulation of Strong Motion and Tsunami for the 2011 Tohoku, Japan Earthquake Stochastic Environmental Research and Risk Assessment 31 9 2337-2355.