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Android Application for Managing Urgent Convalescent Plasma Blood Request for Covid19 Treatment

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Abstract

The emergence of the covid19 pandemic has forced many countries to be more focused on the technologies that can save human life. A lot of efforts have focused on containment and mitigation actions with varying degrees of success. However, lack of attention given to administering urgent requests for convalescent plasma blood as part of treatment for critical covid19 patients although the passive administration of antibodies from a person who has convalesced may be an effective therapy for those patients who have yet to develop their antibody response. Hence, interest in the use of convalescent plasma has been rising, not only commenced by medical professionals but also among patients' family members, especially for urgent requests. This paper proposed timeline-based posts to tackle the urgent-request issue that sort based on first come first serve priority. From this timeline, the people in search of donors may find donors' information and location quickly. Furthermore, we added a timeline page, search function, a virtual assistant (chatbot) that automatically shares posts to social media without exiting the app, etc. These features promote the hit to the right users and their respond faster than before. The previous study reported from the 40 PSARS patients undergoing ribavirin and methylprednisolone treatment, 19 were administered with convalescent plasma, whereas 21 were given an additional dose of methylprednisolone. The group of patients who were treated with plasma therapy showed better recovery and reduced mortality. With this situation, we hope our contribution in the form of an Android app can assist those in need at the right time and save more lives. Moreover, this app can be referred to as a model for other comparable apps.

Keywords

Android application, Blood request, Convalescent plasma, Covid-19 treatment

Introduction

This paper focuses on the increased attention and need for convalescent plasma for the treatment of Covid19 patients before vaccine distribution. The use of convalescent plasma for patient treatment is not something new. The convalescent plasma reported had been used for the severe

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acute respiratory syndrome (SARS), pandemic 2009 influenza A (H1N1), several hemorrhagic fevers such as Ebola, and avian influenza A (H5N1), and other viral infections (Rojas. et.al, 2020). Previous researchers in 2005, have reported outcomes of patients who received convalescent plasma in Hong Kong during the 2003 SARS outbreak. Upon 1775 patients, the 80 who received convalescent plasma had a lesser mortality rate (12.5%) compared with the overall SARS-related mortality for admitted patients (n = 299 [17%]). The antibody titers and plasma transfusion volumes varied and did not appear to correlate with clinical response however, patients who received transfusion within 14 days of symptom onset (n = 33) had better outcomes. No adverse events were reported among patients receiving convalescent plasma (Rojas. et.al, 2020).

From here, the use of convalescent plasma for Covid-19 patients became increasing. Especially after several reports and findings showed that the mortality rate is decreasing among those who received convalescent plasma treatment. For example, (Shen, et.al, 2020) report findings from a preliminary study of 5 severely ill patients with coronavirus disease 2019 (COVID-19) who were treated in the Shenzhen Third People's Hospital, located in China, using plasma from the recovered individuals. The use of convalescent plasma might have contributed to their recovery because the clinical status of all patients had improved nearly one week after transfusion. The evidence was based on normalization of body temperature as well as improvements in Sequential Organ Failure Assessment scores and P_{AO_2}/F_{IO_2} ratio. In addition, the patients' neutralizing antibody titers increased and respiratory samples tested negative for SARS-CoV-2 between 1 and 12 days after transfusion. The treatment of Covid-19 patients using convalescent plasma is illustrated in figure 1 below.

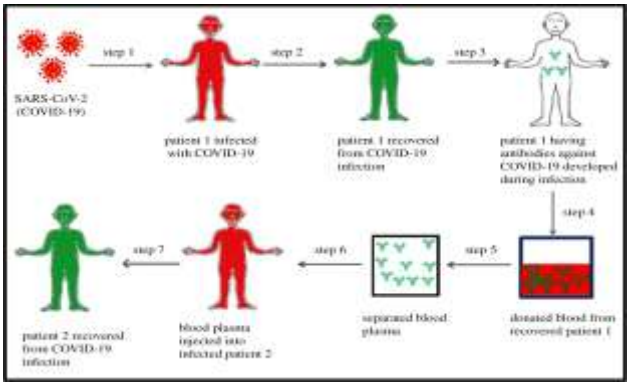

Figure 1. The convalescent plasma treatment for Covid19 patients

Since finding convalescent plasma donors are not an easy task to do during the pandemic due to social distancing measurements, many people use online social networks to find suitable candidates who survive the infection of Covid-19. Several postings were found on social media through timelines or stories commenced by patients' family members or medical practitioners in the year 2020. This situation became a motivation for us to come up with an alternative platform for donors and recipients to communicate and help each other.

On the other hand, we also observed another figure of blood transfusion emergency needs during pandemic besides the convalescent plasma. With almost around 7.8 billion people in the world, emergency blood request has been massive. According to statistics it has been found every 2 seconds there is a requirement for blood transfusion (injecting blood taken from a healthy person)

for many patients who have suffered from trauma such as heart surgery, organ transplants, pregnancy, cancer, etc. This means the need to get the blood at right time is also a challenge and saving the lives is the bare necessity (Selvamani, K. and Rai, A.K., 2015). Furthermore, blood can be kept in a specialized refrigerator for around 42 days after that, it needs to be discarded since it is considered expired (Trust H, 2019). Hence, a proper mechanism to campaign blood donation (including convalescent plasma) and address the immediate need is deemed critical.

During this pandemic, it is understood that people are keen to avoid gatherings and special visits to hospitals. In this case, donors are situated to stay home and this decreased the rate of donors significantly. According to the New Straits Time (2020) in Malaysia, there has been a drop off of 40 percent of the blood bank stock as stated by the health director Tan Sri Dr. Noor Hisham Abdullah. This is hugely concerning, and it happened because of the current pandemic as people are afraid to attend the blood donation campaigns and tend to avoid it. This indicates people although willing to help, are also trying to avoid gatherings. Therefore, it is very important to look into these factors when trying to come out with a solution. (Krishnan, D., 2020).

In this paper, the authors proposed an application as a platform for donors and recipients to communicate and enable them to help each other remotely. The posting is not only limited to the urgent need for convalescent plasma but also blood requests for critically ill patients. We selected the android platform based on its popularity among mobile users (Statista, 2021). To cater to the immediate need, we employ social media algorithm (for posting requests and responses) that works based on First Come First Served (FCFS) basis. The algorithm includes a timeline for posts, extending posts or requests to be shared on a variety of social medial platforms and we also enable a chatbot as a virtual assistant for donors who can inquire questions regarding the eligibility of being a donor, searching for the nearest hospital, etc. The proposed application was built using several software tools i.e. Android Studio, Java, JDK, SQL Database, Firebase, and the IBM Chatbot. The SQL database is used to store multiple data including the profile of donors and recipients.

Methodology

A prototype model is employed as a research methodology during app development because of its quick design and the involvement of the target user throughout the processes. Figure 2 illustrates the processes of the prototype model.

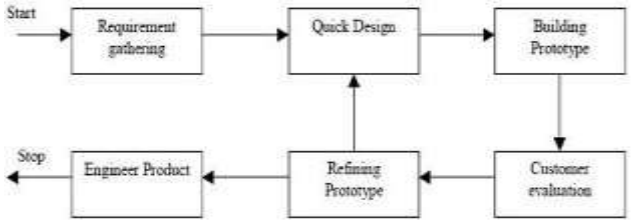

Figure 2. Prototype model

- Step 1 Requirement Gathering: we did the data gathering related to requirements and users' expectations using two methods i.e. interview and questionnaire.

- Step 2 Quick design: we draft the App design based on the requirement analysis and the feedback received from our respondents.
- Step 3 Building prototype: we develop a prototype using wireframing software that includes basic functionalities including timelines.
- Step 4 Customer evaluation: we obtain valuable feedback from the target user for the prototypes that we develop in step 3.
- Step 5 Refining Prototype: We alter the app design after the respondents' evaluation. We perform many cycles of iteration until the requirements are satisfied.
- Step 6 Engineer product: We compile the final version and testing on the functionality of the apps.

Results and Discussion

In this section, we would like to highlight four main features implemented in our app as a result of the social media algorithm that we employed. The four main features are i.e. city-based timeline, sharing to social media and direct call, search donors based on country location, and virtual assistant (chatbot) with speech to text feature.

A city-based timeline enables donors to post their profile with their availability to help the recipients who need blood or convalescent plasma. At the same time, recipients may view the donors' timelines and respond to the posts. Similarly, the recipients who need blood or convalescent plasma donor may post to the timeline on which donors can respond to the request. The overall algorithm for donors and recipients is depicted in table 1 below. The graphical user interface of the timeline algorithm is portrayed in figure 3.

Table 1. Algorithm for donors and recipients

Algorithm for the user.donors	Algorithm for user. recipients

begin
user.donors (registration)
save.data (on)
user.donors (eligibility check)
If virtual.assistant(on) then activated
end_if
if user.donors (pass) then
user. Recipients (view_timeline) enabled
user.donors (posting) enabled
user.donors (share) enabled
user.donors (search) enabled
user.donors (virtual_assistant) enabled
else
exit_app
end
	begin
	User.recipients (registration)
	save.data (on)
	user. recipients (view_timeline) enabled
	user. recipients (posting) enabled
	user. recipients (share) enabled
	user. recipients (search) enabled
	user. recipients (virtual_assistant) enabled
	end

Share to social media is the second feature that allows both donors and recipients to share their posts from our timeline to the preferred social media platform. This feature is depicted in figure 4. For search donors feature, it is designed based on country location which enabled both donors and recipients to view and be knowledgeable about the availability of donors in other places

by location and specific blood group/type. The interface of search donors can be seen in figure 5. The virtual assistant in our app is equipped with speech to text feature to speed up inquiries without having to type them. Users may use their voice and the app will translate the voice/speech into text. This makes significant acceleration towards finding information or inquiry. This feature is portrayed in figure 6.

During acceptance testing, which involves target users, 90% of our respondents find this app is very useful and able to cater to the urgent need within the timeline. The most valuable feature besides the timeline is the direct sharing to social media platforms. It makes the app current and reaches many people who need urgent help or search for donors easily. Although the timeline works city-based users can go visit another city to look for information using the search function.

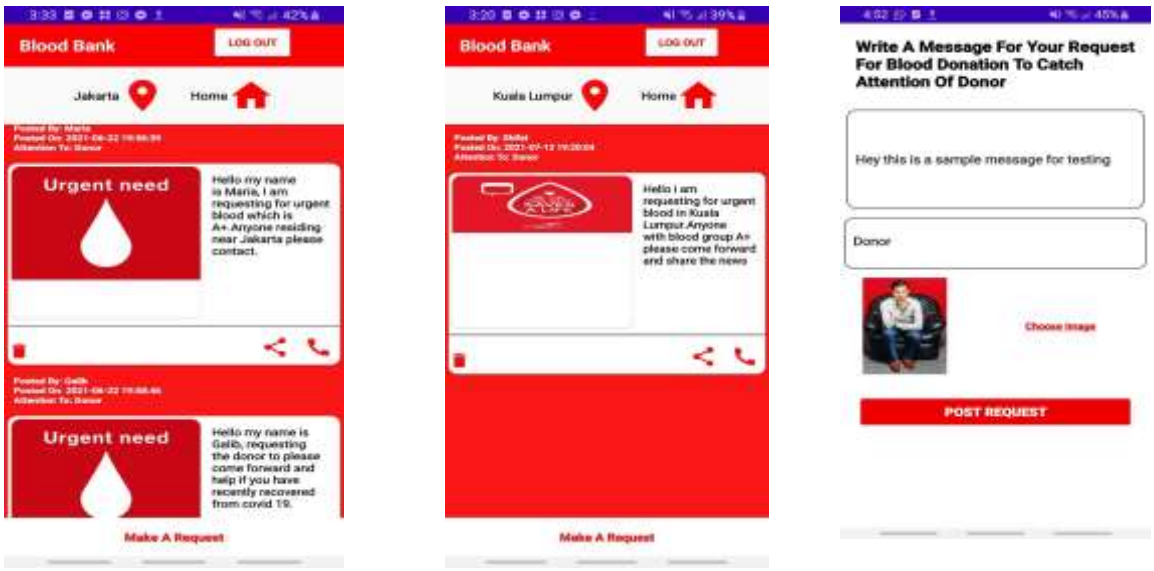

Figure 3. City-based timeline feature

Figure 4. Share to the social media feature

Figure 5. Feature to search for blood donors in cities around the world

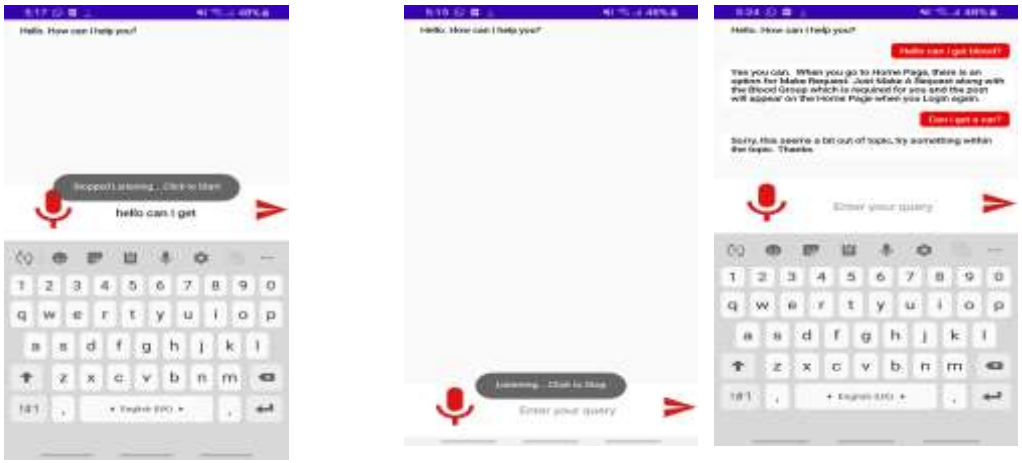

Figure 6. Virtual assistant with speech to text enabled

Conclusion

The research and study in this paper have achieved their objectives to come out with an Android-based application to assist people who urgently need the convalescent plasma blood request. With enhanced features, this app can be a reference model for another similar app that emphasizes speed and flexibility.

Acknowledgments

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