Blood Donor Location Scheduling Application Using Geographic Information System

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Abstract. Data on blood donors in the city of Surabaya has improved during normal conditions, when during the COVID-19 pandemic conditions such as experiencing a shortage of blood donors at the Palang Merah Indonesia (PMI) and several hospitals. This condition continued to decline when conditions in the city of Surabaya experienced an increase in confirmed cases of Covid19. The same thing develops with the existence of geographic information system technology and real-time, dynamic and online services for various activities of daily activities ranging from school, work, to shopping for daily needs. This GPS (Geographic Position System) technology will be very easy to use by the public considering that all smartphones currently have embedded GPS technology. Smartphone with the Global Positioning System (GPS) feature is a solution to be able to assist in the process of taking blood donors, as well as the fulfillment of blood stocks in various regions, this can be seen from the number of blood stocks in Palang Merah Indonesia (PMI) on June 2020. The enthusiasm of the community develops when the ease with which technology can be done to meet the needs of life. This application requires development; this is because the development of GPS technology will have more functions.

Keywords: Geographic Information System, GIS, blood donor location, mobile technology

1. Introduction
The need for blood donors during the Corona Virus Disease 19 (COVID19) pandemic is very much needed by the public. Fear and government regulations related to Large-Scale Social Restrictions are an obstacle and a reduction in blood stocks in the local environment. In this research, the area under review is the city of Surabaya, where the city of Surabaya is the capital of East Java Province. The city of Surabaya itself has become a city with a red zone with the positive impact of COVID 19 reaching 9,875 which was confirmed positive (August , 12 2020, 17.00 pm wib). Smartphones are currently a daily consumption for the wider community, so that basic needs and schools have shifted to the world of the internet with the use of technology in their respective smartphones, Work From Home is a solution for workers currently in the midst of the COVID 19 pandemic, Global Position System (GPS) technology is a technology that is already present in smartphones, and is used to perform attendance work from home. In today’s rapid developing scientific world technology has become a very important aspect of life. Today’s generation is more depended on advanced technology than any other aspect. Today, most of the people use advance technologies in their daily life like Internet, Smartphone[1].

The difficulty in finding the source of blood needed in several hospitals in the city of Surabaya has its own impact on PMI (Palang Merah Indonesia) or blood donor center, where PMI as a moving institution, one of which is accepting blood donors from the public. PMI in Surabaya is currently having difficulty
sending / supplying to hospitals that need blood donor stocks for patients who need them, with this GPS technology it is hoped that it can help the community to make it easier and not afraid to donate blood, such as conditions outside the pandemic. One profound change is the development of real-time GIS. Real-time geographic information is acquired by omnipresent space-based sensors, air-borne sensors, underground sensors, and human observers [2]. Thus, geographic information and its services become real-time, dynamic, and online [3]. This GPS technology will be very easy to use considering that all smartphones currently have this GPS embedded. Real-time GIS is a type of GIS that can acquire, manage, share, process, and service real-time or near real-time geographic objects/information as well as simulate and process dynamic geographic processes [4]. Many existing GIS applications focus on dealing with or analyzing real-time data for an application, such as ice forecasting [5], accident prevention on toll motorways [6], traffic systems [7], high-sulfur gas emergency responses [8], mapping of weather data [9], digital mapping for local governments [10], processing of marine environment data [11], and hydrography applications [12]. Besides this enrollment, the viewing of donor and the management system is not well maintained. The details of the information of donors are given for the usage of the users for contacting them when in need of blood in case of any emergency [13]. The problem which currently exists in the medical field is that blood is needed immediately for an injured person or for any major operation, it is not easily available even though blood is ready in hospital [14]. The hospital is a place where people gather when conditions do not allow for independent treatment. In this paper used built an efficient and reliable blood donor Scheduling and Management system based on GIS integrated in web based and android mobile application. The advantage of this system is it provide solution for the problems such as fake or wrong information of donors, misuse by third parties banks are present [15].

2. Literature Review

In this study, there will be several definitions that can be used as a data dictionary in making a region-based blood donor information system or application.

2.1 Blood Transfusion

This blood transfusion process cannot be taken directly and continuously, the schedule for this blood transfusion has limits. A patient who needs this blood transfusion, has special conditions for which blood the patient needs. A blood donor also has its own schedule to do the blood donation. Still actually, worldwide blood donation is insufficient to the existing needs [16]. He hoped that this research would make it easier for the public to find the blood donor schedule closest to his position at that time.

2.2 Geographic Information Systems (GIS)

Geographic characteristics such as topography and geographic dispersion of population are fundamental factors in fair resources distribution [17]. GIS crosses regular data and their geographic position with the purpose of building maps. This technology allows us to visualize data with data complexity in a different field with an existing digital map. This provides us with a useful way to work between spatial and temporal data. Combining data and applying some analytical rules, it is possible to create a pattern in order to help answer the question previously made. The GIS primary goals in healthcare are inform and educate health professionals and population, support decision making in many levels, prevent results before making any compromises, select priorities in lower resources environments, change bad practices and routines and continuously monitor and watch changes implementations (Maged, 2004). Geographical Information System (GIS) applications lead to the development of various tools that can display progress in the form of images and supporting tools for developing Geographical Information Systems (GIS). This software helps manage geographical information in various ways such as collecting related data for landmarks in travel and directions [20].

2.3 Global Position System (GPS)

GPS is the Global Position System used to track Location and Time information in All Weather on the earth. The GPS was Developed in 1973, fully Working in 1994. Originally 24 satellites, currently 31 satellites in working. A GPS Receiver requires line of sight access to at least 3 satellites for a 3D
(latitude/longitude/altitude) fix [14]. GPS is satellite Navigation Tracking location information on earth, GPS is easy way to find person location and time anywhere when that required. it is efficient way to provide fast information that we required. And show map and route of word

3. Methodology

In this research discussion methodology, data samples are needed that can process and sort data to be used as information that can be applied in the Registration System and blood donor scheduling information based on the Geographical Information System.

3.1 Collecting, Developing Data and Spatial Data

This conventional method lacks validity of data over time and spends relatively long time in re-creating thematic map images [19]. Geographic Information System is used to display, manipulate and analyze spatial (map) data. Spatial data are data that contain a reference to a place [21]. Blood donation data in the city of Surabaya has a good increase when conditions are normal, when in a COVID-19 pandemic, there is a shortage of blood donors. Mapping in an area requires a long time, using Google Maps, you can get a map of the spatial data that will be needed to make a scheduling of blood donation areas in the city of Surabaya.

Figure 1. Covid19 Accumulation Data in East Java
Source : https://covid19.go.id/peta-sebaran (Access 05 August 2020)

Figure 2. Covid19 Accumulation Data in Surabaya
Source : https://lawancovid-19.surabaya.go.id/visualisasi/graph (Access 05 August 2020)
In Figure 1, East Java province shows that the trend or growth of Covid19 patients is still increasing. Figure 2 above shows that the city of Surabaya is still experiencing an increase from day to day. This causes the growth of patients besides Covid to be affected. On the google search page, using a search with the keyword "current pmi blood stock" within the "last 1 month" resulted in several references from several website pages that the Blood Stock at PMI was running low. This is directly related to the process of increasing the number of Covid19 patients in several areas of East Java, especially in the city of Surabaya.

![Figure 3. April 2020 Blood Stock Data in Surabaya](source: PMI Surabaya)

In Figure 3 above shows the blood stock in PMI Surabaya with the capacity of the population of developing cities with this data having decreased from the previous year in the same month. The needs of several hospitals in Surabaya are also experiencing an increasing need.

### 3.2 Diagram

This flow chart can explain how the whole system works from the modeling system based on Global Position System (GPS) technology.

![Figure 4. How Blood Donor Location Scheduling Application Works](source: author)
In Figure 1 above explains, from the provider side this application or system will enter all active scheduling data in the position or an active blood donor organizing point starting from the date, time, location address (based on latitude and longitude), as well as contact persons who can be contacted from the organizer of the activity.

From the user side, later you can access the application provided that you activate the GPS mode on the device first, before searching for a blood donor location and registering as a visitor. Application users can also do a manual search based on the time (date) they want or want to do a blood donation. When the search results have been found, the application user can view and trace the calculation of the distance and travel time to get to the location of the blood donor organizer.

4. Results and Discussions

Mobile technology with the Global Positioning System (GPS) feature is a solution to be able to develop in various fields. In this study, the application of the development of mobile technology based on the Global Positioning System (GPS) was carried out to fight Covid19. With this mobile technology, it is hoped that the public will be able to get the latest schedule information regarding blood donors and their location and can calculate the distance traveled from their own place. The GPS itself will run in accordance with the internet data connection that is on each device, this can cause some errors in searching, so that if this happens, the device is first confirmed that the connection is stable.

Figure 5. Check GPS Location Activated

Figure 5 above shows that if the GPS on the cellphone has been activated, when opening the Blood Donor Location search application, it will be immediately directed to the location registered and active today and on the following dates, for previous dates will not be able to appear on this search page. When the GPS feature on the visitor's cellphone has not been entered, they can search for this location by manually typing in the city name or selecting a city name that is already registered in this application.

Figure 6. Data in Surabaya City
In Figure 6 above shows if the location of this search is done manually, so visitors can freely also search for the desired blood donation schedule. The results of this search do not only show data for today, but also show data for the following days, this can be seen in Figure 6 above. Information will appear complete date with location.

![Jadwal Donor Darah](image1)

**Figure 7. Details on Blood Donor Locations**

In Figure 7 above shows the completeness of the features of the blood donation schedule search application, for details from Figure 6 one location is selected, then the information will appear as in Figure 8. Visitors can immediately find out the details of the location and information that if the donor has donated blood, he will get anything. To find out the distance between the location of the blood donor and the location where the blood donor is, click on the map directly, so that it will reveal distance information and be guided directly by Google maps. In addition, if the donor has chosen a location, it can register online, so there is no need to queue for a list at the blood donation location, this is intended to avoid crowds and the application of physical distancing at the location.

![Jadwal Donor Darah](image2)

**Figure 8. June 2020 Blood Stock Data in Surabaya (Source: PMI Surabaya)**
Figure 8 above shows the increase in blood stock at PMI in Surabaya from the many access that can be done by the community to do blood donations, and the public already cares about the application of Information Technology on their mobile devices, this will be able to help the Indonesian government to tackle the spread and scarcity of blood stocks during the Covid19 epidemic.

5. Conclusion

This GPS-based application has helped many people to find out the location and schedule of blood donors. Even though the application has been developed, there are still some points that can be developed and made improvements. Some of the possible future developments that can be considered are (1) GPS is used to obtain a more accurate allocation of the queue for blood donors, (2) Get the location of the donor dynamically if there is a blood donation bus that moves from one place to another, and (3) Develop applications that are in accordance with field conditions and can contact the nearest blood donor.

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