

# **Masks and Medical Resources Distribution for COVID-19 Treatment in West Java, Indonesia**

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## **1.1 Introduction: Business Problem**

In March 2020, the first suspect of Covid-19 appeared in Depok, a city in West Java, Indonesia. The number of new suspects was growing ever since then in the nearest areas like DKI Jakarta, Banten, and other provinces across Indonesia. Many stakeholders play their part in this pandemic, including central to local government, medical personnel, and even data scientists. In this case, data scientists help assessed the situations in places on specific areas about availability, quantity, and distribution mapping of health infrastructures like the testing centers and authorized hospitals for patients treatment. In this project, I would like to conduct a simple analysis to determine strategic locations for masks and medical resources for COVID-19 treatment in West Java, based on confirmed cases on 6 December 2020, as well as the red zone areas for “new normal” condition.

## **1.2 Data**

There are several factors that would be the consideration in determining the masks and medical resources:

- [Covid-19 cases on each city/regency](#)
- [Total population of West Java in 2020](#)
- [Distribution and Population Density of West Java](#)
- [Hospital for Covid-19 treatment](#)

The following data sources are also needed to extract/generate the required information:

- Processed Covid-19 positive case data collection in West Java as of 6 December 2020.
- The distribution of mask sales based on the population in the West Java.
- The distribution of mask sales based on population density.
- New datasets from hospital data that contains city or residence, along with their latitudes and longitudes.

### **1.2.1 Read and show all data used.**

First, we need to read and show data Covid-19 cases per City/Regency to expose the data of all the cases whether it is active cases, under quarantine, or died. Next, read and show the total population data in West Java 2020.

After we read the Covid-19 cases and the population on each City/Regency, let's take a look the hospital data that provide treatment for Covid-19 patient in West Java. Construct a Pandas data frame for subsequent data analysis.

This part sums up the data mining and data exploration section. Next, in the METHODOLOGY section, will be described the process of how to conduct a 'Visual' approach to better understand all the data using data science and data analytics tool kits.

## **2. Methodology**

First, create a new dataset of only ACTIVE CASES and QUARANTINE from the Covid-19 Case table on 6 December 2020. For further analysis, we only use ACTIVE CASES as an indicator since we only want to see the existing number of patients under medical treatment. So we need to remove/drop irrelevant columns for this analysis, then Check if there are any missing or null values.

Based on these data mining, preparation, exploration, the total number of Covid-19 confirmed active cases in West Java is 9.847 per 6 December 2020, distributed across 27 City/Regency in the province with out of just over 48.683.861 population of West Java.

Depok City has the highest number of active cases with 1.730 people currently under hospital treatment and isolation. Just like any other area, each City/Regency has many neighborhoods that can be used to pinpoint the location of the new proposed Covid-19 testing center along with further analysis of the neighborhood using FourSquare API and Folium map visualization technique.

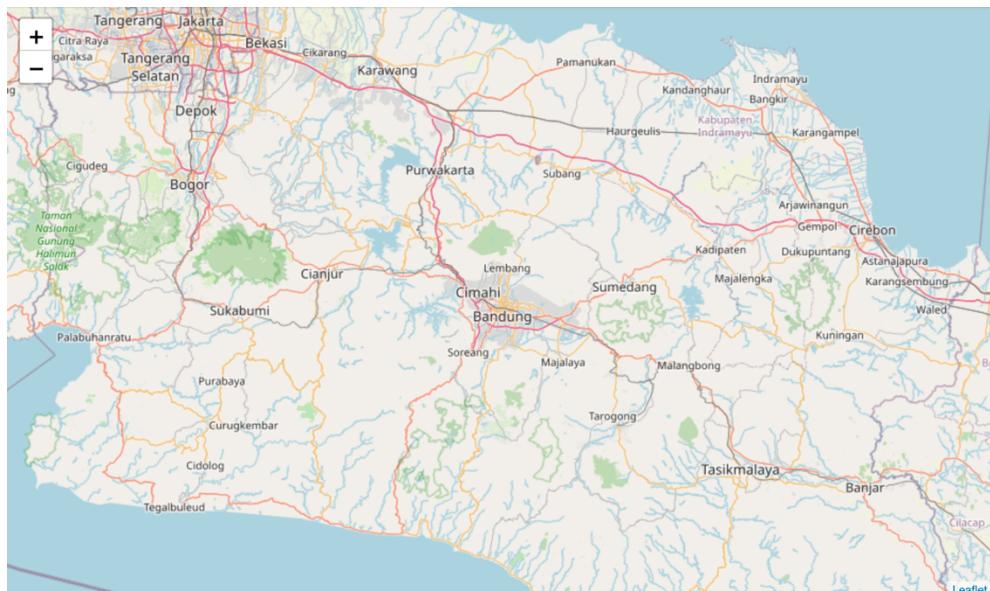
## **3. Latitude and Longitude of West Java and Its Cities**

To support the map visual analysis, I'm using the free service tools provided by Open Cage Geocode to get the latitude and longitude of cities/regencies, particular venues, and surrounding neighborhoods. Open an account and download the required dependencies for the analysis. Please refer to their website for further details. We can as well use the API service from OpenCage Geocoder to obtain the latitude and longitude of all City/Regency in West Java.

#### 4. Latitude and Longitude of Hospital

To see the locations of hospitals in the province, I also need to get the latitude and longitude of all Covid-19 testing centers in West Java that I got from West Java Provincial Government official website: [pikobar.jabarprov.go.id/contact](http://pikobar.jabarprov.go.id/contact).

After identifying the location, next is to visualize the map of the whole province, which in this case is West Java to present the data to the stakeholders using a 'Visualization' approach. First I need to download all the required dependencies earlier in the report, and use the FOLIUM API service.

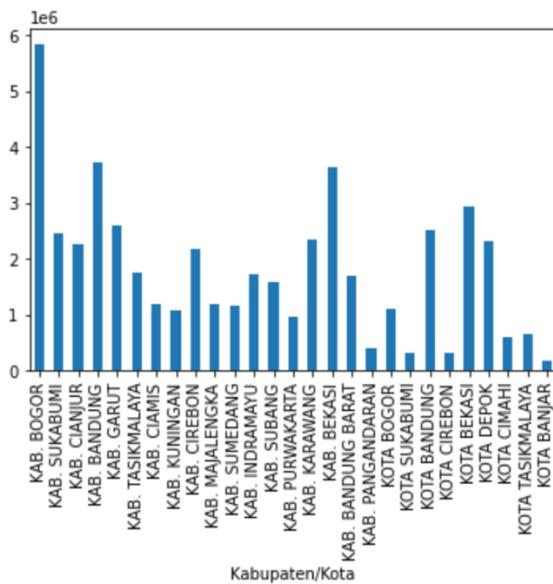


*Exhibit 1. Map of West Java, Indonesia*

The map shows the territory area of West Java, with the boundary shown on the purple line. But it does not show the territory area of each City/Regency within the province. In this scenario, I want to propose a strategic locations (i.e. neighborhood) for the investing group within the West Java area.

#### 5. Results

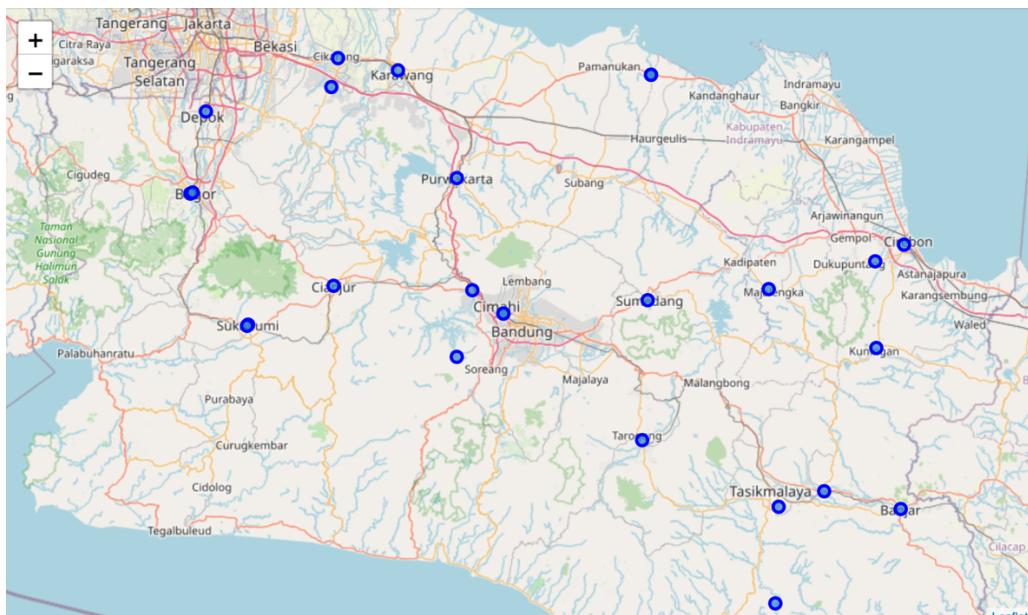
The chart below show the population density of West Java in 2020, based on City/Regency.



*Exhibit 2. Population density of West Java in 2020 chart*

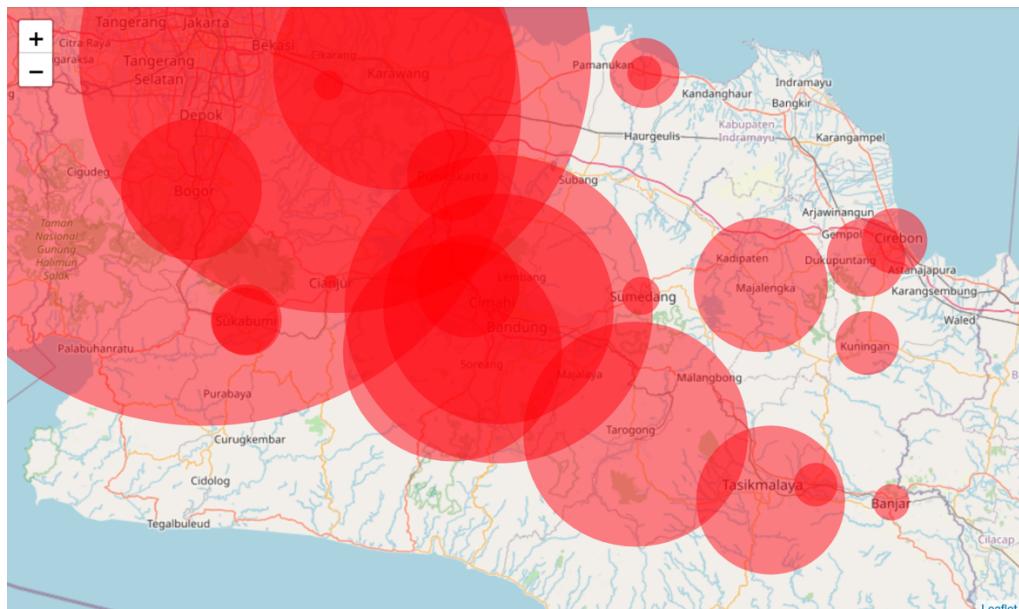
Using the graph above, Kab. Bogor (Bogor Regency) has the highest population with 5.840.907 people. Followed by Bandung Regency, Bekasi Regency, and Bekasi City respectively.

To understand and estimate the territories or areas that are within the administrative area of West Java, let's plot all the districts that have been retrieved from <https://pikobar.jabarprov.go.id/contact> along with their latitude and longitude values.



*Exhibit 3. Map of City/Regency location in West Java*

The map above shows that all of the Cities/Regencies are within the territorial area of the province. To address the business problem, I need to show the extent and the distribution medical devices for treatment of COVID-19 positive case-patients in West Java based on the number that have been obtained from the government site.

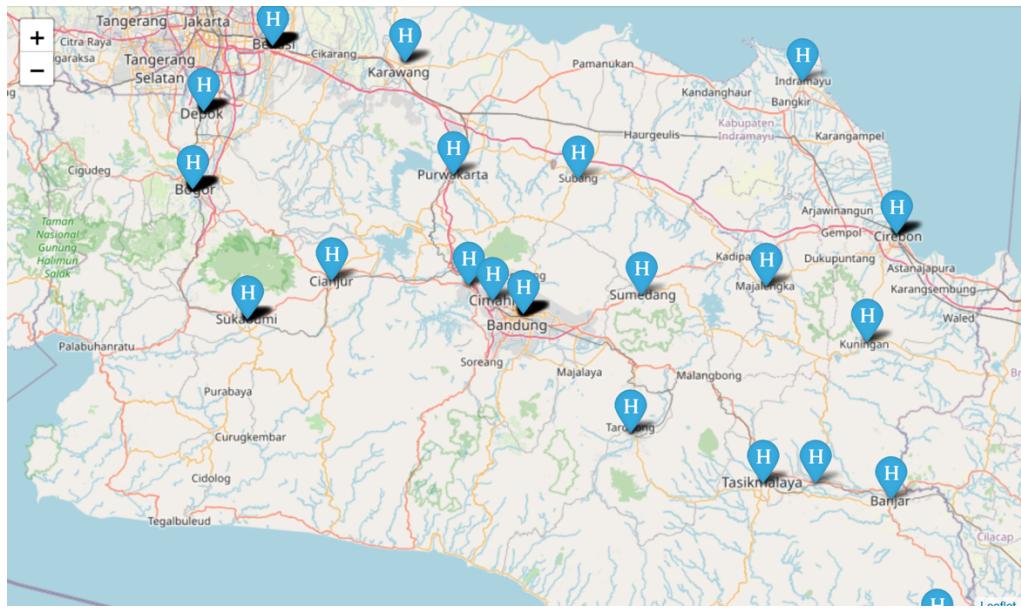


*Exhibit 4. Map of City/Regency with Covid-19 cases*

From this map, it can be seen that most of the regions in West Java are now in the 'RED' zone, with the radius of 6 that most likely represent the relative extent of Covid-19 distribution in West Java. But there are several cities that is not in the red zone, there may be no active cases or no updated data available.

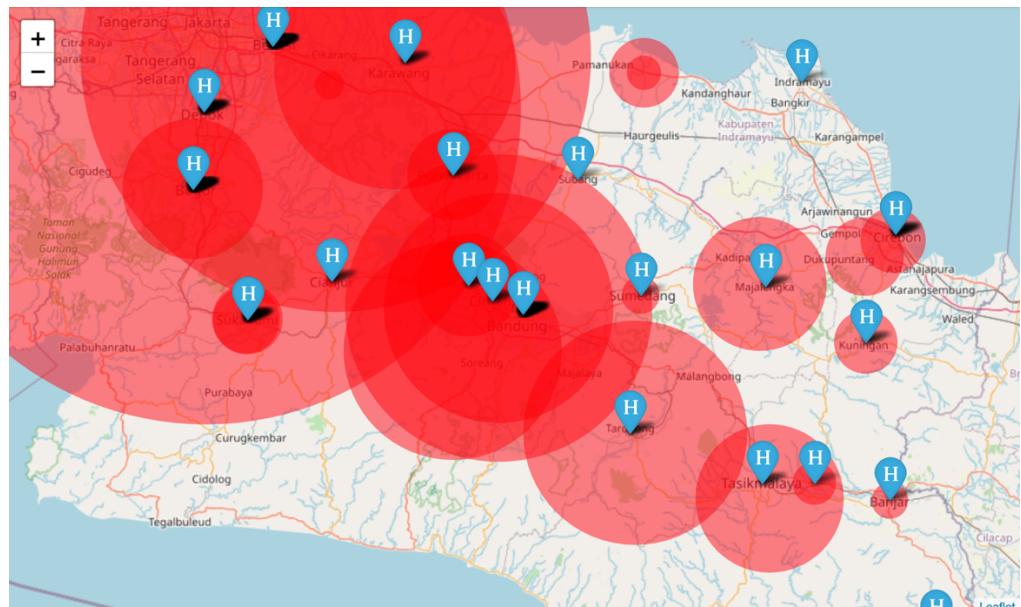
In the government's official website, this data shown in a "slider" format so people can see the daily Covid-19 cases update from March. Therefore, it would be helpful if there is an app or system that alerts vehicles/road users that they are not allowed to pass the RED zone within the city.

We also need to see the hospital location to compare the red zone and hospital capacity in the City/Regency, to see how well the accessibility and distribution of the medical resources.



*Exhibit 5. Map of hospitals location in West Java*

The hospitals are quite sparsely distributed within each other especially in densely populated area like Bandung. Let's see how strategic these hospitals are in accommodating the extent of positive cases patients in the City/Regency.



*Exhibit 6. Map of hospitals location compared to Covid-19 active cases*

From the distribution of COVID-19 cases and hospitals location across the province, can be seen that almost all hospitals require a lot of medical resources for COVID-19 treatment. As the number of cases high in Bandung both the city and regency, Cimahi City, and Sumedang Regency, the number of hospitals in these areas are also high.

## 6. Discussion

In this section, we will analyze locations in the red zone based on the hospital location in the middle of the red zone. Since Depok City has highest number of active cases, we will then determine the surrounding venues and neighborhood of RSUD Kota Depok (Depok Hospital).

Let's begin by trying to get the top 100 venues that are within Depok Hospital neighborhood and are within a radius of 500 meters of our candidate Covid-19 testing center using FOURSQUARE API. First, let's create the GET request URL. After that, name that URL, url.

## Result:

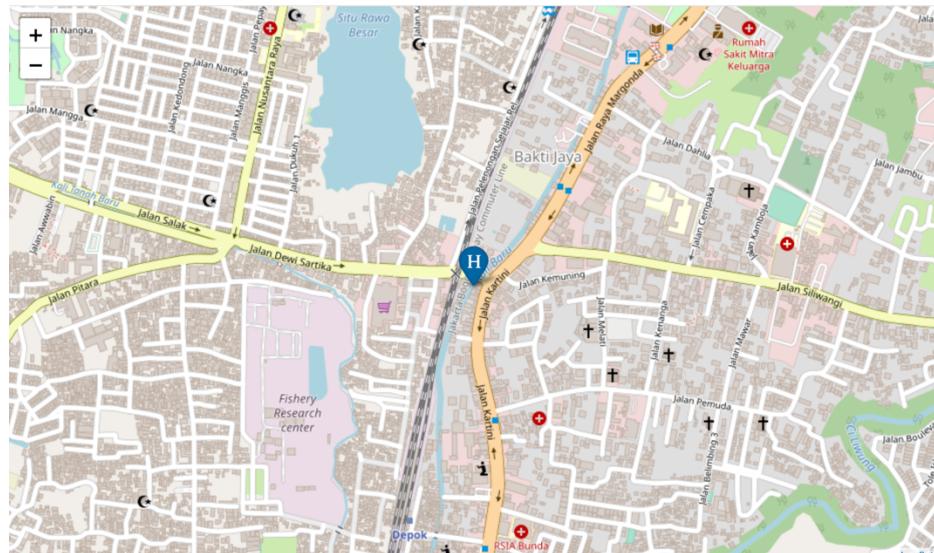
Hospital	Latitude	Longitude
RSUD Kota Depok	-6.4	106.81861

After that, Define function that extracts the category of the venue based on the returned JSON file.

RSUD Kota Depok: -6.39393925 , 106.822624794566

After that, get URL for the API in Depok Hospital neighborhood, then make a request using REQUEST library, and name the query results for Depok Hospital area, results.

Next, we will use the above function (`get_category_type`) to extract information from the JSON file related to venues in the Depok Hospital neighborhood.

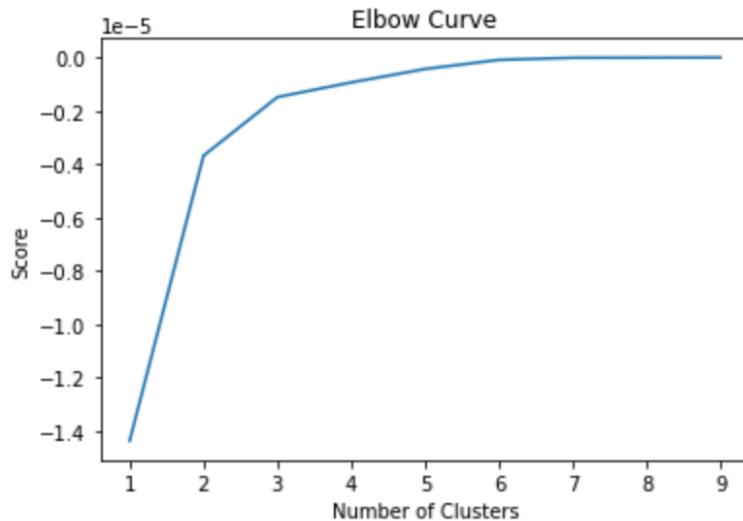


### *Exhibit 7. Depok Hospital neighborhood*

The next set of challenges that we need to tackle is to gain slightly more insights (profile) of the Depok Hospital area. To simplify the analysis, we can use the Euclidian (distance-based)

clustering technique which is part of the unsupervised machine learning technique. In particular, we will use K-means clustering.

First, we need to decide the best K-value for our analysis by utilizing the K-means clustering algorithm.



*Exhibit 8. Elbow curve*

The X-axis shows various number of K-values that we can use for our clustering analysis. From this elbow curve, it can be seen that the curve starts flattening out at K=3, then more flattened at K=6. Therefore, we will use a K=3 to cluster neighborhoods surrounding our proposed Covid-19 testing center.

To visualize the clustering of the neighborhood, we need to create a custom functions called “regioncolors” that would help us differentiate the facilities using color.

	name	categories	lat	long	cluster_label	color
0	Sop Durian Margonda	Snack Place	-6.390426	106.825303	2	red
1	Sop Durian Margando	Lounge	-6.390322	106.825298	2	red
2	D'Cost Seafood	Seafood Restaurant	-6.392386	106.823496	0	green
3	Warung Tekko	Indonesian Restaurant	-6.393244	106.824413	0	green
4	KFC	Fast Food Restaurant	-6.392458	106.823809	0	green
5	Carrefour	Supermarket	-6.392719	106.823285	0	green
6	Depok XXI	Multiplex	-6.392401	106.826079	2	red
7	Haircode Salon	Spa	-6.392370	106.824081	0	green
8	Stasiun Depok Baru	Train Station	-6.391200	106.821960	1	blue
9	Starbuck Depok Square	Coffee Shop	-6.391293	106.821597	1	blue
10	KFC	Fast Food Restaurant	-6.391803	106.825237	2	red
11	Ramayana	Department Store	-6.391858	106.825205	2	red
12	Pasar Kemiri	Grocery Store	-6.389465	106.822461	1	blue

Table 1. Region colors

We have assigned cluster labels to all of the neighborhood venues, as well as unique colors to each cluster. Next, we can then visualize the clustering analysis to a Folium map and see how all of these venues are geographically distributed within the 500-meter radius of the surrounding facilities.

Finally, compiled a map of these business location with a map of the distribution of COVID-19 cases in Depok City.

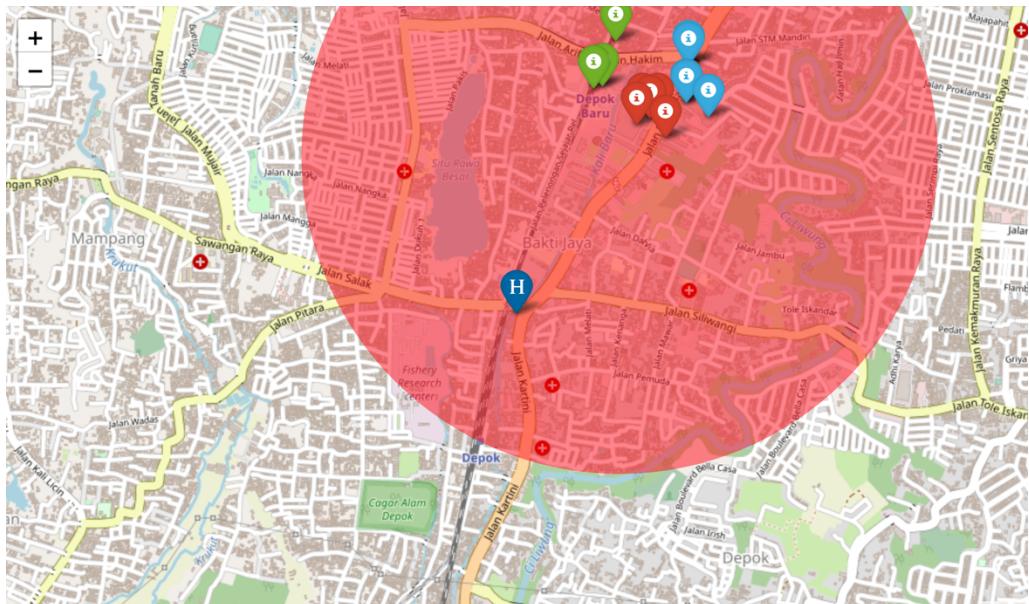


Exhibit 9. Compiled map of business location around Depok Hospital area

The result of analysis is the location of the business which is in the Depok Hospital neighborhood and is within a radius of 500 meters. Then, we also get the most congested cluster if businesses

apply normal conditions in the red zone, potentially increasing cases of contracting the COVID-19 virus within the area.

## **7. Results and Discussion**

The capstone project aims to provide information to local people who must be alerted to go out of the house from the distribution of the COVID-19 case in Jakarta. It also aims to provide information on areas that are most needed for plenty of mask distribution, according to population density in the area.

Furthermore, it provides information on which cities that need the most medical resources for COVID-19 treatment, including medical equipment and personnels. The analysis also provides information on the business neighborhood which shall implement Covid-19 health protocol with a high discipline in new normal situation.

## **8. Conclusion**

The purpose of this capstone project was to identify which areas has the most cases and see the distribution of hospitals and medical resources across the province. This would help mask distributors to understand potential distribution areas according to population density in West Java's City/Regency. Furthermore, it will also help the distribution of medical devices for Covid-19 test devices to hospitals that are estimated to have a large number of patients or even helps analyzing which hospitals need additional medical equipments and personnel.

The analysis will surely provide awareness for business owners who run the business in the red zone areas to adjust their service by enhancing health protocol for its customers. Therefore, hopefully the number of active cases in particular area can be decreased.