

# Developing COVID-19 Heatmap System

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## ABSTRACT

The quick rise of COVID-19's number of cases overwhelms countries all over the world. The United States of America currently has the most number of cases, which is more than 16 million cases. This is mostly caused by the lack of mask use and social distancing practice. In order to help fight the spread of the virus, I am creating a web-based application that is showing the location of people in a certain building, which can be used to monitor the practice of social distancing and also contact tracing.

## 1 INTRODUCTION

The COVID-19 Heatmap can be used to monitor people's movement and how many people are currently inside a building which is suitable to be deployed at essential places like office buildings or hospitals. The idea for the whole system is by attaching a tracking device on people who enters the building, placing a hub/server to retrieve data from the tracking device in the building, and creating a web application that used this data to visualize the movements in the building. For this final project, I am only focusing on the visualization part.

## 2 IMPLEMENTATION AND CURRENT FUNCTIONALITIES

For the scope of this project, I was able to implement a web application using React and d3.js to visualize the randomly generated data to show what the heatmap will look like. In the real-world scenario, the position data would be generated by the tracking device. The current application only has 2 features, which are the heatmap visualization and simulation.

### 2.1 Heatmap Visualization

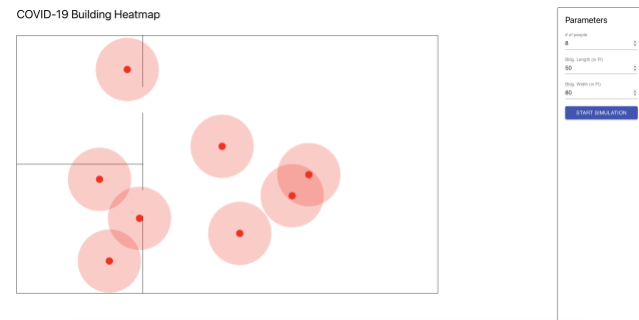


Figure 1: Heatmap Visualization

Fig. 1 above shows the simple layout of a floor plan of a building with simulated people marked as red circles and wider translucent circles indicate the "safe distance" of 6ft which is recommended by the CDC [1]. We can use this visualization to monitor how many

people are inside the building and are they practicing social distancing in real time.

### 2.2 Simulation

Figure 2: Simulation parameters

On the right side of the web application, we can set the parameters for the visualization simulation. We can change these parameters to change the number of people, the building length (which will cause the visualization to increase in height), and the building width (which will cause the visualization to increase in width). Pressing the "Start Simulation" button will start the simulation feature which goal is to show how the visualization will behave when the position data is updated. The simulation uses randomized value to choose whether to go left, right, forward, or backward. It checks for the maximum width and maximum height of the chart to make sure that it doesn't go off the chart.

## 3 FUTURE IMPROVEMENTS

There are a lot of limitations on this project and potential improvements that I could not achieve because of the time limitation, such as floor plan generator and contact tracing algorithm.

### 3.1 Floor Plan Generator

D3.js is a really powerful library which can be used to draw lines, shapes, etc. The current implementation used hard coded values to generate the simple layout of the building. With d3.js and more implementation using HTML and JavaScript, we should be able to create a feature that takes a set of data points and generate a real layout of the desired building.

### 3.2 Contact Tracing

In Fig. 1, we can see that there are 2 person who are in each other's "safe distance" area which indicates that there may be a contact happening between those 2 people. In the scenario that the tracking device attached to these people has an information about its

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owner's identity, we can store this information in a database which we can use later to notify these people if one of them is infected by the COVID-19.

#### **4 CONCLUSION**

With the lack of mask use and social distancing practice, the number of COVID-19 cases will keep increasing. However, I believe we can slow down the spread by following the safety protocol and creating a right tool especially for contact tracing. I hope that I can continue working on this project even after this course and see if it is going to be a useful tool to help slow down the spread of the virus.

#### **REFERENCES**

- [1] "Coronavirus Disease 2019 (COVID-19)." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, [www.cdc.gov/coronavirus/2019-nCoV/index.html](http://www.cdc.gov/coronavirus/2019-nCoV/index.html).