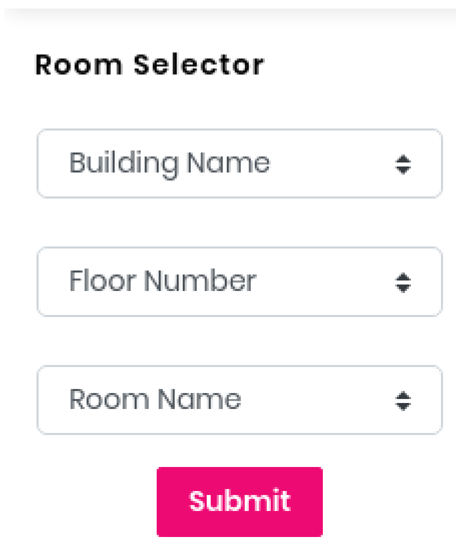
Infectious Simulation in University Environment (ISSUE) Documentation

Infectious Spread Simulation in University Environment (ISSUE) is a browser-based interface that can be used to simulate COVID-19 infection spread in a room at the University of Calgary.

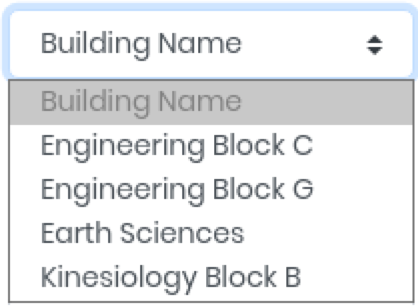
Room Selection Interface:

The collapsible sidebar to the left of the main page contains the room selection interface as shown in figure X.

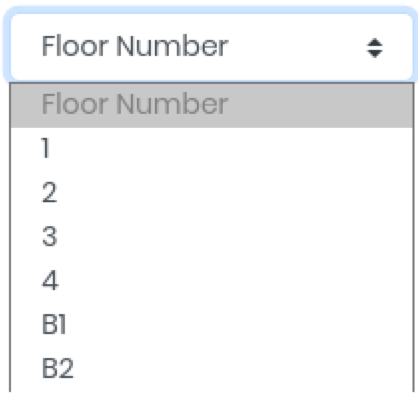


The interface is used to select a room on campus. There are 3 dropdown menus you should select from in order of building, floor, and finally room. The options will not be visible unless chosen in that order, they will be hidden as shown in figure X:

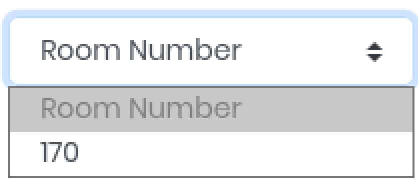
- Building: This dropdown menu lets you select a building on campus e.g. Engineering, Earth Sciences, Science Theatres, and so on.



- Floor: This dropdown menu lets you select a floor for the particular building that was previously chosen.



- Room: This dropdown menu lets you select a room that is available on the selected floor of the chosen building.



Once the selections are made you must click the submit button to load the seat selection interface.

Seat Selection Interface:

Infection Parameter Settings:

Heatmap:

Provides a high-level view of the infection rates across the room. This feature updates in real time as the seat selection interface has students, and infected students placed within the room.

Follows the typical heat map format of using a red shade to indicate the highest probability of infection. The rate decreases as an individual is further away from that “hot” zone. Which is indicated by changing colors to eventually where the seats have no shading on them. A sample heat map can be seen in figure X.

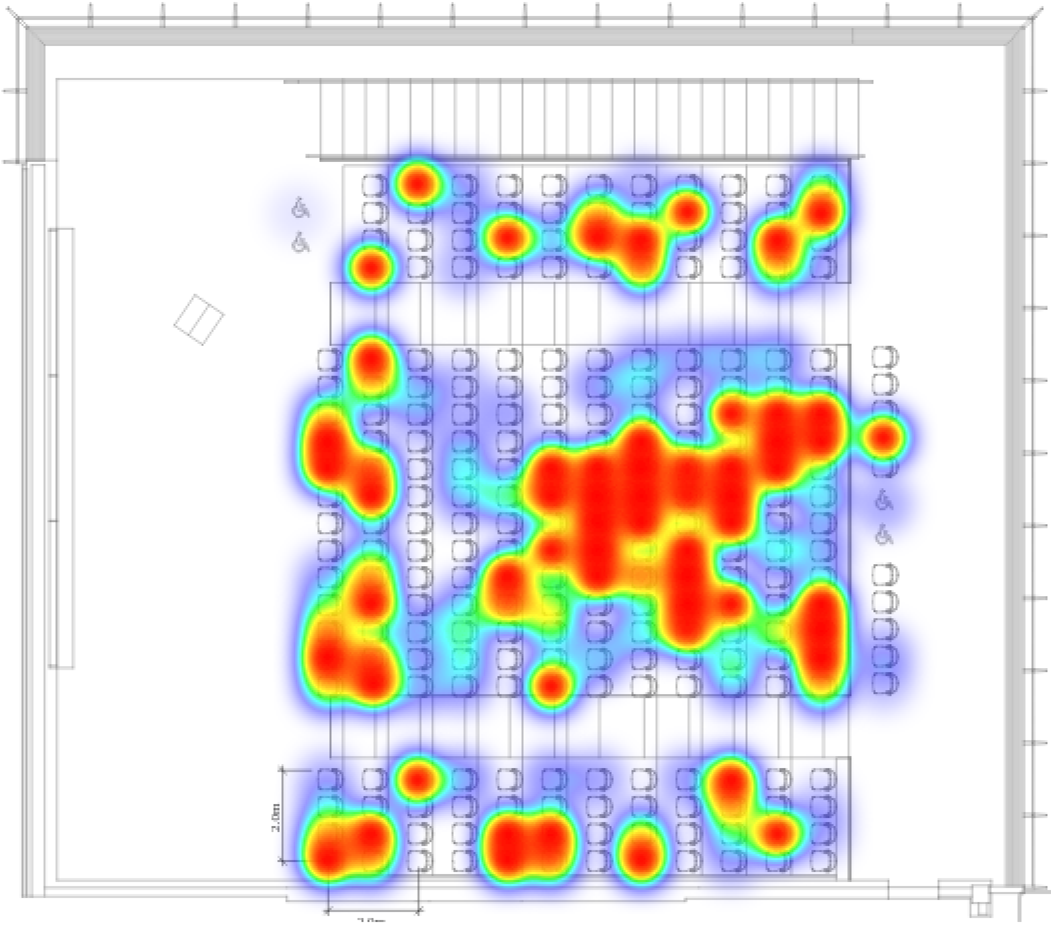


Figure X: Sample heat map showing attack rates of students sitting in a lecture hall (ENC 170)

Temporal Data:

A Line graph showing the temporal effect on the attack rates. Essentially, as the time spent in the particular room starts increasing, the attack rates will also increase proportionally. This graph simply shows how the attack rate will increase with time, not necessarily specific to the room, but more generally how COVID-19 attack rate is affected by time. The time spent in the room can be selected using the Duration Field shown in Figure Y. The temporal graph will start from Time = 0 and continue until the time specified in the duration field. A sample temporal graph can be seen in Figure Z.

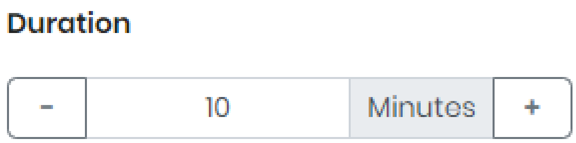


Figure Y: Showing the duration field where users can input duration spent within a room

COVID-19 Model:

A statistical model used to calculate the risk of transmission for the COVID-19 virus, in the event that an infected population is present along with a non-infected population. This model is heavily based on data derived from the research article, “Risk of Coronavirus Disease 2019 Transmission in Train Passengers: an Epidemiological and Modelling Study,” which relates the attack rate of the virus with spatial distance. By using mathematical techniques, such as interpolation and curve fitting, with the data presented in this paper, an equation relating the attack rate with the euclidean distance between an infected and non-infected individual was derived. However, due to insufficient data, the derived equation will only apply to distances less than 3.3m. It is assumed any non-individuals beyond a distance of 3.3m from an infected individual will have an attack rate of 0.05%.

$$AR(x) = \begin{cases} 0.1335x^6 - 1.9309x^5 + 11.291x^4 - 34.12x^3 + 56.193x^2 - 48.069x + 17.104 & 0 \leq x < 3.3 \\ 0.05 & 3.3 \leq x \end{cases}$$

Where *x* is the euclidean distance between the infected and non-infected individual in metres.

In the case of multiple infected individuals that are within the vicinity of a non-infected individual, the probability rule for the union of independent events is applied for the total attack rate. For example, the total attack rate for a non-infected individual that is within the vicinity of infected individuals *A*, *B*, and *C* is as follows:

$$AR = P(AR_A \cup AR_B \cup AR_C)$$

$$= P(AR_A) + P(AR_B) + P(AR_C) - P(AR_A \cap AR_B) - P(AR_A \cap AR_C) - P(AR_B \cap AR_C) + P(AR_A \cap AR_B \cap AR_C)$$

Where AR_A is the attack rate on the non-infected individual from infected individual *A*, AR_B is the attack rate on the non-infected individual from infected individual *B*, and AR_C is the attack rate on the non-infected individual from infected individual *C.*

Temporal Model: