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**Final Course Project Proposal**

The COVID pandemic outbreak in 2020 has impacted people’s lives in many ways, among them are changes to be made on visiting loved ones and traveling to places of interest. While many decide to stay quarantined as long as possible to protect themselves and those around them, others have to leverage between the risk of infection and getting to destinations they are obliged to go despite of the current situation. Out of the many means to travel, the risk of infection is especially high when driving, due to its relatively long duration, high exposure to local communities along the route, and commonly unsupervised self-hygiene (unlike airports/train stations, which provide health measurements to passengers). Moreover, driving is known to be the most common mean to travel for many Americans, further increasing the need to reduce the risk of infection when traveling by car.

Our group aims to alleviate the concern of safety during traveling, by reducing the possibility of trespassing highly infected areas, while maintaining a route of acceptable level of traveling distance. The idea behind this is the assumption that the risk of infection increases when the local community shows a greater number of COVID cases, so a route that avoids such highly infected areas will be considered as a safer route. Though this task has never been done before, most of the resources needed is easily accessible on internet. As an overview and a quick estimation before our group dig into the specific requirements to accomplish our goal, the project can be divided to the 4 major compartments of focus, which are collections of cities information and the routes between them, collection of data regarding to COVID cases with constant updates, a route search algorithm that could find an optimal path given constraints and city nodes, and a GPS tool that could provide real-time instructions to drivers as they travel to their destinations. We estimate that the last compartment will take the least amount of effort to implement, since there are many commercial mobile applications (Google Maps, etc.) that could accomplish the goal with great user interface. Thus, the focus of this project will most likely be on building an algorithm that could provide users a list of cities/counties in which the most optimized route will pass through, and finding and building a data structure on which our algorithm will run. We’ll break them into two paragraphs to discuss:

First about data collection of locations and corresponding COVID cases, this will most likely be the first step of our group as we start our project. We aim to generate a graph, in which nodes are US cities that will be considered for route calculation, and edges being the cost of traveling between nodes. The plan for now is to search for data that could give us the list of US cities, and the distance between them if a path is available. A problem with using distance alone to describe the costs of traveling between 2 locations is that speed requirements may be different on different routes, so distance/speed will be a better option to be the cost if applicable. Another potential problem is the size of the graph, as for a graph that contains every US cities and related edges, a huge amount of storage space and long running time are expected. We could possibly work around this by including only fragments of the complete graph during route calculations, because it’s often unnecessary to include routes of the whole graph when the driver only travel through small regions of the country. We aim to accomplish the contents described in this paragraph before the end of October.

Once our data collection is completed and the graph is built, the route searching algorithm will then be implemented. The algorithm will be similar to the route searching algorithm described in class and implemented in the PACMAN project, as they both aim to find the optimal routes given nodes, edges, and constraints. In addition to what is implemented in PACMAN project, the route searching algorithm will also consider the number of COVID cases of a given node (city), evaluating and adding the risk of infection to the preexisting traveling cost between nodes (which only contains distance/speed cost when the graph is first built). If feasible, we also wish to delegate the power of leveraging between safety and quickness of traveling to our users: they could choose whether to travel faster to their destination with an increasing risk of infection, or to minimize their risk of infection at the cost of slowing down a bit. Note here that traveling safely doesn’t necessarily mean to travel slowly. It is possible for a user to travel through a great distance with high risk of infection, and it’s also possible that the fastest route between two locations is also the safest one. We aim to finish the second part of our project before the final exam.