**Introduction**

Coronavirus disease (COVID-19) is an infectious disease which has created a havoc in the world. It is caused by a newly discovered coronavirus. Even though we have seen that most people who gets infected with the COVID-19 virus, experience mild to moderate respiratory illness and recover without requiring special treatment. The recovery rate varies from 92%-97% around the world, which is probably not a cause of concern. More concerning is that older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness and even can lead to death.

From the various research, we have seen that the best way to prevent and slow down transmission is be well informed about the COVID-19 virus, the disease it causes and how it spreads. One has to protect themselves and others from infection by washing your hands or using an alcohol based rub frequently and not touching your face. Research also says that the COVID-19 disease spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. It’s very important that we practice respiratory etiquette (for example, by coughing into a flexed elbow) among the other etiquette we mentioned.

At the time of writing this report, there are no specific vaccines or known treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments and organizations are also conducting trial on human for finding an effective vaccine.

In this research, we looked at the Covid-19 scenario in India. Recovery rates are higher but since the disease itself is infectious, both central and state governments have announced lockdowns in various regions. People are not encouraged to travel. This has hit the economy hard.

Covid-19 pandemic is set to impact the India growth story and the country’s gross domestic product (GDP) could in fact shrink in 2020, as per a Dun & Bradstreet global report.

In 2020 fiscal year, India's growth rate could get into negative value of 4.5%. One of the reason is the travel restrictions. The hospitality industry has suffered the most. India’s hotels are reimagining the hospitality industry to survive the coronavirus pandemic because how far can they go with just being creative at the time when people are reluctant to even step out of their homes. The corona virus outbreak in India and the ensuing 70-day lockdown enforced by government has crippled the hospitality industry from small restaurants to big hotel chains and travel industry. Hotels are struggling to pay salaries, and in many cases, even are laying off staff. Companies are re-calibrating and localizing supply chains, which will change the way they operate their business. But these measures are not sustainable.

According to The World Travel and Tourism Council (WTTC), tourism generated $240 bn or 9.2% of India's GDP in 2018 and supported 42.67 mn jobs which is 8.1% of its total employment. This was the biggest motivator to carry out this research. Challenge is to come up with best possible routes during Covid-19 times and this could be extended to any such pandemic we might encounter in future as well. Input that we take is the zone classification by the government into Red, Orange and Green. Red zone indicating complete lockdown of non essential goods and certain type of travel is allowed with special permissions. Orange is where the travel is allowed with certain limitation and Green zone has no travel restrictions. Apart from this, even the people travelling would want to visit few or no red zones and minimal orange zones because the chances of getting infected is very high in these areas. With these info in mind, the paper comes up with an efficient travel route based on any two given points.

The generated travel plan would be the least risky of all the possible routes. The time factor is also taken into account but has very low weight. Many similar papers have been referred but none of the papers have spoken about similar situation. There are many articles which talks about coming up with route planners in emergency situation. The conditions and the attributes analyzed in this paper is different compared to similar research done in the past.

This research can be used in multiple scenarios apart from Covid-19 situations. This study can be extended to include in different situations which requires the planner to re-route the planned route for variety of reasons like, collapse of a bridge, heavy rain in certain part, etc. This research can be used by travel industry for route planner, individual people to plan their travel route to have least chances of surprise and also by supply chain planners.

**Literature Review**

There are many research papers which were referred to understand how the route planning is done in similar situations. A paper titled "Travel Time Forecasting and Dynamic Routes Design for Emergency Vehicles" by Giuseppe Musolino and others were published in 2013. The paper presents a framework to dynamically design routes of emergency vehicles taking into account within-day variations of link travel times on a road network presented. The framework integrates two modelling components: (i) a within-day dynamic assignment model that simulates the interaction between the time-varying network and travel demand, and (ii) a dynamic vehicle routing model that design optimal routes of emergency vehicles. The linking variable of the two modelling components is the short-term forecasted travel time, which allows to design routes of emergency vehicles based on anticipatory knowledge of traffic dynamics on the road network. Some procedures of the proposed framework are calibrated and validated in an experimental evacuation test site.

The safe operation of all highway facilities, including intersections, requires the consideration of three primary elements for safe roadway operations: the driver, the vehicle, and the roadway. Robert Layton presented the detailed analysis in a report to Oregon Department of Transportation (US) in 2012.

There was a study done by a team in Egypt on GIS-Based Network Analysis for the Roads. This study was conducted for Greater Cairo area. Sayed Ahmed, Romani Farid Ibrahim and Hesham A. Hefny, in their paper, says in a crowded city like Grater Cairo Region (GCR), Egypt, finding a desired location becomes a difficult task, especially in emergency situations. The main criteria of any emergency response system (ERS) are its readiness to solve the immediate emergency situation such as fire emergency response, police station emergency response, healthcare emergency response system,etc.

Then there are many papers which talks about the vehicle movement in crowded city. Road accidents are a serious problem in the world especially in developing countries. Travel time of Emergency Vehicle (EV) is an important parameter in emergency rescue during accidents. The situation can be improved provided the emergency information services like Web based emergency information and management systems which identifies incident, alerts emergency vehicle (EV), estimate travel time, enhance pre-emption control and route the EV. The study titled "Travel Time Estimation and Routing for Emergency Vehicles Under Indian Conditions" by R. Anil, M. Satyakumar, Jesh Jayakumar proposes a multilayer fuzzy model to determine the degree-of-priority (DOP) based on emergency vehicle pre-emption demand and impact intensity on each road section.

There are few research papers which focusses on shortest path problem. A research paper published in 2016 titled "Dynamic Path Planning of Emergency Vehicles Based on Travel Time Prediction" by Jiandong Zhao in Journal of Advanced Transportation. The dynamic paths planning problem of emergency vehicles is usually constrained by the factors including time efficiency, resources requirement, and reliability of the road network. Therefore, a two-stage model of dynamic paths planning of emergency vehicles is built with the goal of the shortest travel time and the minimum degree of traffic congestion. Firstly, according to the dynamic characteristics of road network traffic, a polyline-shaped speed function is constructed. And then, based on the real-time and historical data of travel speed, a new kernel clustering algorithm based on shuffled frog leaping algorithm is designed to predict the travel time. Secondly, combined with the expected travel time, the traffic congestion index is defined to measure the reliability of the route. Thirdly, aimed at the problem of solving two-stage target model, a two-stage shortest path algorithm is proposed, which is composed of K-paths algorithm and shuffled frog leaping algorithm.

Travel Time Forecasting and Dynamic Routes Design for Emergency Vehicles by Giuseppe Musolino published in 2013 in Science Direct, proposed a framework to dynamically design routes of emergency vehicles taking into account within-day variations of link travel times on a road network is presented. The framework integrates two modelling components: (i) a within-day dynamic assignment model that simulates the interaction between the time-varying network and travel demand, and (ii) a dynamic vehicle routing model that design optimal routes of emergency vehicles. The linking variable of the two modelling components is the short-term forecasted travel time, which allows to design routes of emergency vehicles based on anticipatory knowledge of traffic dynamics on the road network. Some procedures of the proposed framework are calibrated and validated in an experimental evacuation test site.

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