# OfficeTime

***"Be the speed you wish to see in the world"***

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Abstract

The goal of this article is to present the information regarding the prediction of the most appropriate time for a person or an organization who has employees, who needs to travel daily. The motivation behind developing this application is to deliver a feasible and simple platform for users, which will help to save a lot of their time. Using this application, a user can plan his/her schedule before leaving the home for office or can make the necessary adjustments in his/her schedule for the day.

**Keywords: traffic congestion, office hours prediction, ford fulkerson algorithm, dijkstra's algorithm, graphs.**

## I. Introduction

In today's world, the traffic on the roads has worsened to the heights. This has a huge impact on the economic growth. People are often late to work because of traffic congestions. It stresses people before they reach their destination and hence, affect their work. Deliveries are late because of traffic congestion and also, the extra gas costs money. Unfortunately, most of the American cities with the worst congestion also have the largest economies. Due to traffic congestion, people are not able to calculate their estimated travel time, due to which they miss some of their important meetings at office. According to a research by Matthias Sweet, a researcher at McMaster University, higher levels of congestion are initially associated with faster economic growth. But, above of certain threshold, congestion starts to become a drag on the growth. Specifically, congestion seems to slow job growth when it gets to be worse than about 35 to 37 hours of delay per commuter per year (or about four-and-a-half minutes per one-way trip, relative to free-flowing traffic) [1].

In this project, we have made an effort to build a prediction system which will help the organizations and users to plan their schedule in advance according to the traffic congestion on the roads.

## II. Problem Description

Every metropolitan city faces a big issue: traffic congestion during rush hours, mostly between 8 AM to 11 AM in the morning and 5 PM to 7 PM in the evenings. A lot of time of brilliant minds gets wasted, which they could have used productively. There is a need of an application which will analyze the data from traffic sensors and provide schedules to organizations, which they can opt as their work timings to reduce this waste of time of their employees. This application will serve as a common platform on which all companies can register to get an optimized office timing schedule for their employees.

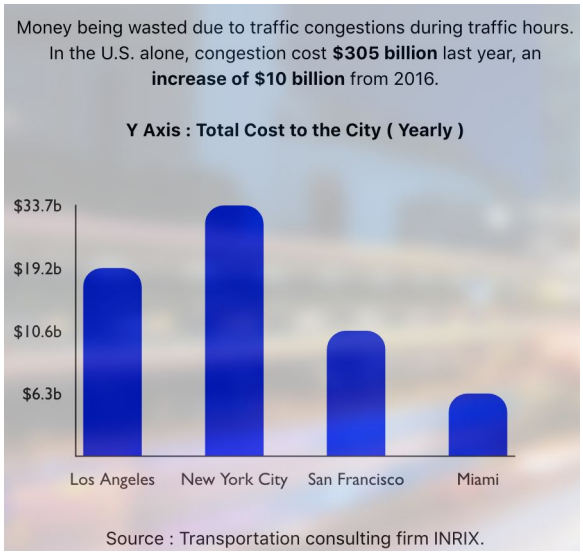


Fig 2.1 - Money lost due to traffic congestion[3]

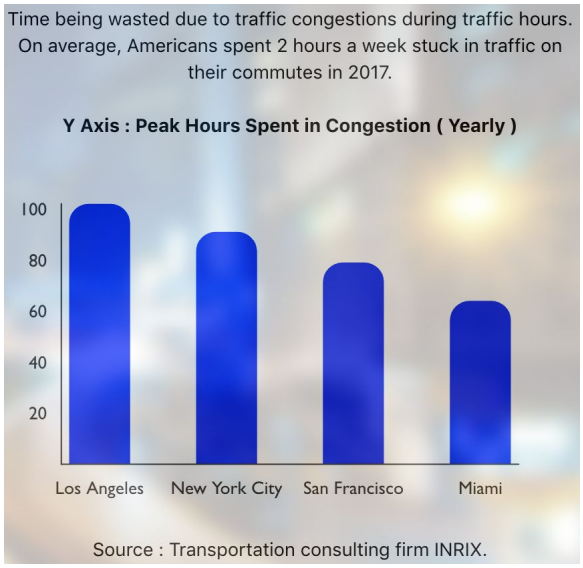


Fig 2.2 - Time lost due to traffic congestion[3]

## III. Methodology[4]

Prediction of best departure time as per the needs of the user is at the centre of our project. If it fails to understand the needs of the user then it will not be able to provide a significant recommendation. For this it is must to understand the traffic flow on different road sections. We gathered data from California State Traffic Department which provides a consolidated section wise data of traffic load on each section.

The traffic data was in the form of road sections and traffic load. We extracted this data into data frames using Python's Panda Libraries.

Usually the traffic flow can be seen as a weighted graph. Road sections represented by edges and intersections by nodes. Thus we used Dijkstra's shortest path algorithm to calculate a path with least cost. Also as more and more user will direct to path we have recommended, the dynamics will change. To handle this we have used Ford Fulkerson maximum flow algorithm. Using the maximum flow value which tells us the maximum number of vehicles that can pass through that section, we control the recommendations once they near the full capacity of the route.

As the load of traffic changes the recommendation given by our algorithm also changes.

Thus by using the already existing graph algorithms we can recommend user the best time on which he should leave for his office to avoid traffic congestion.

The data extracted by running the python script on the pandas library of Python was loaded into NodeJS and then we used the MERN stack to make our web application for the user to interact

with. We used MongoDB for our Backend, React for our frontend, Express as the middleware and Node JS as the Backend.

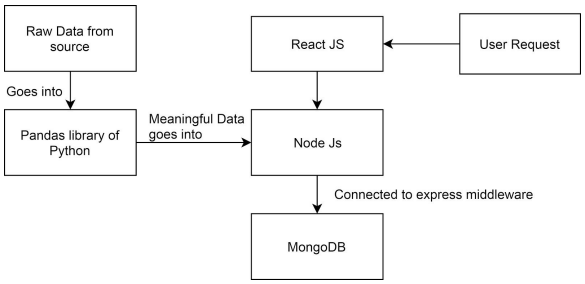


Fig 3.1 -System Design and Methodology

Next sections talks about all the algorithms that were used to process the data and derive a recommendation.

## IV. Algorithms

*Breadth First Search Algorithm :*

Every travelling has two important aspects. Source and destination and travel time. To travel from source to destination there needs to exist a path between them. This is the first step in our project that when source and destination are entered by the user into the system, we first need to determine if a path really exists between them. Breadth first algorithm traverses a graph representing a road map. We used BFS to determine if there exists a path between the source and destination. If the search produces a path between source and destination then the system moves on to next step which is finding the shortest path between them.

*Dijkstra's Algorithms :* Dijkstra's algorithm finds the shortest path between source and destination nodes in a weighted graph. After BFS finds a valid path, the graph representing road map is then can be transformed to a weighted graph with traffic load as the weights assigned to the edges representing road sections. Dijkstra's is a greedy algorithm which on every step chooses the path with least weight. As the traffic load varies every hour, so we used Dijkstra's to find shortest route in every hour.

*Ford Fulkerson Maximum Flow Algorithm :* The Ford–Fulkerson method or Ford–Fulkerson algorithm (FFA) is an algorithm that computes the maximum flow in a flow network.. It was published in 1956 by L. R. Ford, Jr. and D. R. Fulkerson. The Ford-Fulkerson algorithm deals with max-flow min-cut problem. It determines the maximum flow between two nodes in a weighted graph. That is, given a network with vertices and edges between those vertices that have certain weights, how much "flow" can the network process at a time? The graph is any representation of a weighted graph where vertices are connected by edges of specified weights. There must also be a source vertex and sink vertex to understand the beginning and end of the flow network.[5]

## V. Use Case and Results

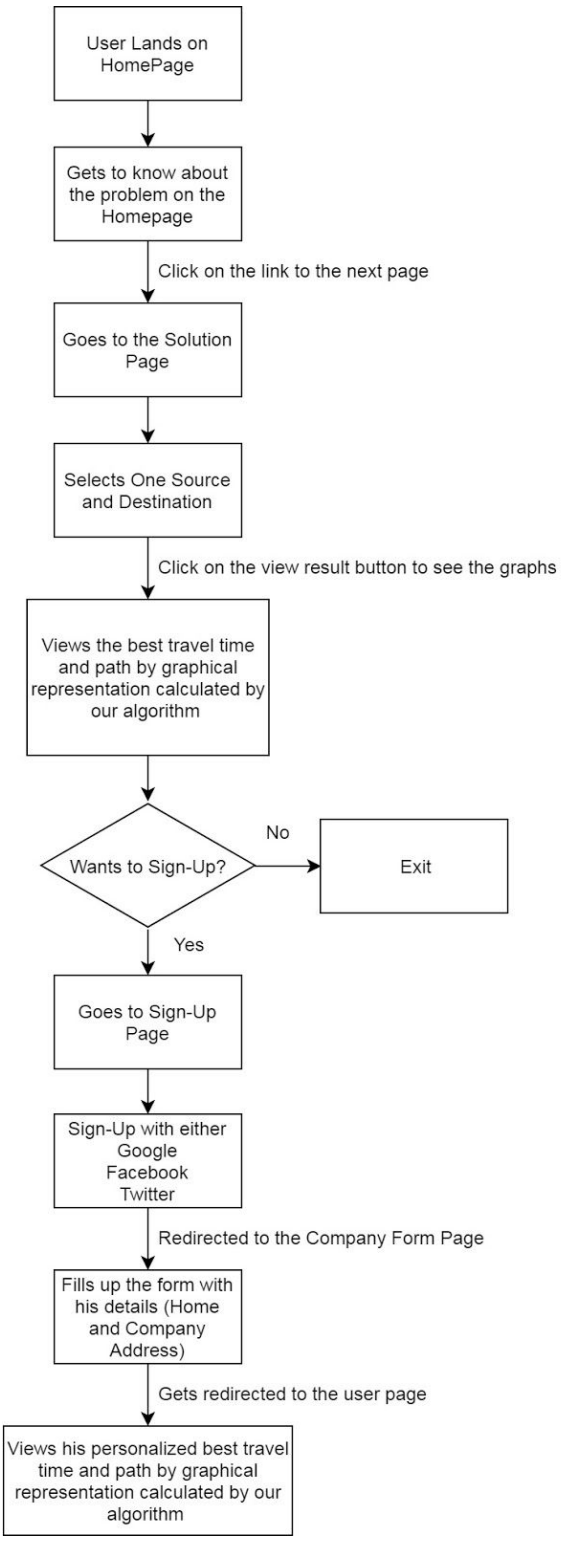


Fig 5.1 -Use Case

We give suggestions to the user based on the their home address and their company address and their suggested travel time. The results that the user gets are an accumulation of all the techniques we mentioned above in methodology. We give the user their best travel time and the route where they would travel with the least traffic [4]

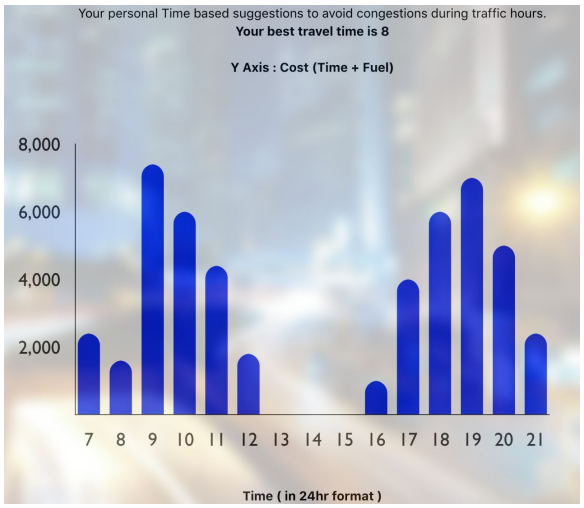


Fig 5.2 - Results provided to the user

## VI. Future Scope

This website currently predicts the time only for the given source and destination. We can extend this functionality to accept any source and destination, which is accepted on the google maps, and then predict the appropriate time.

Another improvement can include the ability to upload the traffic data, which will make it easier for the user to use the website according to their knowledge.

A final modification includes developing this website on Android and iOS. This will increase the availability and convenience of this application. Users will be able to access this

application within seconds on their mobile devices.

## VII.Conclusion

This project is a very simple, convenient and helpful website, which is developed as a course work for CMPE 272 - Enterprise Software Platforms. This website predicts the best time for the companies to operate, depending on the traffic on the roads. It works on a pre-defined data which includes information about the road traffic and the user is simply required to select the route from his place to his office/destination and the website will predict the most appropriate hours, which will help the user to save time. The dynamics change as the traffic is diverted to recommended path increasing the load on the route which was having the least load. Our algorithms handles these changes and recommendations change as per the current data. Thus the system adapts with the traffic and thus is reliable.

## VIII. Acknowledgement

The success and the final outcome of this project required a lot of guidance and support from our **Professor Rakesh Ranjan**, who gave us the opportunity to work on this project and helped us in every step along the way. He took keen interest in our project and provided us with the necessary information for developing a good project. Without his encouragement and guidance, this project would not have materialized.

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