ALGORITHM TO REDUCE URBAN TRAFFIC THROUGH SHARED VEHICLES

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ABSTRACT

It is no secret that traffic increases every day in our city, which generates various problems such as road congestion, deterioration of air quality, inefficiency when moving from one place to another, decrease in productivity, among other problems.

To control and / or reduce the situations mentioned above, it is important and indispensable to find a solution to reduce traffic in the city.

1. INTRODUCTION

In the city of Medellin, for every 1000 people (population) there are approximately 345 vehicles and more than 60% of the vehicles transit through the city every day.

Pollution levels increase significantly in the Valle de Aburrá and in the country, which is why campaigns such as "El Pico y Placa ambiental" are carried out. In addition, the numerous traffic jams due to the number of vehicles generate delays and lost time, among other aspects.

It is essential to get as many vehicles out of the streets as possible, and for this, a solution strategy can be Shared vehicles to go to the university, students who live nearby can share the vehicle.

2. PROBLEM

In order to help the environment and the quality of life of the inhabitants of the city of Medellin, the problem is to perform an algorithm efficiently in order to reduce traffic through the strategy of the Shared Vehicles. The algorithm must determine the minimum amount of vehicles so that all people can reach their destination. Several aspects are assumed:

1) All people go to the same place
2) In each vehicle 5 people can go
3) The driver of the car takes the shortest route

3. RELATED WORK

3.1 Canadian Travelled Problem

The Canadian travelled problem, was defined by Papadimitriou and Yannakak in 1991 [2]. This problem is to find the shortest path between a point of origin and a point to destination. These points are in a graph G = (V, E) (*G is a graph, V are nodes of the graph and E are Edges*) but, the traveler doesn't know the complete information about the graph *(The input graph G may undergo changes).* [3]

In particular, some of the edges from the graph may become blocked and impassable.

The traveler have two options to solve the problem:

1) Advance on the travel and find a blocked edge and determine a new path. The cost of the new path is add to last cost calculate.

2) Pay a surcharge on the cost and determine previously the blocked edges, but the blocked edges may become in a passable edge.

The algorithm to find the shortest path is advance in the graph choosing the node witch has the least expensive edge.

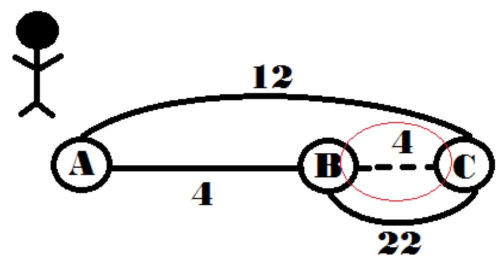

Figure 1. Example

In the previous figure the traveler wants to go from node A to node C, when he arrives at node B, he realizes that the edge between B and C is blocked. The traveler must calculate the new shortest path, which would be to return to node A and go directly to node C, but the cost of this new path will be added to the previously calculated cost.
The other option that the traveler has is to pay an additional cost in node A, where the blocked paths are determined.

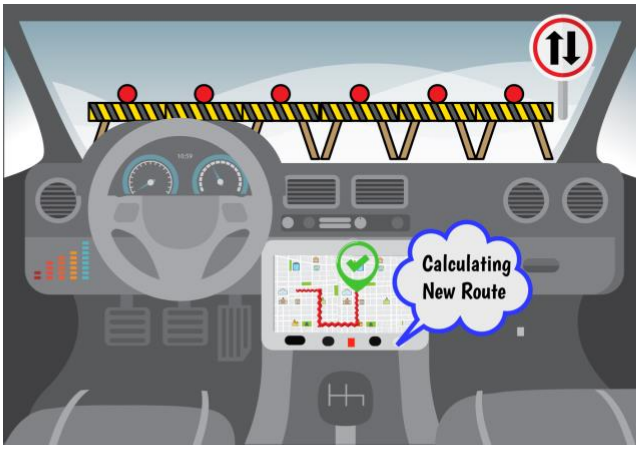

Figure 2. Prototype solution

3.2 Breaking the breakdown

The breakdown is known as the moment in which more cars come out in a given area, this increases the traffic considerably. An algorithm created at the Nanyang Technological University of Singapore has managed to reduce traffic congestion, through the breaking of the breakdown, developing an algorithm that avoids collisions by means of the redirection of vehicles that make use of routes alternatives, thus making changes in the traffic network. This is true through machine learning (AI). The machine is assigned a traffic network and this makes millions of calculations on the network, these calculations are changes of roads and their direction in the graph(Network of traffic), then, analyzing the impact of the new change made in the network, choose those roads that avoid breakdown. [4]

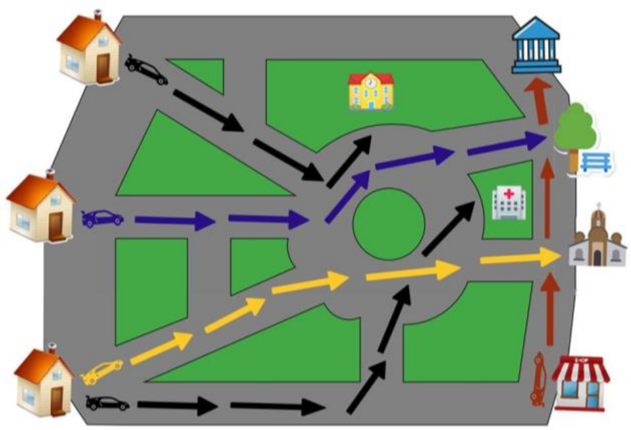

Figure 3. Problem

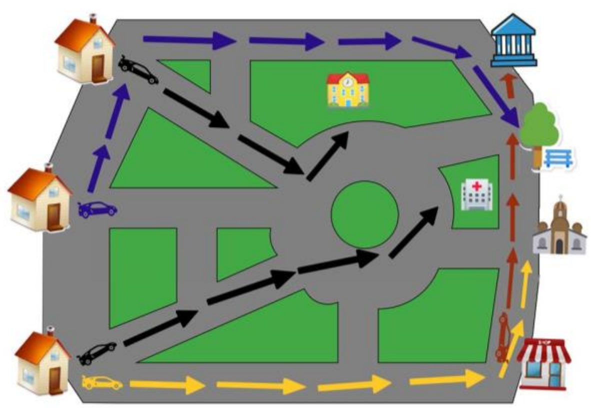

Figure 4. Possible solution

3.3 Taxi Reduction

Italian researchers from CNR (Consiglio Nazionale Delle Ricerche), along with experts from MIT (Medical Innovative Technology) and Cornell University have developed an algorithm that can reduce vehicle fleets, this was due to traffic in the New York city caused largely by taxis, this program guarantees the same levels of taxi service decreasing vehicular, also offering shorter work shifts for taxi drivers. The method is based on the model "Network of exchange of vehicles" and what it does is to find the sequence of trips that can attend a single vehicle, this analyzing the times and coordinates of the point of collection and descent of the passenger. Taxis were organized o that each one made the shortest route without a passenger, thus reducing the number of taxis that offer the service in a city. [5]

3.4 Pathfinding

Pathfinding is an important base for navigation systems, because it is used in areas of robotics, and especially in videogames. The main objective is to find the best possible way from an initial point to an end point in representations of the environment called mesh maps. In the case of video games (especially in strategy games) the characters need to move on the shortest route from their location to a final point and even if they possess these two points, it must also be taken into account that the path must have the minimum of possible obstacles that delay your arrival at your destination. The algorithm of Dijkstra (with a priority queue) oriented to the computational geometry is implemented by the structure of the videogame where techniques of classical geometry, topology, graph theory, set theory and linear algebra are used. So abstract and find the shortest and most efficient way. [6]

Figure 7. Prototype solution

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