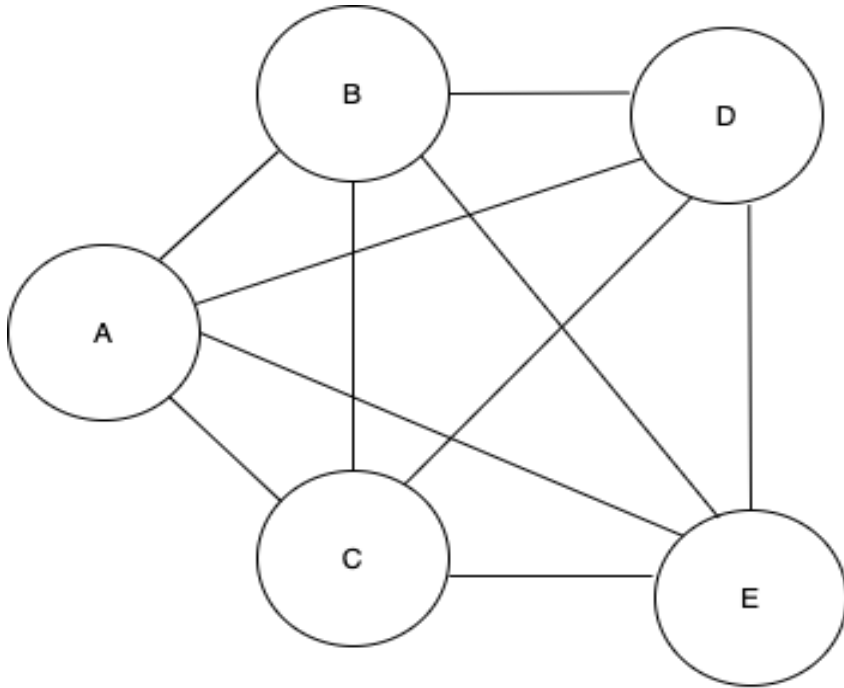# *Algorithm used to find optimal routes for electric vehicles*

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Medellín, Date of the oral presentation

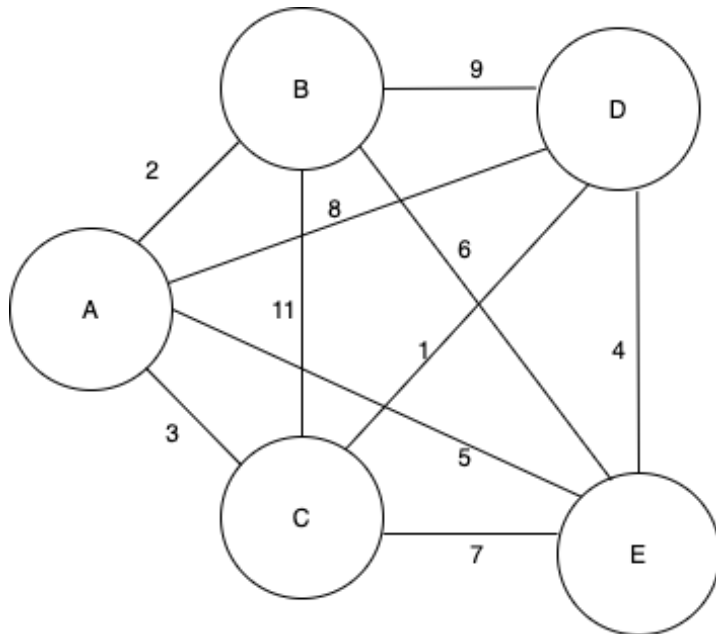**Inspira Crea Transforma**

Data Structures

Figure 1: We use an undirected graph to represent a map where the client and the station will be shown. Each node contains a client and a station.

Route 1	Route 2	Route 3	Route 4	Route 5

Figure 2: An arraylist to save the routes. Each route contains the distances

Algorithm and Complexity

Figure 2: optimal choice of cost in greedy algorithm

Subproblems	Complexity
Create the graph	$O(n)$
Check which nodes are left to visit	$O(m)$
Find the shortest distance from one node	$O(m)$
Total complexity	$O(n+m^2)$

Table 1: Complexity of each subproblem that is part of the algorithm. Let n be the amount of nodes, m the number of clients.

Algorithm design criteria

The algorithm was designed in terms of time consumption, is considerably faster than other options like backtracking or brute force, which might find a better solution, but they are considerably slower, and will possibly occupy more memory, due to the recursive cases in backtracking. This method provides a fast, efficient solution which can also be modified to optimize its answer.

Time and Memory Consumption

	Dataset 1	Dataset 2	Dataset 3	Dataset 4
Best case	0.004 s	0.004 s	0.004 s	0.004 s
Average case	0.00705 s	0.00676 s	0.00655 s	0.00636 s
Worst case	0.016 s	0.014 s	0.014 s	0.015 s

Table 2: Execution time of the data structure for different datasets.
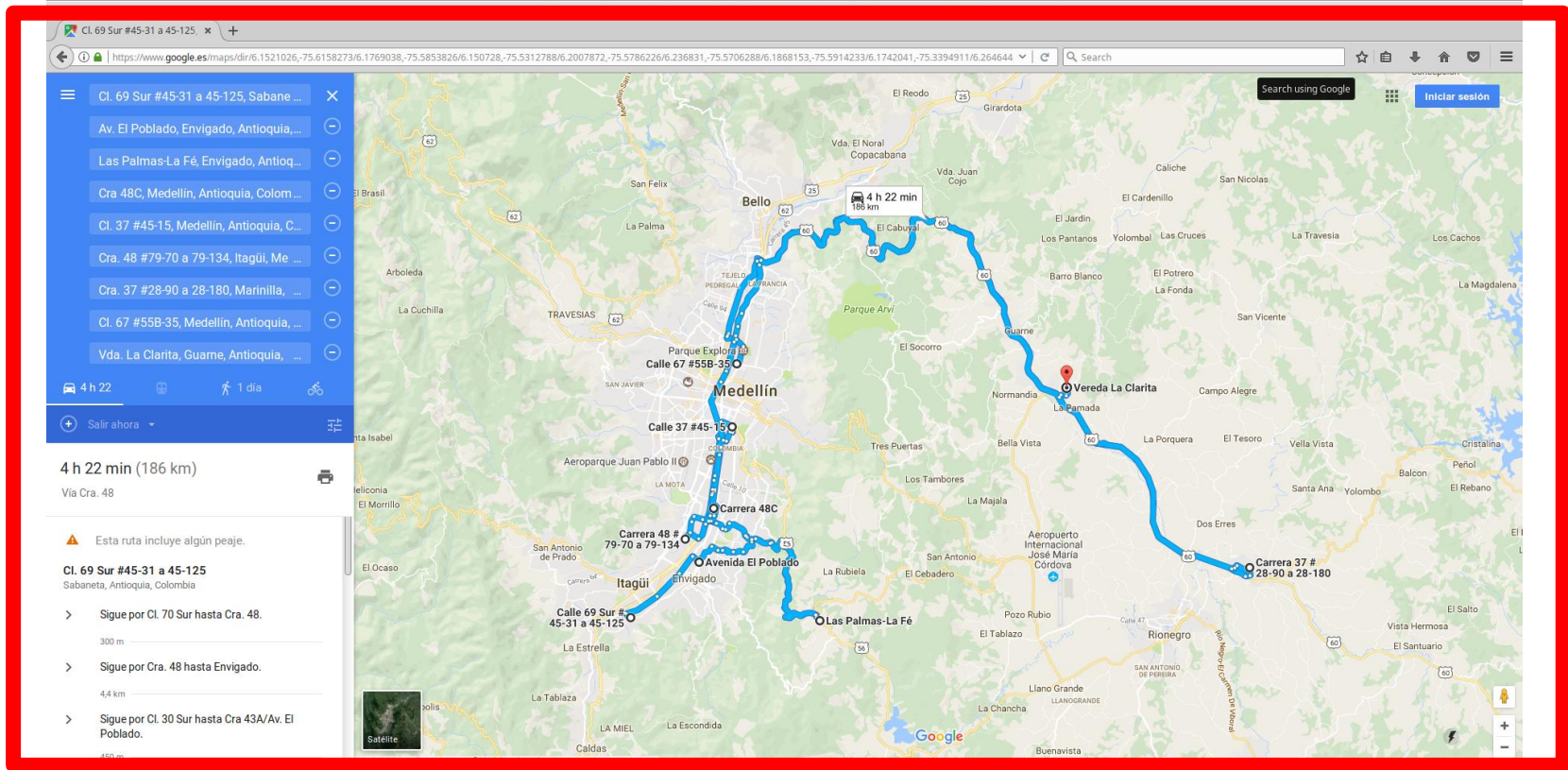
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Time and Memory Consumption

	Dataset 1	Dataset 2	Dataset 3	Dataset 4
Memory usage	1.597 MB	1.596 MB	1.596 MB	1.596 MB

Table 2: Memory consumption of the data structure for different datasets.

Software prototype

Figure 4: System of optimal delivery routing

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C. Patiño-Forero, M. Agudelo-Toro, and M. Toro. Planning system for deliveries in Medellín. ArXiv e-prints, Nov. 2016. Available at: https://arxiv.org/abs/1611.04156

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