**TO DISCOVER QUICK AND EFFECTIVE ROUTES AGAINST SEXUAL STREET HARASSMENT**

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**ABSTRACT**

Despite the human society have evolved a lot on this last centuries, some of the most relevant problems that we have had throughout our history are still relevant to this day. One of them, and a really worrying one is the sexual street harassment. They are non-consensual practices of sexual connotation carried out by an unknown person, in public spaces such as the street, transport or semi-public spaces that usually generate discomfort in the victim. Is something to be concerned of that those kinds of behaviors could be normalized pretty easily in our society, at the same that are beginning to be more and more common along the streets of our city, compromising the free movement of people and their safety, even sometimes refraining them from taking a short path for fear of being abused, taking a longer or simpler one, instead deciding not to go anywhere. Besides, the victims of abuses of this kind can experience fear to be outdoors, social isolation, trigger symptoms of depression and anxiety that are new to the person; or it can exacerbate a previous condition that may have been controlled or resolved.[1] According to above, is pertinent to find an efficient solution by giving an alternative navigation system that take into account both the ease of the journey and the safety of the users as far as this problem is concerned

**Key words**

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| Street sexual harassment, path, fear, alternative navigation system, journey and safety |

**1. INTRODUCTION**

The street harassement against women in Medellín is a complete worrying situation, The office of Councilwoman Daniela Maturana presented a survey in which 940 women participated and which revealed that women are commonly harassed in public spaces. The place where the most respondents reported having been victims of harassment was in the streets, with 94.4%; However, other scenarios are also sources of aggression, since spaces such as the subway and transport (54%), parks (44%), shopping centers (21%), sports venues (20%) and universities (20%) followed. 14%). [2].

* 1. **The problem**

Sexual street harassment is a unwelcome behavior of a sexual nature for example a man who says uncomfortable and sexual comments about a women

In the last years the 61.5% of women of some neighborhoods of Medellín, manifest discomfort when they hang out later than 7:00pm, that reflex that this behavior affects women for the most part, since apart from discomfort, women can also present psychological consequences like depression, anxiety, fear, among others [3]

**1.3 Structure of the article**

Next, in Section 2, we present work related to the problem. Then, in Section 3, we present the datasets and methods used in this research. In Section 4, we present the algorithm design. Then, in Section 5, we present the results. Finally, in Section 6, we discuss the results and propose some directions for future work.

**2. RELATED WORK**

Below, we explain four works related to finding ways to prevent street sexual harassment and crime in general.

**2.1 Preventing Sexual Harassment Through a Path Finding Algorithm Using Nearby Search**

This software developed by Omdena is focused on predict places at high risk of sexual harassment incidents. First, the program generates a heatmap layer using gmaps Python package where the places with high risk are the hottest places, next, the algorithm finds the safest spots on the map based on the previous one. Finally, it superimposes the directions layer on the top of the safest spots of the map, which retrieves the safest routes for a specific place. The directions layer is based on the instruction given by the user, for example, find the nearest hospital.

The software implements the Bresenham’s line algorithm, which is a line drawing algorithm that determines the points of an n-dimensional raster that should be selected in order to form a close approximation to a straight line between two points. This is useful for tracking the hotspots in a map. [4]

**2.2 Beyond the Shortest Route: A Survey on Quality-Aware Route Navigation for Pedestrians**

This work contributes to the existing research domain by providing a big overview of the different quality-aware route navigation systems that have been proposed in past research for pedestrians. Examination different qualities which have been used as key criteria in route recommendation. Also, outlining the various data sources, algorithms and evaluation approaches that have been used to implement quality-aware route navigation systems. Of the most popular algorithms for solving these problems is Dijkstra’s algorithm. This one, given a starting node s in a weighted graph G, Dijkstra’s algorithm finds the shortest path between the node and every other node in the graph. [5] 2.3 Write a title for the third related problem

**2.3 Incorporating a Safety Index into Pathfinding**

This research incorporates a “safe pathfinding process”. It had three objectives: shorter travel time, lower route safety hazard index, and avoidance of sites with the highest safety hazard index along the route. The methodology was applied in a real-world street network to demonstrate its use and prove the concept of finding a safe path. The solution includes two main parts: a route-specific safety hazard index and a route-finding algorithm that considered both travel time and safe. That algorithm is derived from the median shortest-path problem (MSPP), normally solved using Dijkstra's algorithm. [6]

**2.4 Route-The Safe: A Robust Model for Safest Route Prediction Using Crime and Accidental Data**

People who are new to the city, have no idea about the safe routes. Though people rely on google maps for planning their routes; yet it only provides the shortest path & give no consideration for safety of the path

The algorithm uses application such as SafetyPad and Naive Bayes, that use a density map to assign risks to the routes, also through publications on social networks, classify and geocode crimes, so they can suggest routes that vary from the shortest distance to safety [7]

**3. MATERIALS AND METHODS**

In this section, we explain how the data were collected and processed, and then different alternative path algorithms that reduce both the distance and the risk of sexual street harassment.

**3.1 Data collection and processing**

The map of Medellín was obtained from *Open Street Maps* (OSM)[[1]](#footnote-1)  and downloaded using the Python API[[2]](#footnote-2) OSMnx. The map includes (1) the length of each segment, in meters; (2) the indication of whether the segment is one-way or not, and (3) the known binary representations of the geometries obtained from the metadata provided by OSM.

For this project, a linear combination (LC) was calculated that captures the maximum variance between (i) the fraction of households that feel insecure and (ii) the fraction of households with incomes below one minimum wage. These data were obtained from the 2017 Medellín quality of lifesurvey. The CL was normalized, using the maximum and minimum, to obtain values between 0 and 1. The CL was obtained using principal components analysis. The risk of harassment is defined as one minus the normalized CL. Figure 1 presents the calculated risk of bullying. The map is available on GitHub[[3]](#footnote-3) .

**Figure 1.** Risk of sexual harassment calculated as a linear combination of the fraction of households that feel unsafe and the fraction of households with income below one minimum wage, obtained from the 2017 Medellín Quality of Life Survey.

**3.2 Algorithmic alternatives that reduce the risk of sexual street harassment and distance**

In the following, we present different algorithms used for a path that reduces both street sexual harassment and distance.

**3.2.1 Lee Algorithm**

In this algorithm, given a maze in the form of the binary rectangular matrix, finds the shortest path’s length in a maze from a given source to a given destination. Namely, it allows to find the shortest route from a given start point to a given final point in a binary rectangular matrix. Is important to have into account that the time complexity of the backtracking solution will be higher since all paths need to be traveled. The complexity is O(M × N) where M and N are dimensions of the matrix. [8]

Diagrama

Descripción generada automáticamente

**3.2.2** **Floyd-Worshell algorithm**

**The Floyd-Worshell algorithm** is a dynamic algorithm for finding the shortest distances between all vertices of a weighted directed graph. Designed in 1962 by Robert Floyd and Stephen Worshell.

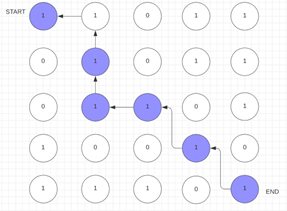
The general problem of finding the shortest paths is to find for each ordered pair of vertices v, w) any path from the vertex v to the vertices w whose length is minimal among all possible paths from v to w. [9]

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**3.2.3 Backtracking**

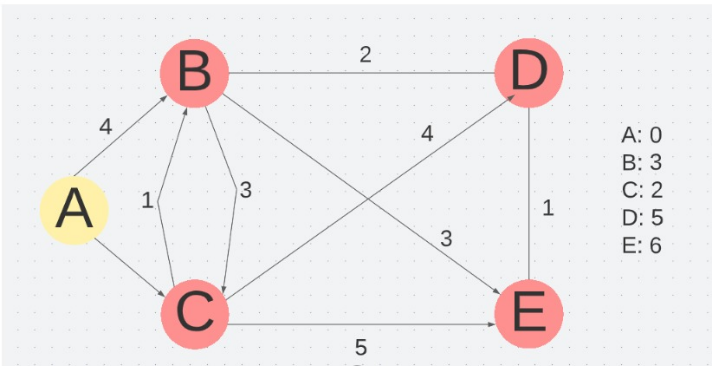
This algorithm looks for shortest path in maze like Lee Algorithm, the difference is that this algorithm go backwards, it means, go from final to start, the idea of this algorithm is keep moving through a valid path until it get stuck, otherwise it go backtrack to the last traversed cell and explore other paths to the destination, this algorithm validate every move before undertaking it. If any move is not valid, it checks for the next one



**3.2.3 Dijkstra's algorithm**

Dijkstra's algorithm allows us to find the shortest path between any two nodes of a graph. It differs from others algorithm because the shortest distance between two vertices might not include all the vertices of the graph.

Dijkstra's Algorithm works on the basis that any sub path B -> D of the shortest path A -> D between vertices A and D is also the shortest path between vertices B and D. The algorithm uses a greedy approach in the sense that we find the next best solution hoping that the end result is the best solution for the whole problem. [10]



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3. https://github.com/mauriciotoro/ST0245Eafit/tree/master/proyecto/Datasets [↑](#footnote-ref-3)