GIS$^2$: a Geographical Information System as a help against the Gender Inequality Society

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Abstract

The feature, called GIS$^2$, uses Geo-ICT methods and tools to provide fair access to safe and inclusive public spaces within University of Salerno. This document discusses the materials and methods used, including React and JavaScript for application development, OpenStreetMap and QGIS for geographic data processing, and NetworkX for the weighted graph and Dijkstra’s algorithm. The potential of this feature is to increase students’ sense of safety and to help the university staff identify areas where security needs to be enhanced. Future developments include real-time calculation of user locations to detect the most crowded and therefore safest areas.

CCS Concepts: • Computing methodologies;

Keywords: GIS, Gender Inequality, Women, Safety, OpenStreetMap, Dijkstra

ACM Reference Format:

1 Introduction

The 2030 Agenda for Sustainable Development is an action program for people, planet and prosperity signed in September 2015 by the governments of the 193 United Nations. It includes 17 Sustainable Development Goals (SDG) that will be in effect by 2030. Goal 11 is to make cities and communities inclusive, safe, continuous and sustainable. In particular, it includes provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

An example of gender inequality can be seen in the Fig. 1, that analyzes Feeling Safe at Night divided by sex and countries. Data used in this histogram was extracted from dataset “How’s Life – Well-being”, offered by OECD.Stat, considering the year of 2021.

![Feeling Safe At Night by Country and Sex in 2021](https://example.com/feeling_safe.jpg)

Figure 1. Feeling Safe At Night in 2021 divided by men and women

2 Materials and methods

According to SDGs and variable Feeling Safe at Night, GIS$^2$ focuses on providing fair access to safe and inclusive public spaces for women, using Geo-ICT methods and tools.
The project takes inspiration from an existing web application, ExploreUNISA, whose goal is to obtain a better knowledge of the Fisciano Campus at the University of Study of Salerno, in terms of moving around within it. Starting from a preliminary analysis, our goal is to develop an additional feature for ExploreUNISA, called GIS$^2$, which allows students to feel more safety by getting the best route both in terms of safeness and distance. The mainly in cartography is based on OpenStreetMap with its data available for the campus, while other data comes from 3D data georeferencing. Data needed to conduct the safety analysis of a specific area is:

- Roads, parking lots, squares and similar aggregation points;
- Security cameras and lighting elements, analysing their absence or presence and if so their extent;
- School and laboratory buildings, School canteen, Libraries, terminal bus and meeting areas.

There is a similar activity in the literature [2], which focused mainly on the study of 10 roads located between meeting points and bus stops, in order to analyse their safety. The parameters chosen are almost similar, with the only difference being that GIS$^2$ performs a dynamic calculation of the route that optimizes safety. By processing all data, we defined the weighted graph used with Dijkstra’s algorithm. We preferred this algorithm to the Bellman-Ford algorithm because the latter minimises the number of nodes to reach the destination [1]. In terms of safety, more nodes are preferred in order to increase the possibility of encountering people on the route. Tools used are:

- React and JavaScript, to develop the application;
- OpenStreetMap and QGIS, for geographic data processing;
- NetworkX, for the weighted graph and Dijkstra’s algorithm.

3 Application and Conclusions

When using the GIS$^2$ functionality, the user enters the starting point, destination point and time. This output takes into account the time entered by the user to evaluate appropriate parameters, such as lighting elements at night and crowded places during the day, modifying the graph. Fig. 2 and Fig. 3 show the graphical interface for interacting with GIS$^2$. It also aims to encourage the university to identify areas where security needs to be increased, such as by adding cameras and lighting. Also, as a result of an increase in the number of users of the application, future developments include real-time calculation of the location of users detecting the most crowded and therefore safest areas.

References


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