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Cartografiere web pentru orientare în interiorul clădirilor

Teză de master

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ANNOTATION

This explanatory note contains a report on the implementation of the thesis on the topic: Web mapping for orientation inside buildings by the student Tîmbur Ștefan.

The explanatory note consists of an introductory part, three chapters, conclusions, a list of sources used, twenty-one images, some of which indicate or explain some concepts in the context of inland navigation.

Keywords: mapping, indoor navigation, digital maps, geospatial system, algorithm.

The aim of the thesis is web mapping to display the interior structure of buildings in order to help users know its interior structure to navigate the space more efficiently.

In this thesis the goal was to analyze and evaluate existing systems for indoor navigation and propose a new system that utilizes existing technologies to improve the user experience. As part of this process, specific tasks and objectives were identified and carried out.

ADNOTARE

Această notă explicativă conține un raport privind implementarea tezei pe tema: Cartografiere web pentru orientare în interiorul clădirilor realizată de către studentul Tîmbur Ștefan .

Nota explicativă constă dintr-o parte introductivă, trei capitole, concluzii, o listă a surselor utilizate, douazeci și unu de imagini, unele dintre ele indicând sau explicând unele concepte în contextul navigarii de interior.

Cuvintele cheie: cartografiere, navigare de interior, harți digitale, sistem geospațial, algoritm.

Scopul tezei este cartografierea web pentru a afișa structura de interior al clădirilor cu scopul de a ajuta utilizatorii să cunoască structura interioară a acesteia pentru a naviga în spațiu mai eficient.

În această teză, conform saricinlor și obiectivelor propuse au fost efectuată analiza și evaluarea unor sisteme existente și a fost propus un alt sistem care implementează o nouă metodă folosind tehnologiile existende, pentru a îmbunătăți navigarea de interior al utilizatori

CONTENTS

INTRODUCTION

The development of information technologies allowed the development of many spheres, including that of cartography and map development.

Cartography is defined as the set of scientific, technical and artistic studies and operations, in order to develop and draw up maps, plans and other ways of representing objects, phenomena and processes on the earth's surface, as well as their use. Also represents the geographical reality on the ground on a flat surface of the map board. It plays an important role because it allows people to understand and analyze spatial relationships and make decisions based on them. The maps allow the visualization and understanding in a wider perspective of the distribution of natural resources, transport, disasters and urban planning.

Digital mapping is the process by which a collection of data is compiled and formatted into a virtual image. The main function of this technology is to produce maps that provide accurate representations of a given area, detailing major road arteries and other points of interest. The technology also allows the calculation of distances from one place to another.

Paper maps provide basic scenery similar to digitized road maps, however they are often cumbersome, only cover a designated area, and lack many specific details such as road blocks. Additionally, there is no way to "update" a paper map other than to get a new version. On the other hand, digital maps, in many cases, can be updated by synchronizing with updates on the company's servers.

Although digital mapping can be found in a variety of computer applications, the primary use of these maps is with the Global Positioning System, or GPS satellite network, used in standard car navigation systems.

Early digital maps had the same basic functionality as paper maps they provided a virtual view of the roads, generally outlined by the terrain encompassing the surrounding area. However, as digital maps have grown with the expansion of GPS technology over the past decade, live traffic updates, points of interest and service locations have been added to enhance digital maps to be more "user aware". Traditional virtual views are now only a part of digital mapping. In many cases, users can choose between virtual, satellite and hybrid maps. With the ability to upgrade and expand digital mapping devices, newly built roads and places can be added to appear on maps. Three-dimensional landscape maps can be generated using 3D Scanners or 3D Reconstruction software.

Digital maps rely heavily on a large amount of data collected over time. Most of the information that digital maps contain is usually satellite imagery as well as street level information. Maps must be updated frequently to provide users with the most accurate reflection of a location. While there are a wide range of companies that specialize in digital mapping, the basic premise is that digital maps will accurately

depict roads as they are to provide life-like experiences. Proprietary and non-proprietary computer programs and applications provide street-level imagery and map data for much of the world.

The primary use by which digital mapping has grown in the past decade has been in connection with Global Positioning System technology. GPS is the foundation of digital mapping navigation systems.

Coordinates and position as well as atomic time obtained by a terrestrial GPS receiver from GPS satellites orbiting the Earth interact together to provide digital mapping programming with origin points in addition to destination points needed to calculate distance. This information is then analyzed and compiled to create a map that provides the easiest and most efficient way to get to a destination.

The information from above describes the acceleration of the map digitization process and the huge amount of information it stores to be available to the simple user. By making a few minor steps, the user can access the entire information regarding his position in real time on the globe and all the elements around it, including roads, buildings and points of interest.

BIBLIOGRAPHY

1. Documentation about « Benefits of digital mapping – Modern Cartography » Electronic source: *https://ccs-map.eu/benefits-of-digital-mapping/*
2. Documentation about « Mapping and the importance of POI for GIS mapping ». Electronic source: *https://hardcastlegis.com/blog/poi-mapping-the-importance-of-poi-for-gis-mapping/*
3. Documentation about « The evolution of indoor mapping ». Electronic source: *https://www.mappedin.com/blog/product/indoor-mapping/the-evolution-of-indoor-mapping/*
4. Documentation about « The landscape of the indoor mapping ». Electronic source: *https://www.mappedin.com/blog/product/indoor-mapping/the-indoor-mapping-landscape/*
5. Documentation about « Indoor Positioning Systems & Location Tracking». Electronic source: *https://ccs- https://www.link-labs.com/blog/indoor-positioning-system*
6. Documentation about « Benefits of and use cases for Indoor Navigation ». Electronic source: *https://www.wrld3d.com/blog/indoor-navigation/*
7. Documentation about « Standards of Positioning and Mapping Technology ». Electronic source: *https://www.mdpi.com/2305-6703/2/2/12/htm*
8. Documentation about « The capabilities and solutions of MappedIn Service ». Electronic source: *https://www.newswire.ca/news-releases/mappedin-offers-indoor-mapping-capabilities-to-servicenow-workplace-service-delivery-solution-866668241.html*
9. Documentation about « Google Maps Indoor and it's alternatives ». Electronic source: *https://www.pointr.tech/blog/can-google-maps-work-indoors-and-alternatives*
10. Documentation about « Apple Indoor format standard and IMDF ». Electronic source: *https://www.computerworld.com/article/3609852/apples-indoor-maps-format-is-now-a-standard-heres-why-that-matters.html*
11. Documentation about « Optical Indoor positioning system based on optical light ». Electronic source: *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4732052/*
12. Documentation about « Ultrasonic positioning for indoor navigation ». Electronic source: *https://mapsted.com/indoor-location-technologies/ultrasonic-positioning/*
13. Documentation about « Bluetooth location and tracking for indoor positioning ». Electronic source: *https://www.inpixon.com/technology/standards/bluetooth-low-energy*
14. Documentation about « Introduction to Indoor Positioning using RFID ». Electronic source: *https://www.leverege.com/iot-ebook/rfid*
15. Documentation about « Ultra-Wide Band Positioning and Sensor Technology ». Electronic source: *https://www.inpixon.com/technology/standards/ultra-wideband*

16. Documentation about « Angular Framework ». Electronic source: *https://mdevelopers.com/blog/what-is-the-angular-framework*
17. Documentation about « Quantum GIS (QGIS) ». Electronic source: *https://edis.ifas.ufl.edu/publication/FR428*