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DEVELOPMENT OF A USER GIS INTERFACE TO MANAGE THE CIRCUITS OF SOLID WASTE (CASE STUDY)

CONTENTS

1. INTRODUCTION

- The management of waste is an environmental problem which worries several countries of the world.
- A real problem to which are confronted companies of management and cities concerns :

  the optimization of the circuits of collection of solid waste.
- Due to the urban expansion of cities, the companies of collection of solid waste are daily confronted to the problem of finding the fastest circuit to borrow for the rounds of collection.
- The majority of these companies are using manual or traditional methods to manage these circuits.

1. INTRODUCTION

The management of the household waste is characterized by:

- A bad collection process that creates problems of public health and drags important sanitary risks.
- An insufficient collection that overnights to the purification network of the city.
- The presence of household waste dumps within the urban zones that hinder the development of the economic and touristic activities.
- The wild dumps that pollute underground water.

The present research paper aims to show how GIS can be used as a powerful tool for decision support for the management of household waste

2. METHODOLOGY

- Regarding the goals to be achieved in this study, we have developed a methodology to follow, composed of the following steps:

- Design a data base which includes all the semantic data related to the collection of household waste, and manage the human resources and equipment.
- Data acquisition: integrate the road network and administrative limits with other data.
- Develop suitable algorithms to determine the shortest way for a given round.
- Develop the appropriate programs for a user GIS interface to manage solid waste and optimize their circuits of collection.

3. DATABASE DESIGN

Design the CDM of our Database

- inventory of entities and their attributes
- determine the associations and the cardinalities
- in our case, this CDM composed of 13 entities and 13 associations
- proceed to the generation of the alphanumeric data base in Access format, recognized by ArcGIS software.
- perform the crossing of spatial and non spatial data to conceive a Personal ArcGIS Geodatabase.

4. DATA ACQUISITION

The available data are in different formats:

- **Topographic plans at 1/5000 in dwg format:**
- **Topographic maps at 1/50000 in JPEG format and support paper**
- **Coordinates of the Trash cans as text files**

These data require to be restructured before their integration into the future GIS interface.

The necessary corrections are:

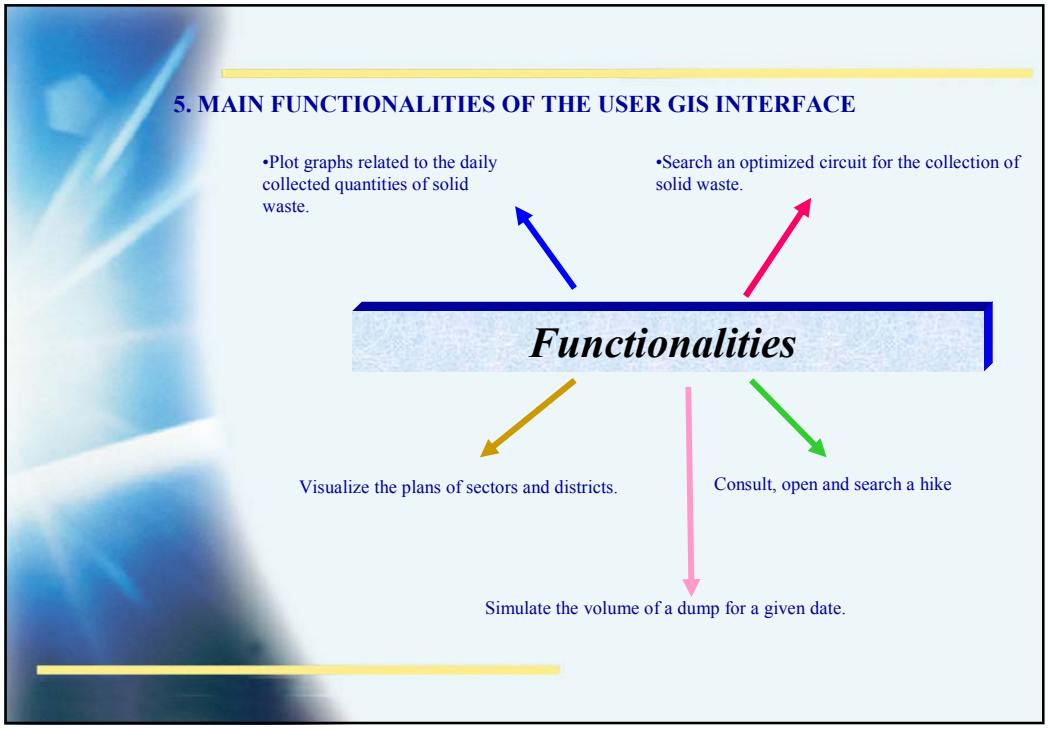
- **Structuring the graphic entities**
- **Constructing the topology**
- **Adopting a System of projection**
- **Making Georeferenciation**
- **Conversion of text files into Shapefiles**

5. MAIN FUNCTIONALITIES OF THE USER GIS INTERFACE

The main functionalities offered by this user GIS interface are:

- Search an optimized circuit for the collection of solid waste.
- Consult, open and search a hike
- Simulate the volume of a dump for a given date.
- Visualize the plans of sectors and districts.
- Plot graphs related to the daily collected quantities of solid waste.
- Provide significant information on the household waste and the staff.

5. MAIN FUNCTIONALITIES OF THE USER GIS INTERFACE



BRIEF DESCRIPTION OF FEW COMPONENTS OF THE USER INTERFACE

Menu "Optimized Hike"

- optimization of the circuits of collection.
- The structured road network and the coordinates of the site of the trash cans are used to perform this operation.
- The optimization process is based on the time of course or on the distance between trash cans.
- The user has a choice to introduce the time passed during the collection of the trash. He might also take into account or not the interdiction restrictions.

BRIEF DESCRIPTION OF FEW COMPONENTS OF THE USER INTERFACE

Menu "Short Path "

- Determine the shortest path between 2 points.
- The road network has been structured in nodes and sections.
- The user has to specify the departure and the arrival nodes.
- Once the circuit found, the length of every section and the names of the streets are displayed
- The application allows the user to print the found circuit or to record it for a future use.

BRIEF DESCRIPTION OF FEW COMPONENTS OF THE USER INTERFACE

Menu "Simulation"

This menu is composed of two sub menus:

Sub menu "Daily quantity "

- permits to follow the daily evolution of the quantities of collected solid waste by sector within a district.
- this evolution is represented by a graph for the chosen month

Sub menu "Expectation"

- research the ideal site for the creation of a new dump.
- It allows estimating the area of a dump and the quantity of waste that will be generated in the chosen district.
- The simulation formula requests certain parameters such as
  - the quantity of waste for the chosen year
  - the population rate
  - the quantity of generated waste per habitant.

6. CASE STUDY

Case study data concerns one district within the city of Rabat.

•Data are supplied by Veolia company.

•Hereafter we present some results based on these data.

Optimized Hike

- Next figure shows the results of finding the optimized hike;

- It gives the time difference between taking into account or not the interdiction restrictions for the same circuit. It is found that

- the time of course is 663 minutes with restrictions

- only 235 minutes without restrictions.

6. CASE STUDY

Optimized Hike

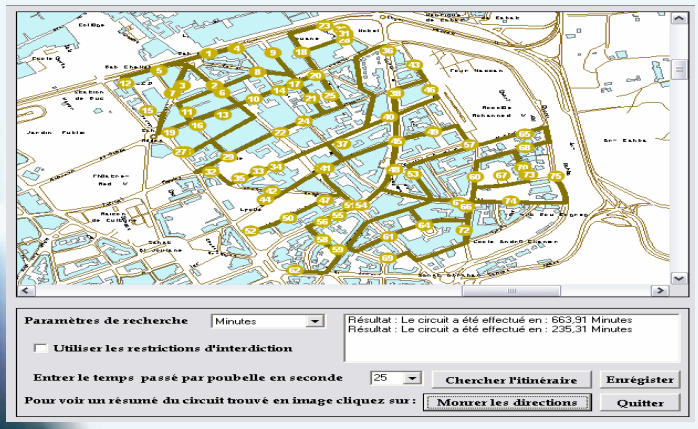


FIG WW stockholm 2008

6. CASE STUDY

Short Path

- Next figure describes the short circuit between two specified points.
- The circuit found is displayed on the screen
- On the right of the circuit, there is a window indicating the length of every section and the names of the streets.

6. CASE STUDY

Short Path

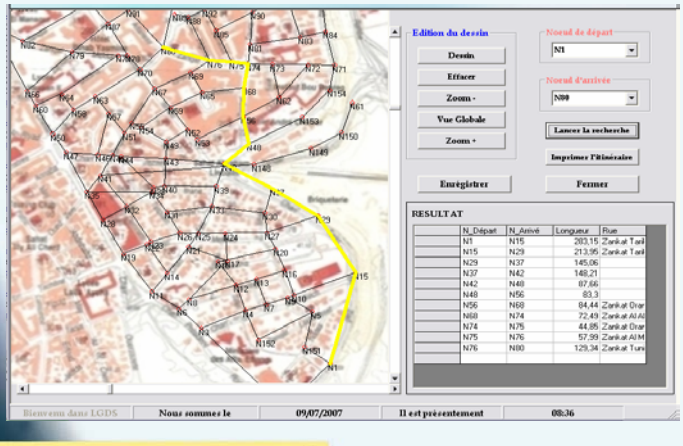


FIG WW stockholm 2008

7. CONCLUSION

Through this paper we have presented a methodology for:

- **designing a database integrating data related to the collection of solid waste,**
- **developing a GIS interface to solve technical problems related to managing household waste and finding the fastest circuit to borrow for the rounds of collection.**

The developed interface possesses the following qualities:

- **Generate an optimized circuit for the collection of solid waste.**
- **Respond to some specific queries on the available layers in the geodatabase**
- **Simulate the volume of a dump for a given date.**
- **Visualize the plans of sectors and districts.**
- **Plot graphs related to the daily collected quantities of solid waste.**
- **Provide significant information on the waste and the staff of the company.**

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Thank you for your attention