Sudan University of Science and Technology

College of Graduate Studies

Emergency Car System for the Sudanese Electricity Distribution Company

نظام عربة الطوارئ للشركة السودانية لتوزيع الكهرباء

A Thesis Submitted in Partial Fulfillment of the Requirements of Master Degree in Computer Science

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الآيـــــــة

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ * خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ * اقْرَأْ وَرَبُّكَ الْأَكْرَمُ *
الَّذِي عَلَّمَ بِالْقَلَمِ * عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَم ﴾

صدقا لله العظيم

سورةالعلق(الآيات 1-5)

Dedication

I dedicate this thesis

To my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake ,dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

It is also dedicated to my husband who has been a constant Source of support and encouragement during the challenges of graduate and life.

To all knowledge seekers and providers,

To all my teachers,

To all my colleagues,

And to my all friends and classmates.

Acknowledgement

I would first thank God for what we have reached and to complete this research. I would also like to thank my thesis supervisor Prof. Dieter Fritsch SUSTECH Visiting Professor, he was guidance me in the right direction.

I' d like to grasp this opportunity for most to express my greatest thanks to all who have helped me towards the successful completion of this research.

Last but not least, I have to confirm that my completion of this project could not have been accomplished without the support of my family, my friends, my colleagues at work and my classmates.

Abstract

This study aims to solve the problem of communications and providing good customer service for the Sudanese Electricity Distribution Company ”SEDC”, through the use of Map Navigation and Geographic Information System (GIS) technology. It is well-known, that GIS plays an important role providing a platform for effective planning, organizing and decision-making, In this research we add the locations and information of customers in ArcGIS10 to ensure access of navigation services to all company customers. A database is created for the study area (Khartoum Bahry) about customers (personal data, Electricity data) in a way to provide full description about the customers. With the help of Esri’s ArcGIS10 software, and here in particular using the Editor tool, we have inserted customer data (location and information). After that we use DiggerQT10 to convert data from ArcGIS10 software to the Map factor navigation software running on a smartphone as map file format. One of the final results from this study is providing good services for the customers and to prove that an Emergency car system is very efficient and very quick to get the technician to the customer’s location to solve the problem.

المستخلص

تهدف الدراسة إلي حل مشكلة البلاغات بالشركة السودانية لتوزيع الكهرباء المحدودة وذلك بجعلها أكثر سرعة وفعالية عن طريق إستخدام تقنيات نظم المعلومات الجغرافية ، حيث أن نظم المعلومات الجغرافية تلعب دورا هاما من خلال توفير بيئة للتخطيط والتنظيم وصنع القرار. في هذا البحث تطرقنا إلي تضمين مواقع وبيانات الزبائن ببرنامج نظم المعلومات الجغرافية ArcGIS10 وذلك بالاستعانة بالنقطة الجغرافية لموقع الزبون وتشمل قاعدة البيانات التي تم انشاؤها لمنطقة الدراسة(الخرطوم بحري) بيانات الزبائن (الشخصية والكهربائية)وذلك لإعطاء وصف دقيق لموقع الزبون يسهل الوصول إليه لتقديم الخدمة . وبمساعدة برنامج DiggerQT10 تم تحويل البيانات من ArcGIS10 لبرنامج عربة الطوارئ على الموبايل Emergency Car System .واحدة من النتائج النهائية لهذه الدراسة أوضحت أن عملية تنفيذ البلاغات للزبائن اصبحت سريعة وفعالة وذلك عن بطريقة توفر الوقت والجهد للشركة.

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Chapter 1

INTRODUCTION

1 Introduction

This research **"Emergency Car System"**, to be provided to the Sudanese Electricity Distribution Company **"SEDC",** will assist making communications and fault access of work vehicles more fast and more efficient than before, by using meter numbers and coordinates.

1.1 What is the meaning of Communication system in "SEDC"?

The communication system in the Sudanese Electricity Distribution Company is a customers care system, that provides services to its customers, when they call the customer care center with telephone number"4848". In order to report and access a malfunction of the electricity meter, the electricity office communicates with an SEDC employee directing him to the place which was generally described by the customer. Quite often, it takes a long time for the employee to arrive at the exact location, because these locations are weakly described.

1.2 What is the Meaning of Meter Number?

A meter serial number (or 'meter ID') is an alphanumeric reference used in Great Britain to identify an electricity meter. Although meter serial numbers are intended to be unique, this cannot be assured and duplicate serial numbers do exist. There are a variety of formats used over many years.

1.3 What is the Meaning of Coordinates?

Coordinates are an ordered set of numbers that define the position of a point. If the point is on a plane, then two numbers are used. To define the position of a point in three-dimensional space, we need three values.

1.3.1 In a plane (2D)

To define the position of a point on a 2D plane, we use two numbers, called the x-coordinate and the y-coordinate. The x-coordinate tells where the point is in the left-right direction, and the y-coordinate tells where it is in the vertical, up-down direction (see fig. 1.1).

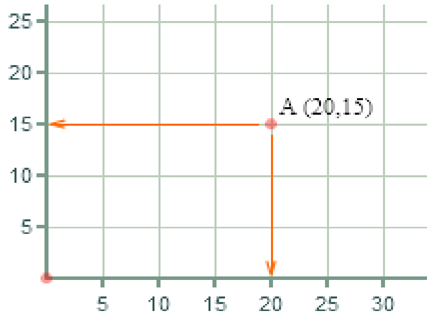


Figure *(1.1) Definition of a 2D Cartesian coordinate system*

In the figure above the coordinates of the point A are 20, 15. The first (x) coordinate tells how far along the horizontal (x) axis it is, here 20. The second (y) coordinate tells how far up the vertical (y) axis it is, here 15. The x coordinate is always first in the pair

1.3.2 In space (3D)

To define a point in 3D space we add a third coordinate called z. This tells how far the point is in the third dimension. You can think of this third (z) dimension as going in and out of the page (see fig 1.2).

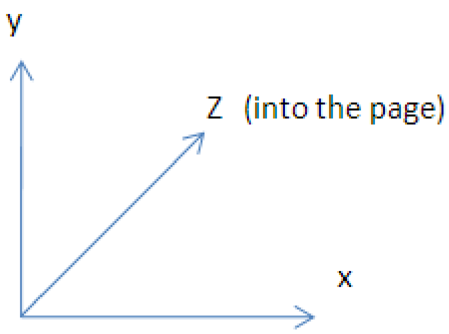


Figure (*1.2) Definition of a 3D Cartesian coordinate system*

2. The research problem

The research aims to solve the problem of communications and providing good customer service.

2.1 What's the communication problem in "SEDC"?

- ✓ **Time:**

Best service means less waiting times, but obviously the actual communication system takes a long time to provide the service. That means, time is wasted in the customer description of the place fault and therefore the working group is not able to access the site with the required speed to carry out the repair.

- ✓ **Transparency:**

Most customers cannot clarify the description of the location and type of fault that needs repair correctly.

- ✓ **Huge number of workers:**

In the company's attempt to provide good customer service allocates a large number of personnel to handle the faults at high speed and accuracy, that needs to wasting big money for the salaries of these workers and this is a waste of the resources of the company's financial and it can be resolved by using emergency car system .

- ✓ **Slow communication:**

Non-fully automatic systems perform the slow service delivery to the customer, customer call Customer Service System. The employee receives the customer communication and converts it to the communications system employee in the designated office. After that steps are initiated to repair the fault. It is the overall objective to resolve this problem by using emergency car system.

3. The purpose of the study

Avoid wasting the time of the company and reduce the technical personnel thus reducing the financial expenses.

4. The objectives of the study

- Provide a better service to customers.
- Easy access to any place where a fault happened without doing the exact description.
- Reduce the time wasted in the search for electrical faults.
- Reduce the number of workers in the company.
- No need for customer service staff.
- Reduce the number of customers gathered in the communications offices

5. The research questions

- How to provide better service to customers?
- How to access without the need for an accurate description of the fault's location.
- How to reduce the time wasted in the search for the electric fault
- How to reduce the number of communications staff and customer service staff.

Chapter 2
Literature Review & Related Work

2. Literature Review

2.1. Definition

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic.

Literature reviews are secondary sources, and do not report new or original experimental work. Most often associated with academic-oriented literature, such reviews are found in academic journals, and are not to be confused with book reviews, that may also appear in the same publication.

Literature reviews are a basis for research in nearly every academic field.

Today, the topic of car navigation system is one of the most important applications of navigation systems, that is frequently used by drivers.

In this paper, we will discuss a number of previous studies on navigation systems.

2.2 Paper1 Title: "Automatic Map Scaling in Car Navigation Systems Using Context-aware Computing"

Name of researcher: *M. Sheleiby, M.R. Malek, A. Alesheikh and P. Amirian*

Study objectives: 3D modeling of Al Hussein Public Parks

Introduction

Context–aware computing is a computing paradigm that enables systems to acquire current user's context and adapt their behavior accordingly. In this paper, the context-awareness potential for presenting maps with various scales adapted to users' context is evaluated. Also various contexts that may have an impact on map scale are studied and then an approach to select proper scale in these contexts is proposed. As a proof of the idea, a prototype context -aware car navigation system is developed, implemented and tested in parts of Tehran, capital city of Iran.

Methodology and Project Planning

In this research, we evaluate, what scales are proper for different context in car navigation systems.

- We also suggest an approach that enables systems to automatically decide which scales must be present at what context.
- To achieve this goal, we propose to use context-aware computing.
- It describes the basic concepts of context-aware computing and the role of this type of computing in generating maps for car navigation with focusing on map scales.
- Discusses the context information that may be effective in car navigation system.
- Describes the proposed approach for determining proper scales and then explains our implementation of a prototype system.

Scope of Study

Tehran city: Tehran, capital city of Iran as one of the biggest and crowded cities in the world, was taken as the study area in this research. Transportation networks of the city became more and more complex with adding new roads in recent years. This complexity hardens the task of car navigation system to display clear navigational information. Also, there are inaccurate data (both in geometry and attribute) from this metropolis.

Implementation and Results

- In order to implement the above concepts, a preplanned route-output of route planning module of car navigation systems between two points in Tehran was utilized. Also, a file which contains information about car positions and car speeds in any time was generated to simulate sensors information (context information).
- Context-aware car navigation applications can read this file, and based on positional information, which is stored in the mentioned file, the current position of the car is mapped on display. Also, using car speed information and screen size of the used device, the proper scales determined and a map with this scale is generated using feature layers (which are resided in a spatial database) to be displayed to the users .
- The context-aware car navigation application was implemented using Microsoft.NET compact framework 2.0.Thementioned application was deployed as Windows Mobile 5.0 Smartphone application on two mobile devices.

Conclusions and Future Work

- In this paper a major part of an ongoing research work on designing context-aware maps for car navigation system has been presented.
- This study focuses on the determination of proper map scales for car navigation system based on current context and adapting maps with this scale automatically.

- During this study, we consider current user context as the most important factor to specify a driver's required information. Therefore, we tried to put context–aware computing into maps in order to acquire context and adapt map presentation with this context. In addition, we emphasized the necessity of presenting maps with different level of details and scales in car navigation in order to increase the readability of maps. Also we consider the car's position, speed of the car and screen size of used devices as effective contexts in determining the map scale.
- Subsequently we offer an approach to select the appropriate scale in any of these contexts.

Society and Sample of Study

Hence, we select a section of Tehran that is shown in Fig. 1. The scale of the base maps that were used in this research was 1:2,000 and other scales derived from these maps using several generalization techniques. The feature layers of the base maps include: road layers (highway, major and minor roads), blocks of buildings, parcels, Points of Interest (POI) and landmarks.

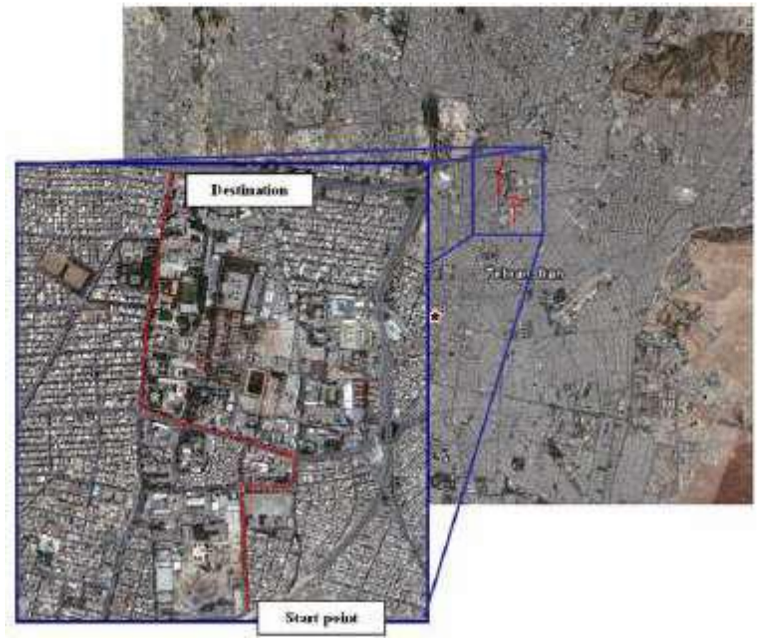


Figure *(2.1)*: Elected area of Tehran and planned route

Own Comments on this Previous Study

The subject of map scaling is important in car navigation systems, but without a device for browsing needless. Therefore we will seek to focus the following search to run a complete car navigation system.

2.3 Paper2 Title: "Extracting Landmarks for Car Navigation Systems Using Existing GIS Databases and Laser Scanning"

Name of Researcher(s): *C. Brenner and B. Elias,*
Institute of Cartography and Geoinformatics, University of Hannover, Germany, claus.brenner@ikg.uni-hannover.de.Commission III, WG III/3

Introduction

Today's car navigation systems provide driving instructions in the form of maps, pictograms, and spoken language. However, they are so far not able to support landmark-based navigation, which is the most natural navigation concept for humans and which also plays an important role for upcoming personal navigation systems.

In order to provide such a navigation, the first step is to identify appropriate landmarks – a task that seems to be rather easy at first sight but turns out to be quite pretentious considering the challenge to deliver such information for databases covering huge areas of Europe, Northern America and Japan. In this paper, we show approaches to extract landmarks from existing GIS databases. Since these databases in general do not contain information on building heights and visibility, we show how this can be derived from laser scanning data.

Methodology and Project Planning

Obviously, the introduction of buildings as landmarks together with corresponding spoken instructions (such as ’turn right after the tower’) would be a step towards a more natural navigation. As we argue below, this would be well integral into today’s car navigation systems as it would not imply a major modification of systems and data structures.
Thus, the main problem lies in identifying suitable landmarks and evaluating their usefulness for navigation instructions.
In this paper we show:

1. How existing databases can be exploited to tackle the first problem.
2. Laser scanning data can be used to approach the second.

Scope of Study

In this paper we used city models for laser scanning. For example the entire Netherlands have been and Germany’s state of Baden-Württemberg is in the progress of being scanned, each with an area of over 30.000 km2.

Aerial laser scanners produce dense point clouds of the earth's surface directly (Baltsavias et al., 1999).

Results

The results will verify if they lead to appropriate landmarks in the real world:

- In addition, the analysis process has to be extended to different object types (traffic constructions, parks, sporting facilities, etc.) extracted for example from ATKIS data.
- Methods for data preprocessing of different object types and categories, and problems when different data mining algorithms are applied to the same data set, have to be investigated.
- The reliability of the extracted landmarks has to be determined by a quality measure to avoid ambiguous landmarks misleading the user.

Conclusions and Future Work

In this paper, we have outlined how landmarks can be extracted and evaluated using existing GIS and laser scanning data.

As for the extraction, we have investigated two different methods based on data mining to reveal prominent buildings. In order to evaluate the usefulness for navigation instructions, we used a visibility analysis based on DSM data from laser scanning.

Society and Sample of Study

Selected Germany's state of Baden-Württemberg because it is suitable for obtaining digital surface models (DSMs) in dense urban areas, as they conserve jump edges quite well.

Comments on this Previous Study

- Firstly it is a good study - it covered an important point in navigation system.
- Secondly this study depends on existing databases that may contain wrong information or not accurate data. In my research, I will collect real data and I will try make sure the correctness of it.

2.4 Sudan Offline GPS Application

Title: Sudan Offline GPS: Car Navigation "APP"

Description

Sudan Offline GPS Car Navigation and its high quality offline map work without internet connection. It finds easily millions of Points-of-Interest (POIs).

Ad: Enjoy a world-class navigation app in your mobile device without any network connection with 100% offline GPS navigation.

Basic Features

- Offline navigation in Sudan: street maps stored on-board your iPhone/iPad.
- Offline 2D / 3D street maps.
- Fully offline address search.
- Day and night modes.
- Comprehensive multi-stop trip planning tools to plan detailed routes before you go.
- Huge database of pre-loaded POIs to easily find local restaurants, gas stations, car parks and other useful places

Sudan Offline Car Navigation Features

- Automatic routing and fast recalculation if you miss a turn.
- Driver-friendly 3D guidance display shows you the way at every turn.
- Speed limit warnings and speedometer.
- Avoid Toll Roads on your route.
- Three alternative routes to choose from: shortest, fastest, and economical.
- Force a detour calculation option when road is blocked
- Pedestrian navigation to walk and explore.
- Bicycle navigation mode

2.5 Conclusions

In this chapter three related works with navigation system are discussed to benefit from the advantages and avoid shortcomings in this research which used GPS to collect real data for effective Emergency car system.

Chapter 3
New Idea and Methodology

3.1 Introduction

This research deals with the problem of communication in Sudanese Electricity Distribution Company.

In this chapter we will briefly describe the company and the current system implemented (see figure 3.1). Afterwards, the proposed system as new idea and its solution are presented.

3.2 The Sudanese Electricity Distribution Company System

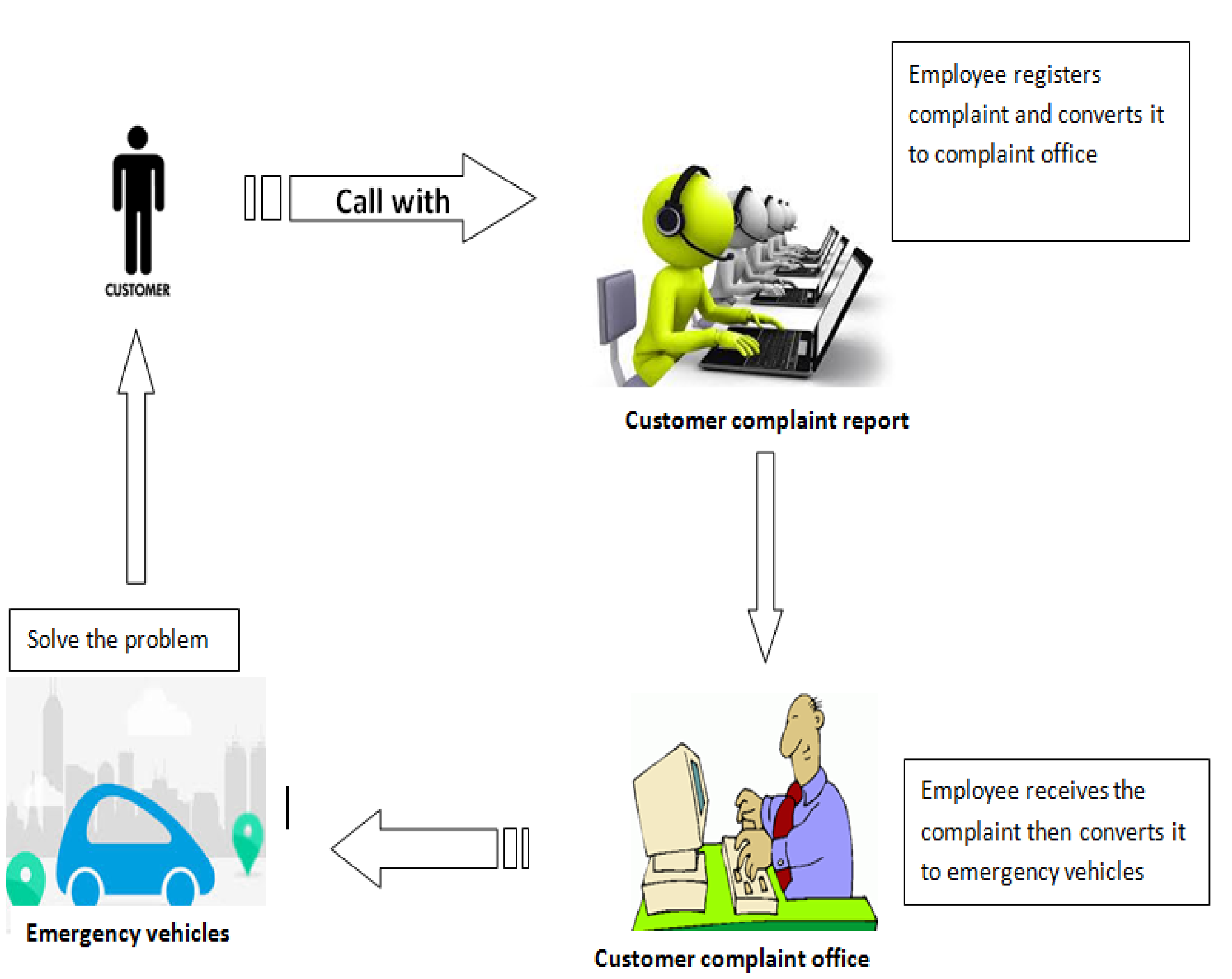


Figure (3.1): The current system of SEDC

3.3 The Problems of the Current System

1. Wasting time and effort.
2. Transparency.
3. Lack of speed in the provision of service.
4. Lack of customer satisfaction.
5. The accumulation of complaints.
6. The large number of workers.
7. Wasting a lot of money.

3.4 Emergency Car System as a New Idea

Nowadays, many people now use emergency car system. Navigation systems are equipped with various functions, and using such system makes it possible to enjoy safer and more relaxed driving. Let us explain here some things people think they know, but surprisingly may not, about how emergency car system work.

How does the emergency car system know a car's location?

The Emergency Car System components receive signals from satellites and identify the vehicle's position and direction by combining that data with information obtained from various onboard sensors.

- Receive signals from satellites and detect the vehicle's location by using a GPS antenna and a GPS receiver.
- Detect the vehicle's direction.
- Direction sensor.
- Detect the vehicle's travel distance.

- Speed sensor.
- Emergency car system screen.
- Additional display integrated in the dashboard
- Map database.
- Check information from the antenna and sensors against the map database and show the results on the display using the Emergency car system's control circuitry, Navigation computer.

GPS antenna and GPS receiver

- The Global Positioning System (GPS) is a means for detecting position information by making civilian use of satellites originally launched for military purposes by the United States.
- Today, most car navigation systems are based on GPS position information.
- To detect GPS position information, a system must be able to receive signals from at least three satellites.
- In emergency car systems, the GPS antenna and GPS receiver serve to receive signals from these satellites.
- Navigation systems, the GPS antenna and GPS receiver serve to receive
- signals from these satellites.

Direction sensor (gyro-sensor)

- Although the GPS antenna allows the detection of the vehicle's position on a map, it cannot determine the vehicle's direction of travel directly (only indirectly)
- Car navigation systems use a direction sensor (gyro-sensor) to determine the vehicle's orientation and direction of rotation.
- The direction sensor (gyro-sensor) contains an oscillating element and calculates the vehicle's direction of rotation and orientation by detecting changes in the element's oscillation triggered by changes in the vehicle's orientation.
- The car navigation system displays the vehicle's orientation on its screen based on the signal from this direction sensor (gyro-sensor).

Speed sensor

- Although the system can verify the vehicle's position using GPS data, it may be unable to refresh the position while driving through long tunnels or between tall building canyons. Requirement: it must be able to receive signals from at least three satellites to do so.

- Car navigation systems use the signal from a speed sensor to determine travel distance, enabling them to refresh the vehicle's position under such circumstances.

Display

- The display presents a variety of information provided by the car navigation system, including map information, city guide information, the vehicle's current position, and the time.
- The screen can also be used as a TV screen, and touch screens that allow users to control the system and enter data using the screen have become common recently.

Map database

- The map database stores a variety of information provided by the car navigation system, including map information, city guide information, and audio data.
- The system displays the vehicle's current position on the screen by comparing information from the GPS antenna and onboard sensors to information in the map database.
- Map databases are currently available on a range of media, including CD-ROM, DVD-ROM, and state-of-the-art hard disk drives (HDDs).

Navigation computer

- The navigation computer is the brain of the car navigation system.
- It compares information from the GPS antenna and onboard sensors to information in the map database, calculates the vehicle's current position and time/distance to the destination, and shows the results on the display.

How does the system search for the route to a destination?

Between locating a car's current location and directing a driver to a destination, a car navigation system uses the following four databases to decide about the best the route for the driver.

- Road network data (road configuration, connection condition, attributes… etc)
- Background data (rivers, shores, railroads, contours….etc.)
- Site information data (building name, addresses … etc.)
- Voice data.

Identification of current location

Initially, the current location is identified and indicated on the map display. At that time, the configurations and the locations of nearby roads, connecting routes between roads, as well as attributes such as one-way streets and intersections are ascertained from the system's database.

Finding and setting the destination (searches for the destination of the driver)

Next, the destination is located. Information on destination address, properties (hotel, park, etc.) and other representative features is obtained.

Route search (Route to destination is checked)

After confirming the current location and the vicinity of the destination, the system confirms the route that connects those two locations. Road connection status, intersections, left/right turn conditions, etc. are also displayed.

Searching for recommended route

The system determines various possible routes from the current location to the destination, then verifies the optimum route.

In order to identify the recommended route, the following decisions are made. Factors such as one-way streets, narrow roads, etc. are recognized as costs in terms of route selection, and the route with the least cost is recommended.

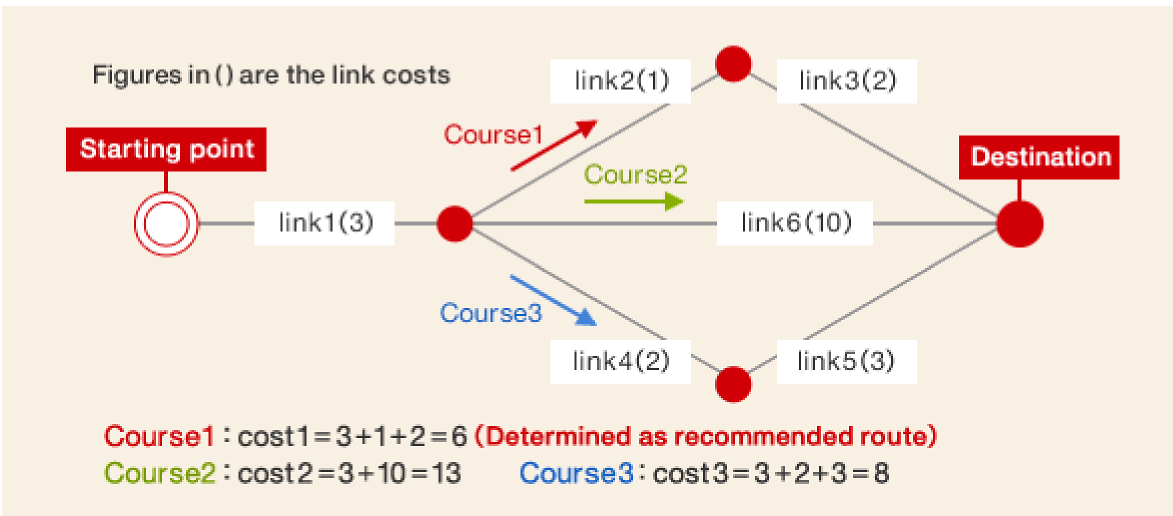


Figure (3.2): Optimum route selection

- Route Guidance (directions are provided for the selected route)
  After the route is decided, driving directions commence.

- Information on buildings and roads along the route is confirmed and displayed.

- The route-related information is displayed on the screen.
  While route directions are being provided, information on the locale through which the car is driving is displayed.

  In this way, roads, buildings, topographical features, etc., along the way are identified.

Chapter 4

The TEST DATA

4.1 Preparing the Data for using in ArcGis10

Definitions of GIS

- A GIS (Geographic Information System) is a powerful tool used for computerized mapping and spatial analysis.
- A GIS provides functionality to capture, store, query, analyze, display and output geographic information.
- A GIS is a computer-based system that stores geographically referenced data, links it with non-graphic attributes (data in tables) allowing for a wide range of information processing including manipulation, analysis and modeling.
- A GIS also provides data and informations for map display and production.

4.2 Data Preparation Steps

In the following we prepare the data to be used. All steps necessary are displayed using screen shots of ArcGIS10.

Creation of a data base:

- Firstly: We create a data base that will store our research data (fig. 4.1)

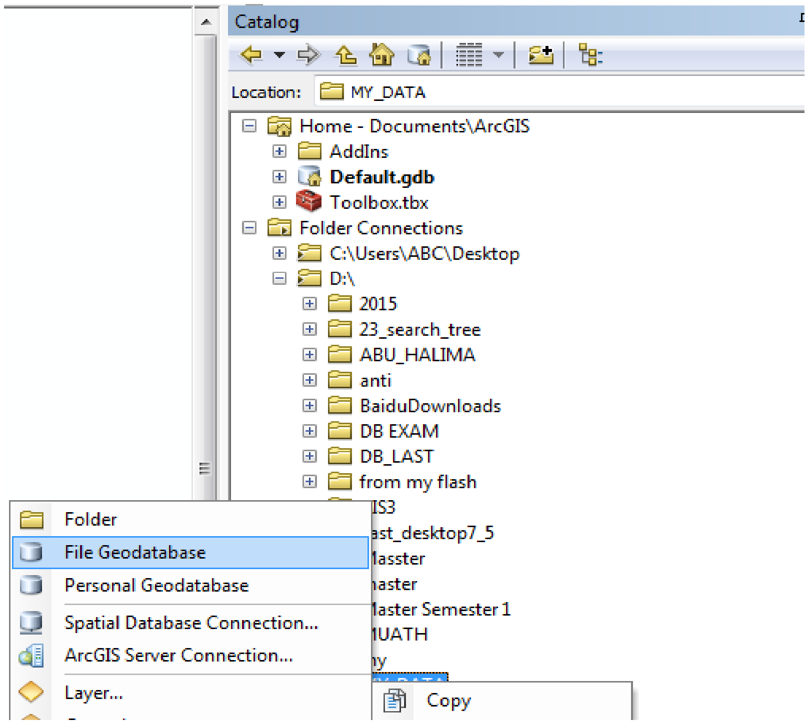


Figure (4.1): Create a data base

- Secondly create point feature classes that contain the customer data (fig. 4.2)

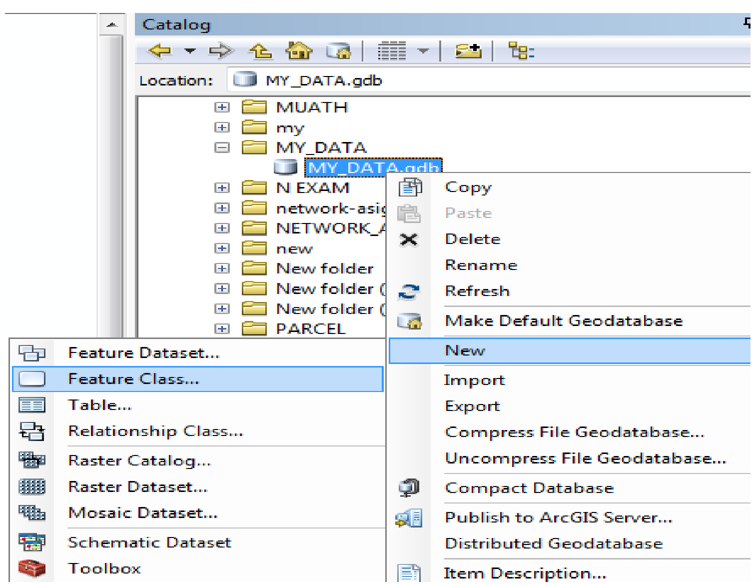


Figure (4.2): Create a Point Feature Class

- Thirdly : Set the corresponding coordinate system for the feature class:

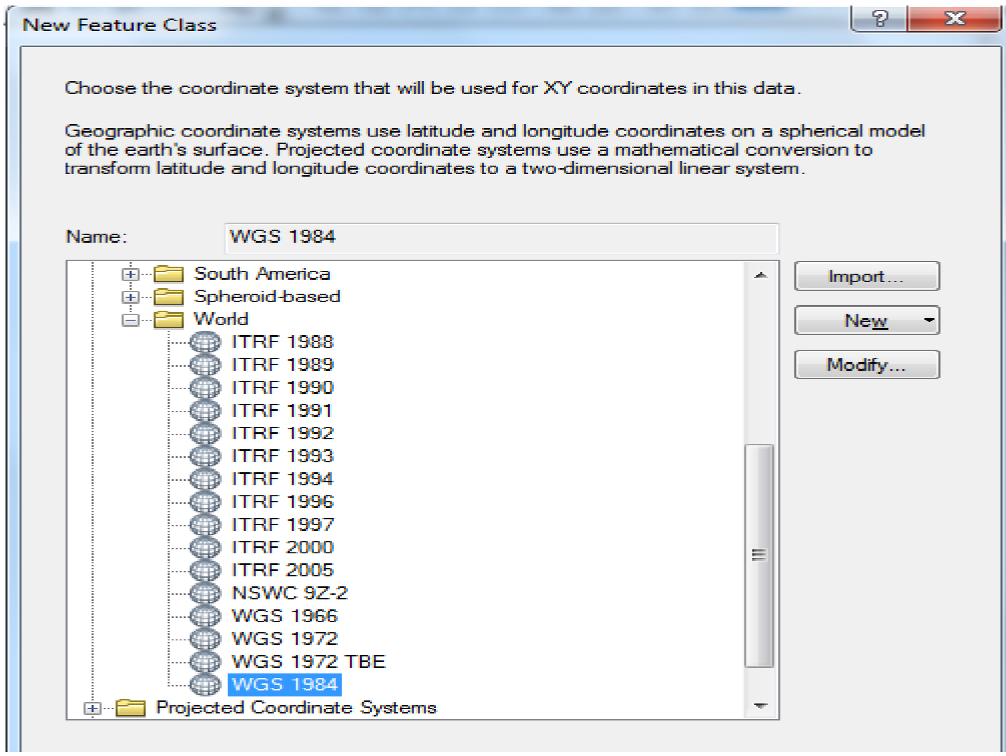


Figure (4.3): Choose the right coordinate system

- Fourthly: Set the attributes for the feature class (fig. 4.4)

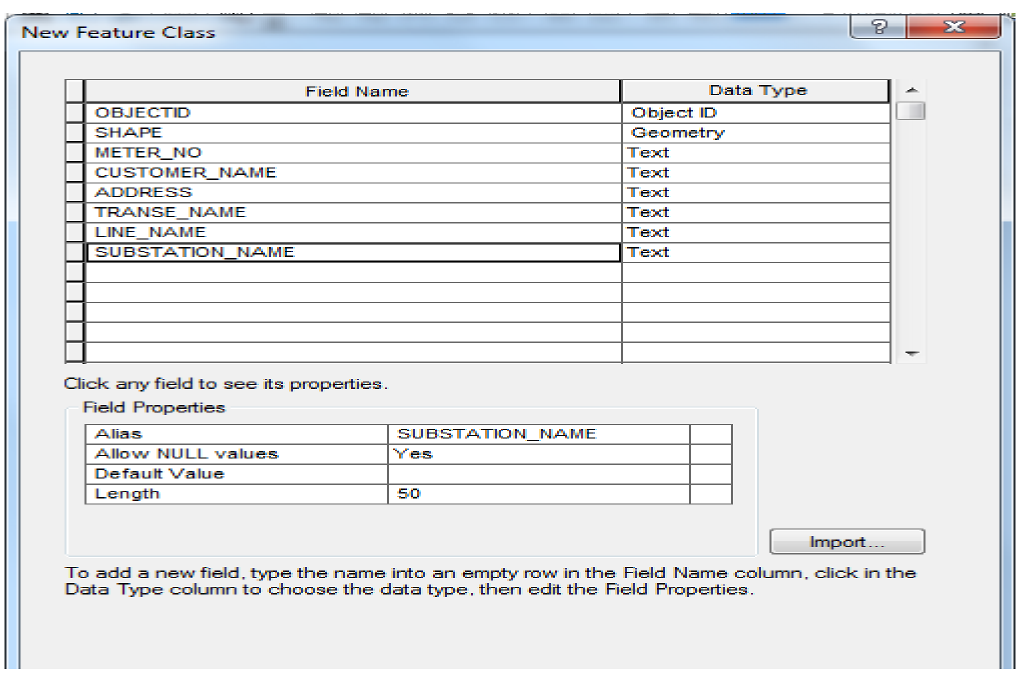


Figure (4.4): Set attributes for the feature class

- Finally: Insert the points in the map and fill in the attribute data (fig. 4.5):

Table

CUSTOMER_DATA

SHAPE *	METER_NO	CUSTOMER_NAME	ADDRESS	TRANSE_NAME	LINE_NAME	SUBSTATION_NAME
Point M	4152552644	Bahry Hospital	Bahry	Mogama Gerahy	Bahry_Hospital	Saad Gishra
Point M	4167989963	Sudatel	Bahry_Khatmeia	Sudatel	Khatmia	Shande
Point M	4207509482	Tanmeia Bank	Bahry_Deium	Tanmeia Bank	Bahry Hospital	Saad Gishra
Point M	4127110544	Elata Ali	Bahry/Elamlak	Jame	Bahry_Hospital	Saad Gishra
Point M	4218455105	Eldiar Alqateria	Bahry_Hela Hamad	Kasara	Heah Hamad	Selah Eleshara
Point M	4218361659	Hassan Mohamed	Bahry_Alamlak 6g	Sewa	Bahry Hospital	Saad Gishra
Point M	4156843981	Bahry Water Station	Bahry_Amlak 1A	Shaheed Mohme	Nagl Mechanic	Shandy
Point M	4129959823	Elmutalab Abas	Bahry_Khatmeia	Mondial	Khatmeia	Shandy
Point M	3715716828	Faisal Gafer	Bahry/Deioum 1n	Alahlam	Saad Gishra	Saad Gishra
Point M	4193888551	Sara Hamed	Bahry/Deioum 2m	Alahlam	Saad Gishra	Saad Gishra
Point M	4194822112	Danagla Helthy cent	Bahry/Danagla	Laloba	Saad Gishra	Saad Gishra
Point M	4208127086	Faisal Islamic Bank	Bahry/Deioum 4k	Shams Elden	Muled	Saad Gishra
Point M	4148419601	Ali Mohmed	Bahry/Helat Khogal	Magaber Elhalab	Almuled	Saad Gishra
Point M	4174251639	Dar Elmal Elwatany	Bahry/Hela Khogal	Magaber Elhalab	Muled	Saad Gishra
Point M	4219914746	Hela Khogaly Mosqu	Bahry/Hela Khogal	Hela Khogly Gad	Hela Hamad	Selah Eleshara

Figure (4.5): Read points and assign attributes

Chapter 5
Simulations and Results

5.1 What are the Applications used in an Emergency Car System

In the following we will present in more detail the data preparation and export for designing the emergency car system. For this purpose ArcGIS has been used.

5.1.1 Definition ArcGIS10:

- **ArcGIS** is a geographic information system (GIS) for working with maps and geographic information.
- It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database.
- The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web.

  ✓ **Steps in the Application:**

- AddCustomers data and export shape file as in the following table (fig.5.1):

Table

Customer_Data

METER_NO	CUSTOMER_N	ADDRESS	TRANSE_NAM	LINE_NAME	SUBSTATION	POINT_X	POINT_Y
4152552644	Bahry Hospital	Bahry	Mogama Gerahy	Bahry_Hospital	Saad Gishra	32.529952	15.626154
4167989963	Sudatel	Bahry_Khatmeia	Sudatel	Khatmia	Shande	32.537534	15.625936
4207509482	Tanmeia Bank	Bahry_Deium	Tanmeia Bank	Bahry Hospital	Saad Gishra	32.53397	15.626424
4127110544	Elata Ali	Bahry/Elamlak	Jame	Bahry_Hospital	Saad Gishra	32.531659	15.62125
4218455105	Eldiar Alqateria	Bahry_Hela Hamad	Kasara	Heah Hamad	Selah Eleshara	32.529902	15.61879
4218361659	Hassan Mohamed	Bahry_Alamlak 6g	Sewa	Bahry Hospital	Saad Gishra	32.529534	15.621468
4156843981	Bahry Water Station	Bahry_Amlak 1A	Shaheed Mohmed Ali	Nagl Mechanic	Shandy	32.53571	15.617807
4129959823	Elmutalab Abas	Bahry_Khatmeia	Mondial	Khatmeia	Shandy	32.536461	15.631401
37157168289	Faisal Gafer	Bahry/Deioum 1n	Alahlam	Saad Gishra	Saad Gishra	32.535256	15.631778
4193888551	Sara Hamed	Bahry/Deioum 2m	Alahlam	Saad Gishra	Saad Gishra	32.533121	15.631501
4194822112	Danagla Helthy center	Bahry/Danagla	Laloba	Saad Gishra	Saad Gishra	32.528485	15.631286
4208127086	Faisal Islamic Bank	Bahry/Deioum 4k	Shams Elden	Muled	Saad Gishra	32.530707	15.629494
4148419601	Ali Mohmed	Bahry/Helat Khogaly 2h	Magaber Elhalab	Almuled	Saad Gishra	32.519832	15.628982
4174251639	Dar Elmal Elwatany	Bahry/Hela Khogaly	Magaber Elhalab	Muled	Saad Gishra	32.519482	15.629988
4219914746	Hela Khogaly Mosqu	Bahry/Hela Khogaly	Hela Khogly Gaded	Hela Hamad	Selah Eleshara	32.5215	15.629055

Figure (5.1): Integrate customer data and shape file data export

5.1.2 Definition DiggerQt11:

- Application used to Convert ArcGIS data and import data to MapFactor.

Steps in the Application:

- Convert and Import ArcGIS data(shape file)in the following steps:

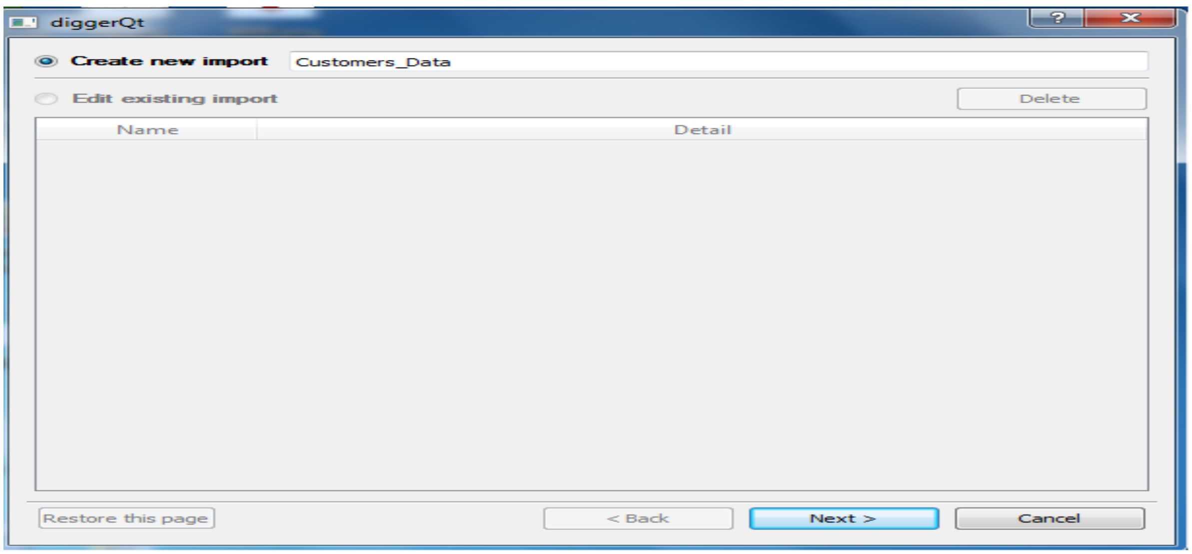


Figure (5.2): Name of import file

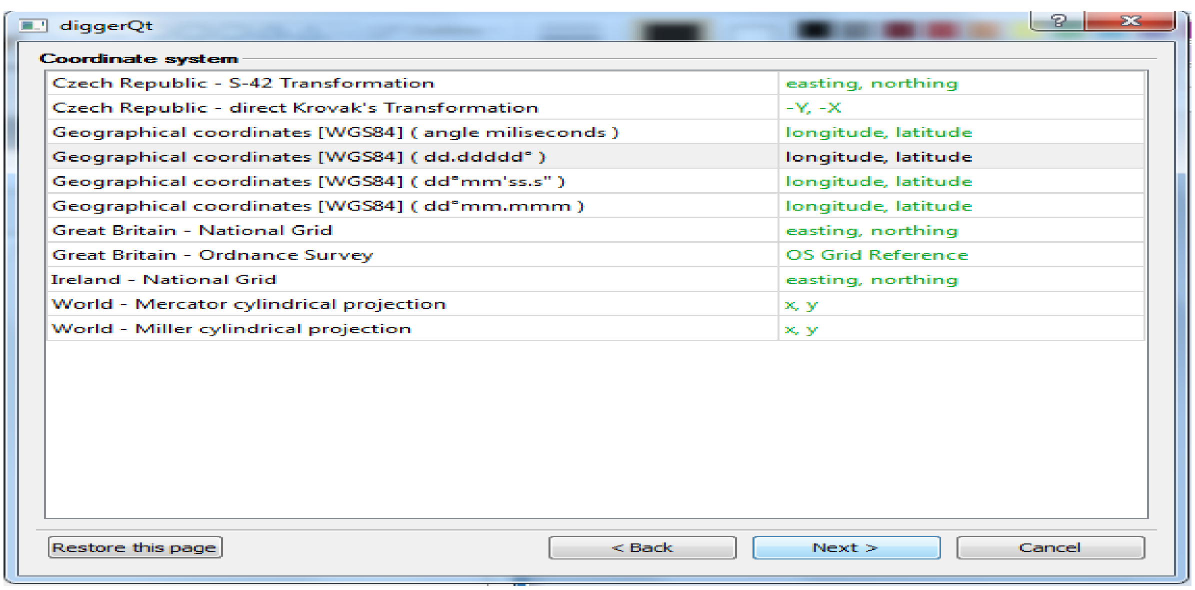


Figure (5.3): Selection type of coordinate system

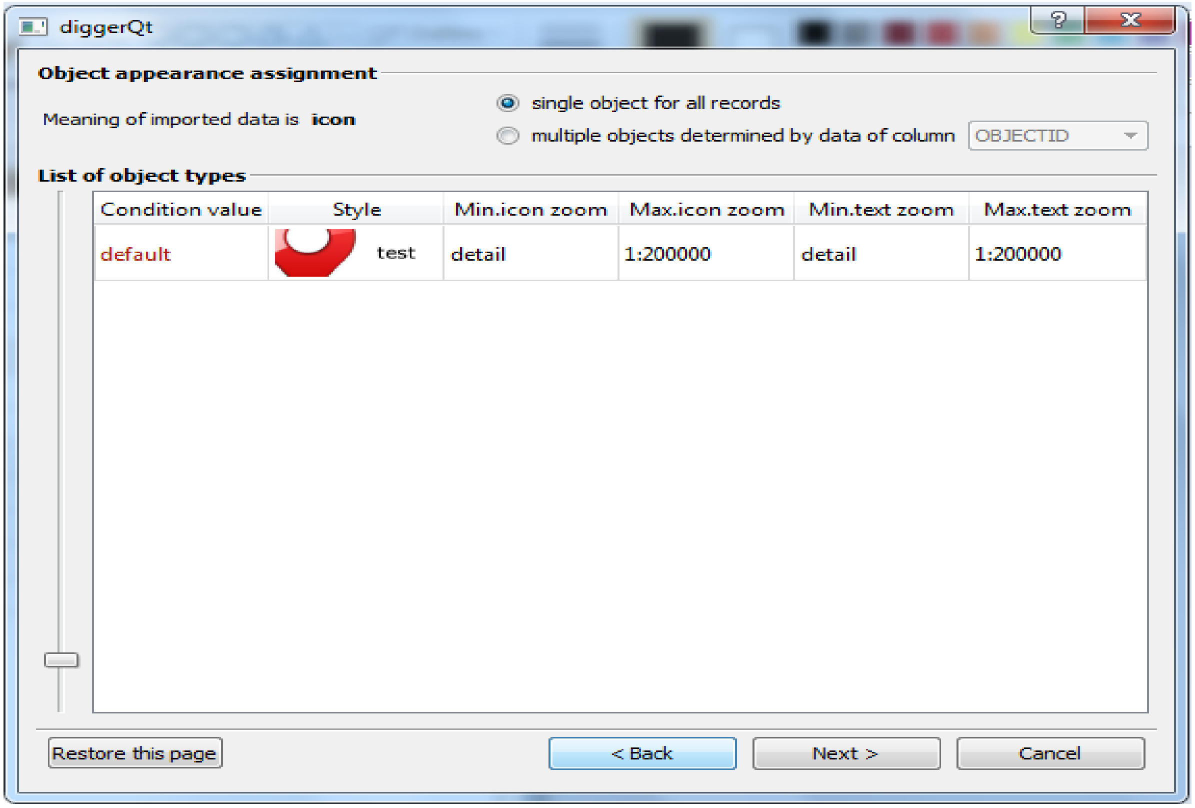


Figure (5.4): Section data will appear on the map

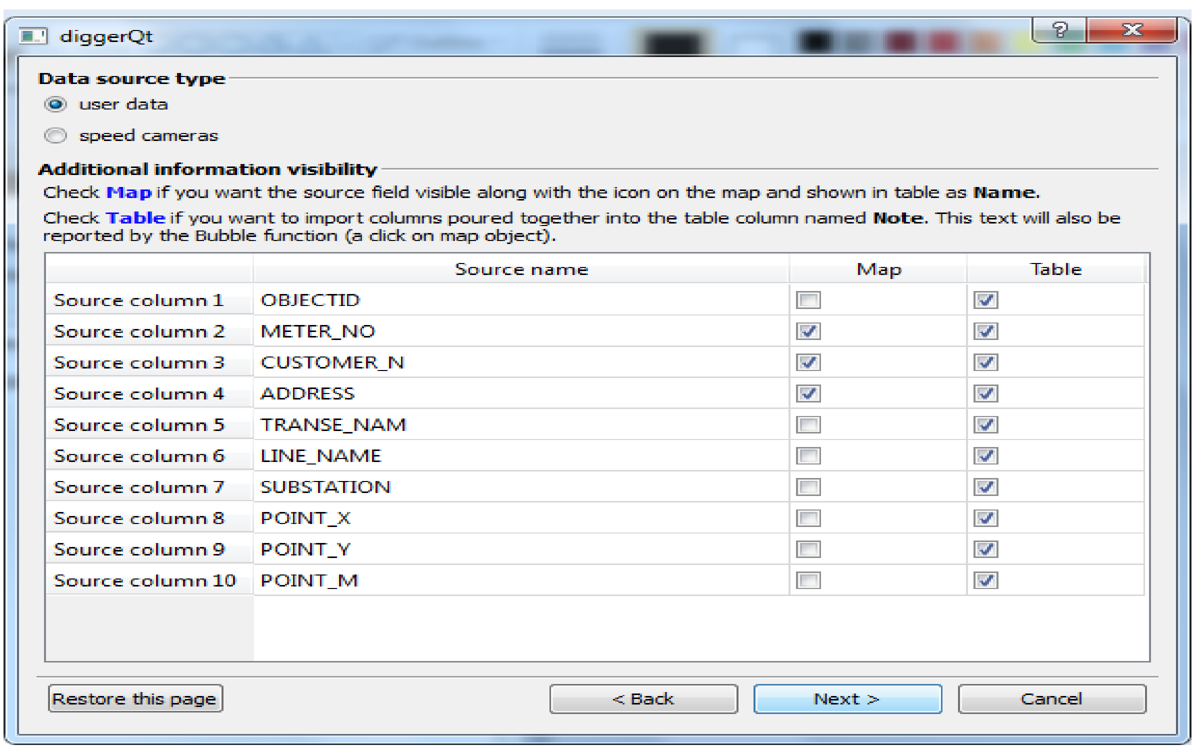


Figure (5.5): Selection of attributes will appear on the map

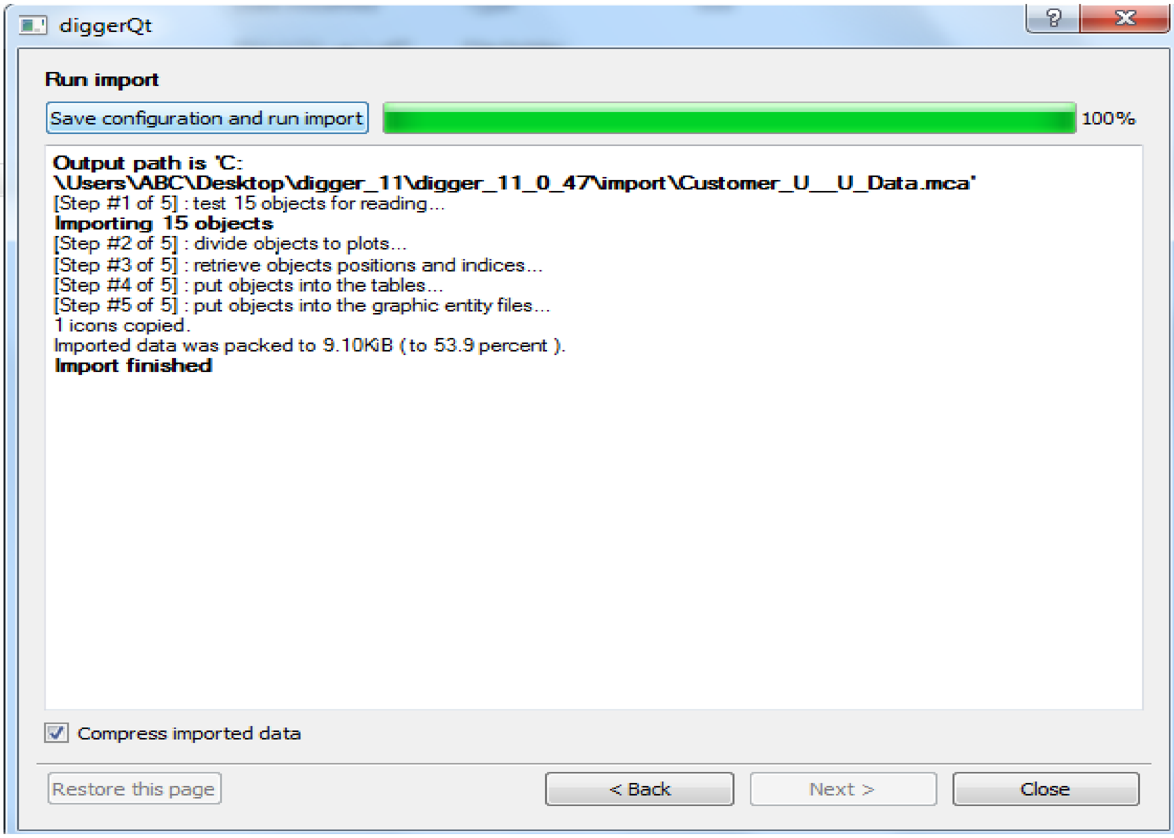


Figure (5.6): Import data running

5.1.3 Definition MapFactor Navigator:

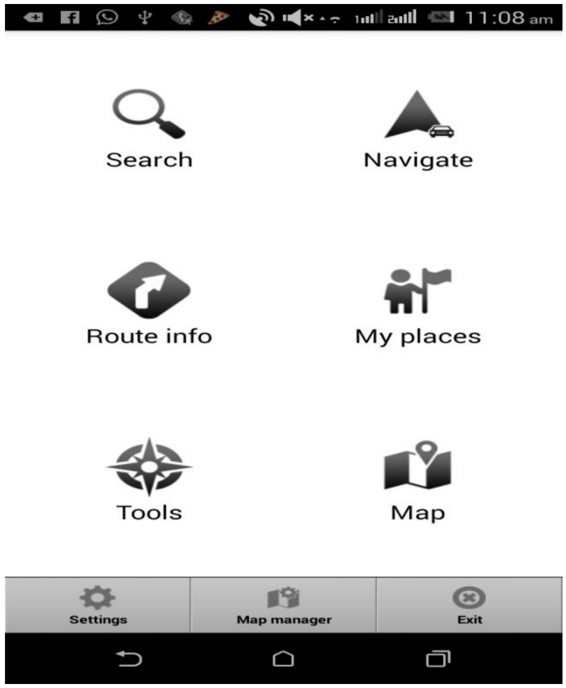
- MapFactor Navigator is a free turn-by-turn GPS navigation app for Android phones and tablets using OpenStreetMaps data.
- Maps are installed on the SD card so there is no need for an Internet connection when traveling. Map and app updates are FREE every month.
- MapFactor also makes the popular navigator free for PC, Pocket PC and WinCE.

5.1.4 Steps in the Application:

- Copy data from DiggerQt11 to Mapfactor as map file (.mca) in memory card in Smartphone.

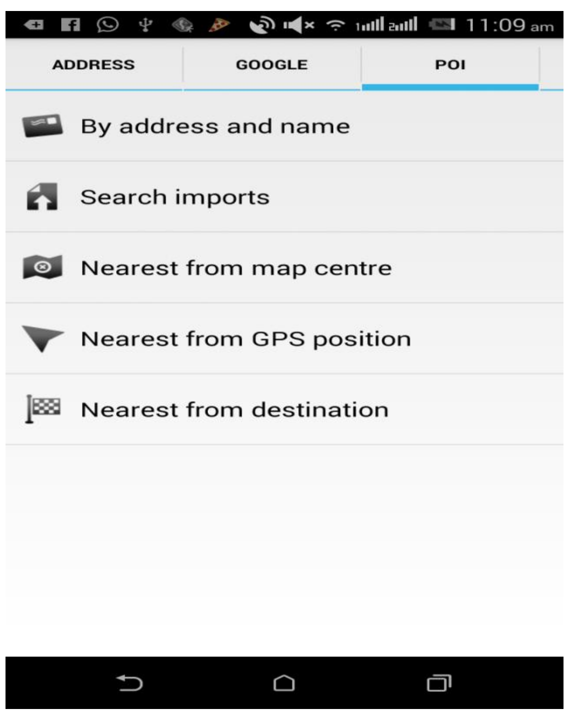
✓ User interface in Emergency car application:

- Main screen:

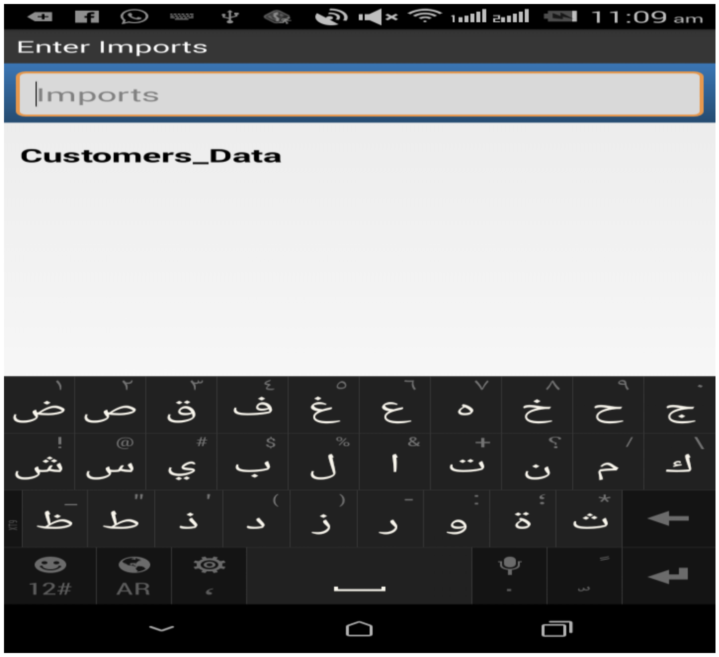


- Search option:

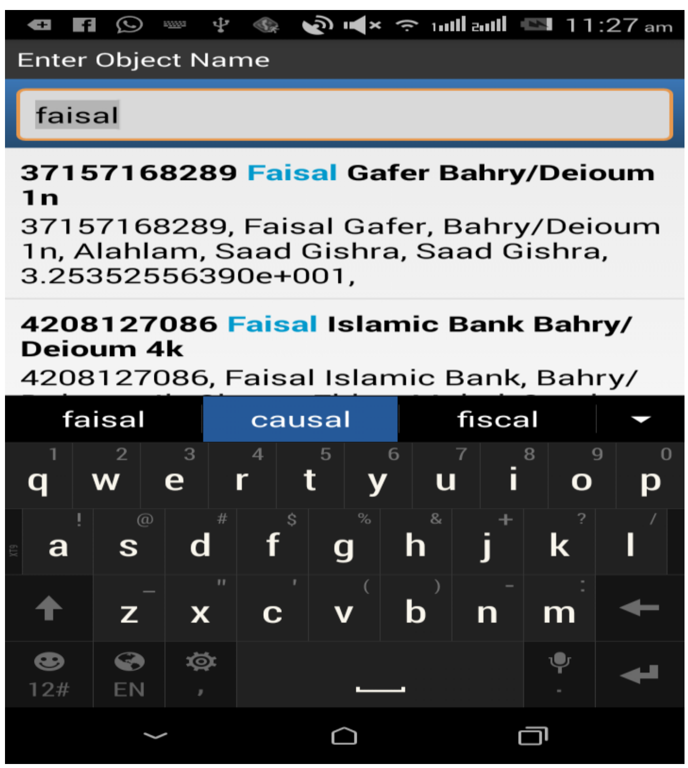
To search in Import Data we can select POI (Point Of Insert) option:



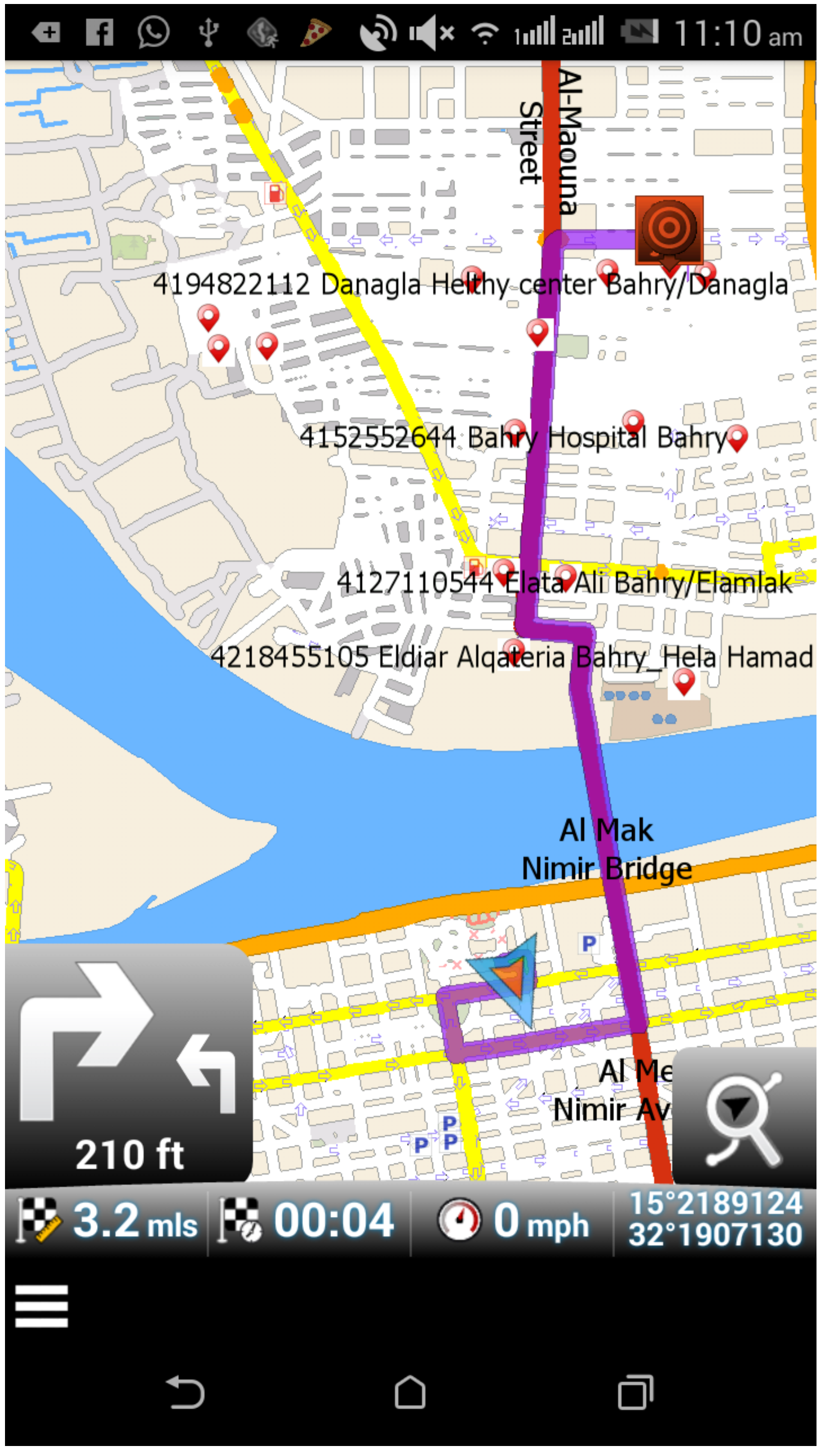
- After select search import from above screen will see following screen that contains the customers imported data.



- Search in Customers imported data with object name:



- The following screen shows customers data in Map factor navigation:



Chapter 6

Conclusions and Recommendations

6.1 Conclusions

We have successfully completed the Application “Emergency Car System” provided to the Sudanese Electricity Distribution Company”SEDC”. This App is assisting in accessing communications and to be a fast and efficient system on the road to activate work vehicles equipped with the system. The App can deliver the vehicle the route to a place of fault, by using meter no and coordinate points.

6.2 Features provided by the Application

- ✓ **Time:**

The application is saving wasted time in reaching the fault location by customer description by using coordinates of the location.

- ✓ **Transparency:**

The application provides highest transparency as compared to the customers’ description of the fault location.

- ✓ **Reduce Number of Workers:**

By using the emergency car application there is no need to employ a large number of workers - one employee is enough to go to the fault place.

- ✓ **Speed of Service :**

Using the automatic application performs well in speeding up the service delivery to the customer, and it provides service delivery fast and efficient.

6.3 Recommendations

Find a mechanism to link the emergency car system with GIS for Sudanese companies distributing electricity systems in order to facilitate data import processes and lower the use of the emergency car system device.

Chapter 7
References

7.1 References

a) Literature Review

- ✓ Automatic Map Scaling in Car Navigation Systems Using Context-aware Computing.
- ✓ Extracting Landmarks for Car Navigation Systems Using Existing GIS Databases and Laser Scanning.
- ✓ Sudan Offline GPS Application.

b) Web References:

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