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1. INTRODUCTION

1.1. Purpose of This Document

After releasing the initial report for the product CoreAccess, CoreTech has spent no time to form a complete and detailed design report. By gaining adequate experience and gathering relevant feedback from our previous requirement analysis report and initial design report, we were ready for detailed design report. The main purpose of the detailed design report was to show all the design processes about the project before the implementation for the project to be efficient and stable. Like initial design, we included several diagrams to make the project clear and easy to understand.

CoreTech is aware that a successful project can only survive if it has a proper design. Keeping this principle in mind, we did hard work to make every point clear. By forming a high quality design report, we think we will not encounter any difficulties at the implementation phase at second semester.

1.2. Project Description

CoreAccess is a Mobile GIS (Geographic Information System) Application, mainly dealing with social activities. These social activity places include cinema, concert hall, theatre, sport centers and the transportation opportunities among these activities. After learning the position of the user (via GPS (Global Positioning System) receiver, via marking on map or just entering his / her position manually) and the position of the cultural activity he/she chose by using PDA, this information is collected and processed. Finally, the result is shown to the user visually with transportation alternatives.

1.3. Project Features

Our product CoreAccess will mainly provide the followings:

- **Search Activity or Place:** The user can search any specific category (cinema, theatre, concert hall, sport centers), any specific activity attribute (name, place, date, etc.) or just browse the map for any activity or place. In addition to these search facilities, user can make search by entering an address keyword for an address search.

- **Ontology Help:** One useful property which CoreAccess serves is the ontology. By the help of ontology, user will be offered some alternative activities, if he/she does an unsuccessful search. Surely a user, who faces with a set of alternatives related to his/her search item, will be happier than a user who just sees a message like “The item you searched is not found!!!”

- **Visual Result:** When a user does any search using CoreAccess, he/she will be faced with a visual result. User will be able to show his/her search items on the map, with a shortest path drown. Certainly, some useful operations such as rotating, scaling, zooming in/out, scrolling the map will be provided.

- **Transportation:** The results will come with several transportation alternatives. Between two points one vehicle is not the only solution. Combination of vehicles for the specific distance is also supplied. User will be given a list of transportation

combination alternatives. According to the selection of the user, details of the vehicles and their paths will be shown. Moreover, CoreAccess will make estimations about the time and cost among these alternatives. Without a doubt, this is a very advantageous property.

- **AI/Algorithms:** In transportation functionality, there will be severe use of shortest path and graph algorithms. A map consists of thousands of nodes or sometimes more, so our algorithms have to be efficient.

- **Web Services:** Platform independency of CoreAccess lies on Web Services mostly. Once we are successful in implementing our project with Web Services, our main application can be called from anywhere.

- **Multilingual Support:** CoreAccess will come with 5 languages, namely Turkish, English, German, French, and Spanish.

1.4. Goals and Objectives

While we are designing our project, these main goals and objectives are considered:

- Organizing a complete project with every aspects,
- Programming PDA effectively and user friendly,
- Making the PDA – Server connection via Web – Service,
- Implementing ontology for cinema and transportation,
- Generating and implementing effective shortest path algorithms,
- Manipulating map data in GIS part.

1.5. Modules of CoreAccess

We have decomposed CoreAccess into modules. These are:

- Web Service Module
- GUI Module
- Administrator Module
- Content Manager Module

We have constructed our UML diagrams around the concept of these modules. While expanding our design, data flow diagrams, use case diagrams and state transition diagrams of our analysis report helped us a lot. Written details of these modules will be given in detailed design report.

1.6. Process Model

We have chosen Iterative Model for CoreAccess as we mentioned at our analysis report. We thought we can release some prototypes at implementation stage and according to success of these prototypes we can return back to the design. Actually, we realized we have made the right decision to have chosen this model. We tried to do our design considering these matters.

1.7. Hardware and Software Requirements

1.7.1 Hardware Requirements

There is no change in our hardware requirements when compared with our analysis report. In this design phase, we have discovered the importance of amount RAM in our server machine because we will store the vector map in RAM for fast processing. We have proposed 1 GB DDRAM in the analysis report and this amount will be sufficient.

1.7.2 Software Requirements

In the initial design report, we have talked about an external product, namely GeoMedia. At that time, there were license problems but now we have the product. We have spent some days for discovering it. InterGraph employees had told us that API comes with Geomedia, however, the other MOBGIS groups and we have seen that GeoMedia is only a desktop application for drawing and managing vector maps. GeoMedia does not supply an API for usage. It stores maps in MS Access tables in a closed format. We will find out the structure of these tables and write our own map editor.

For the server side development, we are using .Net 2005, and our development language is C#. Development on the PDA side has no choice other than .Net for compatibility with Windows CE. We have developed a prototype of the prototype for our TA Oral Dalay on 5.1.2006. We have successfully developed a PDA application which uses the TerraServer (http://terraserver-usa.com) open web services which is a service of MSN. .Net Smart Device application meets our necessities very well. Our premature application can search a place and display the result in 24 different zoom levels for 4 different map types.

2. DESIGN CONSTRAINTS

2.1. Time Constraints

CoreAccess project has to be finished at the end of May 2006. Moreover, we have to release a prototype at the end of this semester. As long as, the group members follow the schedule, the project could be completed successfully.

2.2. Hardware Constraints

In our department, there are only 4 PDA's for testing our application. However, we will use emulator for PDA programming part. It does not affect our implementation very much. Moreover, we have some concerns about the GPS data. Since we do not have a GPS device, we have to simulate some sort of GPS data for determining the position of the user. On the other hand, interpreting the GPS strings is a very trivial job. After the comments made about analysis report by the instructors, we have prepared a detailed GPS Research Report which can be accessed via our web page.

2.3. Software Constraints

We are planning to use GeoMedia which is developed by InterGraph Company. We had a meeting in which the product and its libraries for GIS data manipulation were introduced. At last, we have taken the license of GeoMedia. However, it does not have an api for PDA side. Therefore we are going to write the map manipulation functions and application for PDA user. If we could not find an appropriate vector map, we will design a map in GeoMedia by ourselves.

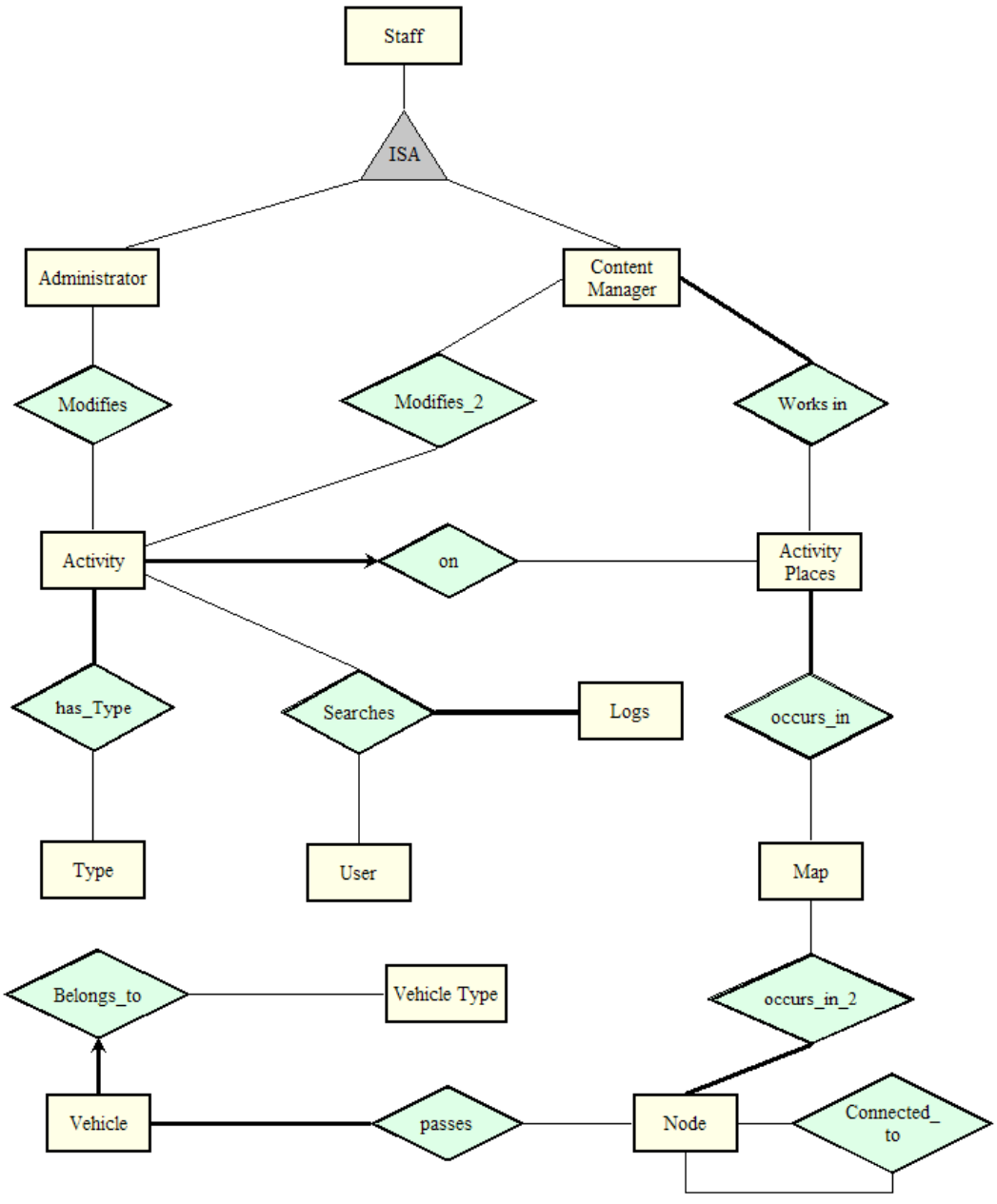
2.4. Performance Constraints

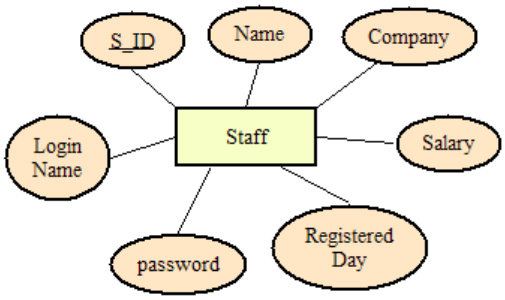
Performance constraints have two aspects, first the PDA side, second the server side. It is clear that PDA has limited capabilities. Because of this reason, we don't let PDA do complex and tiring calculations, it only takes user requests and displays the responses to those requests. For the visual capabilities, since vector maps are light visual objects, we don't expect any problems. On the server side, there will be complex calculations and lots of database interactions. Especially while finding transportation alternatives and shortest paths, there may be cases such that every node of a city has to be traversed. Due to this obstacle, when our server application is first initialized, city map will be loaded to RAM and never get out until map data is changed (behaves just like RAM DISK systems). By this way, disk access will be eliminated, which is the main source of slow calculations.

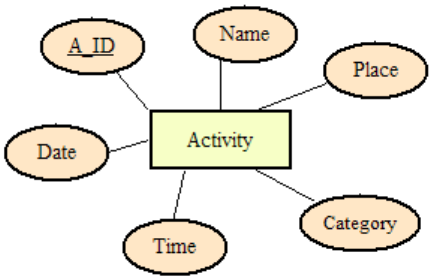
3. MODELLING

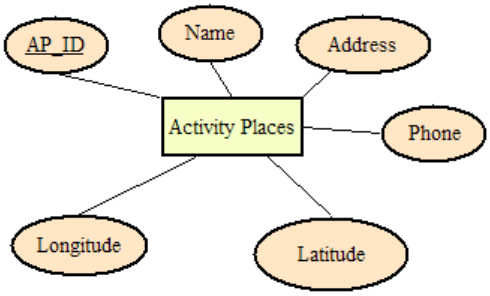
3.1. Data Model

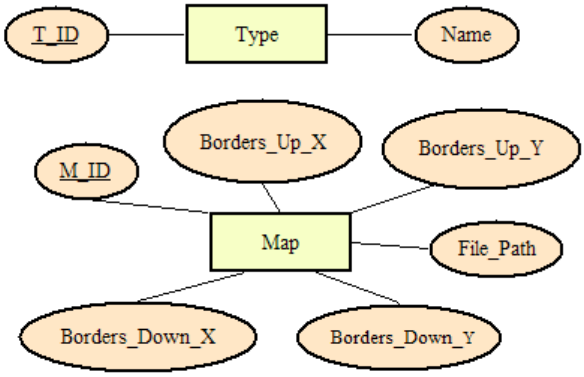
3.1.1. Entity - Relationship Diagram




S_ID
Name
Company
Staff
Login Name
Salary
password
Registered Day


A_ID
Name
Place
Activity
Date
Category
Time


AP_ID
Name
Address
Activity Places
Phone
Longitude
Latitude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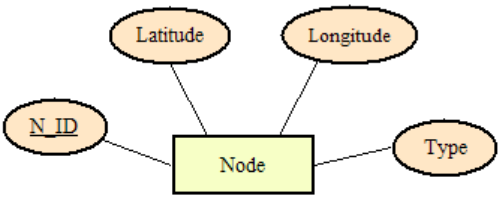
Type
Name
Borders_Up_X
Borders_Up_Y
M_ID
Map
File_Path
Borders_Down_X
Borders_Down_Y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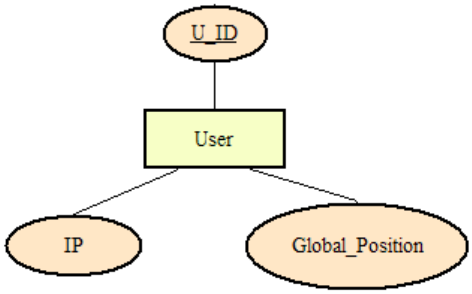
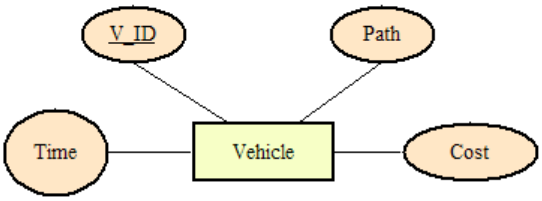
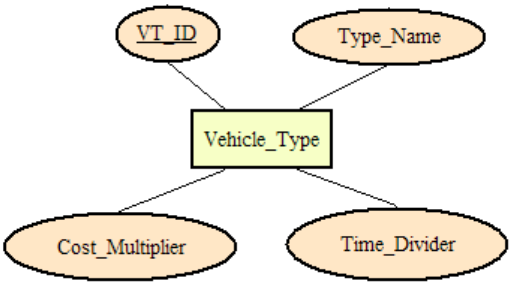
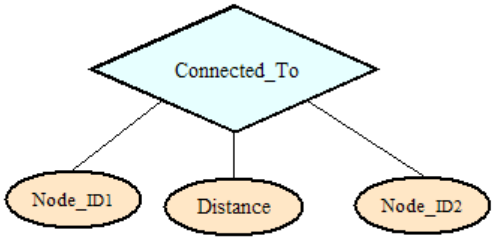
Longitude
N_ID
Node
Type


U_ID
User
IP
Global_Position


V_ID
Path
Time
Vehicle
Cost


VT_ID
Type_Name
Vehicle_Type
Cost_Multiplier
Time_Divider


Connected_To
Node_ID1
Distance
Node_ID2


L_ID
Logs
Date

3.1.2. Description of ER Tables

Staff

Attribute	Data Type	Description
S_ID (key)	Integer	Uniquely defines the staff
Name	String	The name of the staff
Login Name	String	The name for login process
Password	String	The password for entering the system
Company	String	The company of the staff if he/she is a content manager
Salary	String	Salary of the staff
Registered Day	Date	The date of the register of the staff

Activity

Attribute	Data Type	Description
A_ID (key)	Integer	Uniquely defines the activity
Name	String	The name of the activity
Place	String	The place of the activity
Date	Date	The date of the activity
Category	String	The category of the activity (cinema, sports)
Time	Time	The time of the activity

Activity Places

Attribute	Data Type	Description
AP_ID (key)	Integer	Uniquely defines the activity place
Name	String	The name of the activity place
Address	String	The address of the activity place
Phone	String	The phone of the activity place
Latitude	Double	The latitude of the activity place
Longitude	Double	The longitude of the activity place

Type

Attribute	Data Type	Description
T_ID (key)	Integer	Uniquely defines the type
Name	String	The name of the activity type

Map

Attribute	Data Type	Description
M_ID (key)	Integer	Uniquely defines the map
Borders_Up_X	Double	The up – x point of the border
Borders_Up_Y	Double	The up – y point of the border
Borders_Down_X	Double	The down – x point of the border
Borders_Down_Y	Double	The down – x point of the border
File_Path	String	The path information on the map

Node

Attribute	Data Type	Description
N_ID (key)	Integer	Uniquely defines the node
Latitude	Double	The latitude of the node
Longitude	Double	The longitude of the node
Type	Double	The type of the node

User

Attribute	Data Type	Description
U_ID (key)	Integer	Uniquely defines the user
IP	String	The ip of the user
Global_Position	String	The package containing latitude and longitude of the user

Vehicle

Attribute	Data Type	Description
V_ID (key)	Integer	Uniquely defines the vehicle
Path	String	The path which the vehicle follows
Cost	Double	The cost of the vehicle
Time	Time	The time spent for the travel

Vehicle type

Attribute	Data Type	Description
VT_ID (key)	Integer	Uniquely defines the vehicle type
Type_Name	String	The name of the vehicle type
Cost_Multiplier	Double	The value showing the cost for a vehicle in a unit distance
Time_Divider	Double	The value showing the time for a vehicle in a unit distance

Logs

Attribute	Data Type	Description
L_ID (key)	Integer	Uniquely defines the logs
Date	Date	The date of the log

Modifies

Attribute	Data Type	Description
S_ID (key)	Integer	References : Staff
A_ID(key)	Integer	References : Activity

Modifies_2

Attribute	Data Type	Description
S_ID (key)	Integer	References : Staff
A_ID(key)	Integer	References : Activity

Works_In

Attribute	Data Type	Description
S_ID (key)	Integer	References : Staff
AP_ID(key)	Integer	References : Activity Places

On

Attribute	Data Type	Description
A_ID (key)	Integer	References : Activity
AP_ID(key)	Integer	References : Activity Places

Has_Type

Attribute	Data Type	Description
A_ID (key)	Integer	References : Activity
T_ID(key)	Integer	References : Type

Searches

Attribute	Data Type	Description
U_ID (key)	Integer	References : User
A_ID(key)	Integer	References : Activity
L_ID(key)	Integer	References : Logs

Occurs_In

Attribute	Data Type	Description
AP_ID (key)	Integer	References : Activity Places
M_ID(key)	Integer	References : Map

Occurs_In_2

Attribute	Data Type	Description
N_ID (key)	Integer	References : Node
M_ID(key)	Integer	References : Map

Connected_To

Attribute	Data Type	Description
N1_ID (key)	Integer	References : Node
N2_ID(key)	Integer	References : Node
Distance	Double	The distance between nodes

Passes

Attribute	Data Type	Description
V_ID (key)	Integer	References : Vehicle
N_ID(key)	Integer	References : Node

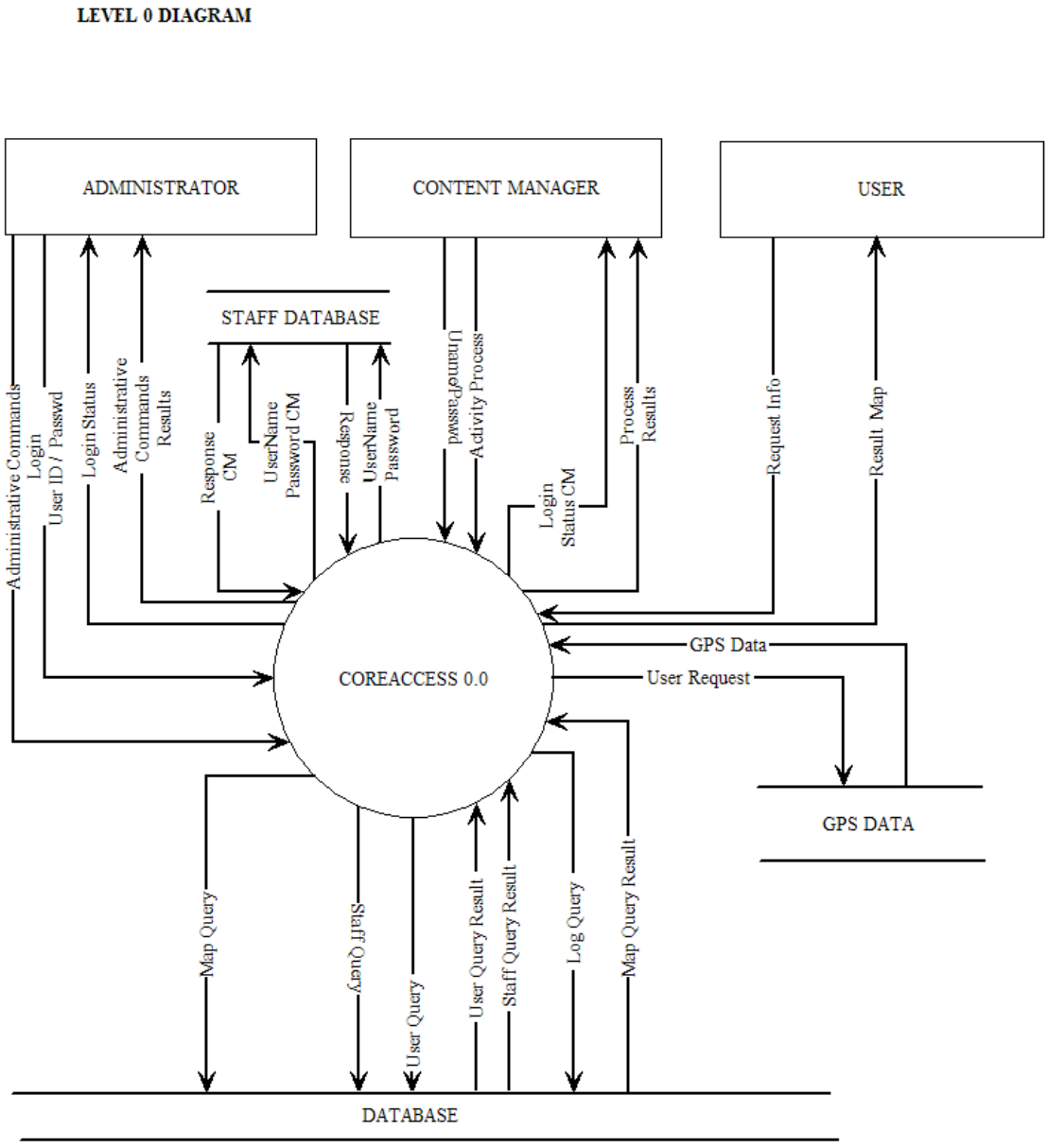
Belongs_To

Attribute	Data Type	Description
V_ID (key)	Integer	References : Vehicle
VT_ID(key)	Integer	References : Vehicle Type

3.2. Functional Model

3.2.1. Data Flow Diagram

3.2.1.1. DFD Level 0



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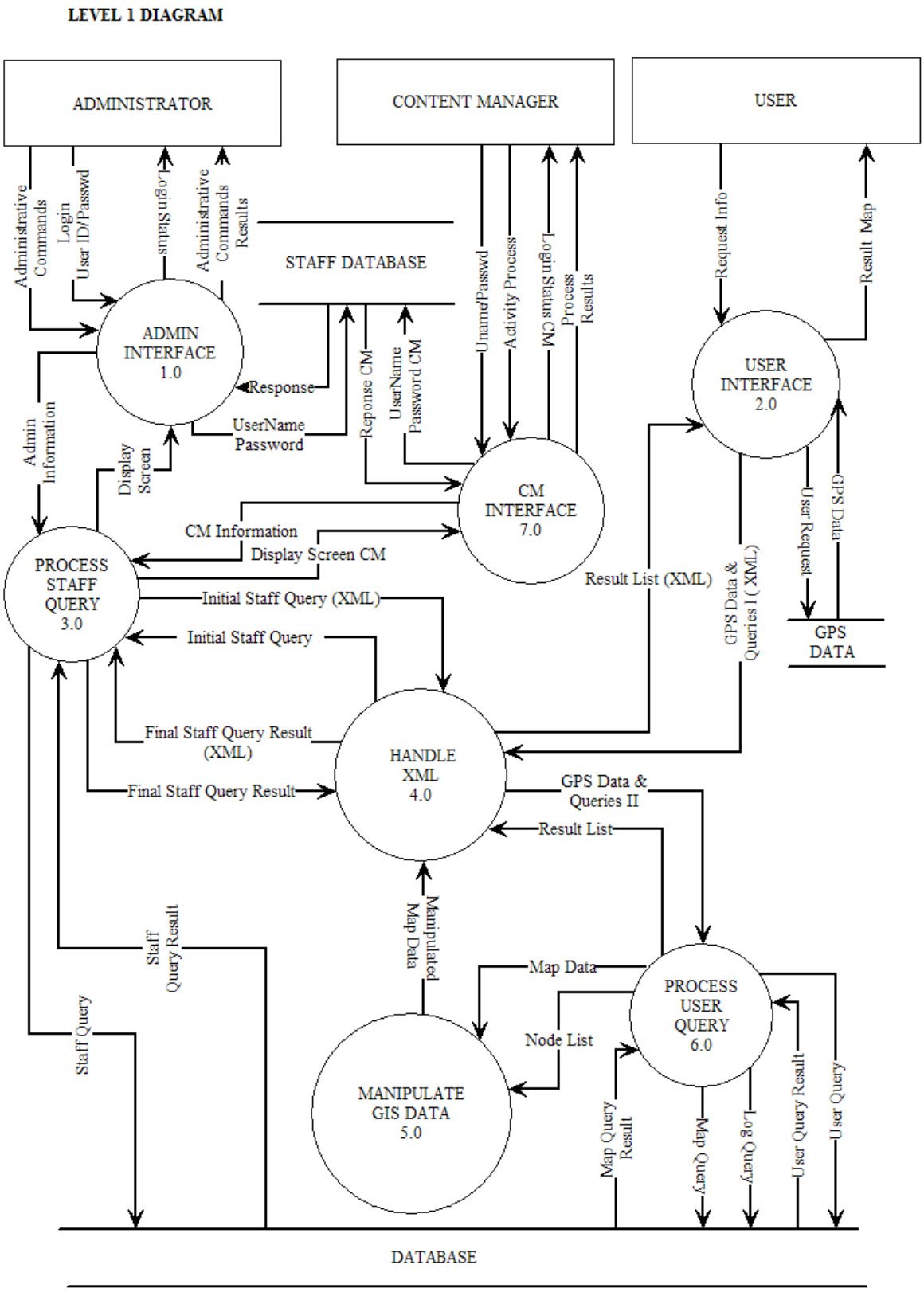
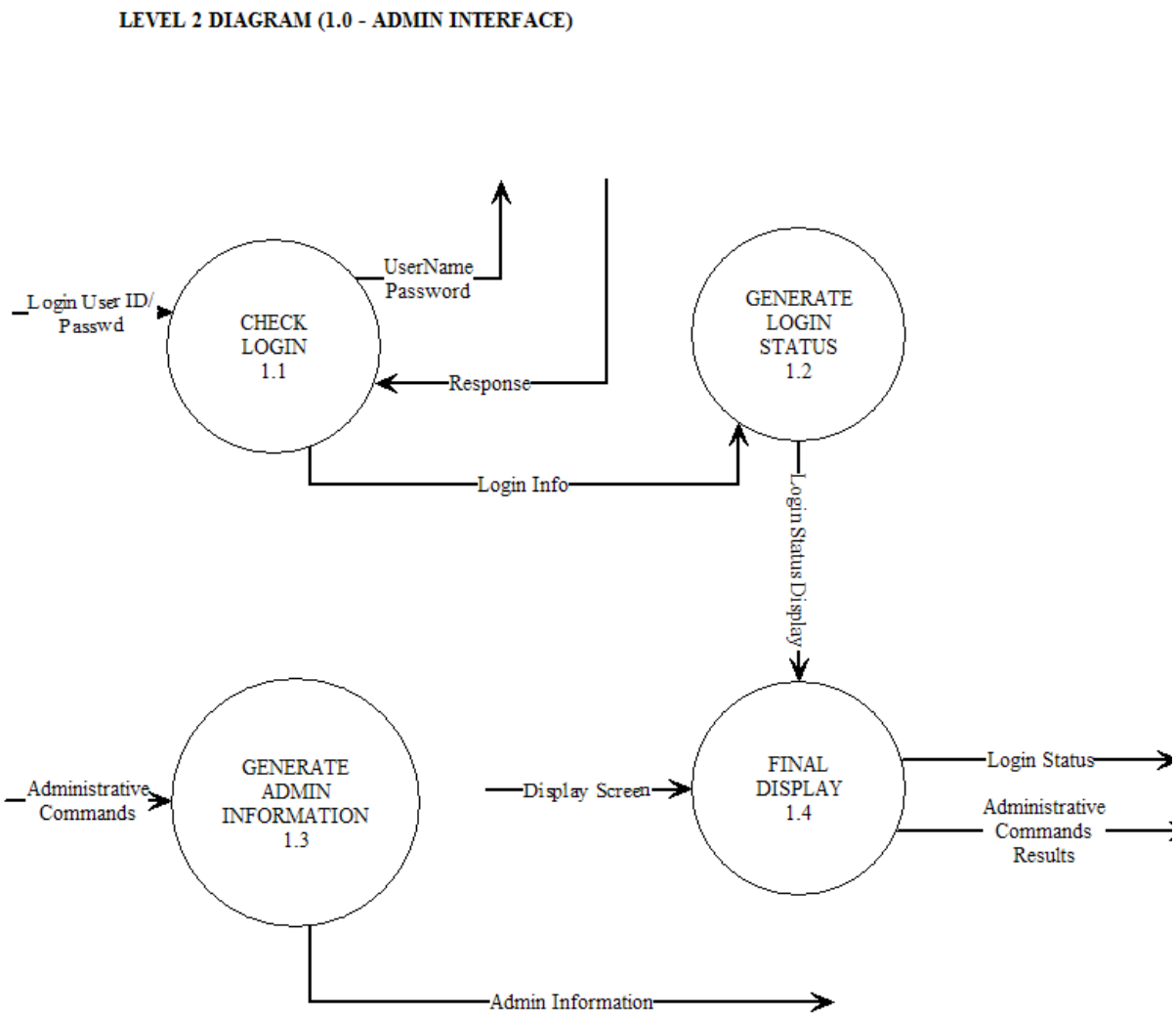
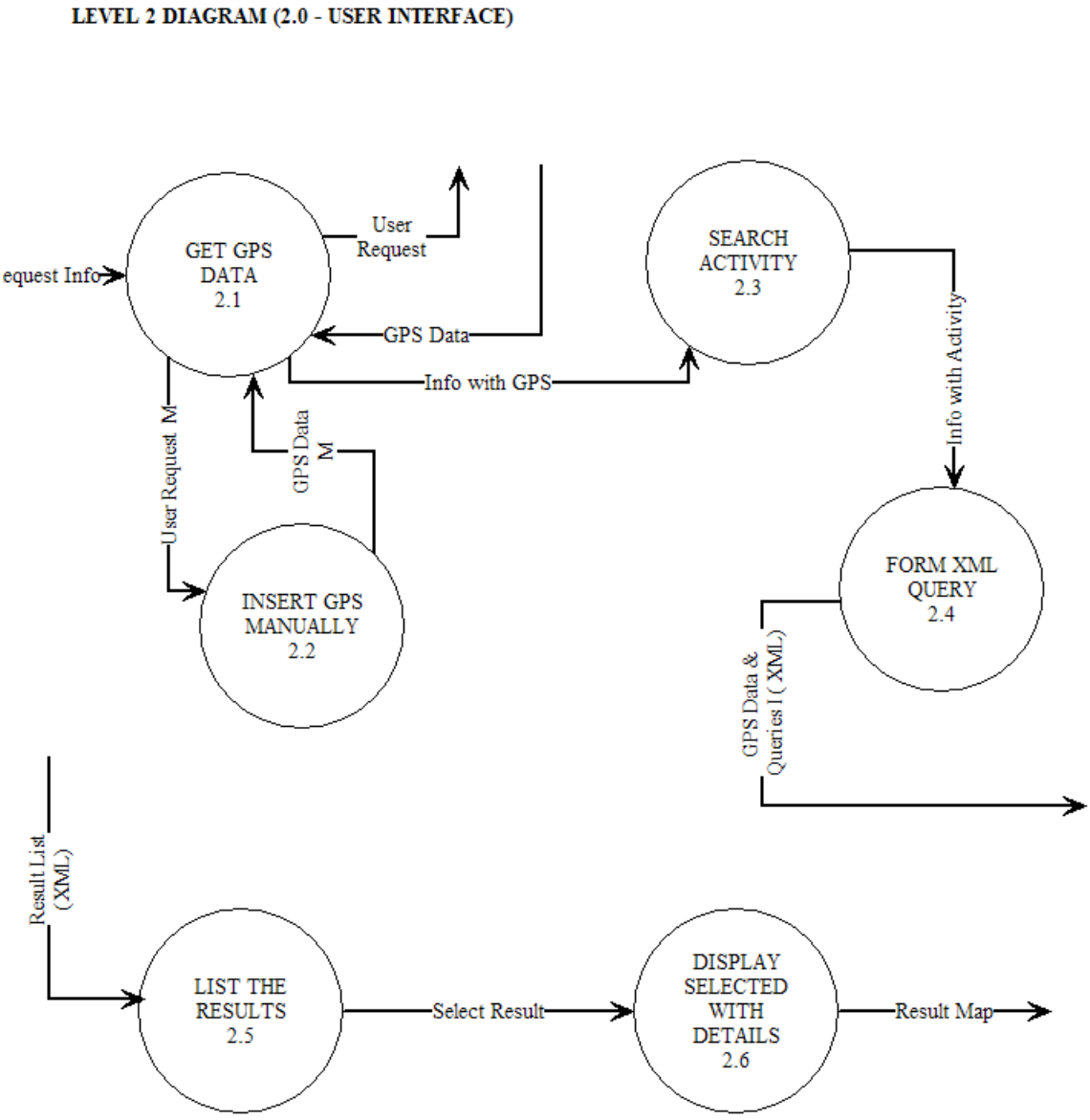


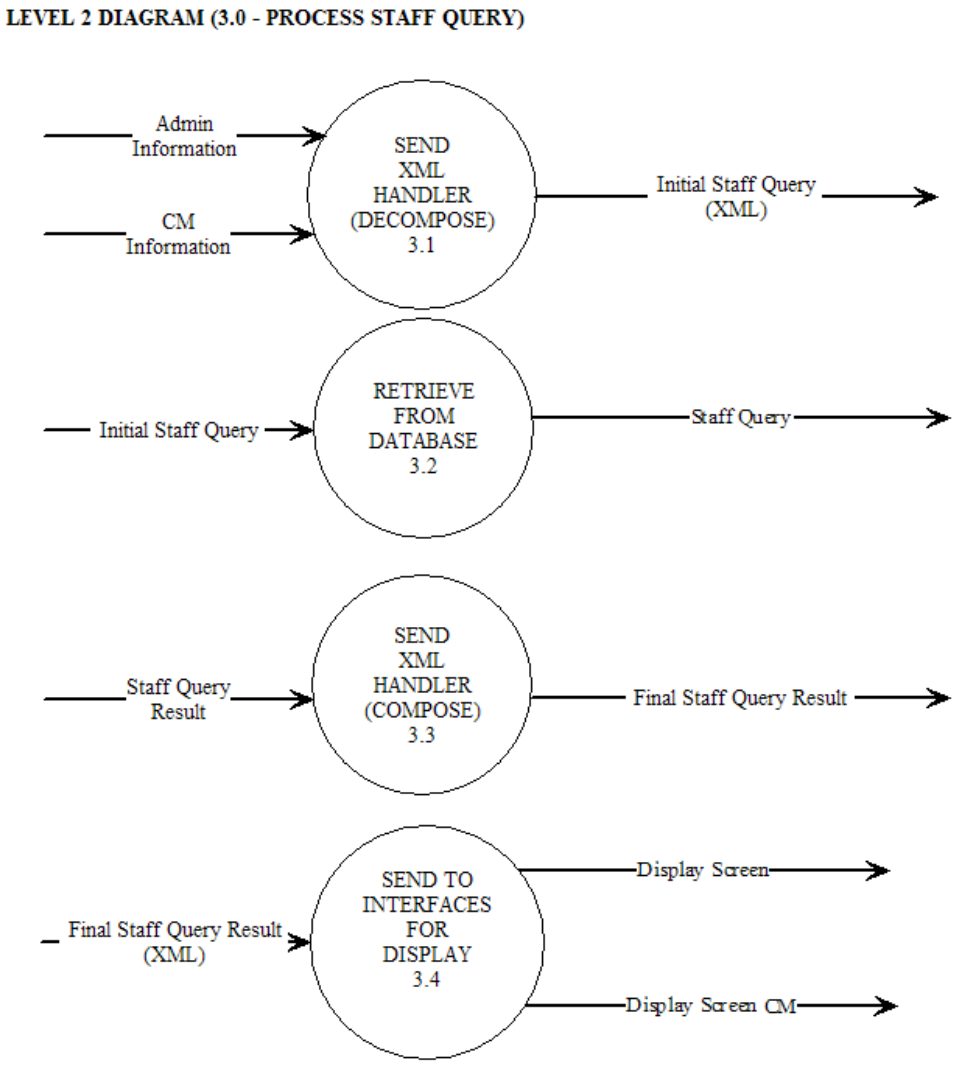
3.2.1.3. DFD Level 2 (1.0)



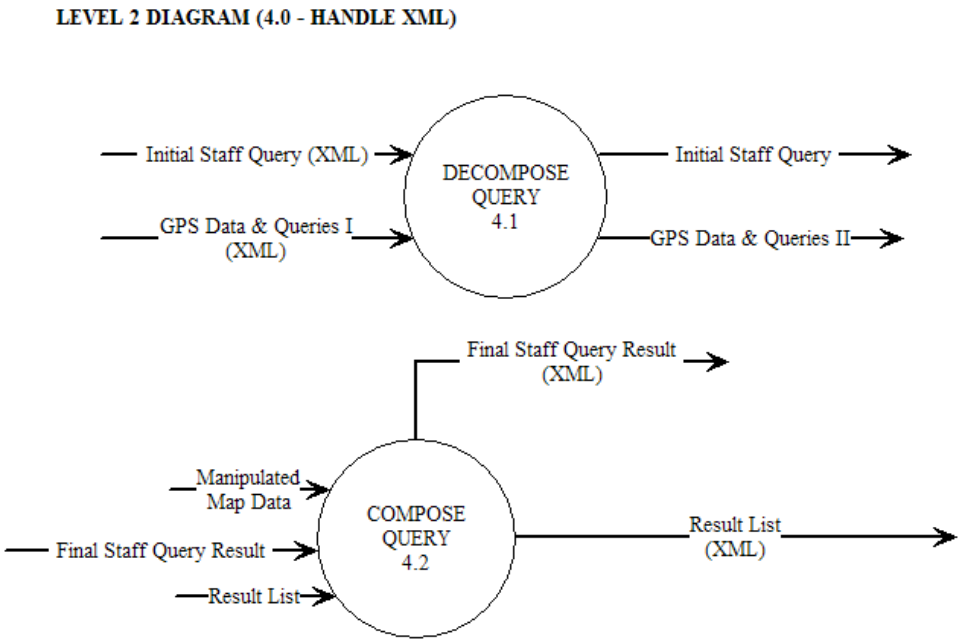
3.2.1.4. DFD Level 2 (2.0)



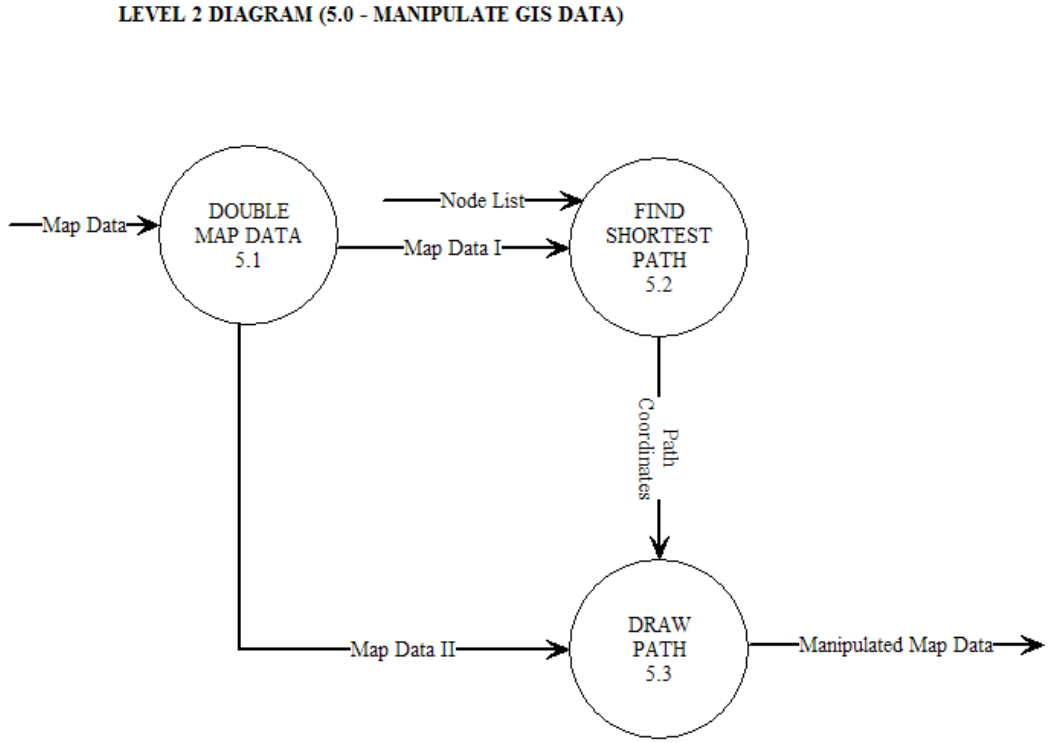
3.2.1.5. DFD Level 2 (3.0)



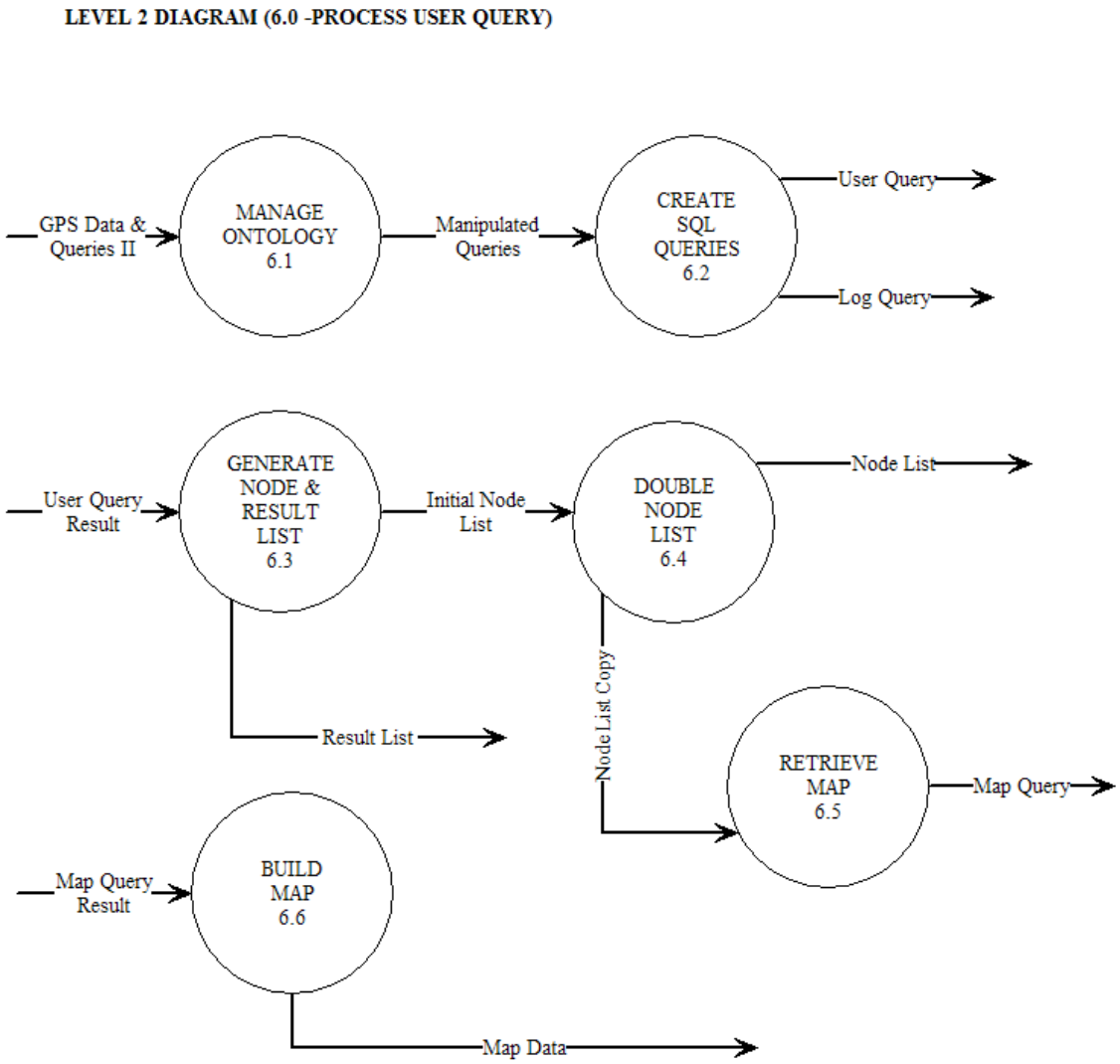
3.2.1.6. DFD Level 2 (4.0)



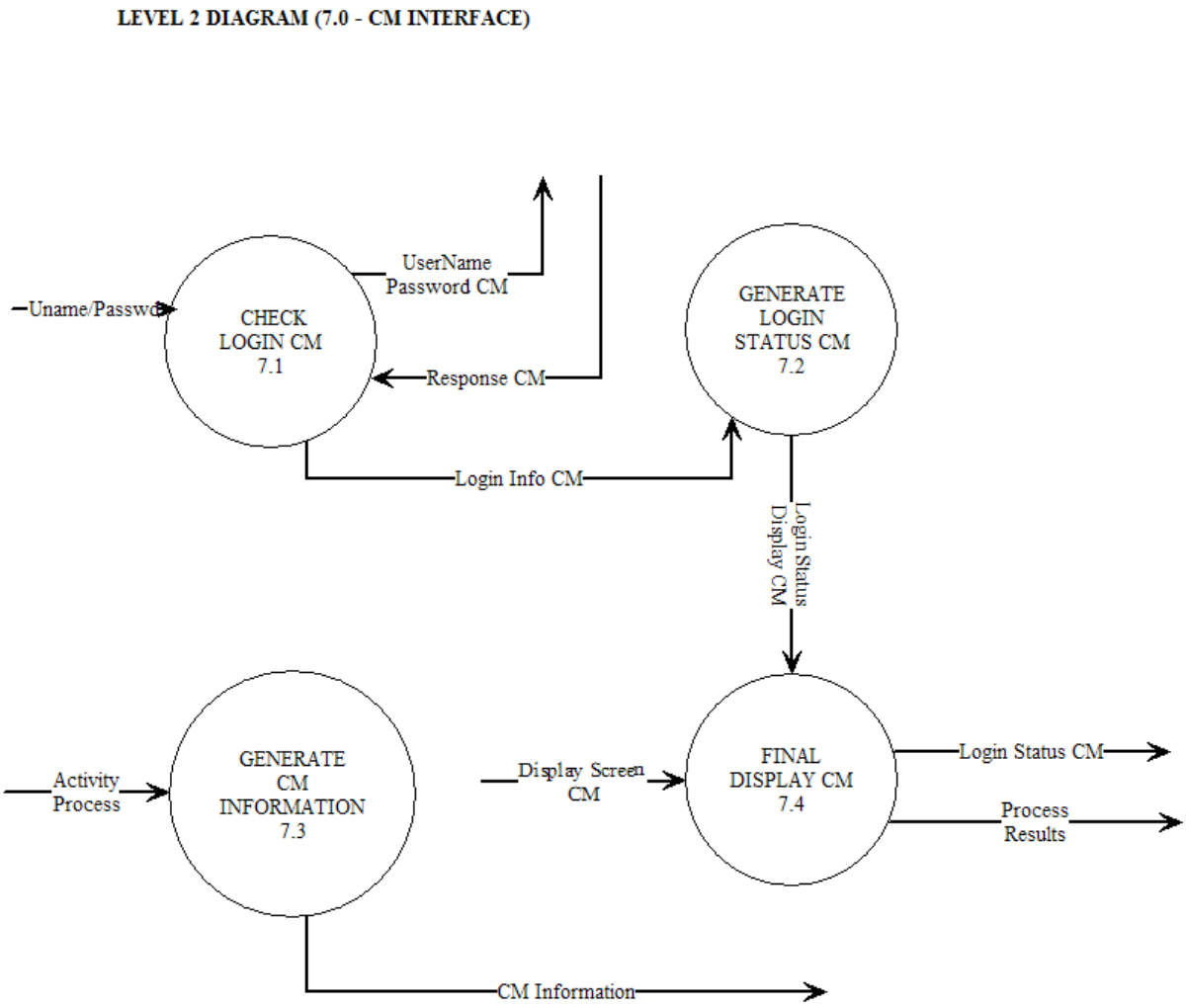
3.2.1.7. DFD Level 2 (5.0)



3.2.1.8. DFD Level 2 (6.0)



3.2.1.9. DFD Level 2 (7.0)



3.2.2. Data Dictionaries

Name:	Login UserID/Passwd
Alias:	Admin Username – Password
Where & How it is used:	ADMINISTRATOR *output* CHECK LOGIN (1.1) *input*
Description:	" sends administrator's username and password for checking"

Name:	UserName Password
Alias:	Admin Username- Password
Where & How it is used:	CHECK LOGIN (1.1) *output*
Description:	" checks username and password of the admin from staff database"

Name:	Response
Alias:	Check Result
Where & How it is used:	CHECK LOGIN (1.1) *input*
Description:	" sends the info about the username password match from database "

Name:	Login Info
Alias:	Login Info After Check
Where & How it is used:	GENERATE LOGIN STATUS(1.2) *input* CHECK LOGIN (1.1) *output*
Description:	"forms the login information after login check"

Name:	Administrative commands
Alias:	System commands
Where & How it is used:	ADMINISTRATOR *output* GENERATE ADMIN INFORMATION(1.3) *input*
Description:	"written commands to interface by administrator"

Name:	Login Status Display
Alias:	-
Where & How it is used:	GENERATE LOGIN STATUS(1.2) *output* FINAL DISPLAY (1.4) *input*
Description:	" sends the final login info for display"

Name:	Login Status
Alias:	User check
Where & How it is used:	ADMINISTRATOR *input* FINAL DISPLAY (1.4) *output*
Description:	"information about validity of the user "

Name:	Administrative Commands Results
Alias:	System Returned Result
Where & How it is used:	ADMINISTRATOR *input* FINAL DISPLAY (1.4) *output*
Description:	"returned information to the administrator whether the changes are done or not "

Name:	Admin Information
Alias:	System Data
Where & How it is used:	SEND XML HANDLER (DECOMPOSE) (3.1) *input* GENERATE ADMIN INFORMATION(1.3) *output*
Description:	"gathered information from user interface which is written to the Browser by system user"

Name:	Display Screen
Alias:	Visible result
Where & How it is used:	SEND TO INTERFACES FOR DISPLAY (3.4) *output* FINAL DISPLAY (1.4) *input*
Description:	"generated result screen to the administrator"

Name:	Result List(XML)
Alias:	Result screen
Where & How it is used:	COMPOSE QUERY (4.2) *output* LIST THE RESULTS (2.5)*input*
Description:	" generated result screen to the user about his/her query "

Name:	GPS Data & Queries I(XML)
Alias:	Written data
Where & How it is used:	DECOMPOSE QUERY(4.1) *input* FORM XML QUERY (2.4) *output*
Description:	"Gathered info from user interface"

Name:	Request Info
Alias:	Info for User
Where & How it is used	USER *output* GET GPS DATA (2.1) *input*
Description:	"sends user request for any activity"

Name:	User Request
Alias:	GPS Data Request
Where & How it is used:	GET GPS DATA (2.1) *output*
Description:	"sends GPS data request to GPS receiver"

Name:	GPS Data
Alias:	GPS Data Response
Where & How it is used:	GET GPS DATA (2.1) *input*
Description:	"sends GPS data from GPS receiver"

Name:	User Request M
Alias:	GPS Data Request Manually
Where & How it is used:	GET GPS DATA (2.1) *output* INSERT GPS MANUALLY (2.2) *input*
Description:	"sends GPS data request for manual insertion"

Name:	GPS Data M
Alias:	GPS Data Response Manually
Where & How it is used:	GET GPS DATA (2.1) *input* INSERT GPS MANUALLY (2.2) *output*
Description:	"sends GPS data from manual insertion"

Name:	Info with GPS
Alias:	Data with GPS
Where & How it is used:	GET GPS DATA (2.1) *output* SEARCH ACTIVITY (2.3) *input*
Description:	"sends info for other processes with GPS Data "

Name:	Info with Activity
Alias:	Data with Activity
Where & How it is used:	SEARCH ACTIVITY (2.3) *output* FORM XML QUERY (2.4) *input*
Description:	"sends activity info for other processes"

Name:	Select Result
Alias:	Select Item from Result List
Where & How it is used:	LIST THE RESULTS (2.5) *output* DISPLAY SELECTED WITH DETAILS (2.6) *input*
Description:	"selects item from result list for further details "

Name:	Result Map
Alias:	Final Map Data
Where & How it is used:	USER *input* DISPLAY SELECTED WITH DETAILS (2.6) *output*
Description:	"shows the final map to user"

Name:	CM Information
Alias:	Content Manager Data
Where & How it is used:	GENERATE CM INFORMATION (7.3) *output* SEND XML HANDLER (DECOMPOSE) (3.1) *input*
Description:	"gathered content manager info"

Name:	Initial Staff Query (XML)
Alias:	XML Query for Decomposition
Where & How it is used:	SEND XML HANDLER (DECOMPOSE) (3.1) *output* DECOMPOSE QUERY (4.1) *input*
Description:	"sends staff query in XML format for decomposition"

Name:	Initial Staff Query
Alias:	Query Response after Decomposition
Where & How it is used:	DECOMPOSE QUERY (4.1) *output* RETRIEVE FROM DATABASE (3.2) *input*
Description:	"receives staff query after decomposition"

Name:	Staff Query
Alias:	-
Where & How it is used:	RETRIEVE FROM DATABASE (3.2) *output*
Description:	"sends staff query to database"

Name:	Staff Query Result
Alias:	Staff Query from Database
Where & How it is used:	SEND XML HANDLER (COMPOSE) (3.3) *input*
Description:	"receives staff query results from database"

Name:	Final Staff Query Result
Alias:	Query for XML Composition
Where & How it is used:	SEND XML HANDLER (COMPOSE) (3.3) *output* COMPOSE QUERY (4.2) *input*
Description:	"sends final staff query for XML composition"

Name:	Final Staff Query Result (XML)
Alias:	Query Response after Composition
Where & How it is used:	COMPOSE QUERY (4.2) *output* SEND TO INTERFACES FOR DISPLAY(3.4) *input*
Description:	"receives final staff query after decomposition"

Name:	Display Screen CM
Alias:	Visible result for CM
Where & How it is used:	SEND TO INTERFACES FOR DISPLAY (3.4) *output* FINAL DISPLAY CM (7.4) *input*
Description:	"generated result screen to the content manager"

Name:	GPS Data & Queries II
Alias:	Query Info after Decomposition
Where & How it is used:	DECOMPOSE QUERY (4.1) *output* MANAGE ONTOLOGY (6.1) *input*
Description:	"sends the user query for further process"

Name:	Manipulated Map Data
Alias:	Processed Map Data
Where & How it is used:	DRAW PATH (5.3) *output* COMPOSE QUERY (4.2) *input*
Description:	"sends the manipulated map data for XML composition and display"

Name:	Result List
Alias:	Result List before XML Composition
Where & How it is used:	GENERATE NODE & RESULT LIST (6.3) *output* COMPOSE QUERY (4.2) *input*
Description:	"sends the result list for XML composition"

Name:	Node List
Alias:	Nodes for Map
Where & How it is used:	DOUBLE NODE LIST (6.4) *output* FIND SHORTEST PATH (5.2) *input*
Description:	"sends node information for map manipulation"

Name:	Map Data
Alias:	Extracted Map
Where & How it is used:	BUILD MAP (6.6) *output* DOUBLE MAP DATA (5.1) *input*
Description:	"sends the received map data from database"

Name:	Map Data I
Alias:	-
Where & How it is used:	DOUBLE MAP DATA (5.1) *output* FIND SHORTEST PATH (5.2) *input*
Description:	"sends a copy of map data for finding shortest path"

Name:	Map Data II
Alias:	-
Where & How it is used:	DOUBLE MAP DATA (5.1) *output* DRAW PATH (5.3) *input*
Description:	"sends a copy of map data for drawing path"

Name:	Path Coordinates
Alias:	Positions of Path
Where & How it is used:	FIND SHORTEST PATH (5.2) *output* DRAW PATH (5.3) *input*
Description:	"sends path coordinates for drawing path"

Name:	Manipulated Queries
Alias:	Processed Queries
Where & How it is used:	MANAGE ONTOLOGY (6.1) *output* CREATE SQL QUERIES (6.2) *input*
Description:	"sends the manipulated queries to form SQL queries"

Name:	User Query
Alias:	-
Where & How it is used:	CREATE SQL QUERIES (6.2) *output*
Description:	"sends user query to database"

Name:	Log Query
Alias:	-
Where & How it is used:	CREATE SQL QUERIES (6.2) *output*
Description:	"writes the logs to the database"

Name:	User Query Result
Alias:	Result from Database
Where & How it is used:	GENERATE NODE & RESULT LIST (6.3) *input*
Description:	"receives user query result from database"

Name:	Initial Node List
Alias:	Map Nodes
Where & How it is used:	GENERATE NODE & RESULT LIST (6.3) *output* DOUBLE NODE LIST (6.4) *input*
Description:	"sends map nodes for making two copies"

Name:	Node List Copy
Alias:	-
Where & How it is used:	DOUBLE NODE LIST (6.4) *output* RETRIEVE MAP (6.5) *input*
Description:	"sends map nodes for retrieving map"

Name:	Map Query
Alias:	Map Retrieving
Where & How it is used:	RETRIEVE MAP (6.5) *output*
Description:	"sends map query to database"

Name:	Map Query Result
Alias:	Map from Database
Where & How it is used:	BUILD MAP (6.6) *input*
Description:	"sends the map data from database for building map"

Name:	Uname/Passwd
Alias:	Content Manager Username – Password
Where & How it is used:	CONTENT MANAGER *output* CHECK LOGIN CM(7.1) *input*
Description:	" sends content manager's username and password for checking"

Name:	UserName Password CM
Alias:	Content Manager Username- Password
Where & How it is used:	CHECK LOGIN CM (7.1) *output*
Description:	" checks username and password of the content manager from staff database"

Name:	Response CM
Alias:	Check Result for CM
Where & How it is used:	CHECK LOGIN CM (7.1) *input*
Description:	" sends the info about the username password match from database "

Name:	Login Info CM
Alias:	Login Info CM After Check
Where & How it is used:	GENERATE LOGIN STATUS CM (7.2) *input* CHECK LOGIN CM (7.1) *output*
Description:	"forms the login information after login check"

Name:	Activity Process
Alias:	Activity Work
Where & How it is used:	CONTENT MANAGER *output* GENERATE CM INFORMATION(7.3) *input*
Description:	"written commands to interface by content manager"

Name:	Login Status Display CM
Alias:	-
Where & How it is used:	GENERATE LOGIN STATUS CM(7.2) *output* FINAL DISPLAY CM (7.4) *input*
Description:	" sends the final login info for display"

Name:	Login Status CM
Alias:	User check for CM
Where & How it is used:	CONTENT MANAGER *input* FINAL DISPLAY CM (7.4) *output*
Description:	"information about validity of the user "

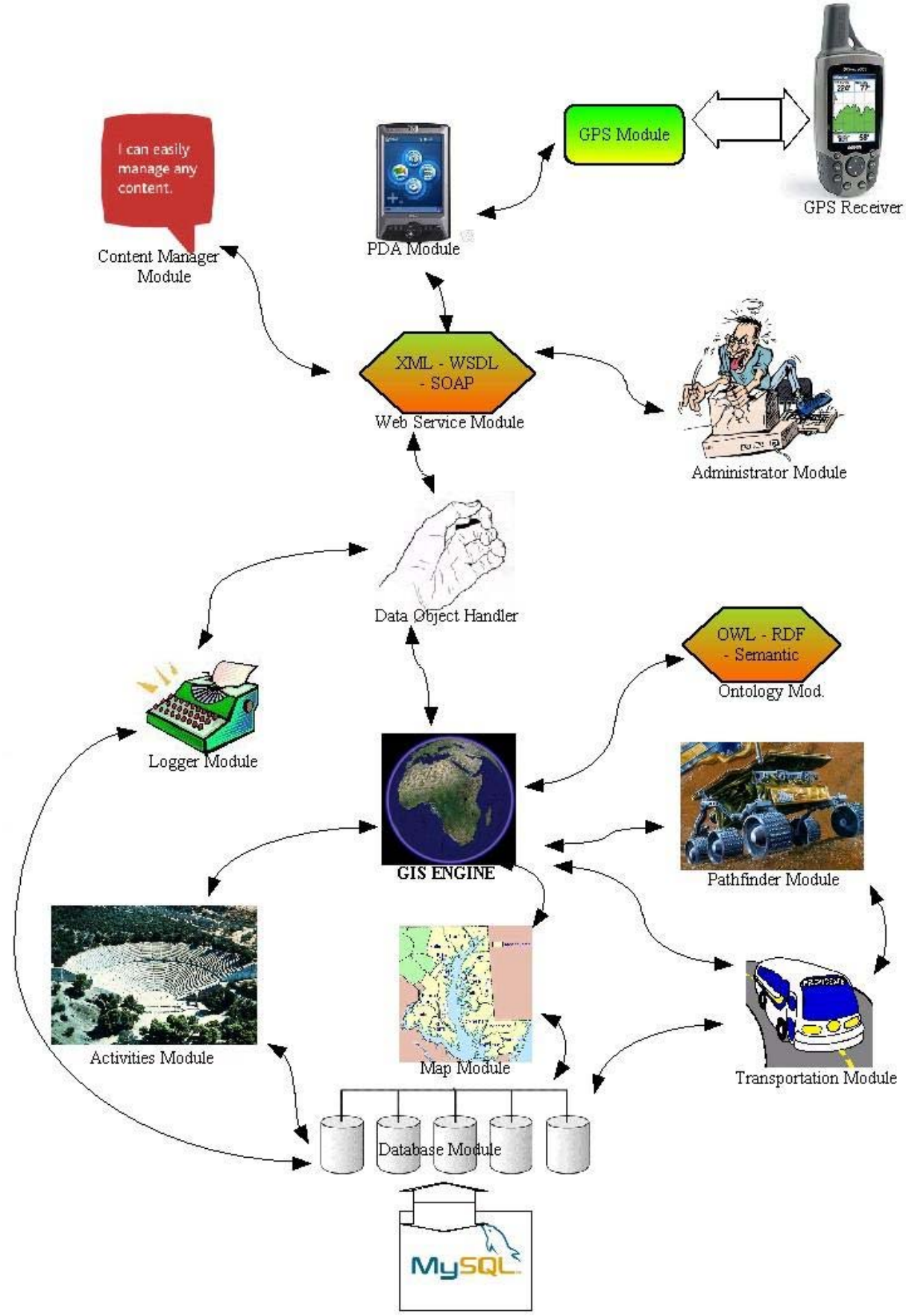
Name:	Process Results
Alias:	Activity Process Result
Where & How it is used:	CONTENT MANAGER *input* FINAL DISPLAY CM (7.4) *output*
Description:	"returned information to the content manager whether the changes are done or not "

4. OVERALL ARCHITECTURE

4.1. List of modules

- GPS module
- PDA module
- Content Manager module
- Administrator module
- Web Service module
- Data Object Handler
- Logger module
- GIS Engine
- Ontology module
- Pathfinder module
- Activities module
- Map module
- Transportation module
- Database module

4.2. Architecture Diagram



4.3. Details of Modules

Main details of the modules will be explained in the following part. However, detailed functionalities of the modules are clear in the diagrams, especially the interaction between them.

GPS Module: GPS module's responsibility is to make the connection between the PDA and GPS receiver. Moreover, it is responsible of parsing the strings of NMEA 0183 protocol and returning them to PDA module as a data object which consists of global position information such as latitude, longitude and time attributes of the user. NMEA 0183 protocol serves lots of different kinds of strings, but "recommended minimum" sentence, namely $GPRMC, meets our necessities very well. Detailed information about the contents of GPS module can be found in our "GPS Research Report" which is accessible in our website (www.cclub.metu.edu.tr/~mustafa/coretech).

PDA Module: PDA module's responsibility is to supply the connection between the user and web service module of server side. It has a friendly graphical user interface which takes in the commands of the user and displays the related outputs. Basic operations such as zooming in/out the vector map are inline facilities of PDA module and connection with the server is not necessary in these cases. All of the other requests of user need connection with the server side. Requests of the user are taken through the GUI of PDA module, then packaged with XML Handler component as XML and sent to the server side via the web service interface of the server application. Next, it takes the response of the server again in XML format, decomposes it and displays to user as maps and written data.

Content Manager Module: Content manager module's responsibility is to supply the connection between the content manager and web service module of server side. It has a graphical user interface which takes in the commands of the content manager and returns the acknowledgement of the operation to content manager. As explained before, content manager has restricted abilities. He/She is responsible of managing the activities of activity places where he/she is assigned. Moreover, he/she can update contact information of activity places. All these operations need connection with the server side. This connection is made through the web service interface of the server side. Messaging standard is XML again, just as explained in the PDA module description. Since content managers will want to do their jobs from anywhere, application of this module will be accessible as a web page which connects with the web services.

Administrator Module: Administrator module is very critical since it deals with the administration of the server side. It provides the administrator with a friendly GUI which can be seen in the GUI Design part of this report. It acts in a similar way with the content manager module; it supplies the connection between the administrator and web service interface of the server side. Communication protocol is again XML. However, this time, application will not be accessible as a web page because administrator has some complex abilities such as managing the map visually. Therefore, this module will be a standalone application which makes the connection itself. Authentication will be done of course at the beginning.

Web Service Module: Web service module is the open window of our server application to outside world. All of the capabilities of our server side will be deployed as web services. This will bring us the platform independency. Authentication will be done again in web service module for the administrator and content manager. Once our WSDL is parsed by the clients,

our server side will be available just like an API as long as they stick to the data specification standards of our web services. To sum up, it can be said that this module is the interface of server side for clients.

Data Object Handler: Data object handler works in a two-sided way. Its first duty is to take the requests of clients (namely, PDA module, client manager module and administrator module) via web service module, decompose them and create understandable data objects for the GIS Engine. Secondly, it will just do the reverse operation. That is, it will take the data objects of the GIS Engine which consist of the responses of the server and create the package for the client side and pass it to the clients (again PDA, client manager and administrator modules) via web service module.

Logger Module: Logger module lies between the data object handler and database module. Its duty is to log the queries of the user with his/her global position and ip. Logger module has its own table in the database. Database module handles the process of entering the logs that has been constructed and sent by logger module to logger table. These logs will serve statistical data of the whole application to administrator.

GIS Engine: The core module of our system is the GIS engine which sits in the middle and controls the data flow mechanism. As it can be clearly seen from the diagram, data object handler, logger module, ontology module, pathfinder module, activities module, map module and transportation module are connected to GIS engine. GIS engine takes the data objects from the data object handler, and then according to the data, it communicates with the related module when necessary. For example, if the user requested transportation alternatives to an activity place, then GIS engine sends the request to the transportation module, gets the response and sends it back to the user. It is the brain of our project.

Ontology Module: Main purpose of this module is to prevent the user from facing with blank screens instead of alternative solutions. Ontology module is only connected with GIS engine. If the response for the original query of the user is empty, then GIS engine will call ontology module and make it produce alternative results. For example, if the user wanted to see a “love movie” but there is not any on the scene, then “love comedy movie” or “love play” would be alternative recommendations.

Pathfinder Module: This module is in connection with GIS engine and transportation module. Its main duty is to find the paths between given points. In fact, its duty can be divided into two parts: obligatory and optional. Its obligatory duty is to find the general shortest path between the users’ global position and found activity place. This shortest path is transportation method (vehicle) independent. Pathfinder module’s optional duty gets into action when user wants to see transportation alternatives for an activity place. This time, pathfinder works for specific vehicles. Behind, there are implementations of shortest path and graph algorithms.

Activities Module: This module is responsible of managing the activities and activity places. GIS engine redirects the data objects that are concerned with activities to this module. Then, activities module gets into connection with database module, sends the queries and gets back the responses. Finally, it sends these results back to GIS engine. Messaging is done via objects and strings. For the content manager and administrator module, it has extra properties such as adding, updating and removing activities or activity places.

Map Module: Map module is just like the activities module. It lies between the GIS engine and database module. According to the request taken from the GIS engine, map module orders related map data from the database module and sends the result back to GIS engine. For the administrator and content manager, there are extra methods for editing the map data.

Transportation Module: Transportation method is responsible for the vehicles and their paths. Managing vehicles and their paths are only visible to administrator. User queries are taken from the GIS engine and sent to database module. Database module takes the response from the SQL tables and passes them to transportation module. Transportation module's duty is completed when responses are sent back to GIS engine.

Database Module: As it is clear from its name, database module is responsible of the connection between the database management system (MySQL in our case) and other modules (logger, activities, map and transportation modules) that need database access. Database module takes the queries from the mentioned modules, commits them via the database connection, gets back the result set and forwards the related results to interested modules.

5. COREACCESS USER INTERFACE

5.1. User Functionality

We have two different users for "CoreAccess". Main users are PDA users who run application from a PDA connected to GPS and internet. However, some PDA users may not have GPS receivers. For this reason, we have added extra positioning methods which are explained in detail in the following part. Second group of users are internet users. Since our server application will serve the information via web services, this will not bring us any additional load. All we have to is designing a web page which calls our web services, then internet users can also benefit from our GIS application. The only difference is, internet user does not have GPS receiver. There is not any other difference between the functionalities of PDA user and internet user. The functionalities of users are explained in detail in the following sections.

- **Select Positioning Method:** This is the first step of our application. Before making any queries, we have to know the position of the user. User has four choices for determining his/her position. First one is determining user's global position "via GPS receiver", second one is "via entering address keyword", third one is "via browsing on map" and the last one is "via manually entering global position". We serve any kind of possibilities for positioning, because main purpose of our application depends on global position of user. In some cases user may not have GPS receiver, so other alternatives are important also.

Select Positioning Method

The details of these methods are:

- **Via GPS Receiver:** This is the first option. If user has a GPS receiver connected to PDA, then this option is enabled. GPS serves the most accurate positioning information among our other positioning methods. The only thing that user has to do is selecting this option. Then NMEA 01803 strings will be read from the serial port, $GPRMC sentences, which are the "recommended minimum" sentences that contain longitude, latitude and altitude information (detailed information can be found in our GPS research report), will be interpreted by our GPS string interpreter class. Once this option is selected, user's position will be updated automatically in specific time intervals like 10 seconds. Additionally, this is the only option that web users are unable to select.

- **Via Address Keyword:** This option is added by the advice of our instructors and we believe it is very crucial. When user does not have a GPS receiver, (s)he can enter some keywords which may be consisting of streets, avenues, towns, etc. Then search query is sent to server and vector map of that place is shown to user. For example, user may enter "100.yıl Pazarı" or "Necatibey Caddesi", then a map with its center having the found place is returned to user. User can now easily determine his/her exact position by browsing on the map, navigating, zooming in and out. All properties of map menu are available to user at that time. This is the best option for web users also.

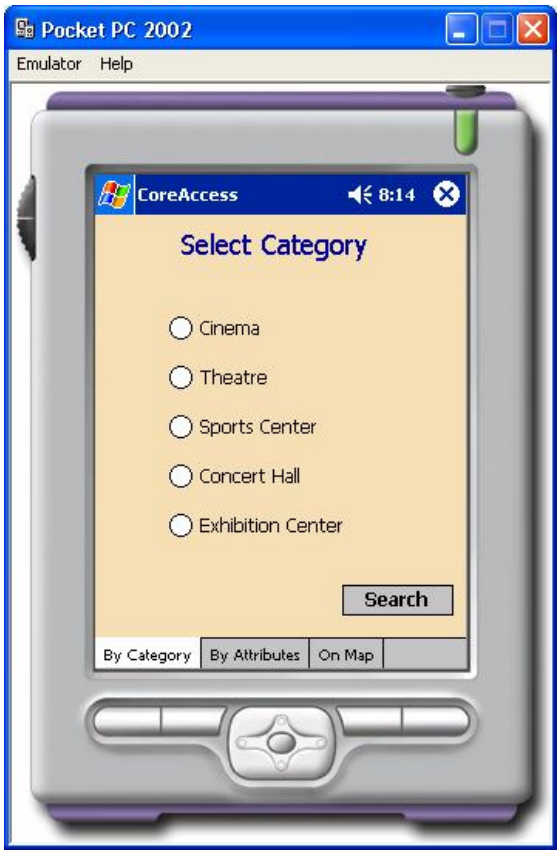
- **Via Browsing on Map:** In fact, this option is similar to the previous one. The only difference is, now user does not specify any address keyword. When this option is selected, city map of Ankara for example is displayed to user. Then the user is able to determine his/her exact position by browsing on the map, navigating, zooming in and out. Again, all properties of map menu are available to user at that time. This option is also beneficial for web users. When user decides a point on the map, the latitude and longitude information of that point is determined and sent to server as the global position of user.

- **Via Manually Entering Global Position:** This is the last option and its main purpose is to meet our testing demands when we don't have GPS receiver, in fact. However there may be some users who are sure about their latitudes and longitudes especially by the help of observing Google Earth in these days. We can not claim that this option is helpful to users in general, so maybe we will hide this property in the final release of our product. Its working mechanism is very easy, user only fills in the latitude and longitude text fields. Then this information is sent to server as global position of the user.

- **Search Activity:** User's global position is taken, now the search menu appears to the user. The application area of our project is social activities. These activities are cinema, theatre, music and sport. There are three different search options in this menu. First one is "search by category" option, second is "search by attributes" option and the last one is "search by browsing map" option. The results of all these three options are identical, they will return a result list. This is very important for modular programming. Graphical representation of this situation can be found in our early State Transition Diagrams. This result list will contain the major identities of found places, which will be explained in the following part.

The details of these three menus are:

- **Search by category:** If user wants to do an activity, but no matter the place, he/she can search for the appropriate places. The only necessity is to determine a category name between the cinema, theatre, music and sport categories. In fact, this option is for users who do not have any idea about what to do. For this reason, user may want to see the social activities around him. For instance, if a user in METU campus decides to go to cinema and select "cinema" category in this menu, our application will find the nearest cinemas around him. Results for this example may be first METU cinema (U3), then Bilkent and finally Tüze Armada. Moreover, he/she can view from the map.

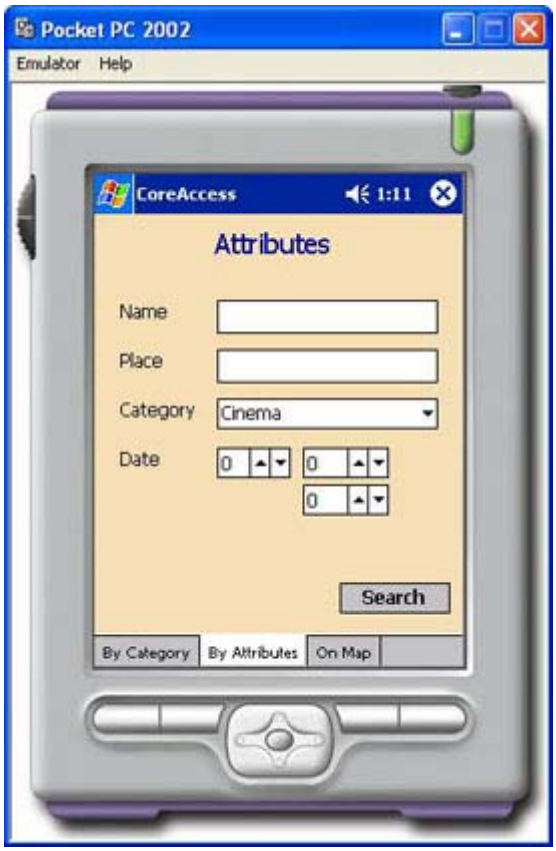


Search by Category

- **Search by attributes:** This option is for users who have at least some idea about what to do. User is able to enter his criterias for the activity he/she wants to do. These criterias may be;

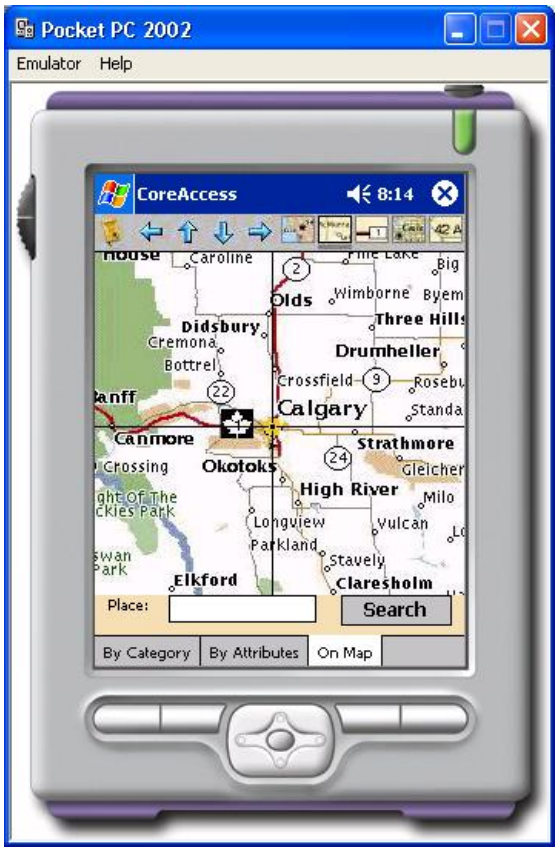
  - Activity name,
  - Activity place,
  - Activity category,
  - Let activity date between preferred dates.

  User is able to specify none, one or many of these criterias. The number of entered criterias increases the detail level of search. Then, according to entered criterias, search is successfully done and results are shown to user as a list sorted according to smallest distance value.



Search by Attributes

- **Search by browsing map:** This option is for users who do not want to use text based menus for searching. In this menu, according to users' global position, local map is shown to user. Moreover, users can also enter some address keywords and then system will bring the related piece of map. User position is signed on the map. He can browse, zoom in/out, rotate map and select the activity place. Visible activity places may vary according to zoom level of the map. After deciding on the activity place from the map, following options will be the same as previous search methods.



Search on Map

- **Select from Result List:** All three search options mentioned above come to this menu. The results are displayed to user as a list sorted from nearest to furthest. There may be more than one result, on the other side search may return empty list if even our ontology definitions fail to find a result. The activities and places are listed with their keywords in this menu. User can select one or more items from this menu. Next, he has two options on the selected items. User can either see the details of the activity and place in written form or see the places on the map. The details of these menus are explained in the following sentences.

Result List

- **Display Written Details:** This menu shows the details of the selected activity or place. The written details in this menu include:

    - Activity name,
    - Activity place,
    - Activity date and time,
    - Activity place's address and phone,
    - Extra properties of the place like having parking place, children playground, etc,
    - Link to transportation options.

Written Details

User can easily go back to returned results menu and display another item's details. Transportation options are not shown automatically because user may not want to see them. Therefore, there is a link for transportation options in this menu. If user selects it, then transportation menu will appear.

- **Transportation Menu:** This menu is a sub menu of "display written details" menu because it is an optional menu. If user selects it, the transportation options between the user's global position and activity place's global position will be shown to user. This menu has both written part and visual part which consists of the shortest path displayed on vector map. The written part includes the followings for the selected transportation option:

    - Names of the vehicles (since there may be combination of vehicles as a result),

- Vehicle information (for ex: 132: ODTU – Kızılay),
- Estimated distance,
- Estimated time (for the work hours, this variable may be treated differently),
- Cost of the vehicle combination.

The transportation methods mentioned here may be “bus”, “dolmuş”, “metro”, “tramway”, “taxi” and finally “on foot”. We have the path of each transportation method in our database. There may be cases when there is more than one possible way to reach activity place, or there may not be any public transportation vehicles available at that time to desired place and taxi would be the only solution. For all cases, “taxi” is the final option in CoreAccess.

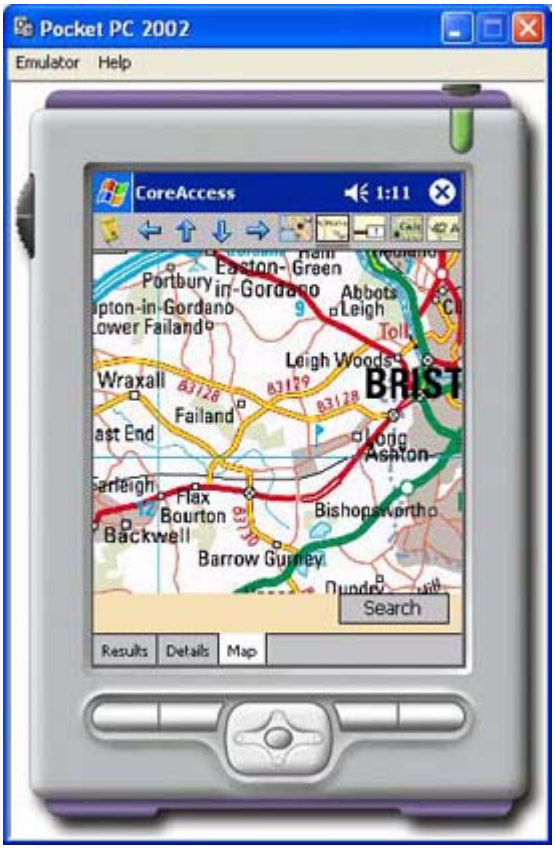
Secondly, as we have mentioned above, user is able to see the combination of vehicles on the map. This time, shortest path for the selected combination will be drawn on vector map. For finding shortest paths, we will use efficient shortest path and graph algorithms. Again, user is able to do all the functionalities of map menu like zooming in / out, navigating, etc. Moreover, the distance of the paths may be shown on the map. This is a good option for comparing the distances of the paths. With the help of this property, user can manage his time efficiently. In the same manner as previous “Display Distance” option, estimated time and cost values may be shown on the map also. This property will increase the time and cost efficiency of the user’s choice.

- **Display Items on Map:** This menu is second sub menu of "result list" menu. In this menu user is able to see his selections on the map. User may select more than one place in the previous selection menu. On the map, his global position and selected activity places will be shown with a placemark. The paths directed from his global position to activity places will also be drawn in different colors. Furthermore, user can make following operations on the map:

    - **Zoom in/out:** Map can be zoomed in / out.

    - **Rotate:** Map can be rotated either clockwise or counter clockwise.

    - **Browse Map:** User does not have to stick to the result map. He is able to browse the map by going upwards, downwards, left and right.



Display Items on Map

User can easily go back to returned results menu and display another item's details on map.

- **Select Language:** Our user application is multilingual. This is a very easy thing to do in fact, we don't expect a locale problem.

Select Language

5.2. Content Manager Functionality

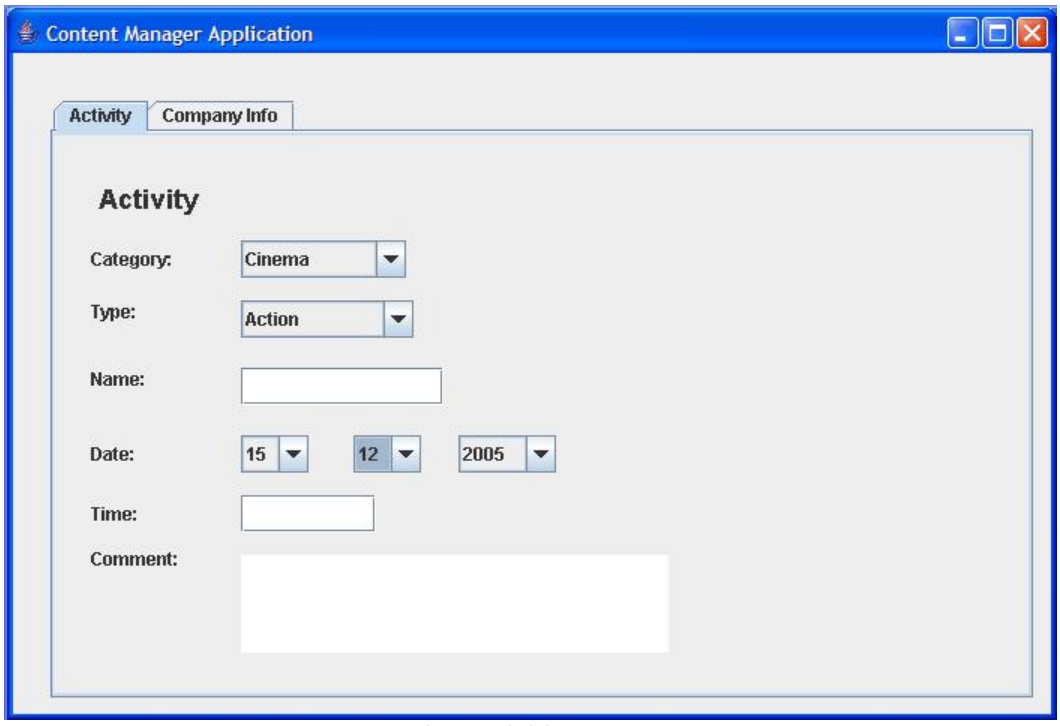
The duty of content manager is to change the contents of their company's social activities. For instance, the content manager of a cinema can add the new films which are on screen. Content manager may be responsible of managing several places' activities. The followings are the capabilities of the content manager's functions:

- **Login:** A content manager has to login to the system first with his id and password. A content manager may have the ability to modify only one place's activities or a number of places' activities.

- **Add/Modify/Delete Activity:** If new activities are available, content manager has the responsibility to add new activities and move the past activities to history. There may be cases when content manager needs to delete or modify the activity. The properties of the activities need to be entered are:

    - Activity Name
    - Activity Time
    - Activity Place (hall)

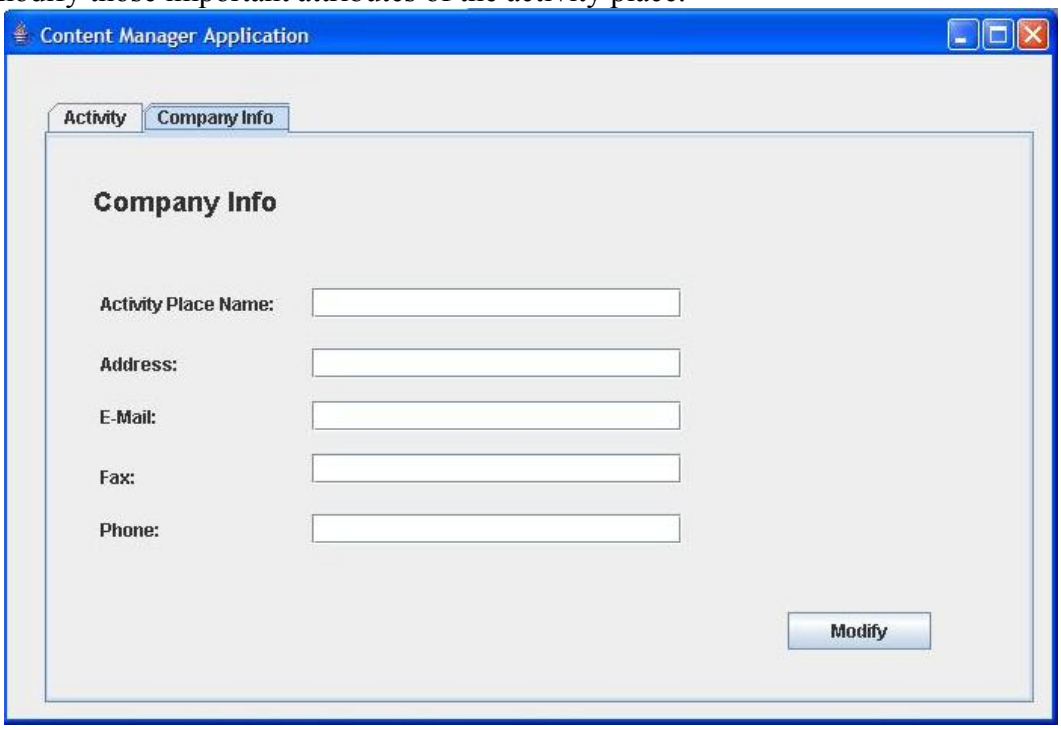
- Activity Cost
- Activity Type



Managing Activities

- **Add/Modify short description about the activity:** Content manager can add brief information about the activity. Thus, users can have some idea before attending any activity.

- **Add/Modify phone number/address/e-mail address:** Content manager can add or modify those important attributes of the activity place.



Managing Company Info

5.3. System Administrator Functionality

System Administrator has the highest level rights. He is able to do anything that user and content manager can do. Apart from those rights, he is responsible for uploading map data, ontology information, determining the relation between instances in the ontology. Functionalities of system administrator are explained below extensively:

- **Login:** In order to accomplish main activities, system administrator has to login to the system for security. This feature enables the protection of database contents of the application. Only system administrator has the right to modify and add the contents of the ontology and map data.

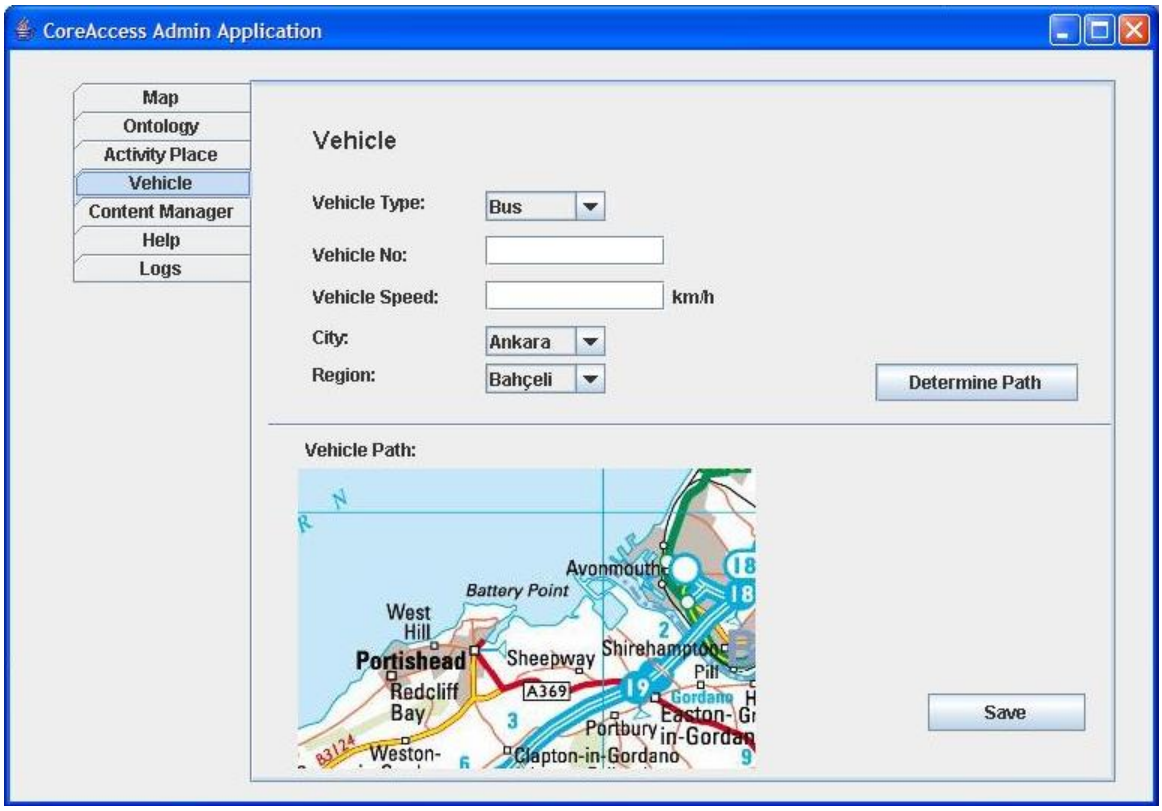
- **Upload/Delete/Modify Map:** In this functionality, system administrator can upload map, delete map, modify map. Some new areas that were not in the coverage area of CoreAccess can be added to extend the coverage area. In the same manner, some areas may be discarded or modified.

Admin - Manage Map

- **Add/Modify/Delete Node:** Nodes are very important in CoreAccess. All maps are processed as connected nodes. Activity places are special nodes. Apart from activity places, there are lots of nodes to describe roads. Vehicles' paths are constructed by series of connected nodes. As a result, its system administrator's responsibility to manage all nodes.

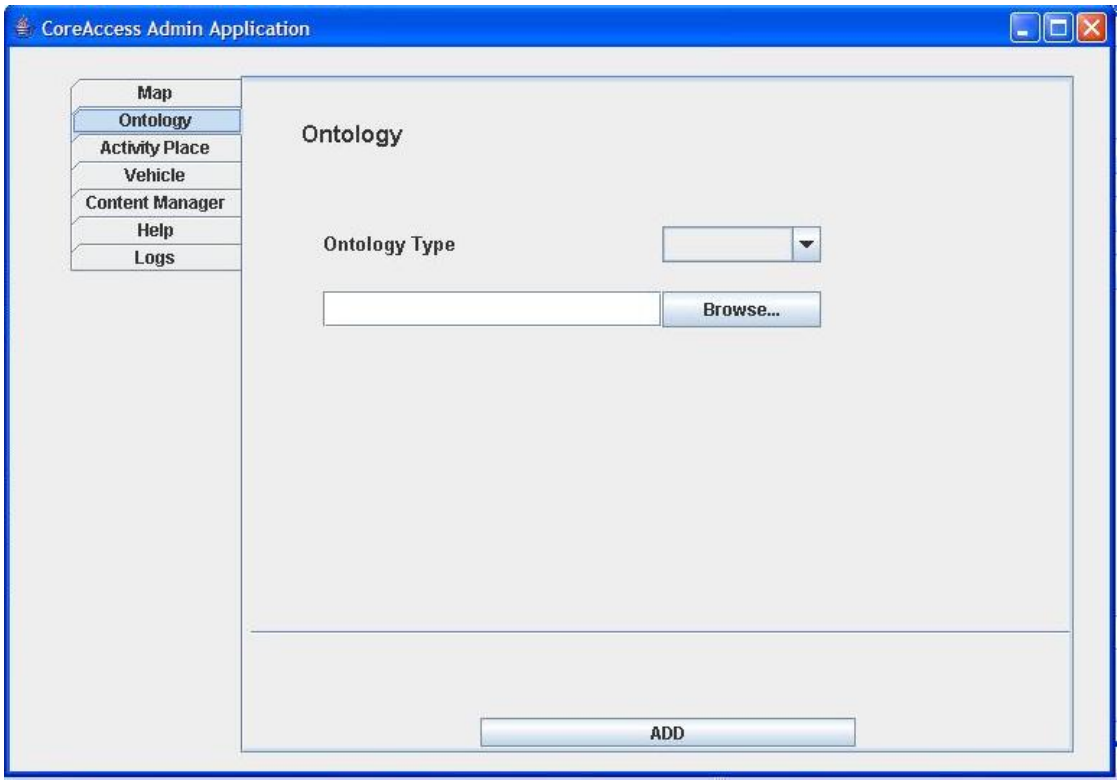
- **Add/Modify/Delete Vehicle:** System administrator can add, modify or delete a vehicle. As explained in the previous part, vehicles' paths are defined by connected nodes. System administrator can change the path of the vehicle by adding new nodes or

removing existing nodes. Moreover, system administrator can manage the type (which may be one of "bus", "dolmuş", "metro", "tramway" or "taxi"), time_divider and cost_multiplier of the vehicle. time_divider and cost_multiplier are vehicle specific properties. These allow the system to estimate cost and duration of a path for selected transportation method.



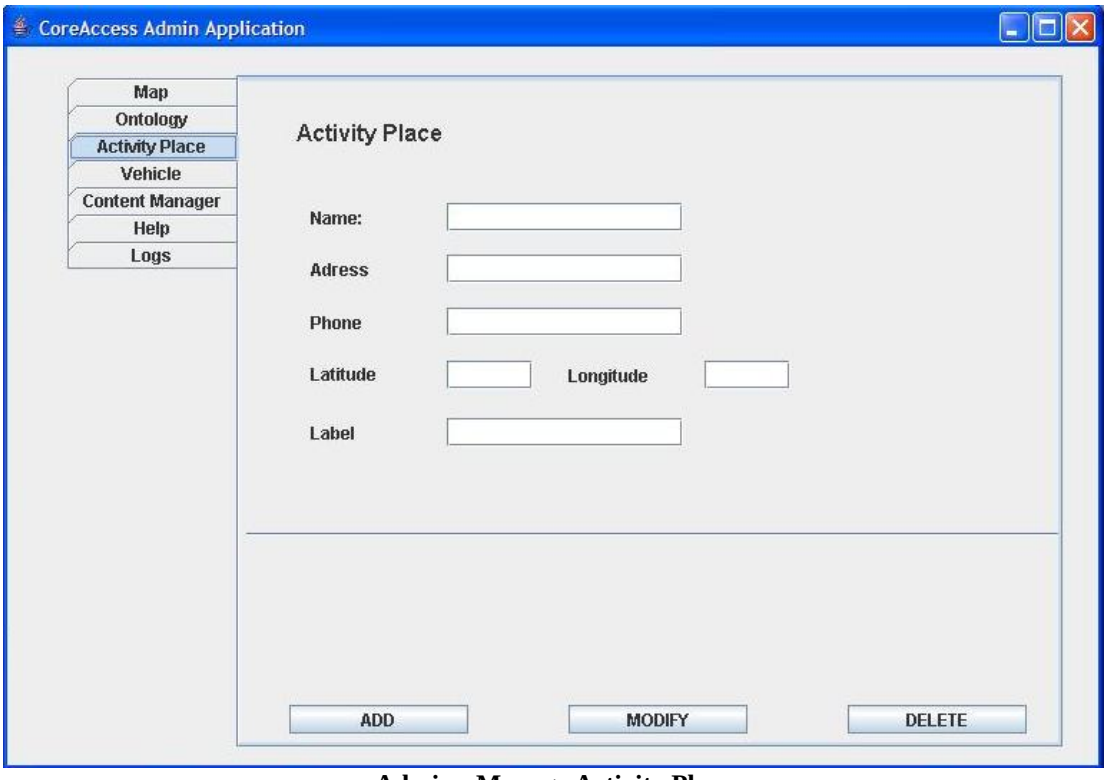
Admin - Manage Vehicle

- **Define/Modify/Delete Ontology:** System administrator can define different ontologies for activities, especially for movies and plays.



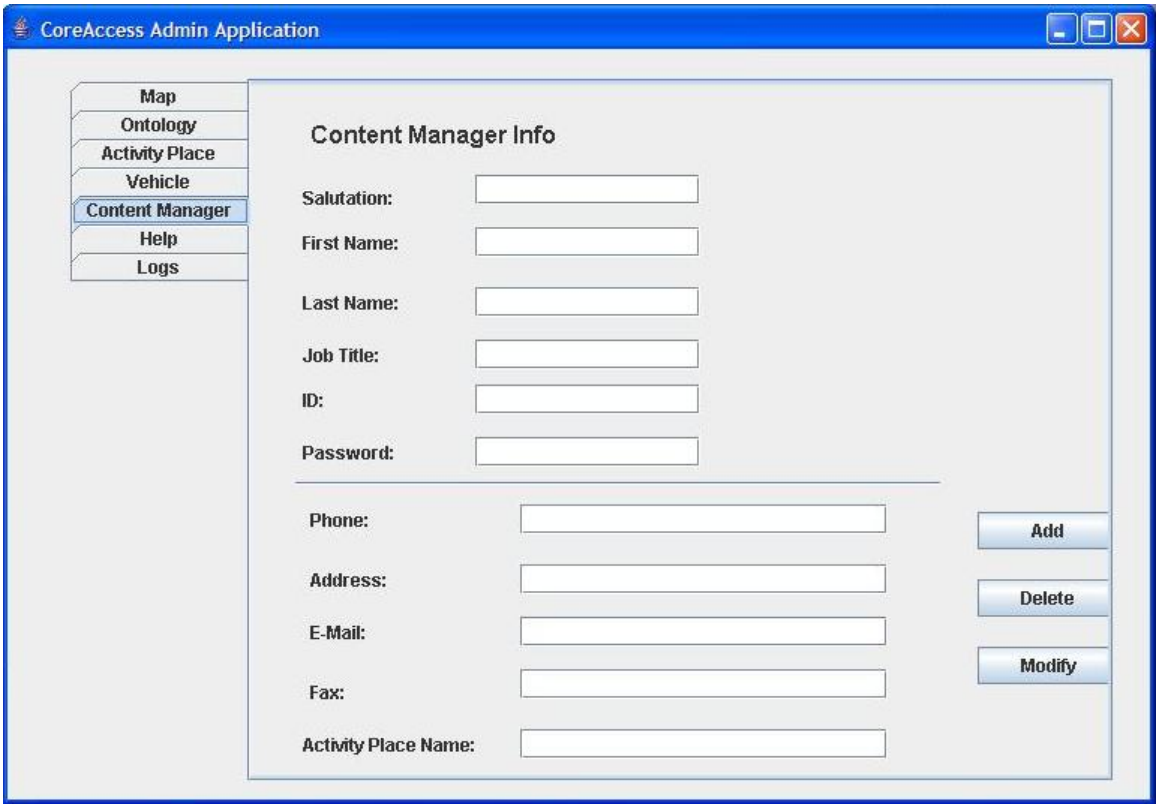
Admin - Manage Ontology

- **Add/Modify/Delete Activity Places:** Content manager can manage activities but its system administrator's responsibility to manage activity places. The attributes that have to be filled are name, address, phone number, e-mail address, Global Position and Node of the activity place.



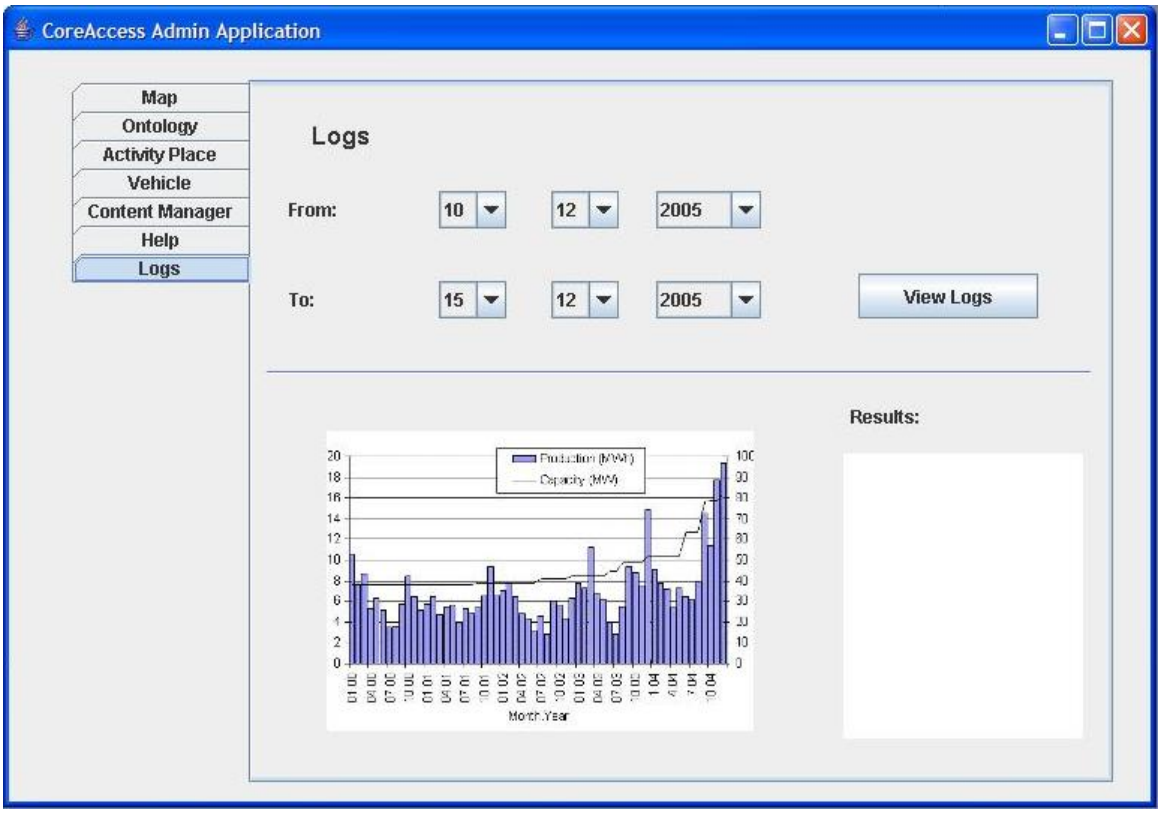
Admin - Manage Activity Place

- **Manage Content Managers:** Its system administrator's responsibility to add new content managers or delete old ones. System administrator gives user id and password to content managers and defines their abilities. Therefore, content managers have limited right to access and modify the database elements.



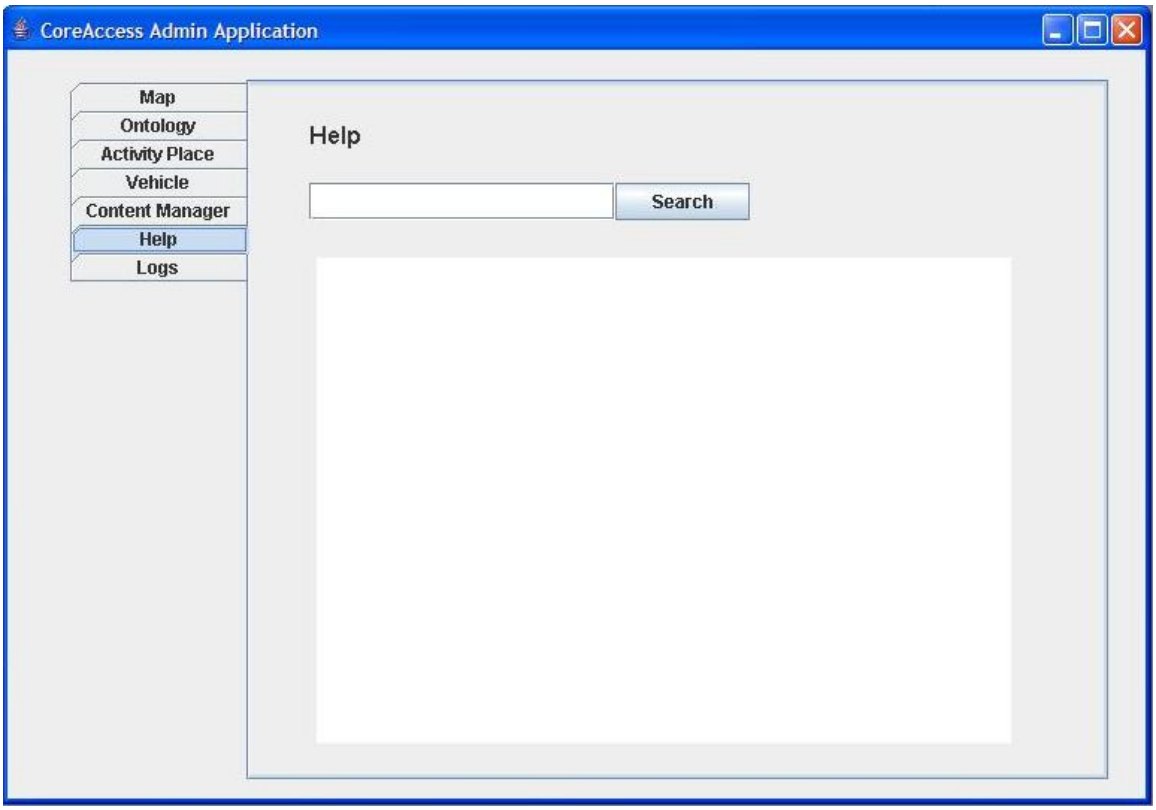
Admin - Manage Content Managers

- **View Logs/History:** One of the most usable properties of CoreAccess is logging. CoreAccess logs all of the user activities. When user makes a search or requests details of any activity/place, CoreAccess stores this information to database. The attributes of the logs are: user ip, global position of the user, time and date, search details, requested activity's details, etc. System administrator is able to see and print these logs any time. By this way, statistical data will be taken and managers and companies will be informed about the usage statistics.



Admin - View Logs

- **Help Menu:** All applications should have a help menu, so this is for the administrator.



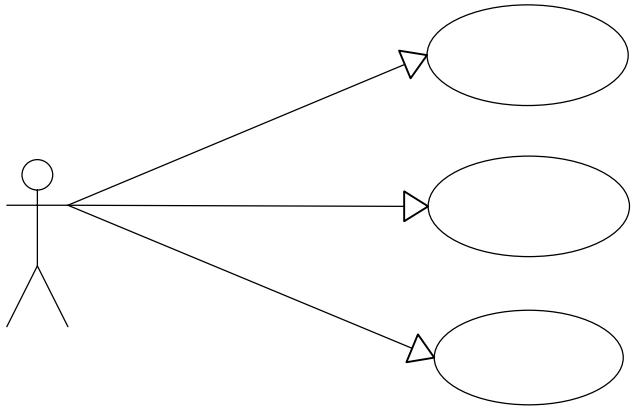
Admin - Help Menu

6. UML DIAGRAMS

6.1. Use Case Diagrams

6.1.1. Use Case Diagrams of the User

6.1.1.1. Positioning Use Case

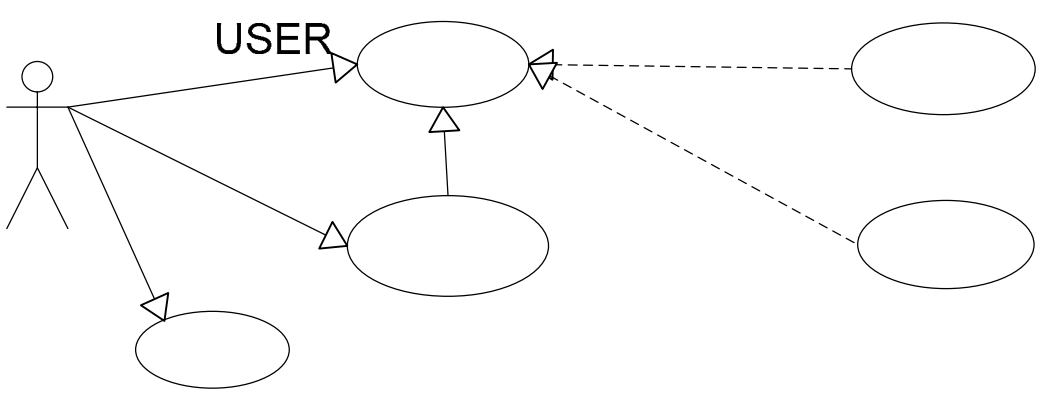


Flow of Events for the Positioning Use-case	
Objective	*To allow the user to get GPS Data from 3 ways*
Precondition	-
Main Flow	*1. User has 3 ways to get GPS Data.* *2. First option is simply getting the GPS Data from a GPS Receiver connected to PDA.* *3. Second option is browsing the map to find the location of the user.* *4. Last option is mainly for users who know exact position of himself/herself by entering manually.*
Post-condition	*The user has the GPS information now. The system knows where the user is.*

Via GPS Receiv

Via Browsing Ma

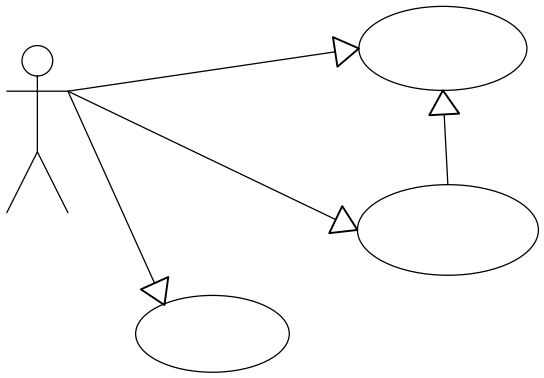
6.1.1.2. Search by Attributes Use Case



Via Manually Entering

Flow of Events for the Search by Attributes Use-case	
Objective	*To allow the user to search the activities with a specific attribute.*
Precondition	*The GSP Data should be received.*
Main Flow	*1. User interacts with the activity attributes interface.* *2. User can view all the attributes for a specific activity. Actually there are some fixed attributes such as "activity name", "activity place", "activity date", etc.* *3. User can make search for the attributes he/she desires.* *4. User can add/update/delete attributes.* *5. Some extra features can be selected in addition to attributes.*
Post-condition	*The user managed the search by activity attributes.*

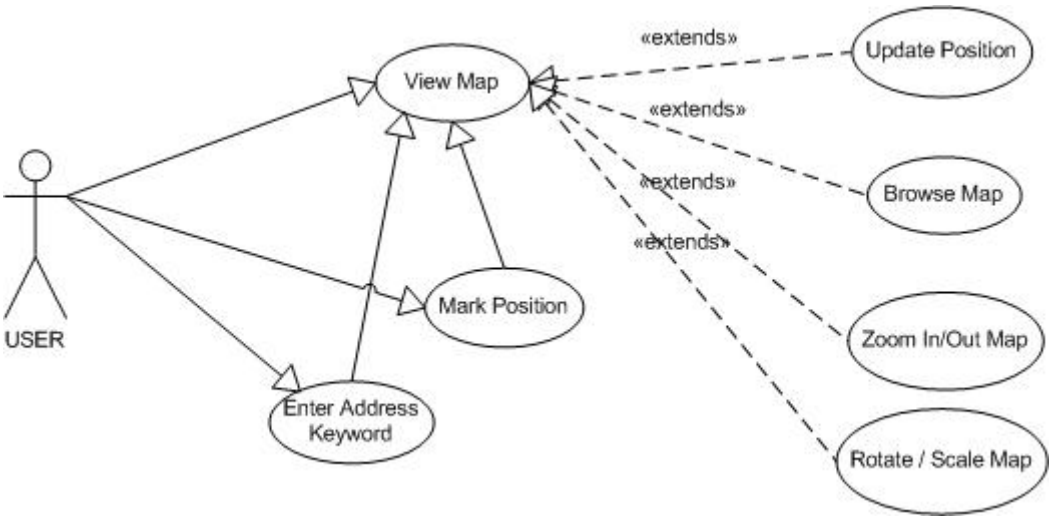
6.1.1.3. Search by Category Use Case



Flow of Events for the Search by Category Use-case	
Objective	*To allow the user to search the activities with a category.*
Precondition	*The GSP Data should be received.*
Main Flow	*1. User interacts with activity category interface.* *2. User can view the four current categories, namely "cinema", "theatre", "concert hall" and "sport center".* *3. User can select category among these four categories.* *4. User can search the database for the selected category.* *5. Some extra features can be selected in addition to activity category.*
Post-condition	*The user managed the search by activity categories..*

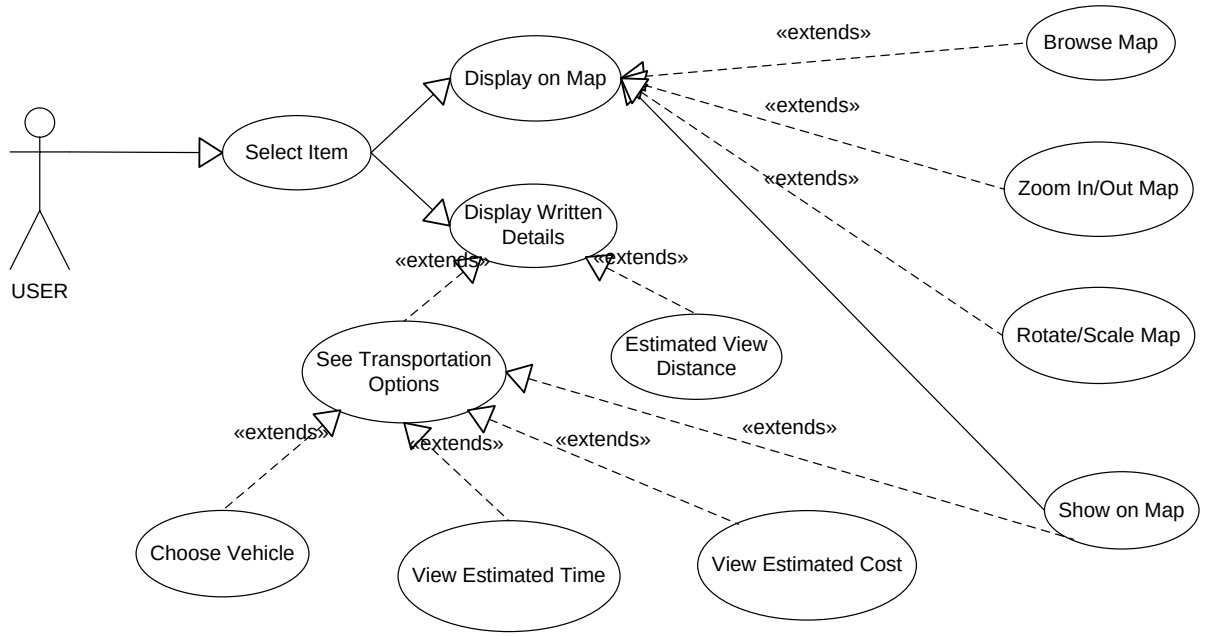
View Category

6.1.1.4. Search on Map Use Case



Flow of Events for the Search by Category Use-case	
Objective	*To allow the user to search the activity place on map..*
Precondition	*The GSP Data should be received.*
Main Flow	*1. User interacts with search on map interface.* *2. User can view the map and mark the activity place on the map.* *3. User can enter a keyword for searching an address.* *4. User can update the position he/she has already done.* *5. User can browse the map according to his/her wish.* *6. On the map the zoom in and zoom out applications can be applied.* *7. On the map rotate application can be applied.* *8. On the map scale application can be applied.*
Post-condition	*The user managed to browse the map for a specific activity.*

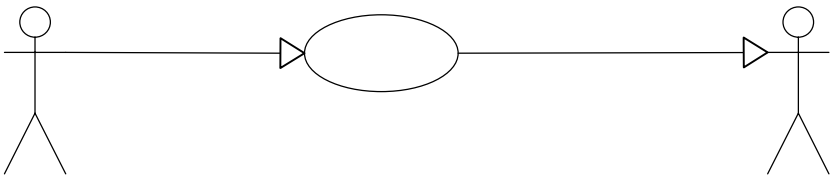
6.1.1.5. Display Results Use Case



Flow of Events for Display Results by Category Use-case	
Objective	*To allow the user to view the search result list.*
Precondition	*The result list for the searches should be returned.*
Main Flow	*1. User interacts with result list interface.* *2. User is faced with results when he/she makes a query.* *3. After the results are displayed, user chooses one item from the result list.* *4. When an item is selected, either the written details of the selection item or the map display of it is seen on the screen.* *5. If user chooses the written details of the item, he/she comes across with the written information about the results. It contains activity name, place, date, time, address and phone number of the activity place, estimated distance etc. In addition to this, transportation options can be seen if user desires. The transportation options include choosing the transportation vehicle, viewing the estimated time and cost for the distance. User can switch to map view from this view.* *6. If user chooses the map display of the selected result item, he/she can observe the activity place and the routine on the map. User can do browse, zoom in, zoom out, rotate and scale operations on the map. Switching to written details of the selected item is possible as told above.*
Post-condition	*The user managed to see the query results.*

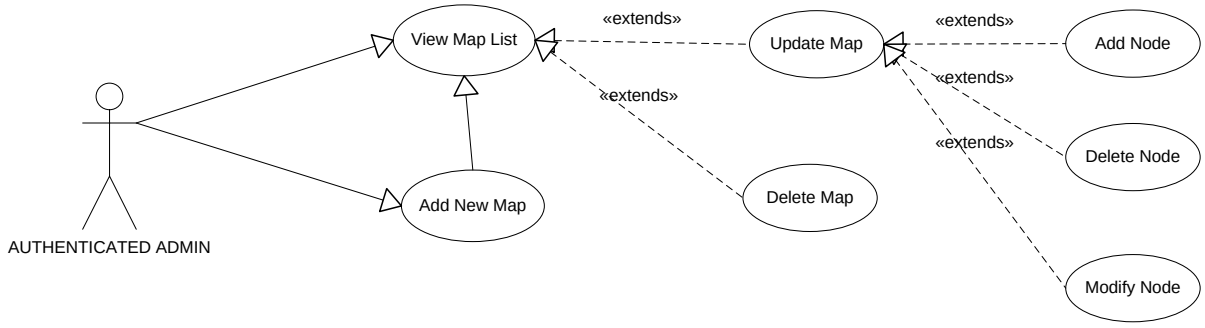
6.1.2. Use Case Diagrams of the Administrator

6.1.2.1. Login Use Case



Flow of Events for Login Use-case	
Objective	*To allow the administrator to get into the system.*
Precondition	-
Main Flow	1. *Administrator interacts with the login interface..* 2. *Administrator is requested to enter his/her username and password for getting into the system.* 3. *After entering his/her information, the validity of these is checked.* 4. *If the information is false, the administrator is simply rejected, warned and prompted to enter the information again.* 5. *If the information is true, the administrator is allowed to get into the system.*
Post-condition	*The administrator is in the system now.*

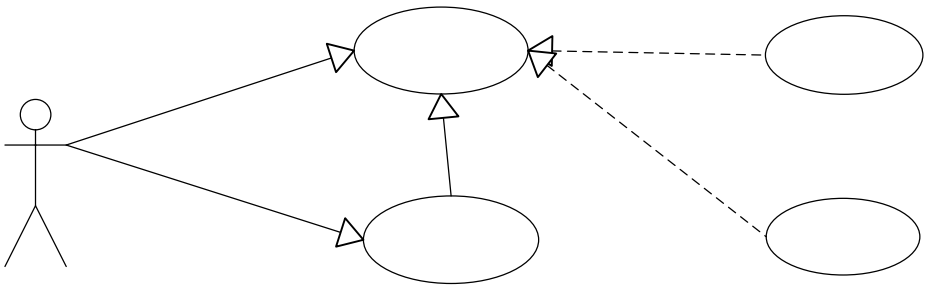
6.1.2.2. Manage Map Use Case



Flow of Events for Manage Map Use-case	
Objective	*To allow the administrator to manage the map.*
Precondition	*The administrator should be logged in.*

Main Flow	*1. Administrator interacts with the map managing interface.* *2. Administrator can view all the map lists.* *3. Administrator can add new map to the map list.* *4. Administrator can update a specific map.* *5. Updating the map can be done by adding/modifying/deleting nodes.* *6. Administrator can delete a specific map from the map list.*
Post-condition	*The administrator did map managing work.*

6.1.2.3. Manage Activity Place Use Case



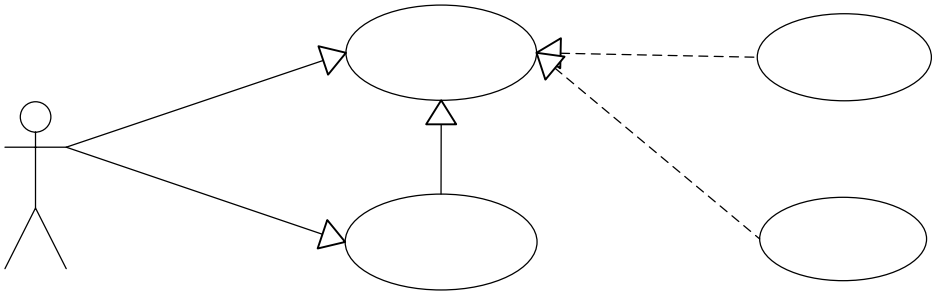
Flow of Events for Manage Activity Place Use-case	
Objective	*To allow the administrator to manage activity place.*
Precondition	*The administrator should be logged in.*
Main Flow	*1. Administrator interacts with activity place interface.* *2. Administrator can view the entire activity place list.* *3. Administrator can add new activity places.* *4. Administrator can update a specific activity place.* *5. Administrator can delete a specific activity place.*
Post-condition	*The administrator is managed to do activity place operations.*

View Place Li

Add New Pla

AUTHENTICATED ADMIN

6.1.2.4. Manage Vehicle Use Case



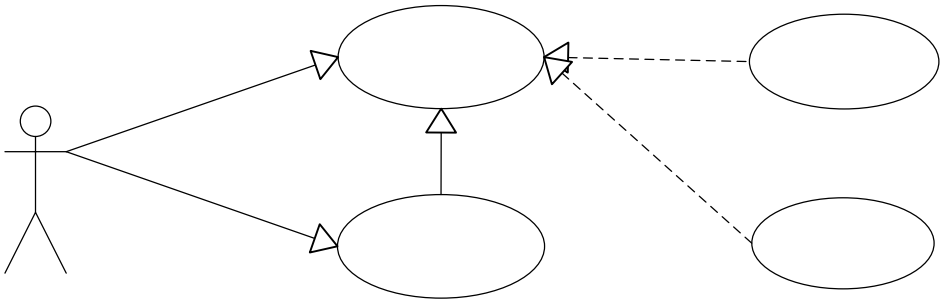
Flow of Events for the Manage Vehicle Use-case	
Objective	*To allow the administrator to manage the vehicles.*
Precondition	*The administrator should be logged in.*
Main Flow	*1. Administrator interacts with vehicle interface.* *2. Administrator can view the entire vehicle list.* *3. Administrator can add new vehicles.* *4. Administrator can update a specific vehicle.* *5. Administrator can delete a specific vehicle.*
Post-condition	*The administrator did vehicle managing work.*

View Vehicle L

Add New Vehi

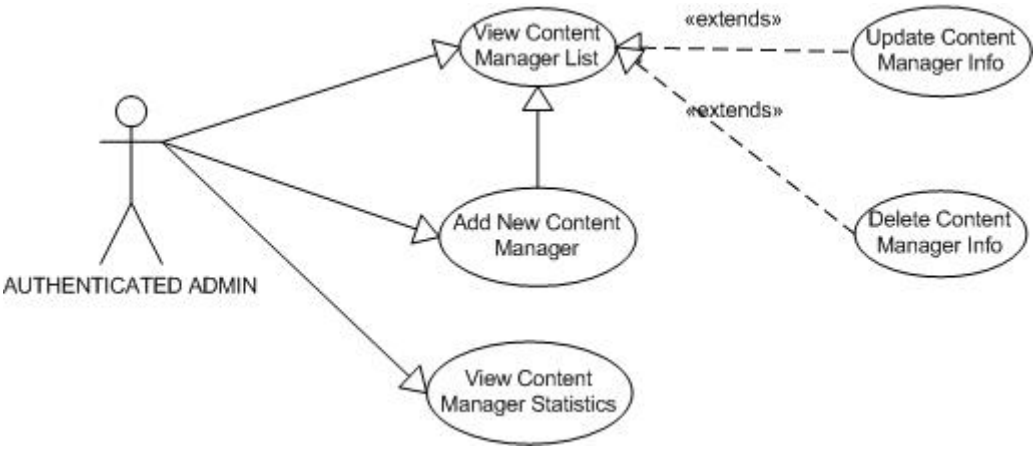
AUTHENTICATED ADMIN

6.1.2.5. Manage Ontology Use Case



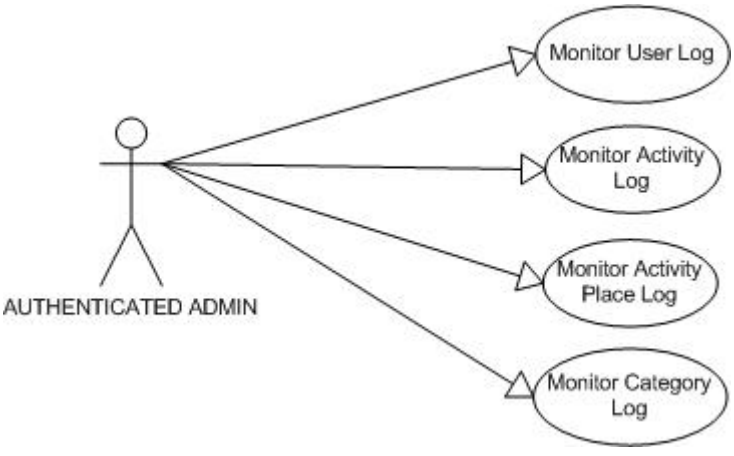
Flow of Events for the Manage Ontology Use-case	
Objective	*To allow the administrator to manage the ontologies.*
Precondition	*The administrator should be logged in.*
Main Flow	*1. Administrator interacts with ontology interface.* *2. Administrator can view the entire ontology list.* *3. Administrator can add new ontologies.* *4. Administrator can update a specific ontology.* *5. Administrator can delete a specific ontology.*
Post-condition	*The administrator did ontology managing work.*

6.1.2.6. Manage Content Managers Use Case



Flow of Events for the Manage Content Managers Use-case	
Objective	*To allow the administrator to manage the content managers.*
Precondition	*The administrator should be logged in.*
Main Flow	*1. Administrator interacts with content manager interface.* *2. Administrator can view the entire content manager list.* *3. Administrator can add new content managers.* *4. Administrator can update a specific content manager.* *5. Administrator can delete a specific content manager.* *6. Administrator can view the content manager statistics.*
Post-condition	*The administrator did content manager managing work.*

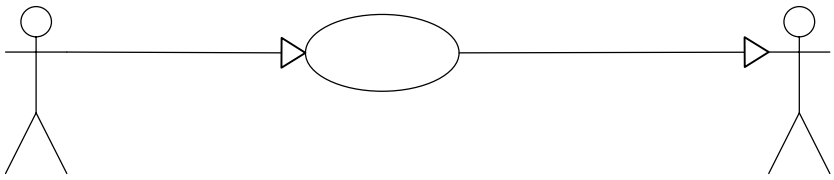
6.1.2.7. Log Use Case



Flow of Events for the Log Use-case	
Objective	*To allow the administrator to manage the logs.*
Precondition	*The administrator should be logged in.*
Main Flow	*1. Administrator interacts with log interface.* *2. Administrator can monitor the relevant user log.* *3. Administrator can monitor the activity logs.* *4. Administrator can monitor activity place log.* *5. Administrator can monitor category logs.*
Post-condition	*The administrator did log managing work.*

6.1.3. Use Case Diagrams of the Content Manager

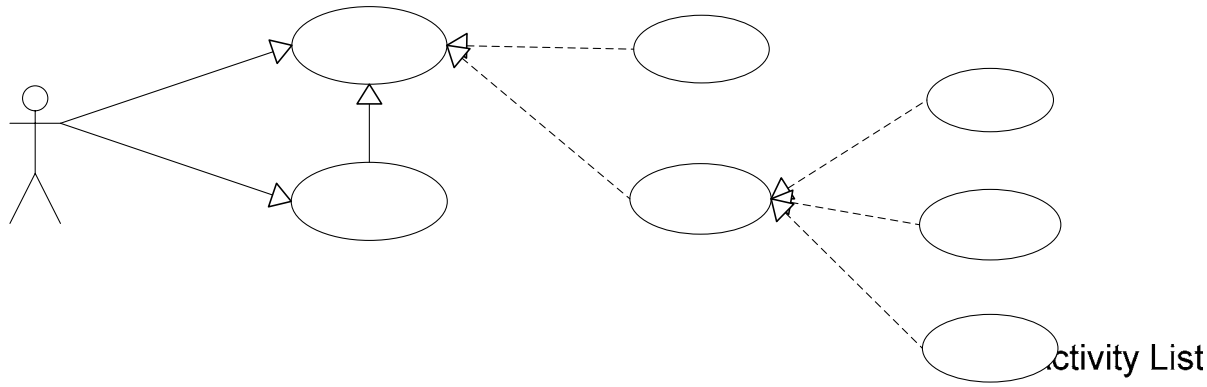
6.1.3.1. Login Use Case



Flow of Events for Login Use-case	
Objective	*To allow the content manager to get into the system.*
Precondition	-
Main Flow	*1. Content manager interacts with the login interface.* *2. Content manager is requested to enter his/her username and password for getting into the system.* *3. After entering his/her information, the validity of these is checked.* *4. If the information is false, the content manager is simply rejected, warned and prompted to enter the information again.* *5. If the information is true, the content manager is allowed to get into the system.*
Post-condition	*The content manager is in the system now.*

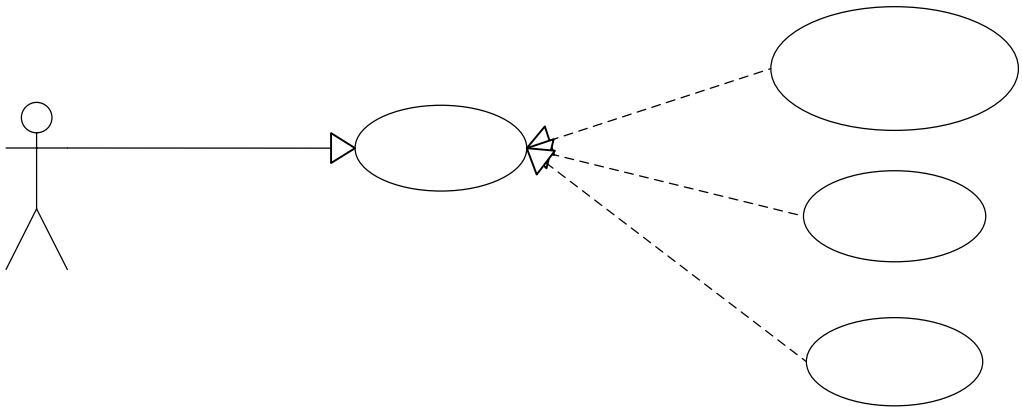
Login

6.1.3.2. Manage Activity Use Case



Flow of Events for Manage Activity Use-case	
Objective	*To allow the content manager to manage the activities.*
Precondition	*The content manager should be logged in.*
Main Flow	*1. Content manager interacts with the activity interface.* *2. Content manager can view the entire activity list.* *3. Content manager can add a new activity to the list.* *4. Content manager can update a specific activity.* *5. Updating an activity can be done by adding/modifying/deleting the activity description.*
Post-condition	*The content manager managed to do activity work.*

6.1.3.3. Manage Activity Place Use Case

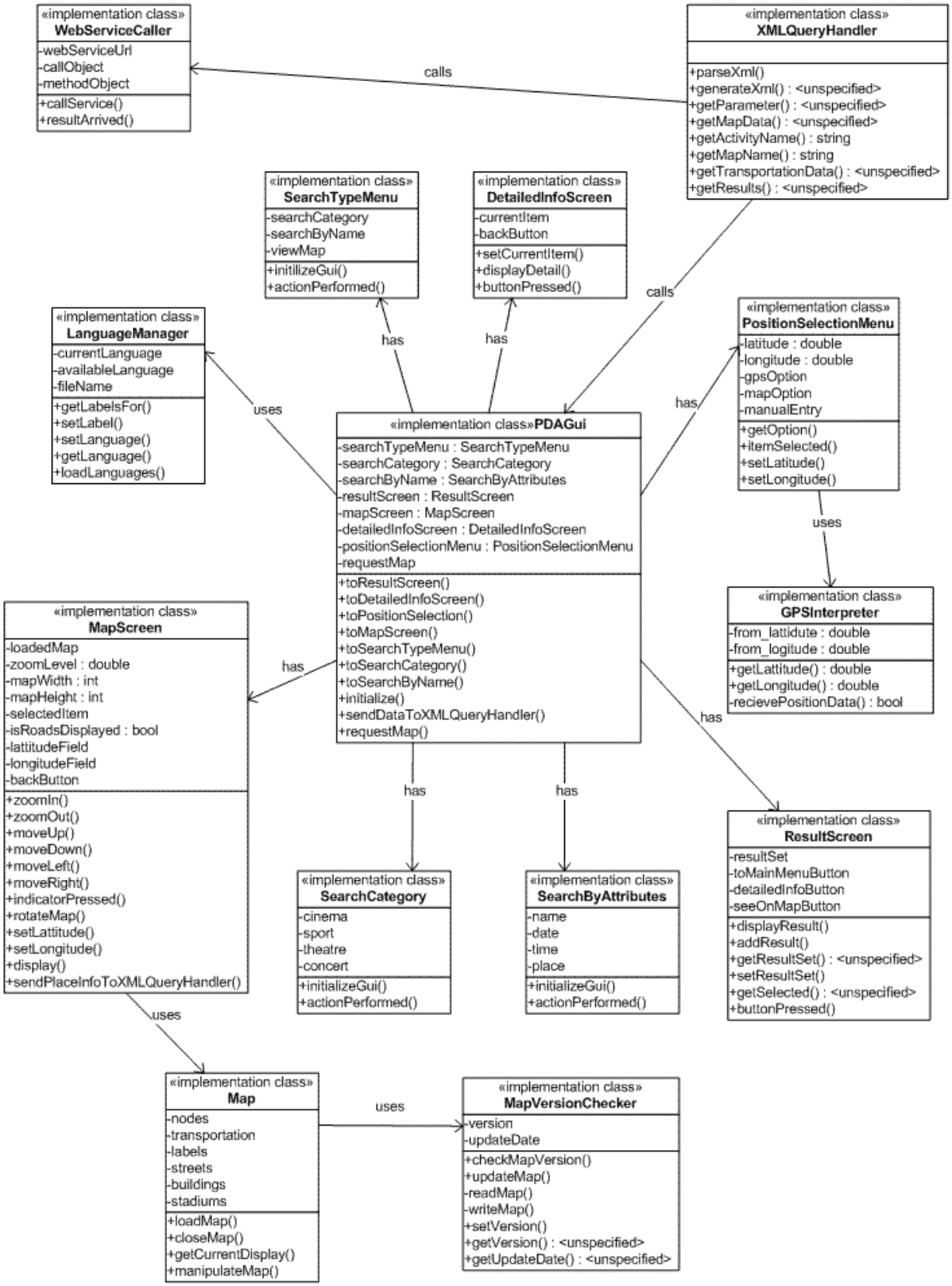


Flow of Events for Manage Activity Place Use-case	
Objective	*To allow the content manager to manage the activity places.*
Precondition	*The content manager should be logged in.*

Main Flow	*1. Content manager interacts with the activity places interface.* *2. Content manager can update the activity places.* *3. Content manager can update the phone numbers of activity places.* *4. Content manager can update the addresses of activity places.* *5. Content manager can update the e – mails of activity places.*
Post-condition	*The content manager managed to do activity places work.*

6.2. Class Diagrams

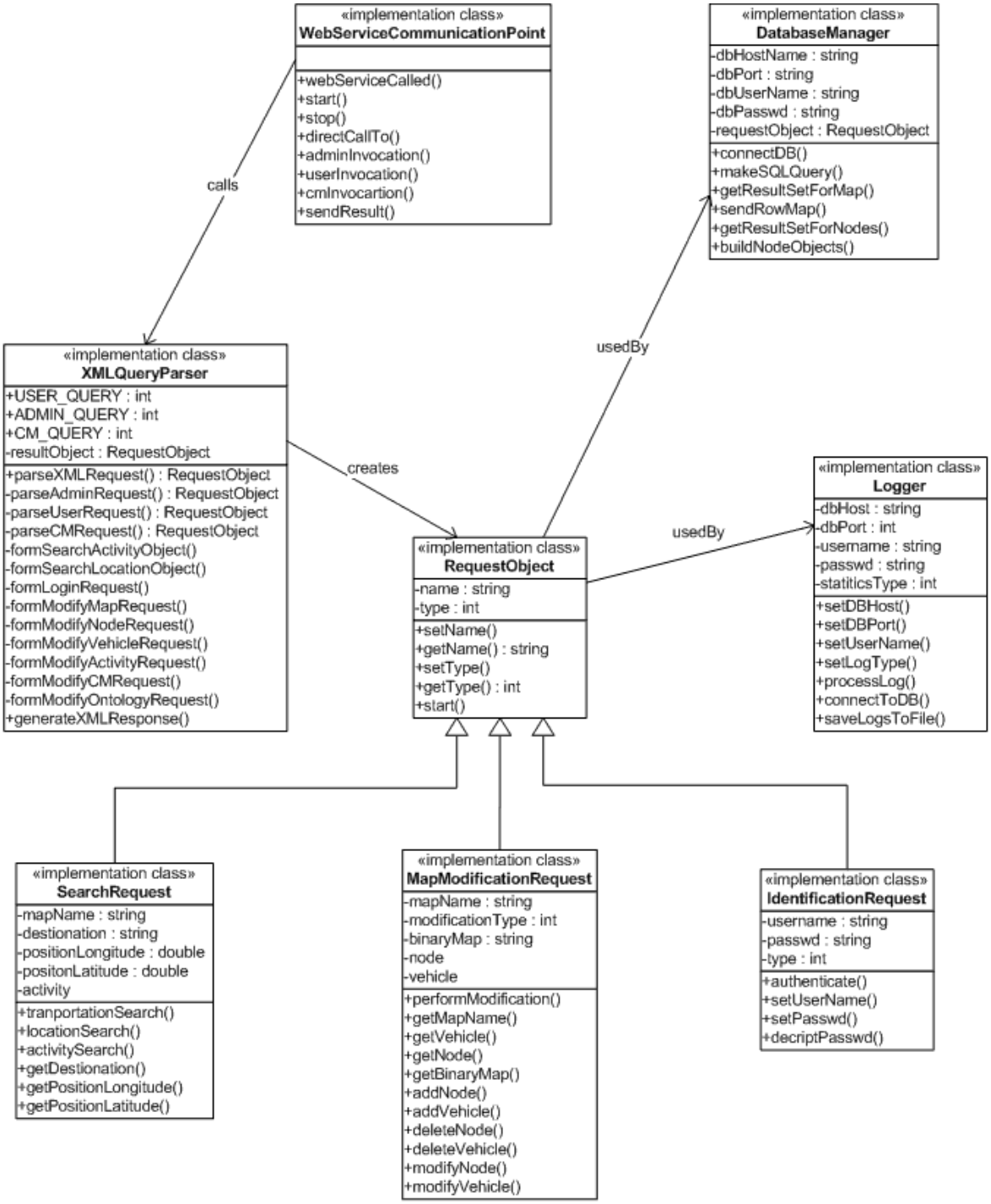
6.2.1. PDA Class Diagram



The classes in this part are PDA Gui and some interaction classes which communicates via web service with server. In order to manage user interface forms a class called **PDAGui** is designed. This class contains methods which send signal to other forms in order them to be activated. Other classes that depend on the received signal from PDA Gui are in the following. PDA Gui class has these classes. They are:

- **PositionSelectionMenu:** This class is for selecting the way of gathering position of user. These ways are via GPS device, via indicating from map and via manual entry of latitude and longitude.
- **SearchTypeMenu:** This class is for determining search option. The presented options in CoreAccess are "search by category", "search by activity name" and "browse on map for activity". Please refer to Analysis report for detailed explanation about choices.
- **SearchByAttributes:** This class is for starting search by activity name and some propoperties of activity such as date, time, etc.
- **SearchCategory:** This class is for starting search by category which are theatre, cinema, sport and concert.
- **ResultScreen:** This class is for displaying the results in a list. When user selects an item from this list, s/he can see the details of the item or see the item on the map.
- **DetailedInfoScreen:** This class is for illustrating details of activity or place which is selected from result screen.
- **MapScreen:** This class is for displaying the item selected from result screen on the map. In this way user can see the direction and distance of the activity and browse on the map.
- **LanguageManager:** This class is for enabling multilingualism. User can change language in every screen in PDA. PDAGui class controls "change language" signal which comes from this class when it is called.
- **GPSInterpreter:** This class is for getting information from GPS. This class accesses to the GPS device and gets latitude and longitude of the user from GPS device and sends it to the PDA.
- **Map(In PDA part):** This class is for storing map in PDA. If user runs the program first time, map is loaded to the PDA via this class. If it is not first time, the version is checked. If the original map was changed, it is loaded again. If not, it is remains as it is.
- **MapVersionChecker:** This class is for checking the version of map. As it is mentioned above, It is interacts with Map class. Keep the version of the map and controls the new map version. If the versions are different, it informs that to the PDA.
- **XMLQueryHandler:** This class is for handling the XML files which come to web service and which are sent to the PDA. The gathering information from PDA are added to the XML file and generateXml() function of this class is called. When an XML file come from web server, parseXml() method is called and the file is parsed in that class and the information sent to the PDA.
- **WebServiceCaller:** This class is for calling web service. After XML file generated the web service is called and communication is built.

6.2.2. Request Handler Class Diagram



This Part is for generating object according to the request come from user. We have an main class called **RequestObject**. Some classes are inherited from the RequestClass. These objects are in the following:

- **SearchRequest:** This class represents search request of user about. According to the received information, the object initializes itself with the attributes.
- **MapModificationRequest:** This class represents the modification request for map. The database gathers nodes according to instance of this class.
- **IdentificationRequest:** This class represents the authentication request of Administrators and Content Managers. According to the password and id of the staff, it decides whether give permission or not to enter to the system.

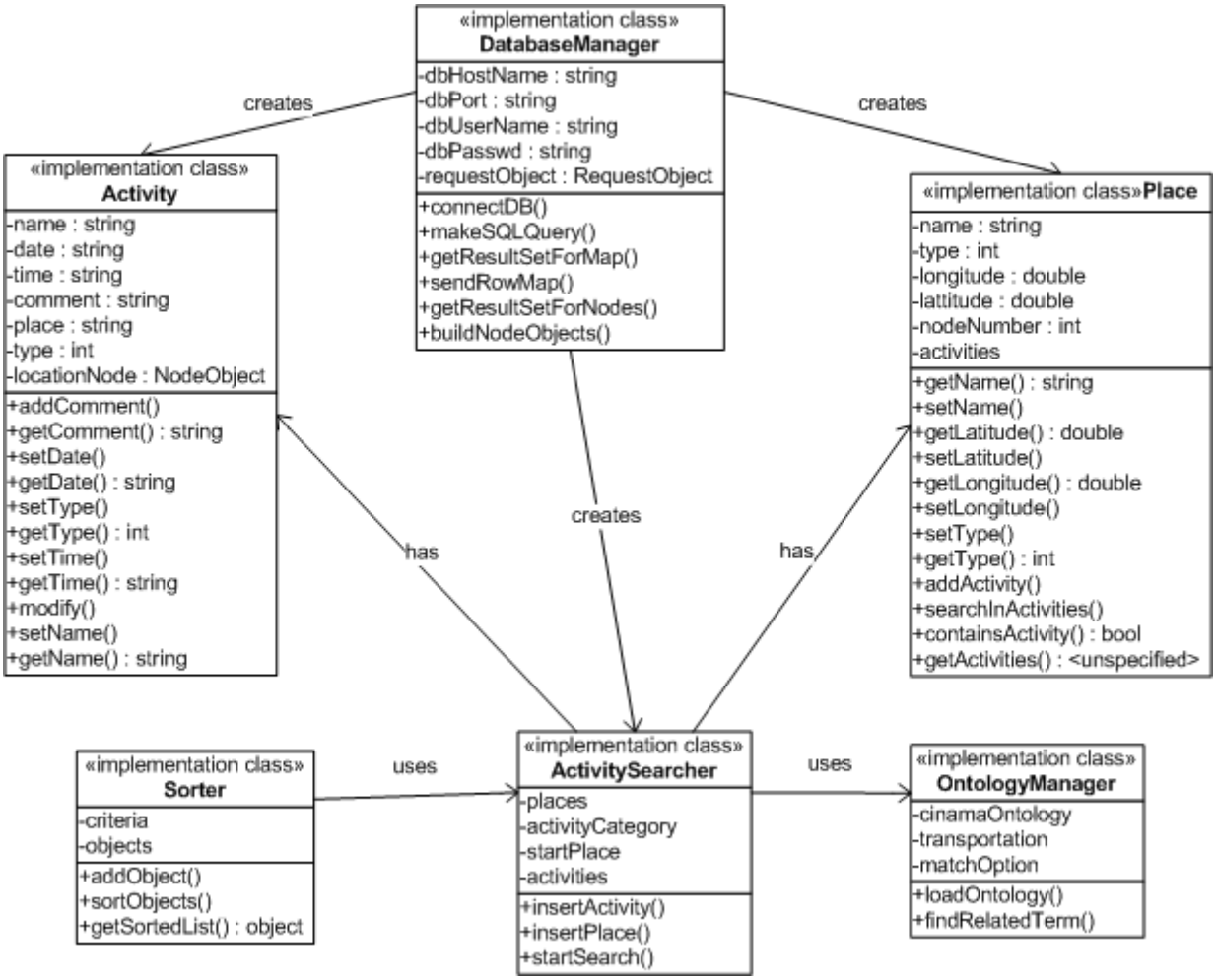
When the request object is created, it is firstly sent to **Logger** in order it to be saved in the database for statistical information.

XMLQueryParser class is responsible for parsing the received xml messages and forming the request objects using the information in xml.

DatabaseManager is the responsible class in dealing with database. According to the RequestObject arrived it forms the required sql queries. Other duties of this class are explained below.

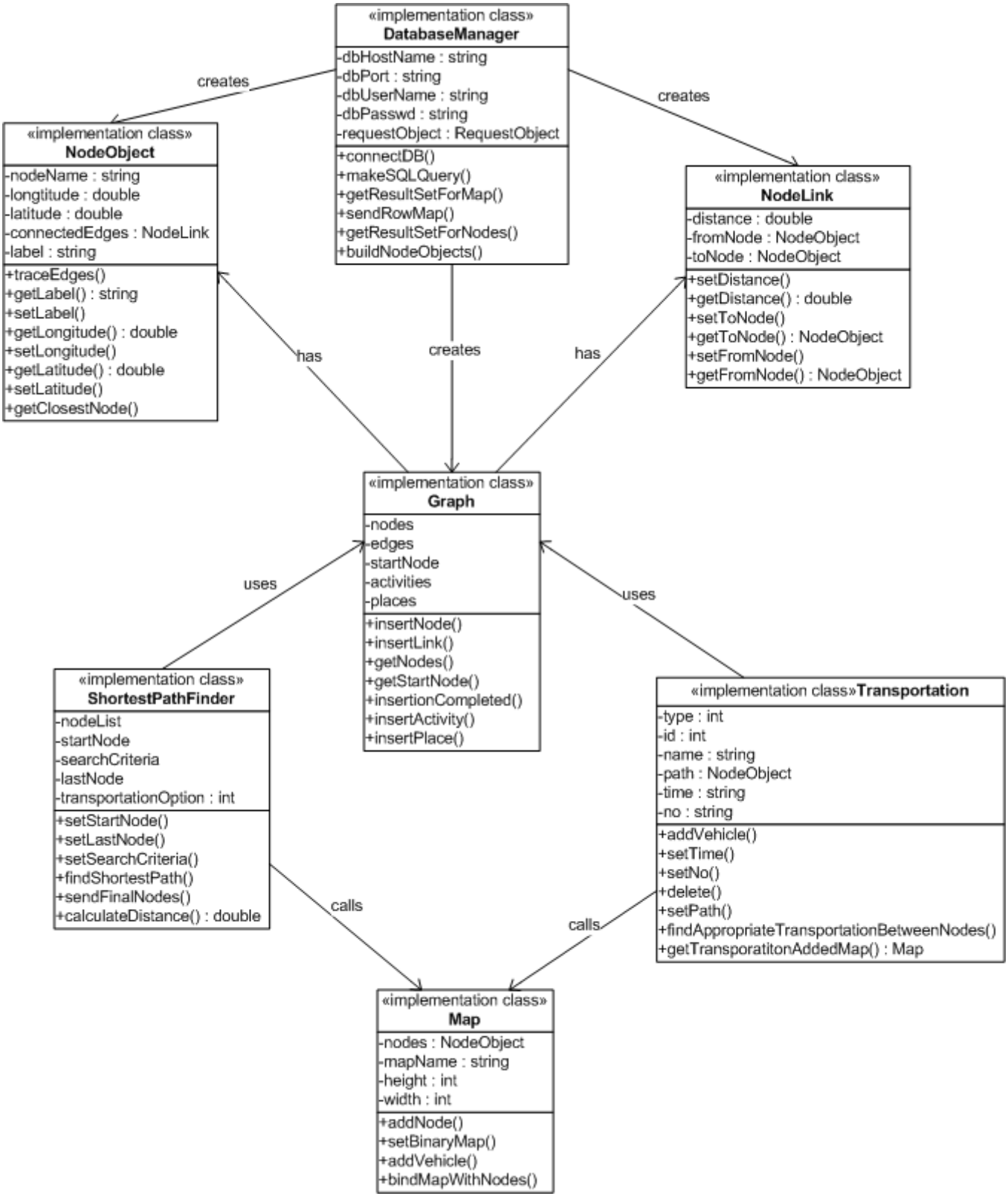
WebServiceCommunicationPoint is the class which receives web service calls from the clients. It directs the received xml message to XMLQueryParser class. It returns the result of the request also in xml format.

6.2.3. Activity Search Class Diagram



This part is the class diagram of the server module which finds the activities which the user queries. As mentioned above **DatabaseManager** deals with database communication. It firstly creates **ActivitySearcher** class. DatabaseManager also creates **Activity** and **Place** instances according the database query result. Each created class inserts itself to ActivitySearcher object. Then ActivitySearcher finds the appropriate activity and its place according to the request object. Moreover, it uses **OntologyManager** class in order to find related activities in case of not finding any suitable activity. At the end **Sorter** class gets the results from ActivitySearcher and sorts the activities according to a criteria such as alphabetic order of activity name.

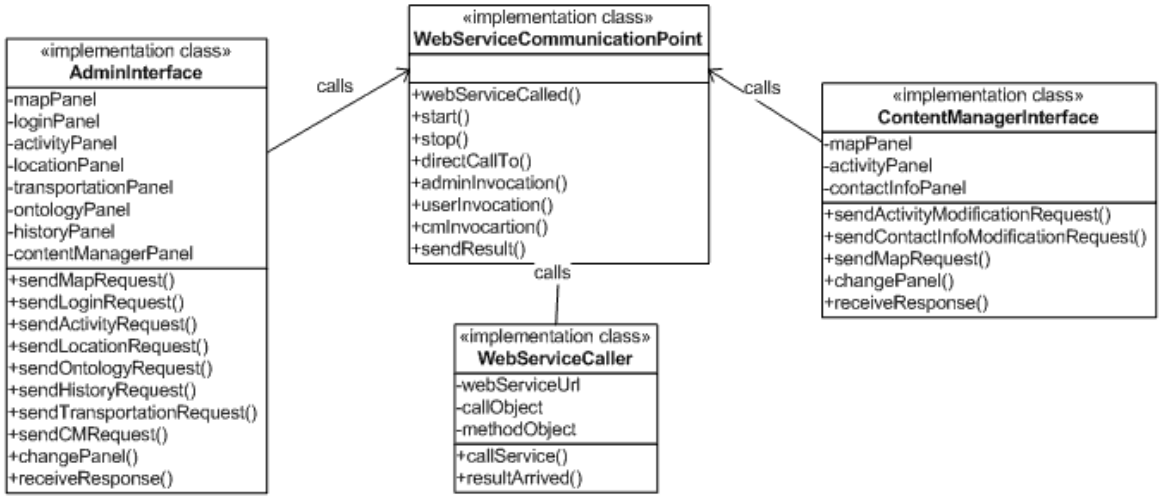
6.2.4. Transportation Class Diagram



This part is the class diagram of the server module which finds the transportation options and indicates the paths of these vehicles. Again **DatabaseManager** has an active role. It creates

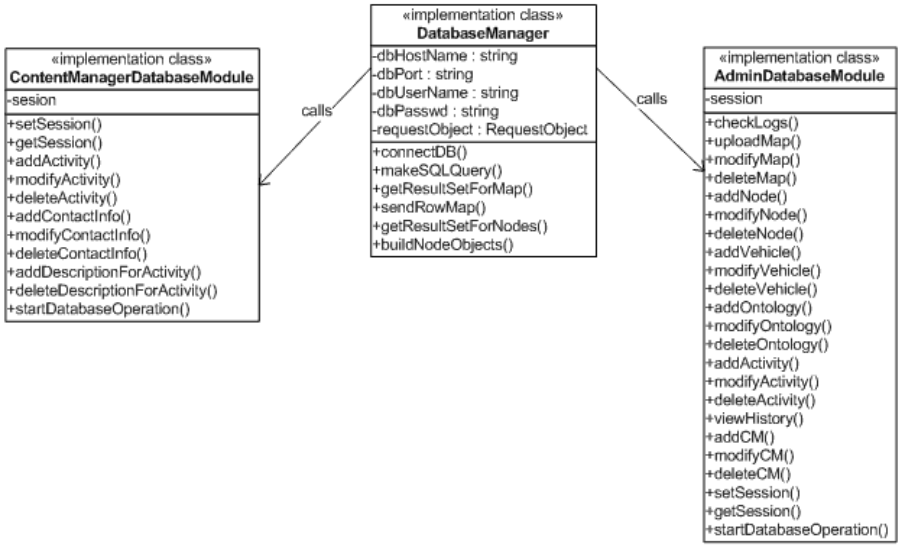
Graph, **NodeObject** and **NodeLink** object. Each created NodeObject and NodeLink inserts itself into created Graph object. Then Graph object sends its nodes to **ShortestPathFinder** in order to find the shortest path. Also the nodes are sent to **Transporatation** class. Transportation class adds some vehicle objects if necessary. Then these nodes are merged in **Map** class to form the complete map.

6.2.5. Web Service Class Diagram



WebServiceCommunicationPoint class received calls from **AdminInterface** and **ContentManagerInterface.** These interface classes generates the queries according to written information gathered from the staff.

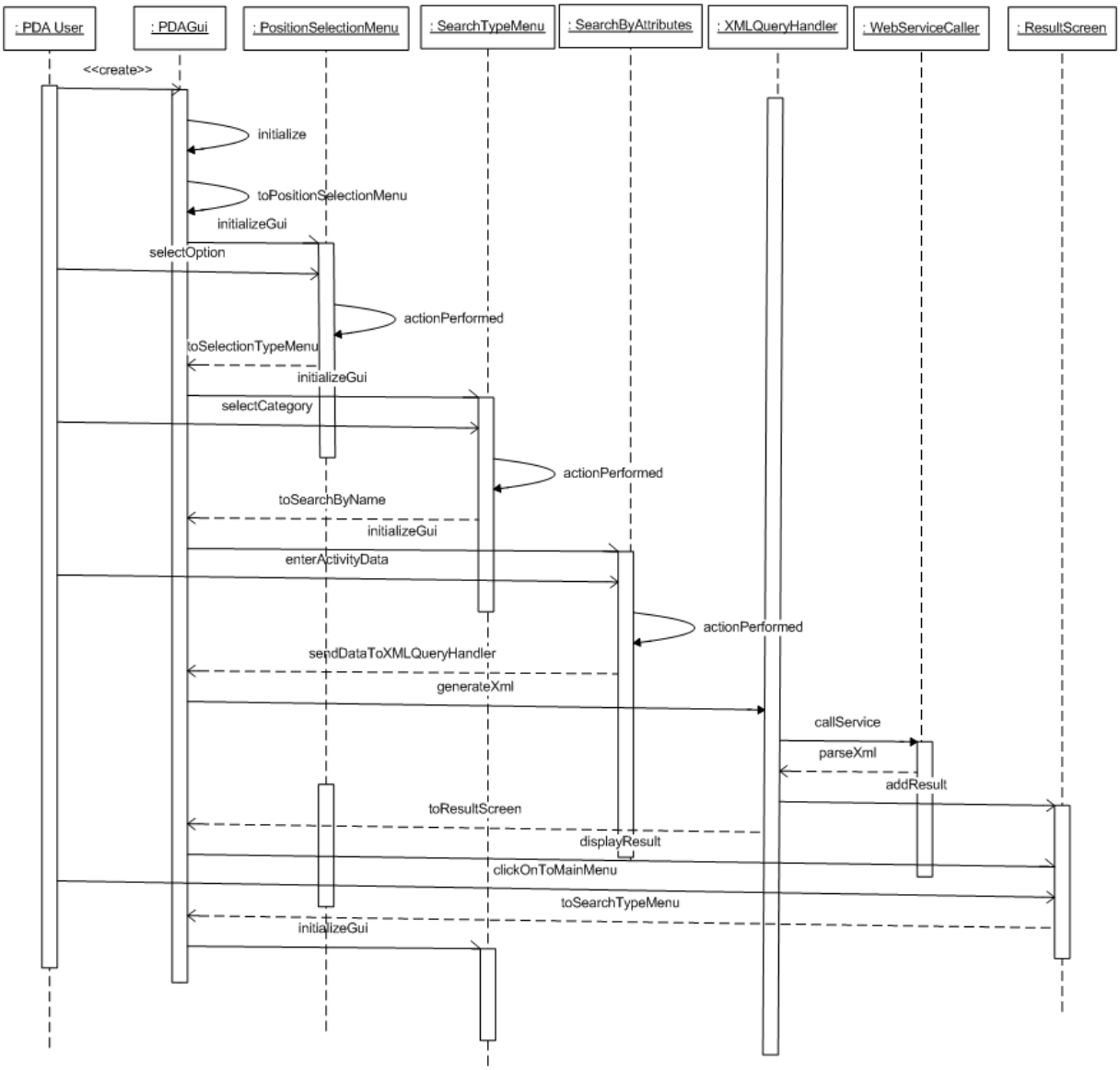
6.2.6. Database Class Diagram



For staff queries, **DatabaseManager** passes the request objects to **ContentManagerDatabaseModule** and **AdminDatabaseModule** objects. These objects forms the staff specific queries and manages the returned result sets in a way that it can be send as xml message.

6.3. Sequence Diagrams

6.3.1. Search by Attributes



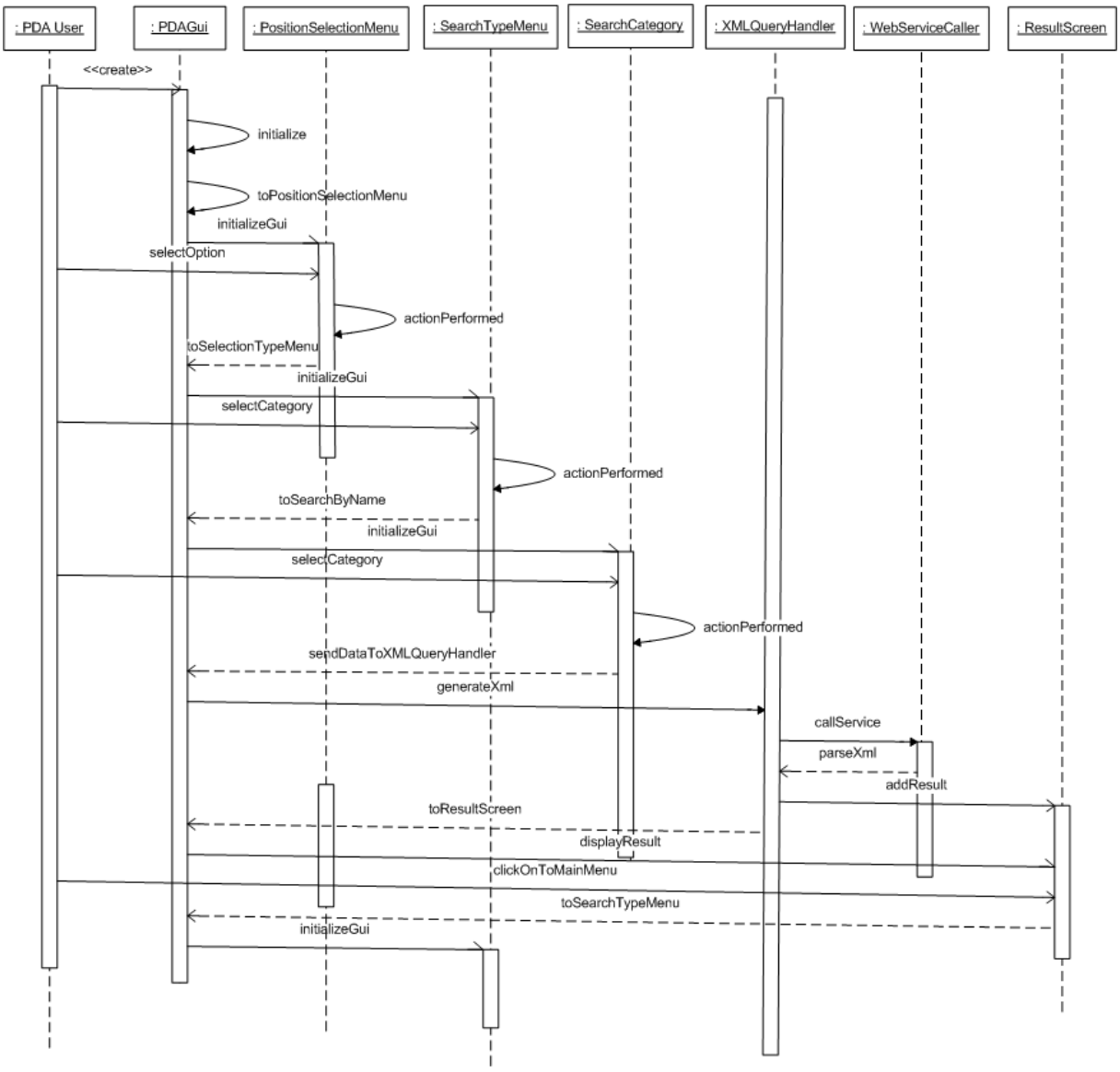
In order to perform a search according to the attributes of the wanted place or activity, PDA user accesses to the *PDAGui*. When *PDAGui* is started, it initializes itself. In this initialization all of the user interface components are created and their content are organized. After completing the initialization, *PDAGui* is ready to go to *PositionSelectionMenu*. To show and make the necessary preparation, *initilizeGui* method of *PositionSelectionMenu* is called. Now user interface is visible and shows the position selection alternatives to the user. For the details of position selection please see **"4.3.4. Retrieve Position"** part. When the user selects an option and clicks the next button, an ActionListener in *PositionSelectionMenu* catches this action and invokes *actionPerformed* method. In the *actionPerformed* method the position information is retrieved and it is sent to *PDAGui* which is the responsible class for coordinating the user interfaces. Now the system has the position information of the user.

The next step is the selection of search type. For this purpose, *initializeGui* method of *SearchTypeMenu* is called. Upon receiving this call, *SearchTypeMenu* makes necessary initializations and shows the interface to the user. User selects an option; in this case this option is Search-By-Attributes. This select event is caught. Since the search type is Search-By-Attributes, *toSearchByName* method of the *PDAGui* is called. This call triggers *initializeGui* method call for the *SearchByAttributes* object. In this method, the arrangements of the contents of SearchByAttributes menu are completed and the menu is shown to the user in order to get the attributes of the wanted destination or place. When the user finishes entering the attribute information, he or she clicks on the search button which invokes the *actionPerformed* method of *SearchByAttributes* class. The gathered information is organized and sent to the PDAGui class via *sendDataToXMLQueryHandler* method. *PDAGui* passes this information to *XMLQueryHandler* by invoking its *generateXml* method. *XMLQueryHandler* rearranges the search information in XML format. This new format of search query is sent to *WebServiceCaller* by invoking *callService* method. *WebServiceCaller* initiates a call to Server and gets its result. For the details of web service communication please see the part **"4.3.7. Web Service Communication"**.

The returned search result is in XML format and should be converted to human understandable format. Therefore, *parseXml* method of the *XMLQueryHandler* is called. As *XMLQueryHandler* parses the messages, it invokes the *addResult* method of *ResultScreen*. This method is called multiple times because for each item of the search result *addResult* is called. When all of the results are sent to *ResultScreen*, *toResultScreen* method of *PDAGui* is called. In fact, we could directly call the *displayResult* method of *ResultScreen* instead of indirectly calling *toResultScreen*. However, we have chosen the second one for the sake of consistency of user interface management. *PDAGui* calls the *displayResult* method of *ResultScreen* and *ResultScreen* shows the result as a list.

In order to perform another query, user clicks on "go to main menu" button. This action triggers the call of *toSearchTypeMenu*. When *PDAGui* receives this call, it will invoke *initializeGui* method of *SearchTypeMenu* object. An important point here is that we skipped choosing the position selection method in the second and next searches in order not to bother the user with the unnecessary repetition of choosing position selection method. However, if the user wants, he or she can change the position selection method from the settings menu.

6.3.2. Search by Category



Retrieving position information is similar to the one on Search By Attributes. We included it in the diagram for the completeness of the search.

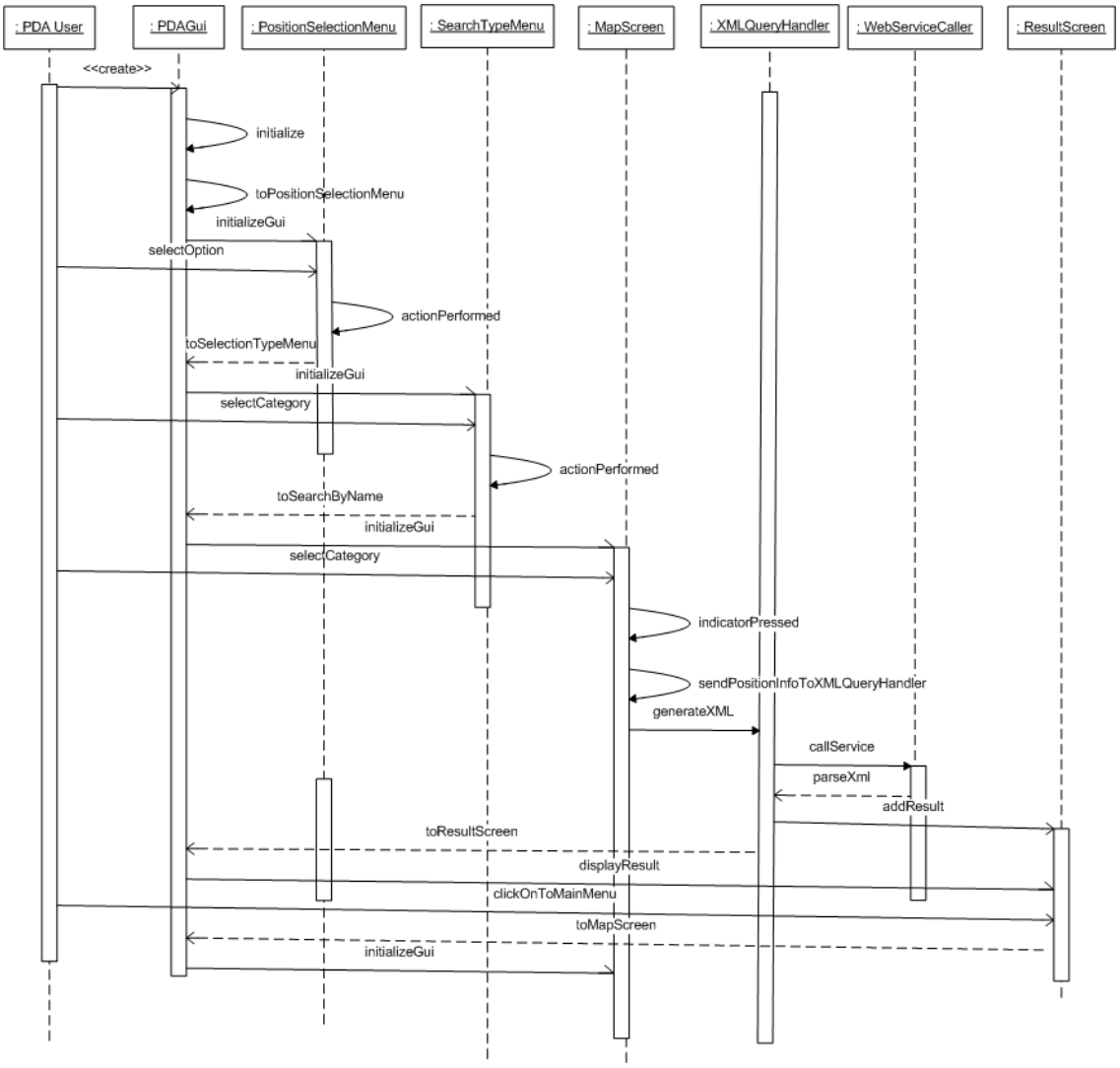
Now we have the position information (If the position selection method is "via GPS", then the position information is continuously updated).

Again similar to the previous section, *initializeGui* method of *SearchTypeMenu* is called in order *SearchTypeMenu* to prepare itself and show the search type selection menu. In this sequence user selects Search-By-Category. *SearchTypeMenu* obtains this choice and calls *toSearchByCategory* method of *PDAGui* which calls *initializeGui* method of *SearchCategory* class. *SearchCategory* class prepares a menu on which a number of categories are shown to the user. The user selects one of the options (cinema, theatre, concert hall, sports center). This information is retrieved by *actionPerformed* method of the *SearchCategory* class and is sent to *PDAGui* via *sendDataToXMLQueryHandler* method. *PDAGui* forwards the category information to *XMLQueryHandler* by invoking *generateXML* method. We preferred sending

the query indirectly through *PDAGui* because we wanted to preserve the coordinator role of *PDAGui* so that information flow between user interface and internal part of our system is easily maintainable. *XMLQueryHandler* puts the category information into XML format and passes the data to *WebServiceCaller* by invoking *callService* method. *WebServiceCaller* calls the web service method of server and returns the result by calling *parseXML* method of *XMLQueryHandler* in order to parse it and retrieve the necessary information.

The steps for forming the result screen are the same as the steps in Search-By-Attributes. We included it for the completeness of the search.

6.3.3. Search on Map



The explanation of retrieving position selection method is skipped. Please refer to **"4.3.1. Search by Attributes"** for the explanation.

In this sequence diagram, after the *SearchTypeMenu* is initialized, the user selects Search-On-Map option. *SearchTypeMenu* informs *PDAGui* about this request by calling *toMapScreen*. At this moment user browses the map by applying zoom-in/zoom-out or scroll down/up/right/left. When the user finds the place he is looking for, clicks on the place which will initiate the

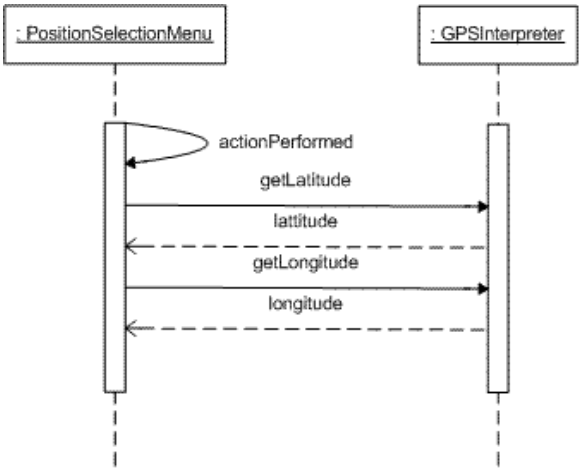
search. The coordinates of the place is sent to *XMLQueryHandler* with *generateXML* method. *XMLQueryHandler* converts the coordinate information in the XML format defined by the XSD given in attachment. Then it sends this XML message to *WebServiceCaller* with *callServiceMethod*. Another duty of *XMLQueryHandler* is to parse the result of the search query received by *WebServiceCaller*. As the results are parsed, they are added to *ResultScreen*. When the result processing is finished, *toResultScreen* method of *PDAGui* is called to switch to result menu.

The user can select on of the results from the result list to see it on map. In this case, *ResultScreen* invokes *toMapScreen* method of *PDAGui*. Then, *PDAGui* will initialize *MapScreen* for displaying the result on map by *initializeGui* method. Upon receiving this call, *MapScreen* will arrange the viewed part of the map and display it.

6.3.4. Retrieve Position

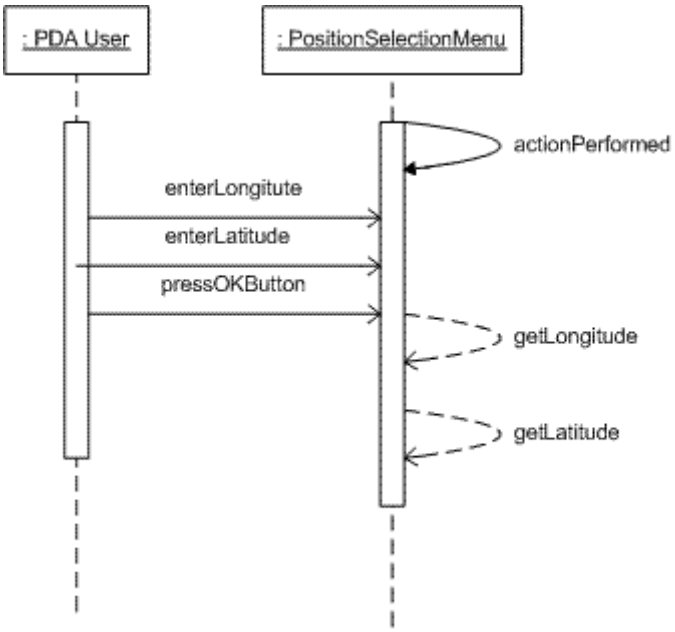
In this part, how position information is gathered is explained. There are three ways of gathering position: from GPS, manual and from map.

6.3.4.1. Via GPS Receiver



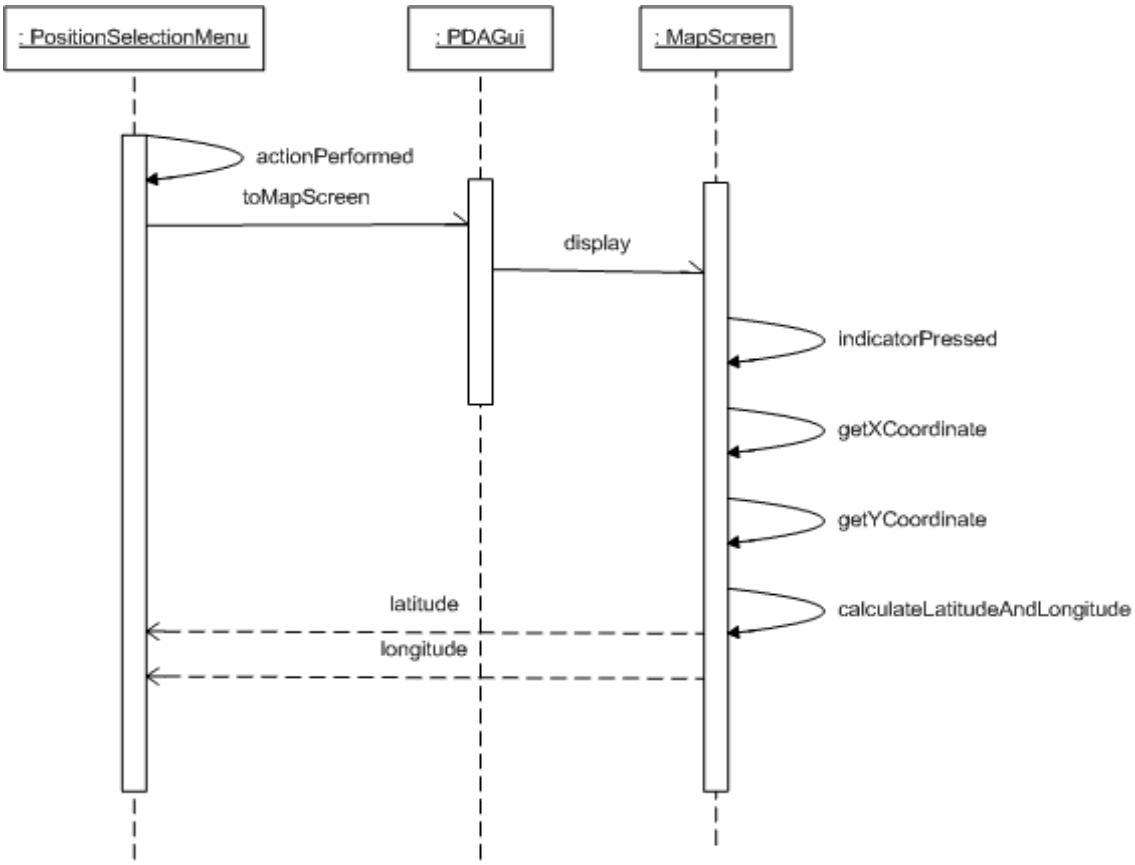
This process is realized automatically transparent to the user when the user makes a search. *PositionSelectionMenu* is informed about the position request. Then *getLatitude* and *getLongitude* methods are called respectively.

6.3.4.2. Via Manually Entering



This process is mainly used for testing purposes. The user enters the longitude and latitude values. These values are assigned to the properties of *PositionSelectionMenu* for retrieval of position information later.

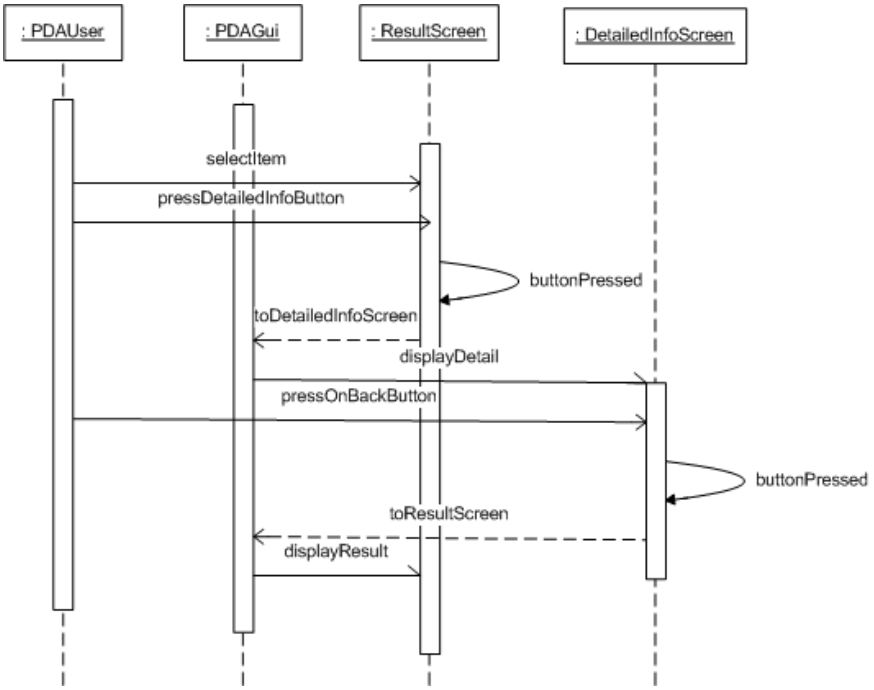
6.3.4.3. Via Browsing Map



When the GPS device is not available, user can select the position on the map. We will also add a functionality providing users with a text based search option which enables to benefit from well-known places while searching his/her position.

In order to show map to the user, *PositionSelectionMenu* invokes *toMapScreen* method of *PDAGui*. Then, *PDAGui* calls the display method of *MapScreen*. After browsing the map, the user selects a place. The position is obtained by *getXCoordinate* and *getYCoordinate* methods of *MapScreen*. According to these values, by calling *calculateLattitudeAndLongitude* longitudes and latitudes are calculated and sent back to *PositionSelectionMenu*.

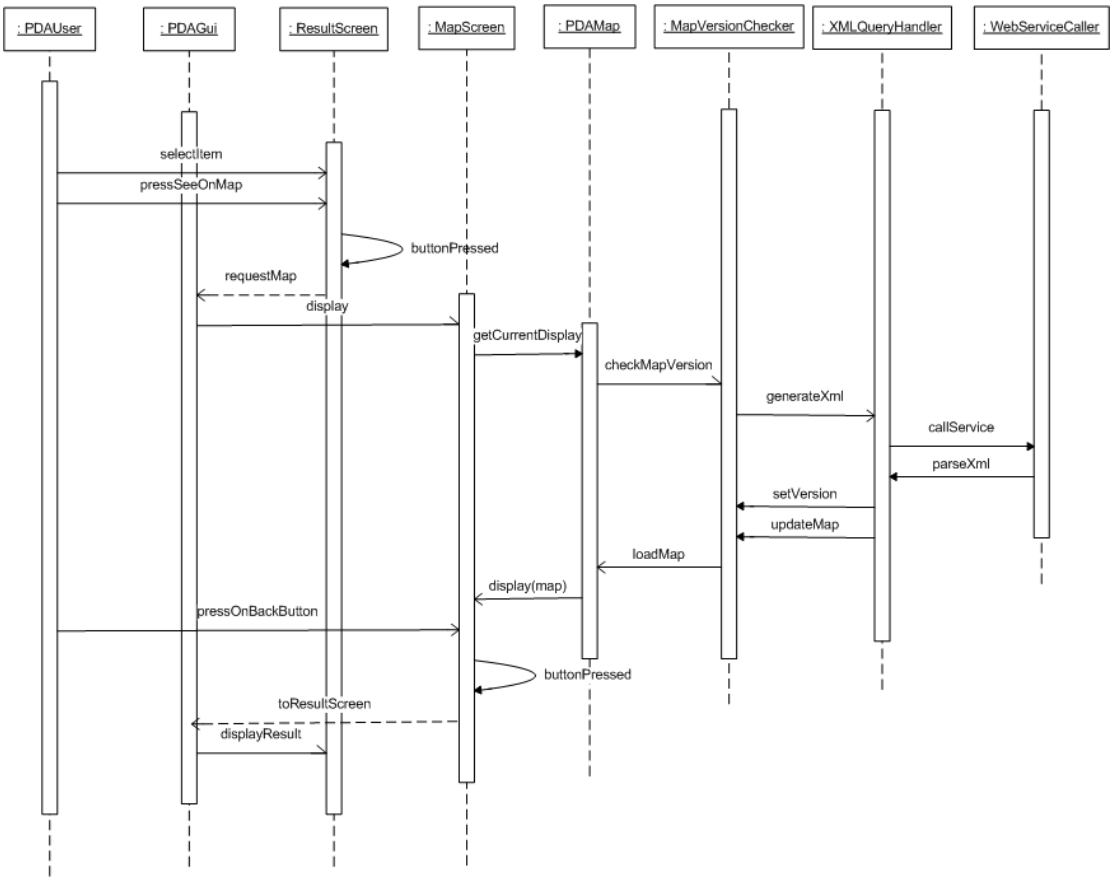
6.3.5. See Detailed Information



This sequence diagram describes which calls are performed when the user wants to see the details of results in the result list. The details includes the name, contact information, address and comments about the place or activity.

On the *ResultScreen* user selects an item and clicks on detailed info button. This invokes *buttonPressed* method of *ResultScreen*. *ResultScreen* sends the information of selected item to *PDAGui* with *toDetailedInfoScreen*. *PDAGui* forwards this information to *DetailedInfoScreen*. When *DetailedInfoScreen* receives *displayDetail* call, it performs necessary initializations according to selected result information and displays them to the user. When the user clicks on back button in order to see the details of other results or in order to see a result on map, *DetailedInfoScreen* calls *toResultScreen* method of *PDAGui*. Then *PDAGui* will make visible *ResultScreen* again.

6.3.6. See Transportation on Map



From the *ResultScreen* user may want to see the transportation information to a place in the result list. This transportation information defines the possible paths to the destination by also indicating the vehicle types available along with their time and cost estimations.

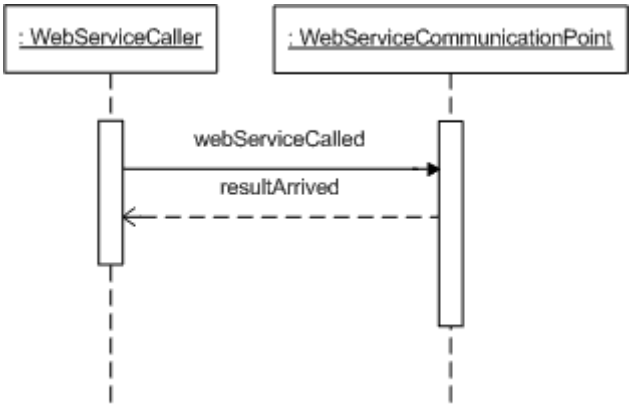
By selecting and clicking on SeeOnMap button, the user initiates the transportation display process. *ResultScreen* calls requestMap method of *PDAGui* with the information of selected item as parameters. *PDAGui* forwards this information to *MapScreen* and tells it to display the corresponding map. We will use caching of maps in order to increase the speed. Therefore, we should consider whether the map available in PDA should be updated or not. This task is independent of *MapScreen*. *MapScreen* just request the map from *PDAMap* with *getCurrentDisplay* method which consults *MapVersionChecker* for checking the version of the map. If the version is not sufficient (the map needs update), *MapVersionChecker* calls *generateXML* method of *XMLQueryHandler*. *WebServiceCaller* calls the server and returns the map. The version of the current map updated and displayed to the user.

When the user clicks on back button, *PDAGui* is informed with *toResultScreen* method and calls *displayResult* method of *ResultScreen*. Then, the results available at the beginning will be shown. Now the user can select another result from the result list for obtaining further details.

6.3.7. Web Service Communication

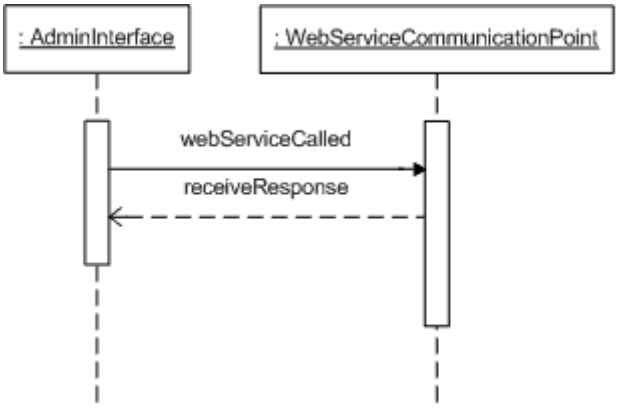
We have built our architecture over web services in order to avoid platform and language dependence. Thanks to web services, we are also planning to make our software available to everyone. In this way, with any program supporting web services an application which uses our server side can be developed. In this section we describe how our client applications access to the server.

6.3.7.1. PDA Web Service



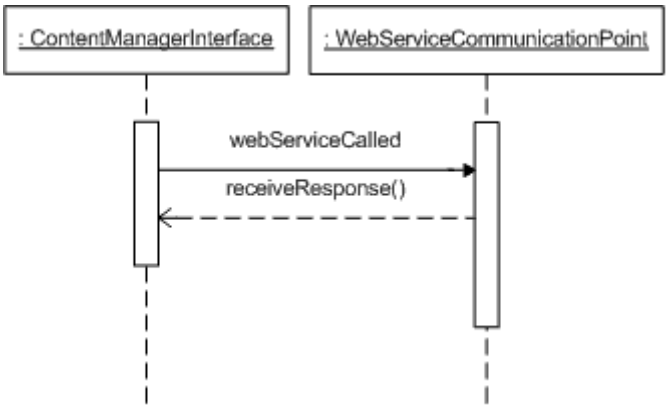
WebServiceCaller calls *webServiceCalled* method of *WebServiceCommunicationPoint* with which resides on server side. The request information which is in XML format is passed as parameter. *WebServiceCommunicationPoint* delivers this request to related modules. When the result arrives, the result is sent back to *WebServiceCaller*.

6.3.7.2. Administrator Web Service



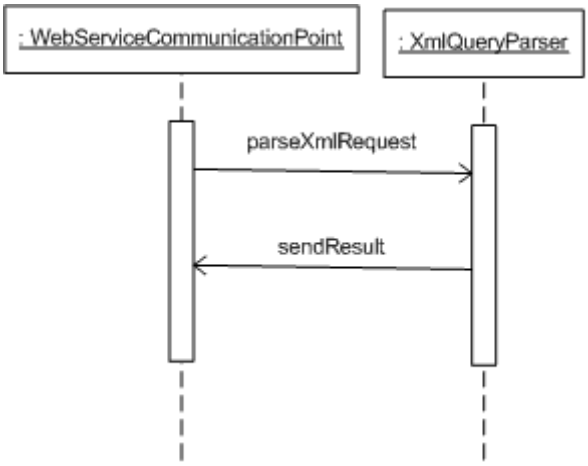
AdminInterface calls *webServiceCalled* method of *WebServiceCommunicationPoint* with which resides on server side. The request details which is in XML format is passed as parameter. *WebServiceCommunicationPoint* delivers this request to related modules. When the result arrives, the result is sent back to *WebServiceCaller*.

6.3.7.3. Content Manager Web Service



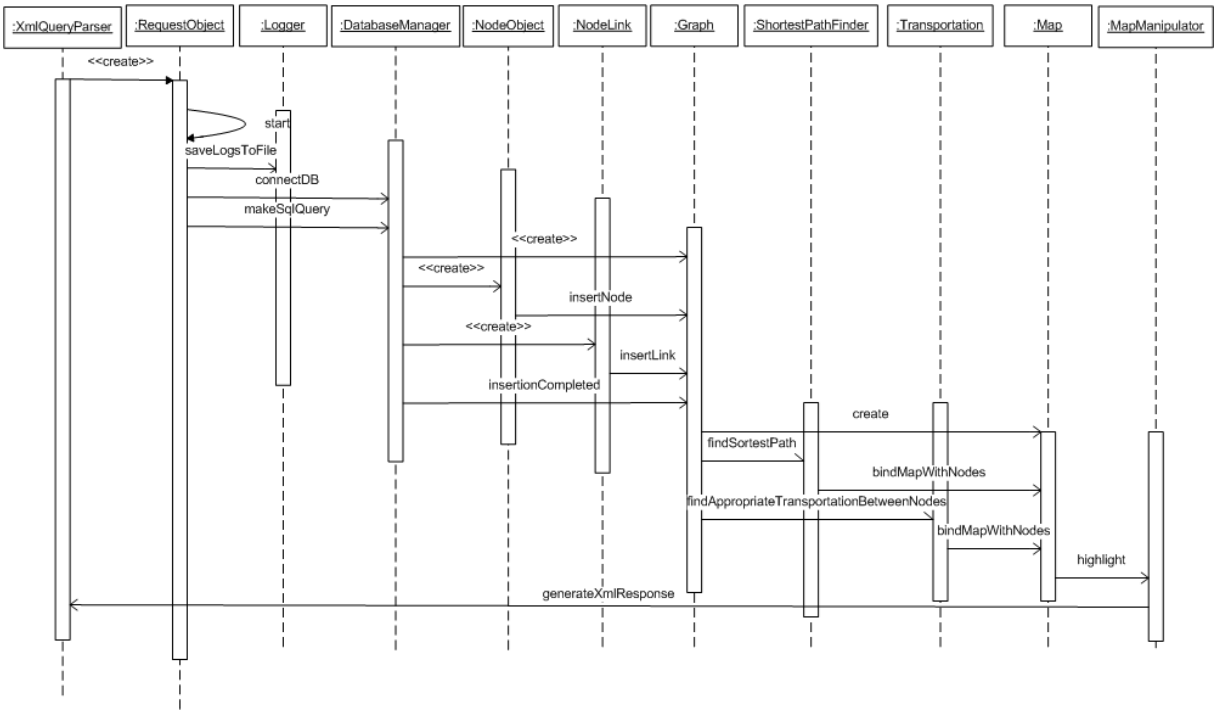
webServiceCalled method of *WebServiceCommunicationPoint which is* on server side is called by *ContentManagerInterface* invokes. The request details which is in XML format is passed as parameter. *WebServiceCommunicationPoint* delivers this request to related modules. When the result arrives, the result is sent back to *WebServiceCaller*.

6.3.8. Handle XML



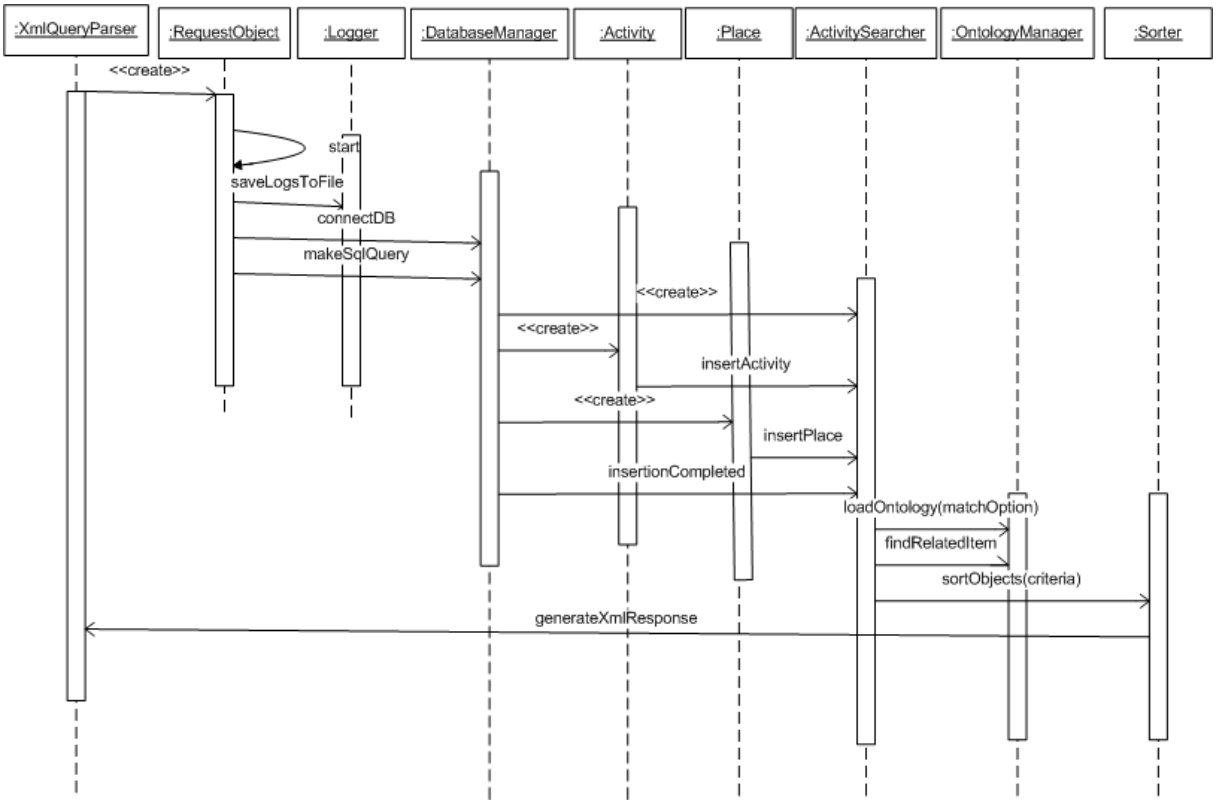
Since *WebServiceCommunicationPoint* receives the request in xml format and sends the result again in xml format, xml data should be processed. This is achieved by *XmlQueryParser*. XmlQueryParser parses the xml data by *parseXmlRequest* and sends the result of request to *WebServiceCommunicationPoint* by *sendResult* method.

6.3.9. Find Vehicles



In this part, the sequence in server side for finding the vehicles. When *XMLQueryParser* gets the request in xml format, it creates *RequestObject* to be used by other modules. One of these modules is logger module. *RequestObject* calls *saveLogsToFile* method of *Logger* and *Logger* extracts the necessary information and saves the request. The other module which uses *RequestObject* is database module. *RequestObject* first connects to the database via *connectDB* method. Then it invokes *makeSqlQuery* method of *DatabaseManager* so that necessary sql queries are created according to the request information. *DatabaseManager* gets the required information from database and creates *Graph*, *NodeObject* and *NodeLink* objects. Inserting the *NodeObject* and *NodeLink* objects into *Graph* is also responsibility of *DatabaseManager*. In order to indicate that insertion process is finished, it lastly calls *insertionCompleted* method of *Graph*. Then *Graph* class constructs a vector map from these links, and also sends the node related objects to *ShortestPathFinder* in order it to find the shortest path via the method *findShortestPath*. Next, *Graph* notifies *Transportation* for finding the appropriate transportation vehicles. Both *Transportation* and *ShortestPathFinder* passes the path and transportation knowledge to *Map* object. Lastly, *MapManipulator* highlights the path to the destination and calls *generateXML* method of *XMLQueryParser* which converts the constituted objects to XML format.

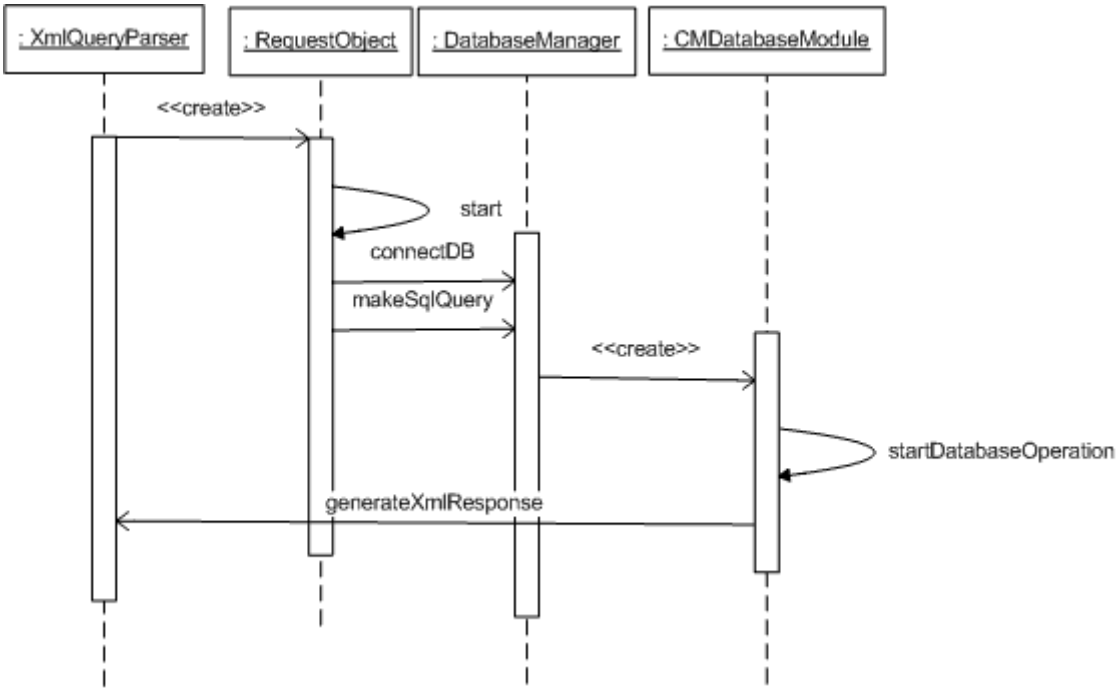
6.3.10. Find Results



Constructing the request objects is the same as in **"4.3.9 Find Vehicle"**. They are included for the completeness of the process only.

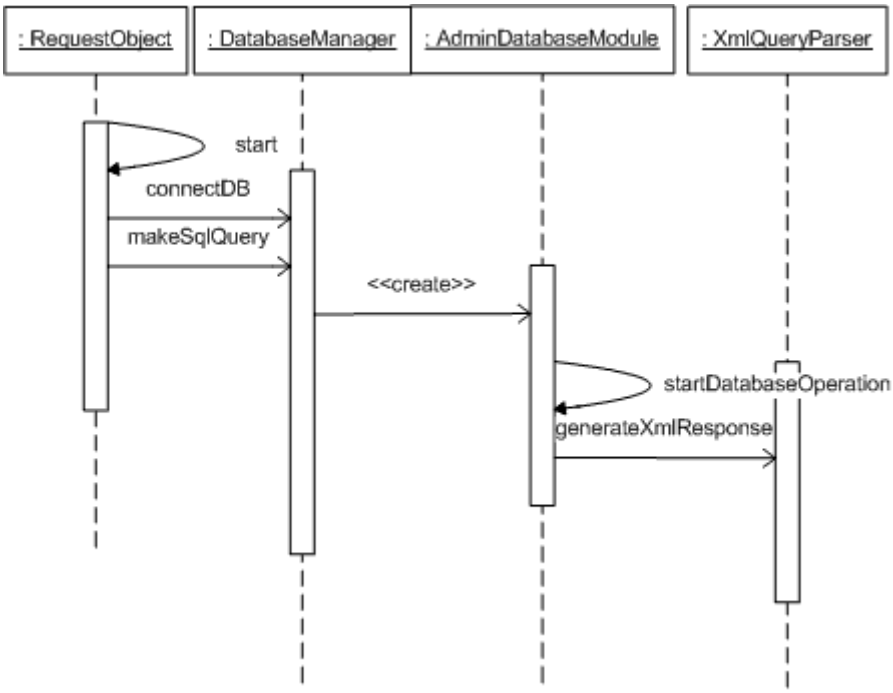
This time *DatabaseManager* builds different objects. These are *ActivitySearcher*, *Activity* and *Place* objects. As *Place* and *Activity* objects are created they are inserted into *ActivitySearcher* by *insertPlace* and *insetActivity* methods respectively. When the creation of the objects is finished, *DatabaseManager* calls *insertionCompleted* method. If the exact match is not found, ActivitySearcher requests related items by first loading the ontology by *loadOntology* method and next calling *findRelatedItem* method of *OntologyManager*. According to the new relations activity search is performed again. Then the results are sent to *Sorter* class in order it to sort them according to different criteria such as cost, time, distance etc. Lastly, Sorter class calls generateXmlResponse method of XMLQueryParser class so that the response objects are translated into xml form to be send thorough web service.

6.3.11. Content Manager Database



Similar to the other processes *XMLQueryParser* generates *RequestObject*. *RequestObject* initializes itself by *start* method. *RequestObject* next calls *connectDB* and *makeSqlQuery* method of *DatabaseManager*. Then *DatabaseManager* extracts the information from database and sends them to *CMDatabaseManager*. After *CMDatabaseManager* completes its job, it calls *generateXmlResponse* method of *XmlQueryParser* which performs the conversion between response objects and xml.

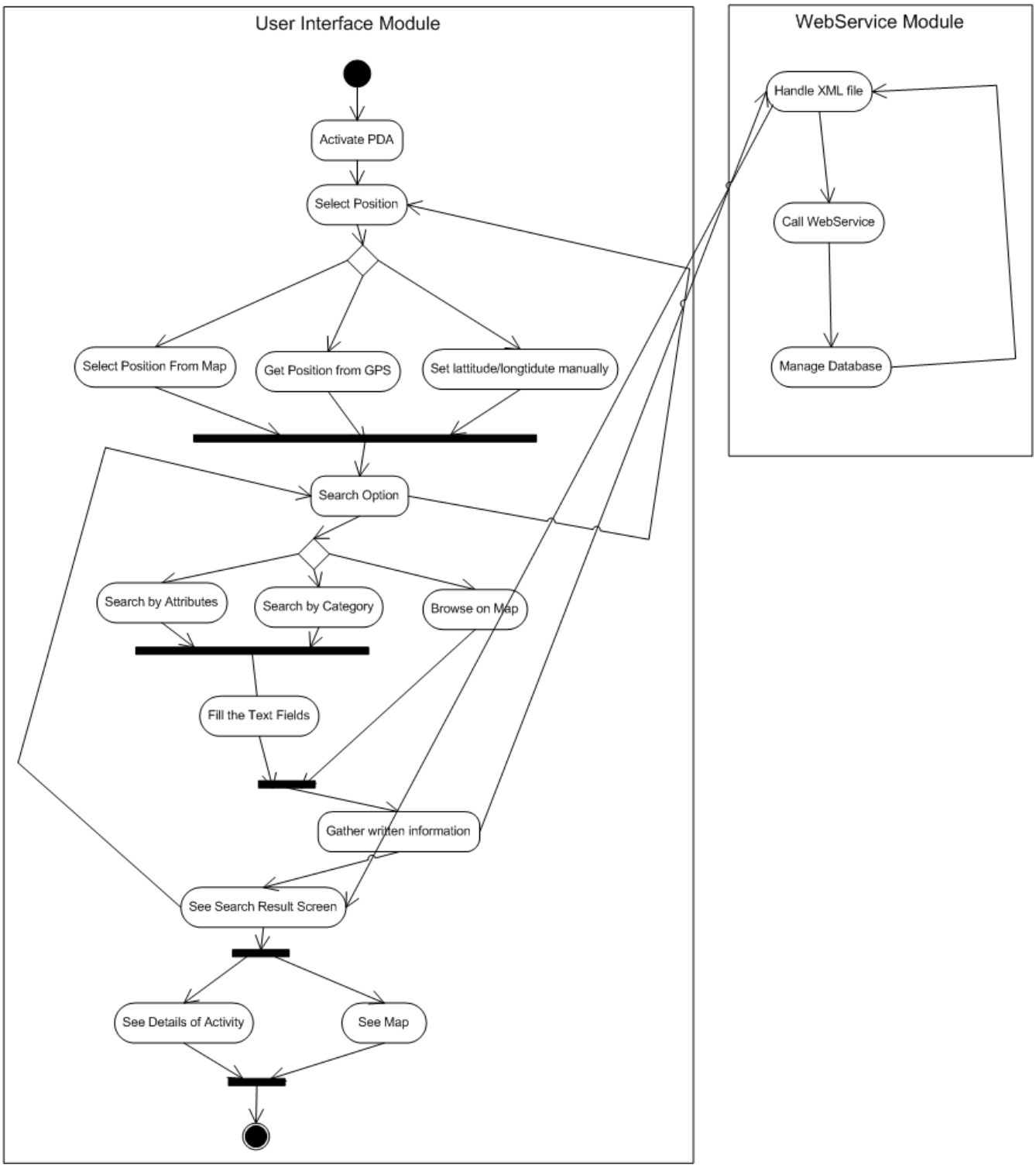
6.3.12. Administrator Database



After *RequestObject* is created by *start* method, *RequestObject* initializes itself. Next it sends signal to *DatabaseManager* to connect to database and the parsed data is passed to DatabaseManager by *makeSqlQuery*. *DatabaseManager* sends the extracted data to *CMDatabaseManager* for further process of the data. When this process is finished, *generateXmlResponse* method is called and *XmlQueryParser* converts the response objects into xml format.

6.4. Activity Diagrams

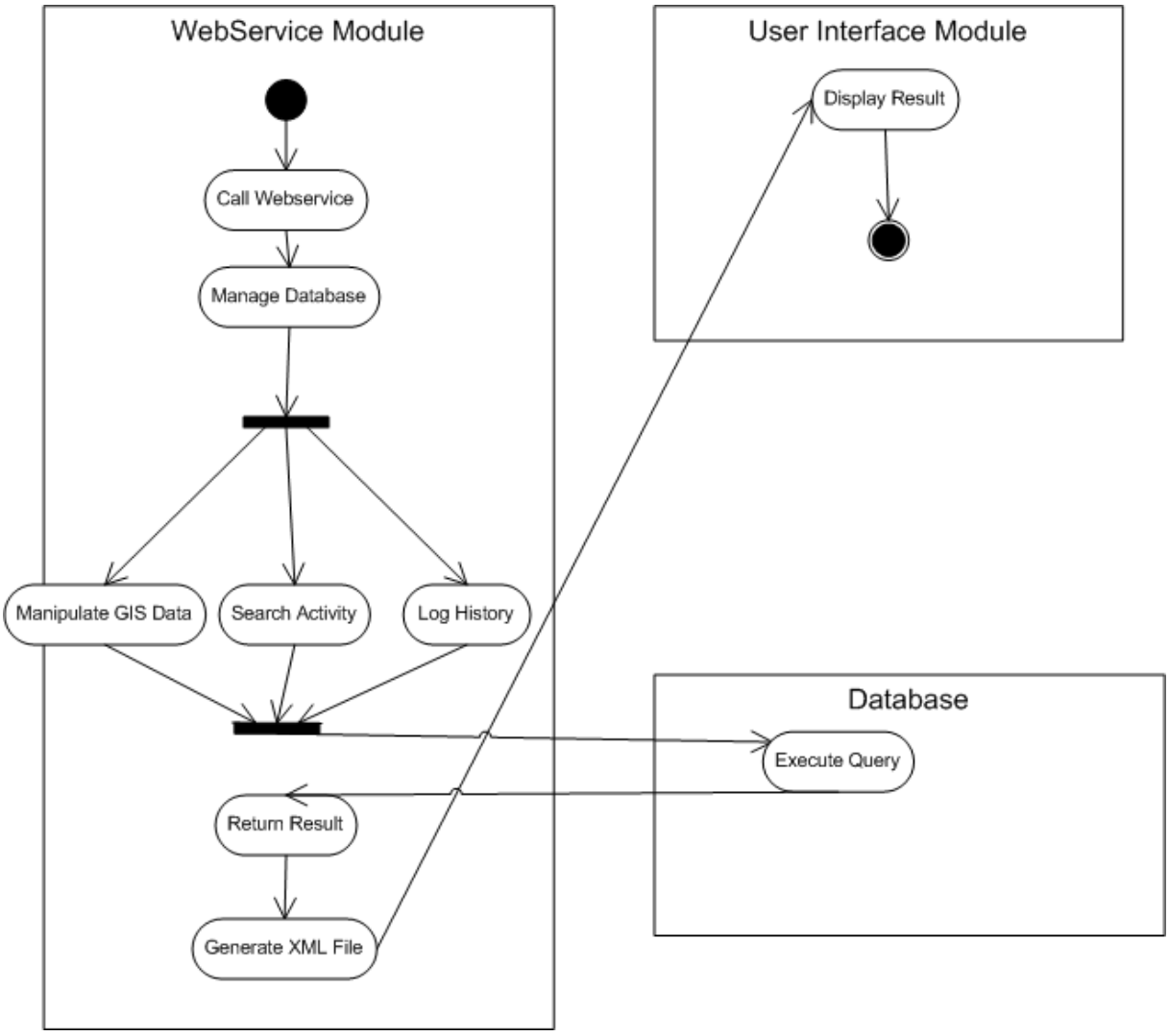
6.4.1. User Activity Diagram



In this activity diagram, User Interface Module interacts with Webservice Module. PDA user activates the system with an external force for instance run the application in PDA. Then, user selects his/her position with one of three selection options which are selection position from map while zooming in/out and scaling, from GPS device and entering the latitude and

longitude manually. After setting position information properly, user passes to the following screen which is searching. In this phase, user has 3 selection options which are searching by attributes, searching by category and searching on map. In the first two options, user has to fill some fields. For instance, if user wants to search an activity according to date, he/she only fills date field in search by attributes and do the search. However, it is a bit different in searching on map. In this option, map is directly displayed and user can navigate on that map by zooming in/out, scaling, etc. When user indicates a point on map and searches for activity places, the information of the point is collected in an XML file. At this point, WebService Module occurs. WenService is called and gathered XML data is handled by an XML parser. Parsed objects sent to the database and manipulated. After relevant processes are done in database manager side, the results return to the PDA user with the help of WebService. List of items are illustrated on the PDA screen. In that case, user has two possible options. One of them is picking one item from the list and seeing the detailed information of selected activity place or activity. The other one is viewing transportation options for an activity place. From both interfaces, user can return to the result screen. For a new search, user has to jump to the selection menu from result list.

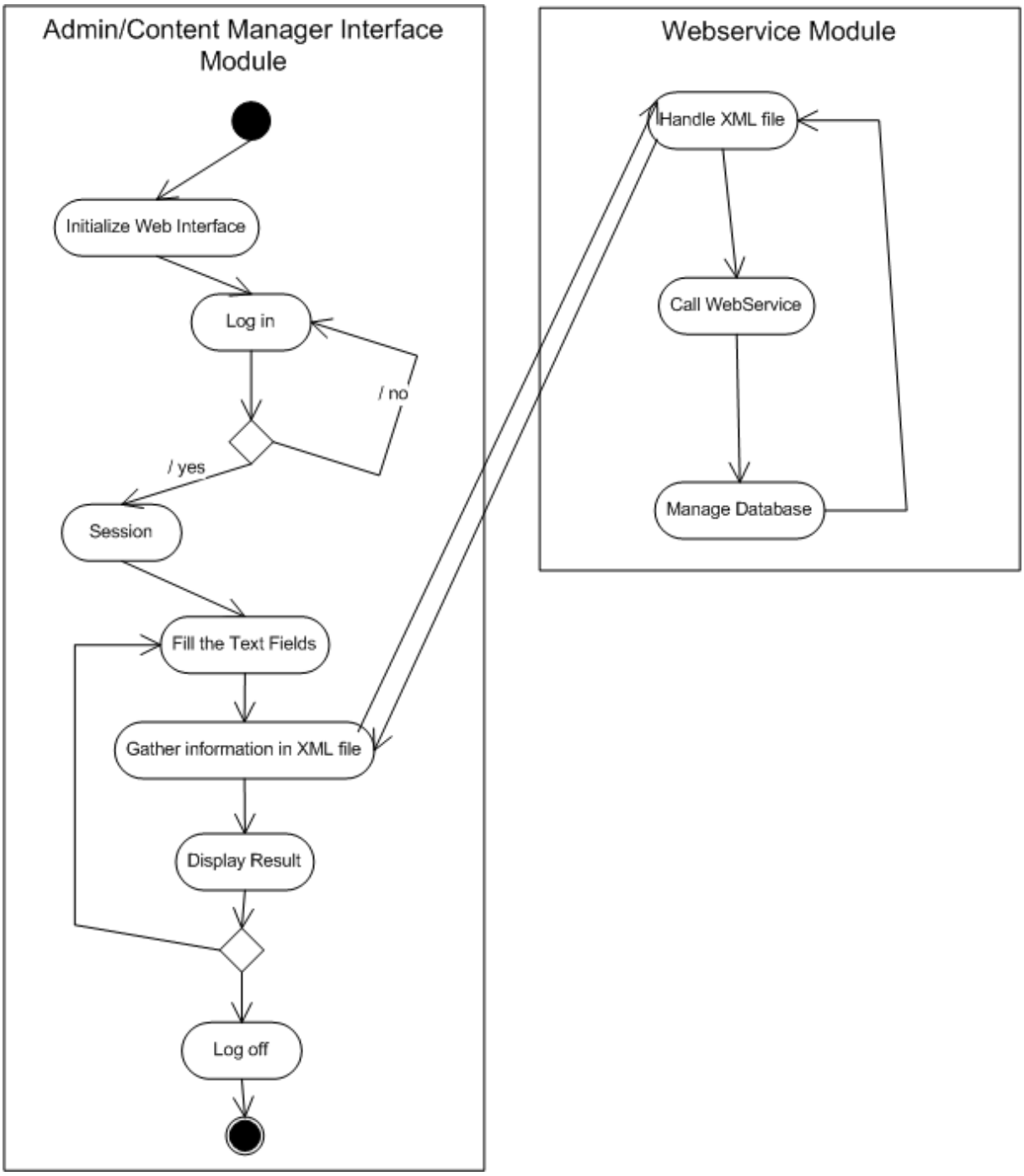
6.4.2. Web Service Activity Diagram



The above diagram demonstrates the process on activity and GIS data in server part. This diagram contains has 3 modules interacted with themselves which are WebService module, user interface module and database module. The process sequence starts by calling the webservice. The retrieved information in XML format parsed and relevant data structures are generated in managing database side. The next step is generating sql queries in order to be sent to database. In this phase, there are 3 different search queries according to the contents. They are activity information result returned query, map data result returned query and queries about history of searches. After formation of the search queries, they are sent to the database in order to be executed. At the end the result list is packed as an XML file and displayed in the PDA screen of user.

6.4.3. Administrator and Content Manager Activity Diagram

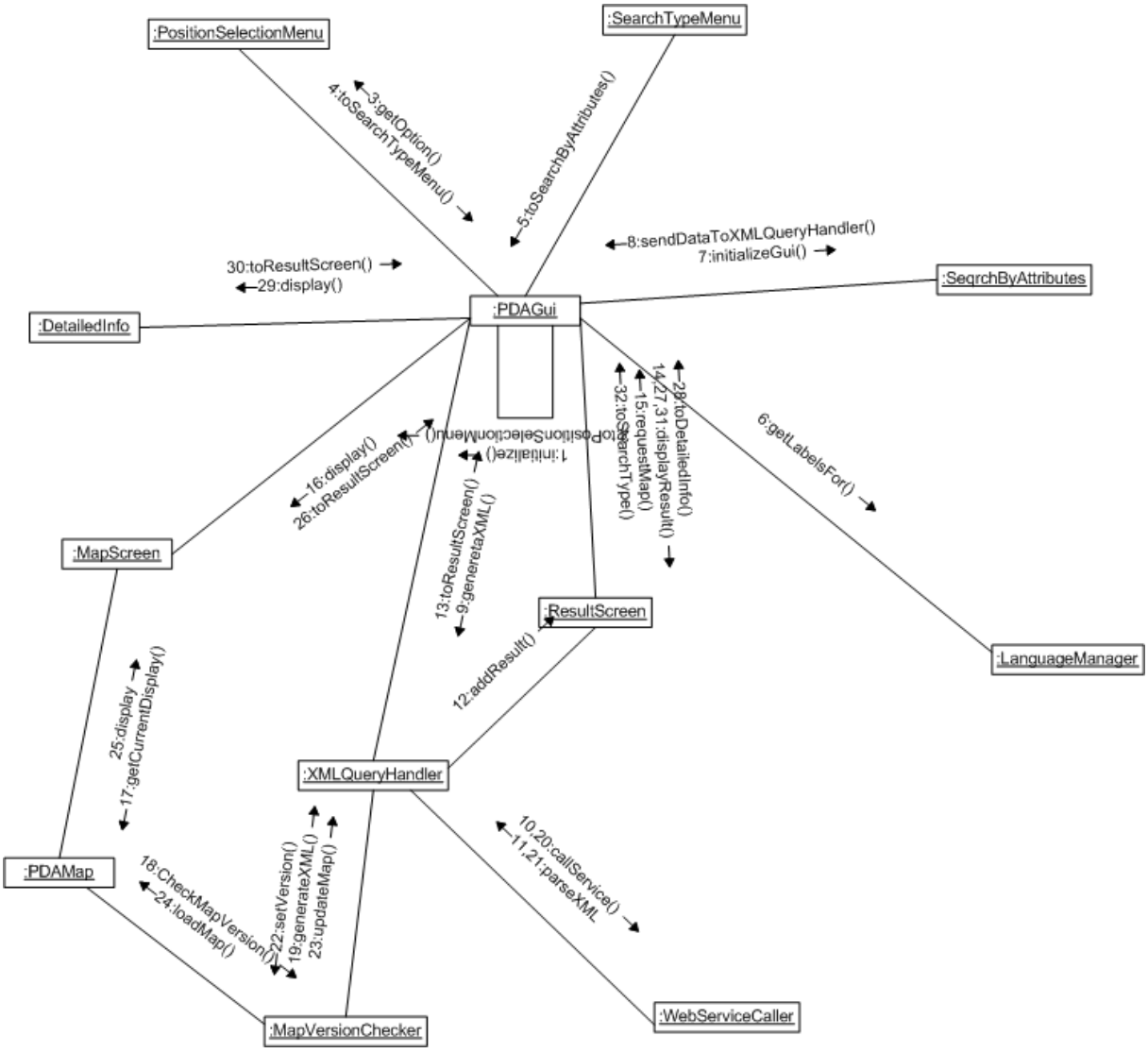
The following diagram illustrates the admin and content manager. Admin/Content Manager Interface module and Webservice Module have an interaction between each other. In order to enter the system, admin and content manager login to the system. After login, a screen for changing the map, activity place, activity appears. They can fill the text fields on the screen and send it to the webservice. Since we use webservice, we sent the data in the XML format. After parsing the received information, database manipulates these data and returns results for instance activity insertion success. Like the above diagrams this diagram packed the result in an XML format and sends it to the user interface. Admin and Content Manager can make different modifications in database.Finally they can exit from the system by logging out.



6.5. Collaboration Diagrams

Our application CoreAccess supply the user so many options in finding the appropriate activity place and activity itself. Therefore, different collaboration diagrams are generated in order to illustrate the actions and event of the user. Moreover, the system has some signals that wake up a module. Thus, system functions in an order. In addition to these, system administrator and content manager can activate some modules. In the following diagrams, the processes and operations are explained clearly.

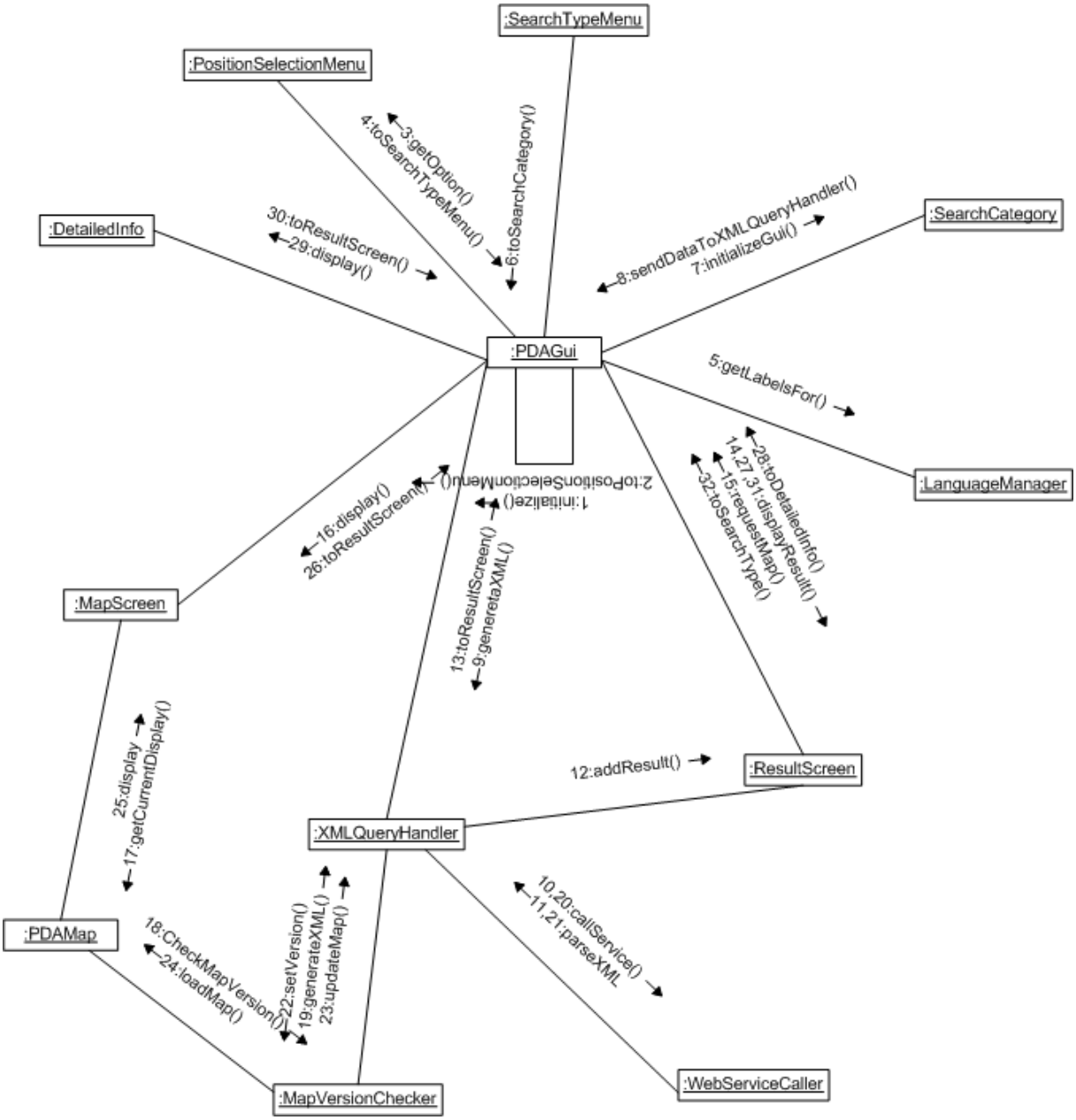
6.5.1. Search by Attributes



This collaboration diagram illustrates one of the user activities which is searching an activity with one of the attributes which are the name, place, date, time etc. Before searching, user has to determine its position via GPS device, manually or via map. After that, user can search type which are search by attributes, search by category and search activity on map and activate toSearchByAttributes() method in PDAGui class. Then, detailed search begins. After typing the attributes, data is sent to the XMLQuery handler class. In there XML file is generated with relevant information. Subsequent to this, WebSevice is called. Server is responsible for the tasks between the time sent XML and the time returned results as XML. Returned results are parsed in XMLQueryHandler class and listed results are seen on the result screen. With the help of the user external force, toDetailedInfo() method is activated and the interface switch to the DetailedInfo. User can returned to the result list again and can see the transportation options and the place of activity on map by calling requestMap() method in PDAGui. The MapVersionChecker is activated before viewing the map on the pda screen. If there is not coherence between current map version in the pda and last updated one, new map is requested from server by calling callService method. At the end of the processes done on server, new

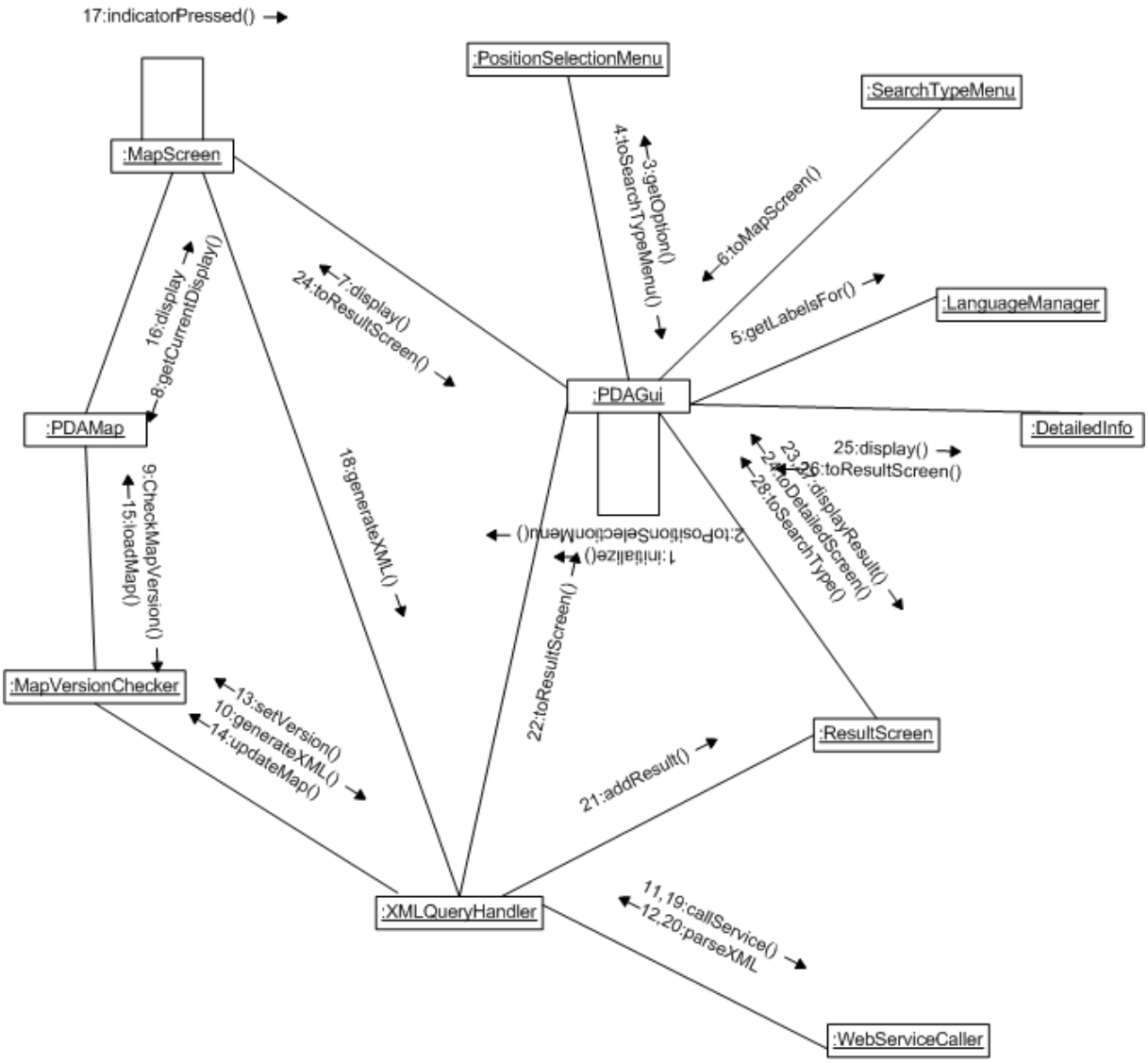
map is gathered and illustrated on the pda screen. Moreover, for multilingualism user has option for selecting language.

6.5.2. Search by Category



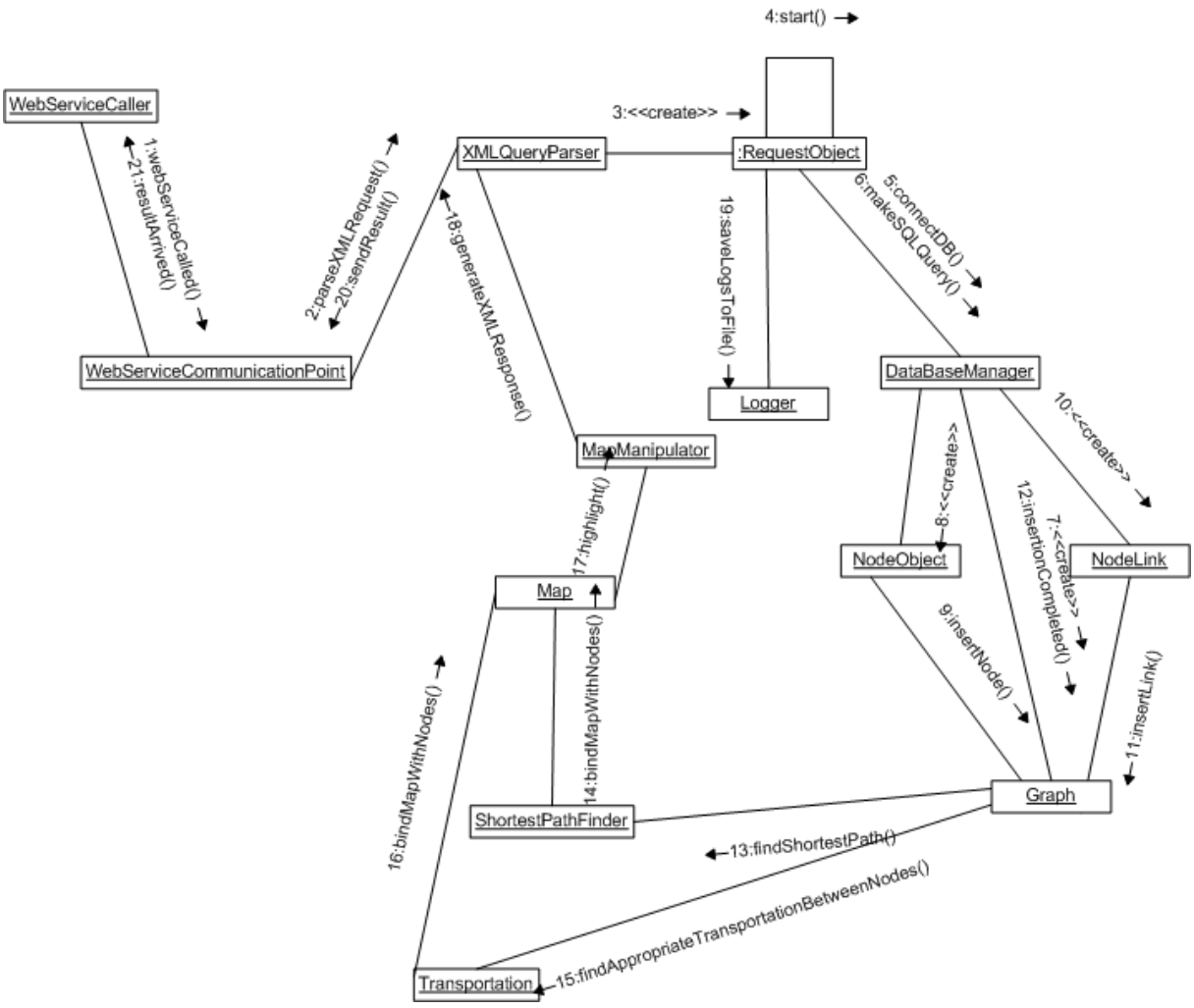
This diagram illustrates one of the types for searching activity which is based on the category which are cinema, theatre, concert hall, sport center and exhibition hall. Data flow is like the above. One important difference is that user does not know about a specific activity. Instead of SearchByAttributes class, SearchCategory class is put in the diagram.

6.5.3. Search on Map



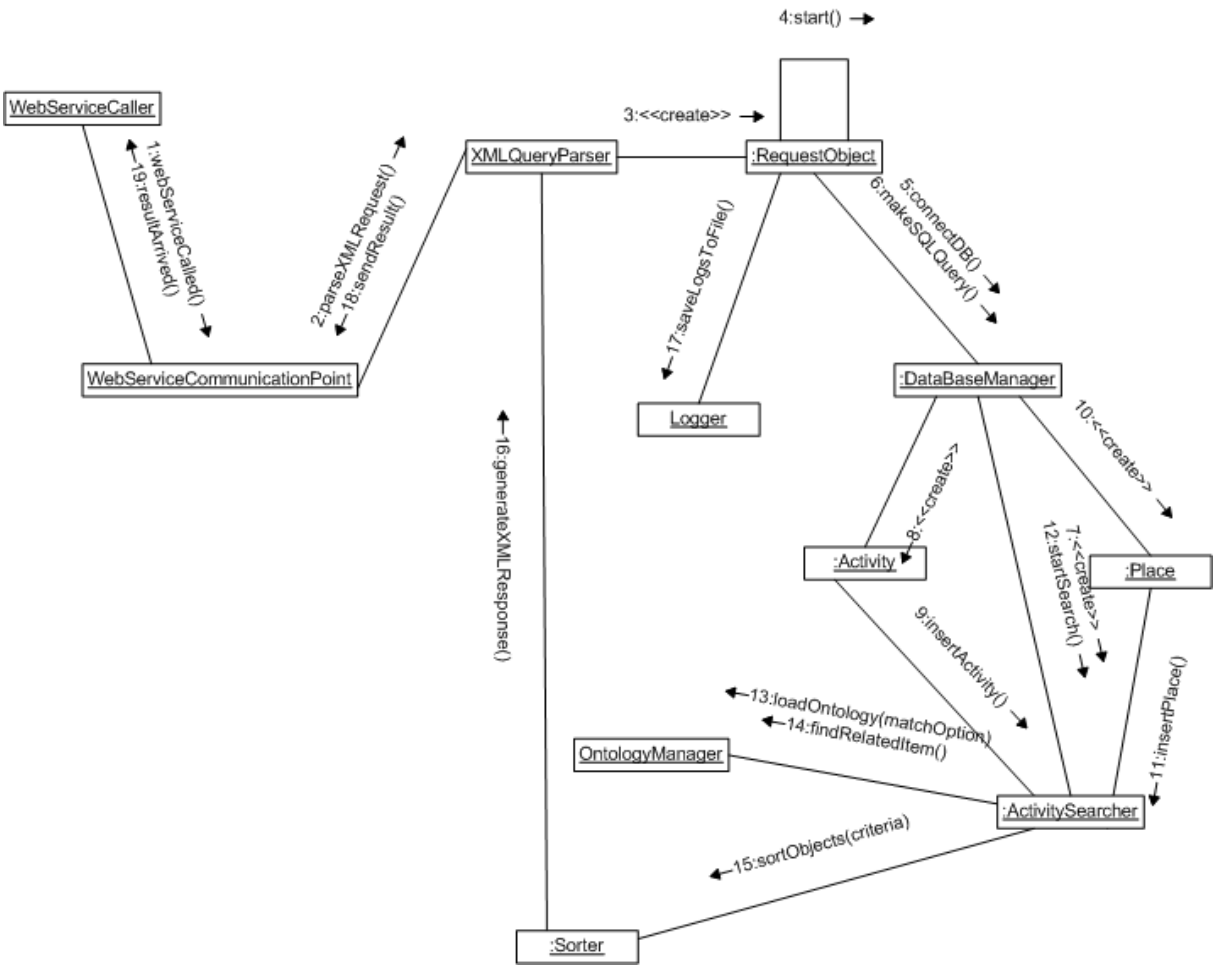
This diagram demonstrates the last type of search which is search on map. It has same data flow. However, the accessing order of map is different. When user selects a type in SearchTypeMenu class, MapScreen class is activated. User can navigate and make a search on the map by zooming in/out, scaling. When indicatorPressed() method is activated by an external force, it sends information to the XMLQueryHandler. XML file is generated and sent to the server. Webservice is called. The following step is displaying the result list on the screen. Therefore addResult() method in ResultScreen class and toResultScreen() method in PDAGui is activated. After listing, seeing detailed info is same as above.

6.5.4. Transportation Manipulation on Server Part



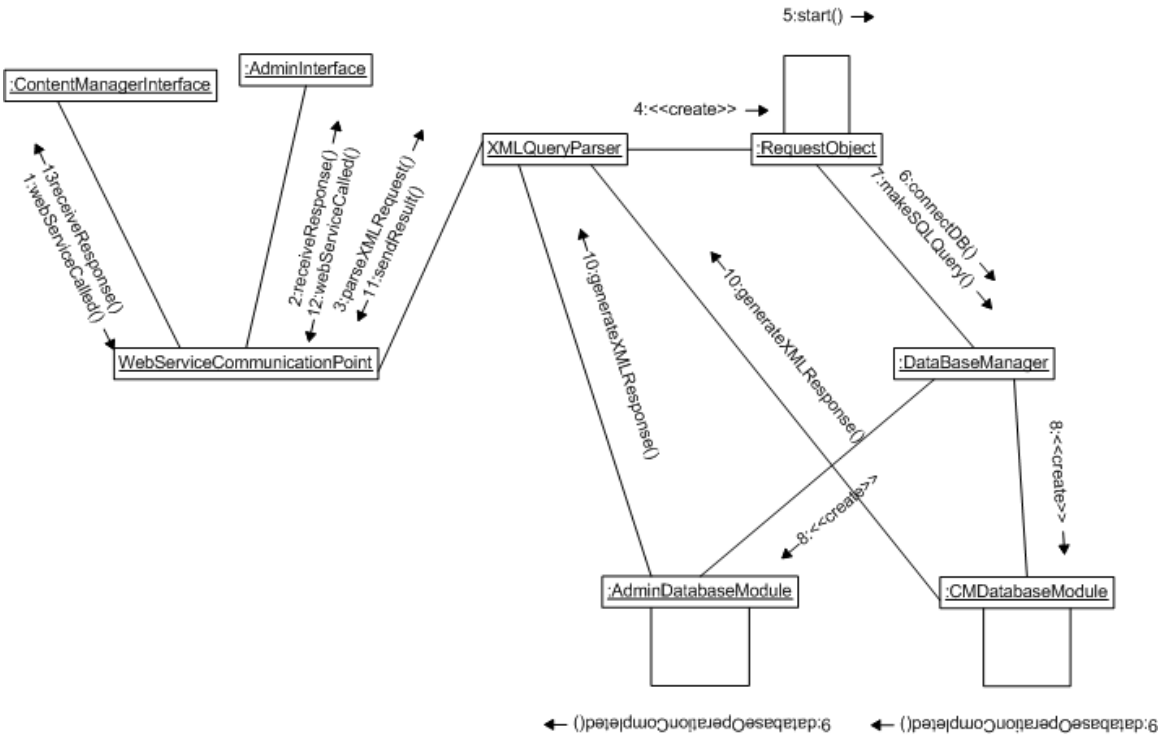
This part of application is about the transportation manipulation in webservice side. When webservice is called by the pda user, WebServiceCaller class initiates the processes in server part. Received XML file is parsed in XMLQueryParser and RequestObject which is an activity is created. After that, search queries of coming objects are generated and sent to the database. While database searches for query results, it generates nodeobjects and nodelinks in order to find shortest path and distance between activity place and user. At the end of this process, graph of the paths is obtained. With the help of the extracted graph, shortest path and transportation options are found. Found paths are matched in Map class and MapManipulator highlight the indicated paths. At the end of map manipulation, this map data is packed in XMLQueryParser as XML file and sent to the user with WebServiceCommunicationPoint. The result list is received by the pda user. Finally, CoreAccess holds some statistics about search items for feedback.

6.5.5. Activity and Place on Server Part



The above diagram represents the requested activity manipulation in server side. The coming XML file from Pda user to WebServiceCommunicationPoint class sent to the XMLQueryParser. The file is parsed and a new RequestObject is created. New query for searching activity is generated with this object. The relevant activities with their places are found and listed. Moreover, if result list is empty, CoreAccess consults to the ontology reasoner in order to serve alternative choices to user. After all searches are done the activities are sorted according to the some attributes such as path distance, alphabetic order, etc. Moreover our system keeps some logs about the searched activities and items for feedback

6.5.6. Administrator and Content Manager Interface Communication



In this collaboration diagram, the interaction between content manager and admin is demonstrated. Content manager and admin communicate with the system via the ContentManegerInterface and AdminInterface classes. The entered data to the interfaces are sent to the server as an XML file. In this phase, XMLQueryParser class parses the file and generates a request object according to the received information. After the queries are formed according to the generated object, queries are sent to the database and manipulated. At the end, the results are obtained and form a return XML file in XMLQueryParser. The file is sent to the user interfaces of the content manager and admin via webservice.

7. SYNTAX DEFINITION

7.1. XML File Representation

In this part, we have defined the structure of the XML messages that will be used in providing the communication between server and the other clients. Our design lies on web service technology so we used XML in order to make processes communicate with each other. The message syntax is composed of User Requests, Administrator Requests, Content Manager Requests, and Responses for Users, Administrators and Content Managers. Details of the message syntax can be found below:

```
<?xml version="1.0" standalone="yes"?>
<MessagingSyntax>


    <!--  USER REQUESTS  -->

    <SearchLocationRequest      name=""      currentPosition=""      map=""
destinationPosition="">
    </SearchLocationRequest>

    <SearchCategoryRequest            name=""            currentPosition=""
map=""></SearchCategoryRequest>

    <TransportationAlternativesRequest          fromPos=""          toPos=""
map=""></TransportationAlternativesRequest>

    <MapRequest name="" zoomLevel="" position=""></MapRequest>

    <DistanceCalculationRequest                map=""                loc1=""
loc2=""></DistanceCalculationRequest>




    <!--  ADMIN REQUESTS  -->
    <LoginRequest type="CM | A" name="" passwd=""> </LoginRequest>

    <ViewActivityListRequest session=""></ViewActivityListRequest>

    <ModifyActivityRequest name="" mapName="" session="">
        <AddActivity>activityData</AddActivity>
        <DeleteActivity></DeleteActivity>
        <RenameActivity newName=""></RenameActivity>
        <ModifyActivityDescription>
            <DeleteDescription descName=""></DeleteDescription>
            <UpdateDescription newDescp=""></UpdateDescription>
            <AddDescription newDescp=""></AddDescription>
        </ModifyActivityDescription>
    </ModifyActivityRequest>

    <ViewMapListRequest session=""></ViewMapListRequest>

    <ModifyMapRequest name="" session="">
        <UploadMap>mapData</UploadMap>
        <DeleteMap></DeleteMap>

        <ModifyNode name="">
            <AddNode>nodeData</AddNode>
            <DeleteNode></DeleteNode>
            <RenameNode newName=""></RenameNode>
        </ModifyNode>
    </ModifyMapRequest>


    <ViewPlaceListRequest session=""></ViewPlaceListRequest>

    <ModifyPlaceRequest name="" mapName="" session="">
        <UploadPlace>mapData</UploadPlace>
        <DeletePlace></DeletePlace>
        <ModifyPlace newName=""></ModifyPlace>
    </ModifyPlaceRequest>
```

```
<ViewVehicleListRequest session=""></ViewVehicleListRequest>

<ModifyVehicleRequest name="" mapName="" session="">
    <AddVehicle>vehicleData</AddVehicle>
    <DeleteVehicle></DeleteVehicle>
    <RenameVehicle newName=""></RenameVehicle>
</ModifyVehicleRequest>


<ViewOntologyListRequest session=""></ViewOntologyListRequest>

<ModifyOntologyRequest name="" mapName="" session="">
    <AddOntology>ontologyData</AddOntology>
    <DeleteOntology></DeleteOntology>
    <UpdateOntology>ontologyData</UpdateOntology>
</ModifyOntologyRequest>


<ViewCMListRequest session=""></ViewCMListRequest>
<ViewCMStatisticsRequest session=""></ViewCMStatisticsRequest>

<ModifyCMRequest name="" session="">
    <AddCM> CMDATA AS XML </AddCM>
    <DeleteCM></DeleteCM>
    <UpdateCM> CMDATA AS XML </UpdateCM>
</ModifyCMRequest>


<MonitorRequest>
    <UserLog></UserLog>
    <ActivityLog></ActivityLog>
    <ActivityPlaceLog></ActivityPlaceLog>
    <CategoryLog></CategoryLog>
</MonitorRequest>



<!--  CONTENT MANAGER REQUESTS  -->
<LoginRequest type="CM" name="" passwd=""> </LoginRequest>

<ModifyActivityRequest name="" mapName="" session="">
    <AddActivity>nodeData</AddActivity>
    <DeleteActivity></DeleteActivity>
    <RenameActivity newName=""></RenameActivity>
    <ModifyActivityDescription>
        <DeleteDescription descName=""></DeleteDescription>
        <UpdateDescription newDescp=""></UpdateDescription>
        <AddDescription newDescp=""></AddDescription>
    </ModifyActivityDescription>
</ModifyActivityRequest>

<ModifyActivityPlaceRequest name="" mapName="" session="">
    <UpdatePhoneNumber phone=""></UpdatePhoneNumber>
    <UpdateAddress address=""></UpdateAddress>
    <UpdateEmail email=""></UpdateEmail>
</ModifyActivityPlaceRequest>
```

```
    <!--  RESPONSE FOR USERS  -->

        <SearchLocationResponse>
            <Place name="" type="" phone="" email="" currentPosition="">
                <Address>address</Address>
                <Path color="">
                    nodeListSeperatedByCommas
                </Path>
                <DrawPoint langitude="" latitude="" color=""></DrawPoint>
                <Distance type="" quantity=""></Distance>
            </Place>
            ....
        </SearchLocationResponse>

        <SearchCategoryResponse name="" currentPosition="">
            <CategoryInfo name="">
                <Place name="" type="" phone="" email="" position="">
                    <Address>address</Address>
                    <Path color="">
                        nodeListSeperatedByCommas
                    </Path>
                    <DrawPoint            langitude=""            latitude=""
color=""></DrawPoint>
                    <Distance type="" quantity=""></Distance>
                </Place>
                <Activity name="" type="" time="" date="">
                    <descr>descr</descr>
                </Activity>
                ....
            </CategoryInfo>
            ....
        </SearchCategoryResponse>

        <TransportationAlternativesResponse fromPos="" toPos="">
            <VehicleList>
                <Vehicle name="" time="" type="" fromPos="" toPos="" min=""
cost="">
                    <Path color="">
                        nodeListSeperatedByCommas
                    </Path>
                    <Distance type="" quantity=""></Distance>
                </Vehicle>
                ....
            </VehicleList>
            ....
        </TransportationAlternativesResponse>

        <MapResponse name="" zoomLevel="" position="">
            <MapData>mapdata</MapData>
        </MapResponse>


        <!--  RESPONSE FOR ADMIN  -->
        <LoginResponse       type="CM       |       A"       isSuccessful=""
session="">message</LoginResponse>


        <ViewActivityListResponse isSuccessful="">
```

```
            <Activity name="" location="" type="" address="" date="" time=""
phone="">description</Activity>
            ....
        </ViewActivityListResponse>

        <ModifyActivityResponse name="" isSuccessful="">
            message
        </ModifyActivityResponse>

        <ViewMapListResponse isSuccessful="">
            <MapData name="" zoomLevel="">mapdata</MapData>
        </ViewMapListResponse>

        <ModifyMapResponse name="" isSuccessful="">
            message
        </ModifyMapResponse>


        <ViewPlaceListResponse isSuccessful="">
            <Place name="" type="" phone="" email="" destinationPosition="">
                <Address>address</Address>
                <Path color="">
                    nodeListSeperatedByCommas
                </Path>
                <DrawPoint langitude="" latitude="" color=""></DrawPoint>
                <Distance type="" quantity=""></Distance>
            </Place>
            ...
        </ViewPlaceListResponse>


        <ModifyPlaceResponse isSuccessful="">
            message
        </ModifyPlaceResponse>



        <ViewVehicleListResponse isSuccessful="">
            <Vehicle  name=""  time=""  type=""  fromPos=""  toPos=""  min=""
cost="">
                <Path color="">
                    nodeListSeperatedByCommas
                </Path>
                <Distance type="" quantity=""></Distance>
            </Vehicle>
            ...
        </ViewVehicleListResponse>

        <ModifyVehicleResponse isSuccessful="">
            message
        </ModifyVehicleResponse>


        <ViewOntologyListResponse  isSuccessful="">
            <Ontology name="" location="">ontology</Ontology>
            ...
        </ViewOntologyListResponse>

        <ModifyOntologyResponse isSuccessful="">
            message
        </ModifyOntologyResponse>
```

```
        <ViewCMListResponse isSuccessful="">
            <CM   name=""   passwd=""   email=""   phone=""   address=""   id=""
company="" regDay=""/>
            ....
        </ViewCMListResponse>

        <ViewCMStatisticsResponse isSuccessful="">
            <Action name="" query="" cmID=""></Action>
            ...
        </ViewCMStatisticsResponse>

        <ModifyCMResponse isSuccessful="">
            message
        </ModifyCMResponse>


        <MonitorResponse isSuccessful="">
            <UserLog>log</UserLog>
            ...
            <ActivityLog>log</ActivityLog>
            ...
            <ActivityPlaceLog>log</ActivityPlaceLog>
            ...
            <CategoryLog>log</CategoryLog>
            ...
        </MonitorResponse>


        <!--  RESPONSE FOR CONTENT MANAGERS  -->
        <LoginResponse       type="CM       |       A"       isSuccessful=""
session="">message</LoginResponse>


        <ViewActivityListResponse isSuccessful="">
            <Activity name="" location="" type="" address="" date="" time=""
phone="">description</Activity>
            ....
        </ViewActivityListResponse>

        <ModifyActivityResponse isSuccessful="">
            message
        </ModifyActivityResponse>

        <ModifyActivityPlaceResponse isSuccessful="">
            message
        </ModifyActivityPlaceResponse>


</MessagingSyntax>
```

7.2. XSD of the System

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema                        xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified"   xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
```

```
  <xs:import           namespace="http://www.w3.org/2001/XMLSchema-instance"
schemaLocation="xsi.xsd"/>
  <xs:element name="SearchLocationRequest">
    <xs:complexType>
      <xs:attribute name="currentPosition" use="required"/>
      <xs:attribute name="destinationPosition" use="required"/>
      <xs:attribute name="map" use="required"/>
      <xs:attribute name="name" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="SearchCategoryRequest">
    <xs:complexType>
      <xs:attribute name="currentPosition" use="required"/>
      <xs:attribute name="map" use="required"/>
      <xs:attribute name="name" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="TransportationAlternativesRequest">
    <xs:complexType>
      <xs:attribute name="fromPos" use="required"/>
      <xs:attribute name="map" use="required"/>
      <xs:attribute name="toPos" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="MapRequest">
    <xs:complexType>
      <xs:attribute name="name" use="required"/>
      <xs:attribute name="position" use="required"/>
      <xs:attribute name="zoomLevel" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="DistanceCalculationRequest">
    <xs:complexType>
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      <xs:attribute name="loc2" use="required"/>
      <xs:attribute name="map" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="LoginRequest">
    <xs:complexType>
      <xs:attribute name="name" use="required"/>
      <xs:attribute name="passwd" use="required"/>
      <xs:attribute name="type" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="ModifyActivityRequest">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="AddActivity"/>
        <xs:element ref="DeleteActivity"/>
        <xs:element ref="RenameActivity"/>
        <xs:element ref="ModifyActivityDescription"/>
      </xs:sequence>
      <xs:attribute name="mapName" use="required"/>
      <xs:attribute name="name" use="required"/>
      <xs:attribute name="session" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="AddActivity" type="xs:NCName"/>
  <xs:element name="DeleteActivity">
    <xs:complexType/>
```

```
</xs:element>
<xs:element name="RenameActivity">
  <xs:complexType>
    <xs:attribute name="newName" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyActivityDescription">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="DeleteDescription"/>
      <xs:element ref="UpdateDescription"/>
      <xs:element ref="AddDescription"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="DeleteDescription">
  <xs:complexType>
    <xs:attribute name="descName" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UpdateDescription">
  <xs:complexType>
    <xs:attribute name="newDescp" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="AddDescription">
  <xs:complexType>
    <xs:attribute name="newDescp" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyCMRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="AddCM"/>
      <xs:element ref="DeleteCM"/>
      <xs:element ref="UpdateCM"/>
    </xs:sequence>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="AddCM" type="xs:string"/>
<xs:element name="DeleteCM">
  <xs:complexType/>
</xs:element>
<xs:element name="UpdateCM" type="xs:string"/>
<xs:element name="ModifyMapRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="UploadMap"/>
      <xs:element ref="DeleteMap"/>
      <xs:element ref="ModifyNode"/>
    </xs:sequence>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UploadMap" type="xs:NCName"/>
<xs:element name="DeleteMap">
  <xs:complexType/>
</xs:element>
```

```
<xs:element name="ModifyNode">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="AddNode"/>
      <xs:element ref="DeleteNode"/>
      <xs:element ref="RenameNode"/>
    </xs:sequence>
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  </xs:complexType>
</xs:element>
<xs:element name="AddNode" type="xs:NCName"/>
<xs:element name="DeleteNode">
  <xs:complexType/>
</xs:element>
<xs:element name="RenameNode">
  <xs:complexType>
    <xs:attribute name="newName" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyOntologyRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="AddOntology"/>
      <xs:element ref="DeleteOntology"/>
      <xs:element ref="UpdateOntology"/>
    </xs:sequence>
    <xs:attribute name="mapName" use="required"/>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="AddOntology" type="xs:NCName"/>
<xs:element name="DeleteOntology">
  <xs:complexType/>
</xs:element>
<xs:element name="UpdateOntology" type="xs:NCName"/>
<xs:element name="ModifyPlaceRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="UploadPlace"/>
      <xs:element ref="DeletePlace"/>
      <xs:element ref="ModifyPlace"/>
    </xs:sequence>
    <xs:attribute name="mapName" use="required"/>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UploadPlace" type="xs:NCName"/>
<xs:element name="DeletePlace">
  <xs:complexType/>
</xs:element>
<xs:element name="ModifyPlace">
  <xs:complexType>
    <xs:attribute name="newName" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyVehicleRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="AddVehicle"/>
```

```
      <xs:element ref="DeleteVehicle"/>
      <xs:element ref="RenameVehicle"/>
    </xs:sequence>
    <xs:attribute name="mapName" use="required"/>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="AddVehicle" type="xs:NCName"/>
<xs:element name="DeleteVehicle">
  <xs:complexType/>
</xs:element>
<xs:element name="RenameVehicle">
  <xs:complexType>
    <xs:attribute name="newName" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="MonitorRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="UserLog"/>
      <xs:element ref="ActivityLog"/>
      <xs:element ref="ActivityPlaceLog"/>
      <xs:element ref="CategoryLog"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="ViewActivityListRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewCMListRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewCMStatisticsRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewMapListRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
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<xs:element name="ViewOntologyListRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewPlaceListRequest">
  <xs:complexType>
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  </xs:complexType>
</xs:element>
<xs:element name="ViewVehicleListRequest">
  <xs:complexType>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
```

```
</xs:element>
<xs:element name="ModifyActivityPlaceRequest">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="UpdatePhoneNumber"/>
      <xs:element ref="UpdateAddress"/>
      <xs:element ref="UpdateEmail"/>
    </xs:sequence>
    <xs:attribute name="mapName" use="required"/>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="session" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UpdatePhoneNumber">
  <xs:complexType>
    <xs:attribute name="phone" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UpdateAddress">
  <xs:complexType>
    <xs:attribute name="address" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="UpdateEmail">
  <xs:complexType>
    <xs:attribute name="email" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="SearchLocationResponse">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="Place"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="SearchCategoryResponse">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="CategoryInfo"/>
    </xs:sequence>
    <xs:attribute name="currentPosition" use="required"/>
    <xs:attribute name="name" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="CategoryInfo">
  <xs:complexType mixed="true">
    <xs:choice minOccurs="0" maxOccurs="unbounded">
      <xs:element ref="Activity"/>
      <xs:element ref="Place"/>
    </xs:choice>
    <xs:attribute name="name" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="TransportationAlternativesResponse">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="VehicleList"/>
    </xs:sequence>
    <xs:attribute name="fromPos" use="required"/>
    <xs:attribute name="toPos" use="required"/>
  </xs:complexType>
```

```
</xs:element>
<xs:element name="VehicleList">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="Vehicle"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="MapResponse">
  <xs:complexType>
    <xs:complexContent>
      <xs:extension base="MapData">
        <xs:attribute name="name" use="required"/>
        <xs:attribute name="position" use="required"/>
        <xs:attribute name="zoomLevel" use="required"/>
      </xs:extension>
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</xs:element>
<xs:element name="LoginResponse">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:NCName">
        <xs:attribute name="isSuccessful" use="required"/>
        <xs:attribute name="session" use="required"/>
        <xs:attribute name="type" use="required"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
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<xs:element name="ModifyActivityResponse">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:NCName">
        <xs:attribute name="isSuccessful" use="required"/>
        <xs:attribute name="name"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyCMResponse">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:NCName">
        <xs:attribute name="isSuccessful" use="required"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
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        <xs:attribute name="name" use="required"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
<xs:element name="ModifyOntologyResponse">
  <xs:complexType>
```

```
      <xs:simpleContent>
        <xs:extension base="xs:NCName">
          <xs:attribute name="isSuccessful" use="required"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
  </xs:element>
  <xs:element name="ModifyPlaceResponse">
    <xs:complexType>
      <xs:simpleContent>
        <xs:extension base="xs:NCName">
          <xs:attribute name="isSuccessful" use="required"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
  </xs:element>
  <xs:element name="ModifyVehicleResponse">
    <xs:complexType>
      <xs:simpleContent>
        <xs:extension base="xs:NCName">
          <xs:attribute name="isSuccessful" use="required"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
  </xs:element>
  <xs:element name="MonitorResponse">
    <xs:complexType mixed="true">
      <xs:choice minOccurs="0" maxOccurs="unbounded">
        <xs:element ref="ActivityLog"/>
        <xs:element ref="ActivityPlaceLog"/>
        <xs:element ref="CategoryLog"/>
        <xs:element ref="UserLog"/>
      </xs:choice>
      <xs:attribute name="isSuccessful" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="ViewActivityListResponse">
    <xs:complexType mixed="true">
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        <xs:element minOccurs="0" maxOccurs="unbounded" ref="Activity"/>
      </xs:sequence>
      <xs:attribute name="isSuccessful" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="ViewCMListResponse">
    <xs:complexType mixed="true">
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      </xs:sequence>
      <xs:attribute name="isSuccessful" use="required"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="CM">
    <xs:complexType>
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      <xs:attribute name="company" use="required"/>
      <xs:attribute name="email" use="required"/>
      <xs:attribute name="id" use="required"/>
      <xs:attribute name="name" use="required"/>
      <xs:attribute name="passwd" use="required"/>
      <xs:attribute name="phone" use="required"/>
```

```
    <xs:attribute name="regDay" use="required"/>
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</xs:element>
<xs:element name="ViewCMStatisticsResponse">
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    <xs:sequence>
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    </xs:sequence>
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  </xs:complexType>
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  <xs:complexType>
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    <xs:attribute name="name" use="required"/>
    <xs:attribute name="query" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewMapListResponse">
  <xs:complexType>
    <xs:complexContent>
      <xs:extension base="MapData">
        <xs:attribute name="isSuccessful" use="required"/>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
</xs:element>
<xs:element name="ViewOntologyListResponse">
  <xs:complexType mixed="true">
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    <xs:attribute name="isSuccessful" use="required"/>
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</xs:element>
<xs:element name="Ontology">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:NCName">
        <xs:attribute name="location" use="required"/>
        <xs:attribute name="name" use="required"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
<xs:element name="ViewPlaceListResponse">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="Place"/>
    </xs:sequence>
    <xs:attribute name="isSuccessful" use="required"/>
  </xs:complexType>
</xs:element>
<xs:element name="ViewVehicleListResponse">
  <xs:complexType mixed="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="Vehicle"/>
    </xs:sequence>
    <xs:attribute name="isSuccessful" use="required"/>
  </xs:complexType>
</xs:element>
```

```
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  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:NCName">
        <xs:attribute name="isSuccessful" use="required"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
<xs:element name="UserLog" type="xs:string"/>
<xs:element name="ActivityLog" type="xs:string"/>
<xs:element name="ActivityPlaceLog" type="xs:string"/>
<xs:element name="CategoryLog" type="xs:string"/>
<xs:element name="Place">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="Address"/>
      <xs:element ref="Path"/>
      <xs:element ref="DrawPoint"/>
      <xs:element ref="Distance"/>
    </xs:sequence>
    <xs:attribute name="currentPosition"/>
    <xs:attribute name="destinationPosition"/>
    <xs:attribute name="email" use="required"/>
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```

```
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</xs:schema>
```

8. CONCLUSION

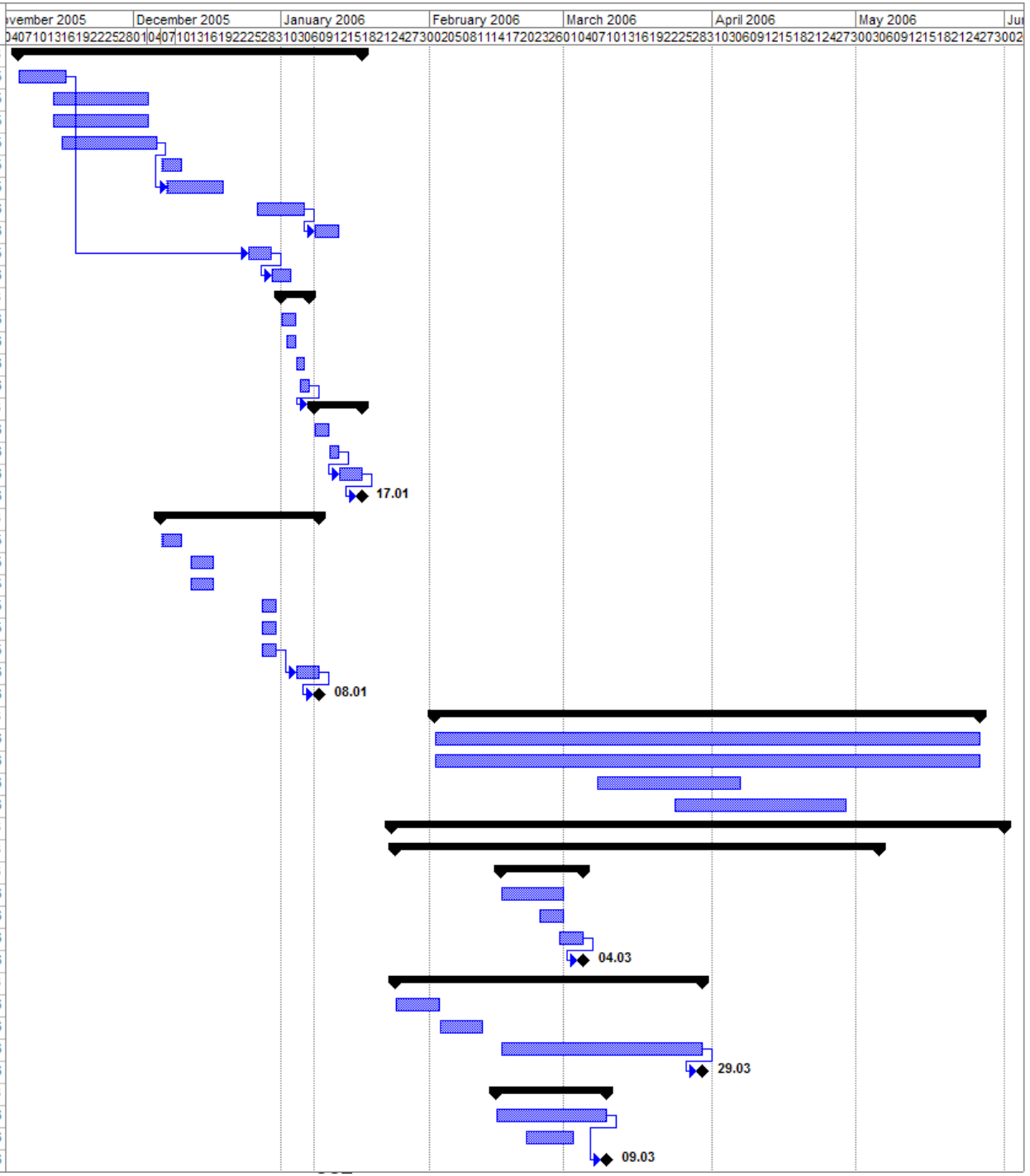
Preparing the complete design report of CoreAccess was a very profitable milestone for CoreTech. Designing the project with several diagrams in the initial design helped us with making our minds more clear about project. Then in the complete design, we have prepared the graphical user interfaces of our project. Moreover, we have explained the diagrams clearly. As a result, we believe we did good work by forming the complete design report and we will have the benefit of it soon.

9. APPENDIX

9.1. Updated Gantt Chart

Updated Gantt Chart can be found at the next page.

ID	Task Name	Duration	Start	Finish
1	**Demo Preparation**	**69 days**	**Mon 07.11.05**	**Tue 17.01.06**
2	Example User interface that runs on the PDA emulators	10 days	Mon 07.11.05	Wed 16.11.05
3	Research on GIS	20 days	Mon 14.11.05	Sat 03.12.05
4	Research on vector maps	20 days	Mon 14.11.05	Sat 03.12.05
5	Research on ontology (OWL, OWLS, OWL instance)	20 days	Wed 16.11.05	Mon 05.12.05
6	Running a sample program on the real PDA	4 days	Wed 07.12.05	Sat 10.12.05
7	Studying tutorials on Protege	12 days	Thu 08.12.05	Mon 19.12.05
8	Study on web services	10 days	Tue 27.12.05	Thu 05.01.06
9	Implementation of a simple webservice caller	5 days	Sun 08.01.06	Thu 12.01.06
10	Developing user interfaces of PDA User	5 days	Sun 25.12.05	Thu 29.12.05
11	Adding links between user interfaces	4 days	Fri 30.12.05	Mon 02.01.06
12	**Prototype of Prototype**	**6 days**	**Sun 01.01.06**	**Fri 06.01.06**
13	Studying on documentation of TerraServer	3 days	Sun 01.01.06	Tue 03.01.06
14	Calling an arbitrary method of TerraServer	2 days	Mon 02.01.06	Tue 03.01.06
15	Improving the prototype by calling a sequence of met	2 days	Wed 04.01.06	Thu 05.01.06
16	Implementing zoom functionality	2 days	Thu 05.01.06	Fri 06.01.06
17	**Implementing Basic Browsing for Map on PDA**	**8 days**	**Sun 08.01.06**	**Tue 17.01.06**
18	Adding navigation functionality	3 days	Sun 08.01.06	Tue 10.01.06
19	Adding scale functionality	2 days	Wed 11.01.06	Thu 12.01.06
20	Demo Integration	3 days	Fri 13.01.06	Tue 17.01.06
21	Milestone	0 days	Tue 17.01.06	Tue 17.01.06
22	**Detailed Design Report**	**32 days**	**Wed 07.12.05**	**Sun 08.01.06**
23	Reviewing Initial Design	4 days	Wed 07.12.05	Sat 10.12.05
24	Drawing Administrator Interface	5 days	Tue 13.12.05	Sat 17.12.05
25	Drawing Content Manager Interface	5 days	Tue 13.12.05	Sat 17.12.05
26	Checking & Updating UML Diagrams	3 days	Wed 28.12.05	Fri 30.12.05
27	Checking & Updating Data Models	3 days	Wed 28.12.05	Fri 30.12.05
28	Checking & Updating Flow Models	3 days	Wed 28.12.05	Fri 30.12.05
29	Forming the complete report	4 days	Wed 04.01.06	Sun 08.01.06
30	Milestone	0 days	Sun 08.01.06	Sun 08.01.06
31	**Management of the Project**	**90 days**	**Thu 02.02.06**	**Fri 26.05.06**
32	Updating Web Page	90 days	Thu 02.02.06	Fri 26.05.06
33	Adding Recent Reports	90 days	Thu 02.02.06	Fri 26.05.06
34	Configuration Management and Development Plan	22 days	Wed 08.03.06	Thu 06.04.06
35	Test Plan Specification	28 days	Fri 24.03.06	Fri 28.04.06
36	**Development of the Project**	**101 days**	**Tue 24.01.06**	**Wed 31.05.06**
37	**Implementation of Modules**	**80 days**	**Wed 25.01.06**	**Fri 05.05.06**
38	**GPS Module Implementation**	**14 days**	**Thu 16.02.06**	**Sat 04.03.06**
39	Examining the Examaple GPS Applications	10 days	Thu 16.02.06	Tue 28.02.06
40	Deciding Simulation Model of GPS	3 days	Fri 24.02.06	Tue 28.02.06
41	Implementing Virtual GPS	5 days	Tue 28.02.06	Sat 04.03.06
42	Milestone	0 days	Sat 04.03.06	Sat 04.03.06
43	**PDA Module Implementation**	**49 days**	**Wed 25.01.06**	**Wed 29.03.06**
44	User Interface Design in PDA (C# . net)	7 days	Wed 25.01.06	Thu 02.02.06
45	Implementing Language Manager	7 days	Fri 03.02.06	Sat 11.02.06
46	Map Manipulation and Storage on PDA	32 days	Thu 16.02.06	Wed 29.03.06
47	Milestone	0 days	Wed 29.03.06	Wed 29.03.06
48	**Content Manager Implementation Module**	**19 days**	**Wed 15.02.06**	**Thu 09.03.06**
49	Adding functionality of Add/Remove Nodes	19 days	Wed 15.02.06	Thu 09.03.06
50	Enhancement of User Interfaces	8 days	Tue 21.02.06	Thu 02.03.06
51	Milestone	0 days	Thu 09.03.06	Thu 09.03.06



ID	Task Name	Duration	Start	Finish
52	**Server Side Implementation**	**62 days**	**Tue 07.02.06**	**Thu 27.04.06**
53	**GIS Engine Module**	**18 days**	**Fri 10.02.06**	**Fri 03.03.06**
54	Graph Generation for Path Finding	13 days	Fri 10.02.06	Fri 24.02.06
55	Matching the Nodes with Map Labels	6 days	Sat 18.02.06	Fri 24.02.06
56	Combining the Results of PathFinder and Tr	10 days	Mon 20.02.06	Fri 03.03.06
57	**Activity Module**	**11 days**	**Thu 09.03.06**	**Thu 23.03.06**
58	Creating Activity Database	7 days	Thu 09.03.06	Fri 17.03.06
59	Filling Activity Database	6 days	Thu 16.03.06	Thu 23.03.06
60	**Pathfinder Module**	**15 days**	**Thu 23.03.06**	**Wed 12.04.06**
61	Implementation of Dijkstra's Algorithm	7 days	Thu 23.03.06	Fri 31.03.06
62	Providing Links between Nodes	1 day	Wed 12.04.06	Wed 12.04.06
63	**Transportation Module**	**10 days**	**Wed 12.04.06**	**Sun 23.04.06**
64	Adding Vehicle Support	7 days	Fri 14.04.06	Sat 22.04.06
65	Time Estimation Support	8 days	Wed 12.04.06	Fri 21.04.06
66	Cost Estimation Support	7 days	Mon 17.04.06	Sun 23.04.06
67	Milestone (First Release)	0 days	Sun 23.04.06	Sun 23.04.06
68	**Ontology Module**	**37 days**	**Tue 07.02.06**	**Fri 24.03.06**
69	Developing Cinema Ontology	4 days	Tue 07.02.06	Fri 10.02.06
70	Developing Transportation Ontology	8 days	Wed 15.03.06	Fri 24.03.06
71	Reasoning on Ontology	8 days	Wed 15.02.06	Thu 23.02.06
72	**Logger Module**	**24 days**	**Wed 15.02.06**	**Thu 16.03.06**
73	Storing Coming Information into DB	8 days	Tue 07.03.06	Thu 16.03.06
74	Adding Graphical Display	4 days	Wed 15.02.06	Sat 18.02.06
75	**Administrative Module**	**16 days**	**Thu 09.03.06**	**Thu 30.03.06**
76	Adding Map Editing Option	6 days	Thu 09.03.06	Thu 16.03.06
77	Adding Management Property of CM Accou	7 days	Thu 16.03.06	Fri 24.03.06
78	Developing Statistics Screen	7 days	Wed 22.03.06	Thu 30.03.06
79	**Map Module**	**10 days**	**Wed 12.04.06**	**Sun 23.04.06**
80	Forming Vector Map	8 days	Wed 12.04.06	Fri 21.04.06
81	Defining Activity Places on Map	9 days	Thu 13.04.06	Sun 23.04.06
82	Milestone	0 days	Thu 27.04.06	Thu 27.04.06
83	**Database Module Implementation**	**10 days**	**Wed 26.04.06**	**Fri 05.05.06**
84	Defining Schema of DB	4 days	Wed 26.04.06	Sat 29.04.06
85	Writing SQL Statements	5 days	Wed 26.04.06	Sun 30.04.06
86	Implementing DB Component	5 days	Mon 01.05.06	Fri 05.05.06
87	**Integration of Modules**	**32 days**	**Wed 12.04.06**	**Thu 18.05.06**
88	GPS Receiver - PDA Interaction	25 days	Wed 12.04.06	Wed 10.05.06
89	Server Modules Integration	25 days	Wed 12.04.06	Wed 10.05.06
90	Database- Server Connection	27 days	Wed 12.04.06	Fri 12.05.06
91	Integration of Logger Module	27 days	Wed 19.04.06	Thu 18.05.06
92	Integration of Ontology Module	26 days	Thu 20.04.06	Thu 18.05.06
93	Integration of PathFinder to Map	27 days	Wed 19.04.06	Thu 18.05.06
94	Integration of Transportation to Map	26 days	Thu 20.04.06	Thu 18.05.06
95	Milestone (Second Release)	0 days	Thu 18.05.06	Thu 18.05.06
96	**Testing the System**	**99 days**	**Tue 24.01.06**	**Mon 29.05.06**
97	Implementation Alpha Testing	94 days	Tue 24.01.06	Tue 23.05.06
98	Integration Alpha Testing	27 days	Wed 19.04.06	Thu 18.05.06
99	Beta Testing	27 days	Thu 27.04.06	Mon 29.05.06
100	**Documentation Support**	**18 days**	**Mon 08.05.06**	**Mon 29.05.06**
101	Taking Snapshots	1 day	Mon 08.05.06	Mon 08.05.06
102	Installation Guide	5 days	Thu 11.05.06	Tue 16.05.06
103	User Manual	8 days	Tue 09.05.06	Wed 17.05.06
104	Help Documentation	5 days	Wed 24.05.06	Mon 29.05.06
105	Milestone	0 days	Mon 29.05.06	Mon 29.05.06