INVISIP

IST-2000-29640

Information Visualisation for Site Planning

WP 4 Analyser

D 4.1: Architectural Concept of Analyser

Deliverable Type	Report
Dissemination level	RE
Date	31.05.02
Due date	31.05.02
Version	V1.0
Authors	M. Piccazzo, G. Valfrè, F. Marangon, M. De Martino, A. Bertone, R. Albertoni, M. Dunkars
Institution	DAPP, IMA-TI, KTH
WP co-ordinator	DAPP

Table of content:

1   Introduction

1.1   Document purpose

This report is part of the first phase of the work package WP4 of INVISIP project concerning the conceptual architecture of the analyser. It describes a possible architecture of the analyser tool for the site planning process based on the INVISIP Framework, the information of the WP2: "Technology Analysis" and WP3: "Case Studies".

The aim of this report is to study the project requirements and define the architecture of the analyser describing pros and cons.

The output of this phase will be used to develop the demonstrator and the prototype of the analyser.

1.2   Partner Task

This document is part of the knowledge shared with the partners concerning the project of INVISIP Analyser. All the partners are invited to discuss the conclusions of this work package. Partners involved in this task are DAPP, IMA-TI and KTH.

1.3   Document structure

The document is organised as follows:

- *Chapter 2* describes the *Analysis Process* studying INVISIP Framework, detailing the Workflow and the operations a user can do. It ends with the functionality required in the system;
- *Chapter 3 - Analyser Components* characterises each component of the Analyser;
- *Chapter 4 - The Analyser in INVISIP System* describes the relations among the Analyser and the other components;

- *Chapter 5 – Development environment* describes the proposed architecture and gives the guidelines of implementation of Analyser components;
- *Chapter 6* – contains *Summary/Conclusion.*

2 Analysis process

In this section we summarise the requirements of the Analyser beginning from INVISIP Framework. Afterwards we study the site planning process identifying the workflow of site planning analysis and the essential user requirements. At the end, we list the functionalities required in the INVISIP system.

2.1 INVISIP Framework

The INVISIP Framework shows the INVISIP actors (Analyser, Metadata Browser and Data Integration) and relations among them.

The Analyser is an actor that "enables users to navigate in unfamiliar information spaces and to determine semantic relationships between necessary geodata. The main part of the analyser builds the analysis instrument, which could be used as add-on for local planning tools."

The main problem of the Analyser is that we have heterogeneous data and a set of planning tools (every one for a specific analysis and with a particular syntax): we want to use the same data for several purpose and with different tools. As stated in WP3:"Case studies"[p. 5], "the site planning process is characterized by different working-tasks" so that each working-task could be a single process of the Analyser. We can think that the main task of the Analyser is to assist the user during the input data mining, during the selection of the correct planning tool and during the data output extraction.

At the same time, the INVISIP Framework specifies that "the Analyser consists of three parts: analysis instrument including analysis algorithms, analysis repository including context information with reference to the site planning process (e.g. existing laws, rules and standards or environmental thresholds) and visual data mining techniques which facilitate the decision-

making process for all involved parties." Now the INVISIP Framework describes the Analyser splitting it into algorithms, repository and visual data mining.
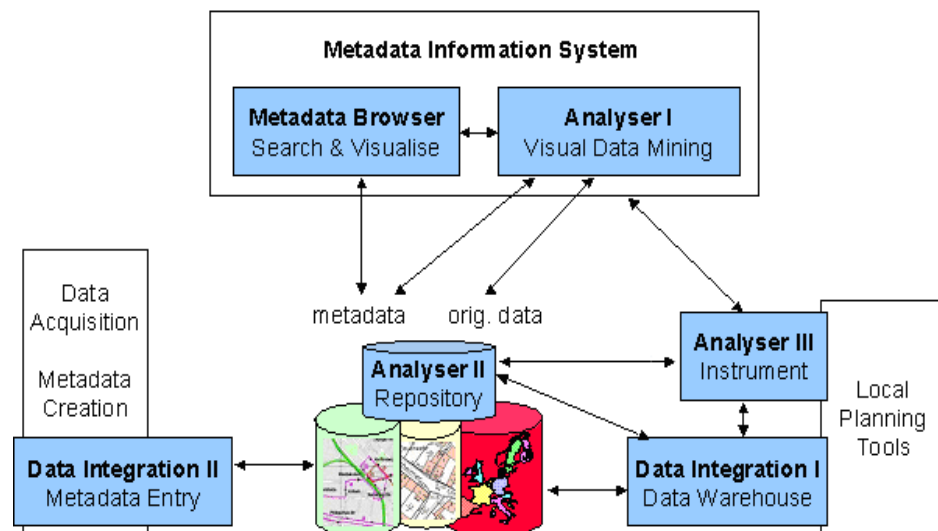

Figure 1: INVISIP Framework

Semplifying, the Repository contains metadata (as defined in the standard ISO 19115) and extensions that are non-standard metadata describing non-geodata. The Visual Data Mining allows the user to find usable patterns in extensions and/or metadata. The Instrument is an add-on for local planning tools: it follows the user during the analysis.

Now we have to define the data flows among the components of INVISIP Framework:

- Instrument sends input specifications for a local planning tools to Repository;
- Repository receives queries from the Metadata Browser and Instrument;
- Repository can be updated by Data Integration Tools with new metadata;
- Visual Data Mining receives metadata from Metadata Browser;

- Instrument sends output result to Data Integration.

2.2 INVISIP workflow

The INVISIP workflow is an abstract model of the site planning analysis. The necessity of define a workflow comes from the fact that all analyses have to perform a list of common steps that the user must complete in order to terminate the site planning analysis.

The INVISIP Workflow reflects the Site Planning Process (Figure 2) where we can identify:

- planning task;
- site planning analysis;
- analysis of results.

Figure 2: Site Planning Process

During the planning task, the user has to configure the analysis defining his objectives: he can build his profile using default settings and modifying

them. In this step the user chooses the analysis and then the Metadata Browser begins the search. When the user has the results of his queries, he can compare the items each other in order to individuate the best using, for example, the Visual Data Mining. In some cases, some items of the result of the search can have a sample application that is a complete case study. This process can be done again until the result satisfies the user and it breaks off when the user has all the information for retrieve raw data.

When the user continues the planning, we suppose that he has input data or samples application. At this moment, optionally, we can have a data integration step and during this step the user must add information in order to complete input data.

When the input of the site planning is ready, the Instrument component helps the user during the analysis: it gives instructions and samples for the local tools. If a specific tool is entirely integrated in INVISIP process, the Instrument interface can run commands on local machine simplifying the analysis process.

At the end of the analysis, due to the Data Integration Tool, the user can write metadata about the output of his analysis and send them to the Repository.

Steps of the workflow can be detailed as follow (Table 1):

- configuration of the analysis;
- research of information about input data using metadata;
- analysis of the results of previous research with Visual Data Mining;
- visualisation of datasets;
- loading of application profile;
- check of input data;
- execution of the planning analysis using local tools;
- analysis;

- visualisation of results
- metadata integration of results;
- turn back to the INVISIP website and send metadata about the results of the analysis.

TASK	Single step	
PLANNING TASK	Configure analysis	
	Refine search	
	Metadata search	Visual Data Mining
		Visualise Datasets
DEVELOPMENT TASK	Load application profile	
	Integrate data	
	Analysis	
ANALYSIS OF RESULTS	Visualisation of result	
	Metadata for results	
	Submit to INVISIP	

Table 1: INVISIP Workflow

The configuration of the analysis involves both Instrument component and Repository in fact the Instrument calls the Repository every time we need a list of tools and default settings. At the end of this step the Instrument sends a list of keywords to the Metadata Browser for the research of metadata about input data. The Metadata Browser asks information to the Repository. Items listed in the result of the last research contain all the links for retrieve data and/or sample applications.

At this moment the user can:
- run a sample application (using Instrument component);
- compare results or study their attributes (using Visual Data Mining);
- browse to the linked websites and retrieve raw data.

In any way, raw data must be integrated (with Data Integration) if they are not according to the Local Planning requirements. The Instrument component is involved during the execution of planning analysis or sample applications.

The last step is the feedback to the INVISIP site: the Data Integration component handles output of the analysis and send their metadata to the repository.

2.3 User requirements

Since user interface directly affects the usability of software, the first requirement of INVISIP website is that the Graphic User Interface must be simple and self-explained. During the site planning analysis the user must see always the same website style even if the component that control the single operation changes (for example we can have first Instrument component and the Metadata Browser).

The second requirement is that the user interface must show what the user should do, that is, we have to visualise the state of the current analysis and relate it to the workflow. We define "session" a series of interactions between user and INVISIP website: it is an instance of the workflow. This means that a session begins when a user executes the first step of the workflow and it finishes when he reaches the last operation of the workflow.

We can add important functions for the session management. The INVISIP system can log the current session and maintains its data (user settings and results), so the user can:
- undo/redo operations;
- restore a previous analysis.

Moreover we can register users and foreseen different levels of accesses (for example administrator, planner, guest, data-entry user) in order to give different privileges.

2.4   Functionality required

The analysis of the INVISIP Framework and the analysis of the user requirements make clear that we have to split the INVISIP architecture in a client and server applications.

The client system is the Graphic User Interface and it appear in the browser.

The server is a set of programs each one for a specific execution of a step.

In the client we have the results of every research (from Metadata Browser, for example), the output of Visual Data Mining and reference pages about Instrument tools. Moreover INVISIP Partners and users can insert data using Data Integration components.

Session management is implemented in a new component: the Control Unit. A client and a server application that exchange data about current session compose it. The client contains the interface where the user can find buttons and menu in order to open, save or interrupt an analysis, it visualises the actual state and it saves local information. On the other side, the server contains a database where it archives information about users and sessions. The server updates the workflow on the client giving the list of enabled/disabled operations.

All the components of INVISIP sends information to the Control Unit through client of the Control Unit, as shown in Figure 3.
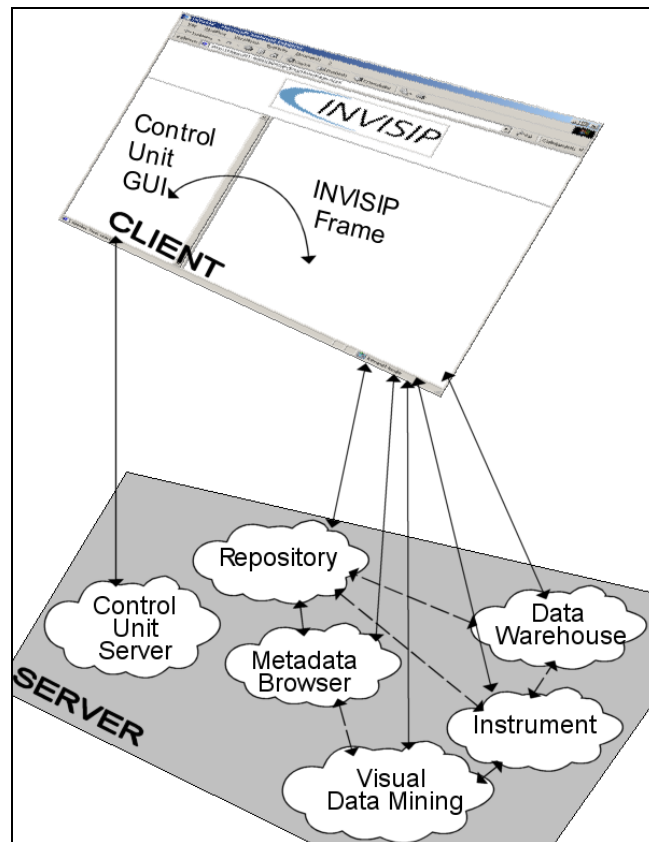
Figure 3: Relation among client and server components

We consider that the state session changes when client interface displays new contents in INVISIP Frame. We do not consider a change of state when the server completes an operation because between the client and the server there is a network connection. In fact when, for example, the Instrument prepared a new page and is sending it to the client, the user can interrupt session without read the new page.

During local planning analysis, the client of the Control Unit stores information about the site planning on local machine. The local information is displayed during the analysis, without computer connection too.

In order to allow all the data flows among INVISIP components and Analyser, components must call each other using a standard protocol that enable the execution of an operation. The Repository must define an

DAPP

interface so that Metadata Browser and Instrument can run a query on database and Data Warehouse can insert/modify data. At the same time, Visual Data Mining and Metadata Browser must use the same formalism to describe results.

3   Analyser components

The analyser is composed by the following components:

- Graphic User Interface (GUI);
- Control Unit (CU);
- Repository;
- Visual Data Mining (VDM);
- Instruments.

The organisation of the different components is depicted in Figure 4 where:

- analyser;
- metadata information system;
- local planning tools;

are highlighted and represented with their principal components.

The main relationships (data/metadata flows) between the different components are represented with arrows, solid for the relationships internal to the Analyser and dashed for the external ones.
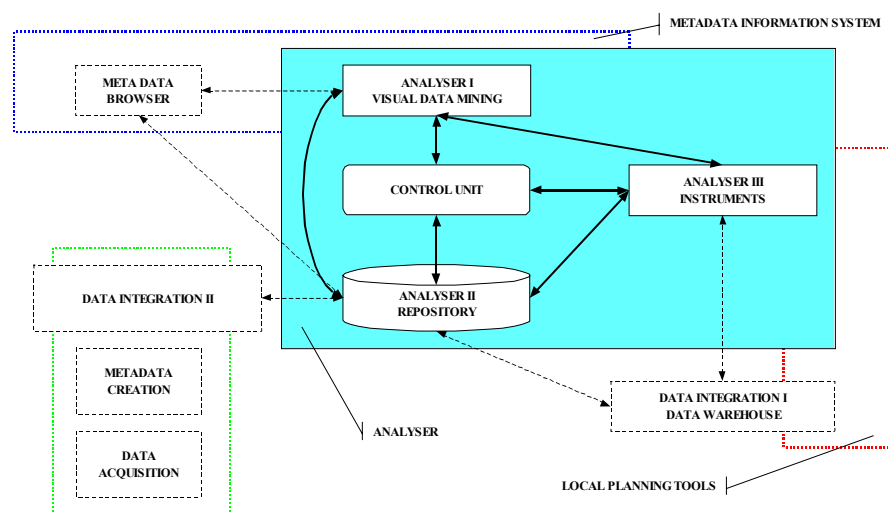
Figure 4: The Components of the Analyser

In the following paragraphs of this chapter the functions of the different parts are briefly described.

3.1 Graphic User Interface (GUI)

The Graphic User Interface (GUI) allows the user to develop the complete session of work suggesting the correct options at each step (Paragraph 2.2). A simplified scheme of the interface is reported in Figure 5.
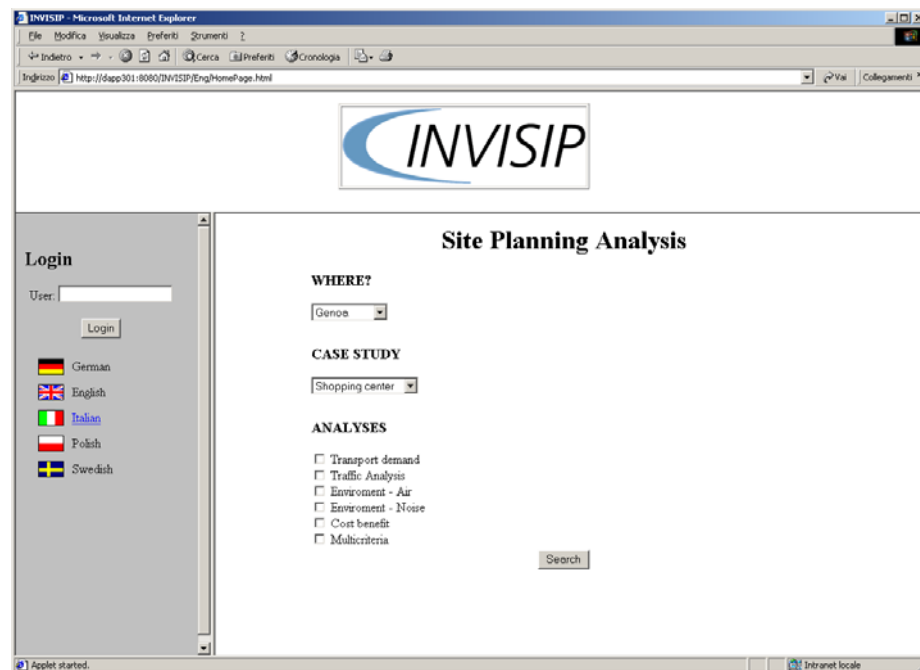

Figure 5: INVISIP GUI

The INVISIP user interface is divided into three different frames that are:

- the static INVISP logo;
- the area dedicated to the Control Unit for visualisation of site planning process status and to the login;
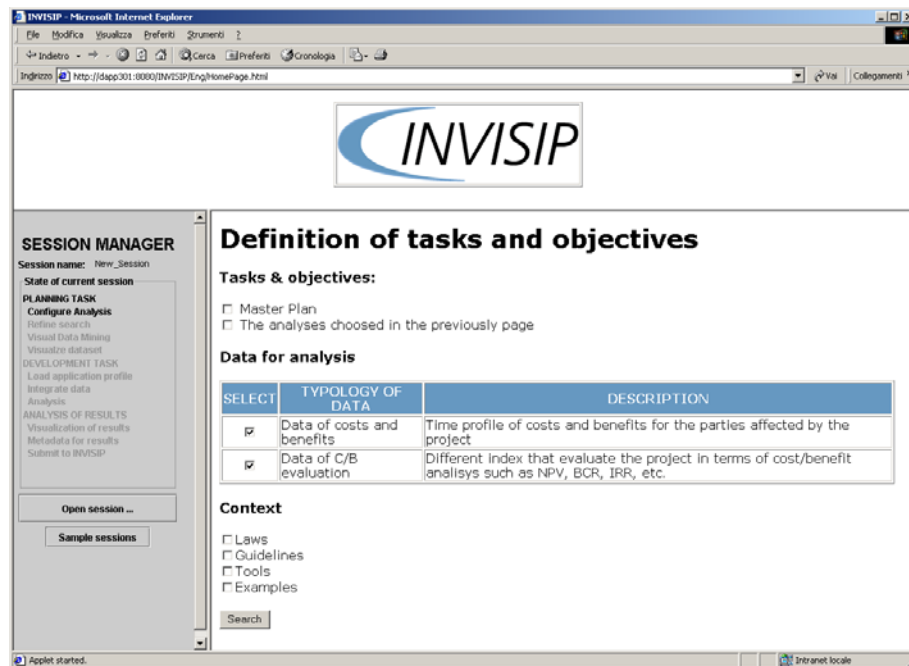- the area where the user interacts with the components.

Figure 6: INVISIP GUI

The first one characterises the screen and stands for all the process long. In the second one are reported all the data related to the session management: here we have the Graphic User Interface of the Control Unit where the planner can inserts his own identification name, he can change the language of the interface or open previous session, for example. In the third frame the instruction of selected instruments are reported as well as the input and output data of every single step of the workflow.

3.2   Control Unit (CU)

The Control Unit (CU) has four basic functions:

- users administration;
- co-ordination of INVISIP components;
- session management;
- representation of the current session status.

The first typology of functions allows managing the user access to INVISIP tools. All users have to be registered and they have different passwords each other. User identifications and passwords are necessary to manage the user work sessions.

The second typology of functions provides the communication among INVISIP components. As shown in Figure 7, the *application n* can register/modify data stored temporarily in the Control Unit. *Application n* notifies the end of its operation also to the Control Unit that runs the *application n+1.* As *application n, application n+1* stores or loads data from the Control Unit.
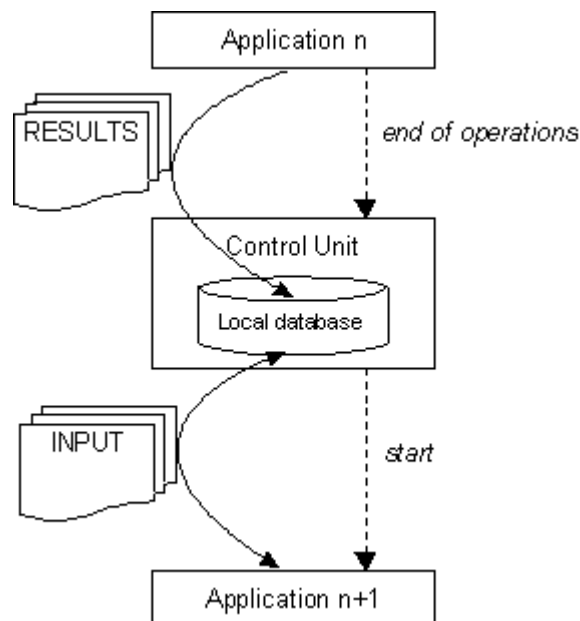

Figure 7: Applications and Control Unit

Session management allows a single user to create and save different work-sessions on the INVISIP system (even if they are not completed) without confuse or overwrite them. Another important function of session management is that user can interrupt or reload a session and restore its status.

The last function is the visualisation of the status of the current session: it displays the operations provided by workflow, it activates/deactivates the operations enabled/disabled. All the parameters related to the each operation performed previously are saved and send to the INVISIP Website. The CU is able to give all the information on the session needed by the user. If a session is abandoned before the end, the CU allowed the user to save the status of the session and to continue the analysis in a second moment starting from last operation done.

3.3   Repository

The repository contains all data necessary for INVISIP to work. The main groups of data are:

- the whole complex of the metadata and extensions;
- a database that contains the operational information for the system;
- a database that contains all the information needed for the management of the users such as user identity, passwords, etc.

The metadata are related to each source if data defined in INVISIP system and describe attribute of data contained. They are used by the metadata browser to select the appropriate data during a search activities.

The operational information system contains the set of data used by the whole system to run properly. For example typical data of this type are the configuration of server as path, directory of a component, default parameter.

The session management database contains all the data necessary to organise the access to the INVISP site in terms of users and passwords. All this type of data are storage in an appropriate and secure way and used to guaranty a correct use of the site and the information.

3.4 Visual Data Mining (VDM)

In INVISIP, Analyser I provide Visual Data Mining instruments that provide functionality to support two main working tasks in the site planning process:

- data selection
- geo-data analysis in site planning process

In data selection task, VDM functionality supports the user to select datasets that are suitable to his site-planning task. VDM component works as a filter to reduce the set of datasets provided by searching with Metadata Browser. The VDM component can also give the user a better comprehension of what task a particular dataset is suitability for.

In geo-data analysis, VDM functionality support the user to perform analysis in different steps of the site planning process, discovering relationships and patterns among geo-data, providing a better comprehension of available geo-data and/or of the analysis results performed by site planning tools.

Before describing the VDM architecture, some details on the modules, which characterised Analiser I are needed. In general a VDM instrument is characterised by at least one of the two modules: Visualisation component and Data Mining techniques.

Visualisation component is characterised by three elements:

- visualisation techniques,
- interaction functionality,
- input data type.

Data Mining techniques is characterised by:

- Data Mining Algorithm,
- input data type,
- output data type

In INVISIP, Analiser I is composed by the following components:

- A set of Configured Visual Data Mining Instruments;
- VDM control panel (GUI);
- VDM Instrument Builder (optional).

A **Configured Visual Data Mining Instrument (CVDMI)** is a VDM tool where each element both of the Visualisation module and of the Data Mining technique is predefined. The idea is to give to the user a list of already combined possibility of visualisation techniques, interaction functionality and data mining algorithm.

VDM control panel provides the following functionalities:

- Selection of a configured VDM instrument.
- Connection among active visualisations (Brushing & Linking techniques). When the user interacts with a visualisation, his data interaction has a repercussion in other open visualisation windows.
- Save of VDM result: results can be stored both as new original data and as new metadata according with the performed analysis.

The **VDM Instrument Builder** is a module to improve the potentiality of Analyser I: it aims to build new Configured Visual Data Mining Instruments. Anyway this component is not mandatory in INVISIP implementation: such component could be provided in a second phase of INVISIP development.

A description of how VDM Component can be applied to data selection and data analysis tasks follows.

3.4.1 VDM & Data Selection

VDM provides functionalities to support the user in the selection of data sets that better fulfil his analysis tasks. In this task VDM component is web-based as it is part of Metadata Information System, and works along with Metadata Browser.

Input:

- metadata about data set selected with metadata browser tool;
- keywords used to select the metadata.

Output:

The process of visual data mining provides a subset of the input metadata set.

How it works

User interacts with VDM Panel to apply configured VDM instruments toinput. For instance, he is able to open different VDM instruments and select his data performing "visual queries". The following diagram (Figure 8) illustrates how the VDM process selects data starting from Metadata & Keywords:

- *Visualisation:* User applies some configured visualisation on initial set of metadata and keywords.
- *User Interaction*: User interacts with activated visualisation in order to explore metadata and keywords and select a subset of initial set.
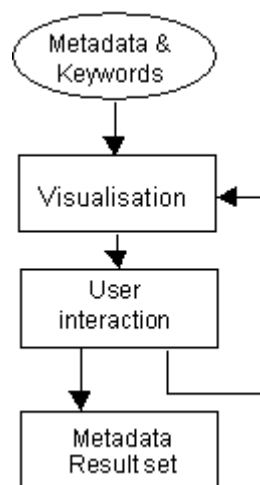- *Metadata result set*: User stores his resulting metadata set.

Figure 8: VDM process

3.4.2 VDM & Data Analysis

In Data Analysis, VDM functionality help the user to have a better comprehension about geo-data. In this case, Analyser I works likewise INVISIP local analysis instruments: it runs as a stand alone local tool, it uses the same modules used by analysis instrument to access original data and attach metadata on data mining results.

Input:

- Geo-data integrated in a GIS/ Warehouse

Output:

Different kinds of output according with VDM approach and data mining techniques. This will include:

- Correlation among geo-data

- Classification of geo-data

- Clustering of data having similar properties

User interacts with VDM Panel to apply configured VDM instruments to input. For instance, he is able to active a DM algorithm and performs the analysis provided by the available instruments.

The following diagram (Figure 9) shows an example of the DM process among geo-data.

- *DM algorithm*: User applies some configured algorithms on Geo-data.

- *Visualisation*: User interacts with activated visualisation to explore intermediate results.

- *Analysis result*: User stores his result both as New geo-data both as metadata.
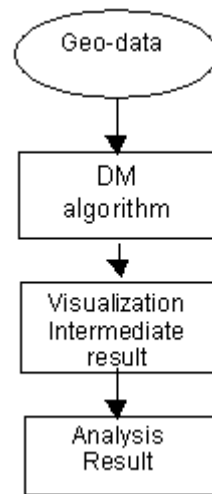
Figure 9: DM process

3.4.3 VDM Requirements

3.4.3.1 Data requirements

Two sets of data are required: Metadata and Geo-data. Geo-data consists of two subset of geographic data: cartographic data and descriptive attributes of geographic data (numerical data). Geo data can be in raster or vector format and should be organised in a GIS/Data warehouse. A great amount of data and attributes are required to have reliable result.

3.4.3.2 Component / Integration requirements

VDM application uses visualisation tools, i.e. Application Programming Interface (API) that could be accessed by external applications. These tools should provide an interface to data management.

VDM application needs also to be connected to the following components:

- Graphic GIS Interface to visualise VDM result (if needed).
- Repository and GIS database/data warehouse to read and select data.
- Module to store results.

3.5   Instruments

INVISIP is able to guide users, who have find out the correct data for the current case study, to perform analysis with most common software tools normally used in site planning activities.

The part of INVISIP system related to the instruments could be divided into three different functions:

- simulation tools management;
- input data management;
- output data and new thematic map management;
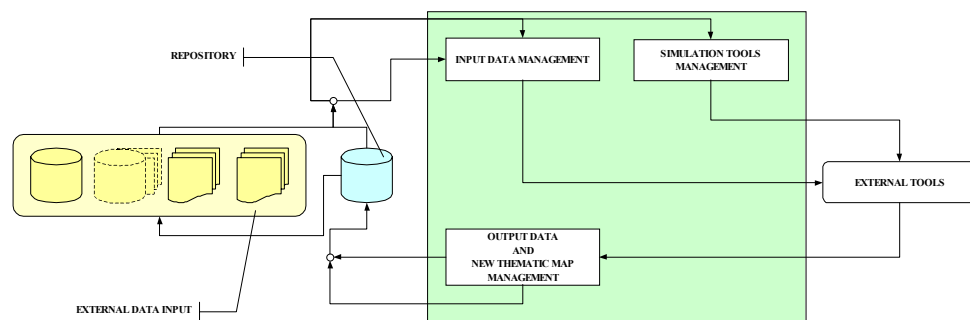
that are depicted in Figure 10.

Figure 10: INVISIP Instruments Tool

The description of the function of the three part are briefly introduced in the following paragraphs.

3.5.1 Simulation tools management

The functions of simulation tools management allow the user to interact with different basics tools for the site planning.

The user could select one of the different tools proposed. The system gives to the user all the information about the tool selected in terms of:

- functions;

- input requirements;

- methodology adopted;

- output data.

The system compares the necessary data and the one detained by the user in order to verify if the analysis could be perform.

If the result of the previous test is positive the system guides the user to prepare the correct input ant to interpret the output results of the tool chosen.

3.5.2 Input data management

A set of different type of tools helps the user to define the different input file necessary to perform the analysis chosen. The system gives, depending on the case:

- a function of auto-composition of the input files;

- some sample of input files;

- guidelines to compile the inputs from the user data.

At the end of the process the input files are available and the analysis could be performed.

3.5.3 Output data and new thematic map management

At the end of the analysis INVISIP helps the user to:

- transfer the data from the output format to a user-define format;

- represent data in an effective way using diagrams, table, etc.;

- create new thematic maps representing the most significant results of the analysis.

If the user supposes that the analysis has an importance for other users can let them classified in INVISP repository sending the analysis to the web master. The analysis would be checked during the process of data integration and the results would be available for other users.

4   The Analyser in INVISIP System

4.1   The Repository

4.1.1 Data Selection

The first functionality of the analyser is to drive the user in the use of metadata browser, defining the research criteria (keywords). This result is achieved trough two steps:

1. Selection of the type of the analysis (e.g. traffic, environmental, etc.);

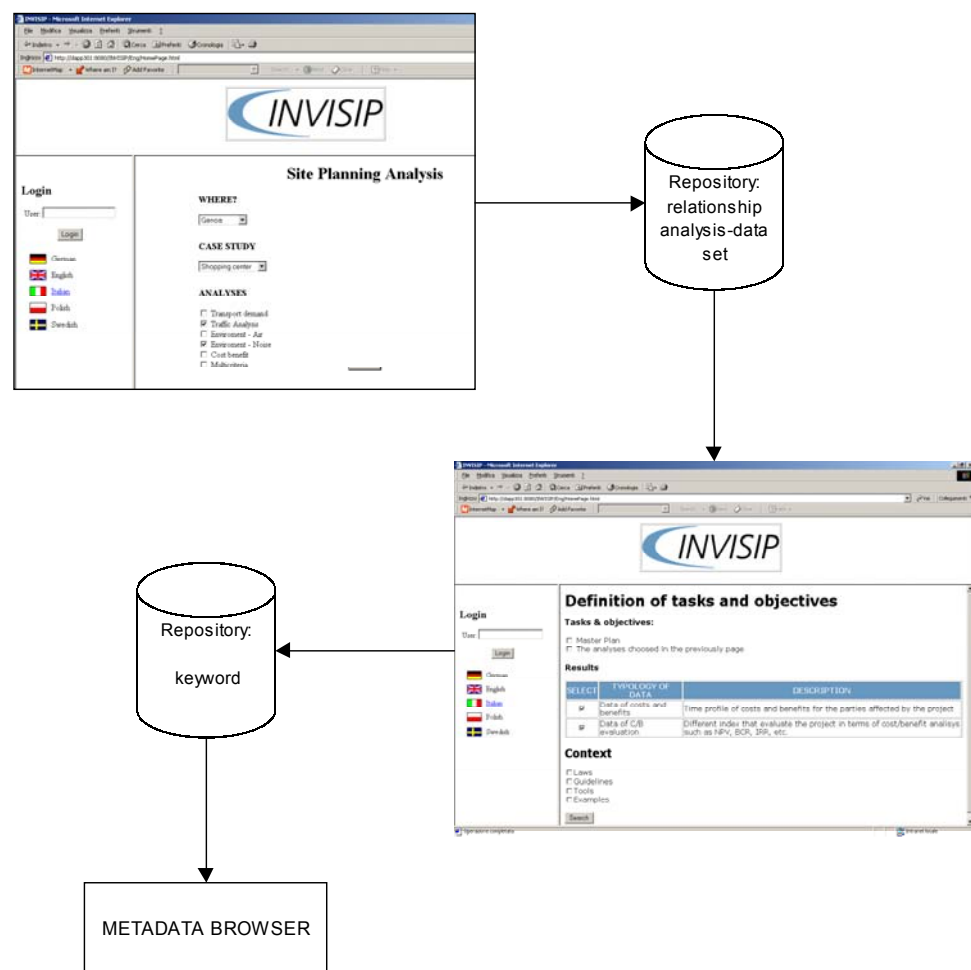2. Confirm the needed using a checklist provided from by system.

Figure 11: Keywords definition process

To perform the above-mentioned phases, the analyser communicates with the repository as shown in Figure 11. The repository contains a table that relates the different analysis with the relative needed data. Therefore the analyser can run a query, based on the user selection and build the second page.

The user can confirm the research criteria and else provide the keywords to the metadata browser. Also this step is performed with support of the repository, that contains the element to define the keywords.

The Table 2 shows the relationships between analysis and data, and the first hypothesis of keywords

KEYWORDS	TYPOLOGY OF DATA	DESCRIPTION	TRANSPORT DEMAND	TRAFFIC ANALYSIS	ENVIRONMENT - AIR	ENVIRONMENT - NOISE	COST BENEFIT	MULTICRITERIA
socioEconomic	Demographic and socio-economics data	Description of the inabitants of the site of the case in terms of population, popolation density, car ownership, employed resident and income, etc.	x		x	x		
landUse	Land-use data	Representation of the different type of land use such as presence of schools, hospitals, commercial centres, industry, etc.	x		x	x		
timeValue	Time value	Time value for the different users (used to evalaute the modal split)	x	x				
GIS	G.I.S.	G.I.S. of the analysed zone	x	x	x	x		
vector	Vector Map	Vector map of the analysed zone	x	x	x	x		
raster	Raster Image	Raster Image of the analysed zone	x	x	x	x		
topology	Network topology	Description of the network in terms of nodes and links (position, length, etc.)	x	x	x	x		
networkTransport	Network transport data	Description of the characteristic of the nodes (type, limitations, stop signs, etc.) and the links (type, capacity, velocity, costs, pavimentation, etc.)		x	x	x		
actualTraffic	Actual traffic flows	Values of the present traffic flows needed to calibrate the simulation		x	x	x		
OD	OD matrix	Representation of the demand of transportation in terms of numbers of trips origns/destination in each TAZ global or distinguished for transport modes	x	x				
calculatedTraffic	Calculated traffic data	Results of the simulation in terms of traffic flows, queues, costs, speed, etc. and their graphic representations		x	x	x		
CBData	Data of costs and benefits	Time profile of costs and benefits for the parties affected by the project					x	x
CBIndicator	Data of C/B evaluation	Different index that evaluate the project in terms of cost/benefit analisys such as NPV, BCR, IRR, etc.					x	x
clima	Climatic data	Representation of the climatic and meteorolgical conditions (temperature, wind direction and speed, humidity, etc.)			x	x		
vehicleComposition	Vehicle park composition	Description of the composition of the vhilce park in terms of classes ad number of vehicles for classes		x	x	x		
networkMorphologic	Network geomorphologic data	Geomorphologic characteristic of the roads (wideness, pavement typology, etc.)			x	x		
surrounding	Surrounding data	Description of the surrounding the roads (presence of adjacent buildings and their characteristic)				x		
airPollution	Air Pollution	Description of the pollutant dispersion in terms of concentration (global and related o the links), iso-cocentration curves, punctual values (observed or simulated)			x			x
emissionData	Emission data	The emission are described in terms of values of the different pollutant emission during the simulation, fuel consumption, etc.			x			x
noiseData	Input noise data (observed/simulated)	Definition of the background noise and the observed/simulated value of the input sound levels				x		
noisePollution	Noise Pollution	Representation of the results of the enviromental-noise analysis suc as sound level (local or avearage), noise emission modal split, time history of the istantaneus sound level, etc.				x		x
pblicTransport	Pubblic transport	Description of pubblic transport supply		x	x			
parkingPlace	Parking place	Description of the parking place sistem (location, dimension, etc.)		x	x			
safetyData	Safety transport data	Other data that could be needed such as driving styles of drivers		x	x			x

Table 2: Relationships between analysis and data

4.1.2 Data Integration

At the end of the site planning process, the user will get a set of results comprehensive of thematic maps. These can be used to increase the available information for the metadata browser.

The repository contains the reference of all available data (URL, keywords, authors, brief description, etc.), else the analyser will have a specific functionality that support the user in this operation, for example providing a forms, that can be automatically sent to the INVISIP webmaster.

4.2 The Metadata Browser

The functionality of the metadata browser is to enable the users to locate and select appropriate data (especially geographic). To perform this activity, the metadata browser is supported by the analyser at different level (Figure 12):

- **Setup of search**: the analyser provides a set of keyword used for the query refinement:
- **Results visualisation**: the metadata browser uses the analyser to show the funded data, providing a set of URL;
- **Geographic data visualisation**: the analyser allows to have a preview of the Geographic data;
- **Chose of data**: the visual data mining techniques, implemented in the analyser, can support the user in data selection of the appropriate data;
- **Metadata integration**: the visual data mining techniques, can be used to integrated to metadata;
- **New data for search**: the analyser supports the user in the site planning simulation. The simulation results (thematic maps) can become new available information for the metadata browser.
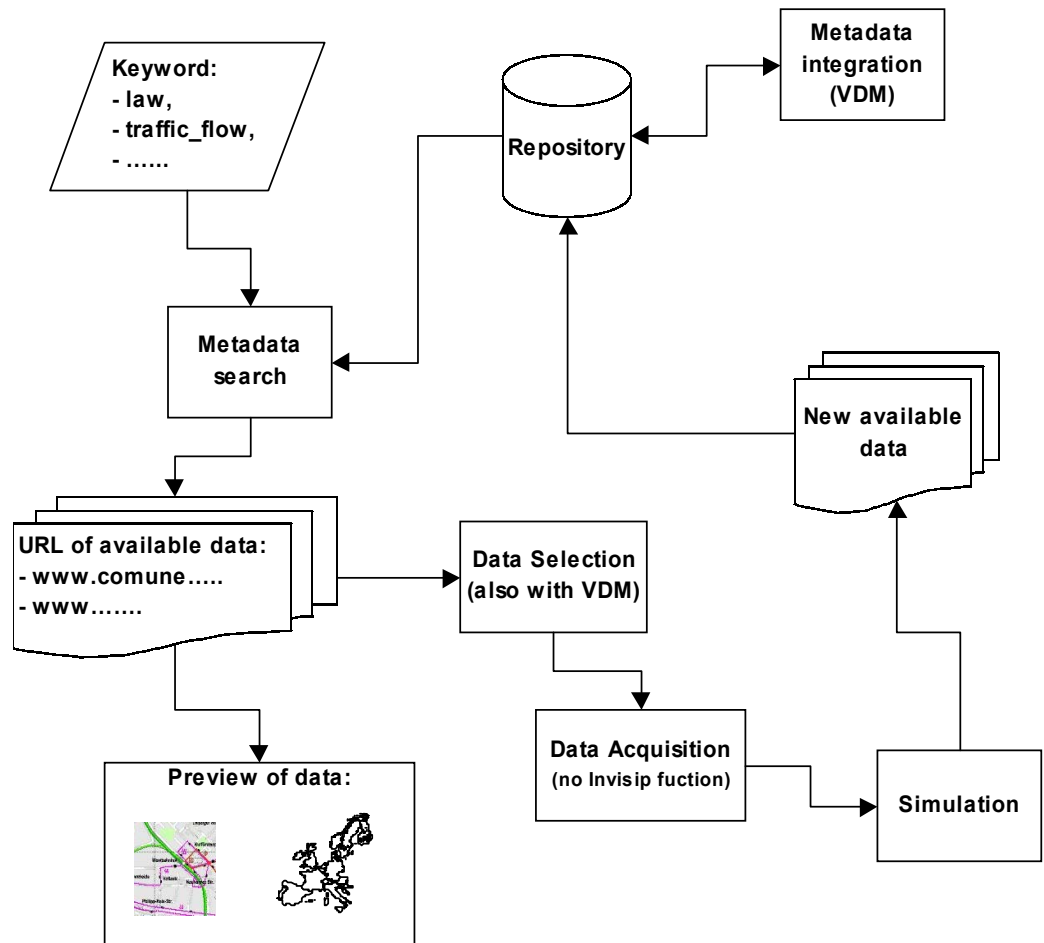
Figure 12: Interaction between Analyser and Metadata browser

5 Development environment

In this section the guidelines of the implementation of the INVISIP Analyser are exposed.

The architecture of the Analyser must be split into the following elements:

- client applications: the GUI for all the application in the browser and the management of local planning tools;
- the server applications that implement the operations of every component.

Both client and server are implemented using Java 1.2 and integrating it with web-technologies (XML, HTML and Javascript).

5.1 The client

In the proposed implementation of the client, the window of the Browser is divided into three frames (Figure 13 and Figure 14): TitleBar, Site_Planning_Frame and Control_Frame:

- the TitleBar is permanent and shows INVISIP Information;
- the Site_Planning_Frame allows to the user to run the different analyses and shows their results. Here the interface of all INVISIP components is displayed. For example, the user can read the output of Metadata Browser, the results Repository queries or Instrument reference;
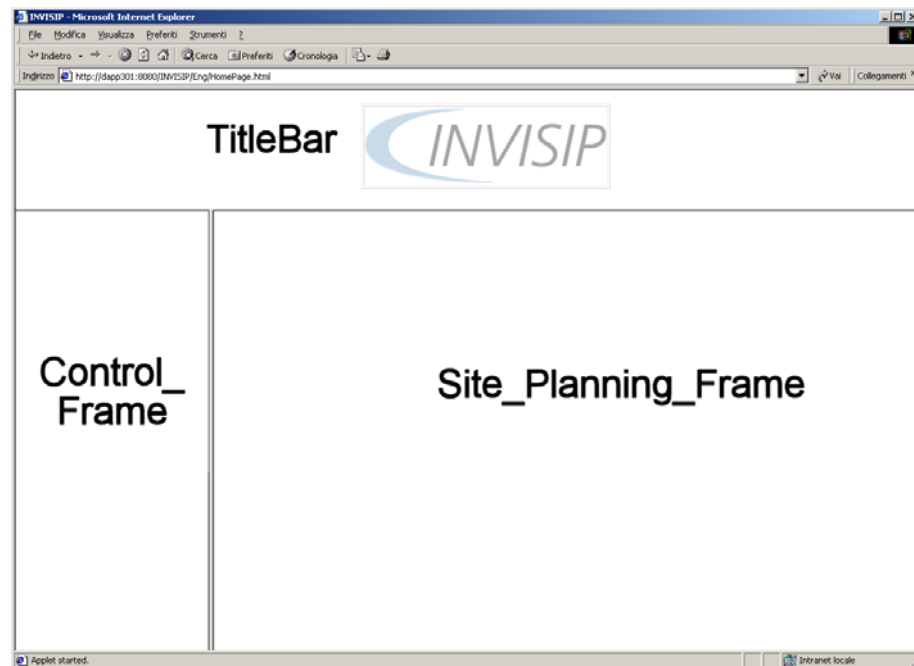- the Control_Frame contains the user interface of the Control Unit.

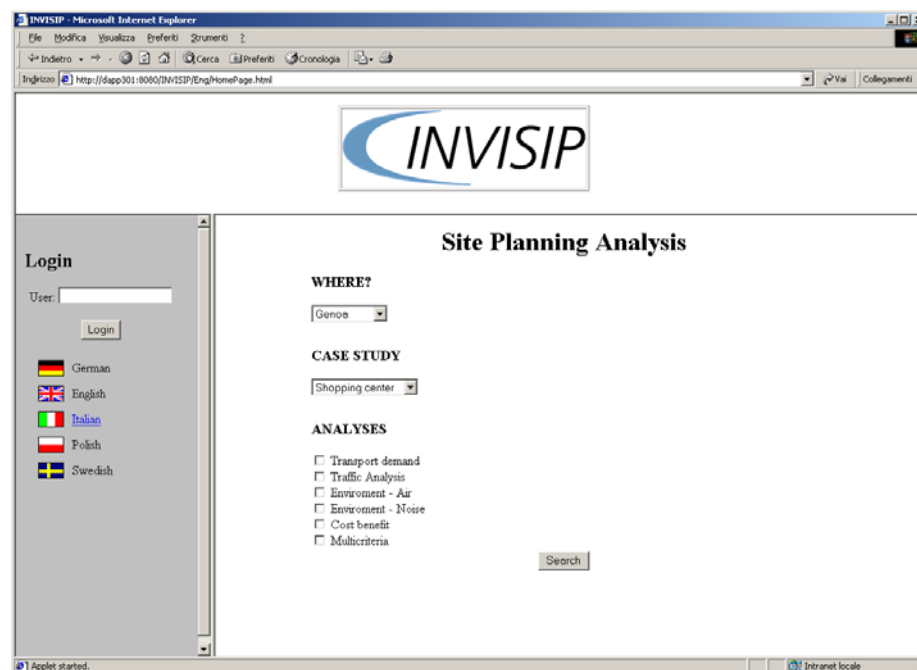**Figure 13: The Graphic User Interface INVISIP**

Figure 14: Implementation of the HomePage

The Control_Frame contains the applet of Control Unit. With it the user can:

1 – login to INVISIP website (Figure 14);

2 – open a session (Figure 15);

3 – save the state of current session (Figure 15);
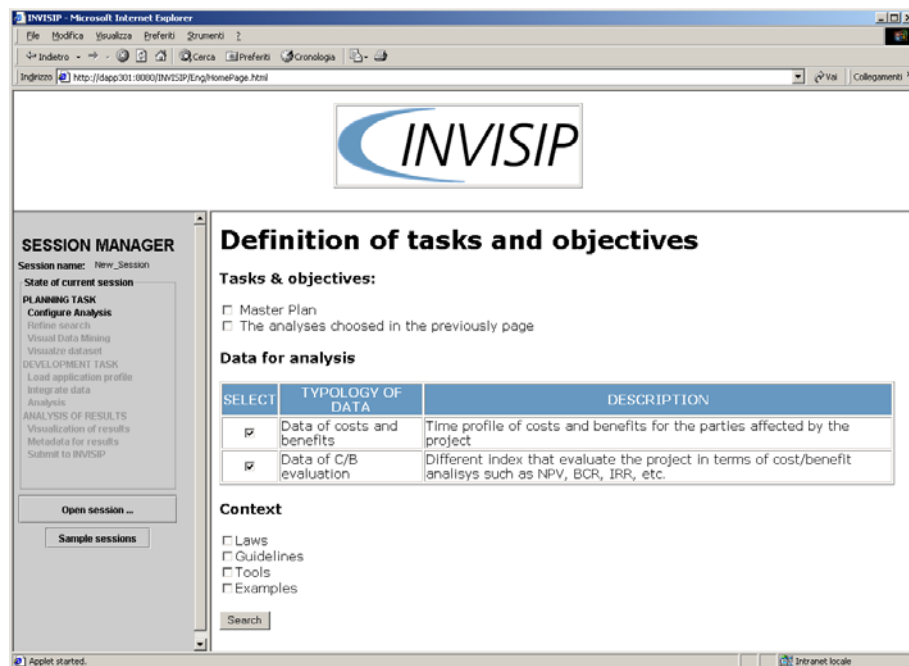
4 – choose sample sessions (Figure 15).

Figure 15: INVISIP website (refining search)

The client application of Control Unit has two operations hidden to the user, too. It has a local database which stores data shared by applications in Site_Planning_Frame (Paragraph 3.2) and it co-ordinates applications. The local database can be improved if the components exchange data XML-formatted with the Control Unit.

The Site_Planning_Frame contains the interfaces of all components that are HTML pages with buttons, text, applets and JavaScript functions as thy need.

The Site_Planning_Frame and the Control_Frame exchange data and commands via JavaScript functions. For example, when the user is browsing in INVISIP website, the Control_Frame receives information about the current session from the Site_Planning_Frame. In details, when the user clicks the button "Search", the first action of this button is to call (via Javascript) the function "ChangeState(param1, param2...)" of the Control_Frame. Then it connects the client with the server and continues its specific operation. With the function "ChangeState" the Site_Planning_Frame:

- stores in the Control Unit the parameters of last step of analysis;
- modifies the state of the workflow (for example, next step can be highlighted).

When the next page is completely loaded in the Site_Planning_Frame, it calls the same function "ChangeState(param1, param2)" to notify the new state and the new data.

The Control Unit can command the Site_Planning_Frame. For example when the user is restoring a previous session, the Control Unit modifies its internal state downloading the state of the session from the server and redirecting last information in Site_Planning_Frame.

5.2 The server

On the server side, INVISIP Analyser is implemented in Java 1.2 integrating Servlet technology, Java Server Pages and connection to database. Each component is a set of programs implemented using the best mix of technologies they need.

Instrument Tools, Visual Data Mining, Repository receive data from the client frames, elaborate them and send results on HTTP connection. The Control Unit can have both HTTP connection and TCP/IP (on a predefined

port). In order to enhance intercommunication, each program defines a public interface. In this way, the components that have to communicate each other have a communication protocol.

The server provides:

- Control Unit Servlet: it manages session data and user access, registering information in a database;
- Repository servlets: they read data from the Repository database that is connected to the server via ODBC;
- Instrument programs: servlet, Java Server Pages and HTML pages are involved in this component that configures the analysis and helps user during site planning;
- Visual Data Mining components.

5.2.1 The Contol Unit development

The Control_Unit is implemented in three servlets at least. Every servlet has its own function: login, data session, data restore. The login function is implemented in LoginServlet and verifies user rights.

Data session is implemented in DataSessionServlet and stores data when the user navigates in the INVISIP website. A session is an instance of the workflow. The session has a name (as a named file). The session, its task and each step have the attribute "state" which can has the values:

- none: if the user does not begin it;
- opened: if the user begun it but do not end it;
- closed: if the user reached the end.

Data restore is implemented in DataRestoreServlet. It has to:

- reads data about user sessions from server database;
- reads the list of sample sessions available to all INVISIP users and can restore them.

5.2.2 The Instrument development

The server side of Instrument is organised in (Figure 16):

- InstrumentServlet provides list of Instrument, their link and general description reading data from Instrument_database
- Application_1_Servlet provides specific information of a site planning instrument reading data from its Application dictionary.
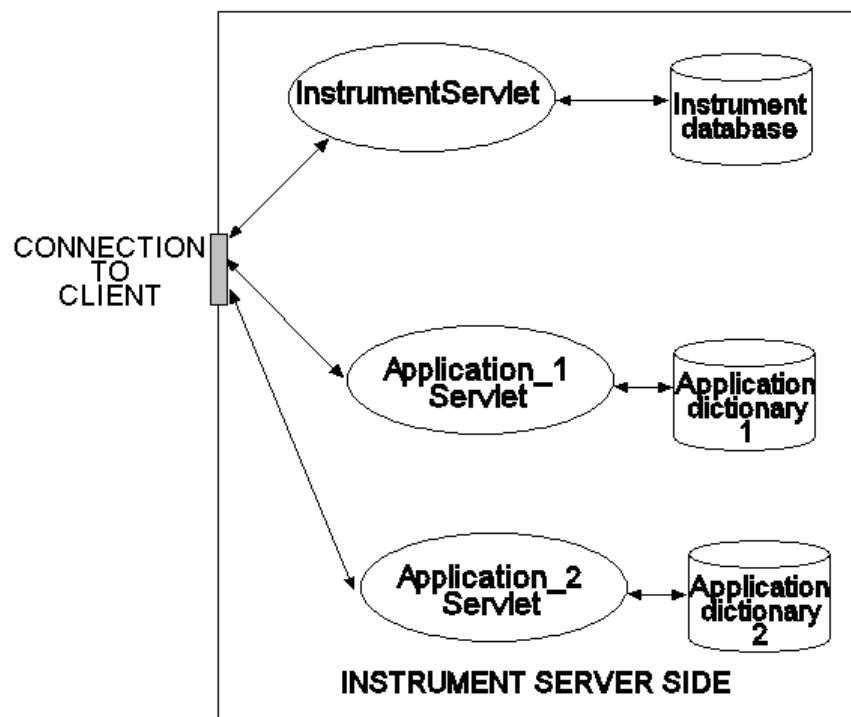
Figure 16: Instrument development on server side

6 Summary / Conclusion

In this report it has been proposed the architecture of the Analyser. In particular it has been considered the client side and the server side of its components.

It has been analysed:

- Control Unit;
- Instrument
- Visual Data Mining
- Repository.

Moreover it has been proposed the list of functions of each component and their implementation guidelines.

7 Lists of Tables and Figures

7.1 List of Tables

7.2 List of Figures