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MANAGMENT SYSTEM ABOUT

BUILDING RETROFITTING

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ABSTRACT

The system will be constituted by a central core (a "super expert") which co-ordinates a data-base, a thermal building behaviour simulating software and the "single expert system" that evaluate the damages of the buildings.

One of these "single expert system" is worked out at the University "La Sapienza" of Rome. Its knowledge domains applied to enquiring into the causes of dampness in building structures.

Such a system will be able to simulate the knowledge required in the various stages of the building process, aiding the design process of building retrofitting.

For about twenty years the operators have taken interest in designing in order to retrofit the existing building property. This discovery originates from some motivations some historical-cultural, because the "minor" building industry represent the connective of monumental works and is the expression of popular culture that is rightly revalued, some economic, because the so called retrofitting buildings: deserted, damaged, badly employed, are generally, in the central zone of our cities.

One of the most frequent subject in the problem of the building retrofitting is the evaluation of the obsoleteness: with regard to this subject it is right to make a distinction between functional obsoleteness and physical obsoleteness. With the first word, we mean the result of the process of transformation that have changed the demands o the uses, asking new performances that the building can't offer. With the physical obsoleteness we mean the consequence of aging process of the building or of a part of it, that can't accomplish the original functions.

The evaluation of degradation is expressed by a comparison. For the physical obsoleteness the comparison is with not-degraded building. For the functional obsoleteness the problem is more complicated, because we must to know the comparison among the question and the changed demands or the user, and after to define a new destination of use or to modify the original one, giving to the building a whole of environment performances consistent with the requirements.

To project the existing involves and asks the "knowledge" of numerous aspects: historical, urbanistic, social-economic, and not last, technical-constructive.

We demand to have an operative instrumentation (a system) able to manage all the phases of the designing process and simulate the results by an operation of modeling.

To build a model of a design means to describe some plans (of the existing) that are at the same time depositories and generators of informations and real informative system. The geometrical and topographical planning is an abstract representation of the reality, that relates just some aspects (in this case the scale-dimensions.)

By an analysis of the demands and the requirements, it is possible to get an another representation, based on the demands, that is the model of obsoleteness-state.

In the case of a new building, the same design is a "model" of prefiguration of the reality. In the case of recovery, the existing is reduced to a "model", that acts as matrix for the projectual-model. Generally the models of comun use are logica-mathematical. Thanks to the last developments done by the studies on the artificial intelligence, it's possible to represent the knowledge in another ways. The traditional softwares serve to potentiate the human abilities in fields, in which the man is limited, and generally. are used, where there are necessary complicated calculations or repeating treatments of large quantities of dates.

The Expert-System, on the contrary, aid the man as "advisers" Their ductility, the facility of adjourment, the simplicity of dialogue hep the demands individualized in the field of the recovery.

Starting from the consideration that, at present, doesn't exists a system fit to manage all the phases of the "recovery" of an existing building, we try to define a methodology of informations management in the projectual phase of the building recovery it so starting from the study of practicability to the relief and to the graphical reinstatement of the building, that is a first representation of the object and of its state of conservation, we can examine closely the analysis of technical elements and constituent materials.

By this search we get informations, both asking questions to the user and "conversing" with the other parts of the system: program of graphic, of structural-control, of thermal calculation, database, etc.

The management of the information is entrused to a database management system, that gets all the news, that are not in its possession, from an external user and at the same time, brings up-to date the data, included in the other system-components, in order to get, everytime, the representation of interested aspects.

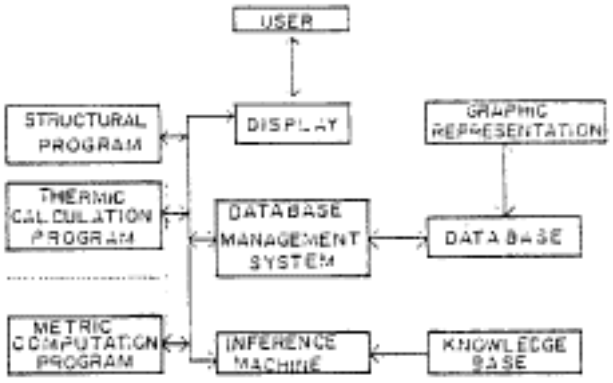

Figure 1. Operative scheme of the information management from the system.

In particular we have limited the ambit of study to the realization of the knowledge base for the recognition and the recovery of the masonry building, affected by dampness. The necessary information can be subdivided in several levels, starting from the building as a whole to the particulars:

- informations pertinent to building as a whole;
- informations pertinent to environment unity;
- informations pertinent to technological unities.

The classes of arguments expresses the relative demands:

- to static safety of the technical elements of the load bearing structure;
- to the environment comfort;
- to the use of environment.

The performances of the building are compared with the performances demanded by the recovery project.

The data concerning the building as a whole relate first of all the environment unity, then the technological unity, to the single technical elements. The informations on the

geometrical configuration, on the dimensions and the locations, are deduced directly from the graphic representation: the informations on the constructive process, on the preservation state, are related in a relational database. The diagnosis of degradation and the choose of the elements to eliminate it are made with help of expert-system.

The "information pertinent to the building as a whole", can be considered a "relief of a large scale" to use, also to making of a databank for survey of a historical center whose can provide a first catalogation, and are, at the same time, the starting point to the preliminary study.

The data to make input are:

- denomination;
- localization;
- environment peculiarities;
- characteristic of the building;
- destination of use (initial, changes in time, actual, hypothetical);
- conservation state;
- hypothetical interventions;
- historical news.

They are accompanied by a possible graphic documentation, found in the land-office, libraries, archives.

The "informations pertinent to the environment unity" attend to the single ambients making up the considered building. They are accompanied by photoqraphic documentation and graphic papers that, in particular, transfer the plan of the ambient in relation to the building as a whole. They give indications on geometrical-dimensional data, on the existing technical elements and on the constituted materials and are a search of the operative level before individualized, because they are exact indications of the project. The input required are:

- localization;
- destination of use (initial, changes in time, actual, hypothetical);
- dimension;
- openings;
- technical elements (dimension, constructive process);
- degree of functional obsoleteness;
- interventions (previous, urgent, hypothetical);
- typological compatibility;
- observation.

The "informations pertinent to the technological unities" are already an operative levels, are united to graphic papers of relief and represent the starting point for recovery project.

The data relate for every technological unity are:

- function;
- placement in the building;
- geometrical shape;
- dimension;

- constructive process;
- age of construction;
- degree of obsoleteness;
- interventions of restoration (previous, urgent, hypothetical).

Going on its research the system co-ordinates and brings up to date the graphical and alpha numerical database, interacting every time, with calculation programs, both thermic and structural, for the organization of the yard, and an expert-system of the evaluation of degree.

In the ambit of the building recovery project we point out at least seven phases:

- preliminary study;
- cost-benefits analyses;
- designing;
- yard organization;
- realization;
- management;
- maintenance.

The preliminary study is made on the, ground of informations pertinent to the building as a whole, includes a visual investigation of sample soundings and an analytica1 structural control always on sample structures. In this phase the system could be formed by calculation programm for the analytical part, and by "expert" that, conversing with the user, advises, on the ground off the indications deduced from the visual investigation, the more opportune point, in which we can effect the soundings, keeping in mind they can cause the inconvenience as little as possible.

In the knowledge-base we'll insert the questions, useful to converse and the production rules necessary to model scheme and to the interpretation of the proceeding from calculation program.

For the cost-benefits analyses we could take the informations derived from the previous phase, and explain for the examined part, availing ourself both of a mathematical model and of a logical model in which are included all the subjective evaluation, as the benefits coming from historical, architectonic and environment values.

In the designing phase the system could avail itself in addition to the data, previously input with the help of a software for the graphic, of relational database containing informations, that can't be represented graphically, and the constructive process, on dimensional characteristics, on the degree of obsoleteness and on the remedies. The single "expert" intervenes in decisional phases, concerning the diagnosis on the degradation type and the choices connected to the intervention necessary to the restoration or to the conferment of new performance consistent with the provided activities. In the knowledge-base we will introduce the rules for the recognition and for the consolidation, the recovery in addition to the question allowing the "dialogue" with "non-expert" user.

For the organization and yard programmation phase are defined the existing bends and on the ground of these last using also the ordinary techniques of linear programmation, we can program the activities.

The remaining phases of realisation management and maintenance of the recovery building are managed by specific management system.

As a first element for the system-realization we have examined the search of the phase pertinent to environment comfort, that isn't separated from the search of static-safely and of the environment use, in particular we refer to the dampness of the mansory building.

The data are acticulated in:

- environment characteristic;
- individualization of the plan;
- much more detailed graphic representation;
- individualization of the constituent materials;
- individualization of the constructive preparation;
- presence and relief of damp manifestation;
- soundings;
- water quantity proceeding;
- causes;
- recovery interventions;
- observations.

In the moment in which we have arrive to the design of the recovery and the recognition of the dampness type of the technical elements, intervenes the "expert" that completes the knowledge with the information received from the system (drafting packet, database, calculation program) and the user informations.

It is been realized the system of rules and questions to put in expert-system knowledge-base for the recognition and the recovery of vertical closing in damp wallings. For a methodological example this argument seems enough exhaustive and explicative for the aim in view. The system reads the informations on the placement (out of earth and against earth) and on the function (load bearing, of containment and of delimitation and separation), from the graphic restoration and ask the "non-expert" user or the relational database the data necessary to the diagnosis on dampness aggression type and provisionment source. It has individualized the causes and suggests the recovery techniques.