The use of fuzzy output systems to represent the comfort factors of an apartment building

Nataliia Kostyshyna, Postgraduade of Department of IT. Svitlana Tsiutsiura, DSc (Eng.), Professor, Head of Department of IT. Oleksandr Poplavskyi, Ph.D., Assistant professor of Department IT. Mykola Prystailo, Ph.D., Assistant professor, Assistant professor of Department VTB

Kyiv National University of Construction and Architecture, Kyiv Povitroflotskyi Avenue, 31, Ukraine

ANNOTATION

At the moment, the typology of housing construction in Ukraine is impressive in its diversity. Today, there are about a third of multi-section buildings, but among designers and architects there is an opinion that this typology of construction will not satisfy the population with comfort. Based on the results of the study, all the characteristics that provide physical and psychological comfort in the most common types of buildings, namely: corridor, sectional, gallery. Still, it is advisable to supplement apartment buildings with modern innovations and nowadays it is quite relevant. This article discusses a large number of factors and their impact is depicted using a hierarchical tree. With the help of a vague attitude, the situation with buildings was presented

Keywords: hierarchical trees, classification, fuzzy sets, binary fuzzy relations, terminal vertices

1. INTRODUCTION

One of the most acute problems of modern Ukraine is to provide our population with a high quality and high level of comfort, as well as pleasant conditions in multi-storey buildings.

When designing such a living environment, it is necessary to meet a wide and diverse range of requirements. This applies not only to new buildings, but also to modernization projects.

Today, the situation in the construction industry is gradually becoming stable, but there are still limitations at the level of the local living environment of Ukrainian people. The main purpose of urban organizations is to meet the needs of residents in their environment.

Modern development of urban planning is a rather complex system consisting of other subsystems. There are many classifications of the city, one of the options of the hierarchy of classifications is described below.

District - has limited boundaries and belongs to the objects of administrative management.

2. The area is divided into several blocks (neighborhoods) - usually limited to pedestrian accessibility (shop, school, kindergarten, pharmacy), etc.

3. The adjacent territory is the closest surroundings of the house, its yard, - are distributed on a part of territories within the quarter [1].

In this article, the following factors were selected to study the comfort of the living environment:

1. Area;
2. Microdistrict;
3. Adjacent territory;
4. House.

Today, a very important problem is to determine and highlight the main properties of the comfort of our home.

Thus, the comfort of an apartment building depends on many qualitative and quantitative factors

2. THE PURPOSE OF THE WORK

The main purpose of this article is to develop a methodological and comprehensive approach to the evaluation of an apartment building based on the use of fuzzy inference systems

To analyze the problems of living comfort: neighborhood, house, adjacent territory.

Use a fuzzy graph to show the relationship between comfort problems

3. PRESENTATION OF BASIC MATERIAL

There are several different ways in which fuzzy relationships can be specified. The most common are:

1. In the form of a list;
2. Analytical form;
3. Graphic form;
4. Matrix form;
5. In the form of a fuzzy graph;

With a large number of factors and their influence, it is convenient to depict in the form of a hierarchical tree of logical inference, the form of which is shown in the following figure

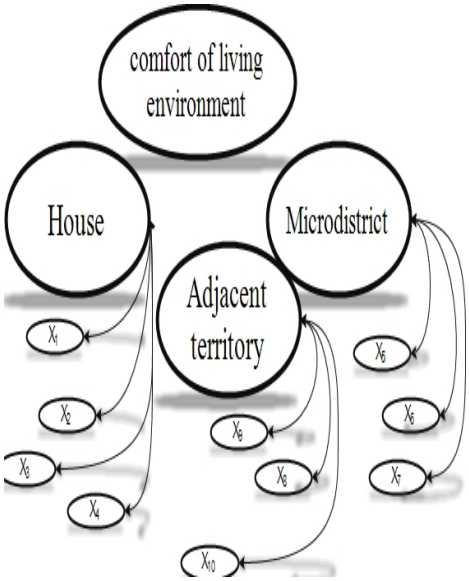

Figure 1 Hierarchical classification of factors, quality of living environment

The elements of the logical output tree can be represented as follows:

The root of the tree - the comfort of the living environment;

Terminal vertices - factors of influence (x1, x2 x3 x4)

The estimation of the coziness of a high-rise building can be considered by means of a tabular fuzzy relation [2]. This method is based on the representation of a fuzzy binary relation with a finite number of tuples [2].

X - We have ten positive integers X = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}.

X1 - Input values of the parameter. These include:

City area;

Population;

Provision of transport conditions

X2- X3 - Factors affecting the comfort of living between the area and the neighborhood. These include:

- Facilities of public services (schools, kindergartens, hospitals, grocery stores, pharmacies);
- Parking for private cars;
- Noise mode

X4- X5 - Factors that affect the comfort of living between the area and the adjacent territory or apartment

- Building density;
- Number of people living in the territory;
- Type of house;
- Age of the house;
- Technical condition of the house;
- View of the house

X6- X7 - External parameters of influence, namely:

- Insolation of the territory;
- Noise level;
- Landscaping.

X8 - X9 - Internal factors of comfort:

- Quality of the house;
- Quality of the apartment;
- Landscaping.

X10 - Initial data of the comfort model for all the factors listed above.

Consider the binary fuzzy relation Q1, which is given on two universals X.

Next, we present a vague relationship, which contains a description of the situation on the comfort of an apartment building

As the first supermarket, let's take a few reasons that negatively affect the comfortable living in our living environment. X = {x1, x2 x3 x4}, in which x1 - not providing the district with social buildings, x2 - distance to passenger transport; x3- Type of house; x4- Age of the house.

As a second supermarket, consider several reasons that arise when solving common problems.

Y = {y1, y2 y3 y4}, where y1- no social buildings are built; y2 = time spent on the road from one area to the destination; y3 = brick, panel, monolithic type of multi-storey building; we see that there is a connection between each element, with the reasons described above [3].

The peculiarity of this situation is that the relationship between the causes of the issues under consideration is considered. And it is quite ambiguous in building a fuzzy model. Having some data on various factors that adversely affect the comfort, this reason for the interaction can be more adequately represented in the form of a binary fuzzy relation P = {<xi, yj>, μp (<xi, yj>)}, which are given on the bases X and Y. In this case, the membership function of this binary fuzzy relation describes the degree of certainty that or other reason fixed.

Next, we present a specific fuzzy relation P, which is written as follows:

P = {(<x1, y1> 1), (<x1, y2> 0.1), (<x1, y3> 0.2), (<x2, y1> 0.8), (<x2, y1> 0.9), (< x1, y2> 0.1) (<x2, y3> 1), (<x3, y1> 0.7), (<x3, y2> 0.8), (<x3, y3> 0.5), (<x4, y1> 1) , (<x4, y2> 0.5), (<x4, y3> 0.2)}.

Since we have a given fuzzy relation P binary finite, it is possible to specify it in the form of table 1.1, which is presented below.

Table 1 Fuzzy relationship of comfort diagnostics

	y_1 (houses are not built)	y_2 (time spent on the road)	y_3 (type of house)
x_1 (social houses)	1	0.1	0.2
x_2 (passenger transport)	0.8	0.9	1
x_3 (type of house)	0.7	0.8	0.5
x_4 (age of the house)	1	0.5	0.2

In order to represent this fuzzy relation in the form of a fuzzy graph, we need to depict on the plane of its vertex as which we have the elements of comfort of the sets X and In the details of the implementation of which the author will present in future works.

4. CONCLUSION

To date, Ukraine does not have a clear classification of apartment buildings by level of comfort.

The main factors that negatively affect the comfort of our home have been studied.

Research on infrastructure near houses is a very important issue today

List of references

[1] Litoshenko, H.V. (2004). Standardization and assessment of home comfort. KNUCEA, Kyiv.

[2] Tovbych, V.V., & Sysoilov, M.V. (2007). Architecture: Art and Science. Dnipropetrovsk: Svidler.

[3] Analyze and develop proposals for improving the functional properties of housing in terms of affordability and environmental friendliness. (2011). Kyiv: State Research Institute of Automated Systems in Construction.