The Development of the Precedent Model for the Latvia Forest Management Planning Processes

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Abstract. The question of nowadays is the application of information technologies in every sector that enables to improve the functionality of system performance. One of the sectors is forestry – in this sector it is essential to manage the forest territories appropriately. As a result, it is possible to develop the system by means of information technologies that would help the forest experts to manage the forest territories in order there would be no lack of timber resources. To develop such system it is necessary, first of all, to perform the analysis of forestry, as a result of which the precedent models are developed. The specification and notation of Unified Modeling Language (UML) is used in the development of precedent models. Consequently, the system requirements are defined according to which it is possible to design and develop the system.

1 Introduction

44% of the territory of Latvia is covered by forests. Forestry is one of the most significant sectors of the national economy of Latvia – its contribution to GDP is 7.5%. This number is especially important because at least one third of it is generated in the regions of Latvia where the enterprises, related to the forestry, are the main sources of income. In fact, forestry is the only sector among the other sectors of Latvia with the positive trade balance – it partially compensates the current significant deficit of trade balance.

The estimation of the wood product is necessary for the rational preparation of timber resources. It means that, first of all, it is necessary to forecast the result of forest production within the cutting process. Thus, the data on forest resources, obtained as a result of forest inventory, are very important. On the basis of forest inventory it is possible to forecast the description of forest plant that influences the composition of atmospheric gases, the level of groundwater, the preservation of soil and agricultural activities carried out next to the forest where the inventory should be made. The territory of forests in Latvia is divided into properties, where the activities are carried out in compliance with 'The Law on Forest'.

2 Use Case Model for the Geodetic Preparation of Forest Territories

The aim of forest inventory accounting is to obtain geodetic materials and general data about the forest properties handing over to a separate manager. The accounting of territories is carried out by geodetic methods, as well as using the materials of aero photography.

2.1 Division of Wood Compartments Into Plots

On the basis of geodetic work that is carried out concerning wood compartments, a plan for every wood compartment is worked out, which divides the wood compartment into plots, firstly, according to the categories of land, secondly, according to at least one rule: the trees are growing in plot from the seeds or from the root of an older tree, there is one type of species dominating in the plot, the trees in the plot have the same height, there is one quality of locality in the plot etc. The decision how the property is to be divided into wood compartments and every wood compartment – into plots is made by a cruiser, who does it in compliance with the regulations of the organization of forest exploitation. Cruiser is the user of the system to be designed, which is the role of the system context. The role of system creates the motivation activity and it is the inner element of system [1].

2.2 Uncertainty of Forest Territory Division

Uncertainty is the state, which is characterized by contradictory interpretations of texts and situations. Uncertainty appears within the process of requirement exploration, which can be interpreted differently. The sources of uncertainty might be: undefined requirements, which are the basic reason of many interpretations and contradictory words with different meanings. In the process of the determination of forest inventory requirements there were identified only two precedents of territory division: division of property into wood compartments and division of a wood compartment into plots.
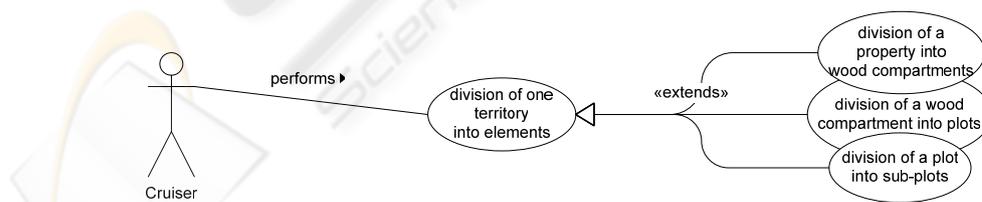

Fig. 1. Territory division precedents of cruiser.

There were analyzed similar and different attributes of precedents. When exploring these two precedents there was a decision made to develop and describe the general

precedent. But the last stages of system designing showed the nature of the require-ment selection uncertainty. Regardless the accuracy and consecutive performance there was identified one more precedent: division of plots into sub-plots (Fig. 1). Since the general division precedent of model had been already developed the situa-tion was dealt with the following way: the general division precedent was defined more precisely with a new precedent "Division of a plot into sub-plots".

3 Stock Volume and the Scenarios of Its Determination

Forest stand is, according to its structure, a continuous forest plot, which covers cer-tain territory and differs significantly from the next situated areas. Any stand is formed by the totality of trees, bushes and live land covering, and the main compo-nent of it is a timber stand. Nowadays, depending on the accuracy degree, there are two main precedents used for the forest inventory: continuous and group measuring. In their turn, every main precedent, depending on the approach applied, is divided into two types of measuring: visual and measuring using instruments. When measur-ing, the diameter (D), height (H), age (A) and type of species (S) of trees are deter-mined.

In the process of the continuous measuring of stock volume there is measured every tree of forest stand. This type of measuring is used, if the territory is not large or there is a necessity to obtain very precise data as final results. The implementation of con-tinuous measuring precedent step by step is shown in the activity model. The cruiser – user, who applies this scenario, defines the attributes of every tree, examining every tree in the certain territory on a cyclic basis. The values of attributes are given in absolute value: diameter – in centimeters, height – in meters, age – in years. All measuring results are registered and become the data base of given theory.

In the process of the group measuring of stock volume there is measured the totality of the group of trees of every type of species, as a result of which there are obtained average values of trees. This type of measuring is used, if the territory is large and there is no necessity to obtain very precise data. The implementation of group meas-uring precedent step by step is shown in the activity model. The cruiser – user, who applies this scenario, first of all, groups visually all trees by species and, examining the group of trees of every type of species, instead of defining the attribute of every tree, defines the average values of attributes for every group of species. The values of attributes are given in average value: average diameter in centimeters, average height in meters, average age in years. All measuring results are registered and become the data base of given theory.

Having analyzed two precedents we can conclude that the cruiser's task is to evaluate the same totality of attributes – diameter, height and age, but in different interpreta-tions. Firstly, attributes are interpreted according absolute value: every tree has its particular diameter, height and age, secondly, attributes are interpreted in terms of average value: every group of tree species has its average diameter, height and age (Fig. 2).
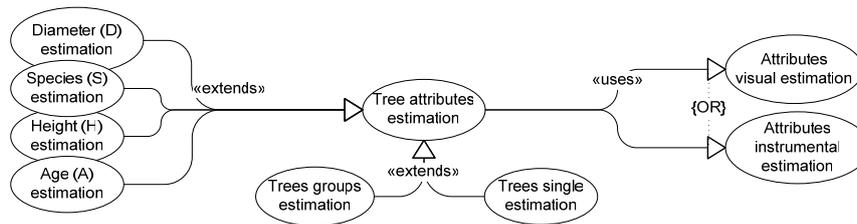
Fig. 2. Forest estimation precedents hierarchy.

The first step in the system development is defining and agreement on system requirements. As a result, the Use Case model is developed. The use model precedents are the types of communication with the user and other concerned persons. During communication the precedent tells what the system is intended to do. System requirements is a guide by testing, evaluating the system during the time of development, as a result of which the qualitative system is obtained [2].

4 Conclusions

As a result of analysis there are obtained and developed precedent models that show the division of forest territory and the requirements of inventory system. The developed precedent models are used to design a system, in the concrete, to develop the category models of system. Identification and registration of uncertainties enable to plan the current system implementation and testing from the view of future work, connected with hypothetical, bet real requirements. In the forestry there was applied the approach of system analysis to model the precedents of forest territory management process. The qualitative system can be worked out, if within its development there had been performed correct analysis, modeling, designing and implementation. If there would be a mistake made when analyzing and modeling, the final product would not correspond to the stated or undefined requirements. The obtained results can be strictly formalized both as the requirement model and the methodology of system testing.

References

1. Robert J Muller, 1999. Database Design for Smarties: Using UML for Data Modeling. Morgan Kaufmann publishers, 1st edition.
2. Leszek A. Maciaszek, 2001. Requirements analysis and system design: developing information systems with UML, Addison-Wesley Longman Ltd. Essex, UK.