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The Solution of Semi-Empirical Equation of Turbulent Diffusion in Problems of Polluting Impurity Transfer by Gauss Approach

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Abstract

The analysis of the solution of the semi-empirical solution of turbulent diffusion in problems of polluting impurity transfer is carried out by Gauss approach. It is assumed that there is a certain occupied industrial point, which has one or several sources of the pollution, the arrangement of which is determined by coordinates x, y, z. For calculation of average impurity concentration from a point source the solution of semi-empirical equation by Gaussian function of impurity distribution, obtained by a method of Green's function was used. Furthermore, the normalization of the key parameters of the problem is carried out and the initial data are defined. By means of the obtained equation, the model of quantity assessment of the aerosol polluting substances arriving from a source with final and continuous duration of action is made. Thus, the considered computational and analytical model of methodology of assessing the concentration of polluting substances is applicable for applied problems of operational control of the condition of industrial region. Proposed model can be adapted to the air pollution monitoring robotic system.

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Keywords: air quality; concentration; Gauss function; equation of turbulent diffusion; pollution monitoring robot system.

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1. Introduction

Development of energy, engineering, chemistry and transport in the XX century led to the fact that human activity became comparable in scale with natural energy and material processes occurring in the biosphere. Anthropogenic effects lead to disruption of virtually all natural biogeochemical cycles, including those that contain heavy metals. Currently, all major industrial centers are in need of constant monitoring of emissions, caused by both stationary and mobile sources of pollution. Modeling the monitoring of ecological status of the industrial region requires an adequate mathematical model, following which it is possible not only to calculate the concentration of pollutants, but also to build a forecast of the concentrations for the coming periods. The considered diffusion equation is one of the quality and adequate mathematical models for solving the problem [1].

To solve above mentioned problem the infological model was build (see Fig. 1.). The model reflects the real world in a human-friendly concept is completely independent of the parameters of the storage environment The semantic data model that maps the semantic content of our system was build and distinguished essential entities, their attributes and the relationships between them were also defined. The essence of "Observation Point" and "Substance" are related attitude, because it is the observation point of the atmosphere provides control for harmful substances into the atmosphere, and determine their concentration.

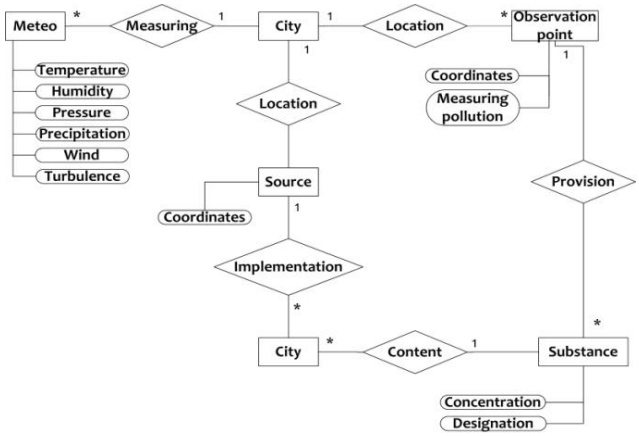

Fig. 1. Infological domain model.

2. Modeling the system using UML instruments

In order to well understood by the person, the model should be organized hierarchically and all the entities, should leave at each level of a small number of entities.

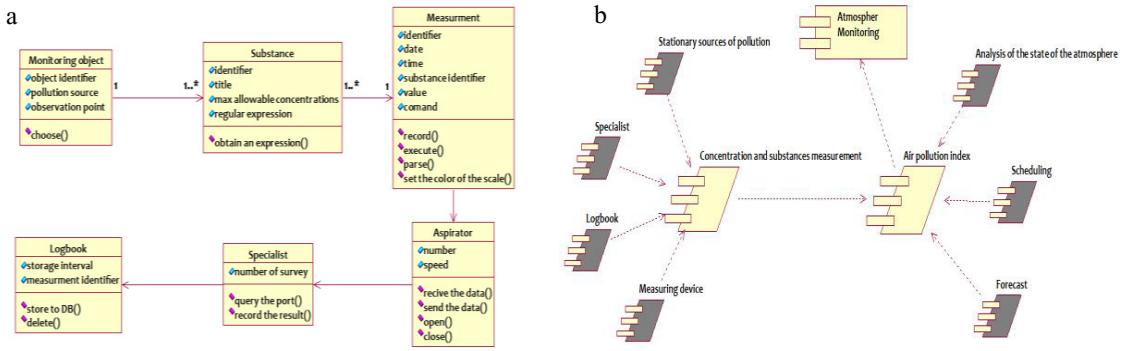

Fig. 2. (a) Static Structure diagram; (b) Component diagram.