MUWAREC TOPIC 2:

An Artificial Intelligent System to Minimize River Pollution During Construction Activities

1. Background and Objective

Rapid development in general has caused high population in an area. Pollution of river is strongly related with high population density, and further water deficit problem is aggravated by river pollution. The continuous degradation of water quality of river is a concern of the public and policy makers. In the last few decades, protection of surface and groundwater from pollution has received high priority since many countries have suffered from considerable deterioration in the quality of their water resources. Among various human activities, construction activity is considered environmental unfriendly because it consumes large amount of natural resources and produces a great deal of pollutants. Therefore, construction activities cause damage to water resources that may become critical in some areas. In every stage of the construction activities, it is supposed that there are a set of impacts on water resources. Construction can disturb soil and travels down it from a building site eventually that finally ends up in a river. Further it can increase the inputs into streams with organic material, oil and grease, and reduces the amount of oxygen in river water.

In recent years artificial systems have been used extensively in environmental related field. They are becoming increasingly useful tool especially in developing countries due to limitation on resources, particularly human expertise and data availability. The development of an artificial intelligent system is to evaluate the possible effects of a proposed construction projects on river water quality and to suggest the mitigation measures to prevent environmental degradation. The system is based on clearly specified potential residual impacts and the mitigation measures. The system is very useful in supporting expert prediction of expected river pollution, the effects of each stage of construction activities on river quality, best practice of construction activities, and mitigation measures to minimize river pollution during construction activities.

2. Brief Long Term Methodology and Way Forward

The following procedures will be taken to develop the system prototype:

i. Task analysis

The purpose of task analysis is to demonstrate the functional capabilities of human expertise and to identify the relationship between individual tasks to the whole tasks involved. The outcome of the analysis is important to identify the strategies, methods and techniques in the development of the prototype. The tool for decision–making process will be applied, which has the capabilities to deal with the presence of multiple objectives. Both tangible and intangible criteria will be prioritized in a decision making process. The tool for the system development is GIS based programming language, which combines the domain of construction management and environmental quality in a knowledge base. The user interface developed will be dynamic and interactive, where the display is updated automatically depending on the current input data being used.

ii. Knowledge acquisition process

Knowledge acquisition is the process of transferring problem-solving expertise from knowledge sources and transforming it into some convenient form for subsequent representation as a computer compatible knowledge base.

iii. Prototype Development

In the earlier phase of prototype development, rapid prototyping approach is applied, where early knowledge acquisition is integrated with the development of the first prototype. In later stage, the whole prototype development requires content (from domain knowledge made explicit during formalisation), form (specified by the language chosen for system development) and integration (involves combining and reorganising various pieces of knowledge to eliminate global mismatch).

iv. Expansion and Refinement

This involves evaluating the performance and utility of the prototype program and revising it as necessary. It involves checking for mistakes in knowledge acquisition and to establish the system performs with an acceptable level of accuracy, user-friendliness, and overall usefulness. It is reviewed repeatedly until a sufficiently satisfactory prototype is achieved.

v. Verification and Validation

Verification involves program debugging, error analysis, input acceptance, output generation, etc. Validation concerns with the diagnosis of how closely the expert system solutions match those of human experts. This is done by meeting with the experts to discuss if he/she agreed with the solution given by the prototype.

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