Jul 1st, 12:00 AM

A Multi-Agent system for water management in river basins

T. Rendon-Sallard
Miquel Sánchez-Marrè
M. Aulinas
Joaquim Comas

Follow this and additional works at: https://scholarsarchive.byu.edu/iemssconference


This Event is brought to you for free and open access by the Civil and Environmental Engineering at BYU ScholarsArchive. It has been accepted for inclusion in International Congress on Environmental Modelling and Software by an authorized administrator of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
A Multi-Agent system for water management in river basins

T. Rendón-Sallard, a M. Sànchez-Marrè, b M. Aulinas, b J. Comas

Knowledge Engineering and Machine Learning Group, Universitat Politècnica de Catalunya
c/Jordi Girona 1-3, E08034, Barcelona, Spain {trendon,miquel}@lsi.upc.edu
Laboratory of Chemical and Environmental Engineering, University of Girona, Catalonia, Spain montseaulinas@gmail.com, quim@lequia.udg.es

Keywords: Multi-Agent systems; Wastewater management; Modelling

Wastewater management in river basins is becoming increasingly complex. Whilst there is an urge to reduce the ecological imbalances in fluvial ecosystems, more wastewater has to be treated because of both demographic and industrial growth. Furthermore, given the intrinsic multidimensionality of river basins, its management must take into account all the agents that affect and are affected by the wastewater Aulinas et al. [2007].

Traditionally hydraulic infrastructures for sanitation have been managed separately, taking into account only the characteristics of the water at the entry and exit points of each installation. The current tendency promoted by the Water Framework Directive is to treat the hydrographic basin as a single area of operations within which hydraulic infrastructures have to be managed in an integrated manner, taking into account the condition of the receptor environment Devesa [2006].

In our work, we are implementing this integrated approach with a Multi-Agent system (MAS) at catchment scale that integrates the main water systems involved (i.e., sewage system, Waste Water Treatment Plants and River) by means of agents who model real environmental situations and work collaboratively for achieving the system’s goals.

The aim of our MAS is to cope with the complexity related to the decision-making processes found in the river basins management (e.g., uncertainty, intrinsic instability, approximate knowledge, multidimensionality of river basins). The MAS can simulate different scenarios for evaluating the consequences of critical processes in a river catchment system in order to recommend alternative courses of actions and thus provide support in the decision-making of river basins management Rendon et al. [2006].

Our software tool is an extension of the agent platform Jadex. We incorporated the artificial intelligence technique Rule-based reasoning as the inference mechanism so we can have rule-based agents capable of representing domain knowledge. In the near future we plan to incorporate Case-based reasoning as well. For the design and development of a prototype for our case study we used the Prometheus methodology Padgham and Winikoff, [2004] and the agent platform Jadex Braubach et al. [2004] respectively.

The case of study is the Besòs river basin, located on the North East of the Mediterranean coast of Spain. The catchment area is one of the most populated catchments in Catalonia, having more than two million people connected. The scope of the study area is around the final reaches of the Congost River. The river sustains, in an area of 70 km², the discharges of four towns which are connected to two Waste Water Treatment Plants (WWTP).

The MAS features the main elements of the hydraulic infrastructure of our case of study, the Besòs river basin, and aims to manage the environmental system as a single area, integrating the two sanitation systems (La Garriga and Granollers) with their respective sewage systems and WWTP’s, as well as the Besòs river as the receptor for their waste water. Other elements are rain control stations, river water
quality control stations, flow retention and storage tanks. There also is a sewer channel that connects both WWTPs, allowing to by-pass the flow from the La Garriga-WWTP to the Granollers-WWTP. To integrate knowledge and control the management of the Storage tanks we use decision trees defined in Devesa [2006]. The set of actuation rules represented in the trees aims to minimise the impact on the water quality of the river.

ACKNOWLEDGEMENTS

This work has been partially supported by the Spanish project TIN2004-01368 and European project Provenance IST-511085.

REFERENCES


Devesa, F., Development of an Environmental Decision Support System for the management of hydraulic infrastructures, with the objective to guarantee the water quality at the Besós river basin. Phd Thesis for University of Girona, Spain , 2006


Rendon-Sallard, T. and Sánchez-Marrè, M., Simulating scenarios for decision-making in river basin systems through a Multi-Agent system. In the 3rd biennial meeting of the International Environmental Modelling and Software Society; iEMSS 2006.