Visualization of water distribution systems in 4D

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Abstract

Our goal in present paper is to describe our research in more descriptive and lively visualization of water distribution system together with visualization of environment where water distribution system is placed. We are linking data from DTM (digital terrain model), orthophoto together with geographical data about water distribution system and data about dynamical processes in the pipe lines system during time.
We have tried to link all those data together in some new more descriptive and interesting way.
Result is 4D model of terrain, water distribution system and dynamical processes through time.
Our approach can be used in case of visualization of planned water distribution system (model) and in visualization of working water distribution systems in real time.

Keywords

Water distribution system/ Civil engineering / Visualization / Building technology/ Digital terrain model, 4D

1 Introduction

Our idea was to give planers, supervisors or even users of water distribution systems more illustrative visual information abut dynamical processes in water distribution systems.
Our first goal was to improve visual presentation of water distribution systems models, but later we use the same approach and tools also for real time control over the water distribution system and also for comparing model and real life.

2 Model

We use data from water distribution system modeling software as input data witch describes pipe line network geometry and technical characteristics and also processes through the time and geographical data about region from several sources.

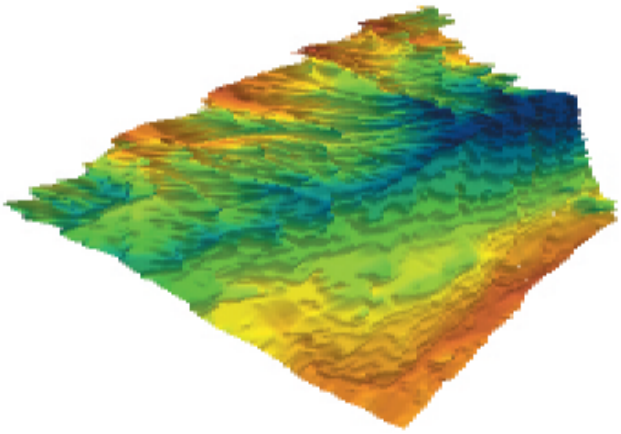


Figure 1: Digital terrain model DTR

In many countries public data about terrain are available. We have digital terrain data and “orthophoto” data about all country is existing in Slovenia.

Figure 2: Orthophoto of earth surface

Also global models as a “Google Earth” are available globally and improved every day.

Figure 3: Ljubljana town view with Google Earth

Towards data in digital terrain model and optical information from orthophoto a lot of additional information about infrastructure may be available and useful in our application. For example all buildings geometry model is available in Slovenia.
In our model we try to use all that data in unique model.

Beside a lot of public available data a strong, fast and in most cases affordable public informatics infrastructure is at our disposal in many countries. For example mobile networks, WLAN networks, ADSL.

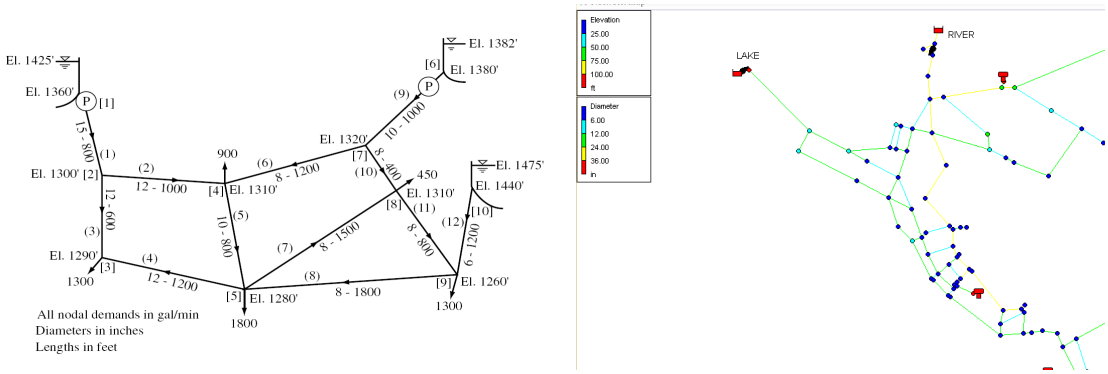


Figure 4: Example of water distribution network in typical software solution

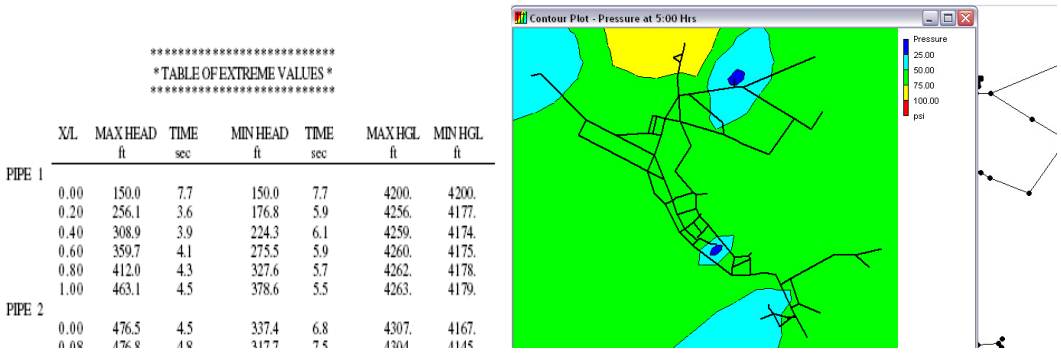
So we have a lot of free or low cost data about our environment, affordable wireless informatics infrastructure and small and cheap computers called java enabled phone always in our pocket.

We just have to force all that wealth to serve our needs.

We use the same sources and the same technology for:

1. Model visualization of planned water distribution systems
2. Real time visualization of working water distribution system

The technology we describe can be used to illustratively visualize all types of dynamical processes in natural and urban environment together with more or less realistic surroundings through the time.



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* TABLE OF EXTREME VALUES *
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	X/L	MAX HEAD ft	TIME sec	MIN HEAD ft	TIME sec	MAX HGL ft	MIN HGL ft
PIPE 1							
	0.00	150.0	7.7	150.0	7.7	4200.	4200.
	0.20	256.1	3.6	176.8	5.9	4256.	4177.
	0.40	308.9	3.9	224.3	6.1	4259.	4174.
	0.60	359.7	4.1	275.5	5.9	4260.	4175.
	0.80	412.0	4.3	327.6	5.7	4262.	4178.
	1.00	463.1	4.5	378.6	5.5	4263.	4179.
PIPE 2							
	0.00	476.5	4.5	337.4	6.8	4307.	4167.

Figure 5: Some more documents from water distribution systems modelling software (EPANET, WaterCad)

Current water distribution systems model's visualizations are pure technical documents. We have pipeline networks plans with data about connections, lengths… , some time depending diagrams and several numerical tables. We can offer more just with connection of same model linked with existing public data and through public information networks.

We use geographical data from several sources as "realistic" scenery for our model, we add 3D geometrical data about our pipe line system together with time dimension which describes dynamical processes in pipe line network.

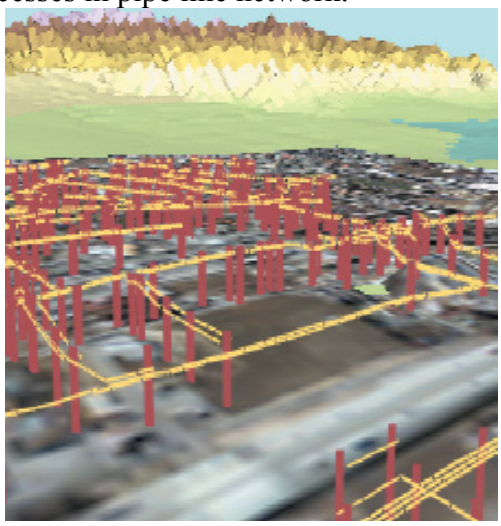

Figure 6: Link of the digital terrain model, orthophoto and 3D infrastructure model

3 Conclusions

This paper presents the basic platform for 4D water distribution systems visualization, describes the integration of existing public data about environment, informatics and communication infrastructure with our water distribution system's model or real time data from water distribution system and defines conditions for successful recognition. We decided to use Java3D for publishing linked to establish hardware independent architecture. We hope that we can offer more lively and descriptive visualization of dynamical processes in water distribution system with use of cheap existing data and technologies not only for office use but also for technology independent mobile users.

4 References

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5 Presentation of Authors

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