

Technical white paper

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1 Warehouse3D

1.1 What is Warehouse3D?

Warehouse3D is a tool that can be used for surveillance of a real or a simulated warehouse, for upgrading a warehouse so it can increase its throughput, removing warehouse bottlenecks, building a warehouse vision and anything that the user can find appealing for his use.

2 Warehouse3D – Technical Overview

Warehouse3D is a suite of applications for creation, simulation, analysis and 3d presentation of real warehouses.

Warehouse3D is comprised of these software components: Warehouse3D Plug-in, Warehouse3D Client, Warehouse3D Simulator, Warehouse3D Statistics and Analysis Tool.

2.1 Components

2.1.1 Warehouse3D Plug-in

The Warehouse3D Plug-in is a tool for modeling warehouses. With this tool warehouses can be modeled so other tools from Warehouse3D can be applied to them. Also it is used as a tool for modifying already modeled warehouses.

2.1.2 Warehouse3D Client

The Warehouse3D Client uses data that is generated by the real warehouse or data that is a result of a simulation to represent the palette movement through the warehouse, and to represent movement and status of the systems and subsystems in the warehouse.

2.1.3 Warehouse3D Simulator

The Warehouse3D Simulator uses data entered by the user as an input to a simulation for a warehouse's work. The user enters the initial state of the warehouse and dynamic changes in the warehouse, defines what should be the storage places in the warehouse and the movement of the palettes (their entering/leaving points and rates of entering/leaving), and after that the Warehouse3D Simulator generates data for the whole warehouse actions so the Warehouse3D Client can visualize the generated simulation (if the

simulation is of type Real-Time), or the Warehouse3D Statistics and Analysis Tool (if the simulation is of type Analyze-Only).

2.1.4 Warehouse3D Statistics and Analysis Tool

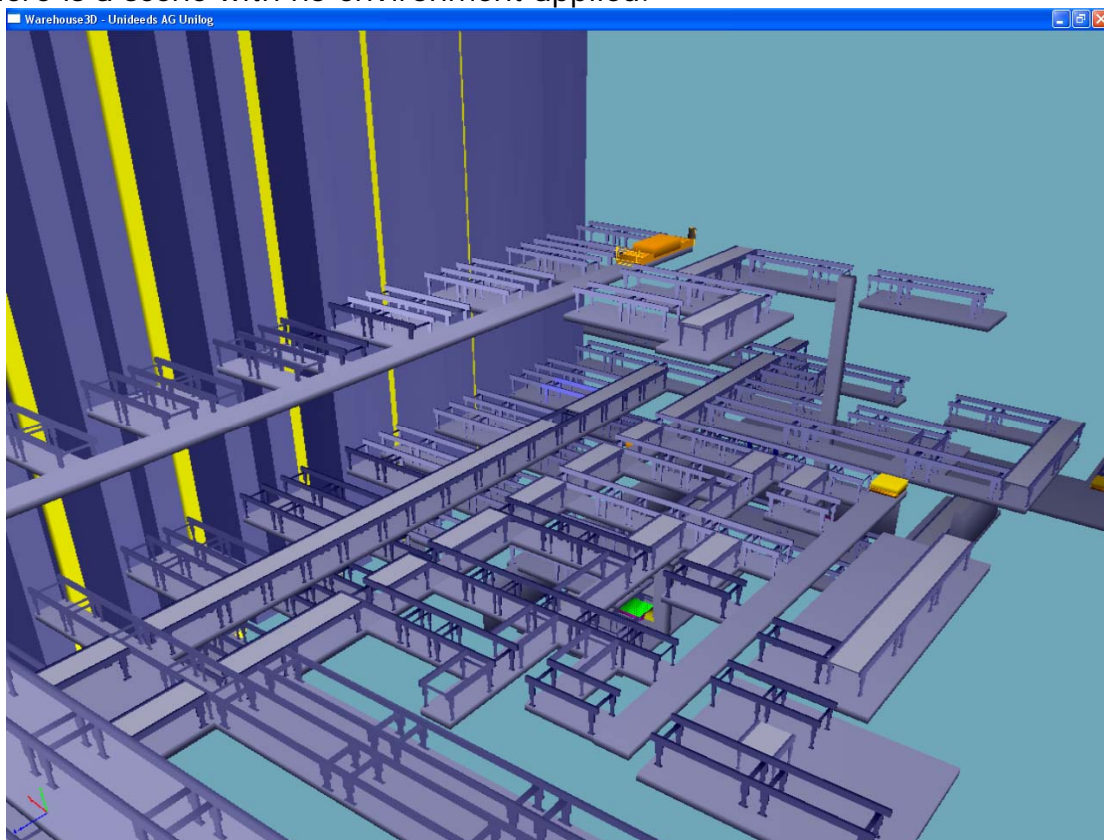
The Warehouse3D Statistics and Analysis Tool is tool for analyzing and visualizing the statistical data that is gathered from either simulation of any kind or real warehouse actions data.

3 Warehouse3D Client

The Warehouse3D Client is a 3D visualization client that is used for visualizing a warehouse and the traffic in it (the palettes that move inside it).

The Warehouse3D Client has a very configurable render of the scene. There are sets of rules of how to render a piece of the scene which are called environments. Every environment is applied on a subset of elements from the scene. Every element can be member of any environment so many different environments can be made that will handle very different sets of elements. Environments can have color as an attribute, which will mean that every element that belongs to the environment in question will be rendered with the color of the environment. Environments can be defined as show/hide which will mean that only the elements of the environment in question will be visible on the scene. Only one environment of type show/hide can be active in any time, and as much as the user wants environment that have color as an attribute can be active at the same time.

Here is a scene with no environment applied:



Environments can be created, saved, edited, deleted, activated and deactivated. Also every environment can define different cameras. Every camera in the environment can be located anywhere in the 3d space where

the warehouse is rendered and also can be of different type (perspective/orthogonal and still/following). So every camera has the ability to follow a palette in the warehouse while it moves (the camera moves along with the palette) or stand still.

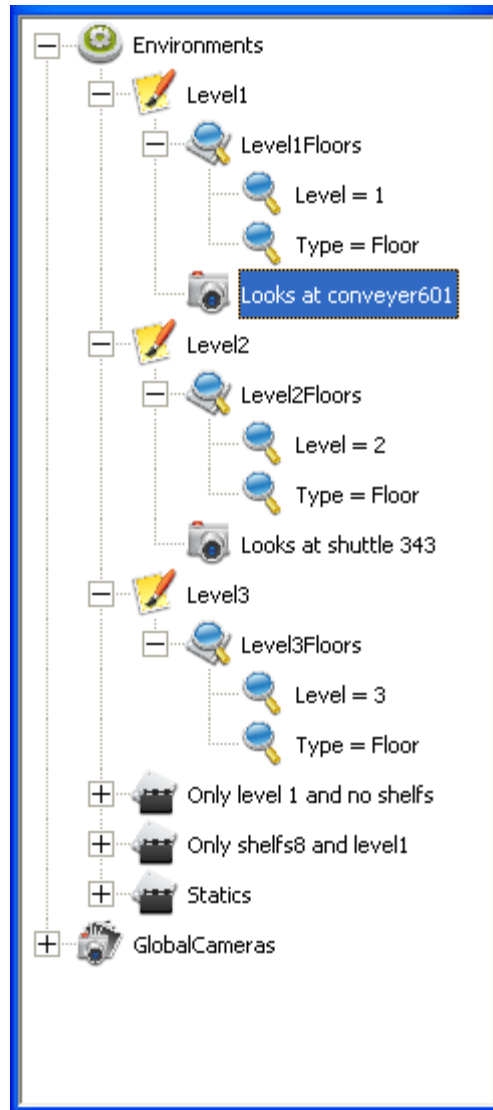
3.1 Environments

Environments are displayed on the right.

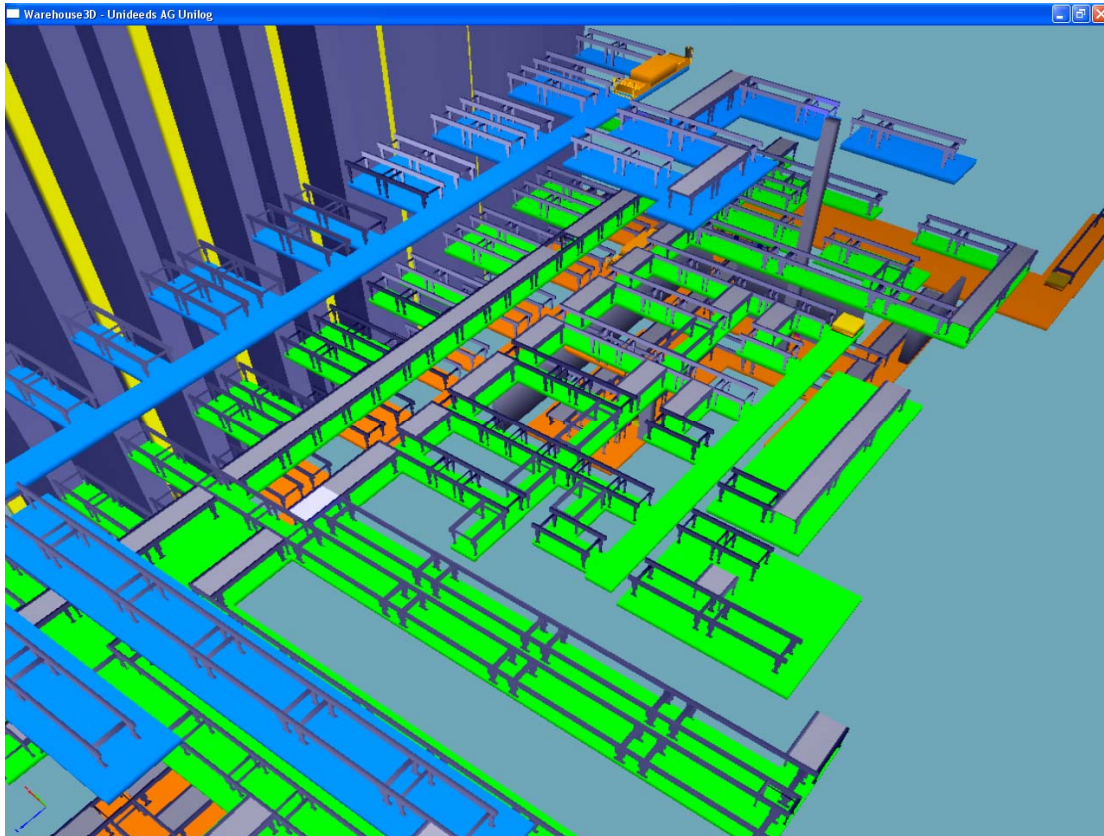
There are environments defined for every level that should color only the floors for that level.

Every environment has expressions to select objects from the scene. Every expression has operations that define specific group of elements. The intersections of groups of elements that define every operation of expression are the elements that are defined by that expression. The unions of groups of elements that define every expression are the elements that are defined by that environment. As in the picture the environment Level1 has expression Level1Floors and that expression has two operations that are Level=1 and Type=Floor. So the expression defines elements that are on Level 1 and that are of Type Floor. Because there is only one expression the group of elements that defines this expression is also the group that defines the current environment. According to the previous all of the floors on first level will be colored with the color defined for the current environment.

Also as you can see there can be defined different cameras for environments. When a camera for an environment is activated, the current environment is activated too.



Here is a scene with three different environments applied (one for every level with different color as an attribute):



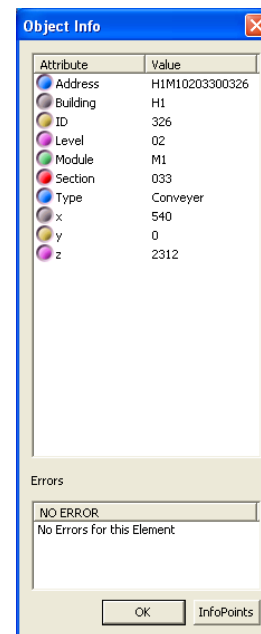
3.2 Elements and Palettes details

The Warehouse3D Client can display info for every subsystem and palette in the system. The info is invoked with double click on the element. It displays the most important information about the element.

Info displayed for element in the warehouse:

The info contains different information about the object as you can see on the example to the right there is information about the:

- Address
- Building
- ID
- Level
- Module
- Section
- Type
- Position in the 3D space in the warehouse



3.3 Errors handling and visualization

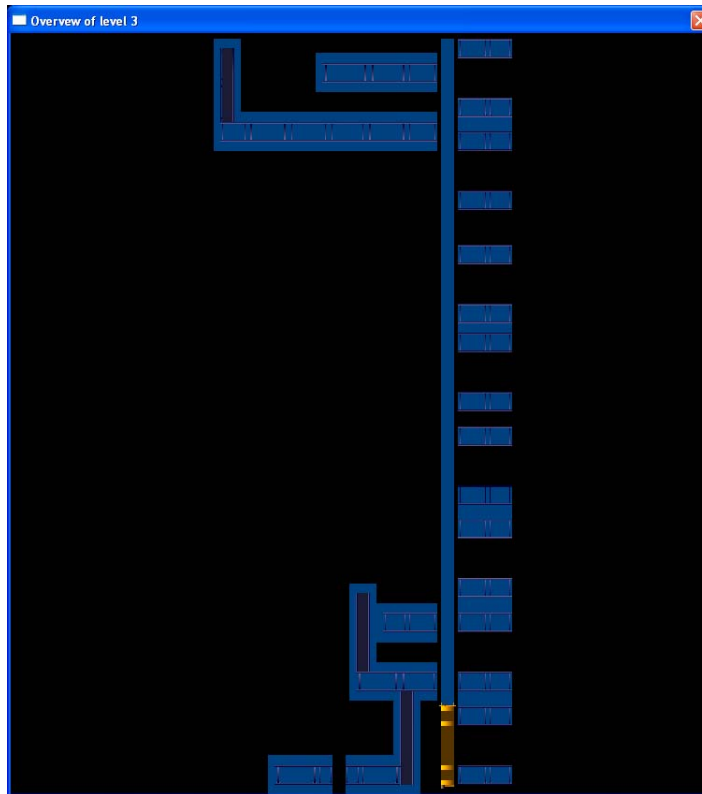
The Warehouse3D Client has the ability to dynamically display errors that can occur in the system. A list of elements that currently have errors can be displayed, and the same list can be used for easy navigation to the element with an error. When an error occur the element with the error is displayed in vibrant red color. The element itself has the information of the error, so when the element info is shown it displays the error state of the element.

The object info displays the errors active on the current element in the lower part of the window. As you can see on the current object info there is no error on the element.

The elements of only one level of the warehouse can be displayed in a different window looked from a camera that is far above the elements and looking at them all. That different window of the level is called overview. The purpose of overviews is to easy find elements error. When the whole level can be seen at once all the red elements (elements with errors) can be spot very easy.

3.4 Overview windows

Overview of one level in the warehouse:



3.5 3D Navigation and movements

You can navigate by the keyboard and by the mouse.

3.6 Lights

Lights have changeable magnitude and position, and theirs appearance can be toggled.

Light showed and their magnitude increased:

