

IRSIMULATOR 3D

3D REALTIME SIMULATION ENVIRONMENT FOR LOWRES-INFRAREDSENSORS

AMBIPLEX' IRSim is a powerful scientific toolsuite for simulating the infrared channel of indoor 3D scenes such as office rooms or hallways. The purpose of IRSim is to provide an easy-to-use, interactive graphical tool that allows for the real-time simulation of "what is seen by" infrared sensors as a basis for AMBIPLEX' localization software development. Furthermore, IRSim can be used as a planning tool for positioning infrared sensors such as motion detectors in a 3D environment. IRSim provides a variety of objects for the interactive composition of 3D scenes, including furniture, doors, windows, and technical devices. Models of human beings may be added to a scene, too. IRSim's animation feature yields a time saving method to simulate movements of persons or objects within a scene, or to evaluate the behavior of heating up or cooling down processes of individual objects or the entire scene. IRSim also accounts for the impact of sunlight warming up parts of a room when shining through windows. The software simulates all relevant aspects of indoor IR radiation propagation such as specular reflections, shadowing, and the emissivity levels of specific surfaces.

Object database Objects in IRSim represent one of the following types:

- ▶ Human beings, furniture or technical devices
- ▶ Rooms
- ▶ Sensor devices

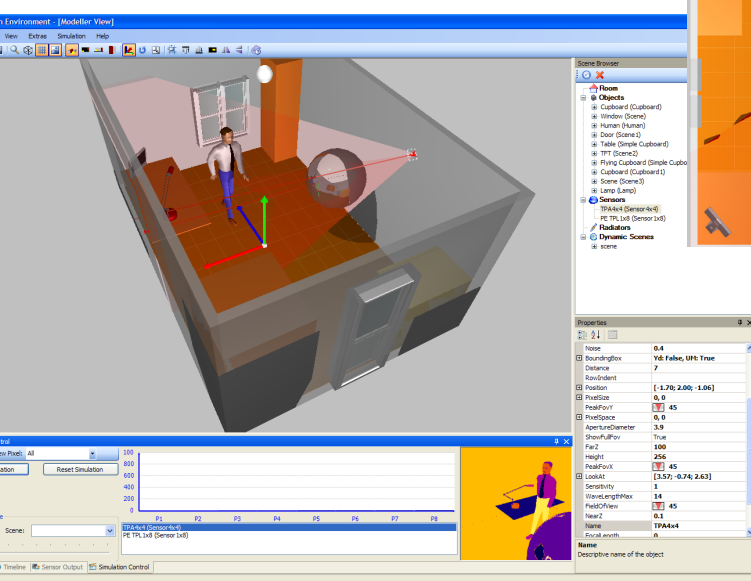
All objects are stored in an object repository. An object contains all data required for simulating heat radiation processes, the 3d model mesh, surface properties, one or several heat profiles, and device specific information such as sensor properties. Heat profiles represent temporal heating up or cooling processes of a device's surface. Heat profiles may also account for regional temperature differences within a model. For example, the temporal temperature profile of the actual screen of an LCD monitor differs from that of the monitor's casing because the screen itself heats up differently, particularly where the LCD backlight is located.

Employment of cutting edge 3D technologies IRSim uses the well established graphics standard OpenGL for the simulation of IR emission and visualization of a 3d scene.

The hardware accelerated render process is supported by modern shader technologies, facilitating simulation of complex 3D scenes in real-time. Compared to traditional approaches in the simulation of optical channels (e.g. raytracing), IRSim saves several minutes to hours per time frame.

Animations Thanks to the short render time per frame, IRSim is also capable of displaying animations, i.e. the temporal flow of a 3D scene, in real-time. Animations can be composed of movements such as a person walking through the room, or temporal heat profiles of objects, such as the heating up process of a radiator. Motion paths are defined by trajectories in the room. The user may even interact with the application during the animation render process, e.g. change the viewing angle, adjust the position of sensors and objects, etc.

Editor IRSim provides a powerful editor for creating and viewing 3D scenes. 3D models can be edited using conventional modelling tools such as Blender, Maya, or 3DS max, and imported into IRSim. Once loaded, an object may be extended by specific heat profiles (e.g. heating up or cooling processes). Animations are created using spline interpolated key frames.



IRSim Features

Simulation of the IR (heat) channel The scene composed by the user can be rendered in several ways. The user may place several sensors from a sensor database at the walls or ceiling of the room. In the following he or she may switch the view according to these sensors' perspectives. If desired, IRSim can simulate a sensor's output signal, e.g. a voltage level. Following this approach, the IRSim toolsuite may be used as a real-time replacement of existing sensors, providing a means to develop and evaluate algorithms for IR signal processing applications. Besides the IR channel, an "optical" view is provided that corresponds to the 3D scene as perceived by the human eye.

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