



Robots have become a standard element in our imagination. Given the enormous progress made in the past decade, it is clear that some day robots will become part of our daily lives. At Research in Philips we believe an important barrier that still remains to be taken, is that of making the interaction between a user and a robot more natural and social. Robots have to become credible and familiar.

iCat is the world's first available plug-and-play desktop robot capable of mechanically rendering facial expressions. It was designed to stimulate Human-Robot Interaction research. By making it available, Philips wants to stimulate the momentum in Human-Robot Interaction research.

Research robot for animatronics

iCat is a desk-top robot for studying human-robot interaction topics. The robot is 38 cm tall and equipped with 11 RC servos and 2 DC motors that control different parts of the face, such as the eyebrows, eyes, eyelids, mouth and head position. With this setup iCat can generate many different facial expressions - happy, surprised, angry, sad - needed to make the human-robot interactions social.

A camera installed in iCat's head can be used for different computer vision capabilities, such as recognizing objects and faces. Each foot contains a microphone to record sounds, to perform speech recognition and to determine the direction of the sound source. A speaker and soundcard are installed to play sounds and speech. Finally, touch sensors and

iCat

user-interface robot

Experimentation platform for Human-Robot Interaction research

What is iCat?

- The world's first available plug-and-play desktop user-interface robot with mechanically rendered facial expressions
- Designed for Human-Robot Interaction research
- Provided with enabling software
- Complete with the world's only robot animation editor and engine
- Supported through an on-line community
- Aimed at increasing momentum in research by stimulating the creation and sharing of software components through a Robot Middleware solution
- Available from Philips Research at a 'no profit' price



multi-color LEDs are installed in the feet and ears to sense whether the user touches the robot and to communicate further information encoded by colored light. For instance, the operating mode of the iCat (e.g. sleeping, awake, busy, and listening) can be encoded by the color of the LEDs in the ears.

iCat can be used for various research purposes, including social robotics, human-robot interaction, human-robot collaboration, joint-attention, gaming and ambient intelligence. Its large range of sensors and the modular applications architecture allow you to develop and test your own computer vision, speech recognition or other software algorithms and to share them with other iCat researchers. Additionally, you can integrate 3rd party robotic software components.

iCat user-interface robot

Enabling software

Programming the iCat is easy with our proprietary Open Platform for Personal Robotics (OPPR)* software. This software can be used both by beginners and advanced programmers. Scripting and graphical tools make developing animated dialogues easy. Advanced programmers can build their own software components, such as vision and speech recognition components, using our Dynamic Module Library (DML) developed in C++. This software library enables you to run your computer vision, speech recognition and other algorithms on several PCs and handles the communication between these software components. The software comes with a ready-to-use library of animations that can be used to build human-robot dialogues for the iCat. A scripting engine makes developing these dialogues easy.

OPPR* also contains the iCat edition of our robot animation editor and engine. The robot animation editor is a graphical tool that gives you precise control over every individual servo and multi-color LED in order for you to develop advanced robot animations. The robot animation engine blends pre-scripted animations and robot behaviors (sensor-actuator loops) at runtime. The complete setup enables you to create separate animations and control algorithms for head movements, facial expressions, blinking of the eyes and lip synchronization.

** Note: Computer vision and speech recognition software are not part of OPPR*



Community

Philips Research is making a limited edition of the iCat robot with the OPPR* development software. These platforms are available at a 'no profit' price to universities and research laboratories for research purpose only. Access to a community website is provided as well, for sharing modules, discussing results and evaluating applications. You can use this website to download software updates, read about the latest iCat developments, start research projects with other colleagues and have discussions with them on various topics in one of the discussions forums.



Specification of the iCat user-interface robot

- Connects to PC using USB
- Height 38cm
- RC servos controlling facial expressions
 - 2 x eye brow
 - 2 x eye lid
 - 3 x eyes
 - 4 x lips
- DC motors
 - 1 x body
 - 1 x head
- Multi-color LEDs
 - 2 x ears
 - 2 x feet
- Capacitive touch sensors
 - 2 x ears
 - 2 x feet
- Stereo microphones in feet
 - Mini jack plug available to connect external microphones
- Loudspeaker in feet
 - Mini jack plug available to connect external speakers
- Proximity sensor
- USB hub
- USB webcam 640x480 in nose
 - Connected to internal hub or via external USB plug on the back to another computer
- USB stereo sound card
 - Connected to internal hub or via external USB plug on the back to another computer
- Philips proprietary OPPR software platform :
 - Graphical animation editor for creating credible animations
 - Distributed software component framework for easy application development
 - Large library of ready-to-use animations
 - Windows XP (Linux support available in 2006)
- Available in yellow and orange