



1 Opel robot »Oskar« in the prizewinning exhibition »Die Roboter kommen«

## MOBILE ENTERTAINMENT AND INFORMATION ROBOTS

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#### Starting Point

Mobile robots provide a uncommon, attractive way of entertaining and informing visitors to museums, trade fairs and events. In recent years Fraunhofer IPA has developed several such mobile entertainment and information robots some which have been in successful continuous operation for several years.

#### Ease of Operation

If mobile robots are to be used on a day-to-day basis in public buildings, they must be capable of being operated by staff who are completely devoid of any programming experience. To achieve this, the implemented systems are equipped with components for self-diagnosis as well as for automatic starting and returning to its parking position.

All the staff have to do is to switch the robot on and off as well as to start and stop the operating program by means of a joystick or touch screen.

#### Person Recognition

One of the key requirements to be met by interactive entertainment and information robots is that they should be able to recognize and address humans. Those people in the robot's immediate vicinity are recognized by means of a laser scanner mounted on the robot which is used both for obstacle detection and for self localization. The measured data from the laser scanner are searched for the typical contours of human legs. Further features, for example the temporary focusing on individual visitors or the storing of positions of persons who have already been welcomed guarantee the correct manners for welcoming the visitors.



### Automatic Route Calculation

In order to escort visitors to a selected exhibit or stand, the robot computes an optimal, collision-free route to the required destination. Dynamic obstacles, such as other visitors, are automatically detected and the computed route is adapted to allow the robot to navigate around visitors at an appropriate distance.

### Ball Game

In this mode of operation, the robot uses its laser scanner to detect and follow round objects that are of a certain diameter. Based on an additional analysis of this data the robot is able to prevent tipping visitors over with the ball. If the robot cannot find the ball, it moves around at random and searches for the ball.

### Interaction with Visitors

Using the robot's touch screen, visitors can access information or select a destination they wish to be taken to. Information can be output not just graphically, but also by means of speech, either in the form of recorded speech files or using commercially available text-to-speech systems. If required this output can be updated on-site by the personnel and thus be adapted to changing exhibits.

### Proven Safety Concept

The robots are provided with several independent safety systems: in addition to obstacle detection by means of the laser

scanner, use is made, where necessary, of sonar sensors in order to safeguard the area above the laser scanner. The robot's permitted area of movement is determined by the control software. Besides software restricting the allowed operation area, magnetic sensors facing towards the ground are used as a secondary backup system to prevent the robots from leaving their assigned operation area. Magnetic strips are installed in the floor around any specifically identified danger areas and that activate an emergency stop if the robot should ever pass over them. All robots are additionally equipped with emergency-stop buttons, which force the robot to halt immediately in hazardous situations and thus enable safety certification by the responsible authorities.

### Reference Installations

With the opening of the Museum für Kommunikation Berlin in March 2000 three mobile robots were installed, which since have been in daily operation in the museum's atrium, entertaining and interacting with museum visitors. »The Inciting« is designed as an animator. Carrying out his role as host, he actively approaches the visitors, welcoming them in a friendly manner and giving them tips for their visit.

»The Instructor« is the educational, speech-making robot, who informs the visitors about the museum's architecture and history. »The Twiddling« is the playful robot, moving around in an uncoordinated manner in keeping with his childlike character and playing with a ball.

Between October 2003 and October 2004, Opel in Berlin used two entertainment robots called »Mona« and »Oskar« to entertain and inform visitors to its exhibition centre. »K-bot-1« since December 2005 is entertaining visitors to the Kutxa-Espacio de la Ciencia in San Sebastian, Spain. This robot operates in the museum's foyer, where it autonomously recognizes and approaches visitors, offering them information about the museum on its screen in several different languages.

### What we offer

Fraunhofer IPA can develop customized robots tailored to your specific needs. More particularly, we offer you:

- Joint development of a suitable application scenario
- Technical implementation of the application scenario with customized speech and video output
- Coordination of hardware development including design and construction of robot covers

In addition to the development of new robot platforms, it is also possible to rent existing robots for selected events. Contact us to discuss your personal application scenario.

2 Museum robots »The Inciting« and »The Twiddling«

3 Museum robot »K-bot-1«

4 Opel robot »Mona« in a hardware store