

# Probo, a Testbed for Human Robot Interaction

Kristof Goris  
Vrije Universiteit Brussel  
2 Pleinlaan  
Brussels, Belgium  
kristof.goris@vub.ac.be

Jelle Saldien  
Vrije Universiteit Brussel  
2 Pleinlaan  
Brussels, Belgium  
jelle.saldien@vub.ac.be

Dirk Lefebber  
Vrije Universiteit Brussel  
2 Pleinlaan  
Brussels, Belgium  
dirk.lefeber@vub.ac.be

## ABSTRACT

The concept of the huggable robot Probo is a result of the desire to improve the living conditions of children in hospital environment. These children need distraction and lots of information. In this paper the concept of a new social robot is presented. This robot can be used in hospitals, as a tele-interface for entertainment, communication and medical assistance.

Besides the prototype of the real robot, a virtual model has been developed. With user friendly software these models can be used as an interface between an operator and a child. That way, Probo becomes a platform for experiments concerning human robot interaction with great opportunities in different disciplines.

## Categories and Subject Descriptors

I.2.9 Robotics [artificial intelligence]: Robotics—*Operator interfaces, Sensors*

## General Terms

Design

## Keywords

robotics, human robot interaction, user interface,

## 1. INTRODUCTION

During hospitalization, children are confronted with difficult situations. This can lead to serious mental health and other health consequences. Moreover, in hospital, a child's experiences are more limited due to the closed and protective environment. Several projects already exist that aim to use Information and Communication Technologies (ICT) like internet and webcams to allow hospitalized children to stay in contact with their parents, to virtually attend lectures at school and to provide information [2]. However, these ICT applications are usually computer animations displayed on PC, television screens or laptops. In fact, people are used to

interact with embodied creatures and have evolved communication skills, which both need a body for expression [1], [3].

In this scope, the development of a social robot, called Probo, has started. The main objective is to offer solutions to some specific needs of hospitalized children by making use of a user friendly robot platform. The huggable robot Probo will assist in providing information and moral support to hospitalized children.

## 2. PROBO, A FRIENDLY USER INTERFACE

### 2.1 Concept

Probo has to be seen as an imaginary animal based on the ancient mammoths. Its name is derived from the word Proboscidea, the order of animals with a proboscis or trunk. By choosing a imaginary animal there are no exact similarities with well known creatures, so there are no or less expectations compared with a real animal. Safe interaction will be the first focus of Probo. Therefore the dimensions of this social pet robot are limited and comparable to the figure of a five years old child. Moreover, all moveable parts are actuated with soft actuators [3]. Probo's huggable and soft appearance, intriguing trunk and interactive touch screen in its belly, are striking (Figure 2). To communicate with the children, the robot is equipped with a fully actuated head. Table 1 shows the different degrees of freedom (DOF) of Probo's robot head in comparison with MIT's social robot Kismet [1] and Philips' iCat [4]. More about the design criteria and the difference between other robotic heads can be found in this work [3].

### 2.2 Real and Virtual Model

To interact and communicate with children a new 3D embodied social robot has been designed. During the development phase, a virtual model has been derived from the real CAD model. The virtual model, based on the real mechanics, was used as a tool to control the design criteria. For instance, by actuating the virtual model, the necessary DOF and ranges of the actuated joints could be checked, so that the robot head would be able to express some basic emotions. Additionally, with the virtual model it was possible to develop control software, without the need of the real model. That way, fast progress in software and hardware developments could be made simultaneously. Figure 1 shows some movements of the robot during an experiment where the real model was linked with the virtual one.

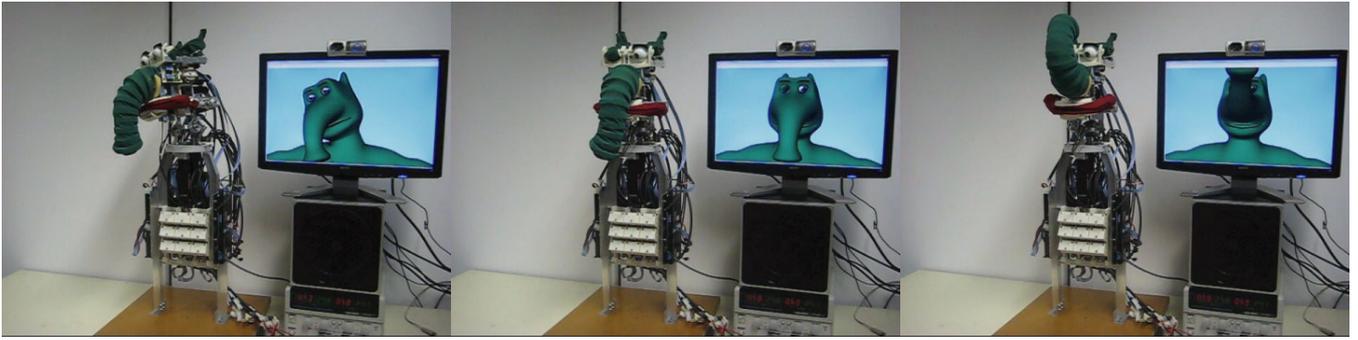


Figure 1: Screen shots from an experimental movie, where the real model was linked with the virtual one.

Table 1: DOF and ranges of the actuated joints of Probo's head in comparison with other non-humanoid robot heads.

Kismet	iCat	Probo		
DOF [#]		Range [°]		
Eyes (3)	Eyes (3)	Eyes (3)	Pan Tilt	100 80
Eyelids (2)	Eyelids (2)	Eyelids (2)		150
Brows (4)	Brows (2)	Brows (4)		45
Ears (4)		Ears (2)		90
Yaw (1)		Mouth (3)	Yaw	45
Lips (4)	Lips (4)		Lipcorners	60
Neck (3)	Neck (2)	Neck (3)	Rotate Nod Bend	120 70 70
		Trunk (3)		360



Figure 2: Computerized 3D representation of Probo, with removable fur jacket.

### 2.3 Friendly User Interface

The huggable and friendly Probo will function as a robotic user interface between an operator and a child. The friendliness refers not only to the funny and attractive behavior of the robot pet, but it refers also to the easy and convenient way to control the robot. An operator, for instance a doctor, a nurse, a parent, a classmate or a teacher can manipulate the robot's actions, by either make use of a *Xbox* game controller, or an easy graphical user interface (GUI) made for a *Microsoft* operated system (PC, or smartphone). With this GUI, one can control the robot and make some sequences in movements, like animations. This can be done, intuitively, by dragging and dropping some icons on the screen.

### 3. CONCLUSIONS

To inform and comfort hospitalized children in an interactive and playful way, a new social pet robot, called Probo is being developed. Probo's main goal is to communicate with the children. Therefore a fully actuated robot head, capable of showing facial expressions, has been designed and build. Compared with other non-humanoid robot heads Probo has an intriguing trunk. By use of soft and flexible materials together with compliant actuators, the design is safe and as a consequence safe human/child robot interaction is assured. In addition to this, user friendly control software, and a virtual model based on the real robot are developed. With this

real or virtual multidisciplinary testbed, new opportunities like robot assisted therapy will be explored in collaboration with pediatricians, sociologists and psychologists.

### 4. ACKNOWLEDGMENTS

This work was supported by the Brussels-Capital Region.

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