

# FaceBots: Robots Utilizing and Publishing Social Information in Facebook

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## ABSTRACT

Our project aims at supporting the creation of sustainable and meaningful longer-term human-robot relationships through the creation of embodied robots with face recognition and natural language dialogue capabilities, which exploit and publish social information available on the web (Facebook). Our main underlying experimental hypothesis is that such relationships can be significantly enhanced if the human and the robot are gradually creating a pool of shared episodic memories that they can co-refer to (“shared memories”), and if they are both embedded in a social web of other humans and robots they both know and encounter (“shared friends”). In this paper, we are presenting such a robot, which as we will see achieves two significant novelties.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces, I.2.9 [Artificial Intelligence]: Robotics

**General Terms:** Design, Experimentation, Human Factors

## Keywords

Social Robots, Conversational Robots, Human-Robot Interaction

## 1. INTRODUCTION

The *main problem* addressed by this project is that of the creation of sustainable and meaningful long-term human robot relationships. This is a most important problem towards our *ultimate goal* of human-robot symbiosis, i.e. harmonious and mutually beneficial living together of the two species. In the *shorter term*, this is an important problem towards the successful application of robots to numerous areas: disabled and elderly assistance / companionship, supporting education, and more. *So far, empirical investigations* have shown that we have not advanced significantly yet towards its solution: Although existing robotic systems are interesting to interact with in the short term, it has been shown that after some weeks of quasi-regular encounters, humans gradually lose their interest, and meaningful longer-term human-robot relationships are not established. For example, in the case of Robovie [1], there was a steady and significant decrease in the total time of interaction of the robot with humans over six months – interest had worn off.

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Our proposed solution to sustainable and meaningful long-term human-robot relationships is based on an *underlying hypothesis*: That such relationships can be significantly enhanced if the human and robot gradually create a pool of shared episodic memories that they co-refer to (“shared memories”), and if they are both embedded in a social web of other humans and robots they both know and encounter (“shared friends”). Thus, here we present a *conversational mobile robot* with face recognition that is connected to Facebook, a highly successful networking website for humans, towards enhancing long-term human robot relationships, by addressing the above two prerequisites.

The contribution to the field of the project is expected to be significant. Apart from many *tangential side-gains* elaborated in the discussion section, our system achieves *two important novelties*: being the first such robot that is embedded in a social web, and being the first robot that can purposefully exploit and create social information that is available online. Furthermore, it is expected to provide empirical support for our main driving hypothesis, that the formation of shared episodic memories within a social web can lead to more meaningful long-term human-robot relationships. The experience gained by the creation of such a system as well as the software created is invaluable towards providing similar capabilities to other robots, and as a starting point for further enhancements of robots truly embedded in a social web that use and create online social information. Finally, the exposure of the robot to Facebook, through the future public availability of its own Facebook page containing its friends and experiences as well as photos, will create public interest that will further support endeavours to similar directions in the future.

## 2. RELATED RESEARCH

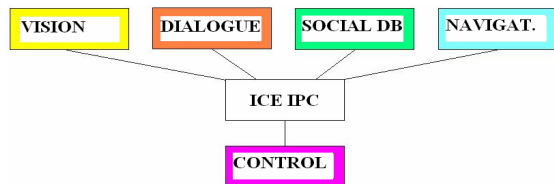
Although numerous attempts towards *social robots* have taken place (Kismet, Leonardo, Maggie, Robovie and more), no existing systems have utilized a connection between robots and Facebook. However, *face-detecting conversational robots* are not new; there are numerous projects built around face-detecting robots [2],[4], potentially carrying out conversations with multiple humans [5]. Regarding the *sustainability of human-robot relationships*, a key long-term (six month) study is [1]. Shorter field studies in other contexts have taken place in the past; for example the 18-day field trial of conversational robots in a Japanese elementary school [3]; and numerous are underway, including a possible massive deployment of humanoids in malls [Ishiguro, personal communication]. Finally, regarding the *real-time utilization of web resources by robots*, much needs to be

done, but exciting prospects exist; for example, “Peekaboom” [6], could serve as a real-time repository for object recognition.

### 3. SYSTEM ARCHITECTURE/FUNCTION

*Hardware:* Our robot is composed of an ActivMedia PeopleBot, augmented with a SICK laser range finder, a touch screen, and a stereo Bumblebee camera on a pan-tilt base at human eye-level.

*Software:* We have created an expandable modular software architecture, with modules intercommunicating through the ICE IPC system. The modules can be running on multiple CPUs or PCs which are part of a network, and are written in C++ and Java. Effectively, a callable-method API is exposed by each module towards the others. The modules we have created are: (M1) *Vision Module* with Face Detection & Recognition, from camera- or Facebook- derived pictures. Includes real-time externally callable training set modification / new classifier generation capabilities, and pluggable face detectors / classifiers (currently viola-jones-based face detection, and embedded HMM-based recognition). (M2) *Natural Language Dialogue Module*, (CEPSTRAL synthesis / Sphinx recognition), with real-time language model switching capabilities. (M3) *Social Database Module*, which locally holds basic personal info / friendship relationship / simple event data / photos for the people the robot knows, and which connects and updates through Facebook for those that are members of it. (M4) *Navigation and Motion Module*, to map its environment and drive to key social locations, and (M5) *Controller Module*, where routines can easily be scripted.



**Figure 1: Modules intercommunicating using ICE IPC**

*Functionality:* A basic demo of the system has been implemented. The robot initially wanders around our lab, avoiding obstacles and occasionally speaking to itself. When a human face is detected through the vision system, an attempt towards recognition is made, and if there is enough confidence about identity, the robot greets them and asks for their name, in order to see whether he/she is indeed the one it recognized. Some pictures are then taken for addition to the training set of the appropriate classifier: either of the already known recognized person, or of a new classifier in case of a new person, who is also asked about their name. In case of a new person, social information may be obtained about him/her through Facebook, if he/she is already a member. For example, if Facebook reports the new person is a friend of an already known friend of the robot, then this is announced and indirectly asked for confirmation. In the case of an already known person appearing before the robot and being saluted and recognized correctly, reference is made to possible meetings with common friends in the mean time or to previous meetings with them. Some pre-scripted segments of dialogue, containing announcements or jokes, embellish the conversations. Finally, the robot says goodbye and continues its wandering.

### 4. DISCUSSION

*Extensions* of this basic demo are currently undergoing testing and development. The realization of such extensions is simple, given the high-level external method calls made through the controller module. An initial *quantitative evaluation* of the performance of the subsystems is also underway (for example, face recognition performance), towards their further enhancement, in order to have guaranteed a level of system reliability that is high enough before the start of long-term human-robot interaction recording. Apart from the evaluation of the subsystems, a quantitative evaluation of the system as a whole is foreseen. Furthermore, many *tangential side-gains* are derived from our project: for example, we are currently experimenting with the usage of both local and Facebook photos for enhancing face recognition, with the possibility of *utilizing social information* (i.e. if the robot sees a known face in one of the photos, it can start recognition attempts for other faces in the same photo by biasing towards its first- and second- level social circle, or mutual circles of the known etc.)

### 5. CONCLUSION

Towards *sustainable long-term human-robot relationships*, a mobile robot with vision, a dialogue system, a social database and a *Facebook connection* was created, which achieves *two important novelties*: being the first such robot that is embedded in a social web, and being the first robot that can purposefully exploit and create social information that is available online. Many side-gains, extensions, as well as a long-term evaluation of our main hypothesis are underway, and we hope that we have brought our ultimate goal of human-robot symbiosis a step closer.

### 6. ACKNOWLEDGEMENTS

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