Autonomy in Human-Robot Interaction Scenarios for Entertainment

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ABSTRACT

Decision-making is the natural way that makes any animal autonomous. To improve the autonomy of social robots, we propose to apply a bio-inspired decision-making system to manage the actions related with the human-robot interaction. In this paper, we present the system and how we apply it to one-by-one entertainment scenarios. Our robot has been equipped with several devices for interaction such as an interactive tablet, a microphone, a speaker, and a camera. Thus, the goal of the system is to have a robot deciding its own actions based on the preferences of the user.

Keywords

human-robot interaction; decision-making; autonomy; social robots; education; entertainment;

1. INTRODUCTION

There are studies which say that robots are very useful for education and entertainment [2][4]. In these scenarios, researchers usually apply the wizard of oz paradigm to control the robots. In this paper, we propose an autonomous social robot conducting HRI activities with a person. This robot decides its own actions while interacting with the user based on her preferences. As an example of the application of the system, we present a simple scenario where the interaction is done one by one (one robot, one person) and the robot is the main character who decides what to do in an autonomously way.

The robot employed in this scenario is *Mini* [3], a *desktop* social robot intended to entertain, assist, and watch elders or children at their homes. In order to strength these facets, *Mini* has been equipped with actuators, and sensors detailed in Figure 1. The robot behavior has been designed to convey the robot's emotional state, its intention, or its excitement.

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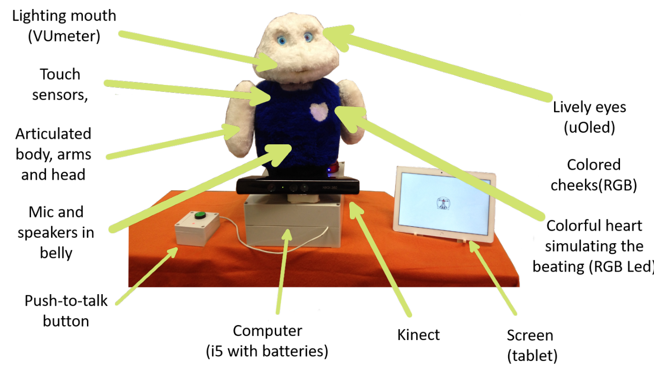

Figure 1: Body configuration of the robot *Mini*.

2. AUTONOMOUS DECISION-MAKING SYSTEM

We have implemented a bio-inspired decision-making system previously developed by Castro-González et al. [1] but improving the system with some new functionalities and applications related to HRI. This implementation facilitates the continuous monitoring of the environment, either objects or people.

The decision process (Figure 2) is formed by the **state** (inner and external), the **dominant motivation** (it represents the inner state, that is the result of the drives and the external stimulus), the **drives** (it represents a demand that causes the desire to be satisfied), and the **external stimulus** (signals coming from the environment).

In addition to that, the DMS is pre-configured with a repertoire of **actions** which have several *effects* on the motivations. Thus, the DMS will use *machine learning techniques* to personalize the behavior of the robot for the interaction.

Thus, every action executed by the robot will have an effect that will cause a *reward*. This reward will be positive or negative depending on the effect of the action executed and the information extracted from the interaction.

In this paper, we propose a DMS that considers actions related to the interaction. Thanks to the learning mechanism, the robot's behavior will be customized to each user,

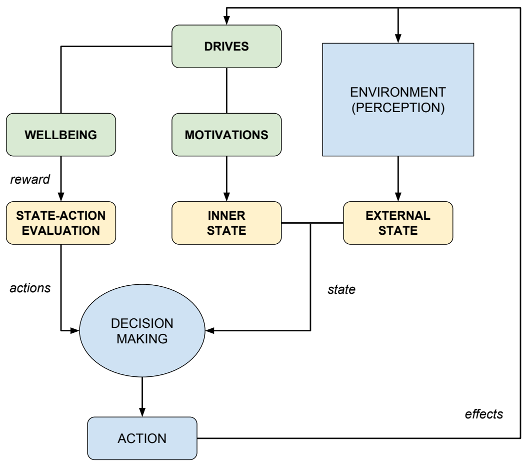

Figure 2: Decision-Making System (DMS) architecture.

Figure 3: Human-Robot Interaction scenario.

improving her satisfaction the more the user interacts with the robot.

3. HRI SCENARIO

Thus, the DMS developed could be applied to several HRI applications (e.g. educational or entertainment games).

3.1 Scenario

The robot applications were designed to be applied in scenarios where Mini interacts with only one person naturally (Figure 3). Thus, the robot is able to interact speaking and showing multimedia content on its screen.

It is not so relevant whether the person is near to the table where the robot is placed. This is because the tablet device can be moved from the docking station. However, the face-to-face configuration has to be maintained.

3.2 Interaction

The interaction will be conducted all time by the autonomous robot. However, the person will be able to leave the scenario whenever she/he wants.

The robot will be controlling continuously if the person is attentive or distracted. It will be monitoring also if there is no person present. In that case, the robot will be sleeping or trying to attract the attention of any near person.

4. FUTURE WORKS

In this paper we have presented a decision-making system for improving the autonomy of a social robot in human-robot interaction scenarios. It has been implemented on *Mini*, a desktop social robot designed to interact mostly with elders and children.

As it has been shown, *Mini* has been provided with a repertoire of actions that can be activated depending on the state of the robot. In addition, a typical scenario for human-robot interaction for autonomous robots has been presented. This system allows a wide range of applications and experiments, conveying different intentions, emotions, and, in general, endowing the robot with a greater autonomy.

Nevertheless, with this scenario we will be able to improve the engaging in HRI through the self-adaptation of the robot behavior to the user.

Hence, in order to evaluate the system, it is necessary to make real tests with users. That is why in the subsequent months we intend to carry out some experiments where *Mini* will interact with several people (children or adults) to evaluate whether the system is learning appropriately and the user are responding according to the parameters to evaluate.

5. ACKNOWLEDGMENTS

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