

# SMRT: UniRHOCU

## Universal Robot Human Operations Cooperative Unit

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### ABSTRACT

*In this presentation we describe our idea for the student design competition of the Human Robot Interaction conference in March 2008 (HRI2008)<sup>1</sup>. The main purpose of the challenge is to generate interest and foster new ideas to ease human robot interaction. The teams are also asked to implement a prototype with a LEGO Mindstorms NXT set. Our project explores ways to simplify the automatic transition from close-by human interaction to autonomous behavior to remote control. The (simple) task of the robot is to find points of interests in his vicinity and contact a human operator.*

### 1. INTRODUCTION

During the third annual Human Robot Interaction conference in March 2008, which will be held in Amsterdam, a student design competition is organized. A maximum of 12 teams will present their ideas of new ways for robots to interact with humans and show their prototypes realized with a limited set of sensors and a LEGO Mindstorms NXT set. The available sensors are: an IR (light) sensor, a RFID sensor, an ultrasonic (distance) sensor, a microphone and a touch sensor (button).

### 2. THE IDEA

Our idea involves a robot searching autonomously for points of interest (POI) around its current location and then trying to establish communication with a human. This robot behaviour will be used in a wide variety of applications: search and rescue (i.e. locating human in distress areas), resource location (i.e. precious material (iron, H<sub>2</sub>, etc)), semi-autonomous transport, smart mapping and other sort of robot tasks where a flexible autonomy is of advantage.

The main focus of our project is on how the robot can engage in a communication/interaction with a human being. As outlined in [1] one of the problems is to decide which context the robot should use and how to contact human beings depending on their distances to it. The (back-and-forth) transition of control from a base station to interaction with a close-by human being is of special interest. The robot should work autonomously and only contact humans if it needs further assistance or found something interesting.

The idea is to use low range sensors to detect human beings

in the vicinity (e.g. ultrasonic, IR, etc) and contact them if possible. To do so the robot tries at first to get the human's attention. In our case this will be done by using the built in speakers. The human then has to react by shouting, clapping, pressing a button or giving a command using an RFID tag.

If there is no human in the vicinity or no reaction is observed the base station is contacted. In our case this is realized with a Bluetooth connection. In a real life environment, e.g. a space mission, using sound notifications to contact humans will not work therefore Bluetooth could be used for short range (e.g. in connection with a handheld device) and radio (RF) transmission for long range communication links.

If no new command is received via either link the robot will record the position and keep on searching and eventually return back home to the base station.

### 3. CONFIGURATION

The robot constructed of LEGO Mindstorms NXT is placed in a restricted area. This search area is bordered by a thick black line, which the robot can detect with its light sensor. The points of interest (POI) the robot is programmed to find are also detected with the light sensor and are marked in red colour. In future versions, which will also not be restricted to the sensors given to us, the robot can detect e.g. iron ore, H<sub>2</sub>, a human being in distress or other features.

To find out if there is someone in the vicinity the ultrasonic sensor is scanning while the robot is rotating beneath it. If an object is detected a sound file is played to check if it actually is a human being or another obstacle and get the human's attention. The robot then waits for a reaction. This response can be shouting, clapping or other detectable human sounds, which will be detected via the microphone, pressing the button or giving the robot a new command using an RFID tag.

If no interaction is started after a few seconds the robot tries contacting the base station via Bluetooth. It sends that it found a POI and in later stages its corresponding characteristics and then awaits further commands from the base station. (This feature would later be supported by a location service, e.g. GPS, stationary beacons or similar, for easier marking of the location.) If there are no commands sent from the base station the robot starts again (autonomously) searching for points of interest.

### 4. REFERENCES

- [1] T. Fong and I. Nourbakhsh. **Interaction challenges in human-robot space exploration.** *ACM Interactions*, 12(2):42–45, 2005.
- [2] S. Kiesler and P. Hinds. **Human-Robot Interaction.** *Special Issue of Human-Computer Interaction, Volume 19 (2004), Numbers 1 & 2.* p1-8

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<sup>1</sup> <http://hri2008.org>