

# UtBot@Home: Applications of Mobile Robotics in domestic environments



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## Introduction

The robot UtBot@Home, equipped with sensors and provided of a control software called **Robot Operating System (ROS)** [1], aims to accomplish some tasks of the RoboCup@Home initiative[2], listed below:

- 1 - Speech and Person Recognition** [3]: The robot has to identify unknown people and answer questions about them and the environment. This test focuses on human detection, speech recognition, and robot interaction with unknown people;
- 2 - Help-me-carry** [3]: The robot must help bringing some objects into the arena from outside. This test focuses on safe, robust navigation, people following and navigation in unknown environments;
- 3 - Restaurant** [3]: The robot is tested in a real environment such as a real restaurant or a shopping mall. This test focuses on online mapping, safe navigation in previously unknown environments, gesture detection, human-robot interaction.

## Incorporation of a robotic arm

A robotic arm with 6 degrees of freedom (6 DOF) was installed in the robot's structure. The robotic arm segments are made of sturdy aluminum and the movement of the joints is performed by **six servo motors** [6]. The end effector is a gripper and the maximum reach of the arm is 460mm, enabling the accomplishment of the tasks proposed by RoboCup@Home.



Figure 2 - Robotic arm manipulating an object

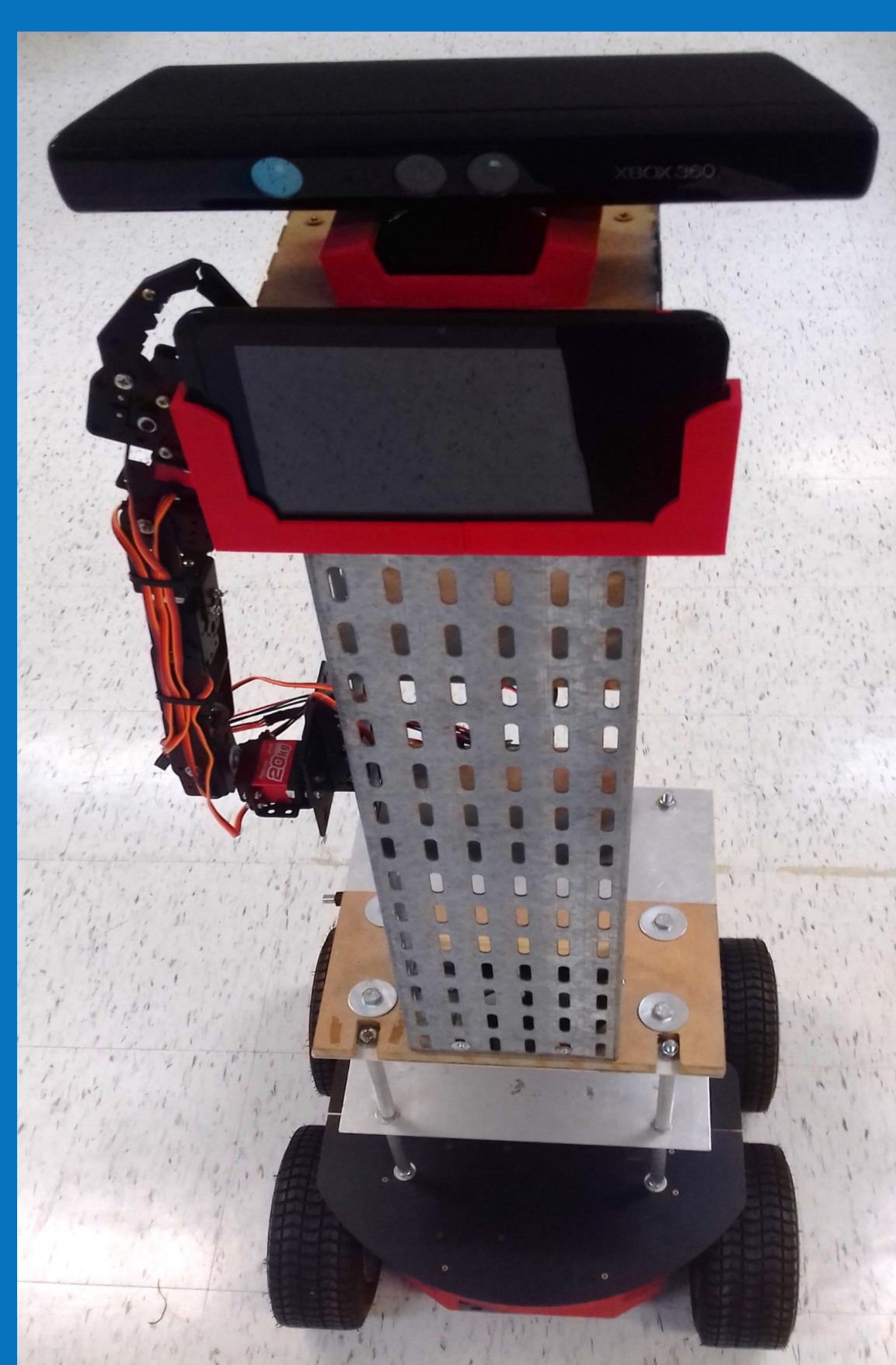


Figure 1 - UtBot

## Hardware

The figure 1 shows the **UtBot@Home** robot, a mobile robot built starting from the **Pioneer 3-AT** robot [4]. In the construction of the UtBot was added a structure measuring 120mm of length, 120mm of width and 690mm of height, allowing the attachment of a tablet, responsible for Human-Machine Interaction, and a **Microsoft Kinect** sensor [5], used for the robot vision system. Finally, an **Arduino Uno** was incorporated to control the servo motors of the robotic arm.

## Autonomous Navigation

The robot observes the environment and is located itself from the odometry, generating a dynamic map. The ROS makes measurements about the data collected by the **LIDAR** sensor [7], a 3D laser scanning, and defines reference points. The **Simultaneous Localization and Mapping (SLAM)** [8] is a set of tasks that allow a mobile robot to move from one point to another identifying and avoiding obstacles along the way in an autonomous way.

## Conclusions

The UtBot robot has, with the aid of packages state-of-the-art computer vision and treatment of data, competence to accomplish several tasks of RoboCup@Home.

## Recognition and Voice Synthesis

With the help of an Android application that uses a voice recognition API that connected to the robot through sockets it is possible to perform the communication between human and machine.

## References

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