Rationalizing Humanoïd Platforms for Studies on Navigation, Interaction and Facial Expression

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1 Introduction

In many robotics labs, we have to maintain a fleet of robots that are costly and time consuming to build, and also require a lot of energy for maintenance.

In our lab, we have robots for three main kinds of experiments: navigation (indoor and outpdoor), interaction (human-robot and object-robot) and facial expressions. We present a modular platform which aims to demonstrate all these possibilities in a unique humanoïd robot while keeping it easy to work on the different parts separately.

2 Needs

For bio-inspired navigation we use robuROC4 robots for outdor and robulabs robots for indoor from Robosoft[5] with some specific equipements. For interaction and manipulation, we use robotic arms like Kinova or Katana [2]. For facial expressions, we used an home made robotic head[6] we have then installed this head on a moving platform Robulab which allows the robot to navigate in museum while displaying different facial expressions[7] (see Fig. 1).

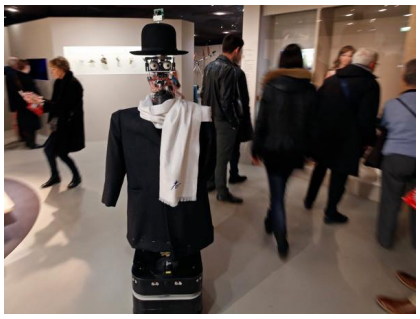

Figure 1: Berenson navigating in a museum expressing its critical

The difficulty with this set of robots is that it is requiring a lot of maintenance and a various setups. Another difficulty is that the companies building the robots may be abroad (Kinova, Neuronics) or may have stopped to produce the robots (Robosoft).

That why we try to rationalize the platforms. First we wanted to use elements that can be used independently (a head, a torso, a robotic base) in order to let students or researchers to work in parrallel on specific parts without interfering with the main robot. The parts should be easy to maintain independently of the building companies. We try to minimise the number of platforms for outdoor and indoor.

3 The proposed platform

For all the precedent reasons, we use on open source humanïd torso Reachy from Pollen-robotics in Bordeaux[4]. It is 3D printed so if needed we can reprint some parts and customize it. It exactly what we have done for the head in order to make facial expressions. We ask a compagny Animatronix at Ivry-sur-Seine near Paris[1] to design and build a compatible head with facial expressions. For the mobile base we wanted the same platform to be able to go indoor and outdoor on uneven terrain and to be able to rotate the torso. We ask a compagny in Cergy-Pontoise to adapt their autonomous mobile robot for logistics and agriculture in order to support and motorize the humanoïd torso.

The resulting robot is presented Fig. 2. We call it Ferdinand in reference to Ferdinand Cheval, a famous french postman which was navigating a lot through the mountain, but who has also very good artistic and building qualities as alone, he did build a magnificent palace[3].

It is smaller than an electric wheelchair so it can

Figure 2: Ferdinand in a task of navigation guided by a human

navigate indoor but it is well suited to go outdoor as it is studied for agriculture. Everything is ROS compatible and we have enough power to add a powerfull computer (intel i9), powering the torso and the head. We have two cameras and microphones in the head. The torso is easy to remove (4 screws and 2 cables) to test the mobile base and the torso separatly. We have added a camera on the mobile base (not on the picture) identical to the one we use on the autonomous car which allow us to use the same algorithm of navigation (with some adaptations due to the size, speed, ...).

4 Discussion

We will propose some feedbacks on the experience of this platform and we will test different applications. A thing that could be interesting is to compare this platform with the holonomic one proposed by Pollen-robotics for indoor (it did not exist when we started the project).

References

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