DREAM: Deferred Restructuring of Experience in Autonomous Machines
H2020-FETPROACT-2014

Deliverable D7.3
Data Management Plan (M30)

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Pending validation from the Management Committee.

CONTENTS

PREAMBLE

This document summarizes the work done between month 6 and month 30 with respect to the data management plan. It complements and updates Deliverable D7.2 (M6), which is summarized in Chapter 1 along with the list of changes since M6. It then provides a description of the final implementation of the data server in terms of hardware and software implementation and usage, as well as a description of updates performed on the web site.

1 SUMMARY OF WORK DONE SINCE M6

In Deliverable D7.2, we described the following items:

- We established three types of data:
  - web site related (public), accessible through `http://Robotsthatdream.eu`
  - large data (public or private), accessible through `https://dream.isir.upmc.fr/databases/`
  - structured data for real-time exchange (private) `https://dream.isir.upmc.fr/databases/`
- We drafted the hardware and software requirement for the data server

Since M6, we implemented the following:

- Acquisition and installation of the data management server hardware (see Section 2)
- Content management for the data management server (see Section 3)
- New content to the website (see Section 4)

There were no significant derivation from the original plan. The new implementations are described hereafter.

2 DATA MANAGEMENT SERVER: HARDWARE AND SOFTWARE SETTINGS

The final specifications for the data management server are closely related to what was announced in D.7.2, and are described below (minor differences are mentionned):

- 8TB of virtual disk space, using four 2 TB disks. We originally planned for 12TB, but the current hardware setting makes it possible to add another 8TB of virtual space if required.
- Maximum transfer speed (in theory): 1Gb/sec
- A RAID 5 scheme (i.e. redundant array of independent disks configuration, level 5) is used for data preservation. We originally planned for a RAID 6 schemes, but a higher RAID level also implies smaller virtual disk space (in this case: RAID 6 would have implied 4TB available disk space, which was estimated to be too small).
- An additional backup strategy (not initially planned), of a different nature, was also set up using two disks mounted in a Network Attached Storage (NAS) device. This enables for a 16TB of backup space, implementing two backup strategies: (1) one backup every day (for 30 days) and (2) one backup every month (for 12 months). The NAS is located in a different location from the Data Management Server to reduce the impact of physical risks (fire, flood, theft).
- Maximum downtime is of 72 hours. However, we plan to move the data server to another building with over-the-week-end surveillance and intervention capability so that maximum downtime can be reduced to 24 hours (scheduled: september 2017).

3 DATA MANAGEMENT SERVER: CONTENT MANAGEMENT

The data management server is accessible through two methods:

- `https://dream.isir.upmc.fr/databases/`: web-based, restricted access, used for browsing and downloading experimental data. This is implemented using owncloud, an open-source professional-level file sharing solution for online collaboration and storage.

- `dream.isir.upmc.fr`: ssh-based, restricted access, used for uploading experimental data. This is implemented naturally though standard features in the Ubuntu open-source linux-based operating system used for the data server.

Access methods, security policy and data organization (as described below) have been discussed in several meetings, incl. the last general assembly (November 2016) and past two Hackademias (June 2016, and minor revisions in May 2017).

The data server is up and running since mid-2016. Since February 2017, it is operational *and* used by members of the consortium for storing and sharing experimental data within the project. As an example, there is currently 9GB of experimental data available on the server, spread over four entries, listed here for illustration:

- *babbling db 1*: dataset produced by a sensorimotor babbling. This correspond to the wave 1-2 and 3. Dataset produced with only one object on a table, with the real robot.

- *crustcrawler pushing*: this dataset contains crustcrawler pushing motions obtained by executing Quality-Diversity search.

- *data archive sim 1*: dataset produced by a sensorimotor babbling. This correspond to the wave 1-2 and 3. This dataset was produced with only one object on a table, in simulation.

Each experimental data directory contains sub-directories which are stamped by date (with a number as suffix for multiple entries on the same day) which corresponds to different batches of data. It is then possible to add new data to an existing experiment. Data are described using a plain text *readme.txt* file and/or PDF document(s) which are included by the user, and

can be visible on-line through the web interface. The raw experimental data itself is compressed, but browsable through an automatically-generated *html* list of file(s) and sub-directorie(s) contained in the archive. Hence, it is possible to easily browse the structure of an archive without having to download the full experimental data.

The data server being hosted at UPMC, all members from this institution with DREAM credentials can connect directly to the server. For each partners except UPMC, one account per institutions has been created to centralize upload of experimental data. The PI from each institution is responsible for the use of the use of the dedicated account.

With respect to access security, the DREAM data server is considered as a stand-alone machine with no special rights over the UPMC computer network. The full access policy is:

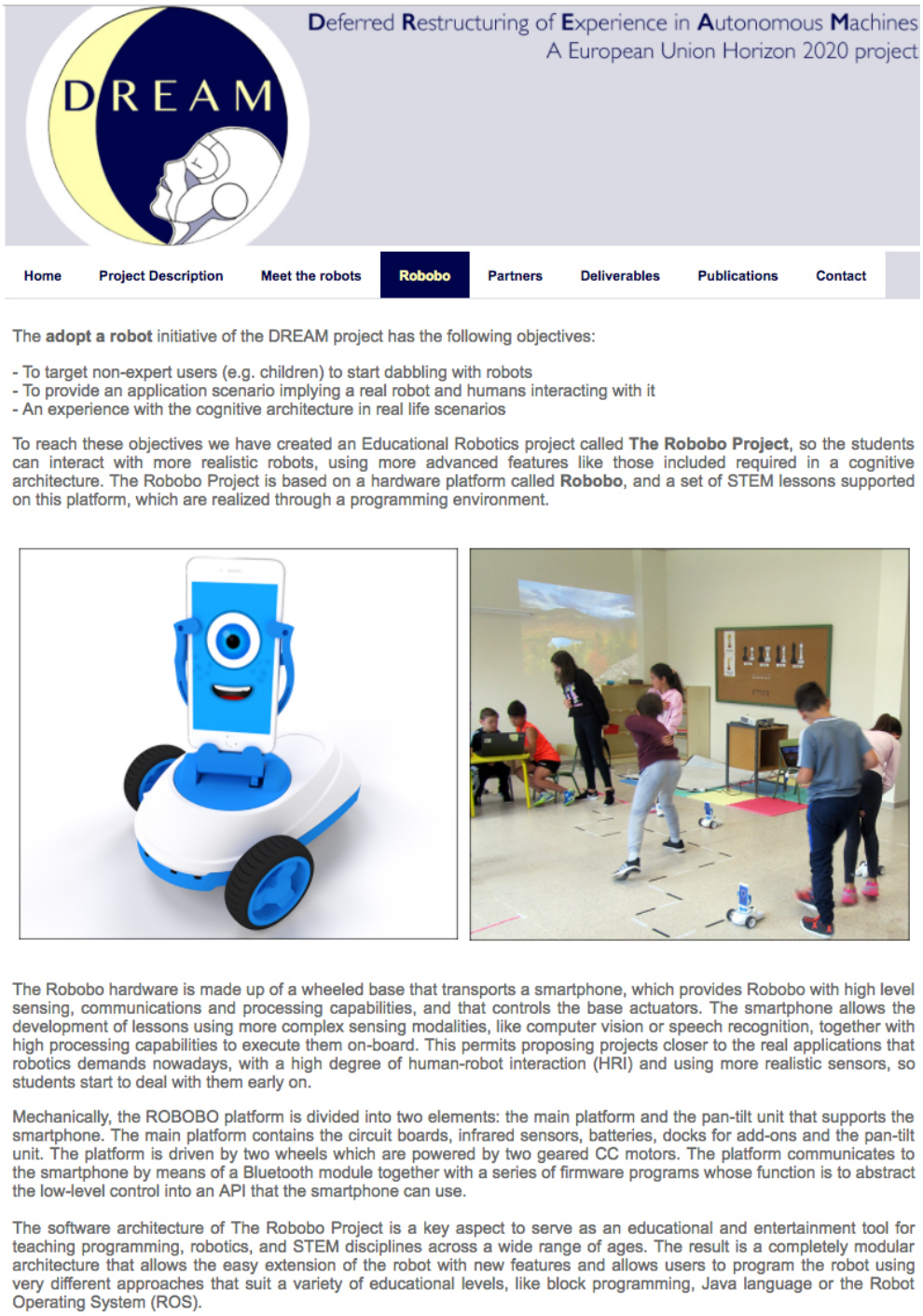
- TCP/22 (SSH): worldwide, protection against brute-force attacks
- TCP/80 (http): worldwide
- TCP/443 (HTTPS): worldwide
- UDP/123 (NTP): restricted IP
- UDP/53 (DNS): restricted IP
- all other ports: closed

Public/private data: specific content can be explicitly made available (or not) to the general public using a web-based authorization method (.htaccess file, to be removed or edited by the content owner exclusively through the ssh-based access). In addition, the web address must be provided to any third party (download-only), and be used for download or inclusion into a web page or scientific paper content, if needed.

4 WEBSITE: NEW CONTENT

The web site was launch in April 2015 and has been on-line since then. Regular updates concerns adding new publications to the publication page. The partner page was also updated to take into account the change of UK partner due to researchers involved moving from Queen Mary University in London to the University of Edinburgh.

A new Section has been added to the web site concerning **Robobo**, an educational robot designed and implemented by University Coruna (in association with local industrial partners) that can be used to demonstrate concepts behind DREAM and autonomous robotics to a general audience, including children. The current web page, which is kept minimal and redirect to the official Robobo page is shown in Fig.1.



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The **adopt a robot** initiative of the DREAM project has the following objectives:

- To target non-expert users (e.g. children) to start dabbling with robots
- To provide an application scenario implying a real robot and humans interacting with it
- An experience with the cognitive architecture in real life scenarios

To reach these objectives we have created an Educational Robotics project called **The Robobo Project**, so the students can interact with more realistic robots, using more advanced features like those included required in a cognitive architecture. The Robobo Project is based on a hardware platform called **Robobo**, and a set of STEM lessons supported on this platform, which are realized through a programming environment.

The Robobo hardware is made up of a wheeled base that transports a smartphone, which provides Robobo with high level sensing, communications and processing capabilities, and that controls the base actuators. The smartphone allows the development of lessons using more complex sensing modalities, like computer vision or speech recognition, together with high processing capabilities to execute them on-board. This permits proposing projects closer to the real applications that robotics demands nowadays, with a high degree of human-robot interaction (HRI) and using more realistic sensors, so students start to deal with them early on.

Mechanically, the ROBOBO platform is divided into two elements: the main platform and the pan-tilt unit that supports the smartphone. The main platform contains the circuit boards, infrared sensors, batteries, docks for add-ons and the pan-tilt unit. The platform is driven by two wheels which are powered by two geared CC motors. The platform communicates to the smartphone by means of a Bluetooth module together with a series of firmware programs whose function is to abstract the low-level control into an API that the smartphone can use.

The software architecture of The Robobo Project is a key aspect to serve as an educational and entertainment tool for teaching programming, robotics, and STEM disciplines across a wide range of ages. The result is a completely modular architecture that allows the easy extension of the robot with new features and allows users to program the robot using very different approaches that suit a variety of educational levels, like block programming, Java language or the Robot Operating System (ROS).

Figure 1: Robobo page on the DREAM web site (extract). Faces are blurred to maintain anonymity.