



Hard Material Small-Batch Industrial Machining Robot

HEPHESTOS Project

European Robotics Forum 2014

12th March 2014, Rovereto

Advances in robot machining

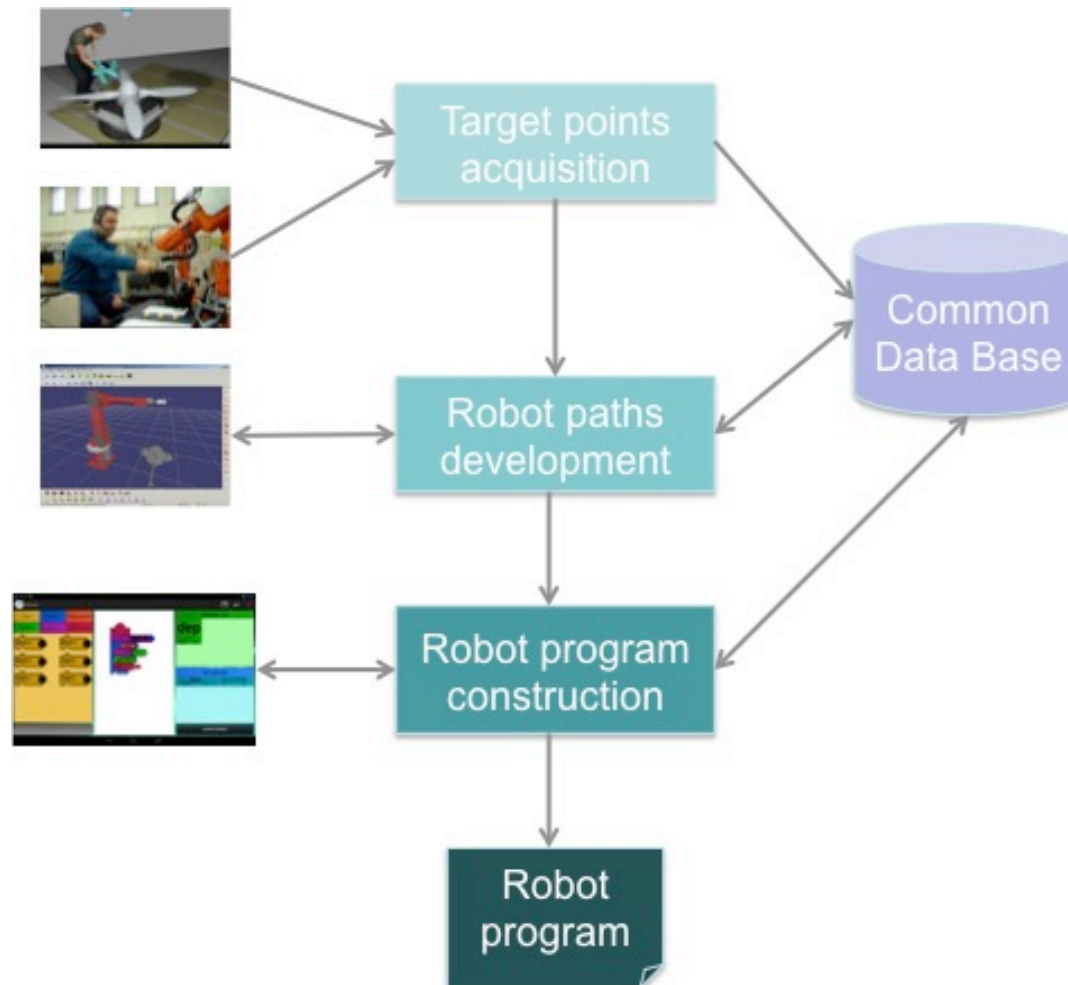
Human-Robot Interaction and Applications

Ernesto Gambao (Univ. Politecnica de Madrid)

Manual Guidance Programming Conception

- Main goal: Develop a complete programming system (methods and tools) integrated with the robot control system and the sensor system.
- Operator-driven programming procedures based on Robot Manual Guidance and Program by Demonstration (PbD) methods.
- Intensive use of sensor system and EASY-ROBs 3D visualization.
- Continuous human-robot interaction.

Manual Guidance Programming Concept



Process oriented programming

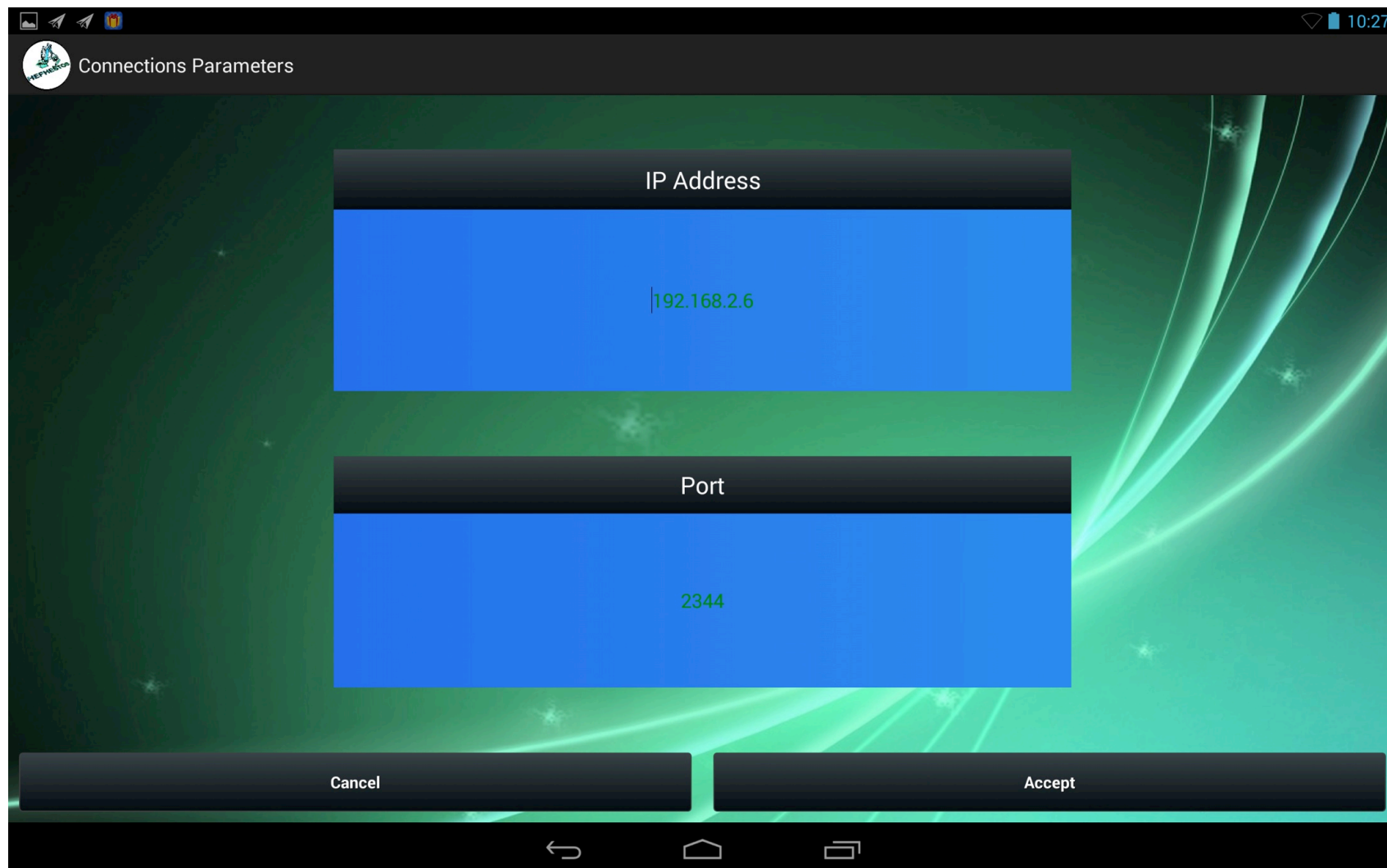
- Programming tool:
 - Based in an advanced GUI
 - Intuitive, easy-to-use and simple
 - Designed for on-line programming/reprogramming
 - Integrated with the manual guiding based programming procedures
 - Easy use of learn by demonstration methods
 - Easy connection with the robot control and sensors systems
 - Safety system integration
- End-user programming techniques
- An Android-base tablet has been chosen as a starting device



App Description: Main Screen



App Description: Configuration Parameters



Connections Parameters

IP Address

192.168.2.6

Port

2344

Cancel Accept

App Description: Environment Manager

Create Environment

Cargar entorno

Lista de entornos XML

1

DemoEnvironment.xml

/storage/emulated/0/Hammer/

Test



Lista de puntos

Índice	Nombre	X	Y	Z
1	P_6/2/14_104842710	0,00	3,80	3,70
	Referido al punto(0 0 0 0)			
2	P_6/2/14_104845230	0,00	3,80	6,40
	Referido al punto(0 0 0 0)			
3	P_6/2/14_104856709	-3,50	2,44	5,89
	Referido al punto(0 0 0 0)			
4	P_6/2/14_105115743	-0,93	-3,25	4,28
	Referido al punto(0 0 0 0)			
5	P_6/2/14_105141954	0,22	-3,12	4,47

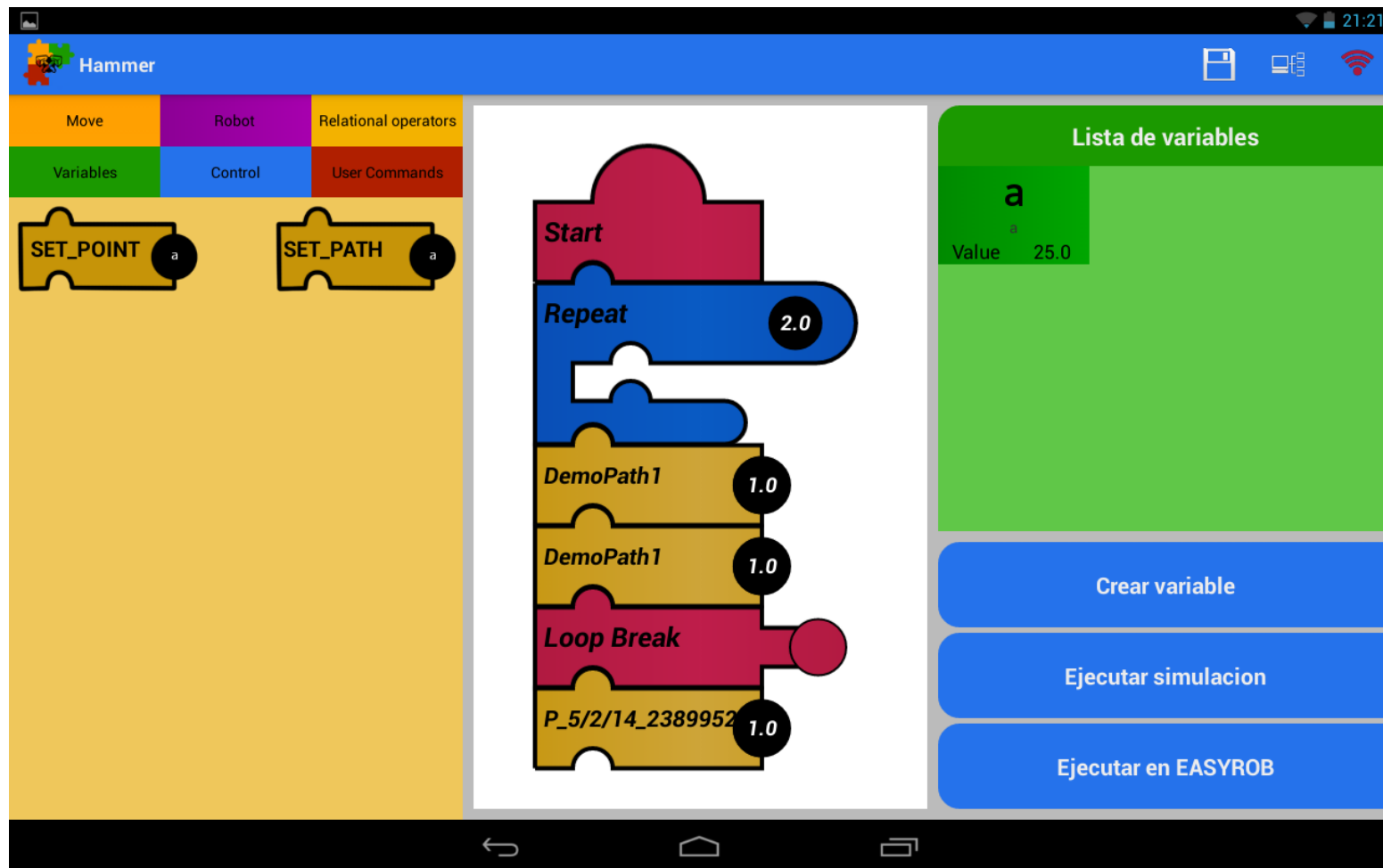
App Description: Program Manager



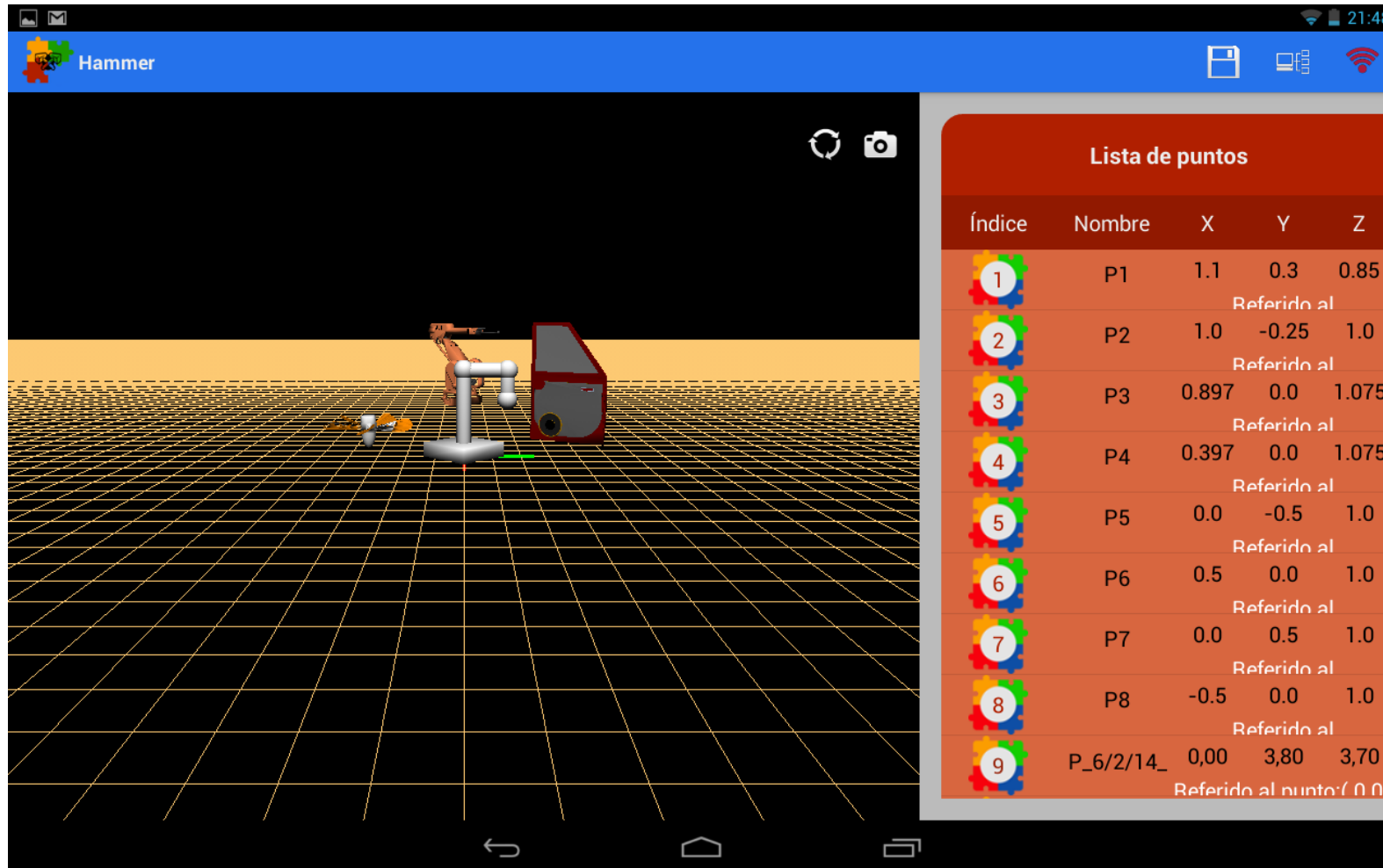
The screenshot shows the Program Manager app interface. The top bar is blue with a 'Create Program' button. Below it, there are three main sections: 'Programa nuevo' (New Program), 'Cargar programa' (Load Program), and 'Lista de programas' (List of Programs). The 'Lista de programas' section lists three programs: 'EasyDemo.hcm', 'DemoPathProgram.hcm', and 'DemoSimulation.hcm'. The 'Vista preliminar' (Preview) section shows a 3D simulation of a robotic arm. The 'Test' section shows a 3D simulation of a robotic arm. The 'Variables' section shows a variable 'Dep' with a value of 0.02. The 'Lista de puntos' (List of Points) section shows a table with 5 points.

Índice	Nombre	X	Y	Z
1	P1	1.1	0.3	0.85
2	P2	1.0	-0.25	1.0
3	P3	0.897	0.0	1.075
4	P4	0.397	0.0	1.075
5	P5	0.0	-0.5	1.0

App Description: Program Editor



App Description: 3D Models



The screenshot shows the Hammer app interface. The main area displays a 3D model of a robotic arm and a table on a yellow grid floor. The top bar is blue with the 'Hammer' logo and icons for settings, save, and connectivity. The right sidebar contains a table titled 'Lista de puntos' (List of points) with columns for index, name, and X, Y, Z coordinates. The table lists 9 points, with the last point (P_6/2/14_) having a reference to point 0.0.

Índice	Nombre	X	Y	Z
1	P1	1.1	0.3	0.85
2	P2	1.0	-0.25	1.0
3	P3	0.897	0.0	1.075
4	P4	0.397	0.0	1.075
5	P5	0.0	-0.5	1.0
6	P6	0.5	0.0	1.0
7	P7	0.0	0.5	1.0
8	P8	-0.5	0.0	1.0
9	P_6/2/14_	0,00	3,80	3,70

Referido al punto: 0.0

App Description: Block Properties



The screenshot displays the Hammer app interface on a mobile device. The top status bar shows the time as 21:49. The app's title bar is blue and contains the 'Hammer' logo and icons for file management, settings, and connectivity.

The main interface is divided into three panels:

- Left Panel (Yellow):** Titled 'Comparer Parameters Constants', it contains a green 'Dep' block with a value of 0.02, a blue block with the number '4', and buttons for 'Accept' and 'Cancel'. Below these is a 'Variable' section for 'Dep' with a value of 0.02.
- Center Panel (White):** Displays a sequence diagram with the following blocks:
 - Start** (Pink)
 - Repeat** (Blue) with a duration of 3.0
 - Test** (Yellow) with a duration of 1.0
 - Loop Break** (Pink)
 - P_2/2/14_1645421** (Yellow) with a duration of 1.0
 - Test3** (Yellow) with a duration of 1.0
 - Final Block** (Green) containing the expression $i? + i?$
- Right Panel (Green):** Titled 'Lista de variables', it shows a table with one entry:

Variable	Value
Dep	0.02

 Below the table are three buttons: 'Crear variable', 'Ejecutar simulacion', and 'Ejecutar en EASYROB'.

The bottom of the screen features a black navigation bar with standard Android icons for back, home, and recent apps.

App Description: Augmented reality

