



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



USABILITY ON THE RAPOSA PROJECT

João Pedro Frazão
Institute for Systems and Robotics
Instituto Superior Técnico
Lisbon, PORTUGAL
12 Nov. 2004



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Presentation Overview

- | **Raposa Project**
- | **Serial Protocol for USB devices**
 - Problem
 - Solution
 - Example
- | **Raposa Usability**
 - Graphical User interface
 - User input Device



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA

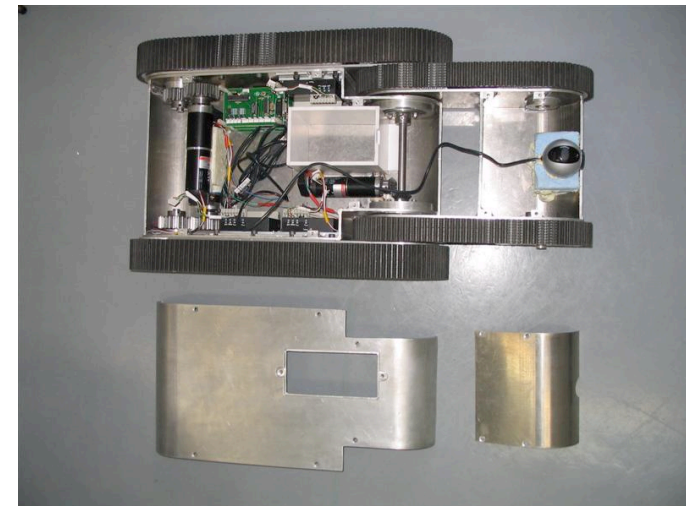
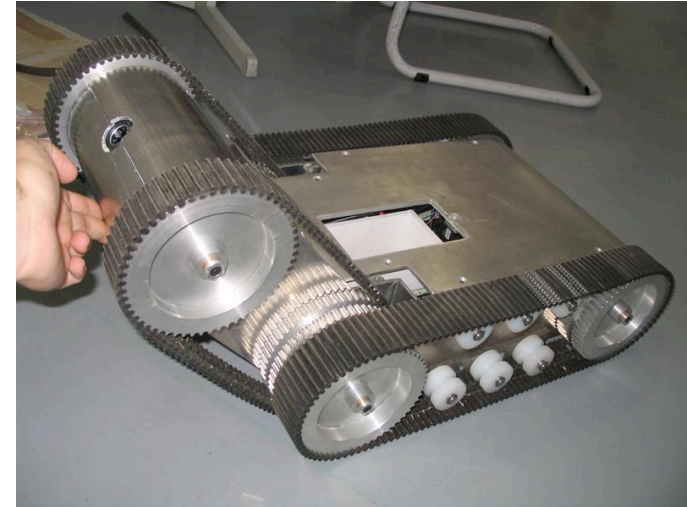


Raposa Project

- | **Search & Rescue Operations**
- | **Remote Operated**
- | **Onboard Processing**
- | **Change Arm Configuration**
- | **Climb stairs capability**
- | **Small**
- | **Several Sensors**
- | **Several Cameras**
- | **Docking Mechanism**
- | **Cable or Battery Operated**

Consortium:

ISR - IDMIND –Lisbon Firefighters – USF





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Protocol For USB Devices

History

- | **Developed For Raposa Project.**
- | **Now also widely used on the ISocRob Project.**

Motivation:

- | **Lots of different Sensors and actuators Types**
- | **General purpose Protocol for all Raposa Hardware.**
- | **Simple and easy.**



INSTITUTO
SUPERIOR
TÉCNICO

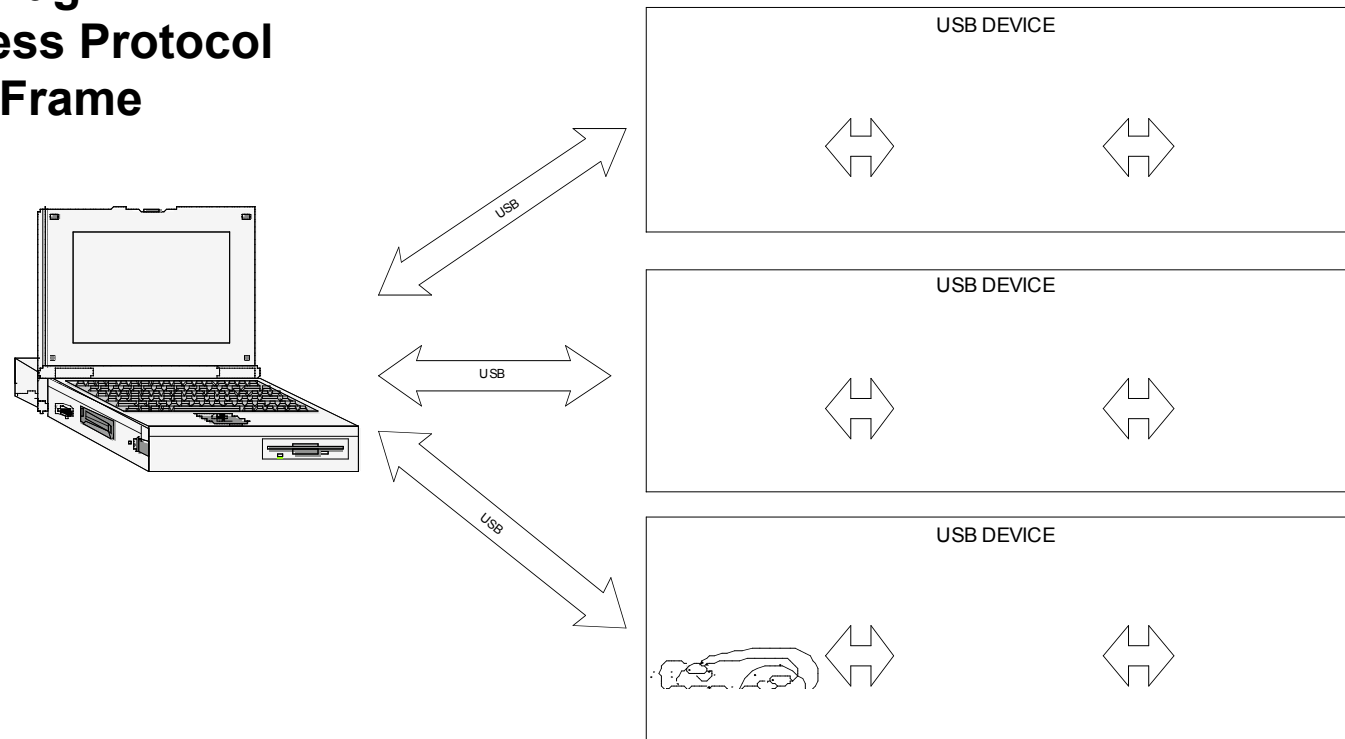


INSTITUTO
DE SISTEMAS
E ROBÓTICA



Draft Solution:

- | **Blackboard Inspired(!?)**
- | **Get and Set**
- | **Error Protection & Recovery**
 - Frame Based
 - Sync Flag
 - Stateless Protocol
 - Reset Frame





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Frame Description:

FRAME: [Flag] [<Body>]

PC->PIC:

| **GET**

[Flag] [<Get_Size_n>] [<Address>]

| **SET**

[Flag] [<Set_Size_n>] [<Address>] [Value_0] [...] [Value_n]

| **RESET**

[Flag] [Flag]

PC <- PIC:

| **DATA**

[Flag] [<Size_n>] [<Address>] [Value_0] [...] [Value_n]



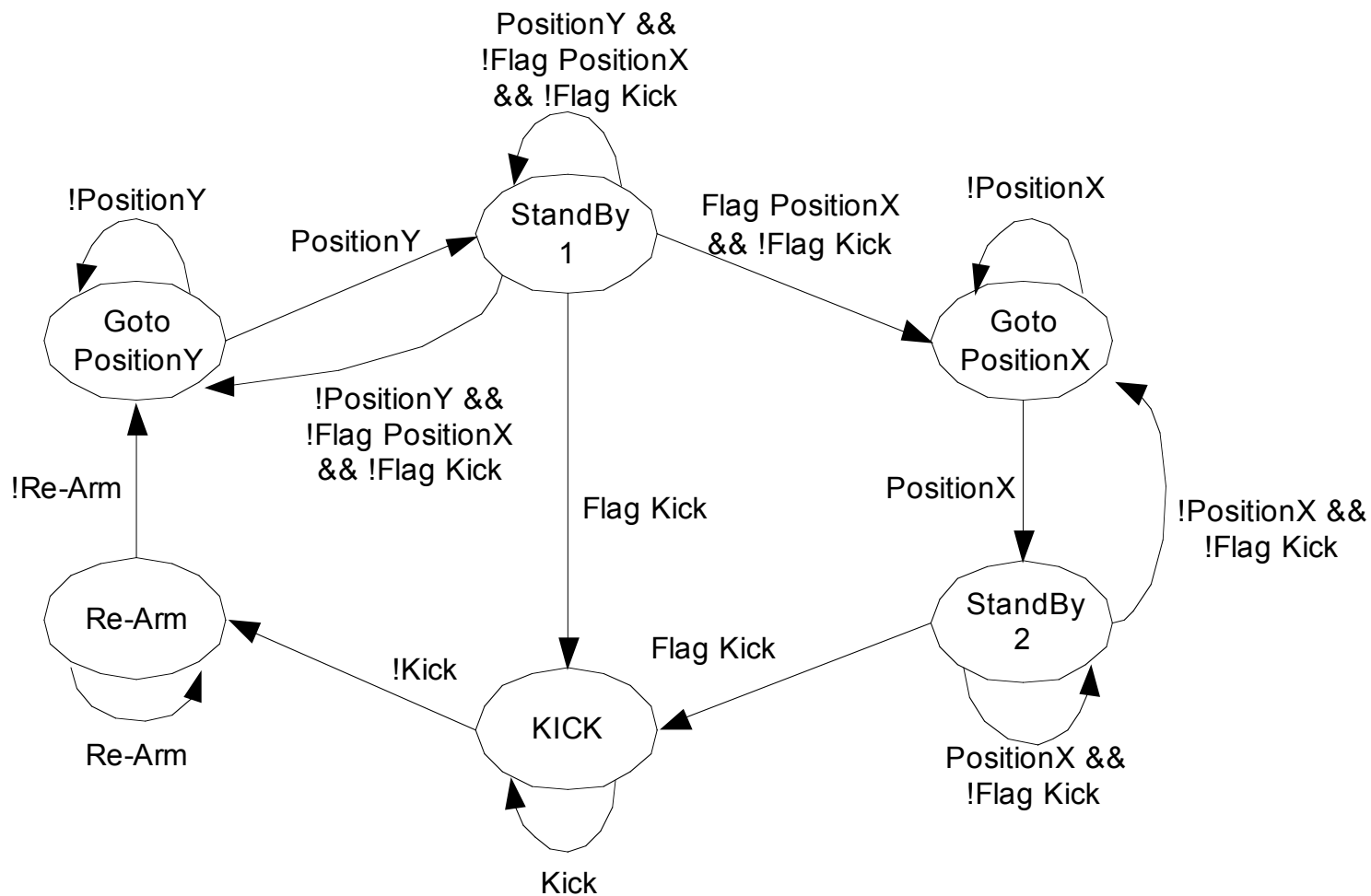
INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



A Kicking Example:





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



A kicking Example:

Name	Address HEX	Address INT	Read/ Write	Definition
ID	0x20	32	R	ID of the Device
Sharpkicker	0x21	33	R	Measure the position of the kicker
SharpBall	0x22	34	R	Measure the distance to the ball
State	0x23	35	R	0000 <Drum> <DrumArm> <Position> <Kick>
Command	0x24	36	R/W	0000 <Drum> <DrumArm> <Position> <Kick>
PositionX	0x25	37	W	Final Position of the kicker
PositionY	0x26	38	W	Standby Position of the kicker
Hysteresis	0x27	39	W	Position Histeresis
KickVelocity	0x28	42	W	Kicker Velocity
DrumVelocity	0x29	40	W	Drum Velocity
DrumTime	0x30	41	W	0,25 periods of time to work

PC -> PIC:

Kick: [255][1][36][1]

Read: [255][67][33]

PC <- PIC

Data: [255][3][x][y][0]



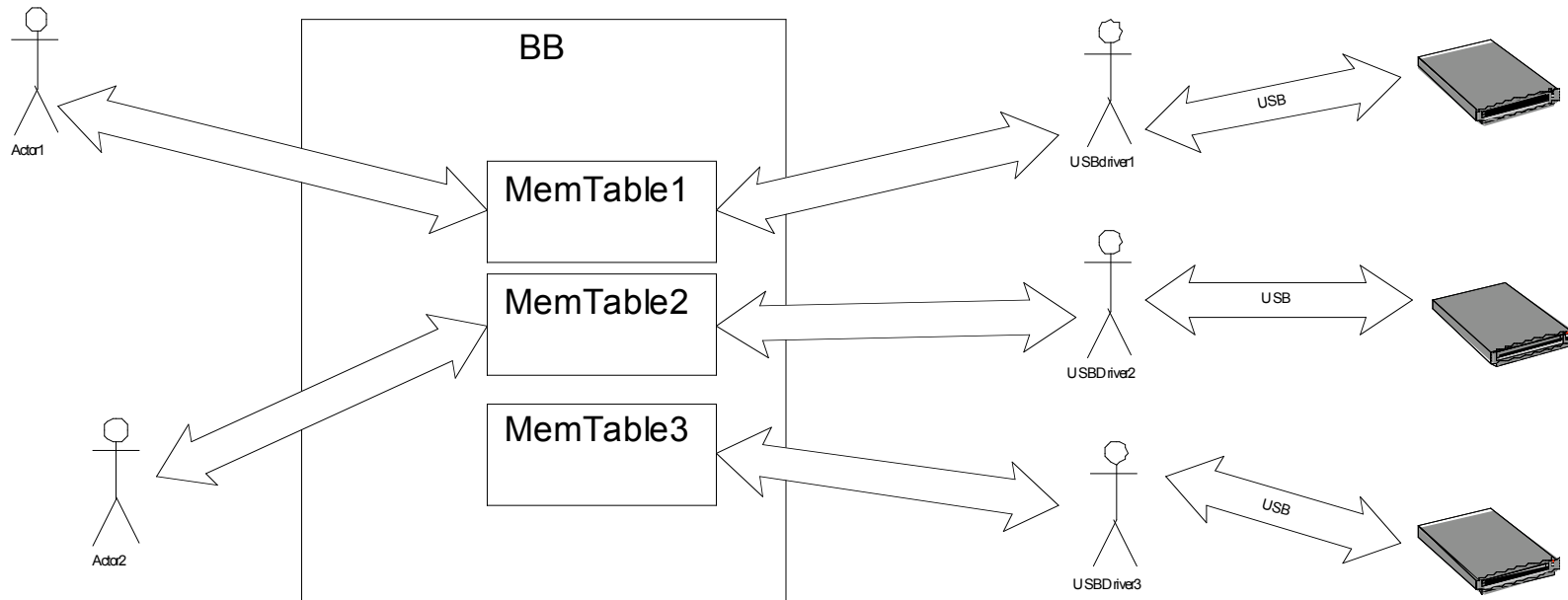
INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Suggestion





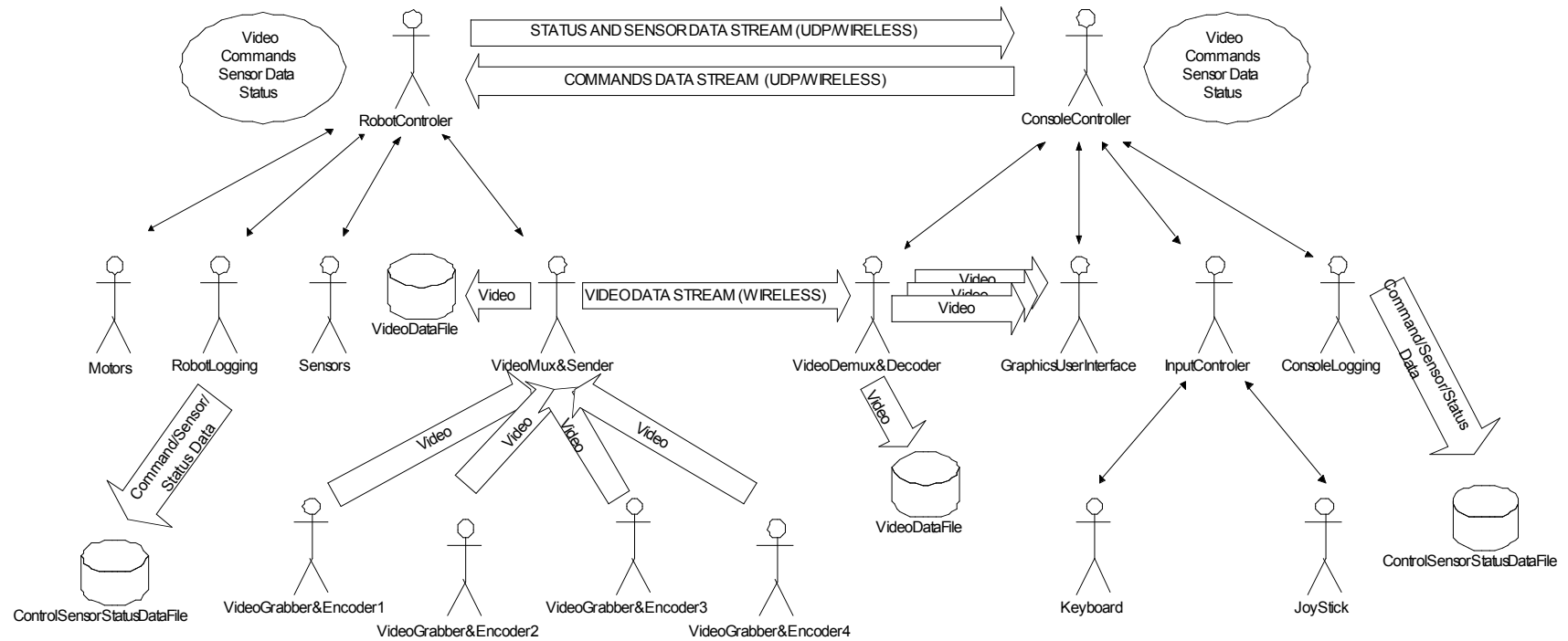
INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



AND NOW: Raposa Usability





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Usability On Raposa Project

- | **Graphical Interface:**
 - Easy to understand.
- | **Levels of detail:**
 - Control mode : Normal & Direct Operations
 - Setup Mode : For Advanced Options
- | **A Natural input control:**
 - Game Pad
 - User tactile Feedback
- | **Task Automation:**
 - Reverse commands if robot flips
 - Turn on lights if too dark
 - Image compression quality based on network status



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Graphical User Interface – Control Mode

The screenshot displays a graphical user interface (GUI) for a robot's control mode. The interface is organized into several sections:

- Top Menu:** Features two tabs, "Operation" and "Setup".
- Control Panels:**
 - Yaw:** A panel showing a value of 10 and a blue arrow pointing right.
 - Roll:** A panel showing a value of 0 and a blue arrow pointing right.
 - Lights:** A panel with a robot icon and a vertical bar representing light intensity.
 - Arm:** A panel showing a value of 20 and a red arrow pointing right.
- Power and Motors:**
 - Power:** Two vertical bar graphs representing power levels for "Cable" and "Batteries".
 - Motors:** Two vertical bar graphs for "Left" and "Right" motor positions, with a digital display showing "0000000000" and a "Motors" indicator.
- Docking:** A panel with indicators for "Thetered" (red) and "Door" (green).
- Environmental Sensors (groupBox12):** A collection of sensors including "Net", "Mtn", "Btn", "H2S", "Temp", "Hum", and "CO", each with a vertical bar graph and a thermometer-style gauge.
- Bottom Control:** A row of radio buttons for "None", "Middle Body", "Back Body", and "Thermal".



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Control and Data

| Controls

- **Motors Velocities**
- **Arm Position**
- **Lights**
- **Docking**
- **Camera Selection**
- **Image Quality**

| Data

- **Three Video Streams**
- **Roll, Yaw, Arm Position**
- **Motors Velocities**
- **Battery Level**
- **Sensors: Gas, CO, Temp, Hum, Etc...**



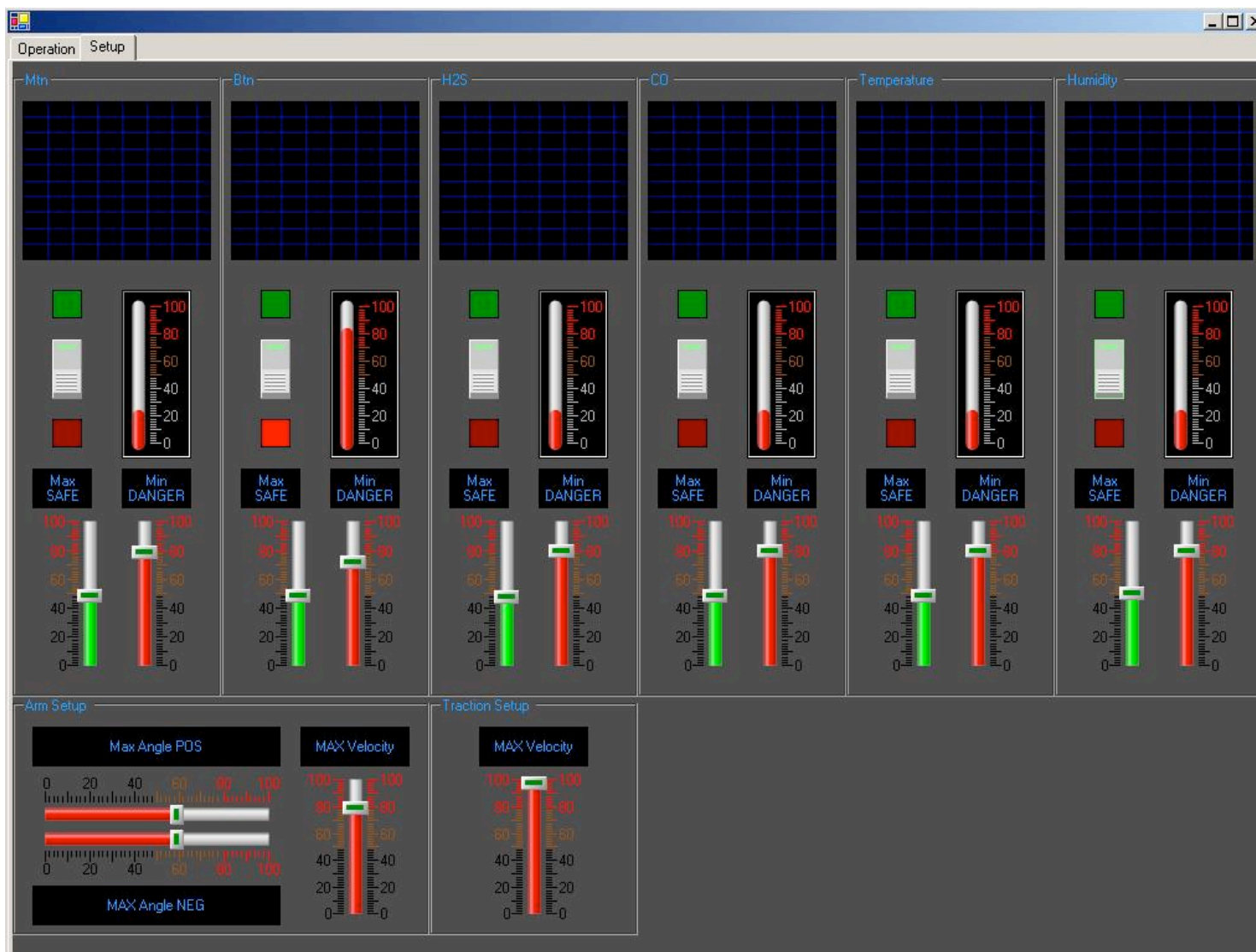
INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Graphical User Interface – Setup Mode





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Setup

- | **Velocity Limits**
- | **Arm Position Limits**
- | **Arm Velocity Limits**
- | **Sensors Alarm Thresholds**
 - **Min**
 - **Max**
- | **Sensors Readings History**
- | **Sensor state (on/off)**



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



User Input Device





INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Game Pad

- | **Two Joysticks**
- | **Four Direction cursor**
- | **One Slider**
- | **Several Buttons**
- | **Hand Held**
- | **Shaking Force Feed Back**
- | **Controls all Interface Functions**



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



See also

- | <http://www.idmind.pt/raposa>
- | <http://Rescue.isr.ist.utl.pt>
- | <http://Socrob.isr.ist.utl.pt>



INSTITUTO
SUPERIOR
TÉCNICO



INSTITUTO
DE SISTEMAS
E ROBÓTICA



Questions