Part 4 –Applications

- Nondestructive inspection of structures
- Visual inspection of transmission lines
- Liquid Level Process
- Water treatment plant
- Automatic Car Guiding
- Consumer Electronics
- Path Planning
- Building Automation – (Ambient Intelligence)

Applications:
Nondestructive inspection of structures

DAMAGE DETECTION USING AN HIBRID FORMULATION BETWEEN CHANGES IN CURVATURE MODE SHAPES AND NEURAL NETWORK.

Miguel Genovese, Adolfo Bauchspiess, José L.V. de Brito,Graciela N. Doz

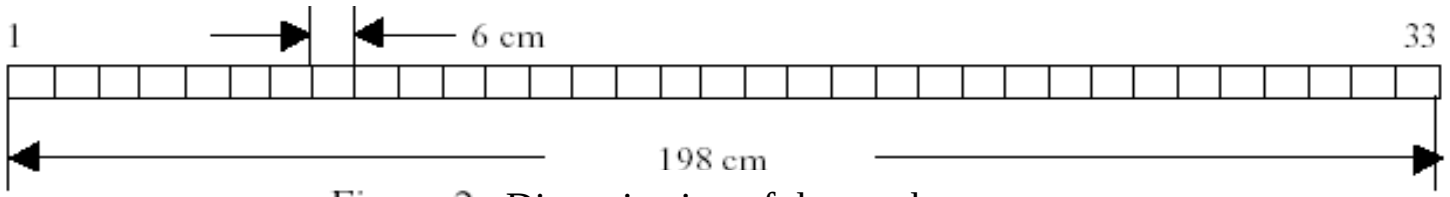
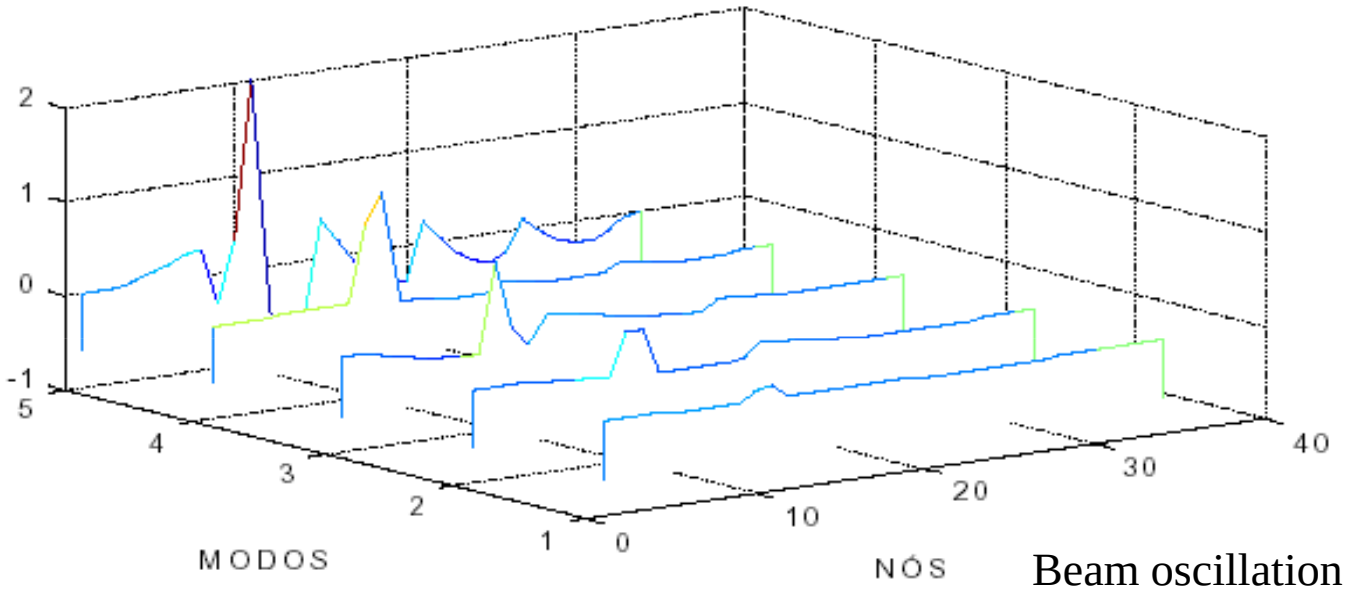


Figura 2: Discretization of the test beam

- strain gauges
- Hammer hit
- Signal acquisition

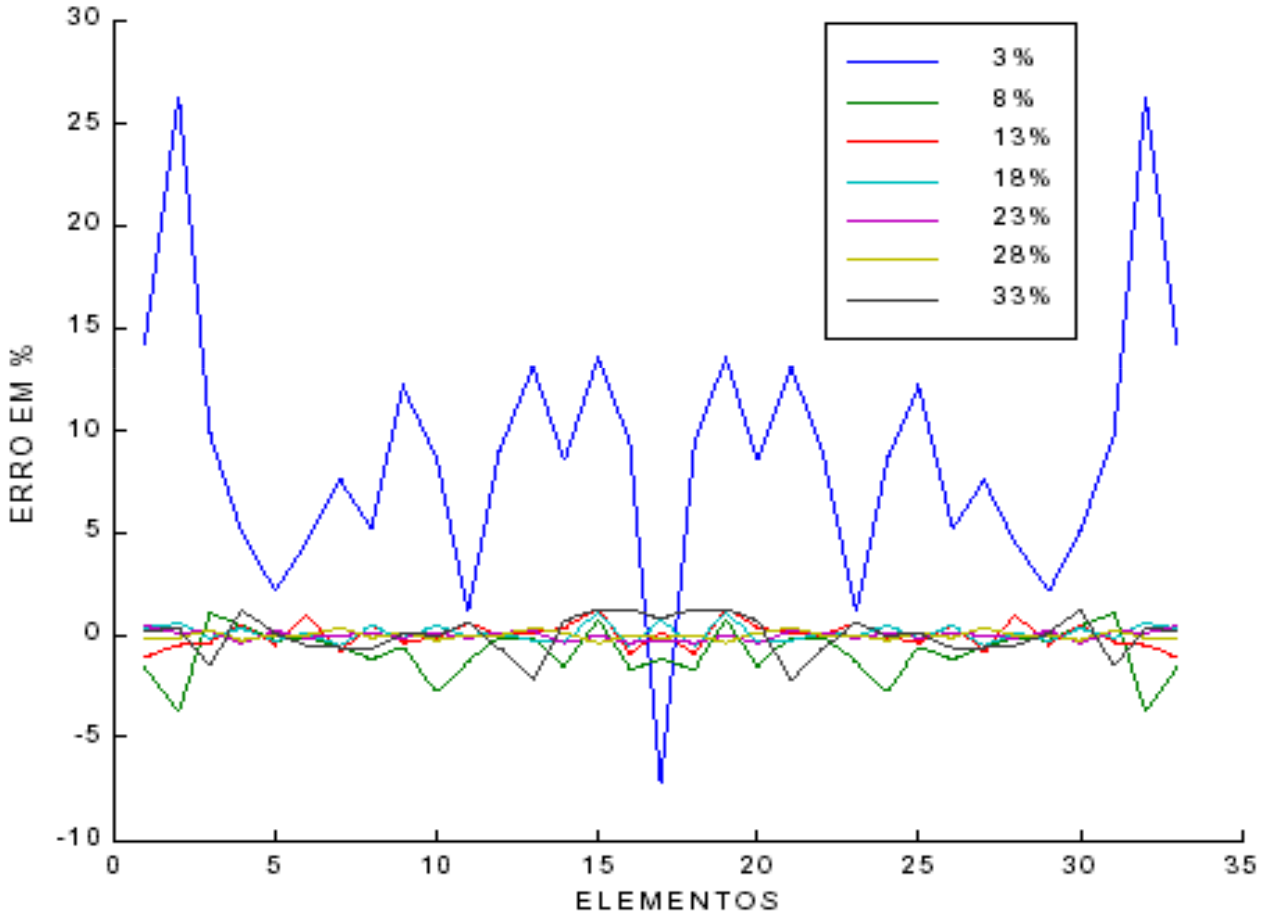
Applications:
Nondestructive inspection of structures



Beam oscillation frequencies (Hz): with and without damage

Harmonics	Beam without damage	Beam with 20% moment of inertia reduction at element 10
First	67.76	67.48
Second	184.22	182.72
Third	354.01	352.62
Fourth	570.26	569.59
Fifth	825.83	821.93

Applications:
Nondestructive inspection of structures



ANN error at the training data

Inspection of Transmission Lines

Inspection of Transmission Lines

- Autonomous computational system for the visual inspection of electricity transmission lines
- Detection of flaws in the gripper of the line spacers

Inspection of Transmission Lines

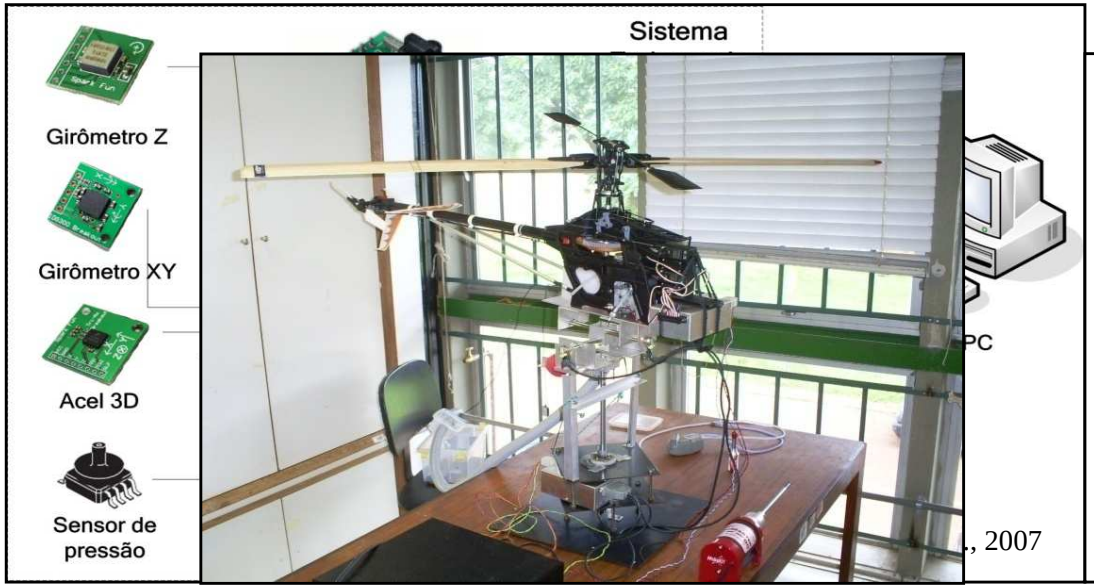
- Traditional inspection of transmission lines:
  - Aerial survey using a helicopter
  - Staff onshore
- Costly and expensive

Inspection of Transmission Lines

UAV – LARA/UnB

Inspection of Transmission Lines

- Adaptation of Unmanned Aerial Vehicles (UAVs)
- Research project UNB / ANEEL - Expansion
  - Development of an UAV to aid inspecting transmission lines



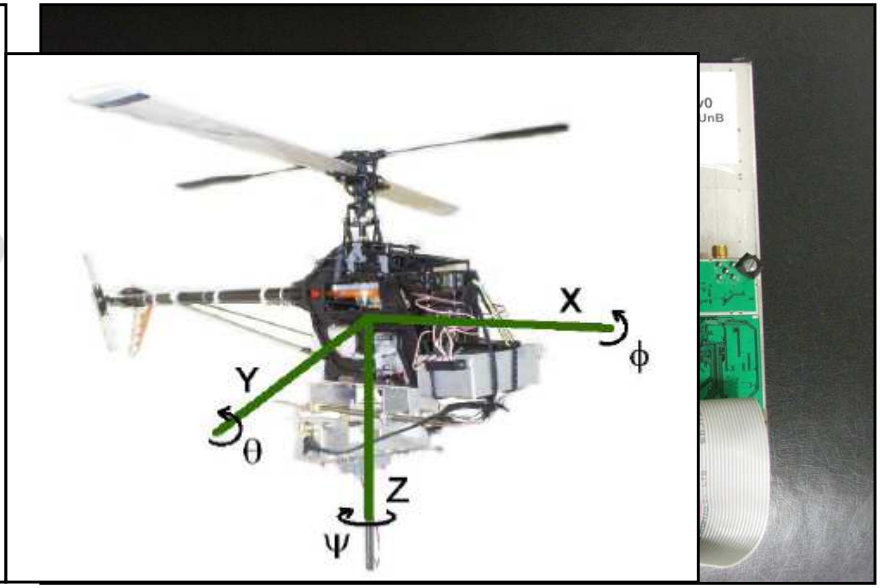
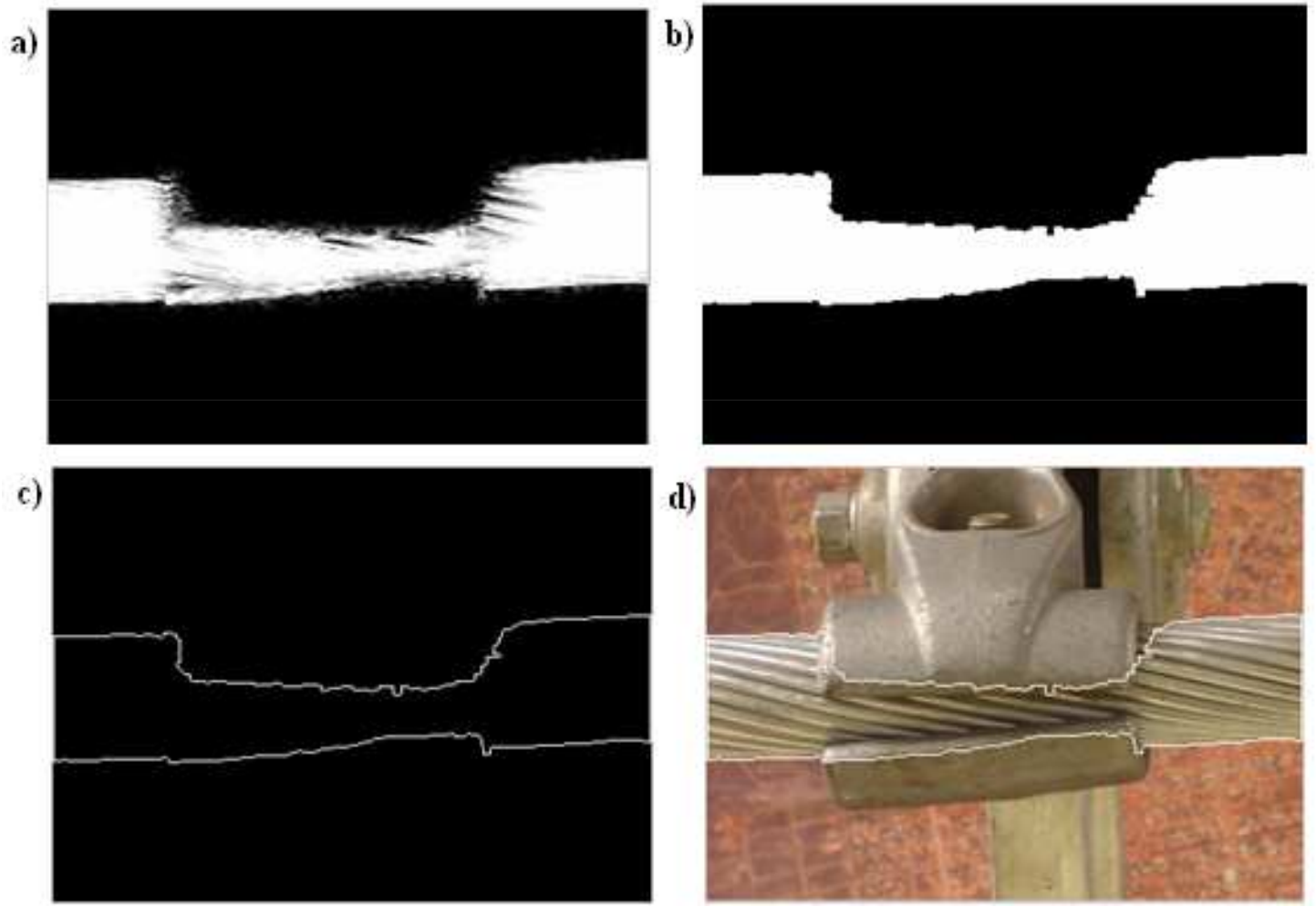
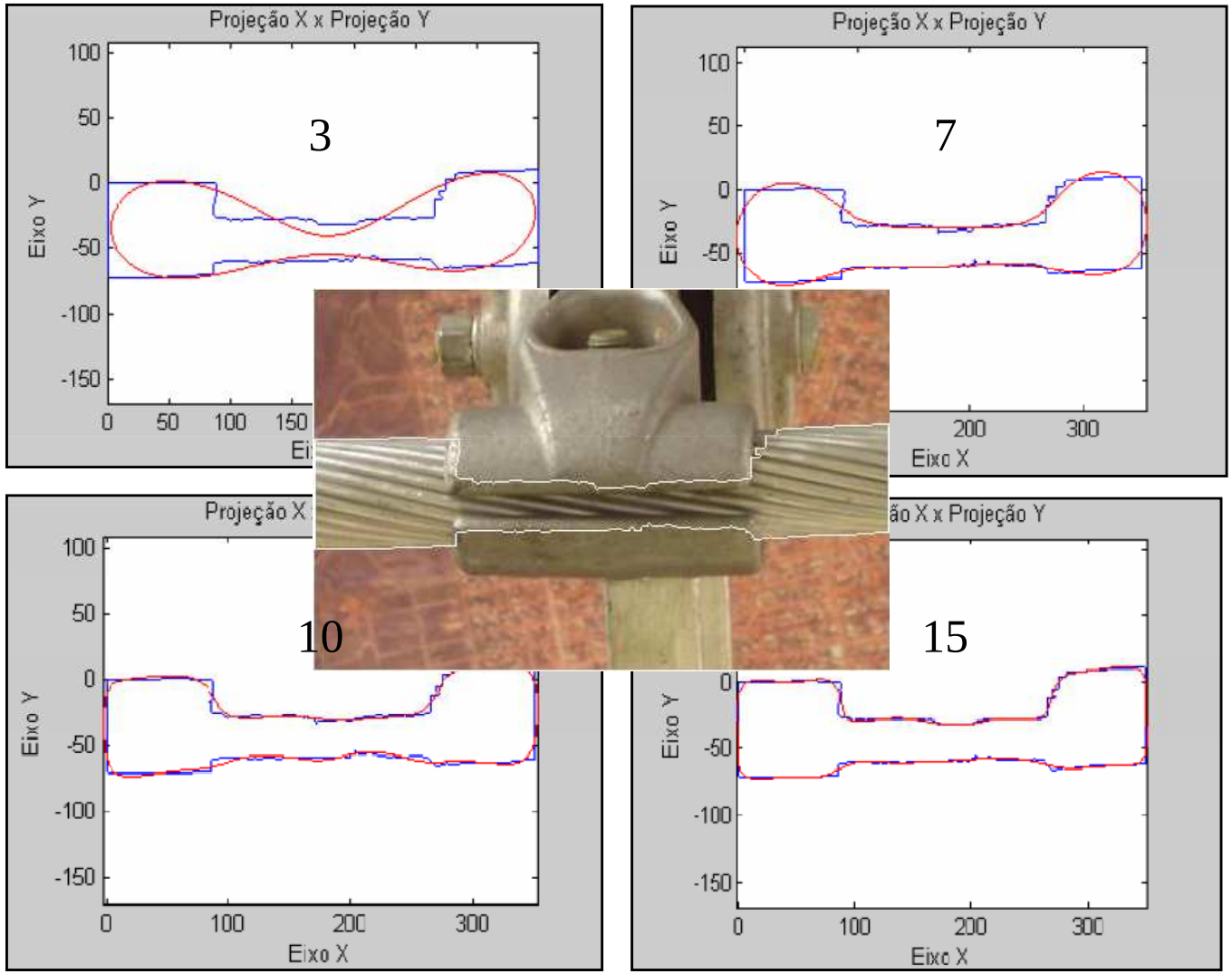


Image Processing

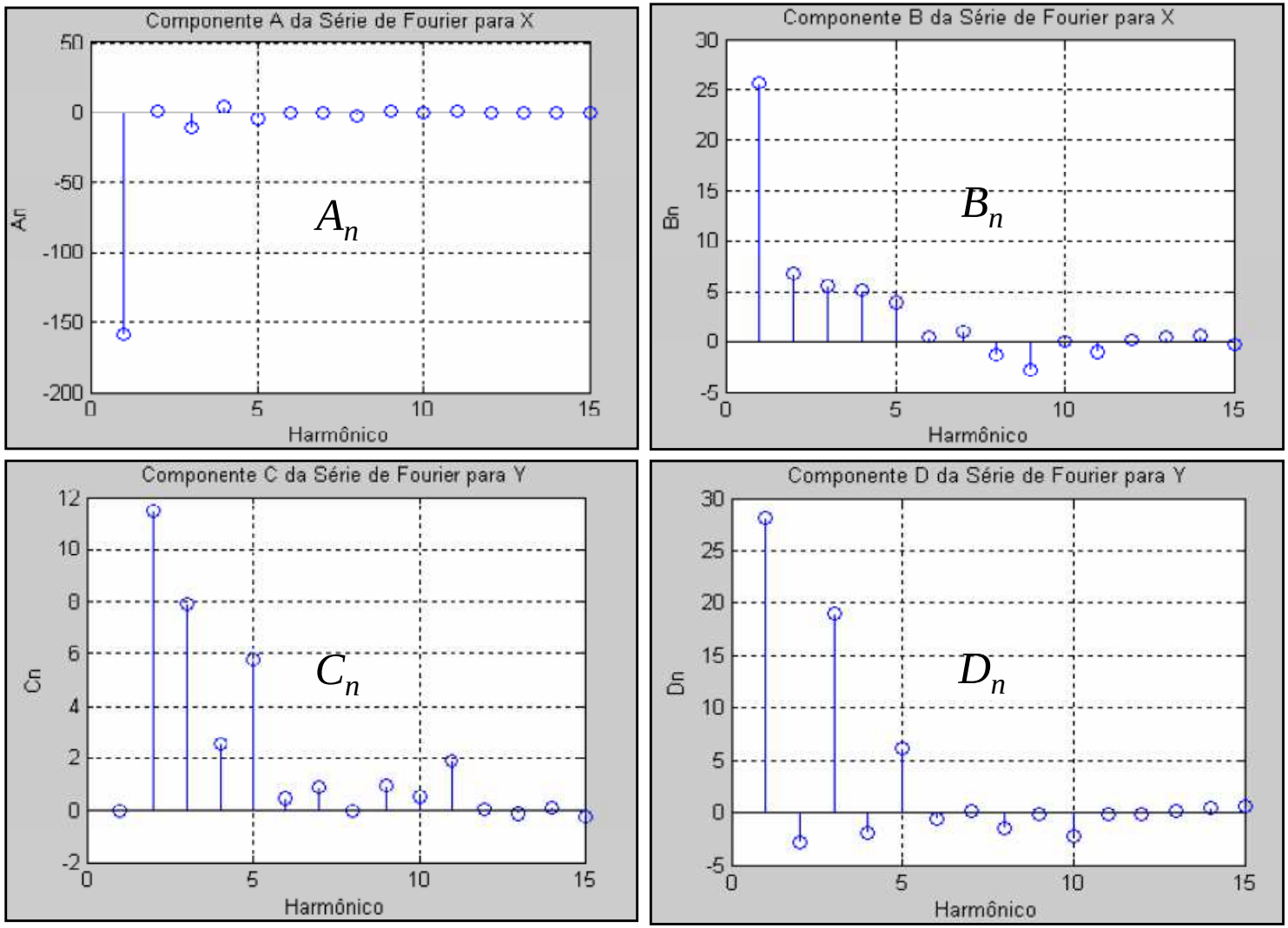
→ Failures Recognition



Results – Representation of the contour

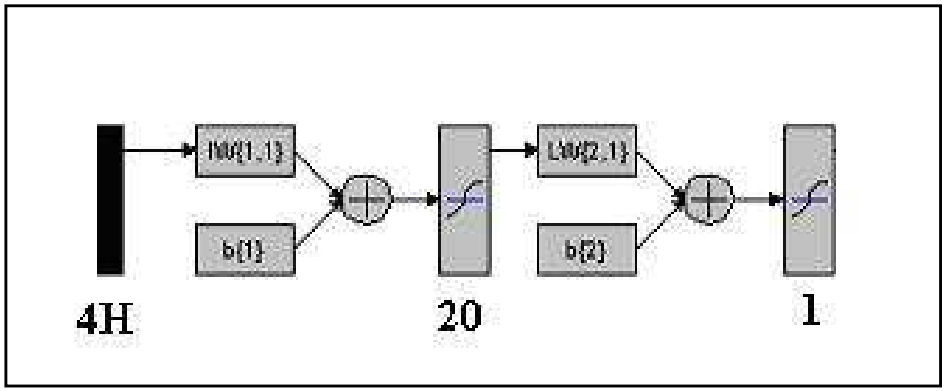


Results – Representation of the contour

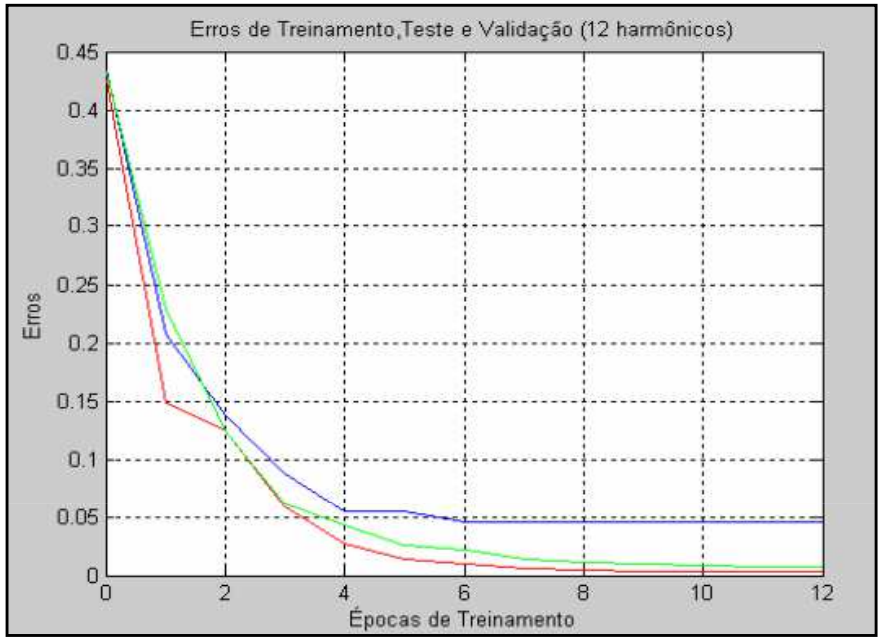


Results – Neural Network training

- Training set: 70 images
- Test set: 25 images
- Validation set: 25 images
- Output Target
  - -0.5 for defect-free images
  - 0.5 for defective images
- Architecture used:



Results – Neural Network training



- Simulation of the validation set for the network trained with 10 harmonics
  - Misclassification of 2 images
- Simulation of the validation set for the network trained with 12 harmonics
  - Misclassification of 1 image

Liquid Level Process

Components

-3 Reservoirs (5x25x35 cm)

-1 Supply Tank

-3 Level Sensors

-2 Pumps (0 to 10 V)

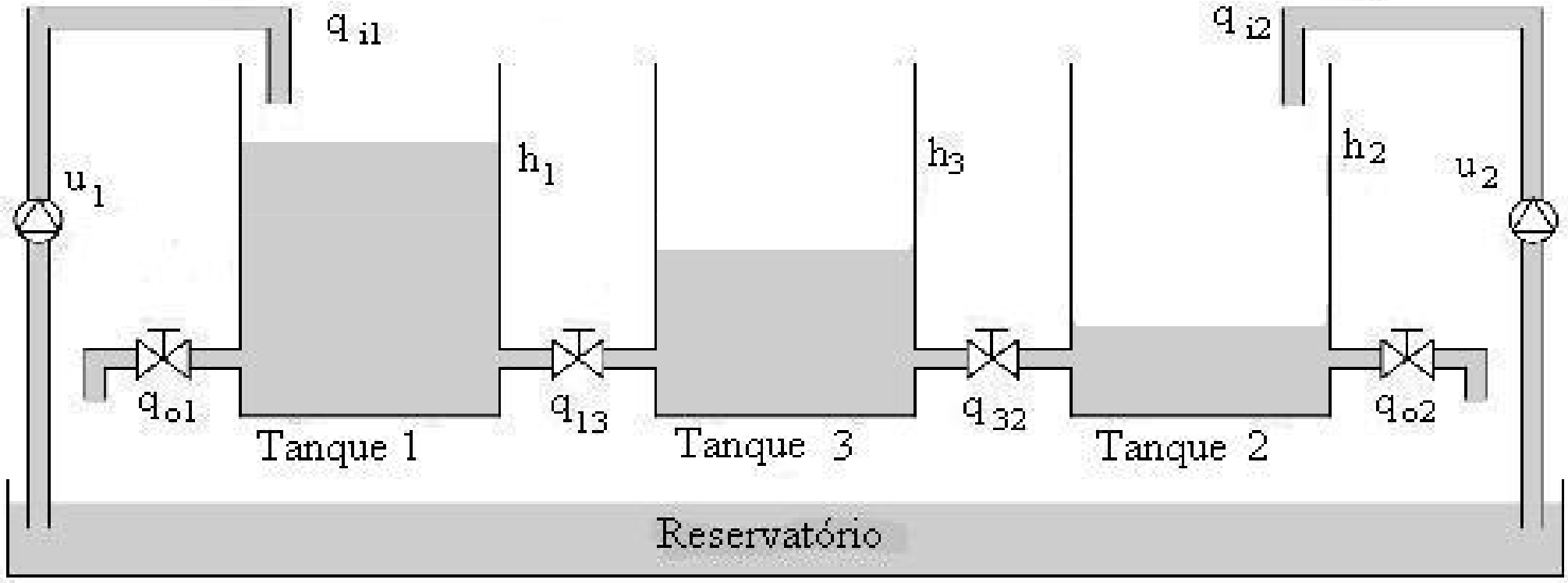
-2 Power Circuits

-A/D & D/A Interface

- Time Constant = 5 *min*

-Sampling Rate = 2Hz

Schematic Diagram



Dynamics

Bernoulli:

$$A\frac{dh_1}{dt} = q_{i1} + signal(h_3 - h_1)k\sqrt{|h_3 - h_1|} - k\sqrt{h_1},$$

$$A\frac{dh_2}{dt} = q_{i2} + signal(h_3 - h_2)k\sqrt{|h_3 - h_2|} - k\sqrt{h_2},$$

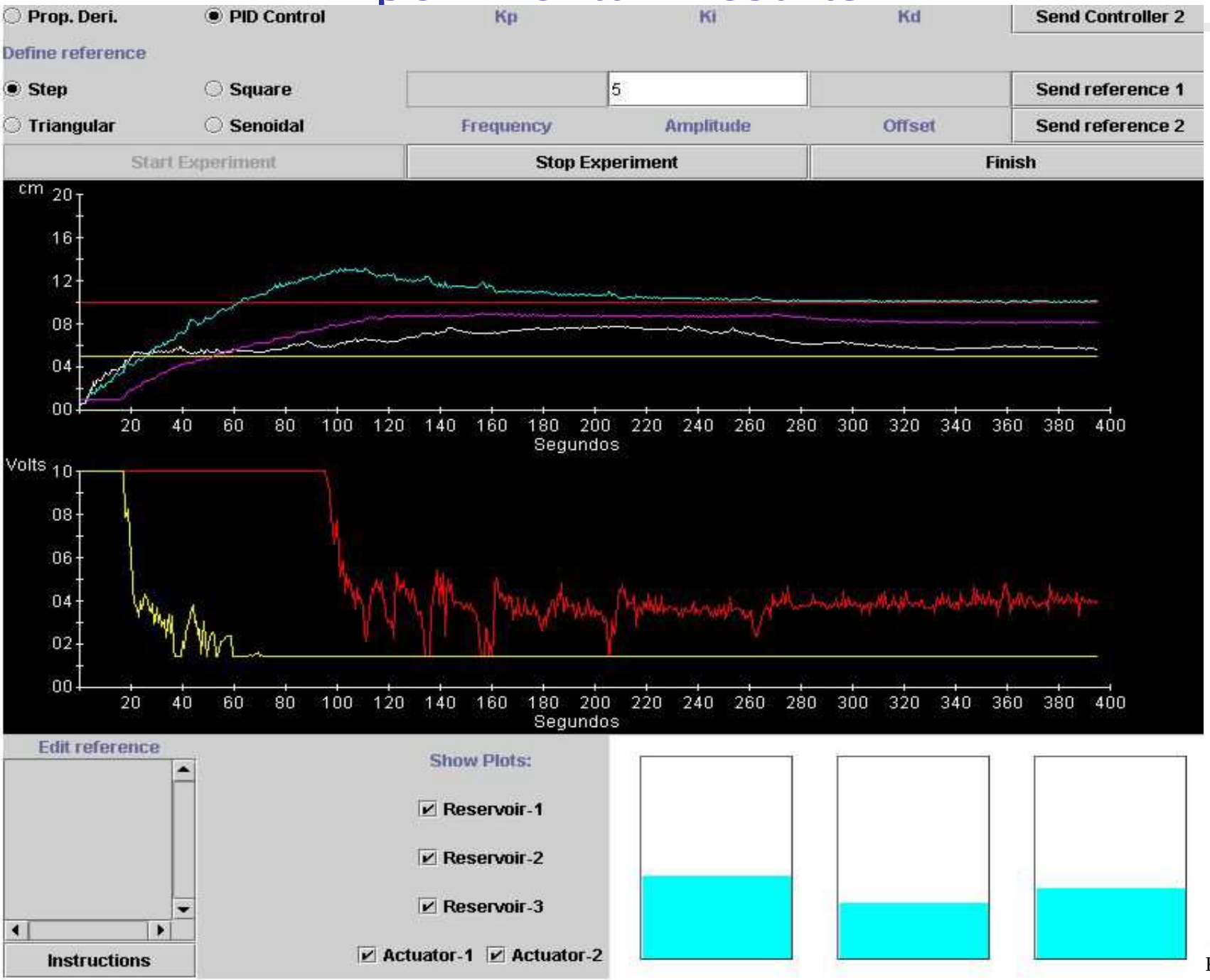
$$A\frac{dh_3}{dt} = -signal(h_3 - h_1)k\sqrt{|h_3 - h_1|} - signal(h_3 - h_2)k\sqrt{|h_3 - h_2|}$$

Non-Linear, Coupled e Multivariable

Remotely operated process - www

Client Process Controller-PC Server

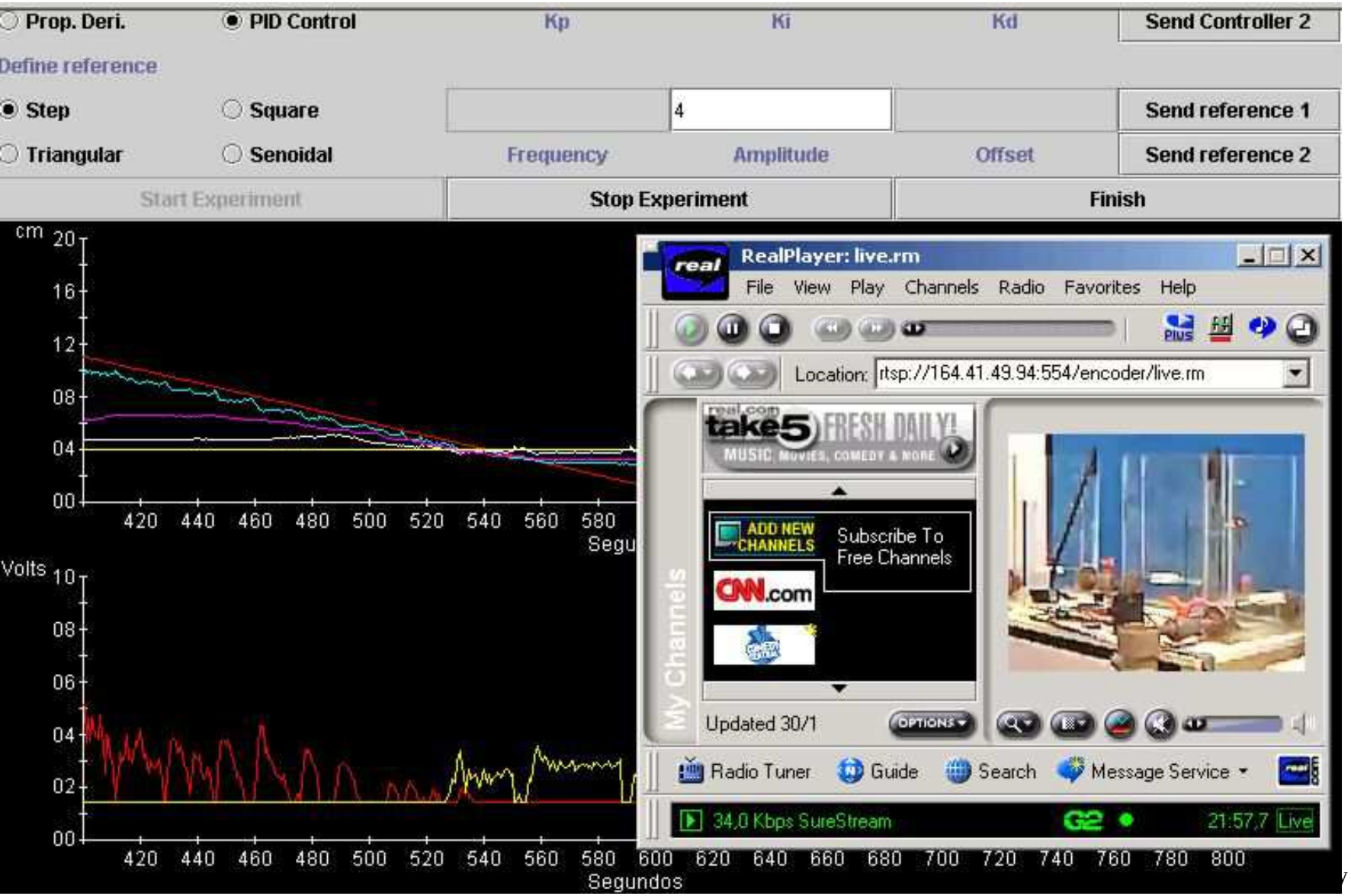
Experimental Results



Step Response

- 10 cm (tank 1)
- 05 cm (tank 2)

Experimental Results



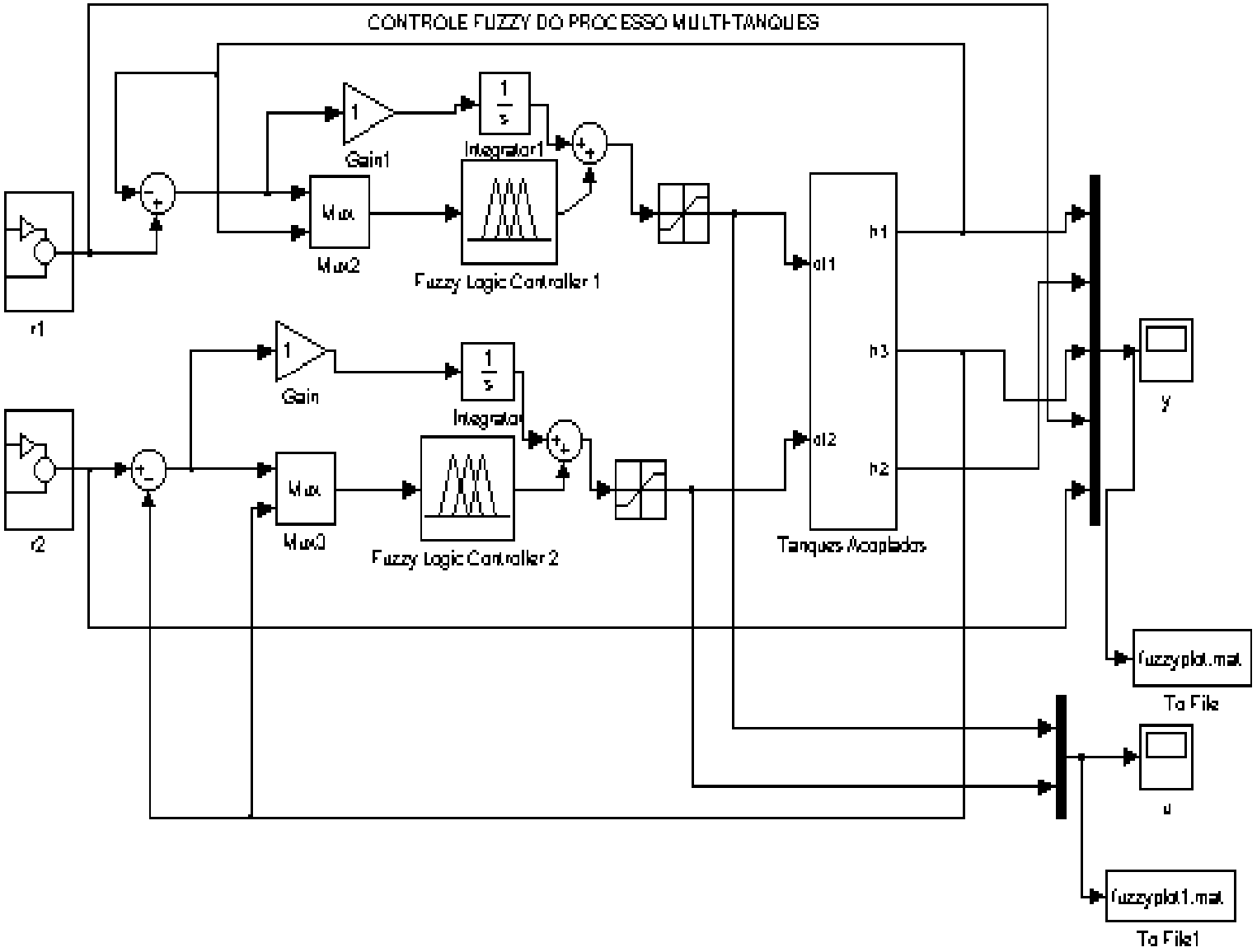
Reference

Step and Triangular

Live Video

Streaming

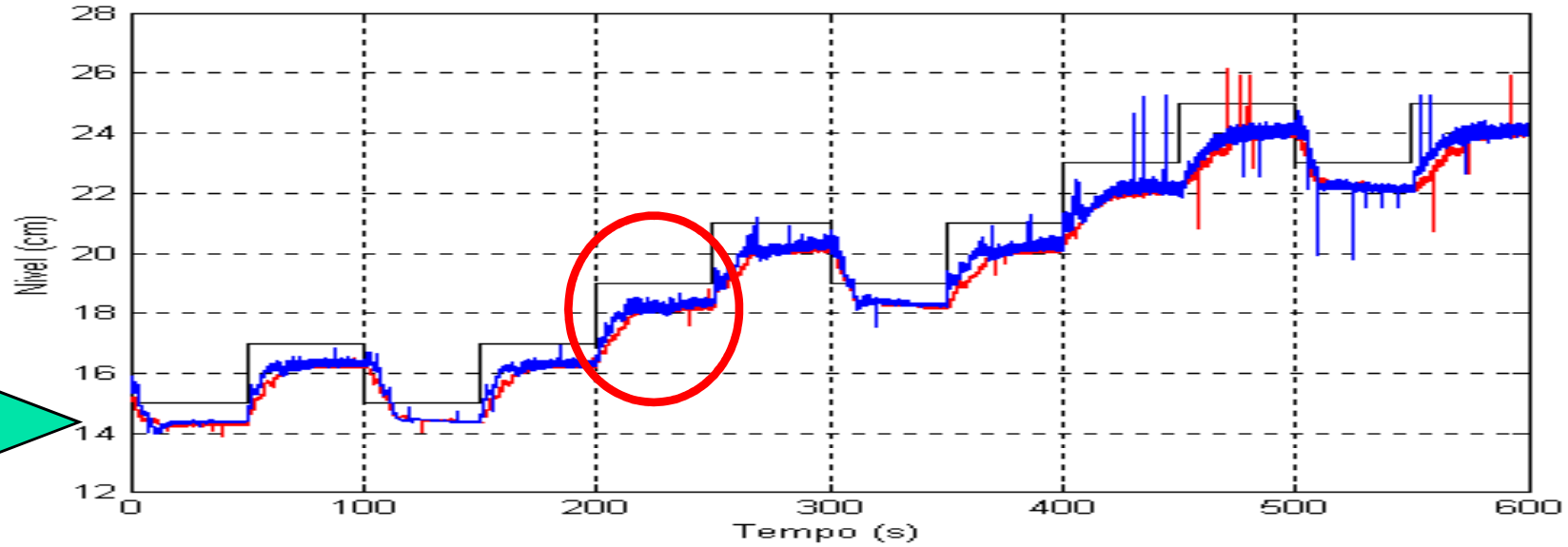
Fuzzy Control in Simulink



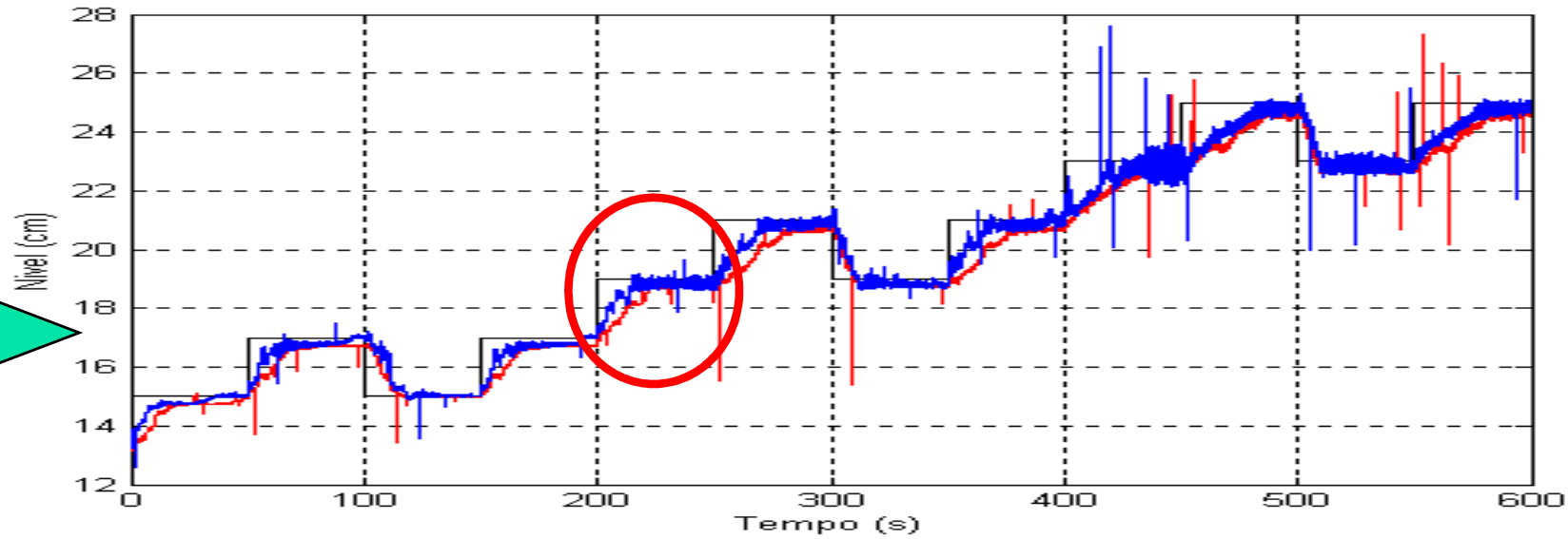
Fuzzy Control

Step Response to different levels:

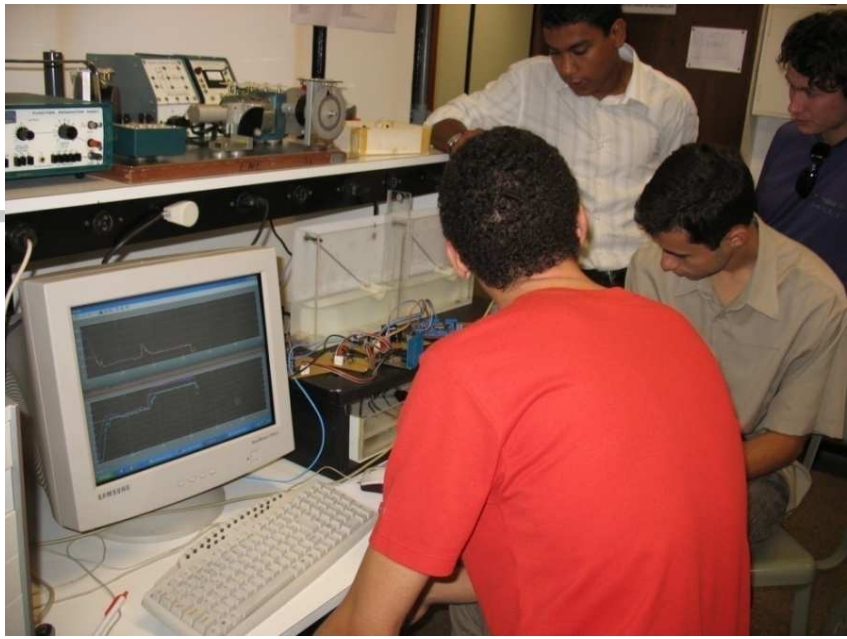
Controle PI



Fuzzy Control



LEARn

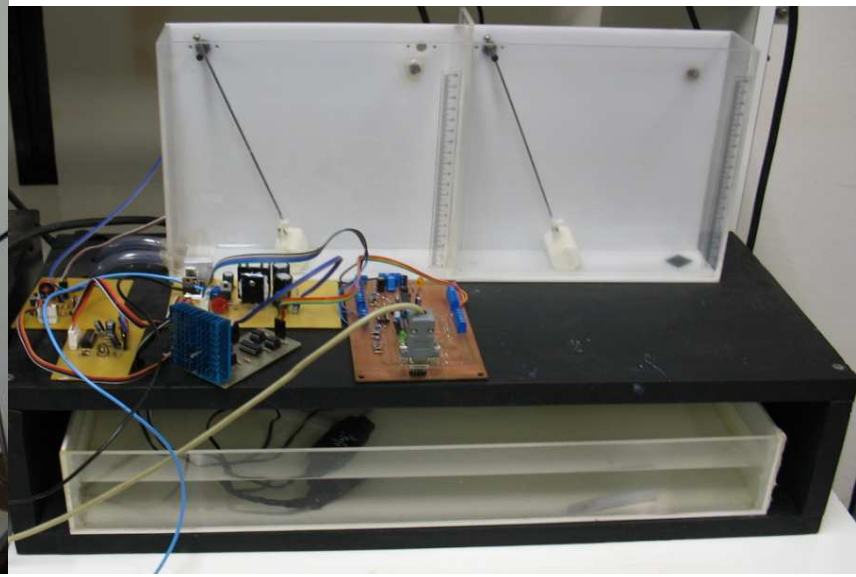


Remotely operated Automation Laboratory
(Laboratório de Ensino de Automação Remoto)

4th order

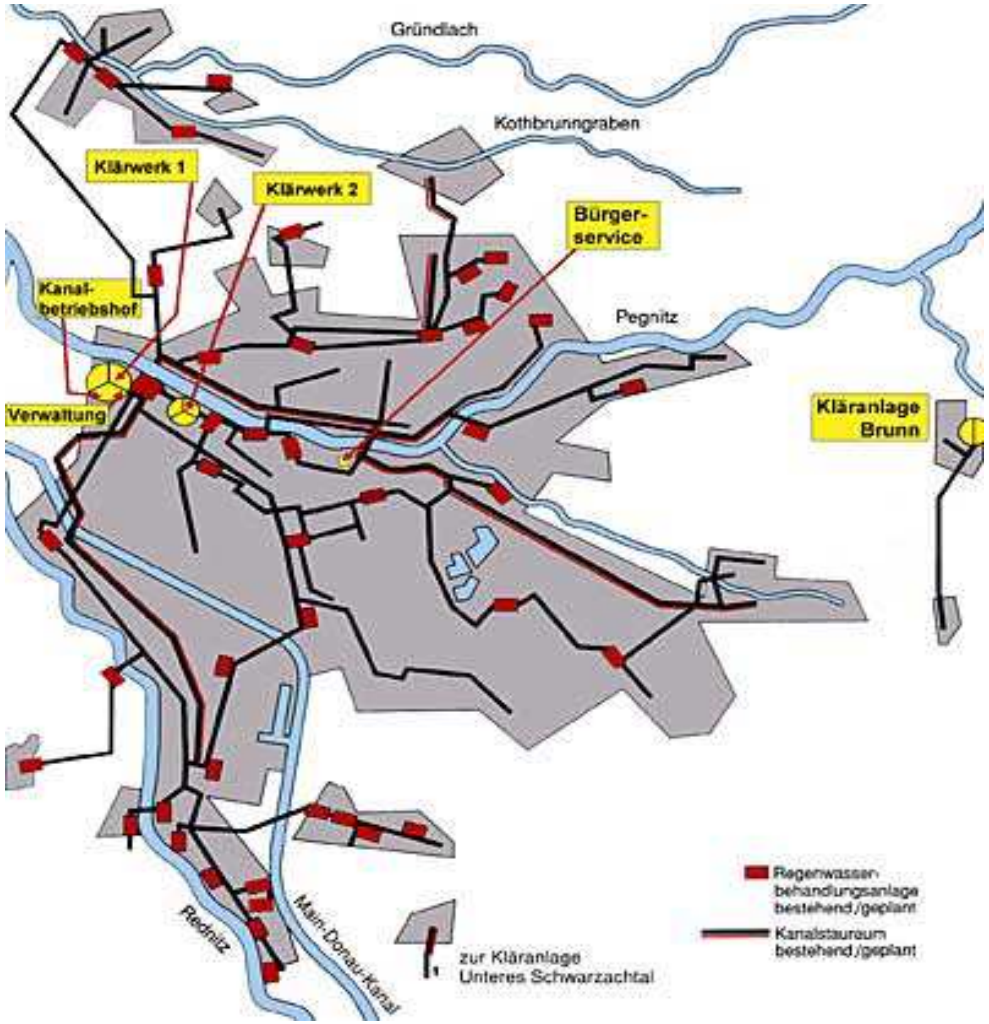
3rd order

2nd order



Water Treatment Station –

www.abwasser.nuernberg.de

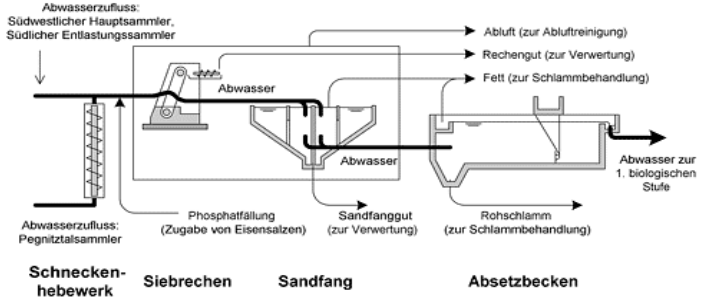


Water Treatment Station –

www.abwasser.nuernberg.de

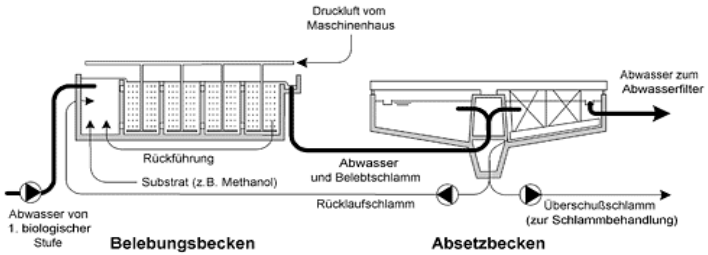
Klärwerk 1

Mechanik (Rechen, Sandfang, Vorklärung)

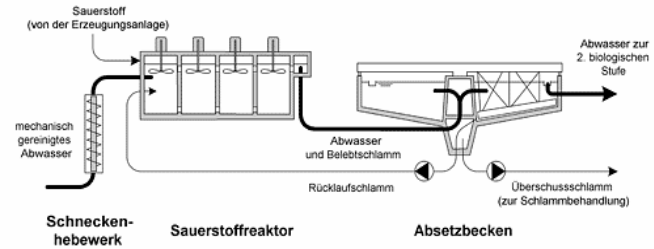


Klärwerk 1

2. biologische Stufe (Schwachlastbelebungsanlage)

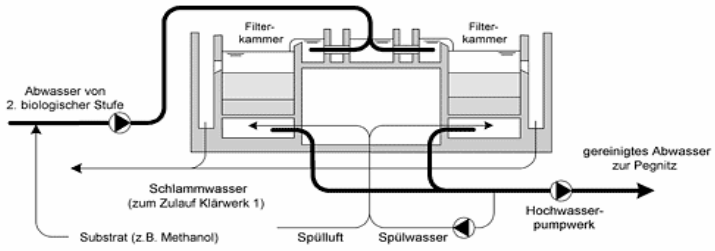


1. biologische Stufe (Hochlastbelebungsanlage)



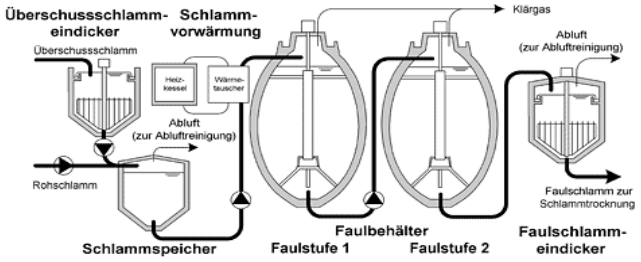
Klärwerk 1

Abwasserfilter



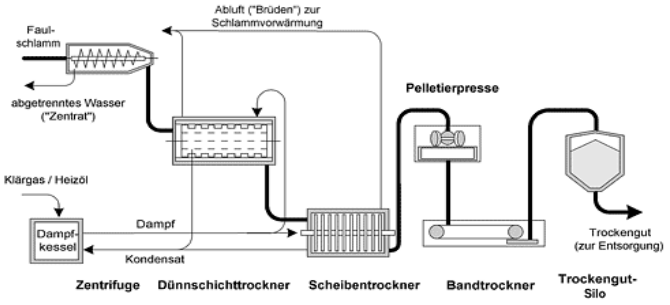
Klärwerk 1

Schlammfaulung



Klärwerk 1

Schlammtrocknung



Automatic guiding - BMW

BMW 645 ci - www.bmw.de

Cruise Control

automatic transmission

User Profile

- sporting
- economic
- cautious

Proximity Sensor

- front
- back
- side

Fuzzy Air Conditioner

LG
Life's Good

A High Definition Of Design And Performance.

ENERGY SAVING, BETTER STARTING CURRENT, PLASMA FILTER, DESIGNER PANEL

LP-K2465QC

- 4 WAY SWING
- DEHUMIDIFICATION
- FUZZY LOGIC
- JET COOL

WHERE TO BUY

Rs.49826
MRP

ADD TO COMPARE

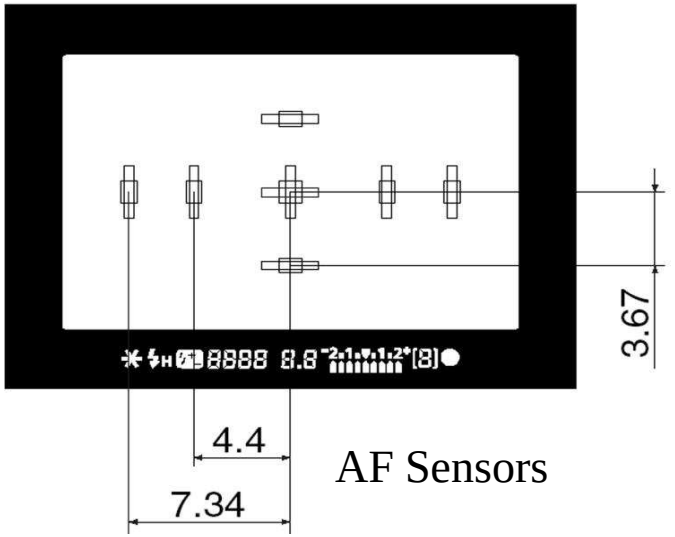
Camera

Olympus IS-5
Auto Focus SLR Camera - 28-140mm 5x zoom lens, Date imprinting capability, Panorama Mode - w/Case & Batteries

Features

...

Programmed Auto Exposure lets you choose between Full Auto, Stop Action, Portrait, Night Scene and Landscape modes
TTL metering system: ***Fuzzy logic*** ESP, center-weighted average, Spot



AF Sensors

Specifications

...

Focus TypeTTL phase-difference detection system with autofocus focus lock. Auto focus beep available. Auxiliary flash activation in low light.
Focus Range0.6 m to infinity in macro shooting; 0.6m to infinity at wide angle and 0.9m to infinity at telephoto in standard shooting. Predictive autofocus (in Stop Action mode only)

Washing machine

- Modern washing machines automatically determine the optimum settings to get your clothes clean with the use of ***fuzzy logic***. That's the 'skill' that gets machines to make 'best case' decisions based on incomplete information.
- Previously, washing machines were manually set. You had to make trial-and-error decisions on the amount of washing detergent, the size of the load, and the length of washing time. A fuzzy logic controller, comprising sensors, microchips and software algorithms, mathematically works out the amount of dirt and type of dirt on the clothes with the help of an optical sensor, which measures the transparency of the water.
- When the clothes are loaded into the washing machine and water added, the sensor checks to see how dirty the water is - dirtier clothes mean dirtier water, naturally. It also checks the type of dirt on the clothes by how fast the water gets saturated by the dirt. With this input, the fuzzy logic controller determines how soiled the load is, decides how much detergent is needed and how long it must wash the clothes.

Vacuum cleaner

Samsung VC-8930EN

Power Consumption : 2000W
Suction Power : 450W
Digital Auto Power Control (***Fuzzy Logic***)
Variable Power Control
5-Stage HEPA-Filter System
Exbug : Mite Killing Function
LED Display Panel
2 Step Smart Brush
Aluminium Telescopic Tube
Smart Protector
3 Built-in Accessories
2-Way Parking System
With Twister System

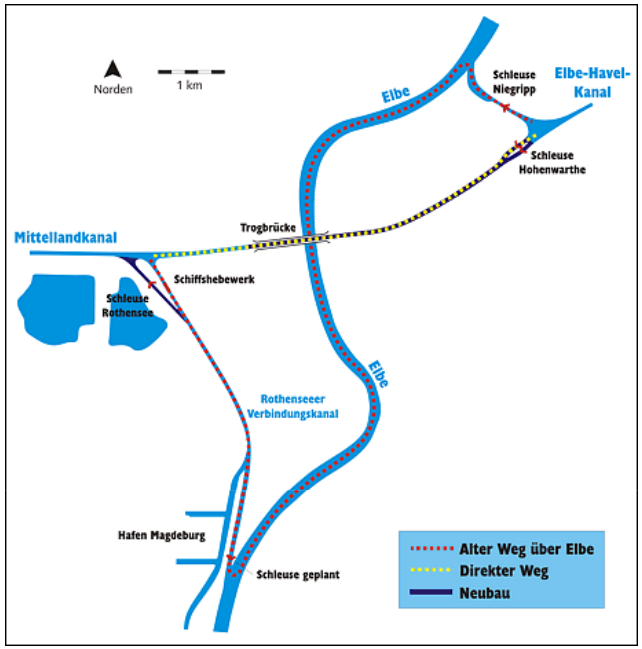
Digital Wrist Pressure Monitor

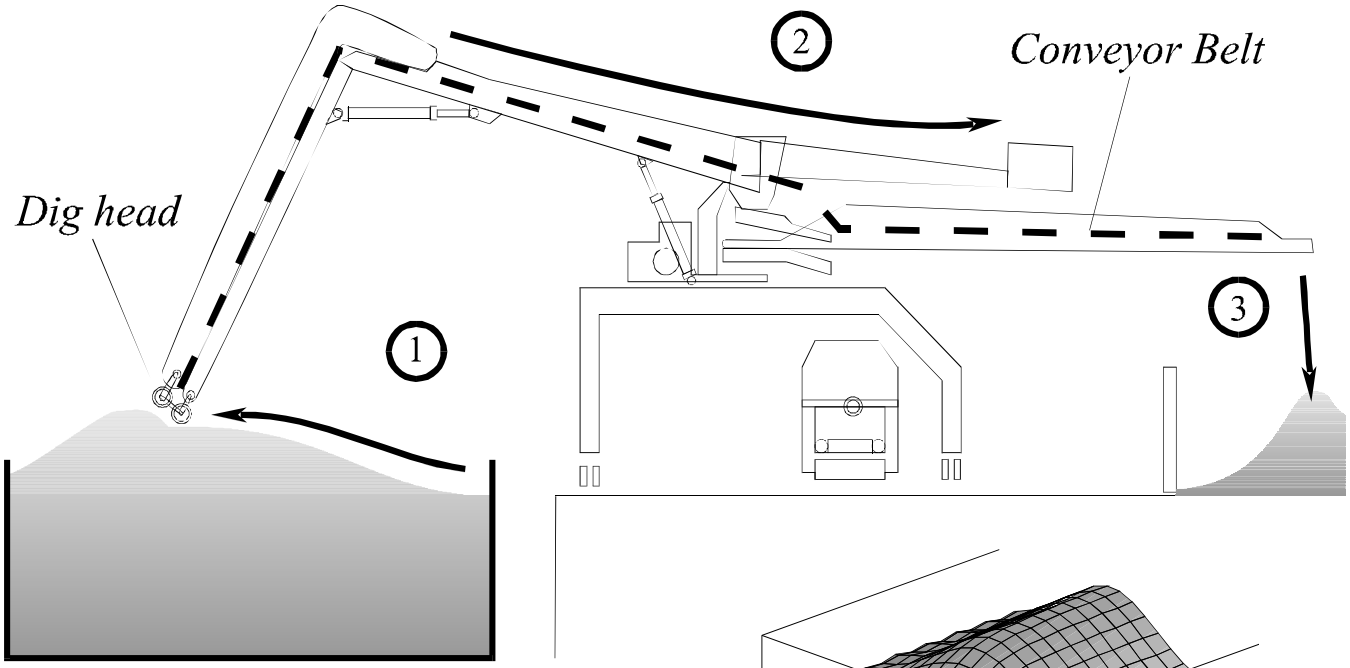
Model WS 501

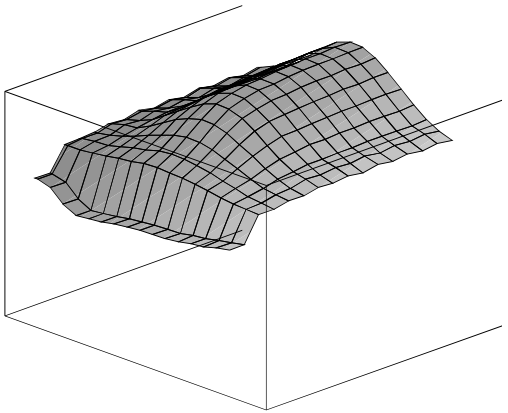
It has 60 memories with date and time (digital clock) that facilitates distance monitoring between doctor and patient.
Battery charge indicator.
Japanese FUZZY LOGIC technology of the latest generation. R$220,00

www.etronics.com.br/detalhes.asp?codpro=495

Coal Unloading – Erlangen/Germany







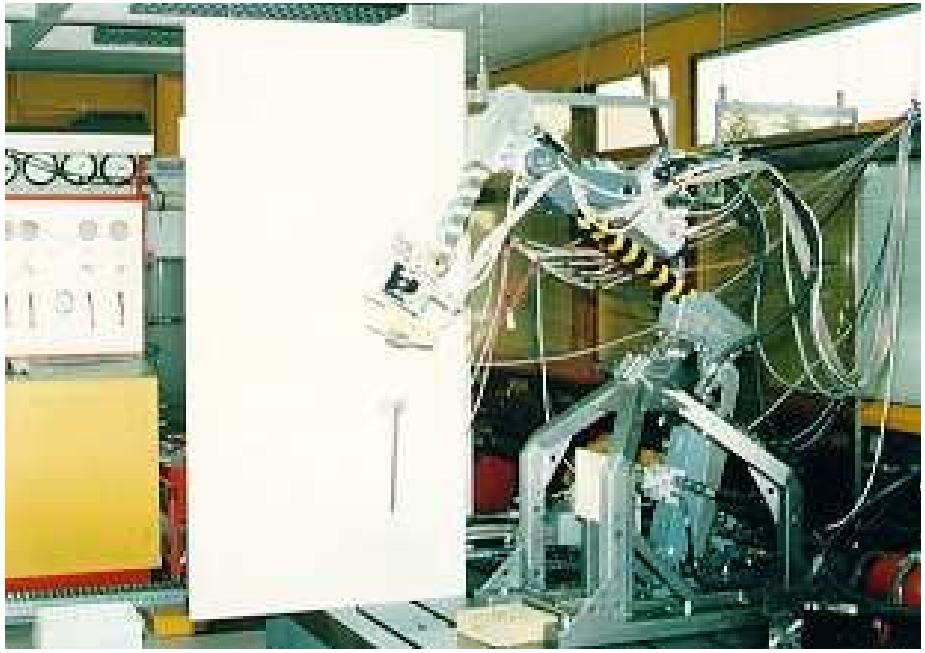
River Crossing – Minden, Elbe, Germany

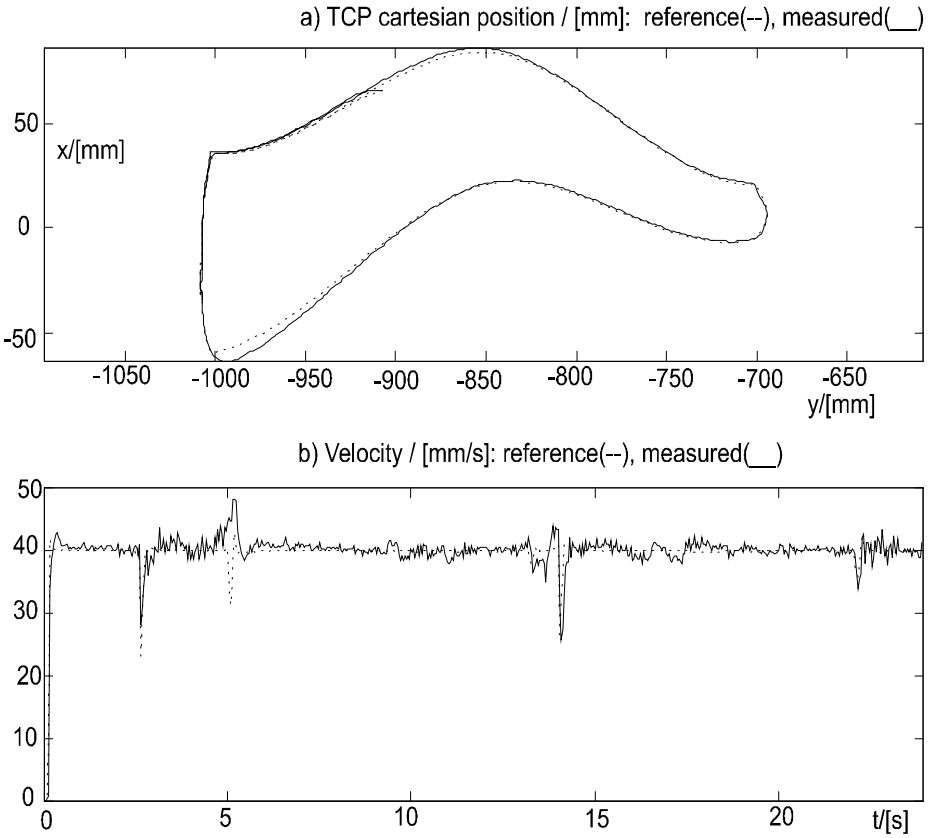
*Trajectory Planning - **Fuzzy***

"Redundant Sensor Guided Unloading Crane"– MAN

Bauchspiess, 1995

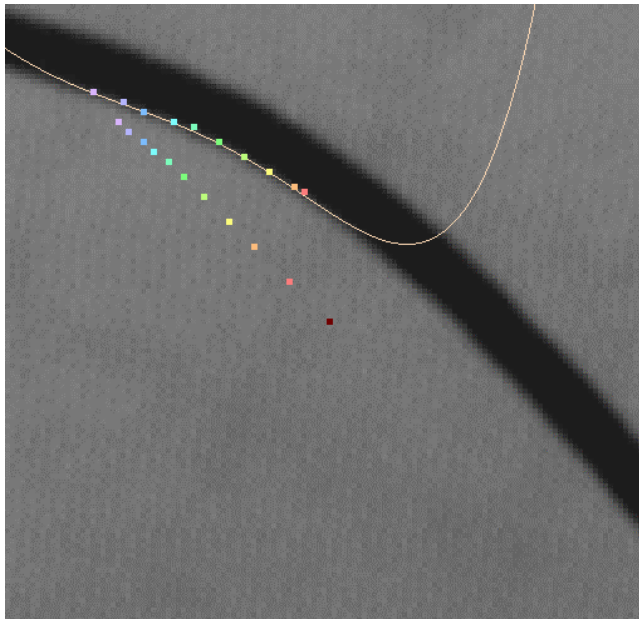
Sensor guided Hydraulic Robot

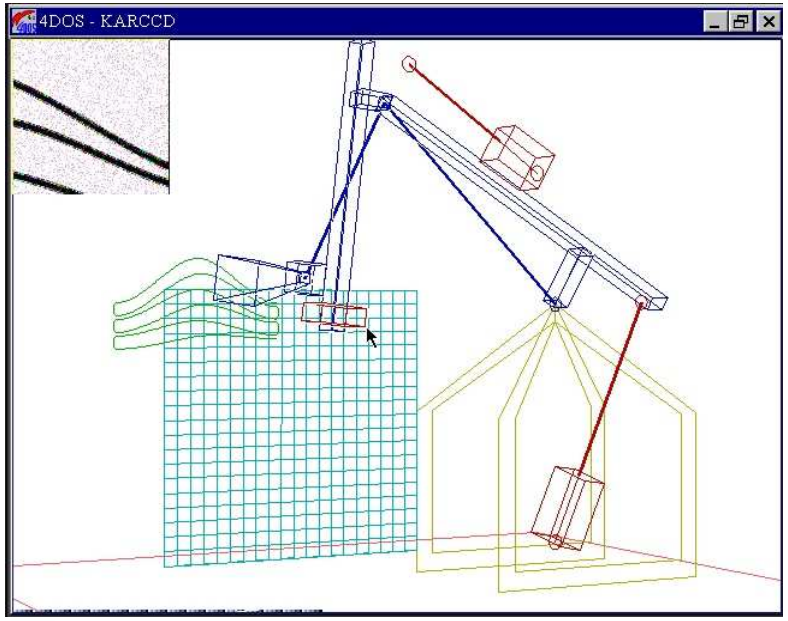


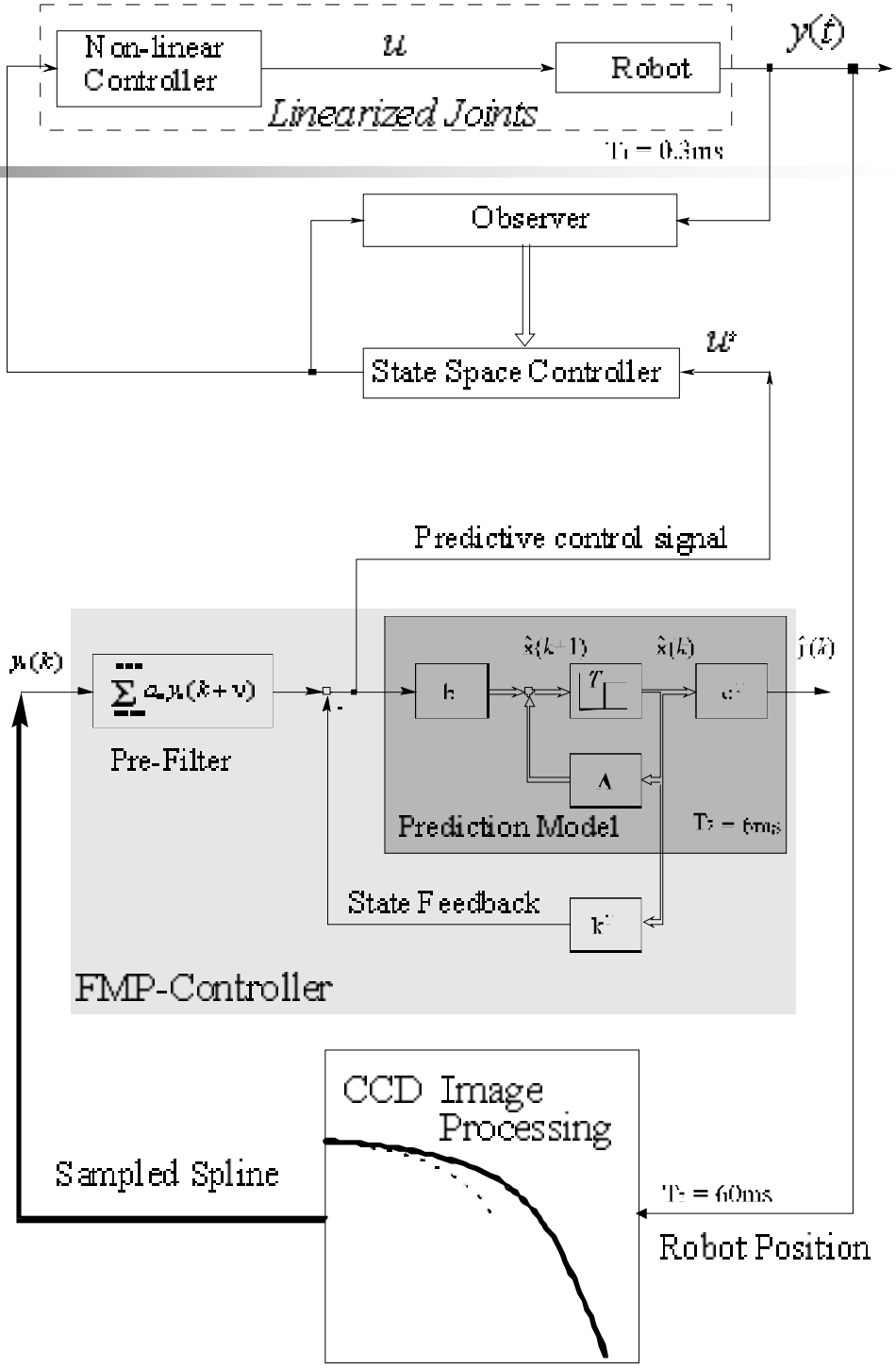


Bauchspiess, 1995

Path tracking



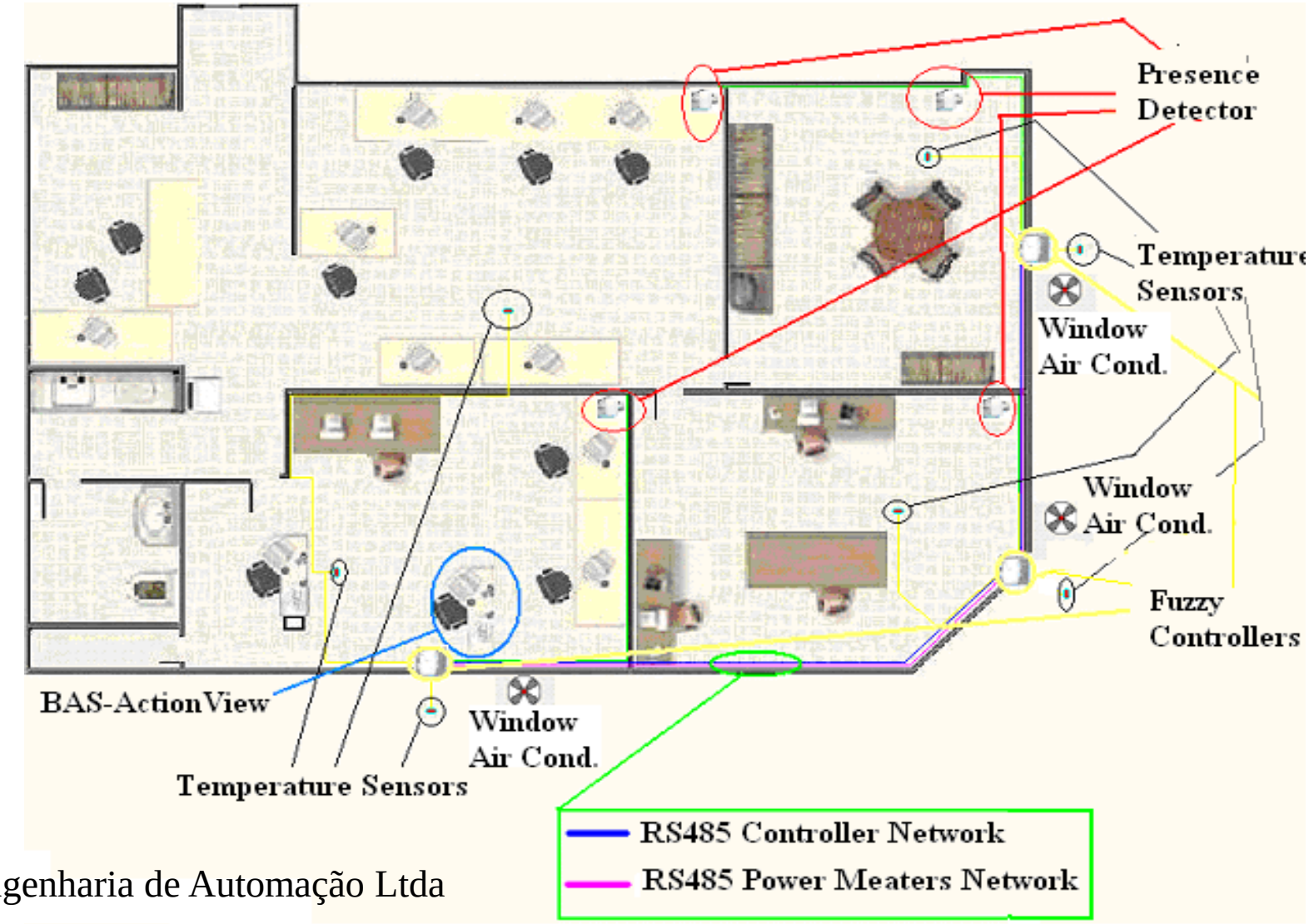




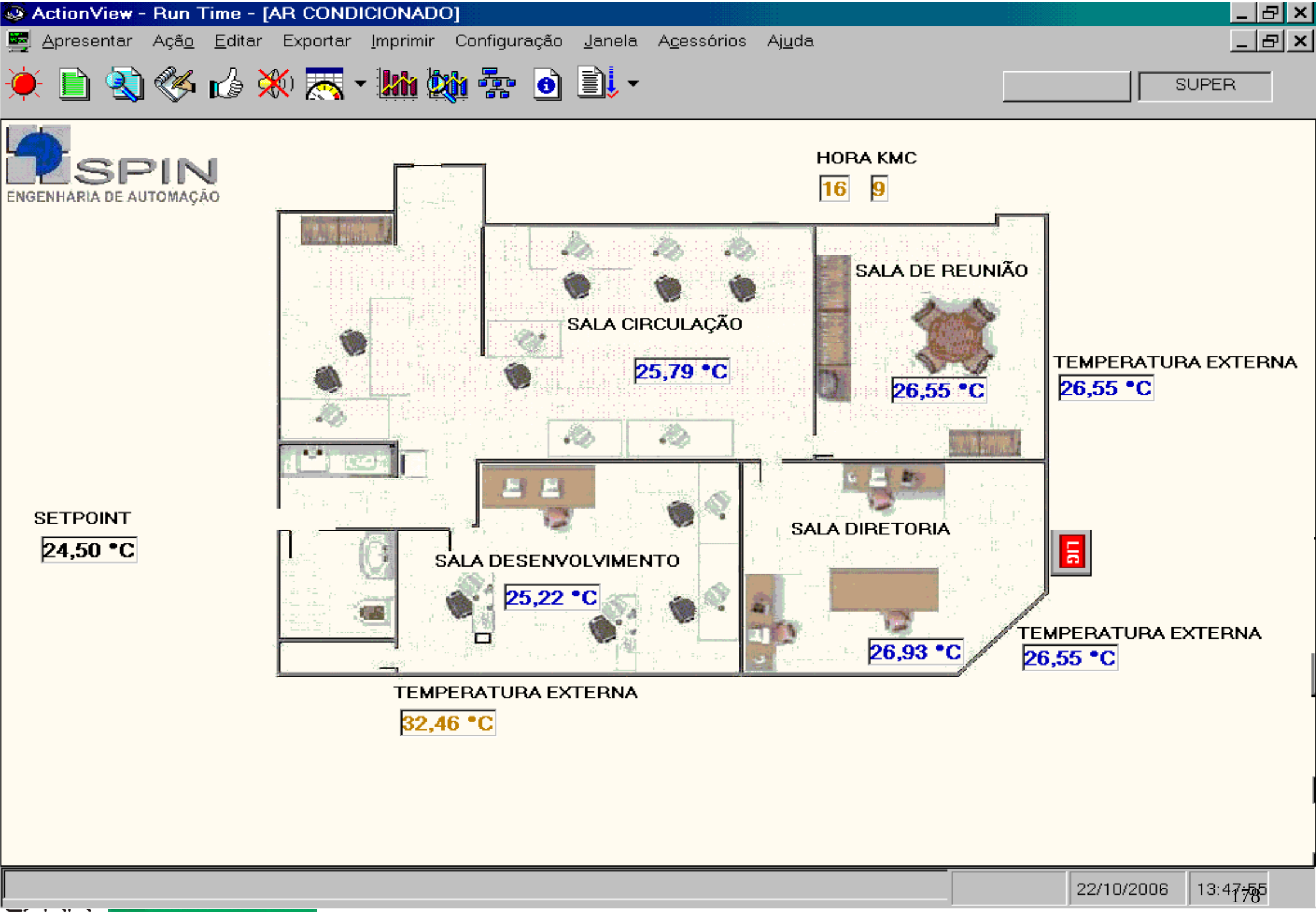
Ambient Intelligence

- Comfort and energy rationalization
  - Factors
    - temperature,
    - humidity,
    - outside temperature,
    - solar radiation,
    - neighboring rooms,
    - presence of persons,
    - furniture int the rooms,
    - heat sources (e.g., computers),
    - windows,
    - heaters,
    - air conditioners
    - etc.

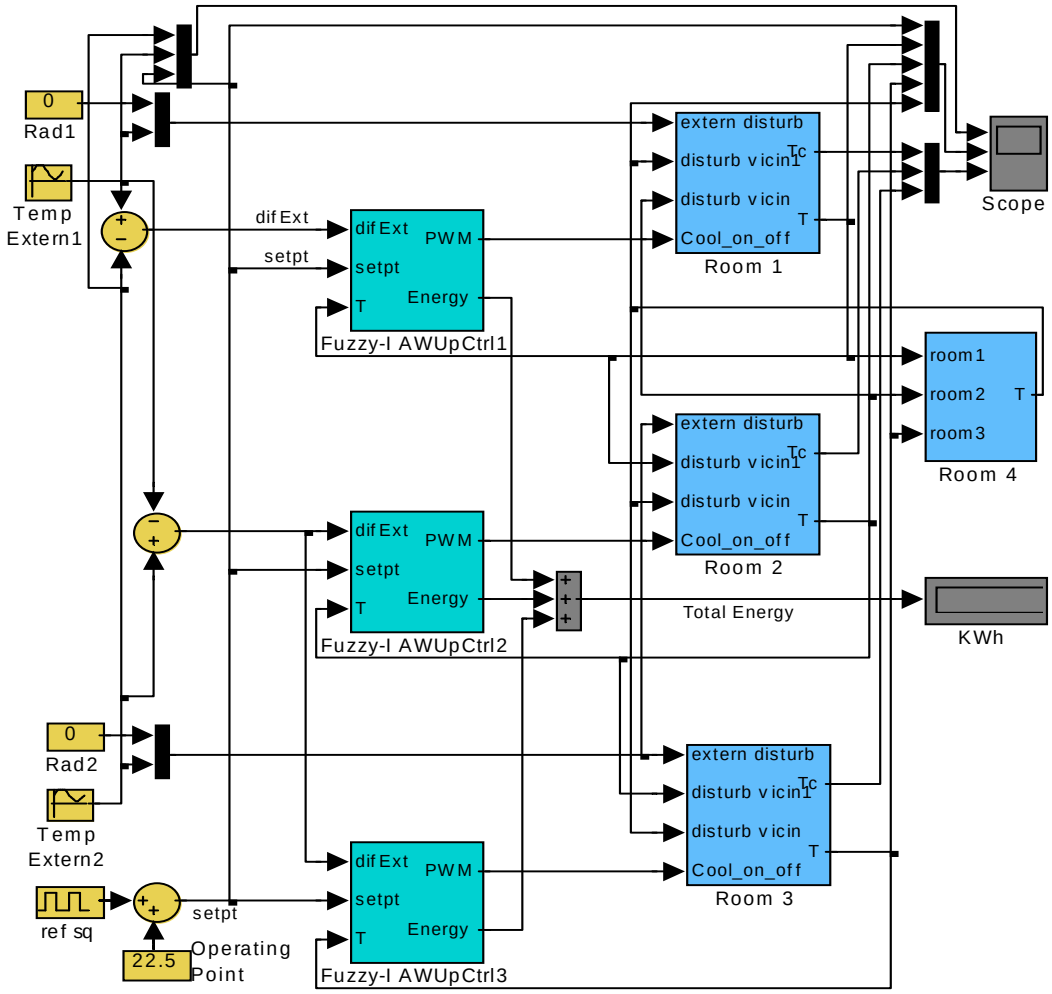
Thermal Comfort x Energy Rationalization



Spin Engenharia de Automação Ltda

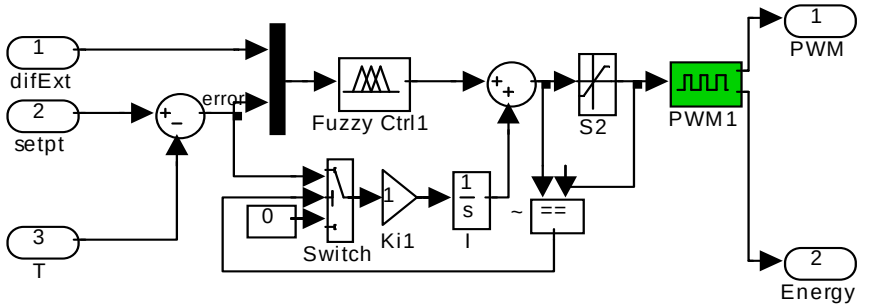

ActionView - Run Time - [AR CONDICIONADO]
Apresentar
Ação
Editar
Exportar
Imprimir
Configuração
Janela
Acessórios
Ajuda
SUPER
SPIN
ENGENHARIA DE AUTOMAÇÃO
HORA KMC
16
9
SALA CIRCULAÇÃO
25,79 °C
SALA DE REUNIÃO
26,55 °C
TEMPERATURA EXTERNA
26,55 °C
SETPOINT
24,50 °C
SALA DESENVOLVIMENTO
25,22 °C
SALA DIRETORIA
LIG
26,93 °C
TEMPERATURA EXTERNA
26,55 °C
TEMPERATURA EXTERNA
32,46 °C
22/10/2006
13:47:55

Simulation of the Energy Rationalization – Thermal Comfort

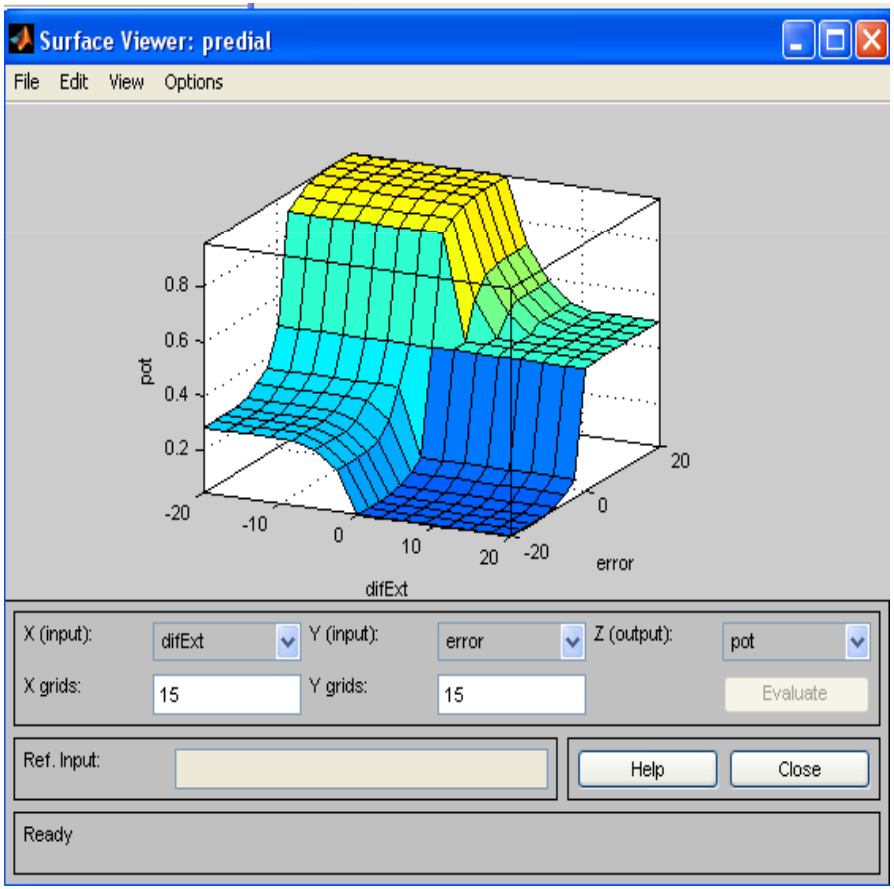


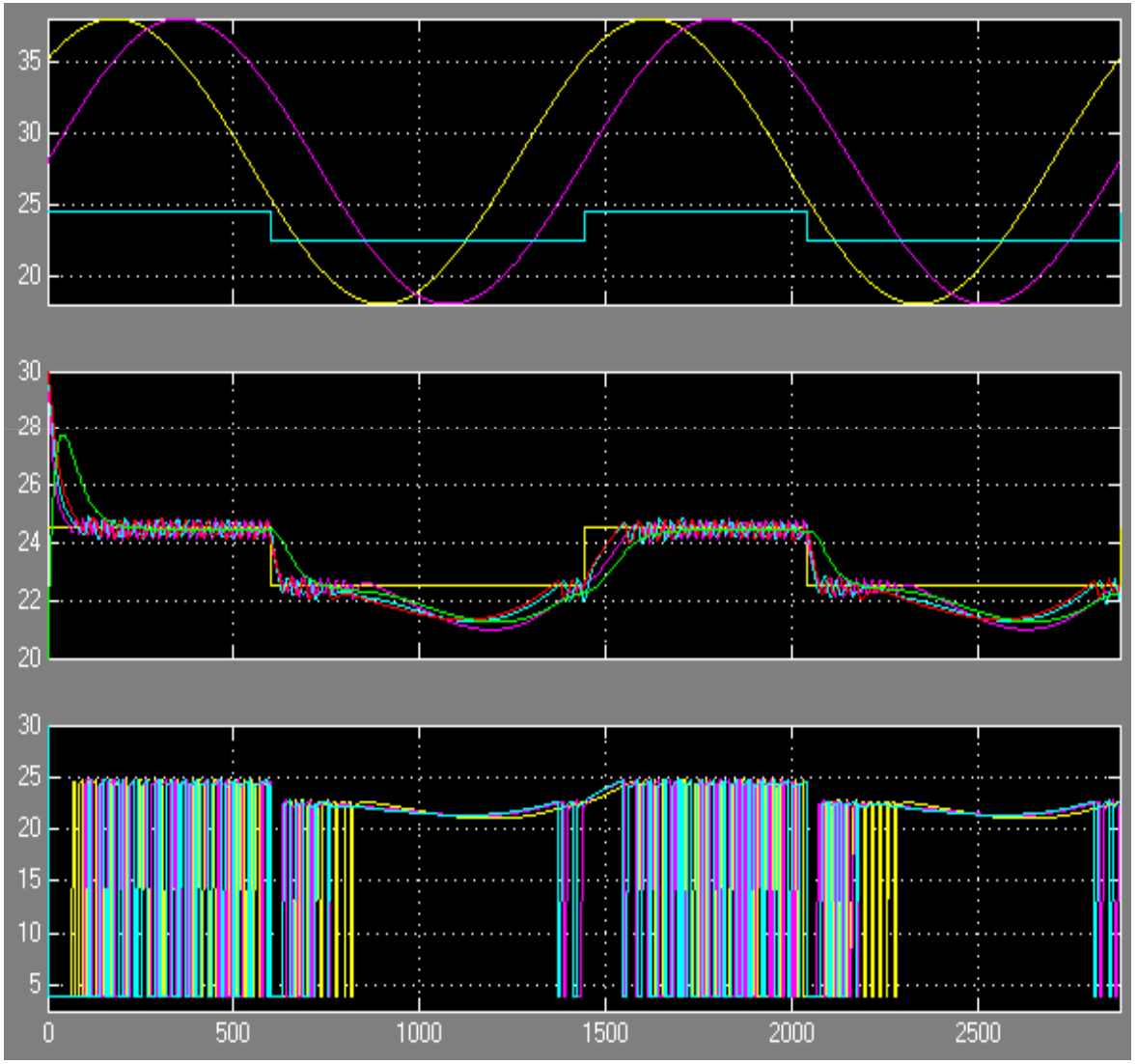
Projects:

FAP-DF
Finep – LabInov



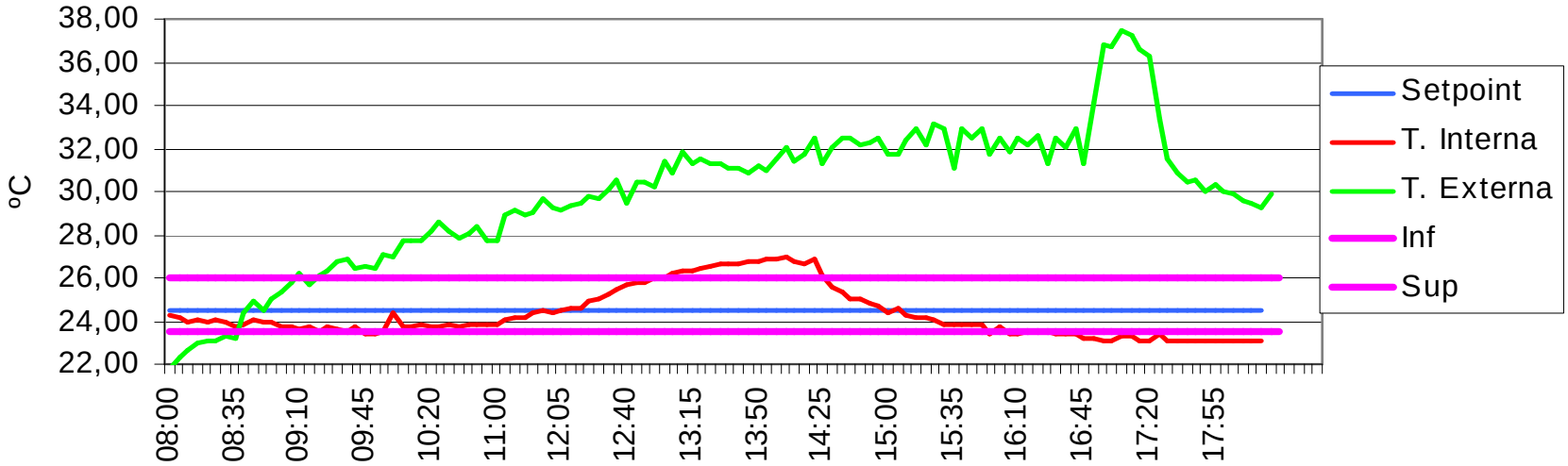
Simulation of Fuzzy Thermal Comfort



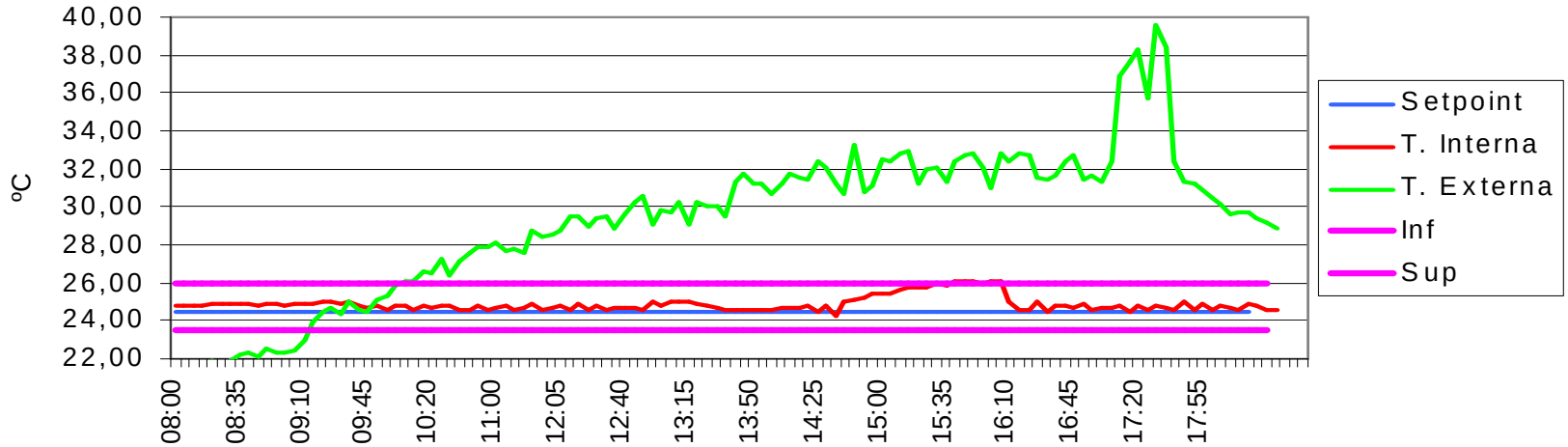


Development Room

On-Off 16-09-2006



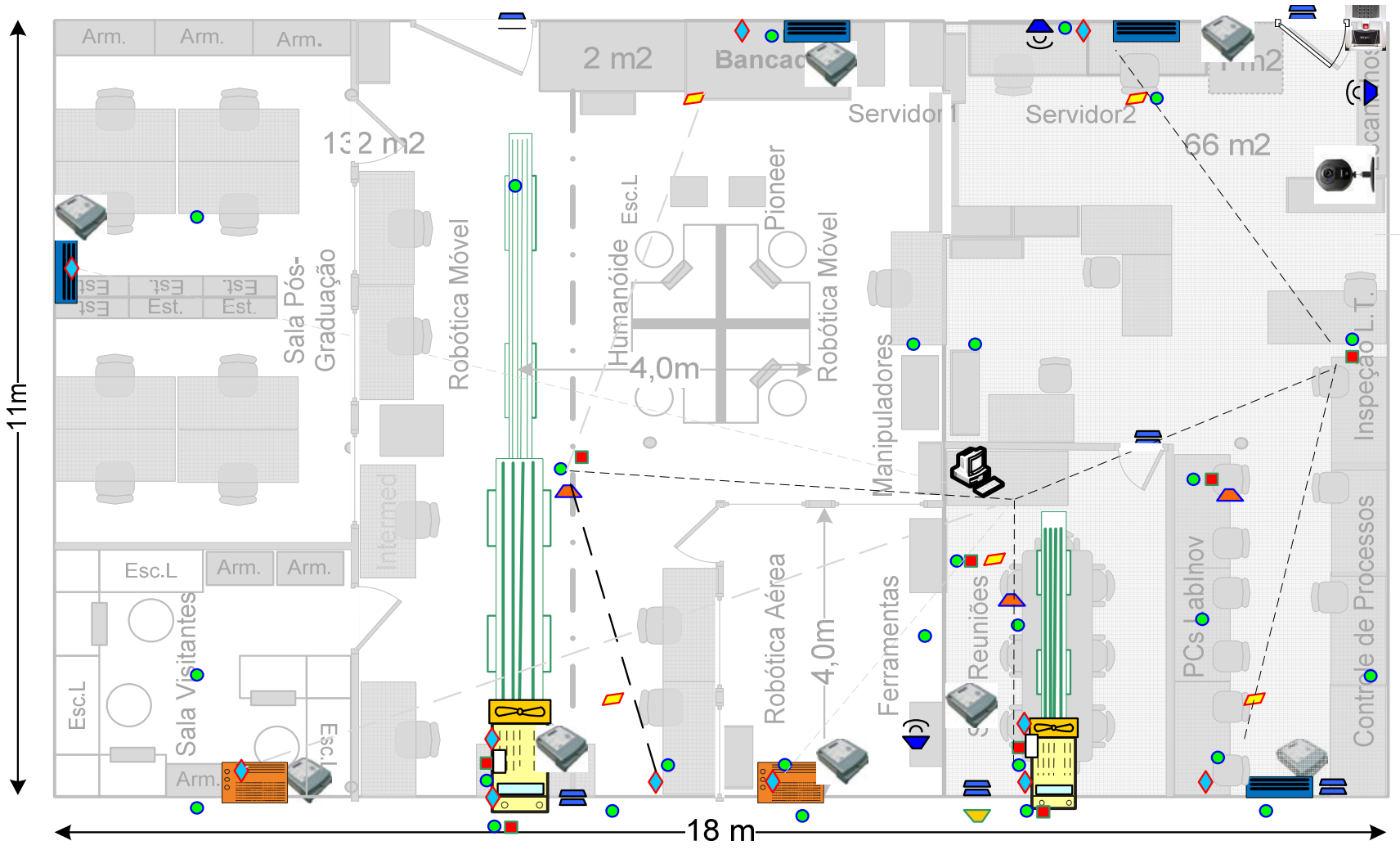
Fuzzy Control 14-09-2006



~30% saving!

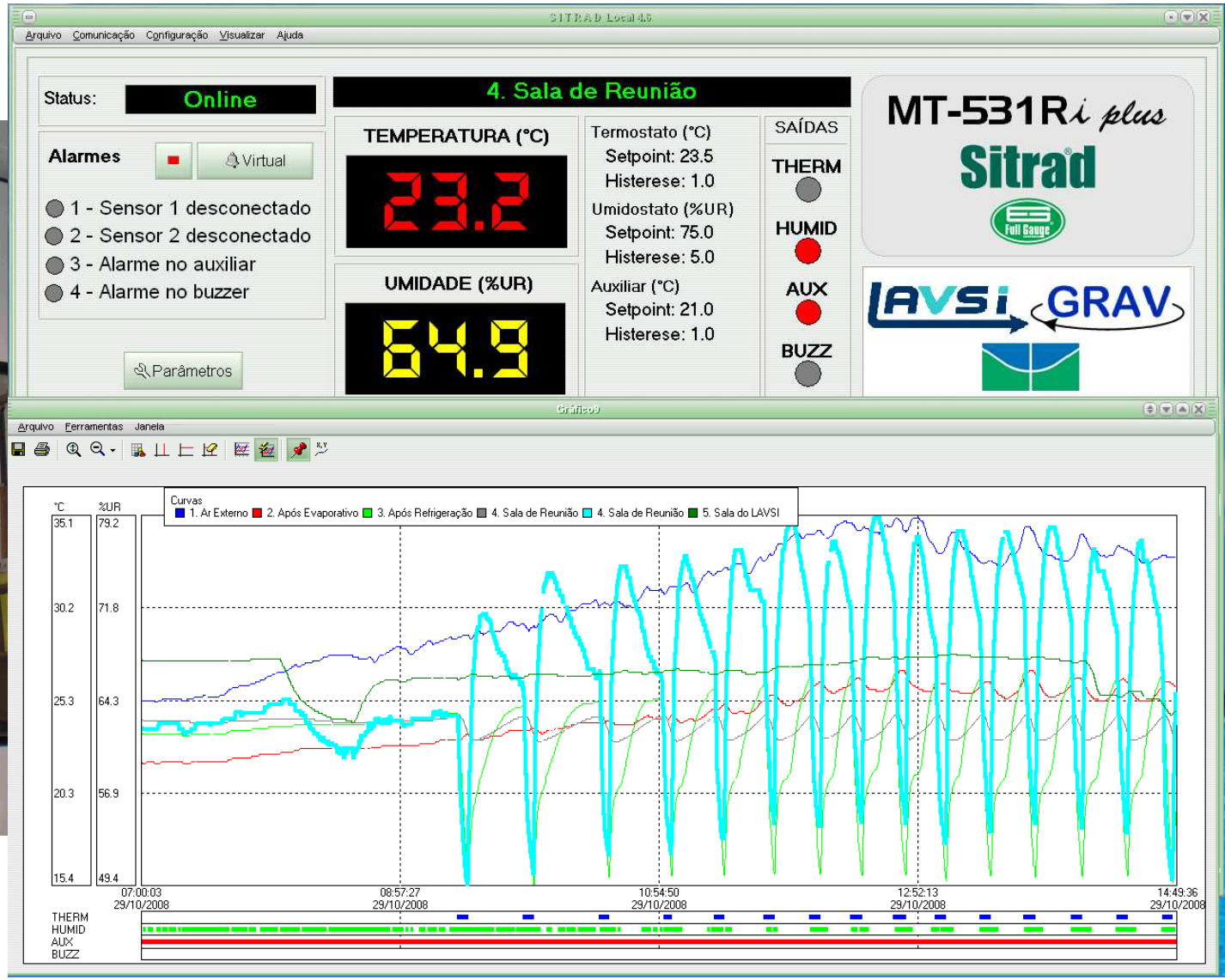
Finep/LabInov

Ambient Intelligence Innovation Laboratory

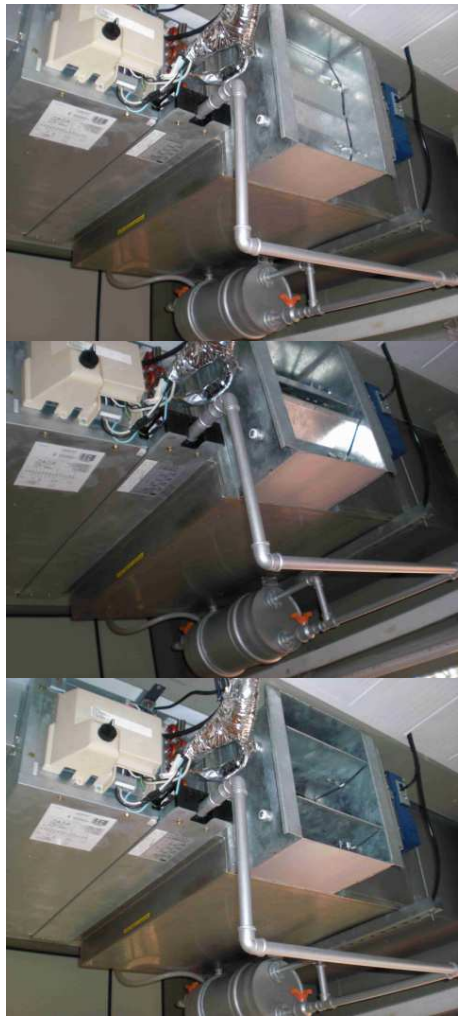


- Temperature Sensor
- Humidity Sensor
- Anemometer
- Thermal medium radiation sensor
- Piranometer
- Ar Cond. Actuator
- Presence Detector
- Open Door/Window detector
- Window Air Conditioner
- Split Air Conditioner
- Evaporative Air Conditioner
- Energy Meter
- Surveillance Camera
- Access Control
- Supervisory

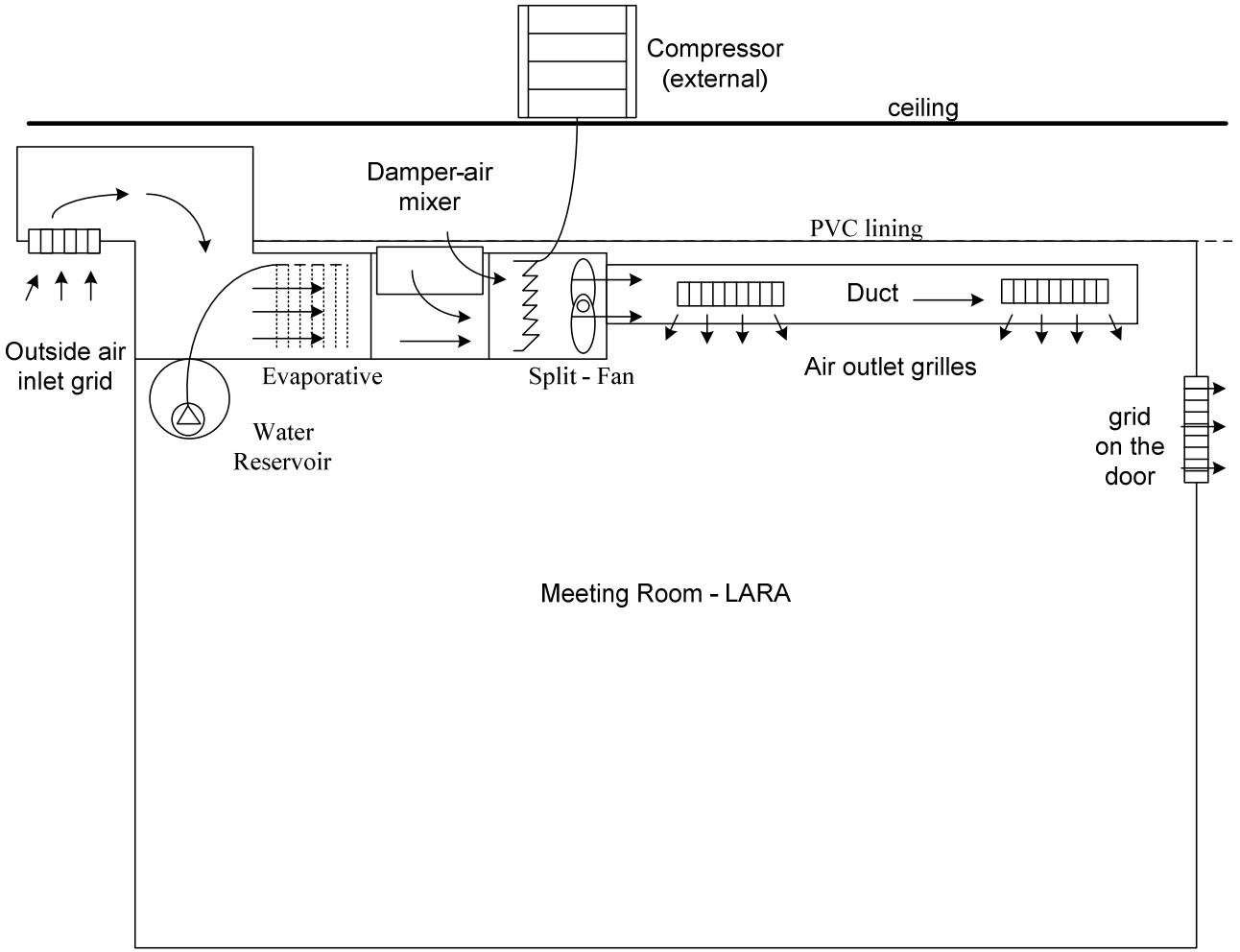
Hybrid Air Conditioning: Evaporative-Conventional



Hybrid Air Conditioning: Evaporative-Conventional

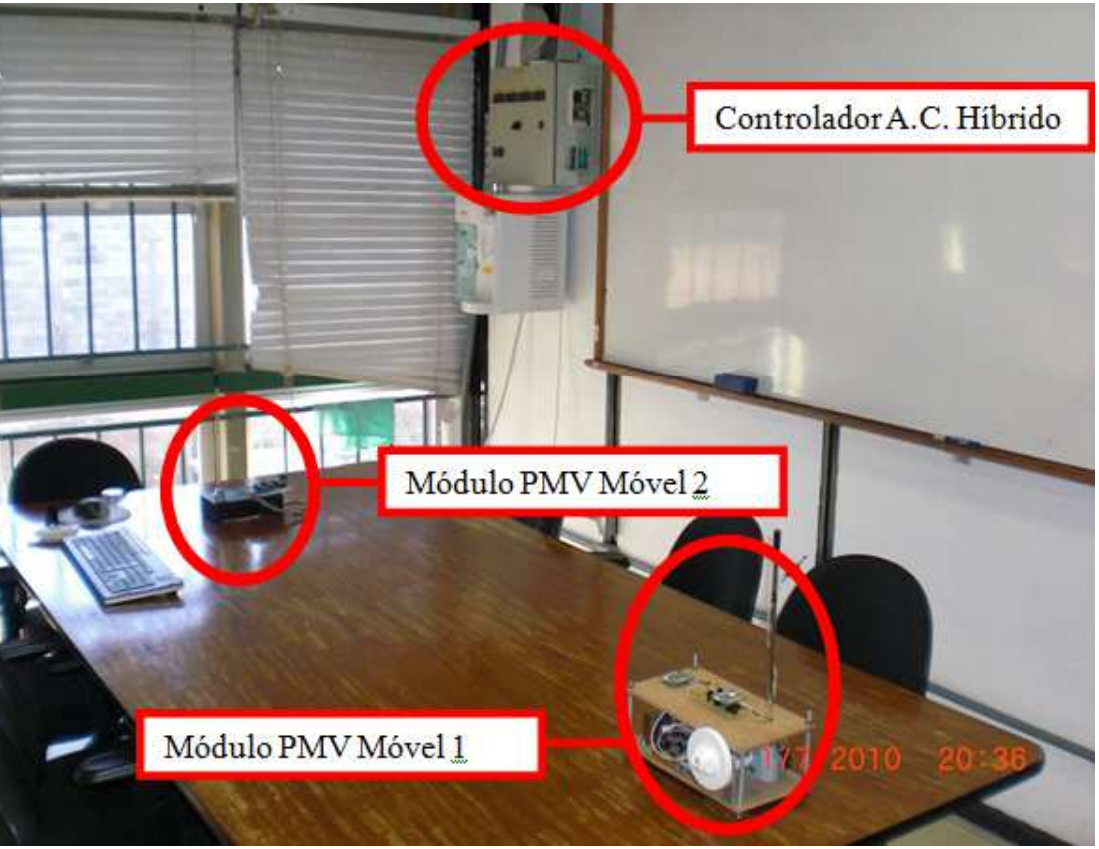


Damper
(air mixer)



Schematic Diagram

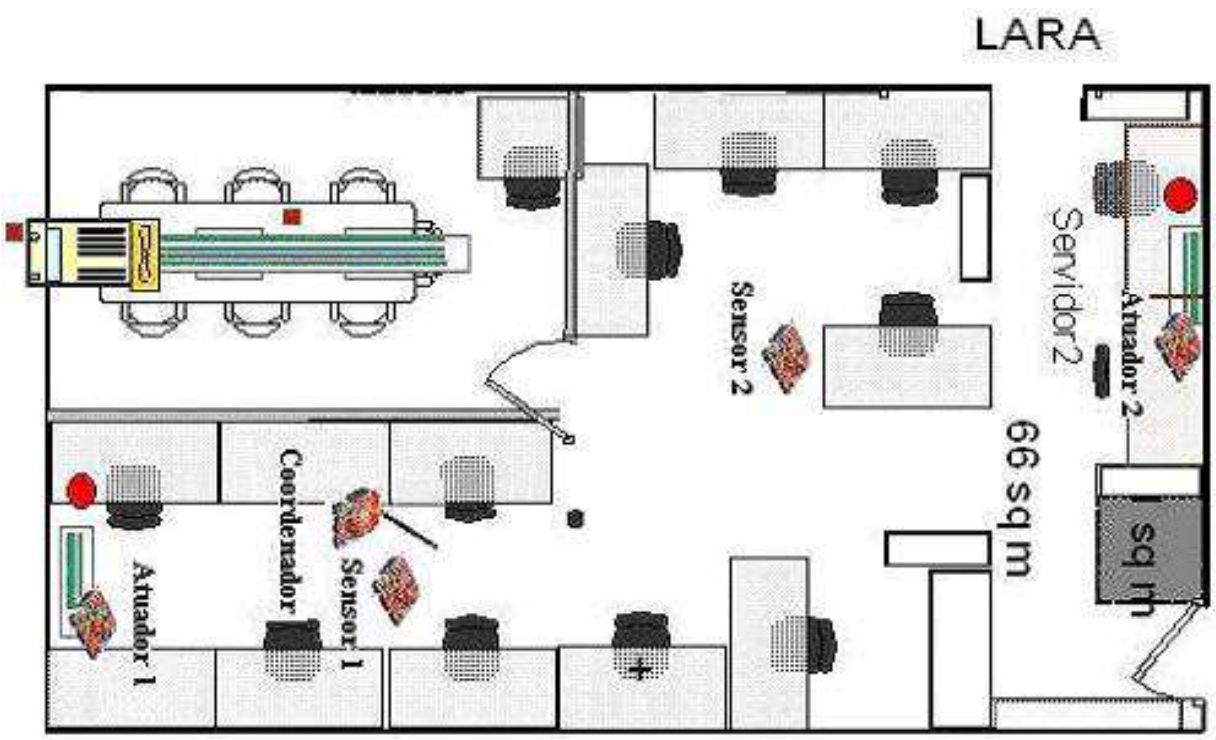
Hybrid Air Conditioner Controller

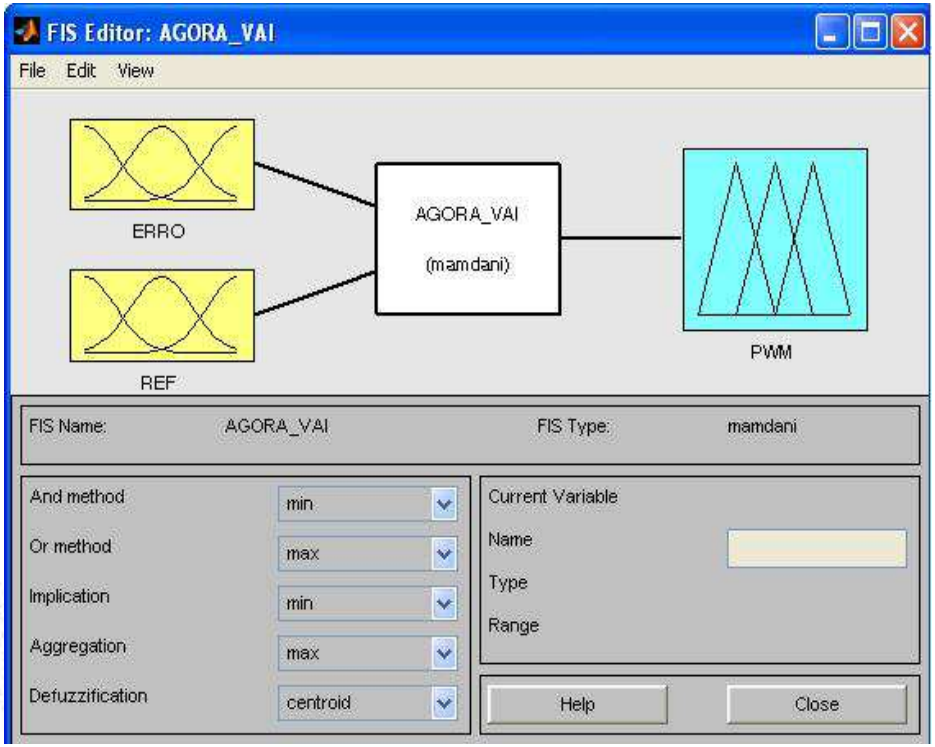


Meeting Room LARA.
Mobile modules 1 e 2. Actuator of the hybrid air conditioner híbrido

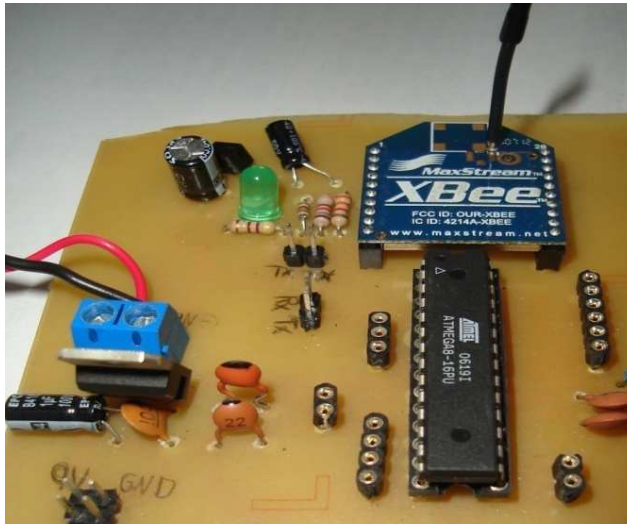
Sensors attached to the wall - Temperature, Humidity and Thermal Radiation

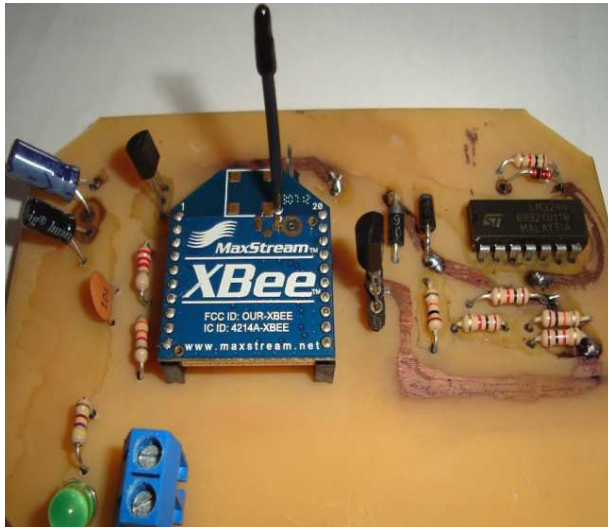
Fuzzy Control in Wireless Network

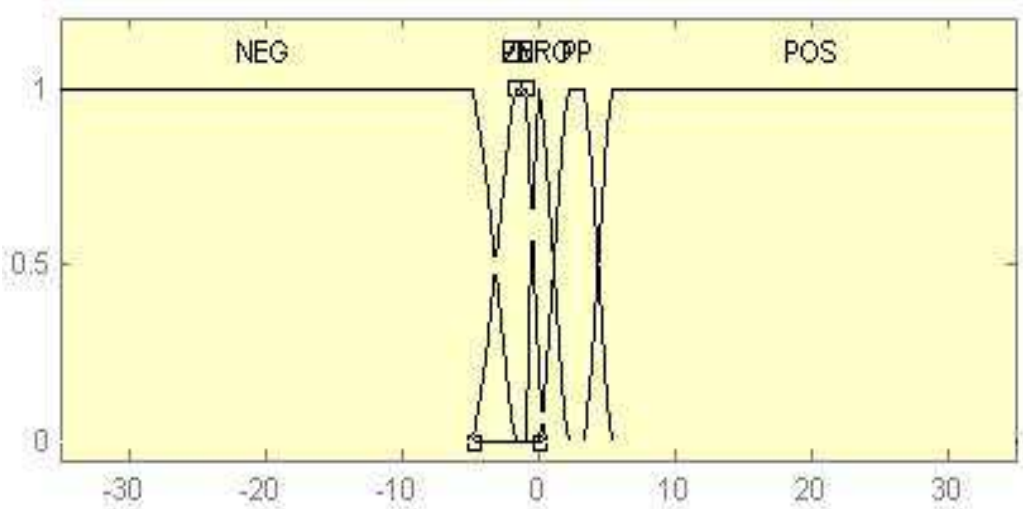




Fuzzy Control in Wireless Network





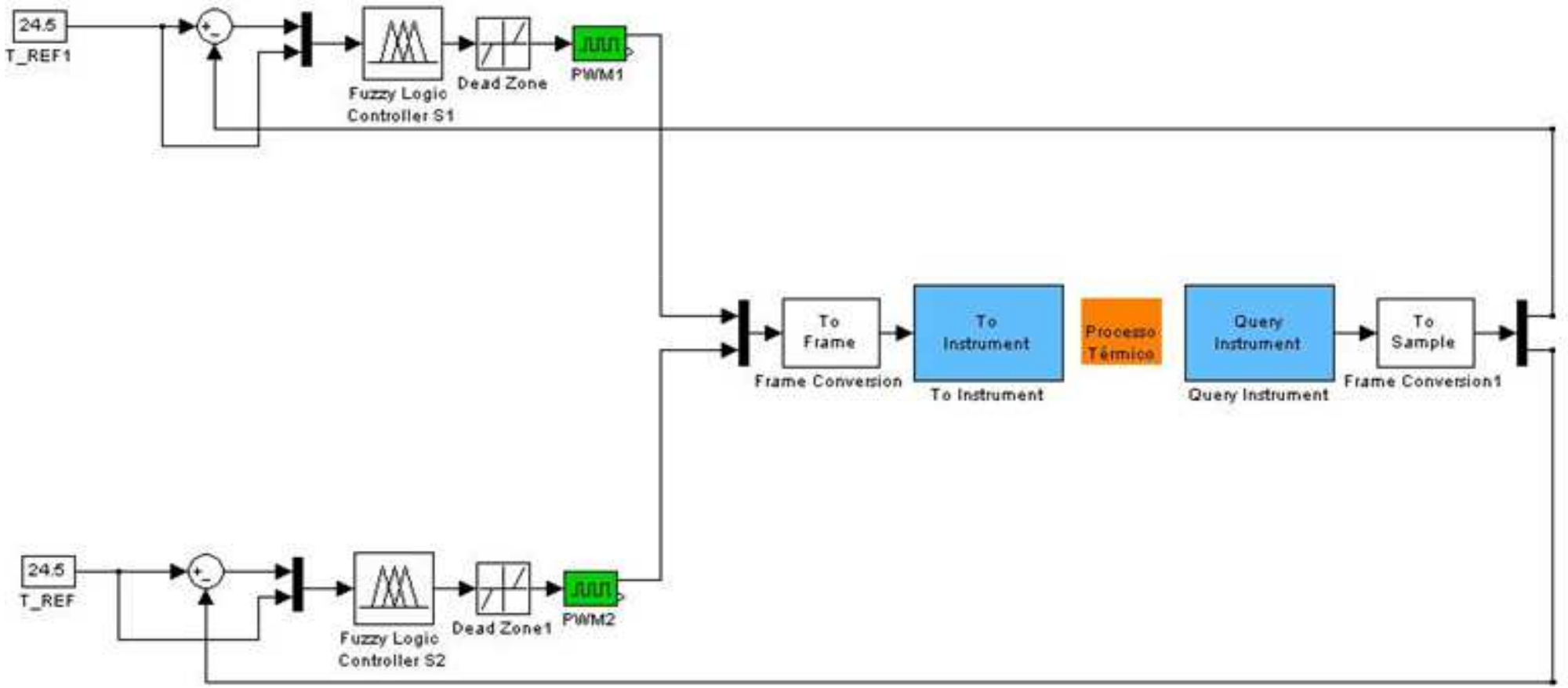


Membership functions of the input variable error

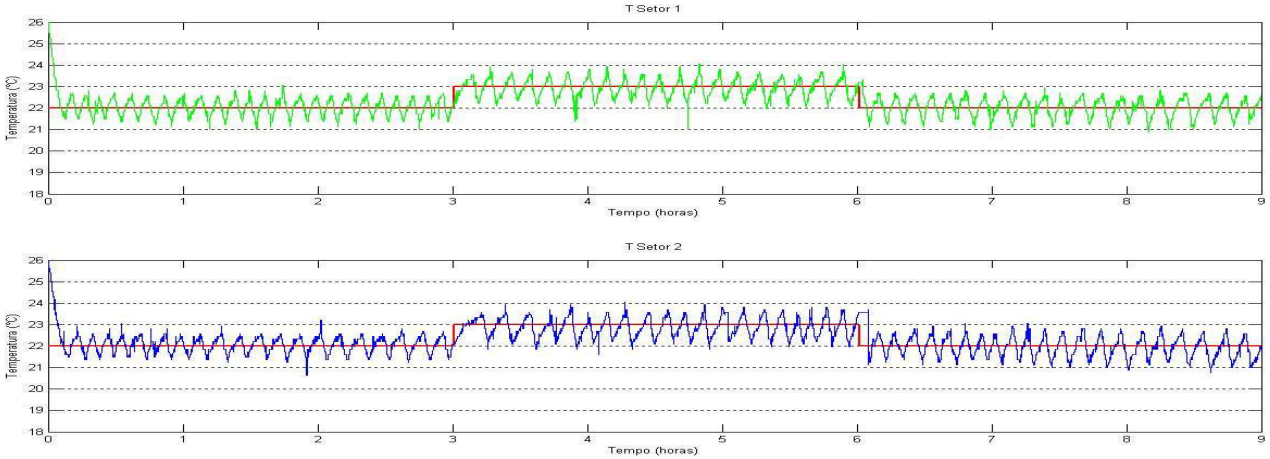
Truth Table of Fuzzy inference-LAVSI/ENE/UnB

Erro x T_ref	MB	B	M	A	MA
NEG	A	A	A	A	A
PN	M	M	M	M	M
ZERO	M	M	M	M	M
PP	MB	MB	MB	MB	MB
POS	MB	MB	MB	MB	MB

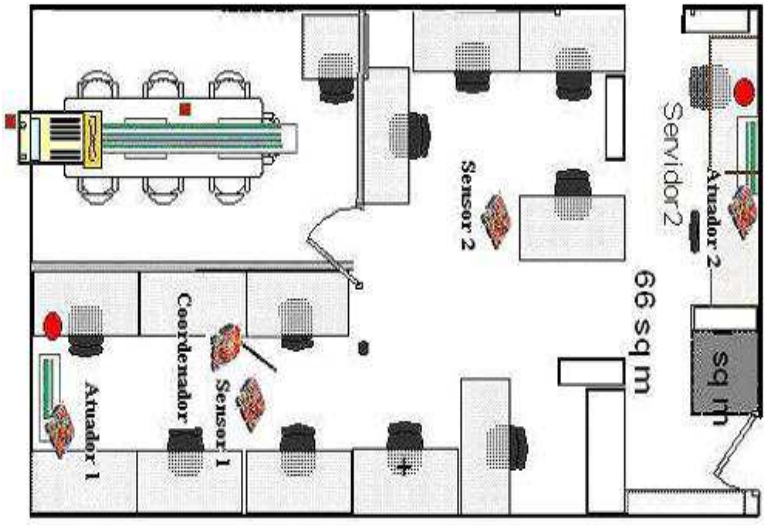
Fuzzy Control in Wireless Network

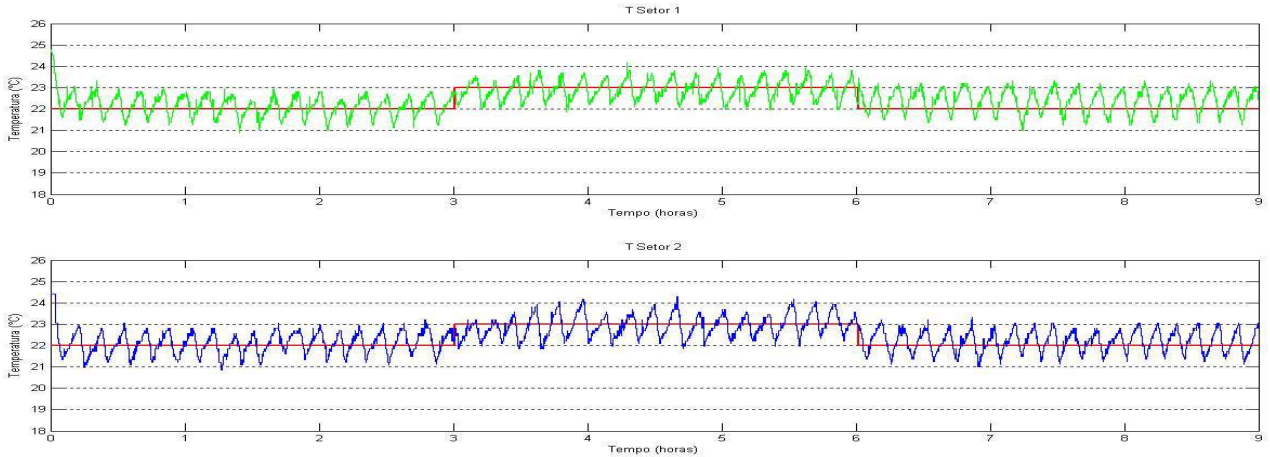


Fuzzy Control in Wireless Network



Temperaturas no setor 1 e setor 2 – Controle On-Off





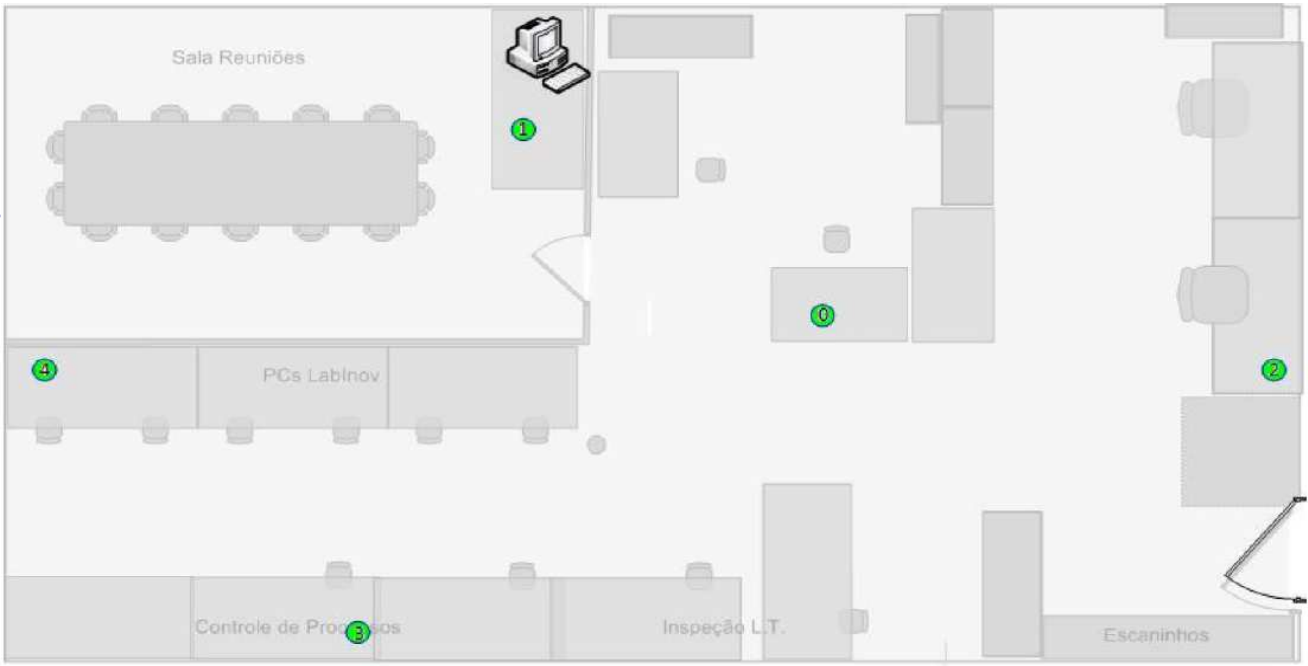
Temperaturas no setor 1 e setor 2 – Controle *Fuzzy*

Energy saving: On-Off x Fuzzy Wireless, Ferreira Júnior, 2009.

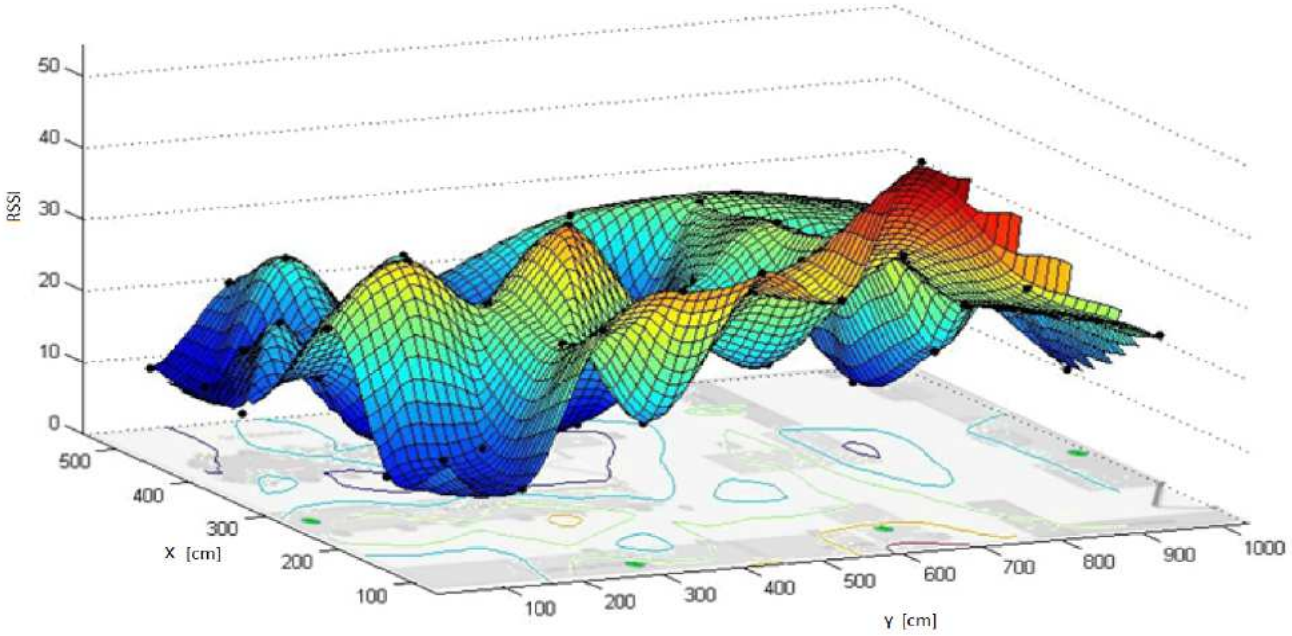
Controller	Energy (kWh)	Energy saving
On-off	15,69	17,00 %
Fuzzy	13,41	

Indoor RFID Localization

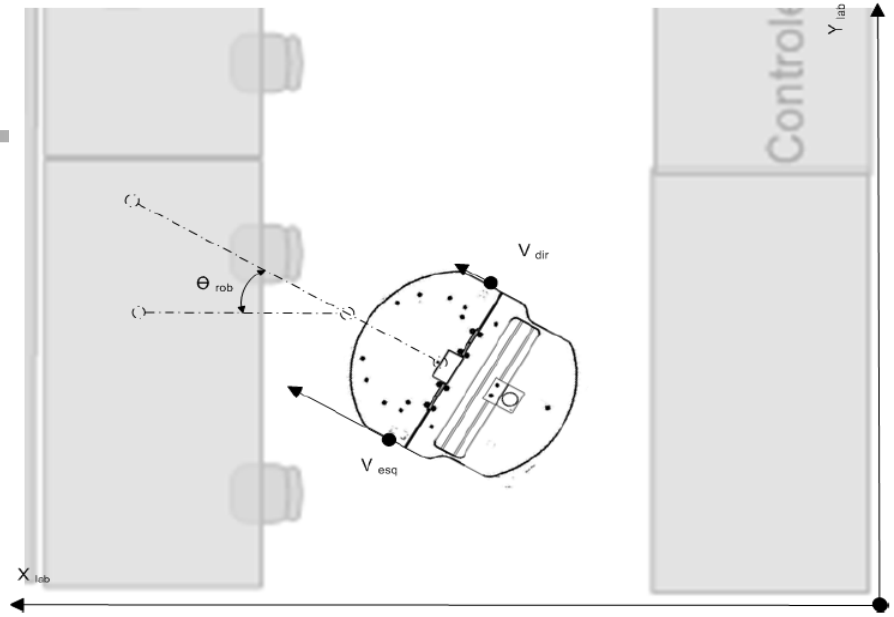
in the Context of Mobile Robotics with Application in Ambient Intelligence

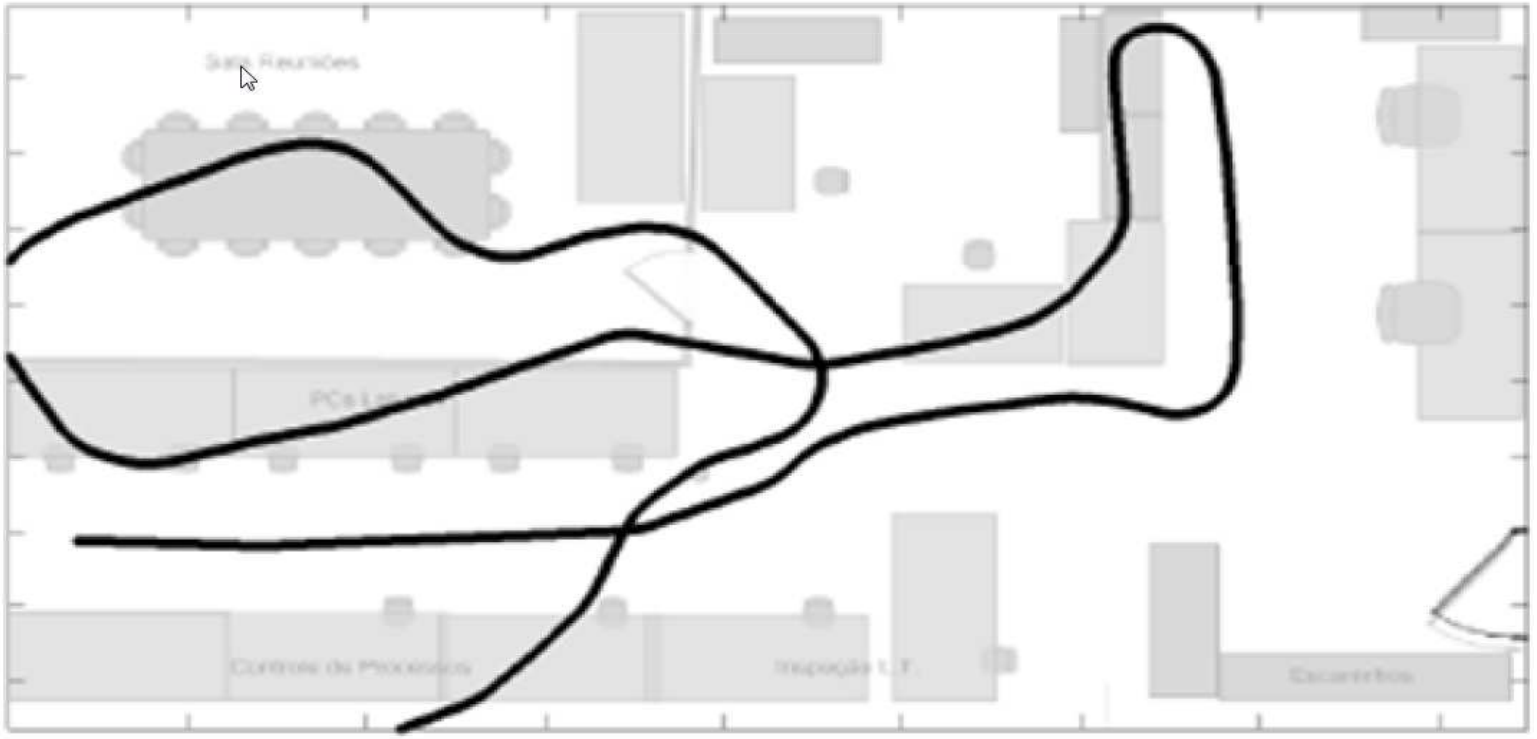


Interpolated from measured RSSI

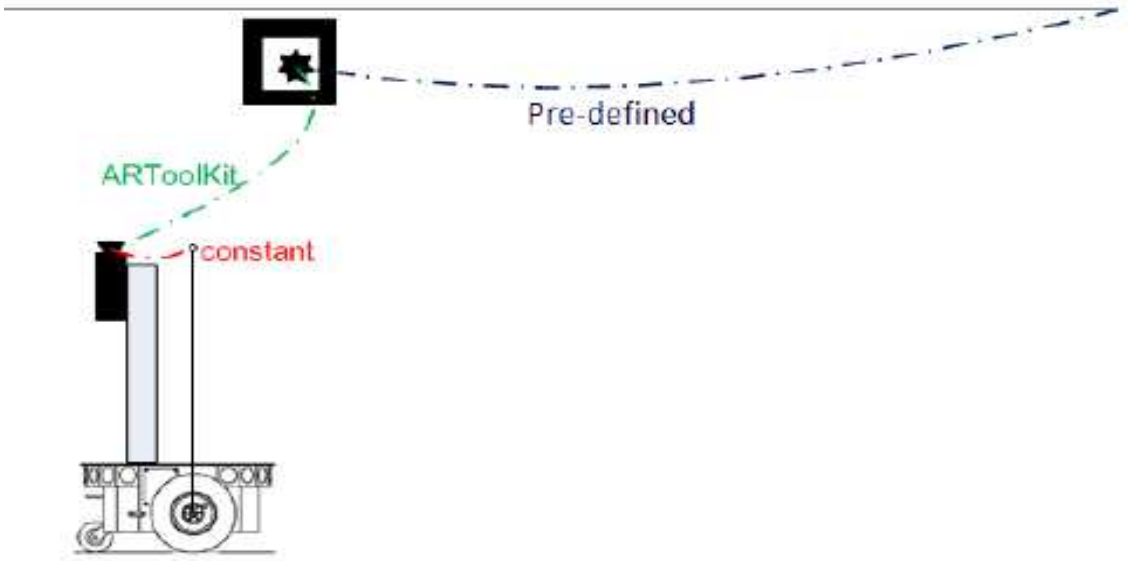


Localization results using encoders information in UKF without any update step

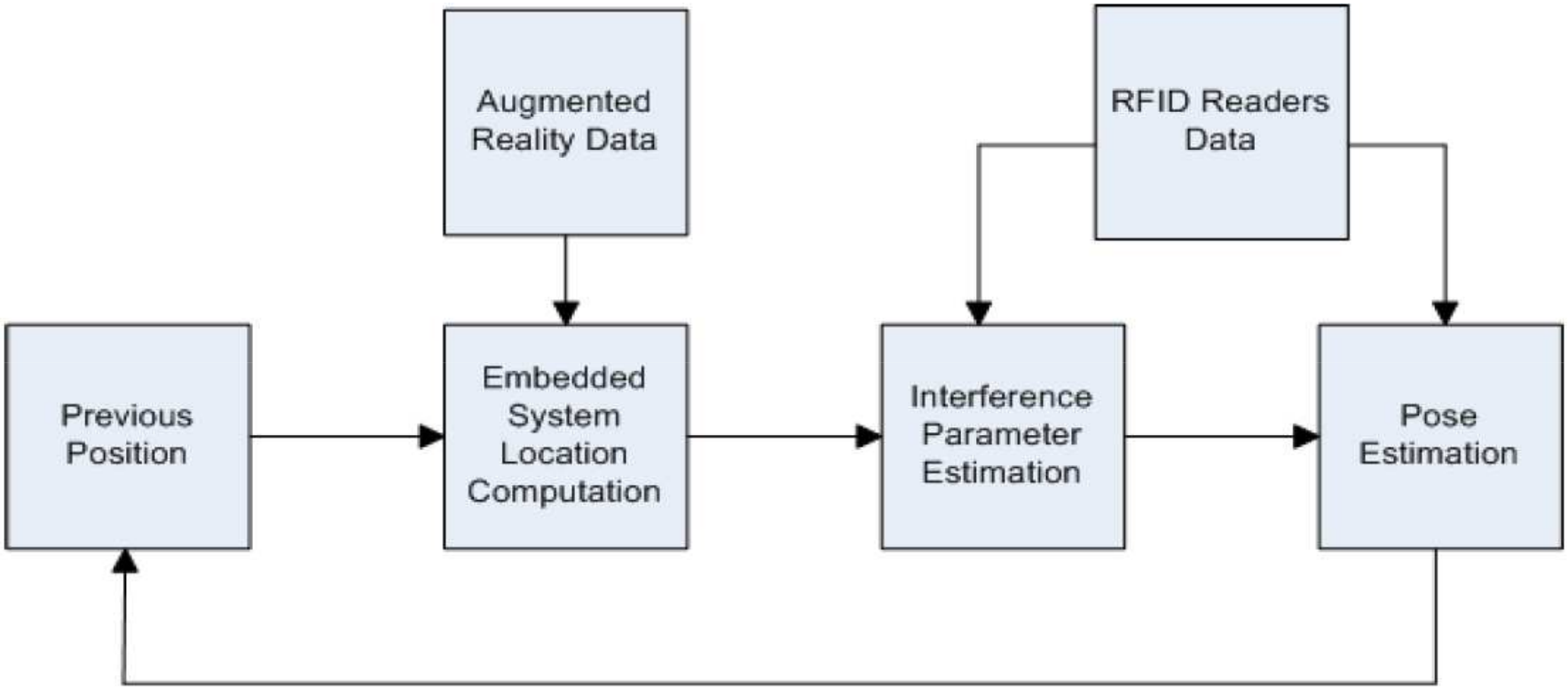




Augmented Reality Localization System

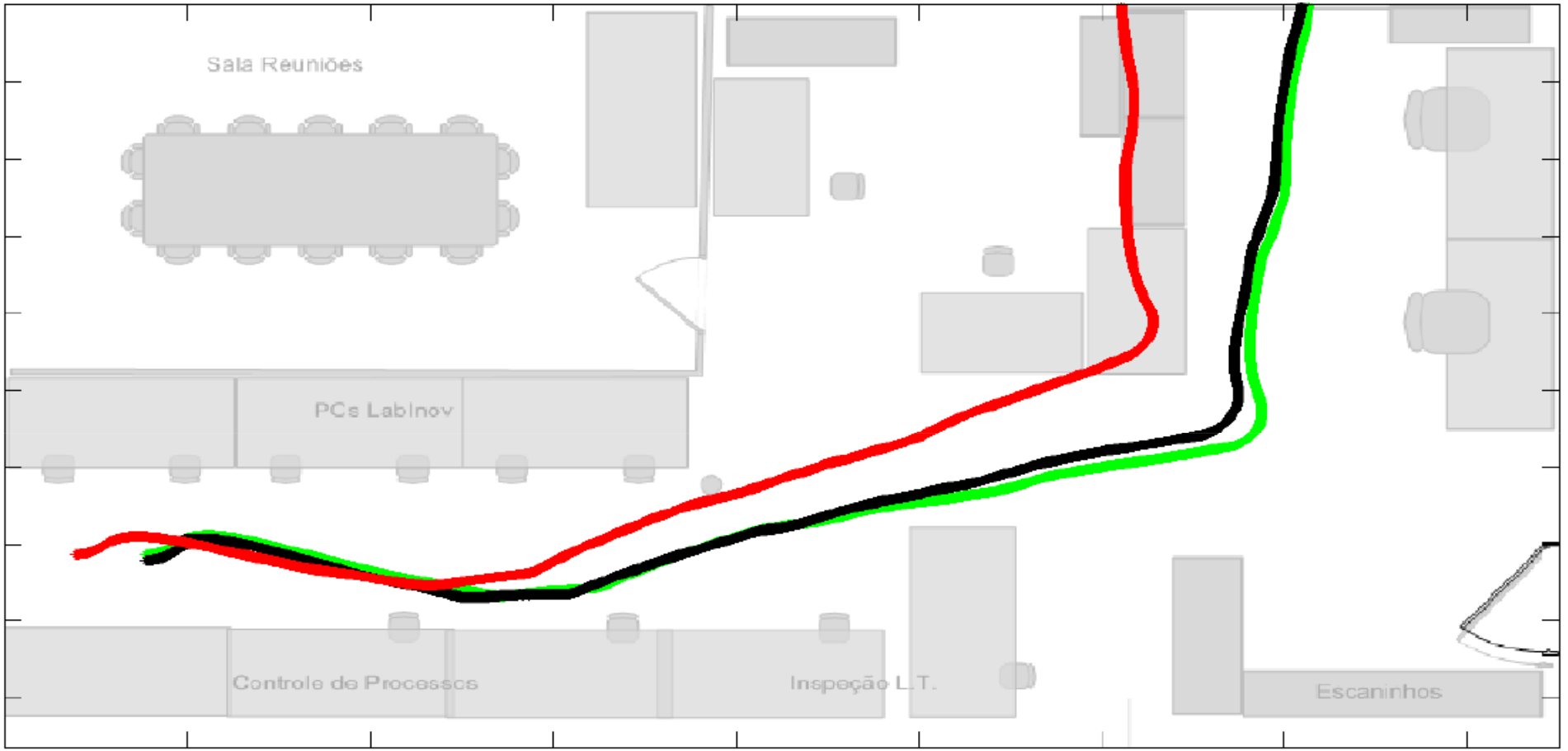


Sensor Fusion



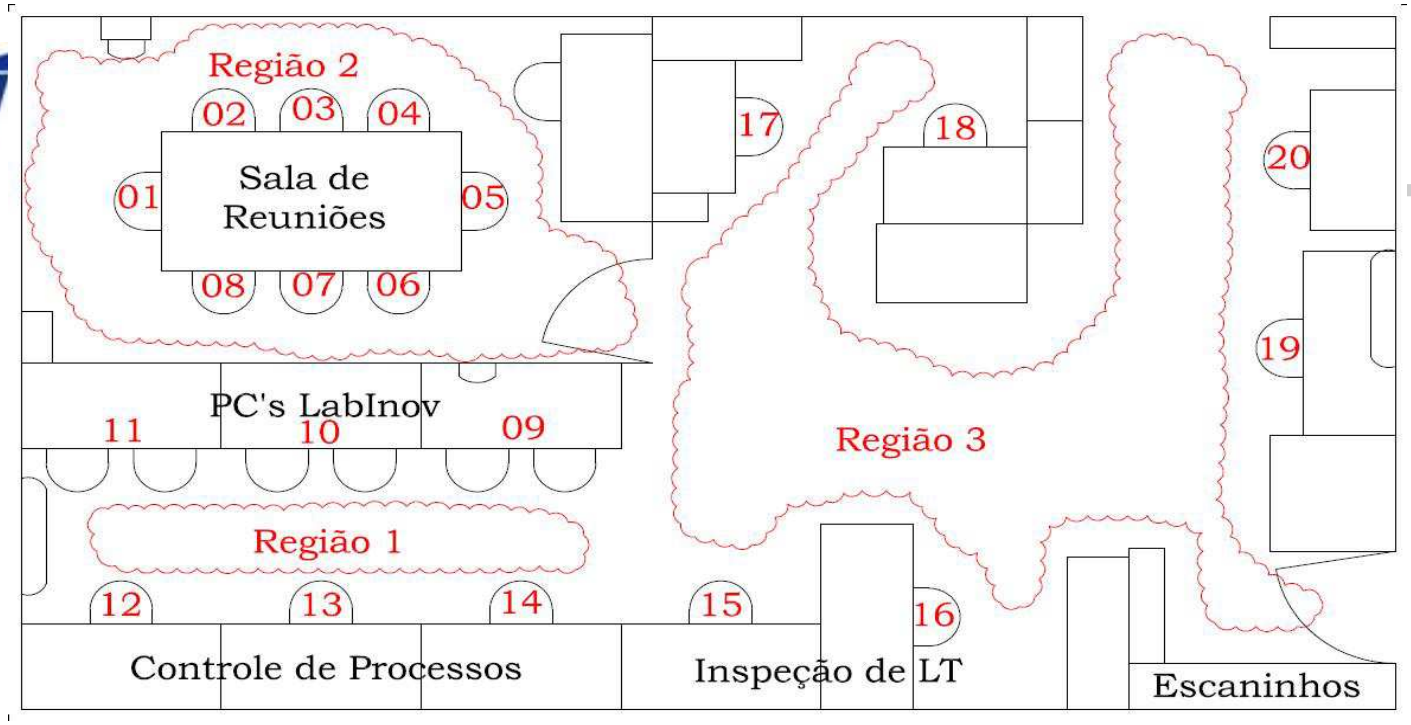
Augmented Reality Localization System Results

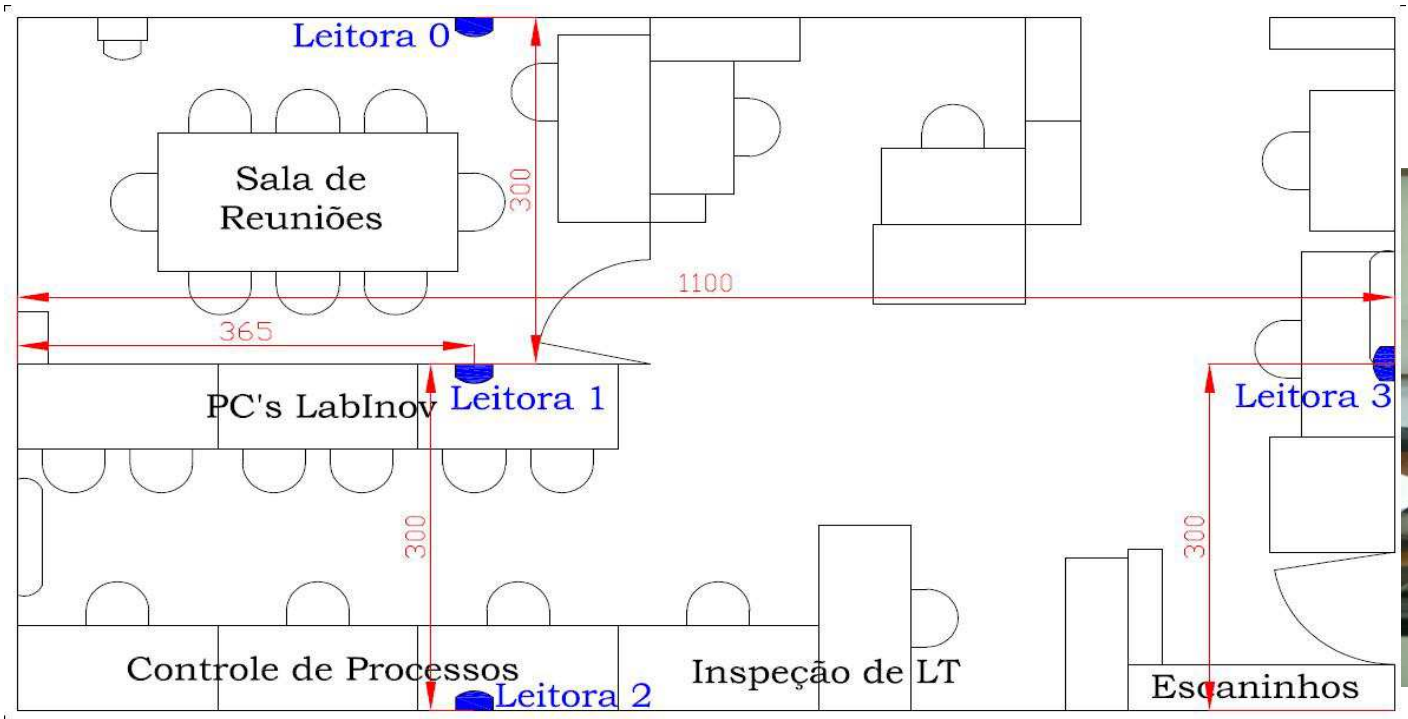
Comparison



Comparative results

- **augmented Reality, RFID RSSI system and odometry (Green),**
- **augmented reality system and odometry (Black)**
- **pure odometry system (Red)**

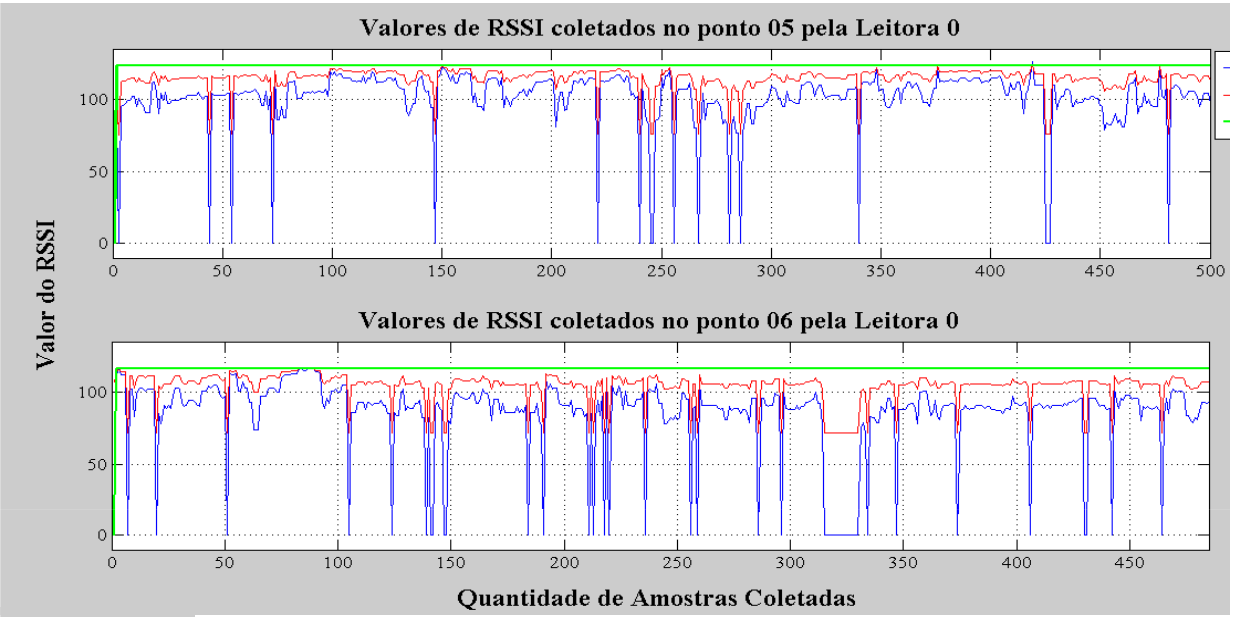




Thermal Load influence Areas

Identification of users in areas by RFID – RSSI classificators

RFID - Occupancy Recognition



EKF

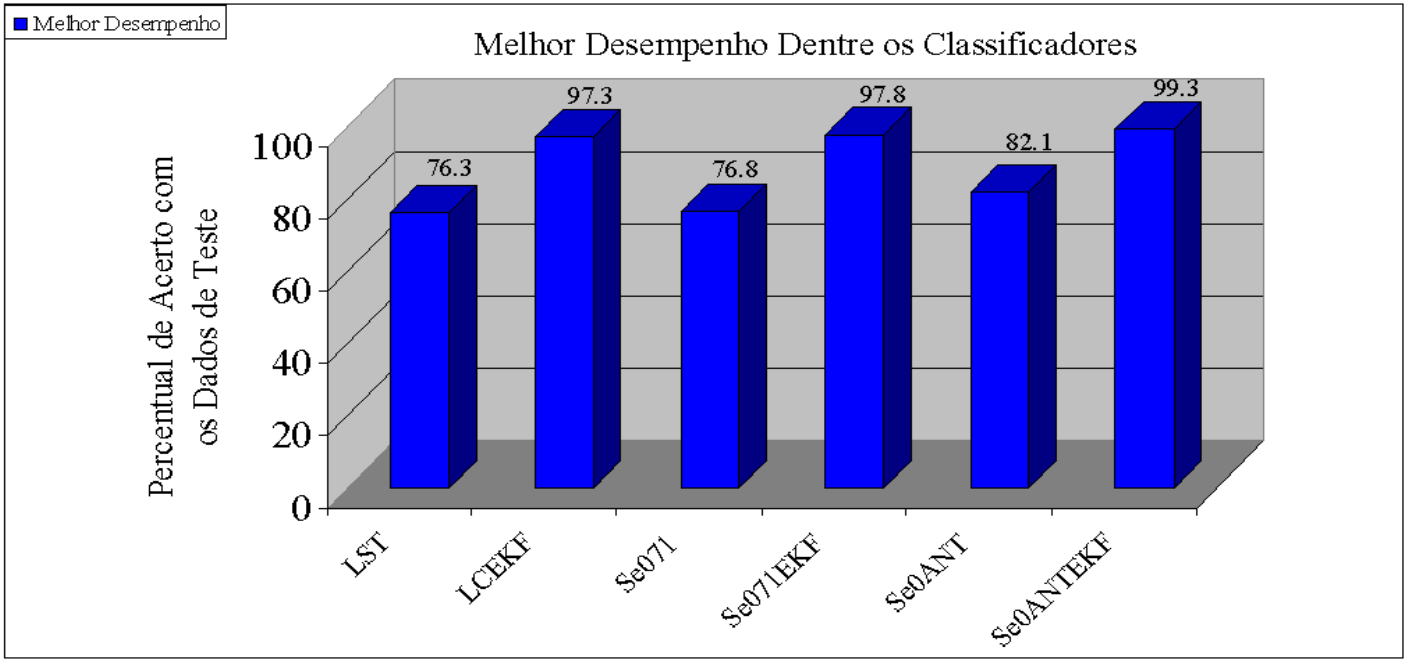
Missing values

- Last value
- least value (71)

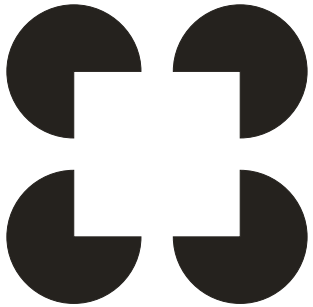
MLP – Multilayer Percetron

LVQ – Learning Vector Quantization

SVM – Support Vector Machine



Part 5 – Conclusions



- RNA - A technique that involves learning
- Fuzzy – Demands a Human Expert
- Neuro-Fuzzy - ANFIS
- Commercial products available

Philosophical origins

René Descartes

"analytic geometry"

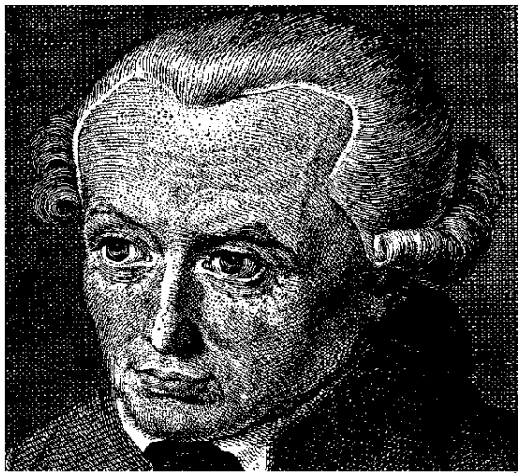
1637

Reason

Immanuel Kant

"Critique of Pure Reason"

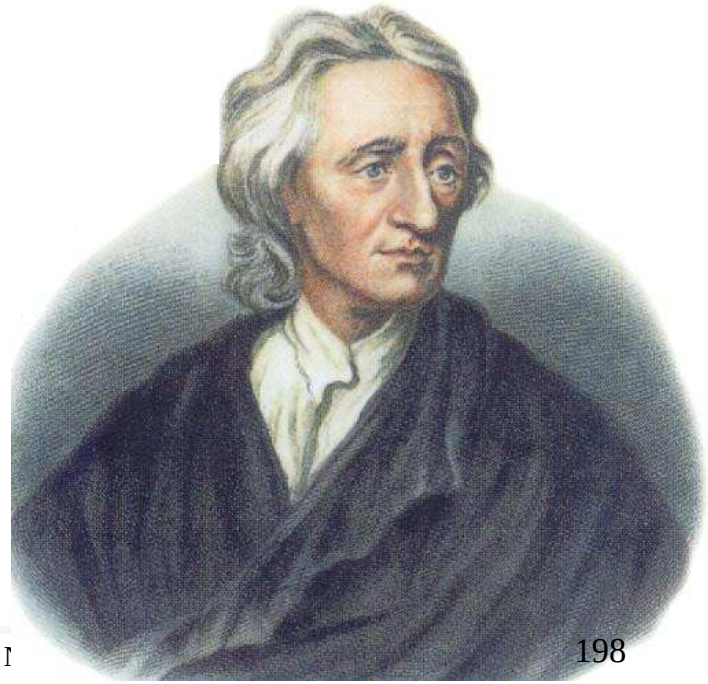
1781



Senses

John Locke

"Essay on Human Understanding"
1689



Philosophical origins

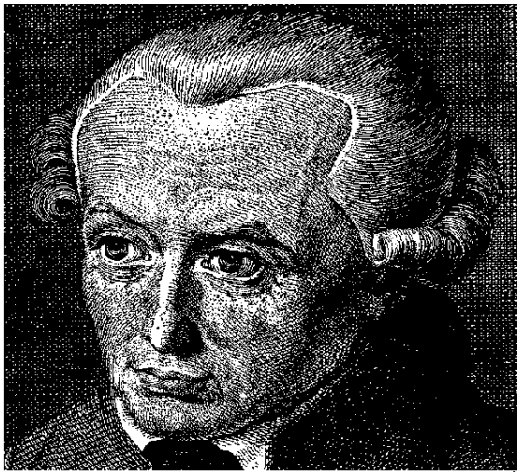
René Descartes

"I think, therefore I am"

Rationalism

Immanuel Kant

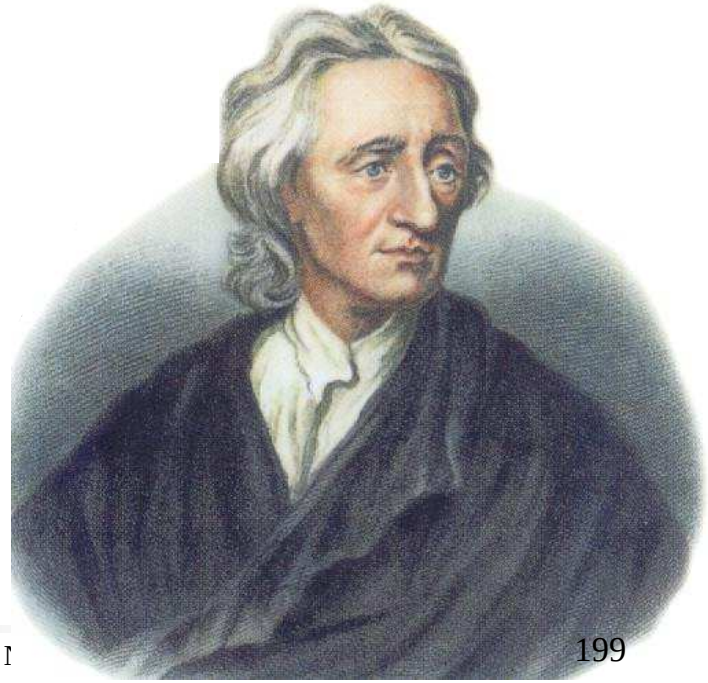
"We can only know what we perceive"



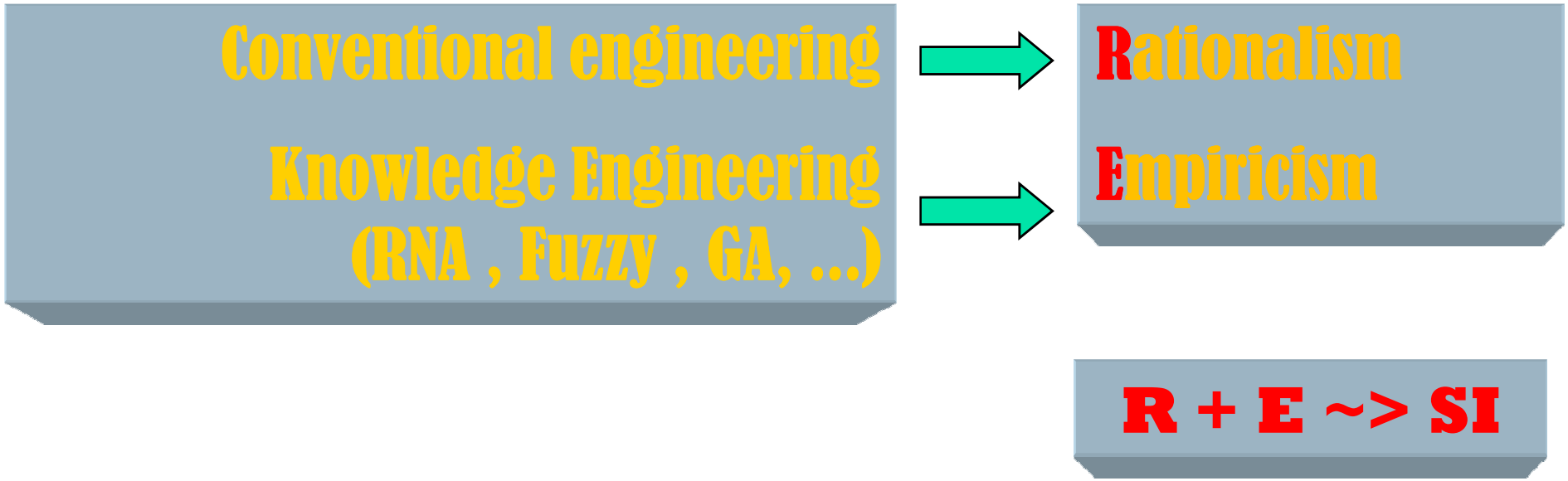
Empiricism

John Locke

"The knowing of no man can go beyond his experience"



Conclusion



To be able to design intelligent systems that are really useful you must have a good theoretical background.

Normally, only what is already known to exist, will be found.

Adolfo Bauchspiess

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