

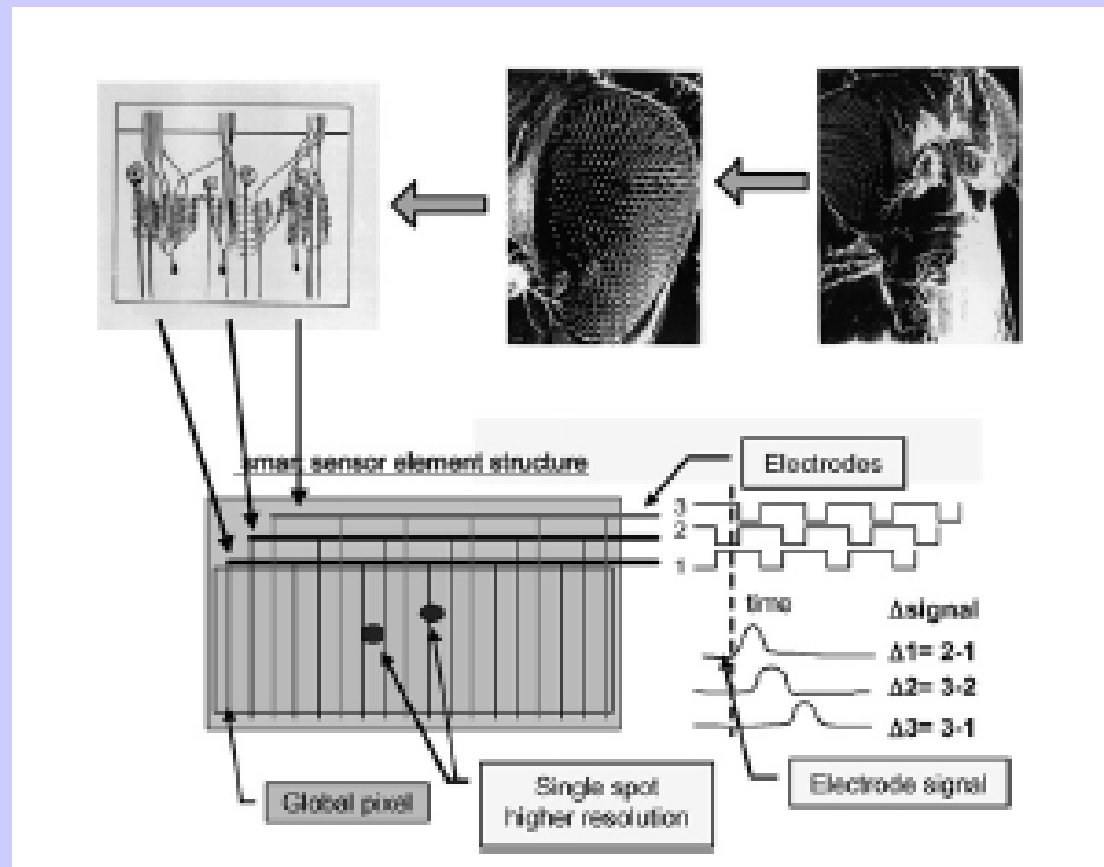
Microsistemas Inteligentes

Smart Microsystems

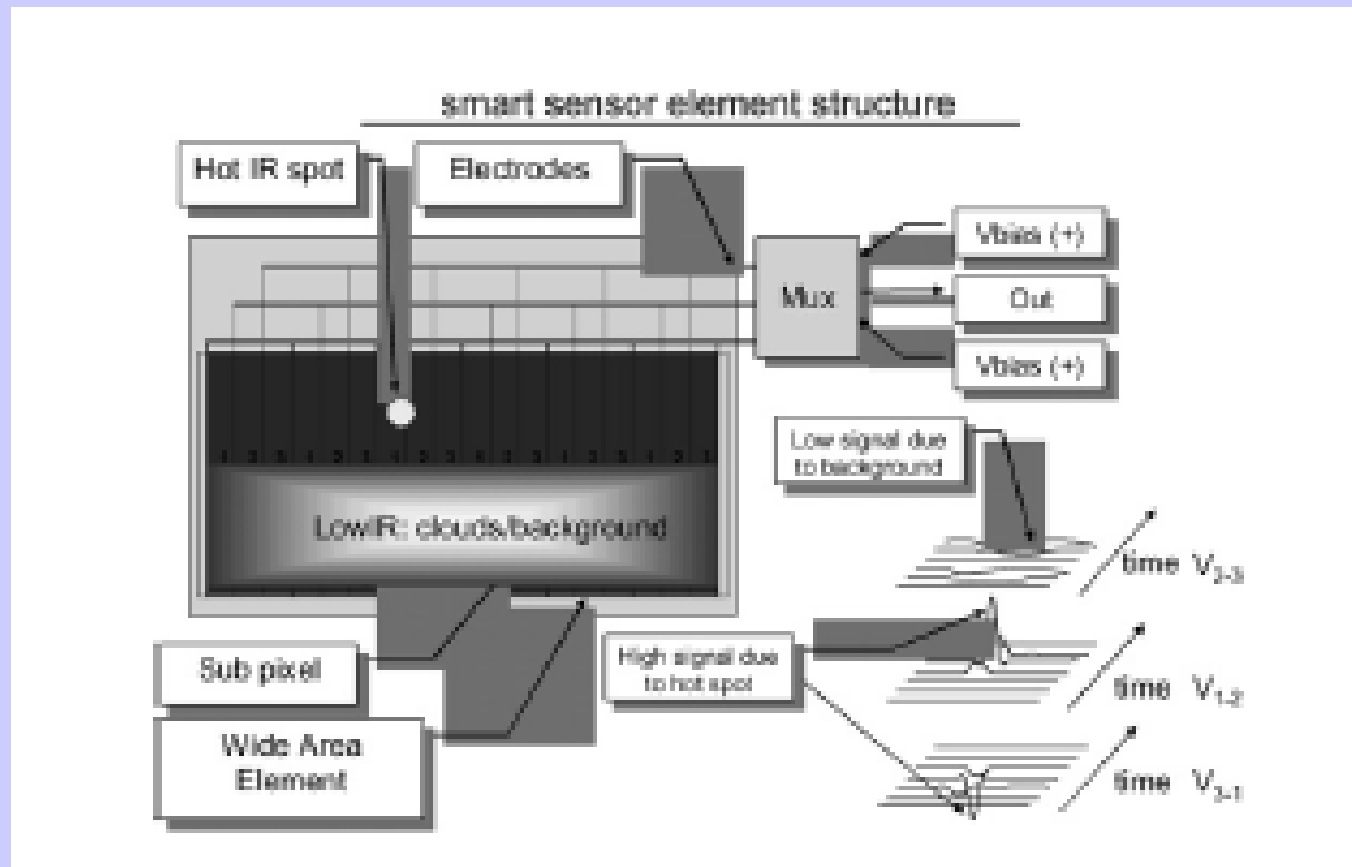
Microsistemas Inteligentes

- Independem do tempo de resposta do usuário;
- Possuem processamento local básico;
- Não são afetados por efeitos eletromagnéticos;
- Podem ser empregados em ambientes agressivos ou insalubres.

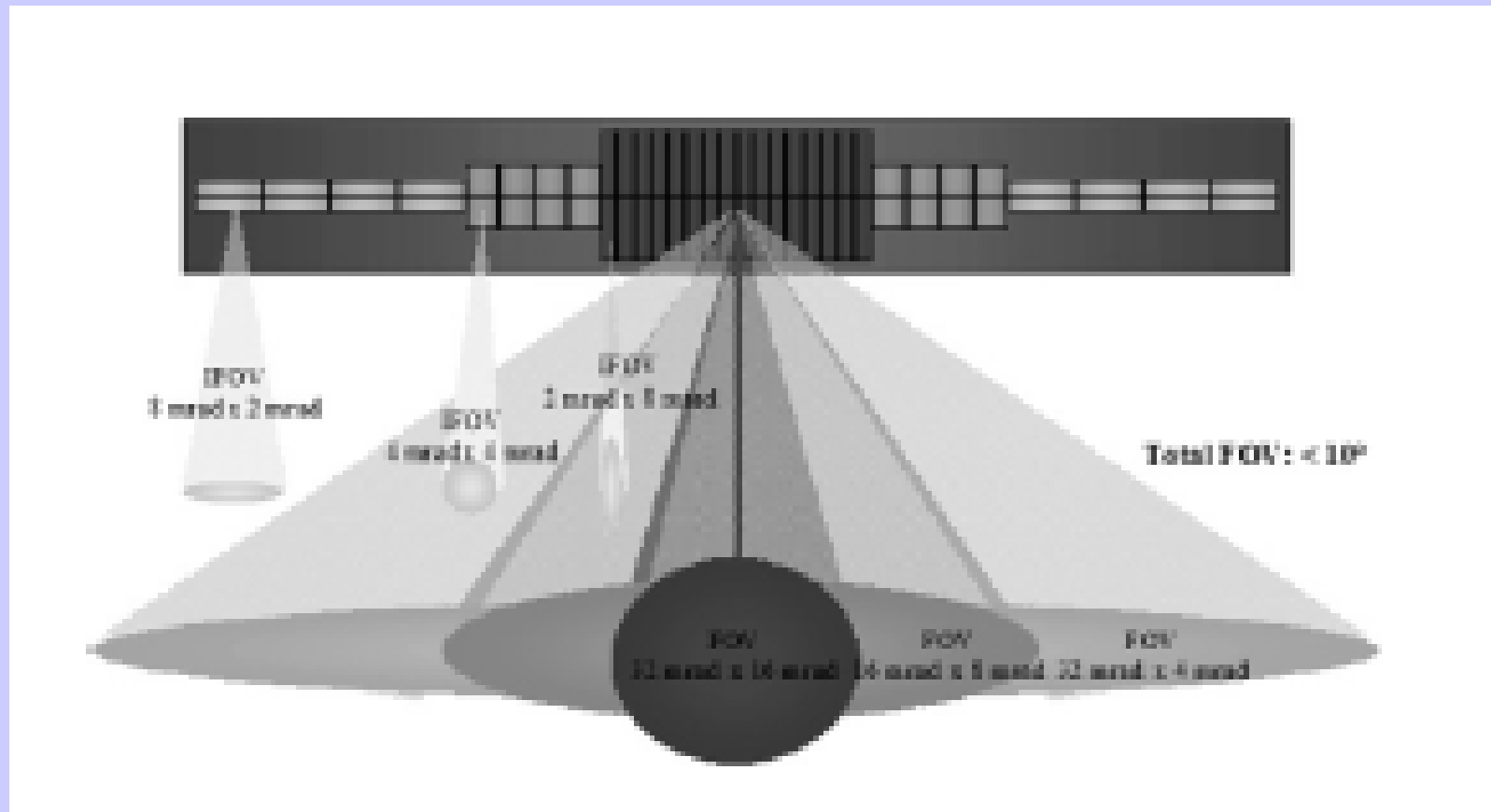
Microsistemas Inteligentes - Visão



Microsistemas Inteligentes – Visão Infra-Vermelho



Microsistemas Inteligentes – Visão - Posição



Microsistemas Inteligentes

- **Baixo Custo;**
- **Redução de cabos e conexões;**
- **Diagnostico remoto;**
- ***Multi-aplicações;**
- **Confiabilidade do sistema;**
- ***Melhora das características dos sensores;**

Multi-aplicações

- **Auto-calibração;**
- **Computação integrada;**
- **Comunicação (com ou sem fio);**
- **Multisensores ou multifuncionalidade.**

Melhora das características dos sensores

- **Redução da não-linearidade do sensor;**
- **Destinção da Multifuncionalidade;**
- **Ajuste de offset “in sito”;**
- **Ajuste imediato da variação dos parâmetros ou dos valores dos componentes.**

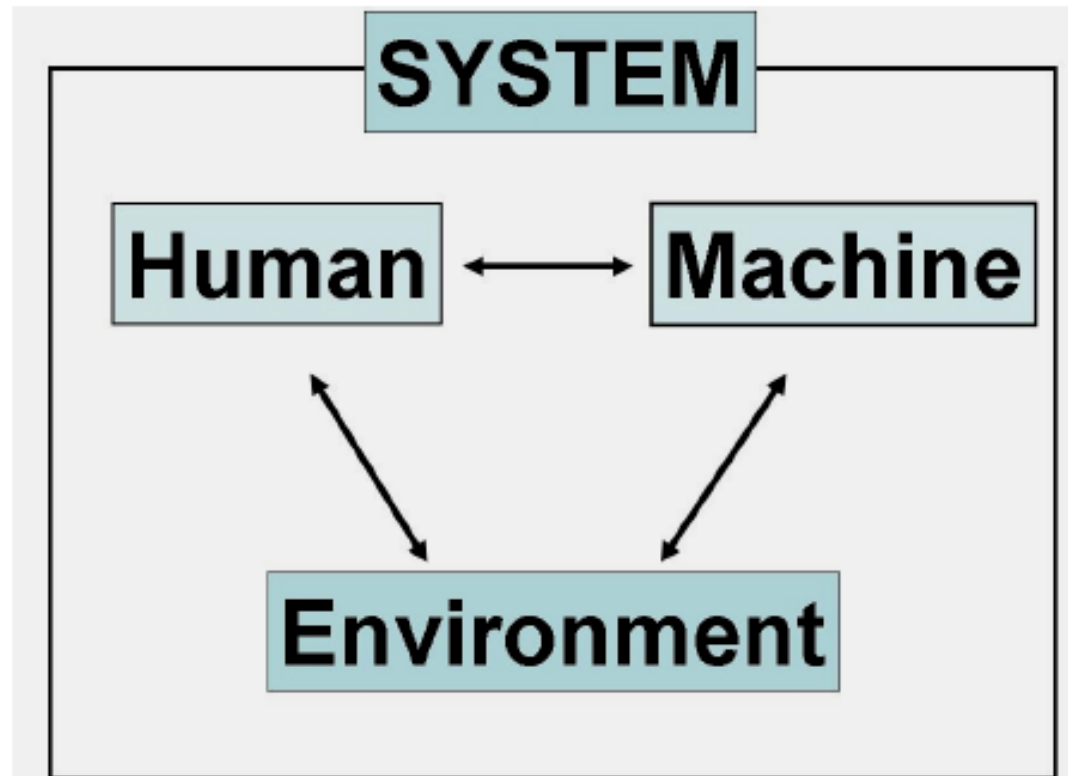
Domínios da análise

Sinais Elétricos	voltagem, corrente, resistência, capacitância
Sinais Radiantes	intensidade luminosa, comprimento de onda, polarização ou fase.
Sinais Mecânicos	força, pressão, velocidade, inclinação, vazão, espessura.
Sinais Térmicos	Temperatura, calor, entropia, condutividade térmica.
Sinais Magnéticos	Intensidade de campo, densidade de fluxo, permeabilidade.
Sinais Químicos	Concentração, toxidade, pH, potencial de redução.

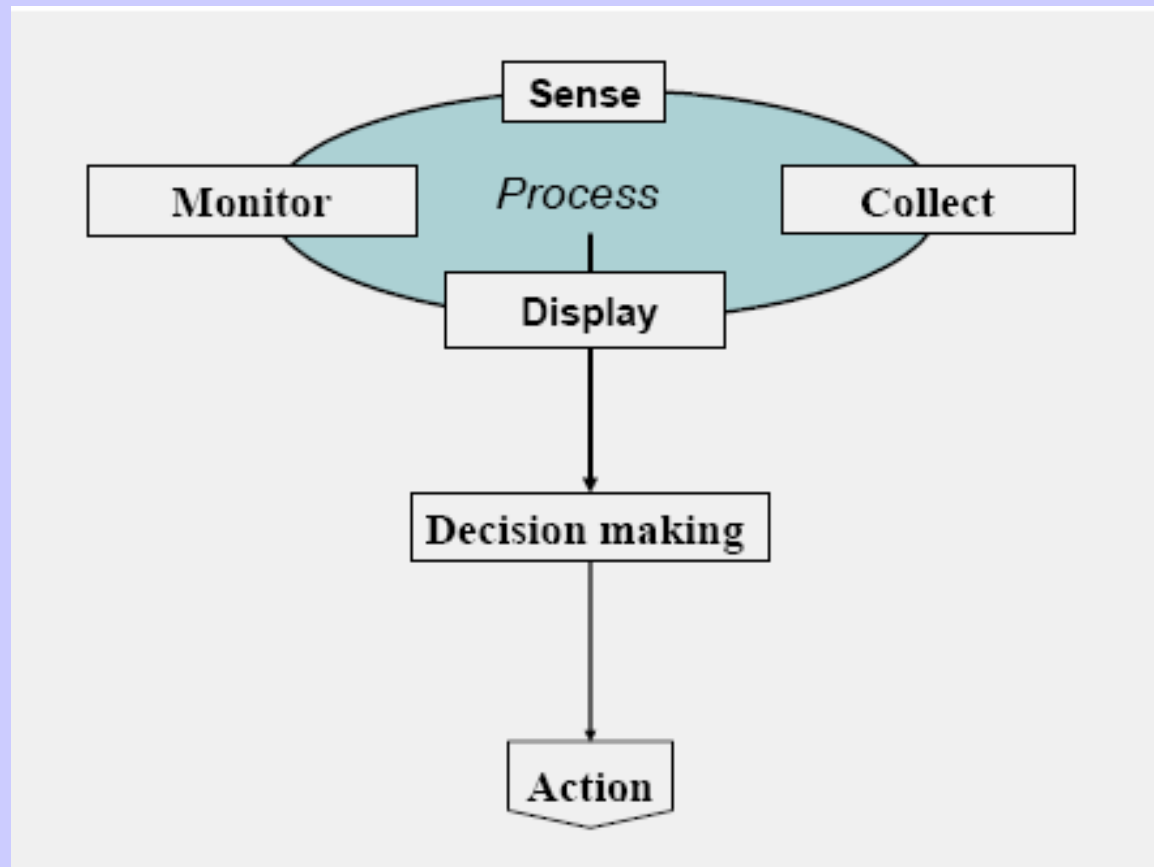
Tipos de transdução

Sinais Elétricos	voltagem, corrente, resistência, capacitância	
Sinais Radiantes	Efeito foto-elétrico	Fototransistor, foto diodo, LDR
Sinais Mecânicos	Piezo-resistividade, capacitância, resistividade	Sensor de pressão, acelerometro
Sinais Térmicos	Efeito Seebeck, resistividade, tensão	Termopares, PT 100, NTC, PTC
Sinais Magnéticos	Efeito Hall, corrente	Sensor Hall, indutores
Sinais Químicos	Absorção de íons	pH ou ISFET

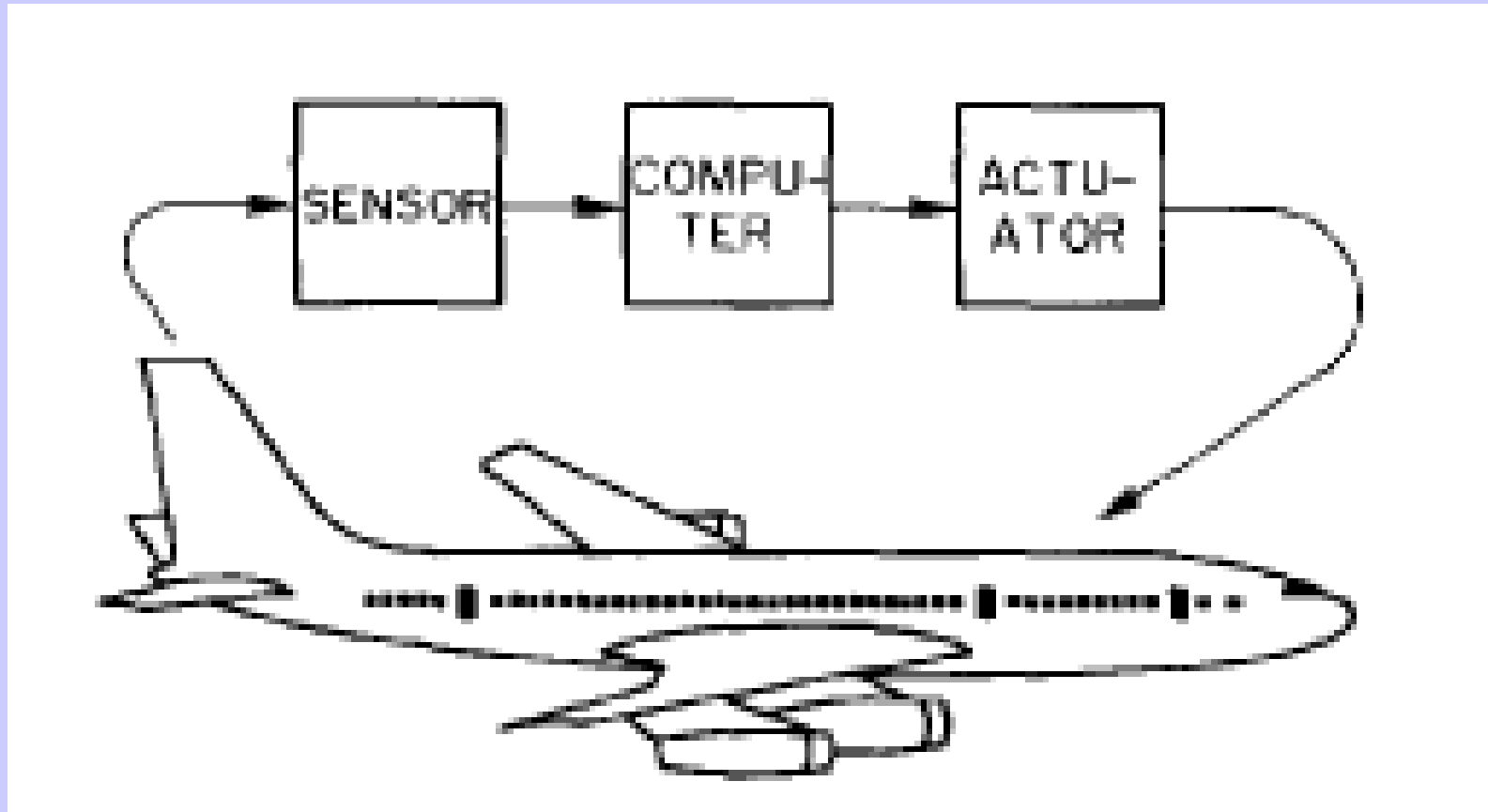
Sistema Convencional



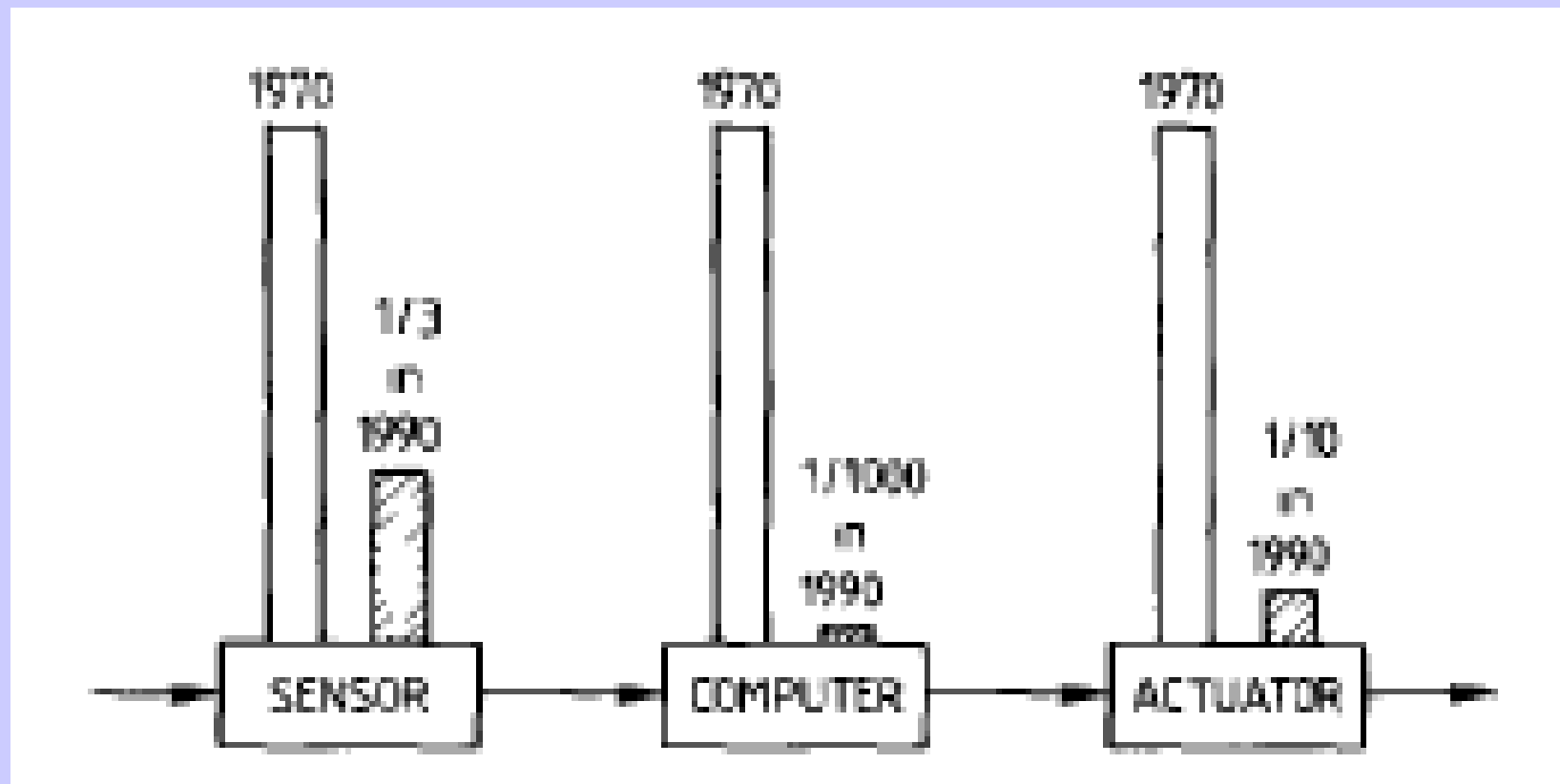
Sistema baseado em smart microsystems



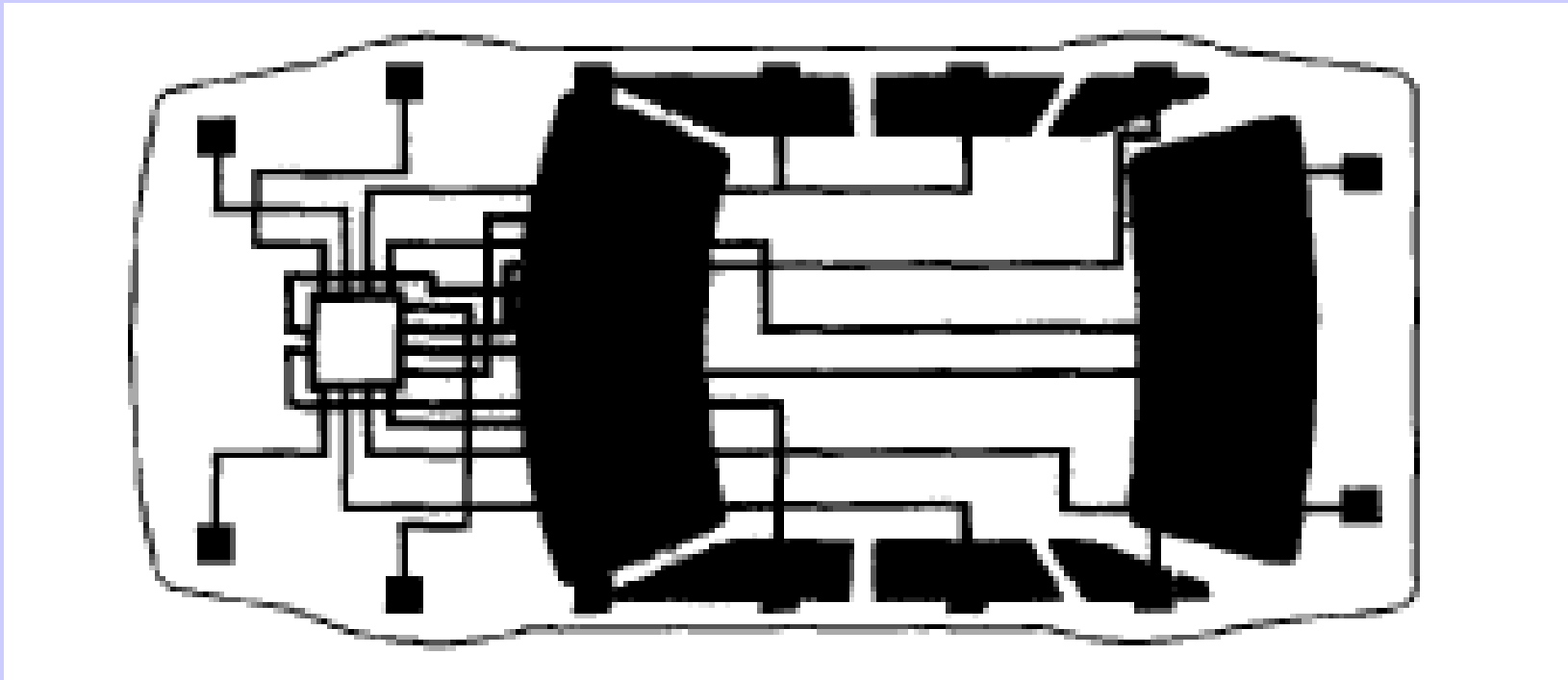
Sistemas Embarcados



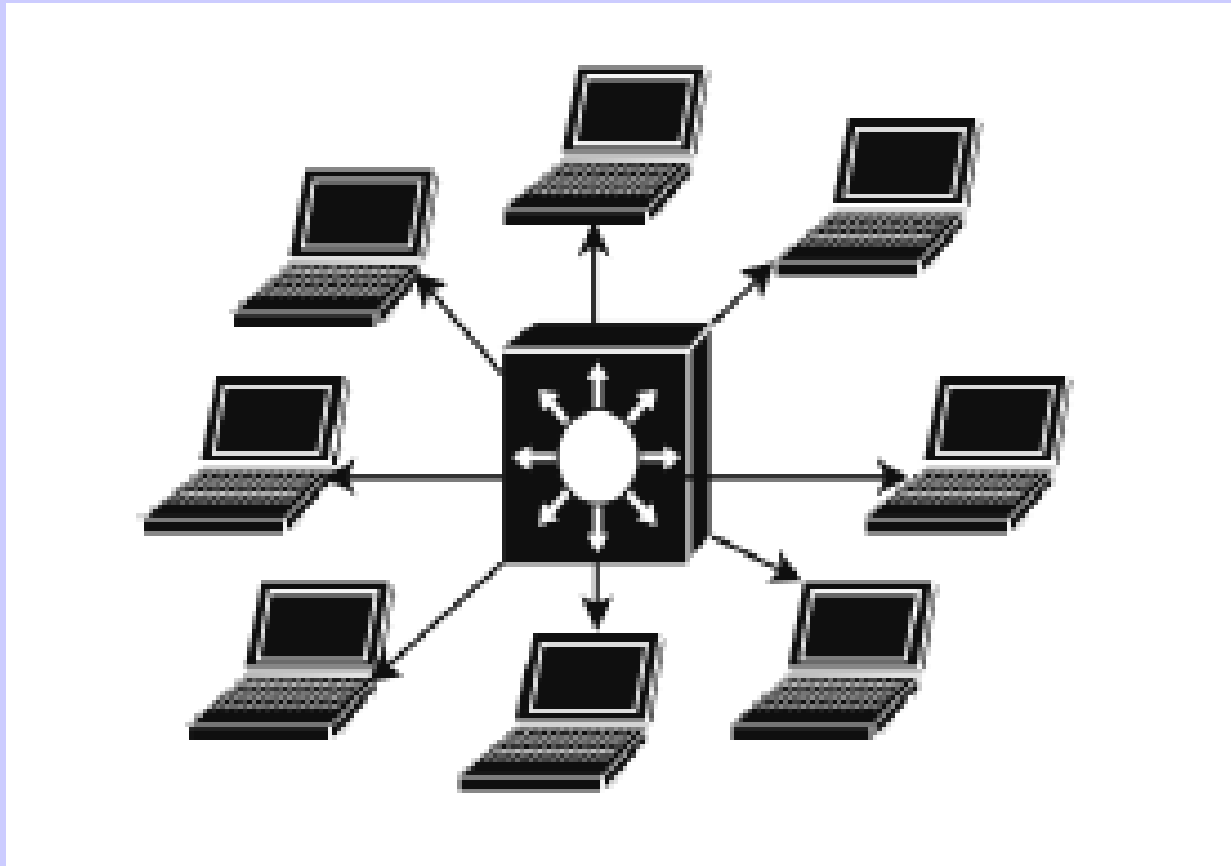
Custo dos Sistemas Inteligentes



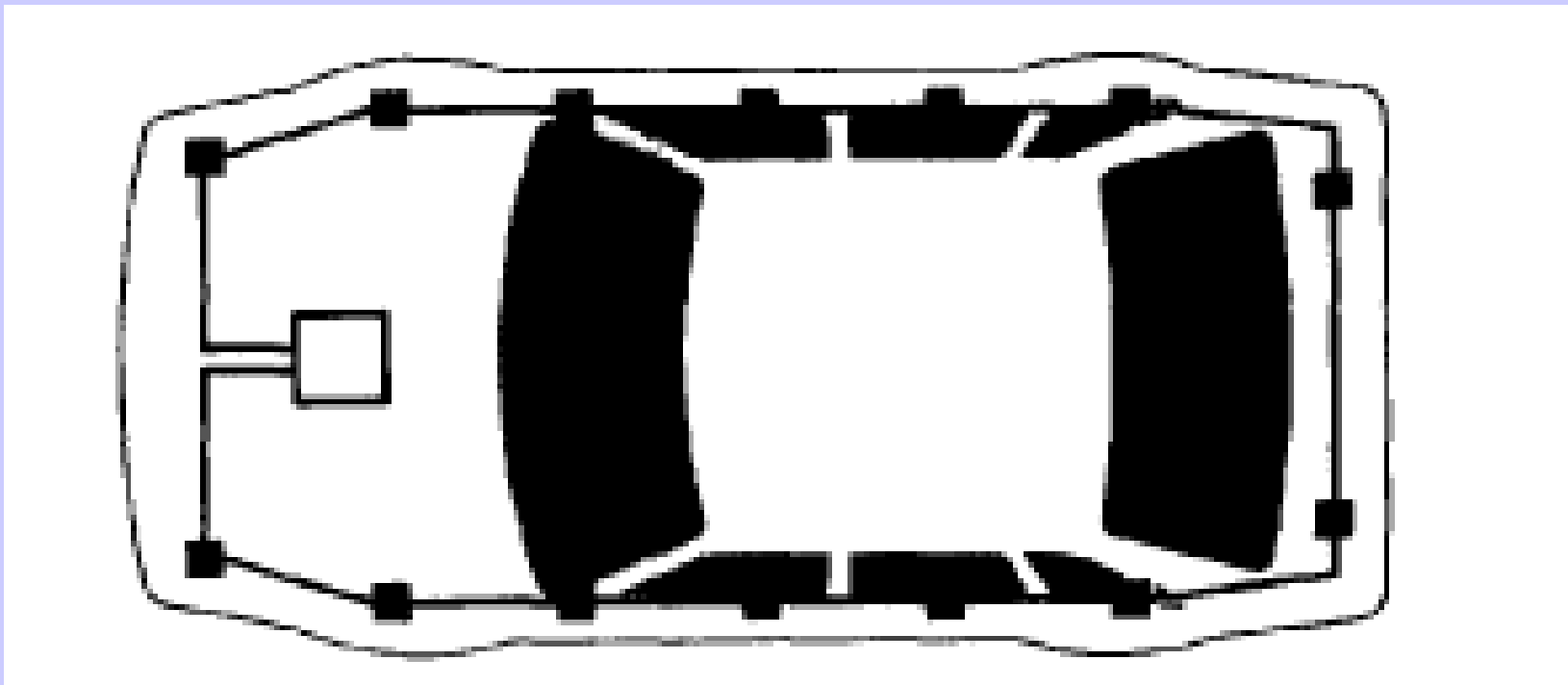
Sistema Centralizado



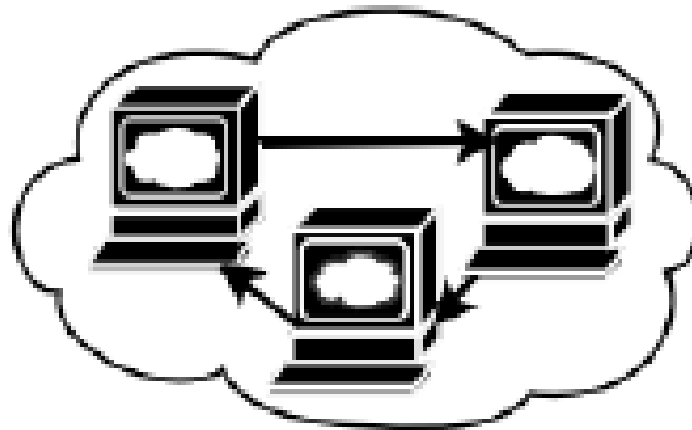
Sistema Centralizado



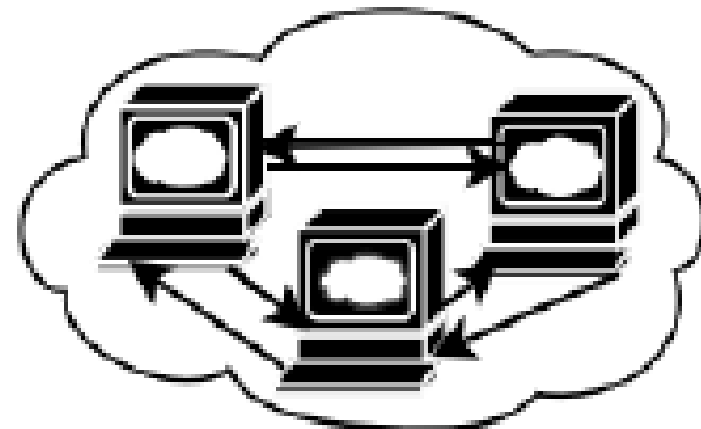
Sistema Distribuido



Sistema Distribuido em Anel

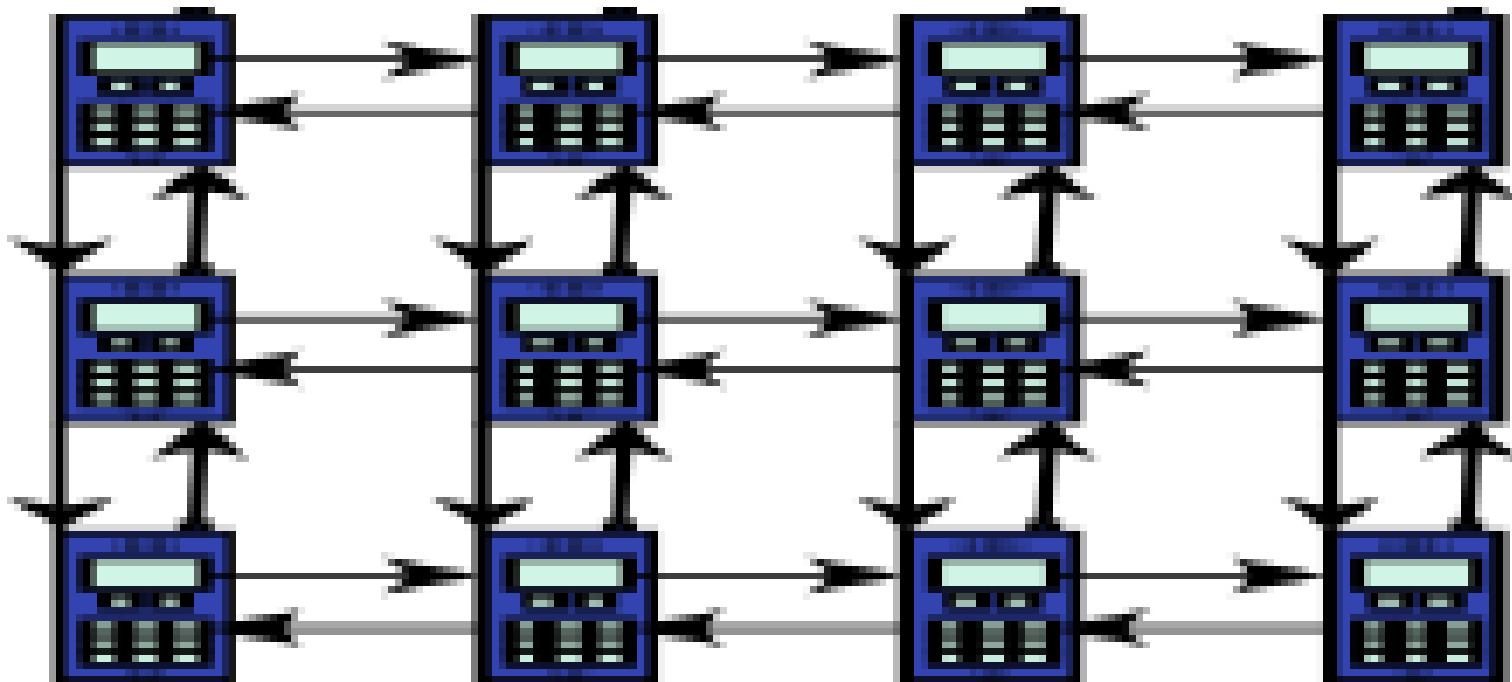


Single Direction Ring

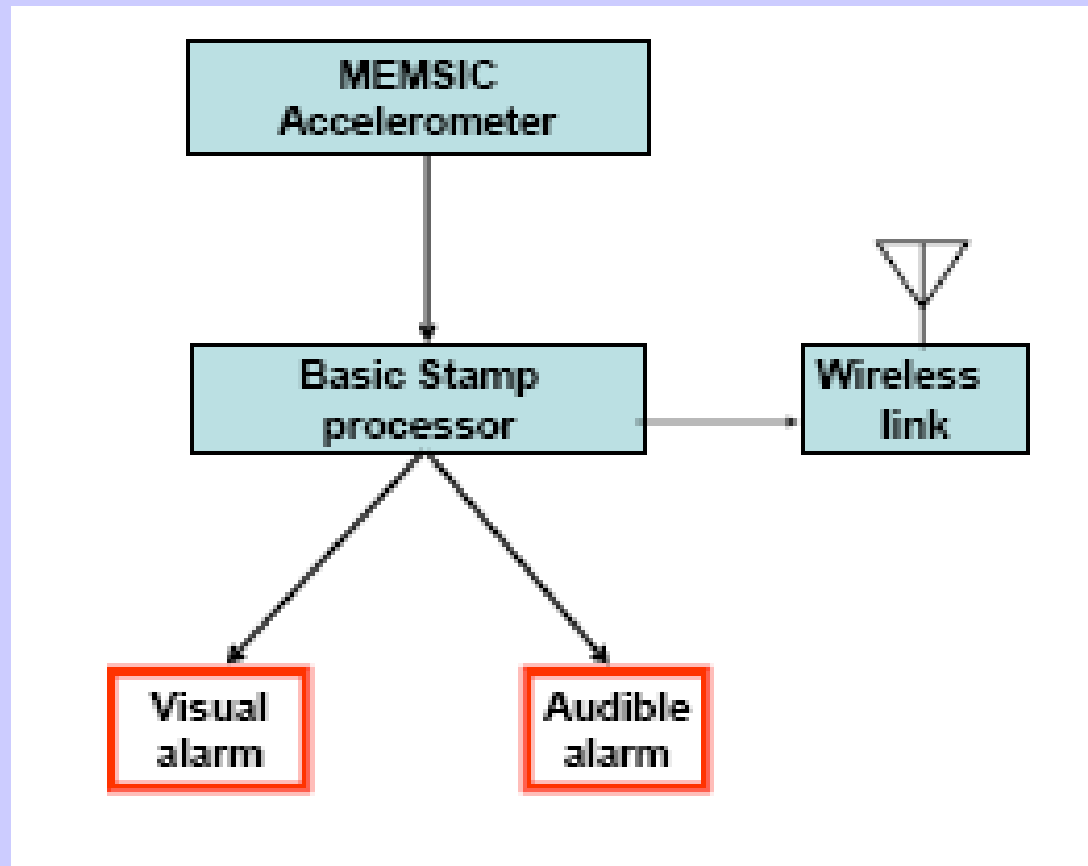


Bidirectional Ring

Sistema Distribuido em Malha



Esquema Básico



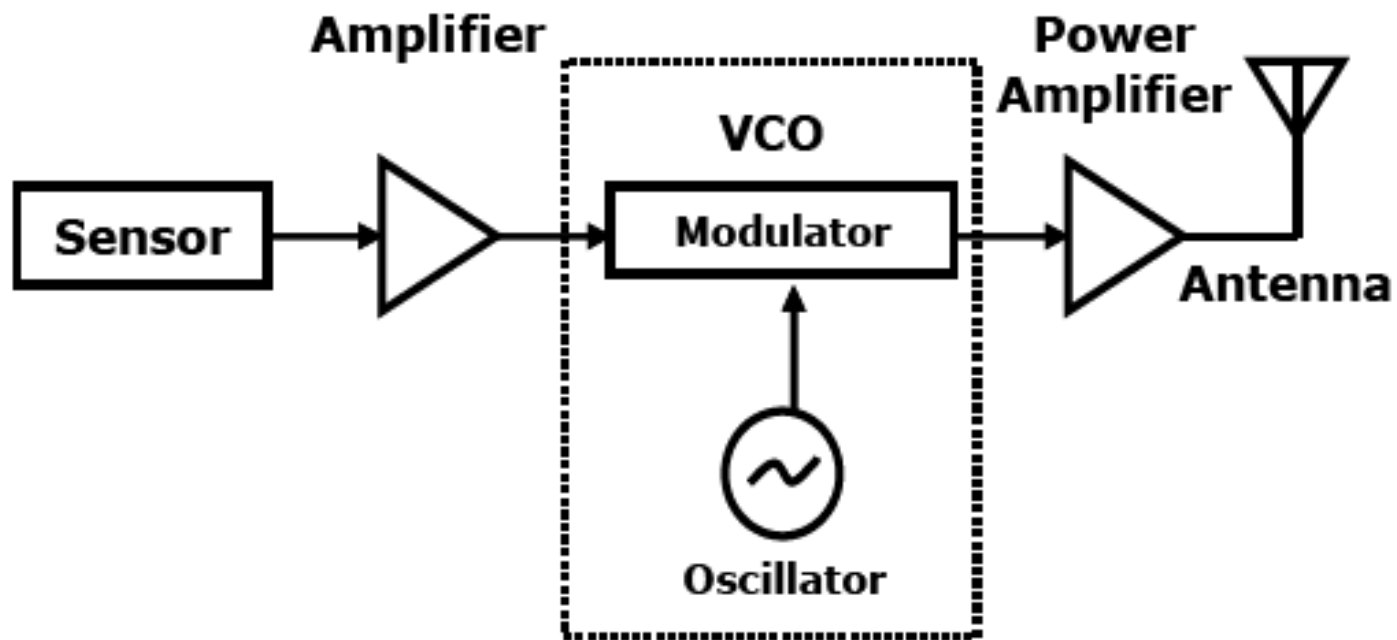
Esquema Básico

**Table 1.—The key specifications of the BASIC Stamp microcontroller
(adapted from Parallax [2006])**

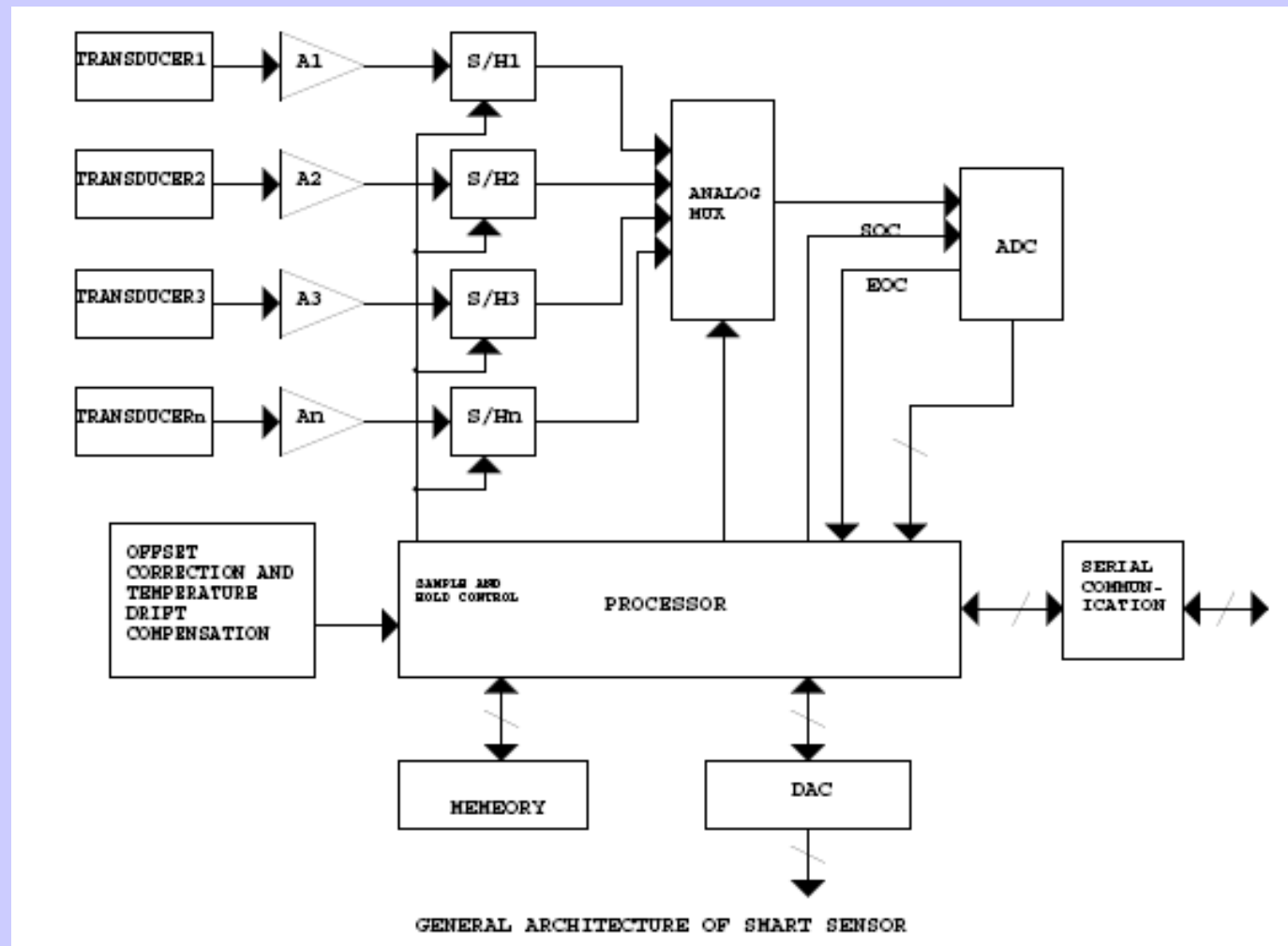
Processor speed	20 MHz
Program execution speed	~4,000 instructions per second
RAM	32 bytes (6 I/O, 26 variable)
EEPROM.....	2 Kbytes, ~500 instructions
Input/output (I/O)	16 + 2 dedicated serial
Voltage requirements	5–15 V dc
Current draw at 5 V	3 mA run / 50 μ A sleep
Physical size.....	1.2 in \times 0.6 in \times 0.4 in
Cost	~\$49 single; \$39 each for 1,000



Sistema Completo



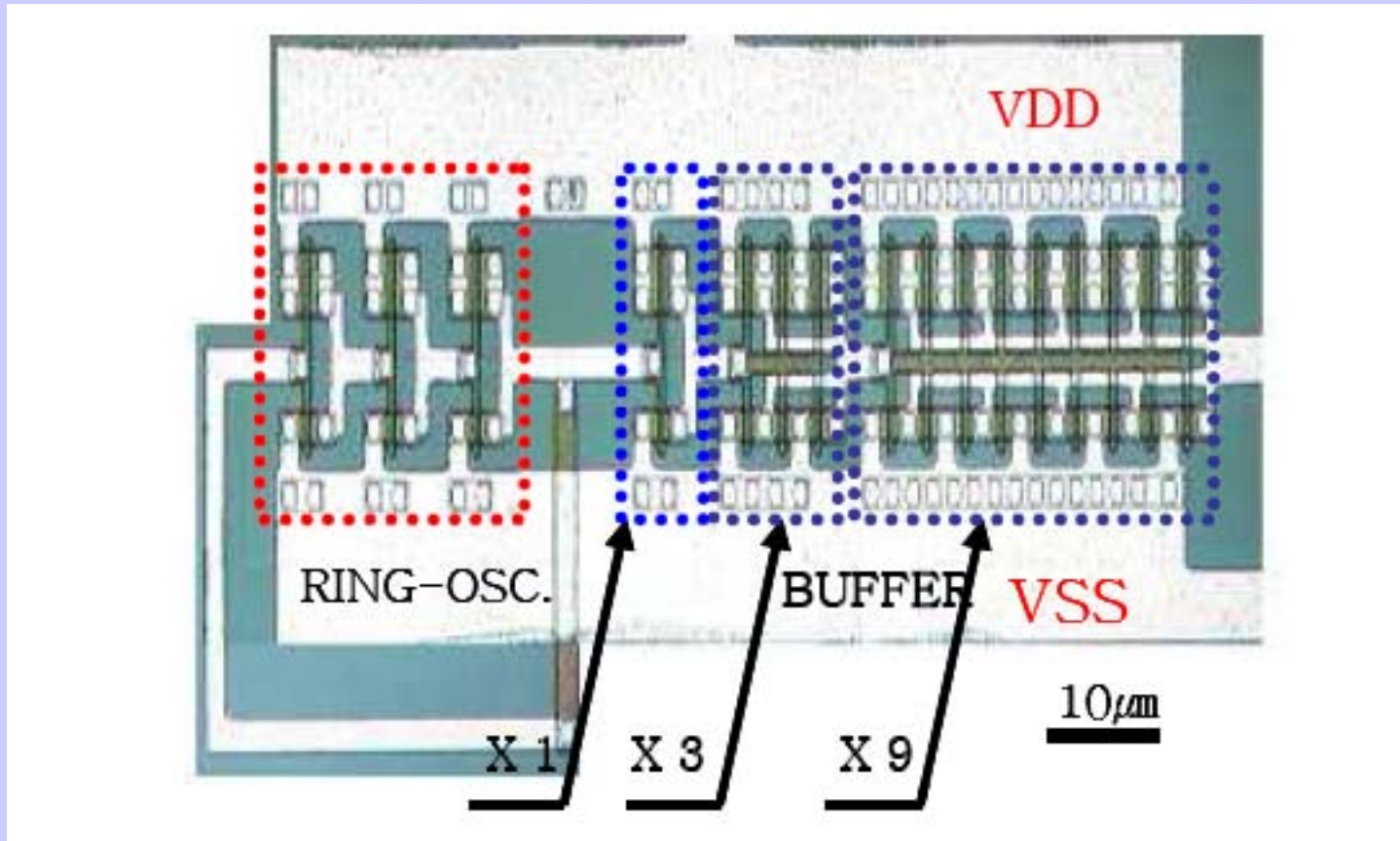
Sistema Completo



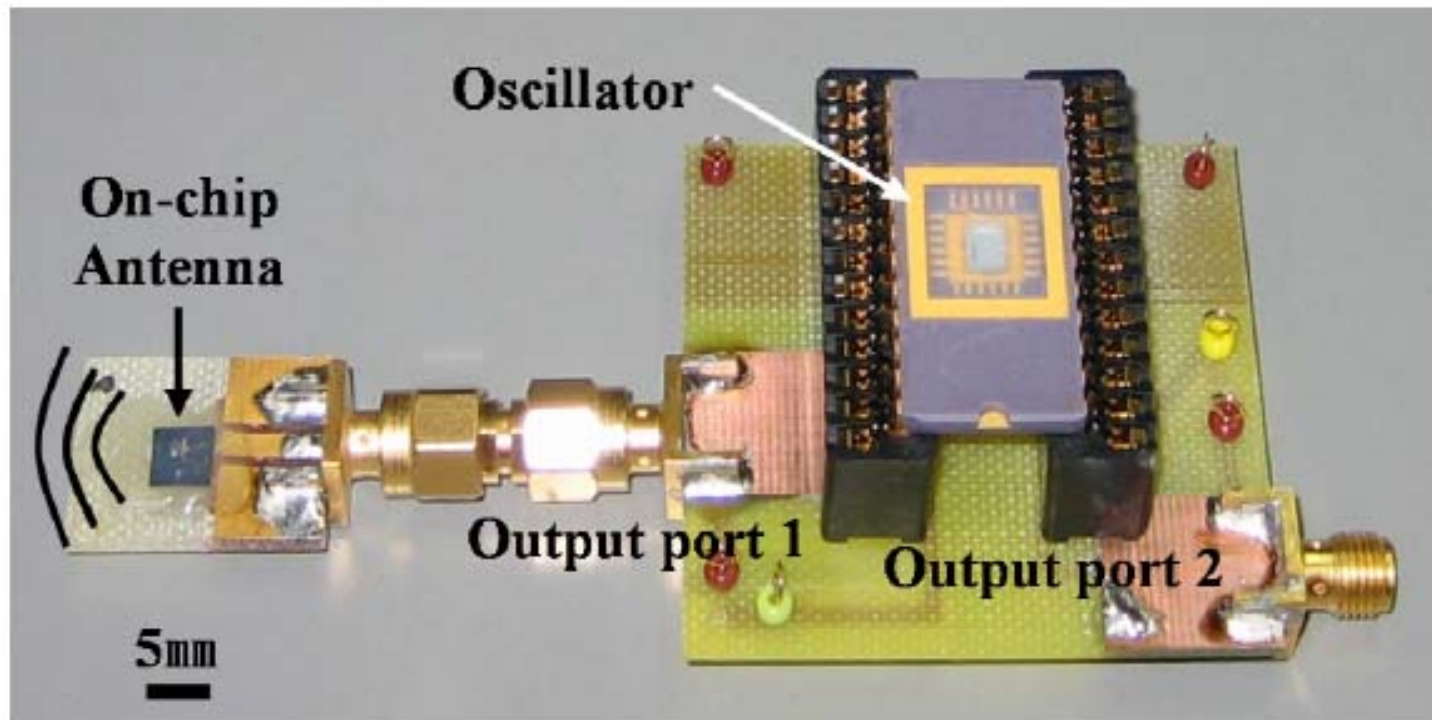
Sistema Completo

- Sensor;
- Entrada de sinal analógico;
- Conversão de dados;
- Interface digital;
- Monitoramento e diagnóstico;
- Processador;
- Comunicação.

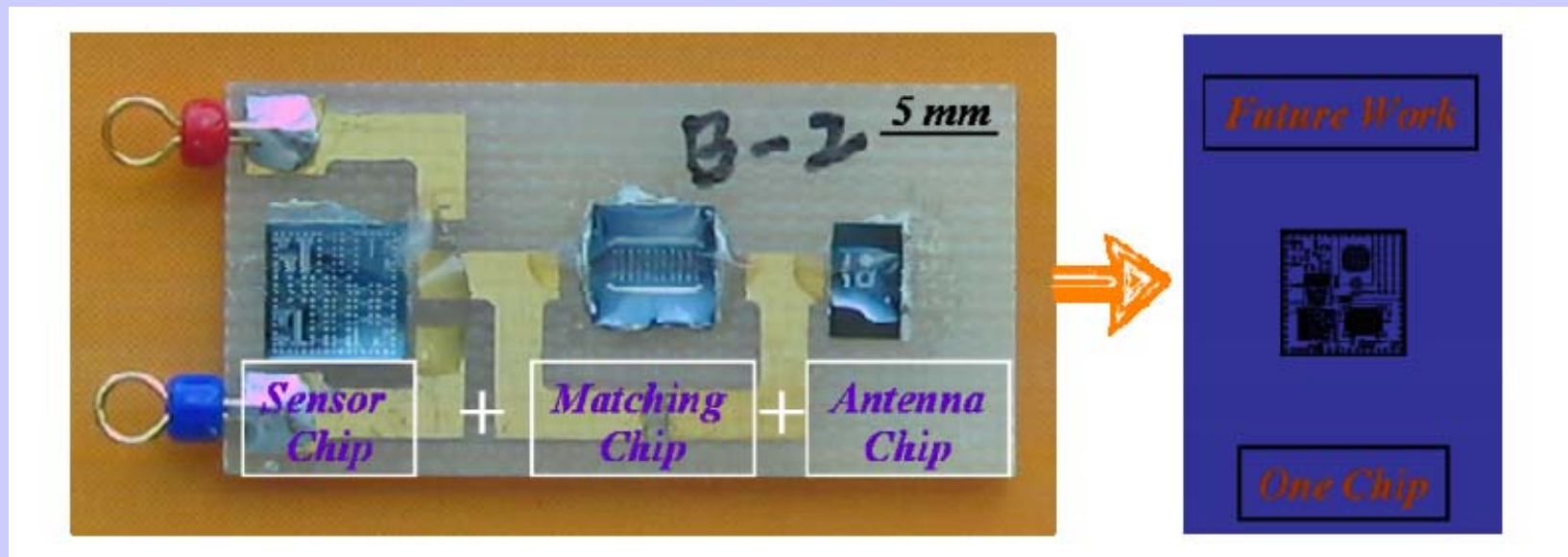
Micro Sistema Integrado



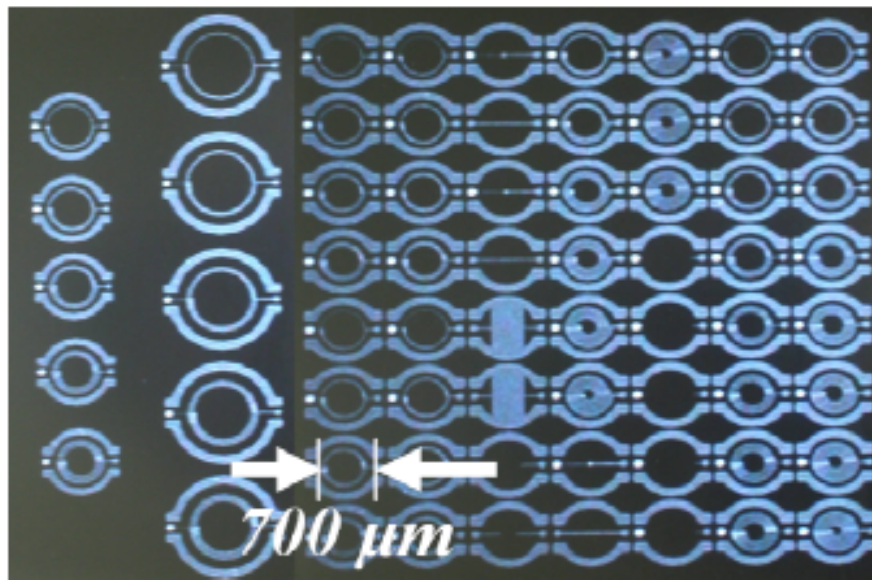
Micro Sistema Hibrido



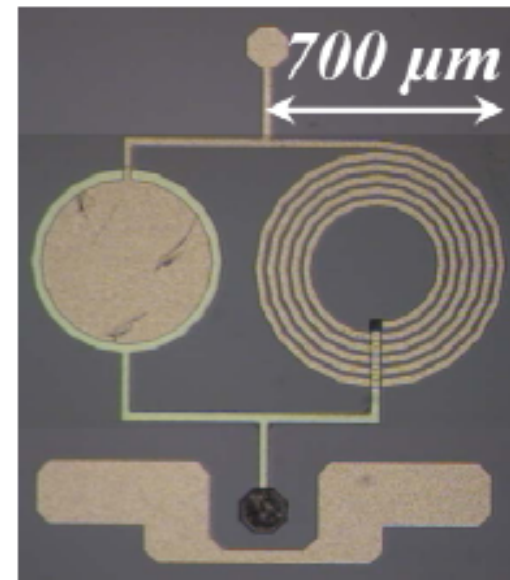
Micro Sistema Hibrido



Antenas Integradas

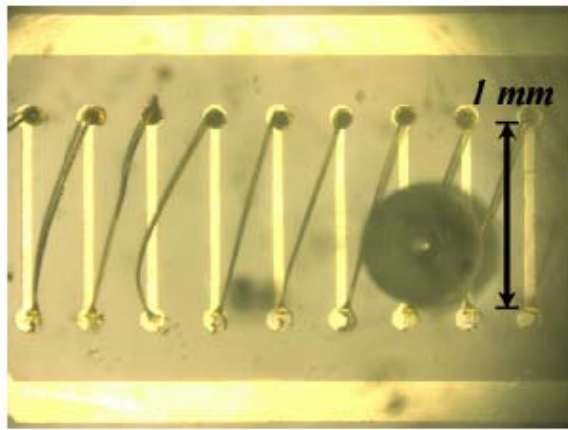


(a)



(b)

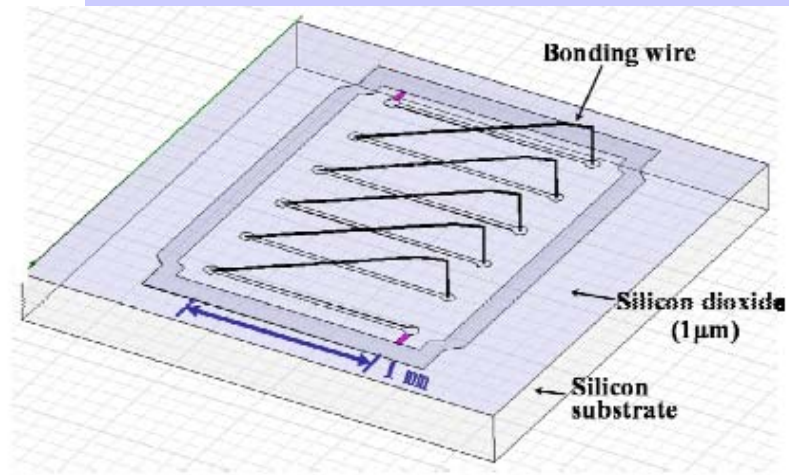
Antenas Integradas



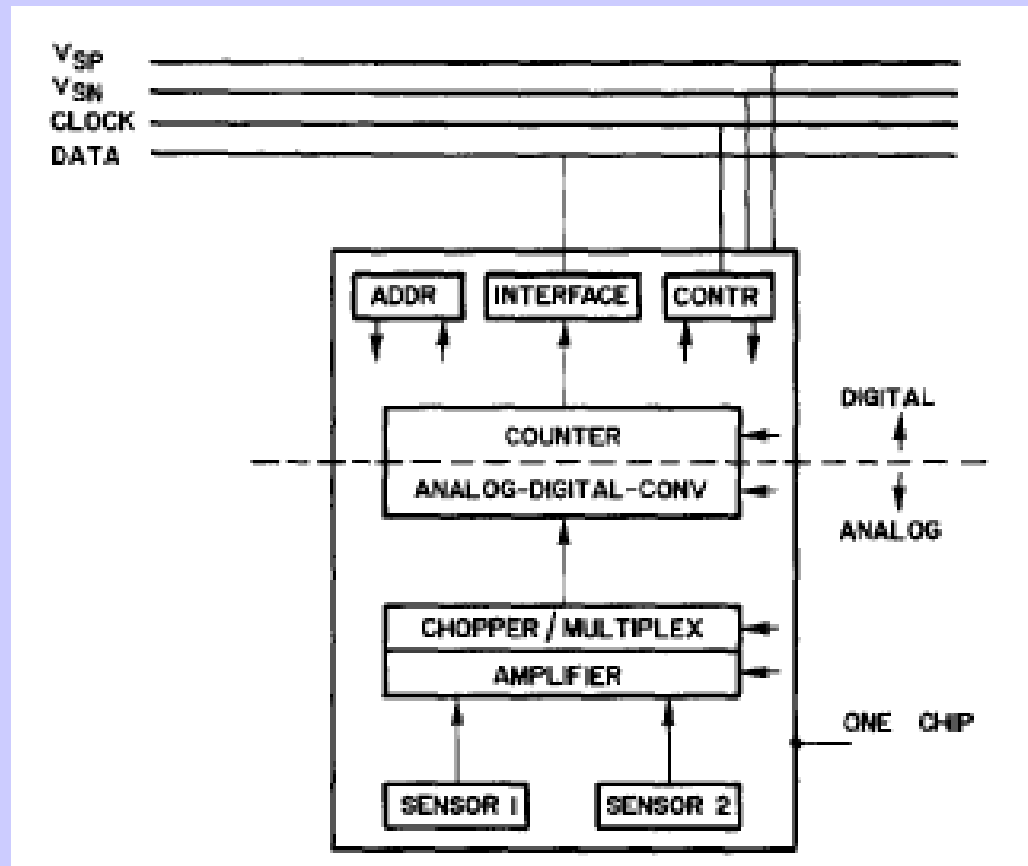
(a)



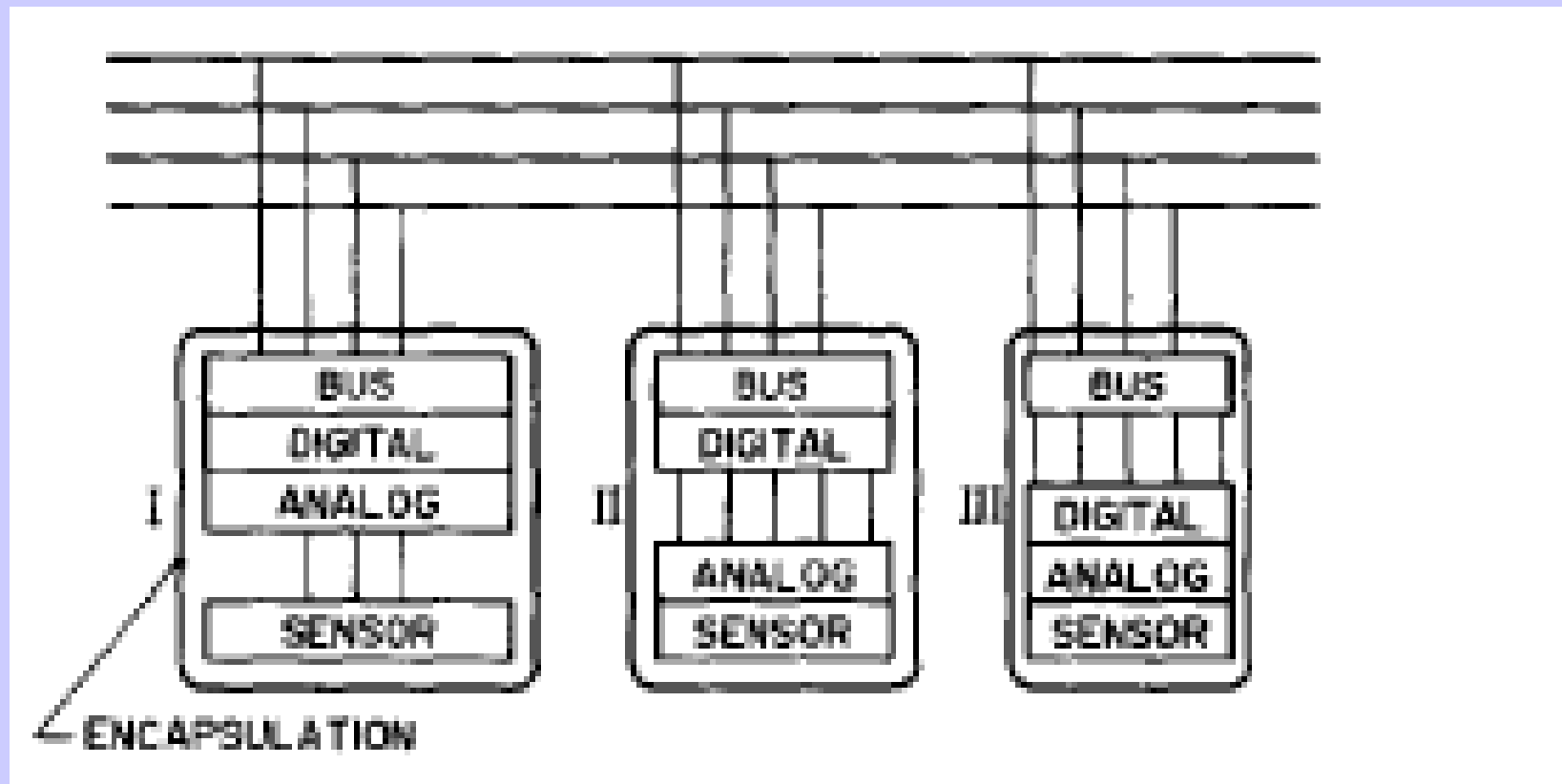
(b)



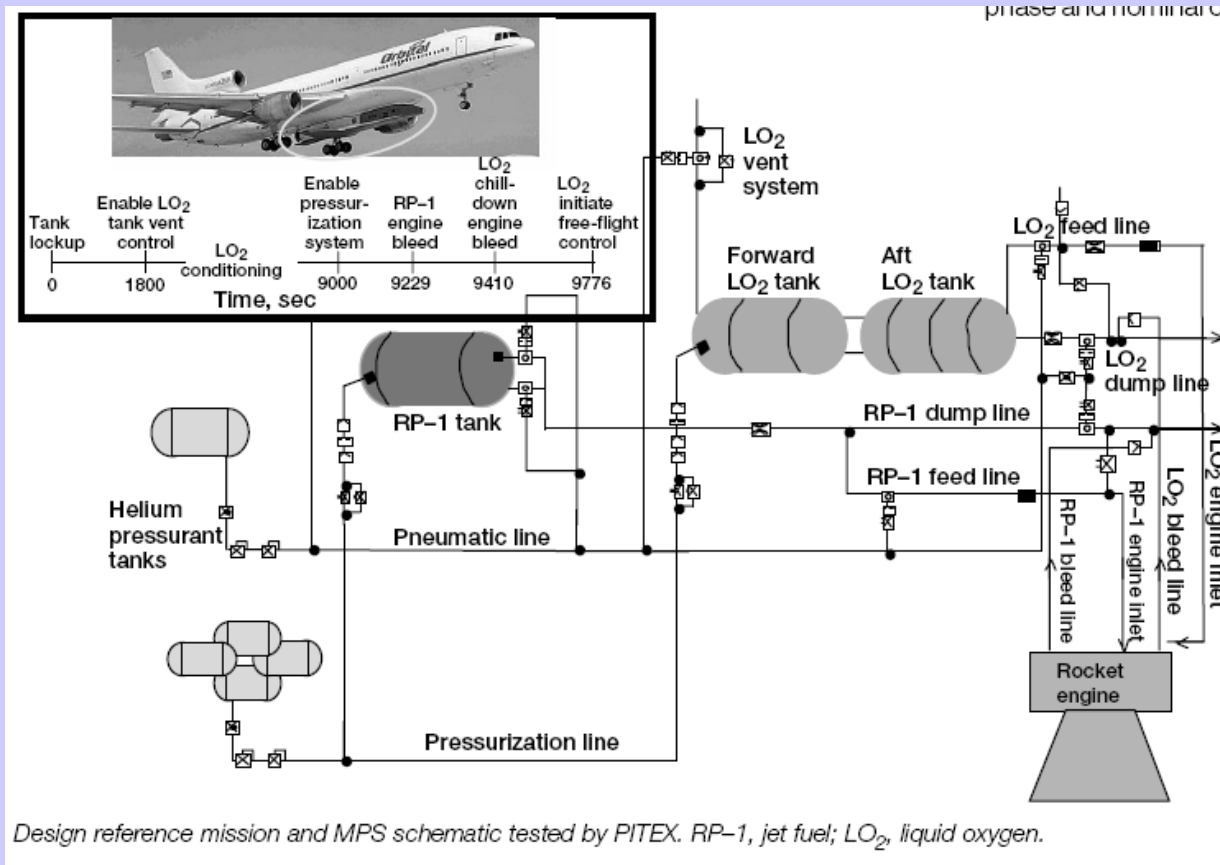
Smart-Microsystem



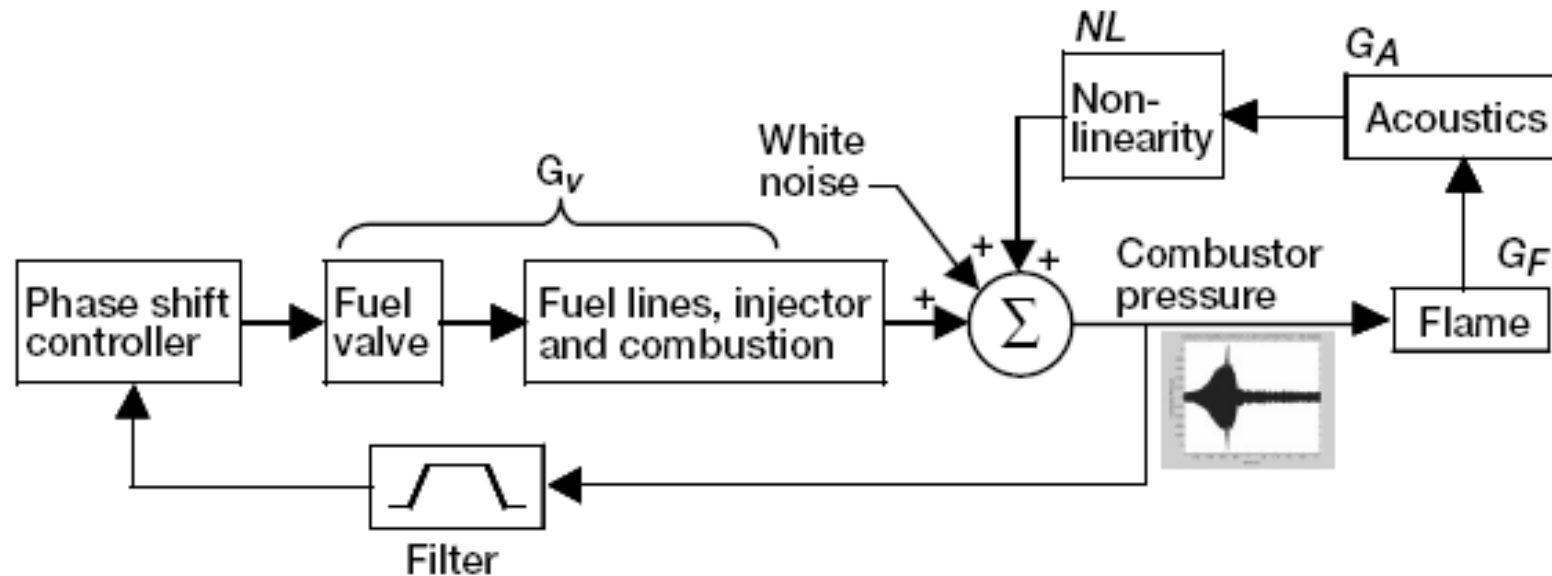
Smart-Microsystem Encapsulamento



Sistemas Embarcados Aeronáuticos

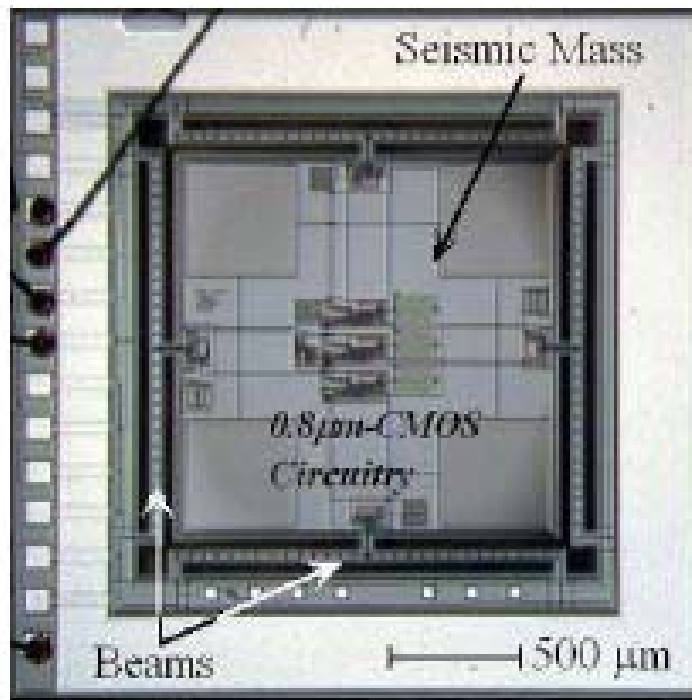


Sistemas Embarcados Aeronáuticos

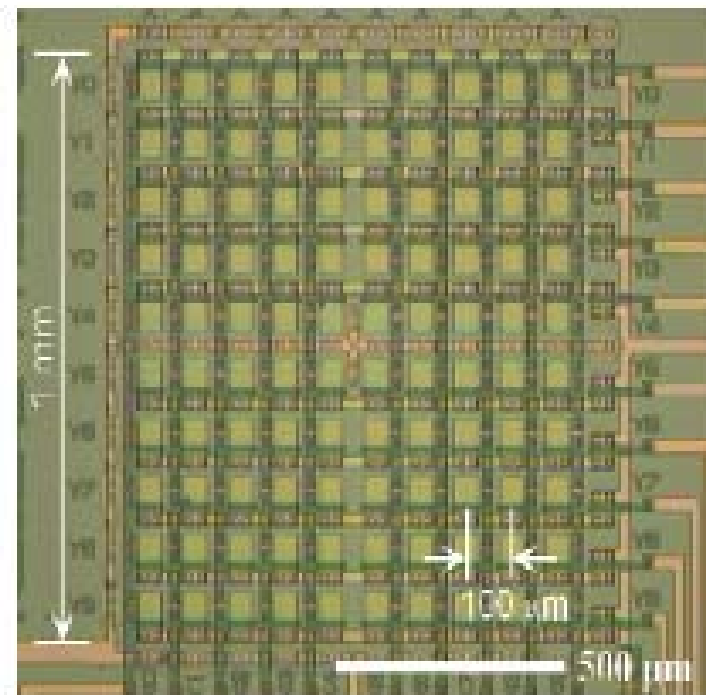


Combustion instability control block diagram. G_V , G_F , and G_A are transfer functions of the associated combustion processes reflected in the figure; NL is a damping nonlinearity that restricts the amplitude of the opened-loop self-excited instability.

Sistemas Embarcados Aeronáuticos (Acelerômetros e Detetores de potencial zero)

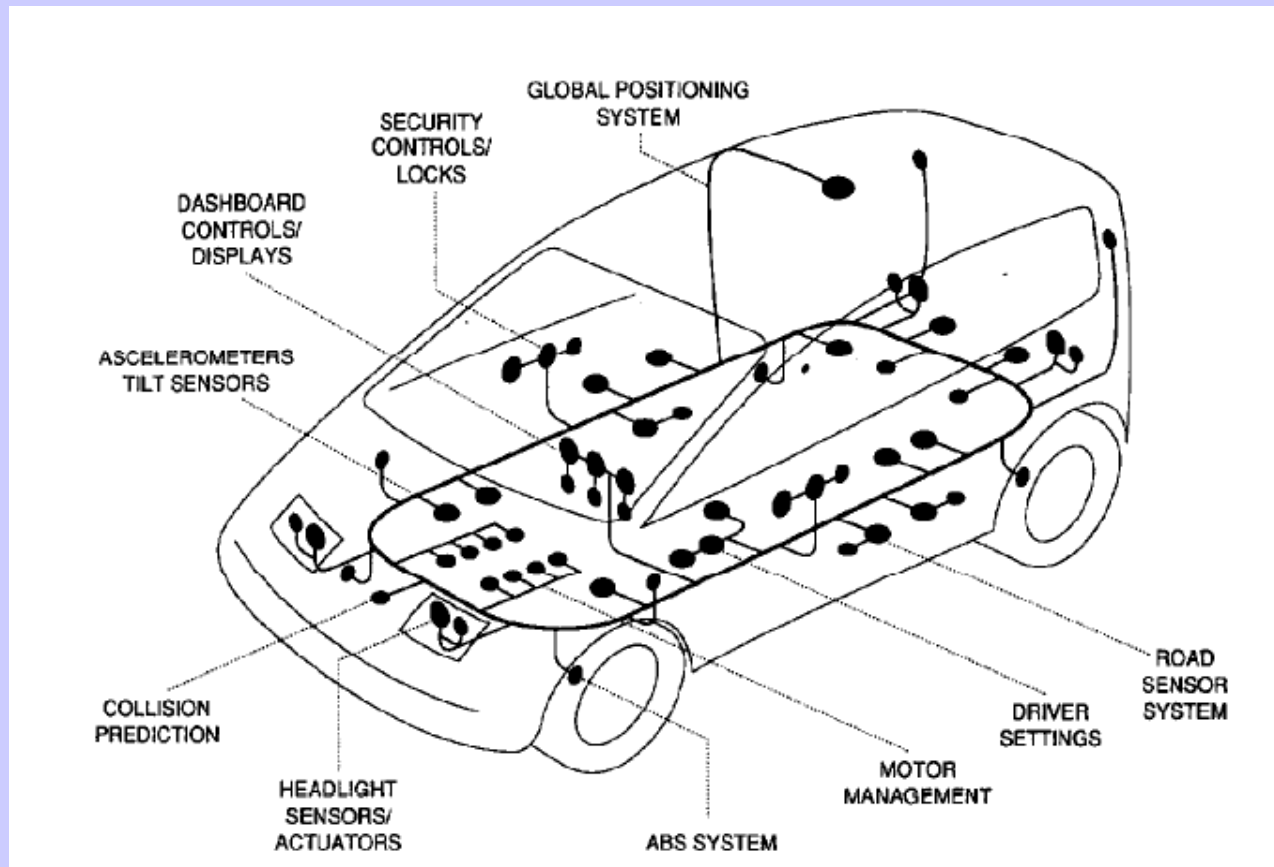


(a)

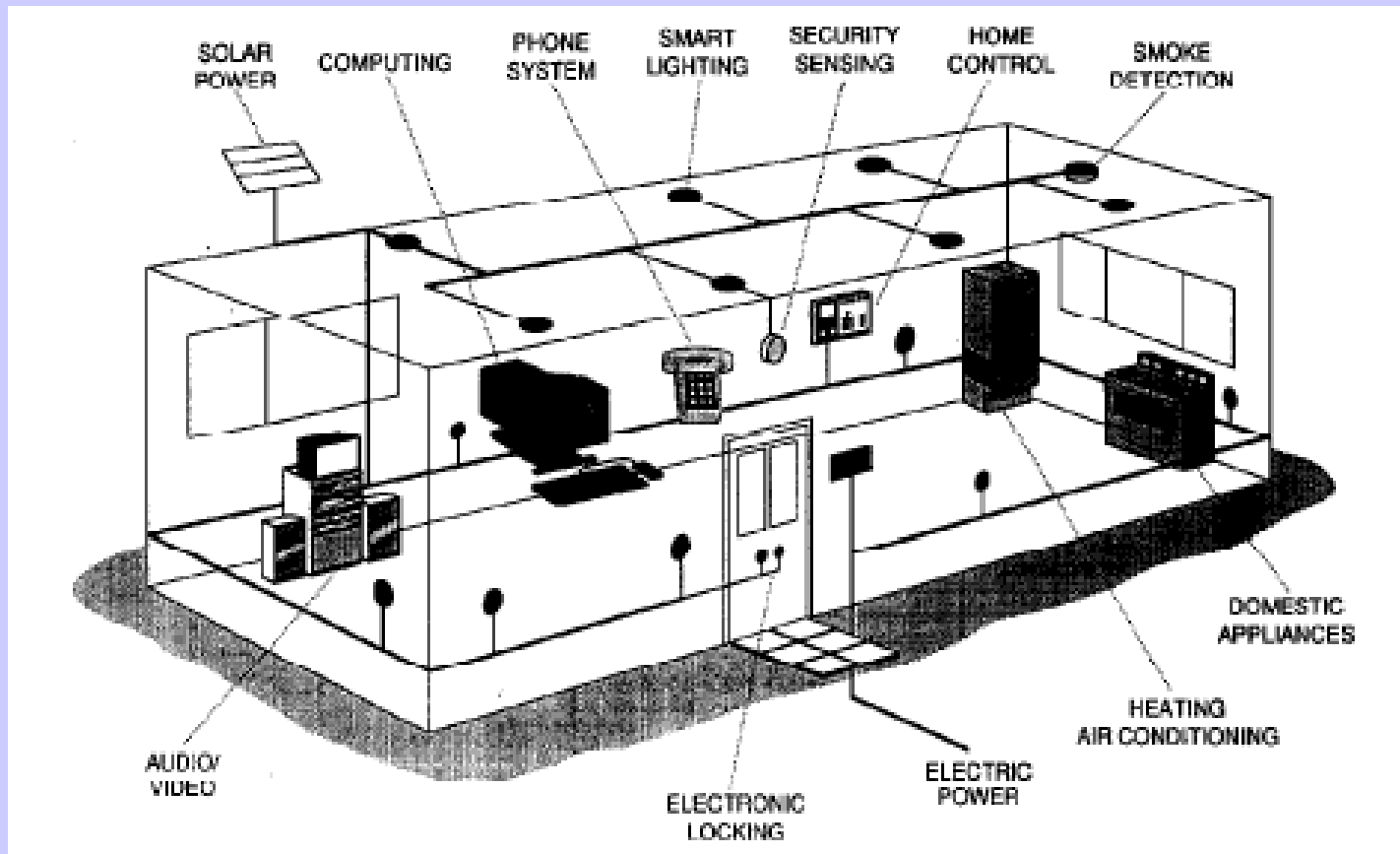


(b)

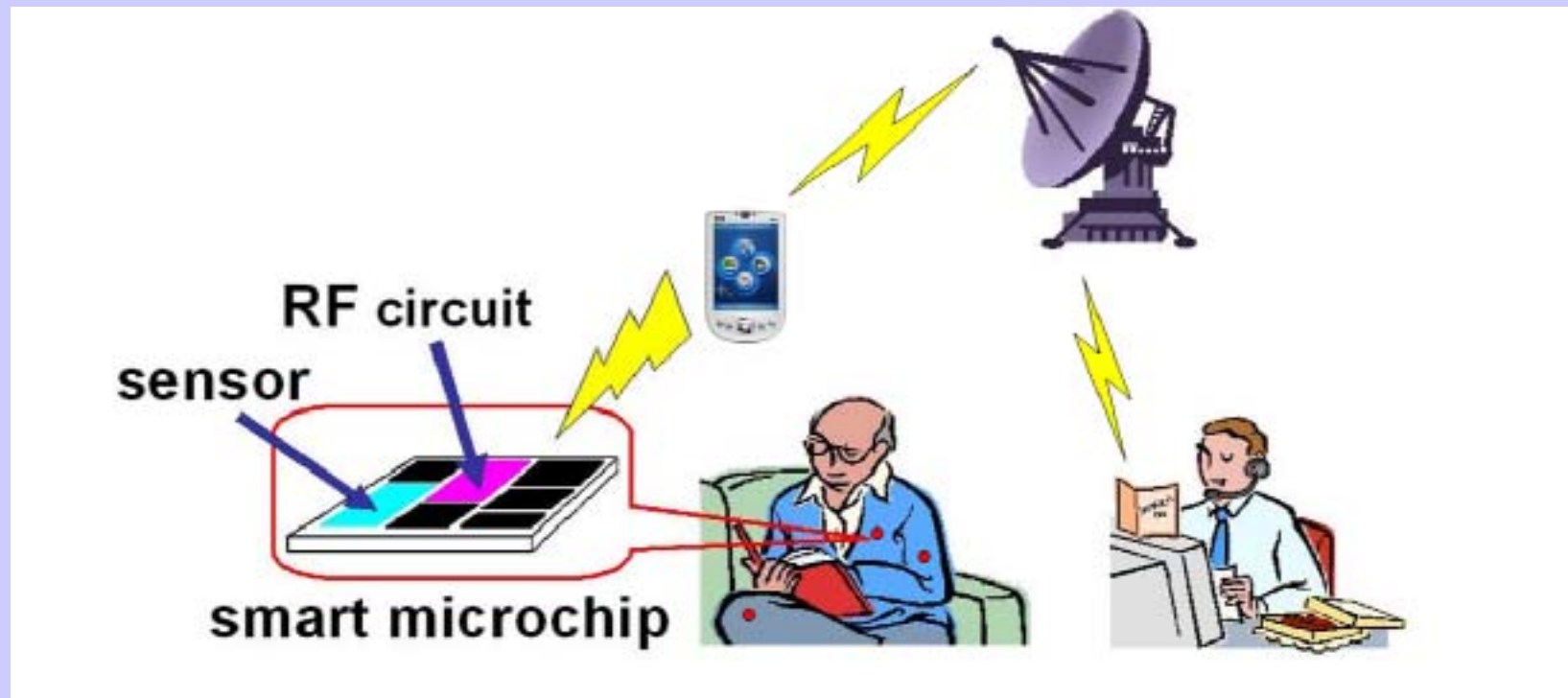
Sistemas Embarcados Automotivos



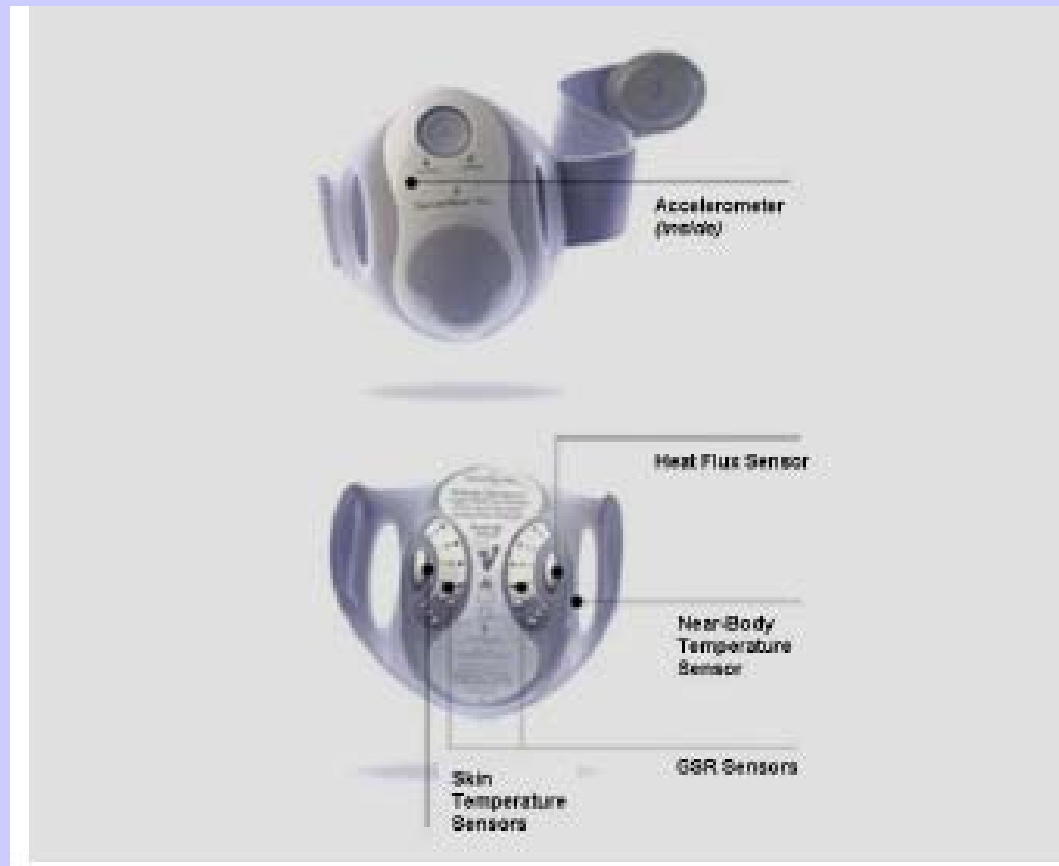
Sistemas Residenciais



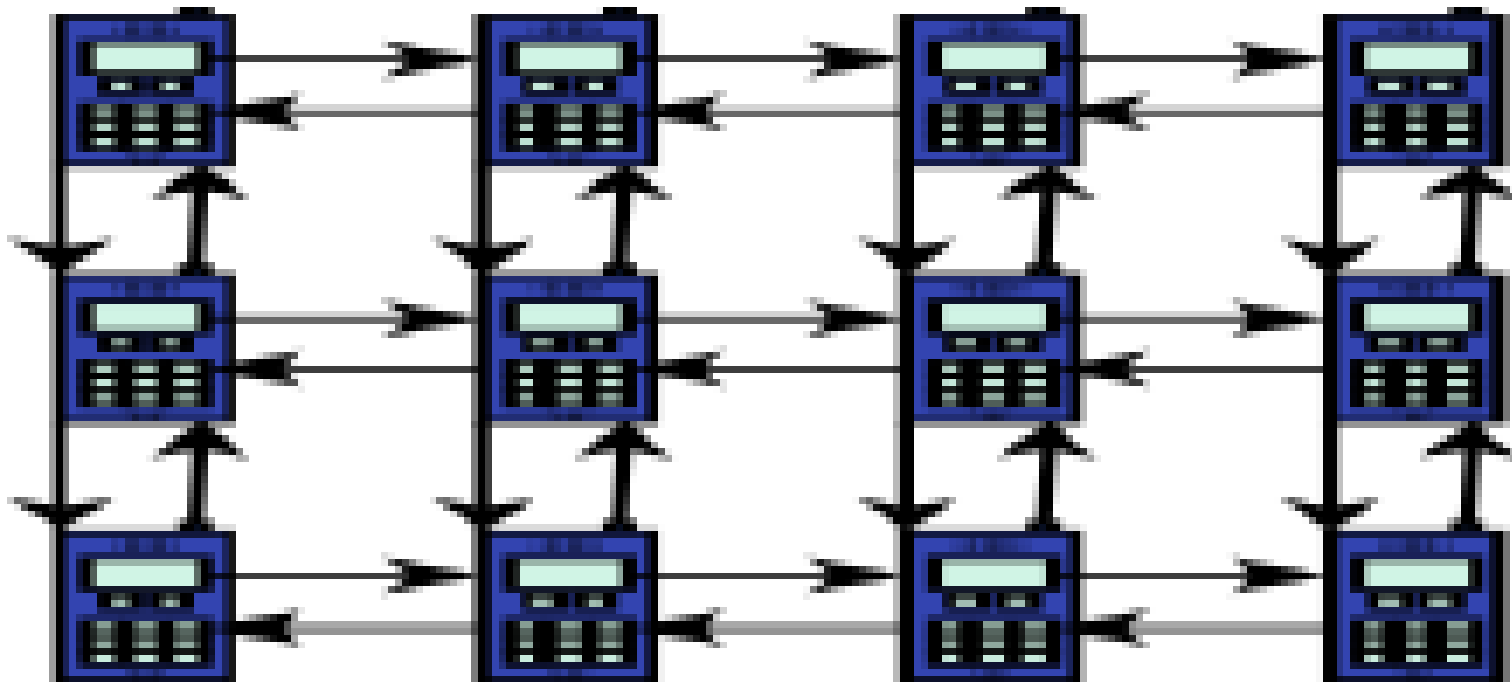
Sistema de Monitoramento Humano



Sistema de Monitoramento Pessoal



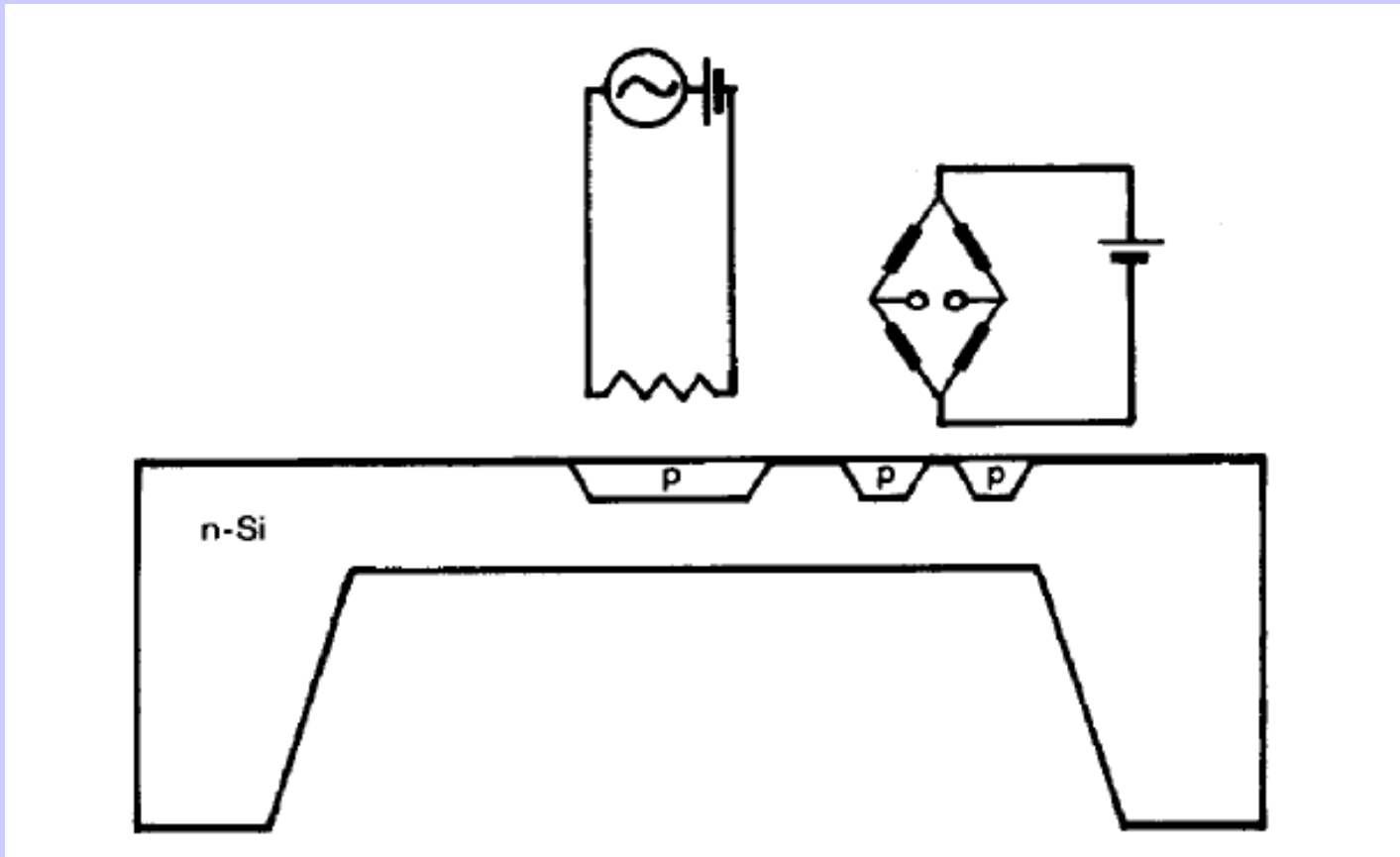
Sistema Distribuido em Malha



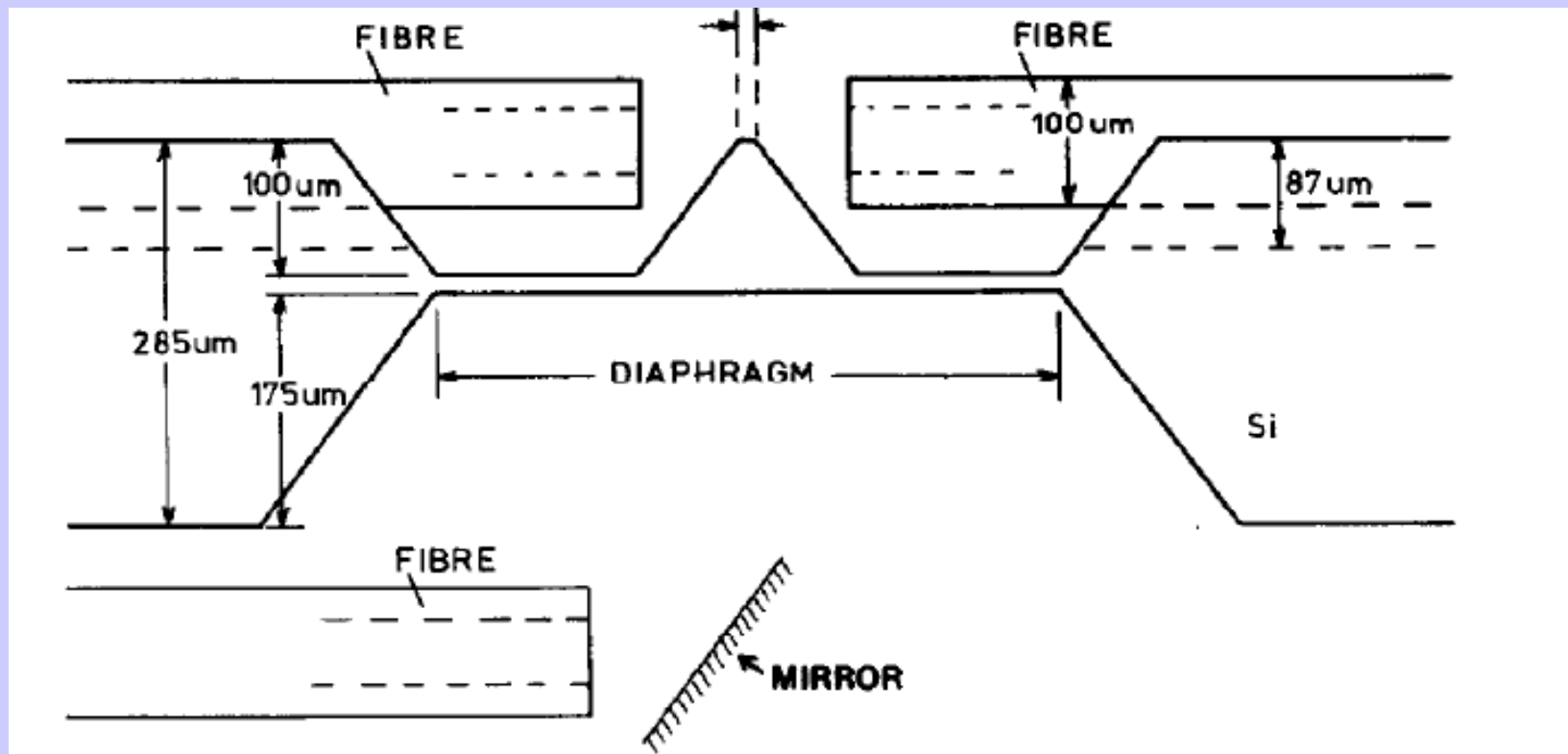
Microsistemas

- **Sensores e multifuncionalidade;**
- **Entrada de sinal analógico;**
- **Conversão de dados;**
- **Interface digital;**
- **Monitoramento e diagnóstico;**
- **Processador;**
- **Comunicação**

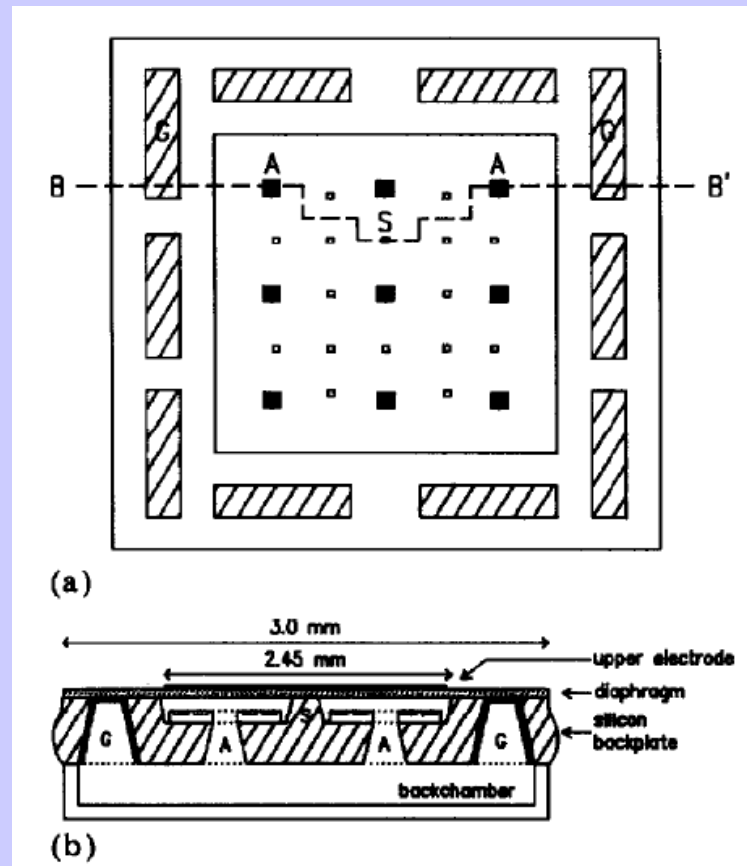
Sensores e Multifuncionalidade



Sensores e Multifuncionalidade



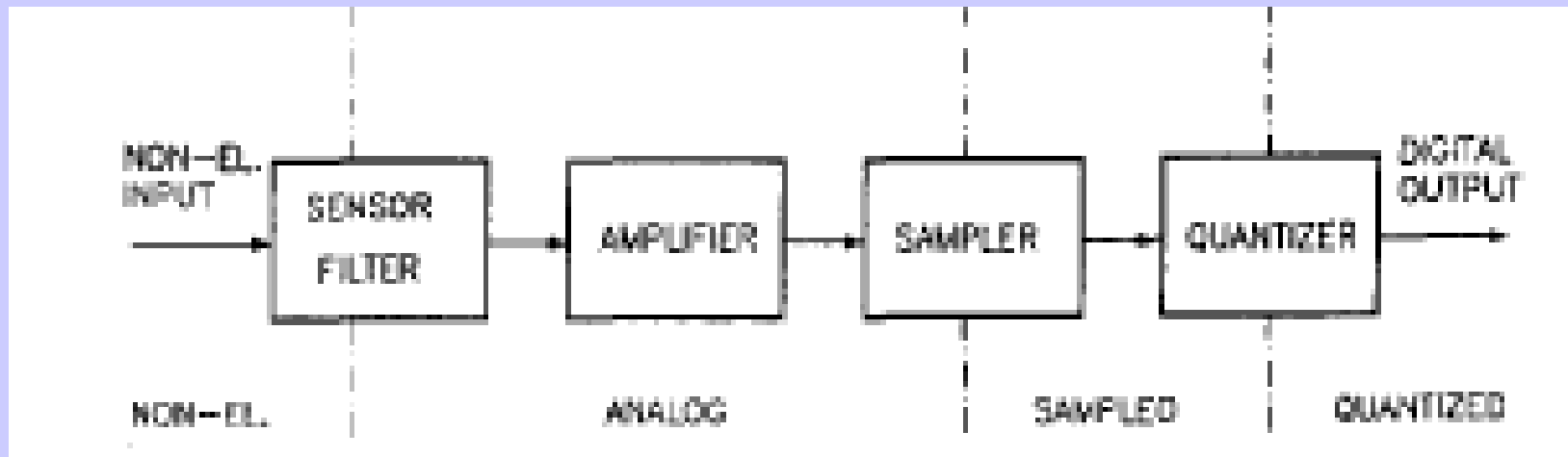
Sensores e Multifuncionalidade (Sensor e atuador)



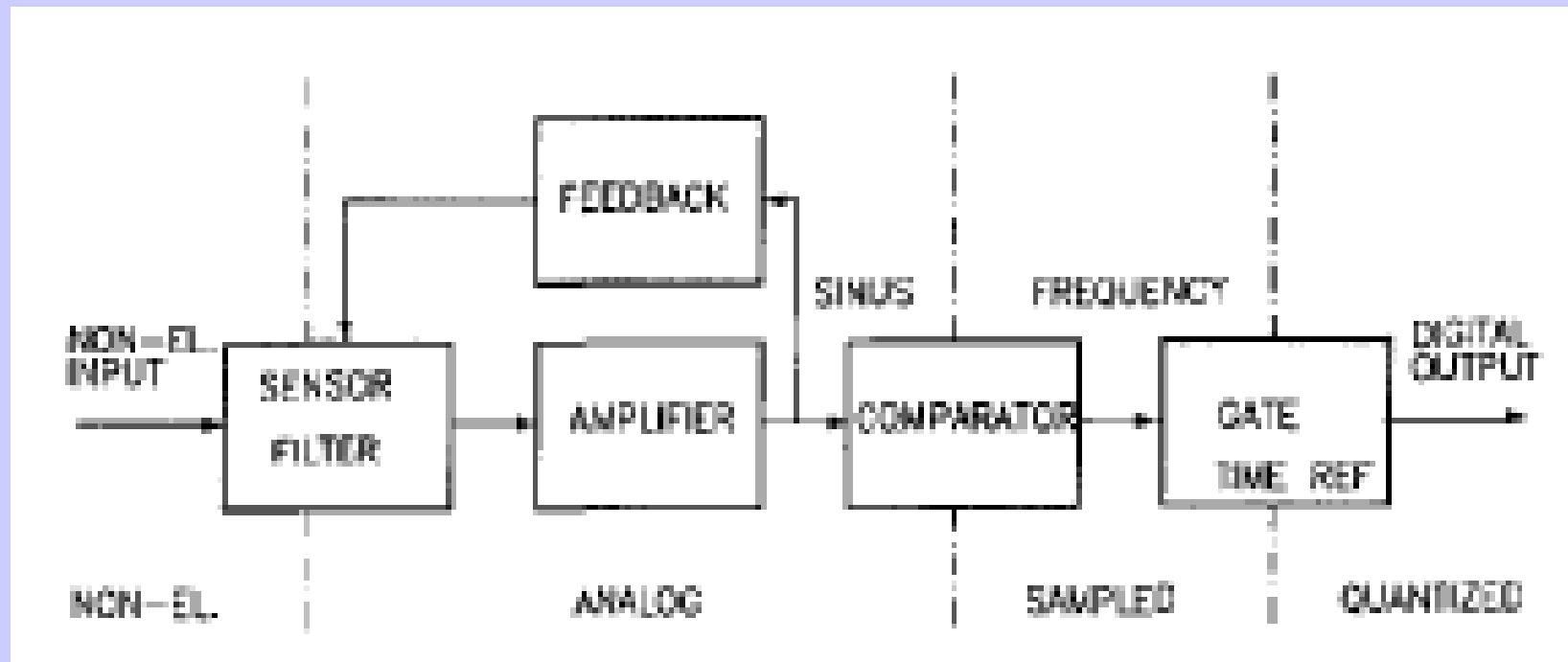
Microsistemas

- **Sensores e multifuncionalidade;**
- **Entrada de sinal analógico;**
- **Conversão de dados;**
- **Interface digital;**
- **Monitoramento e diagnóstico;**
- **Processador;**
- **Comunicação**

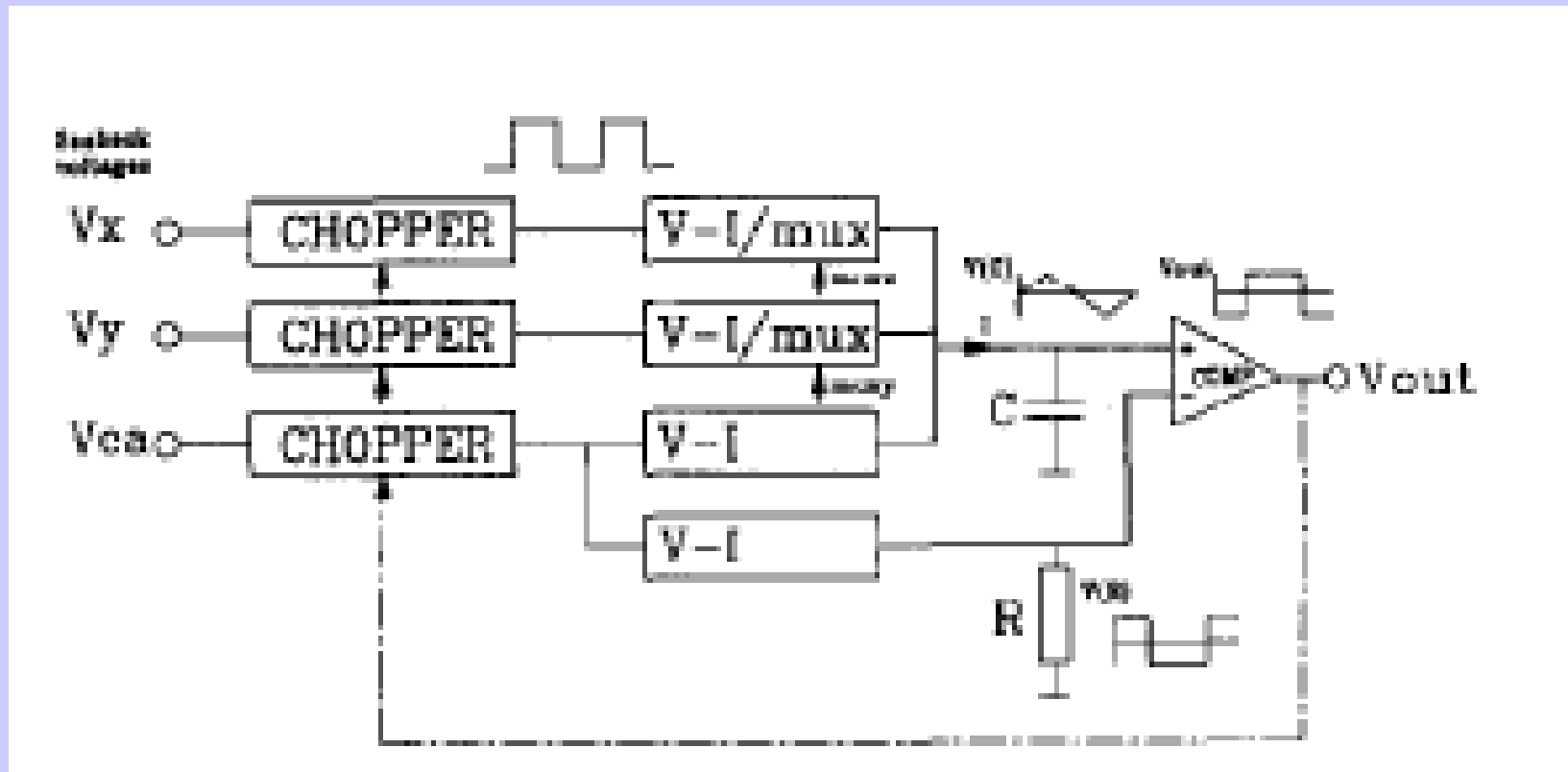
Interface sem realimentação



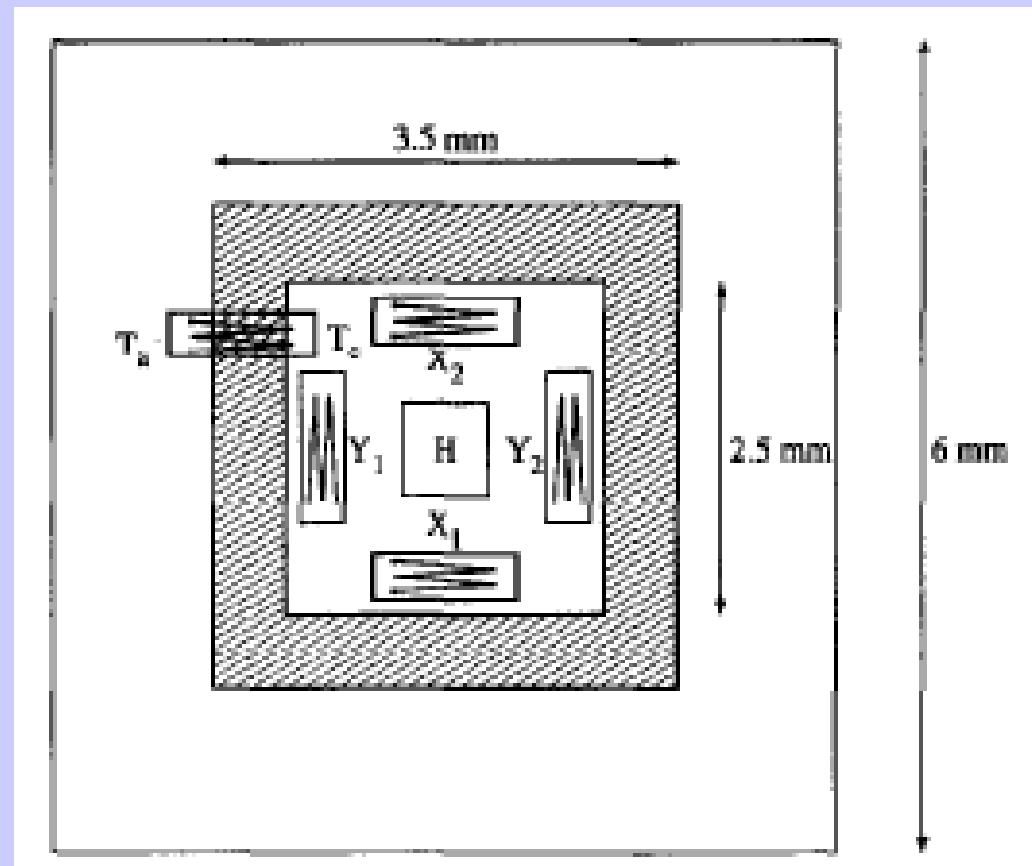
Interface com realimentação e saída alternada



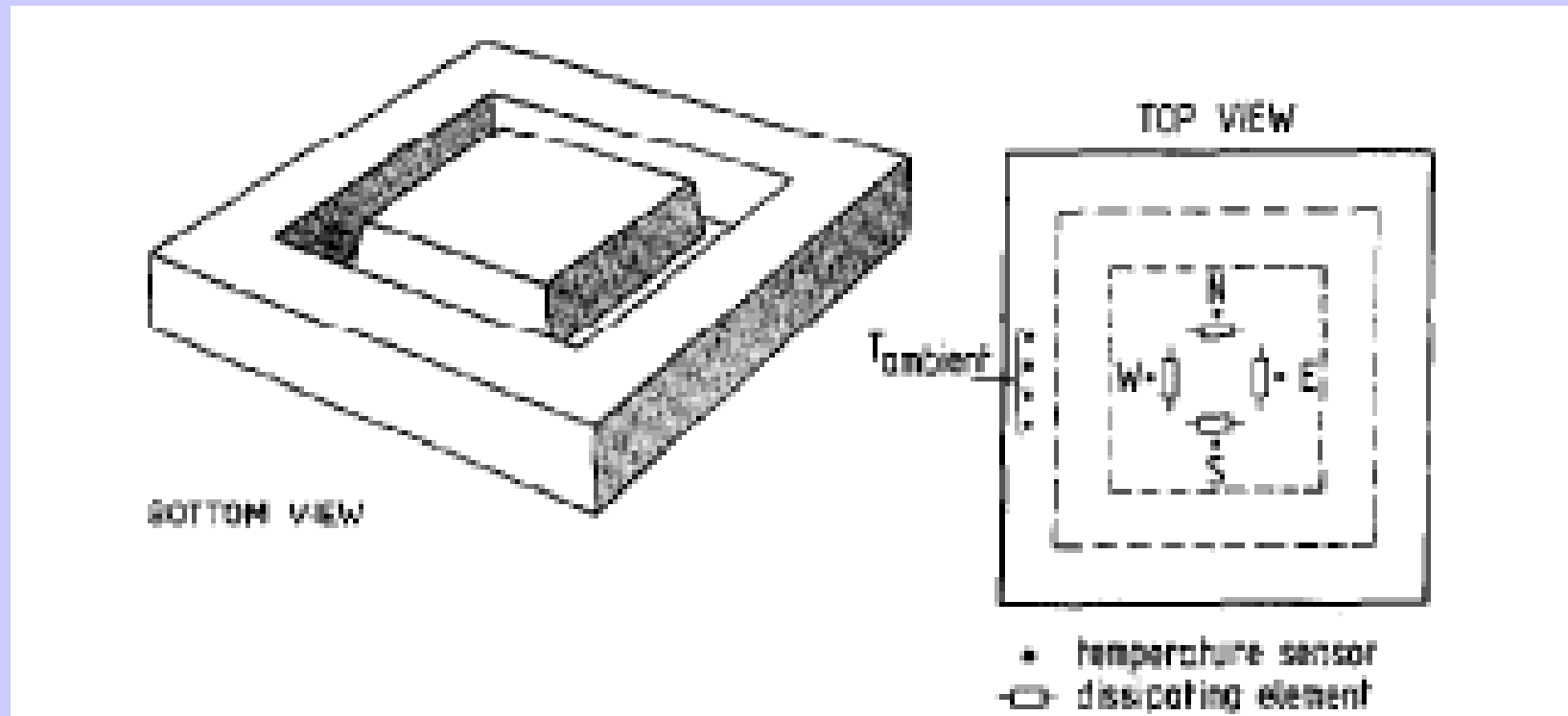
Interface com realimentação e saída alternada



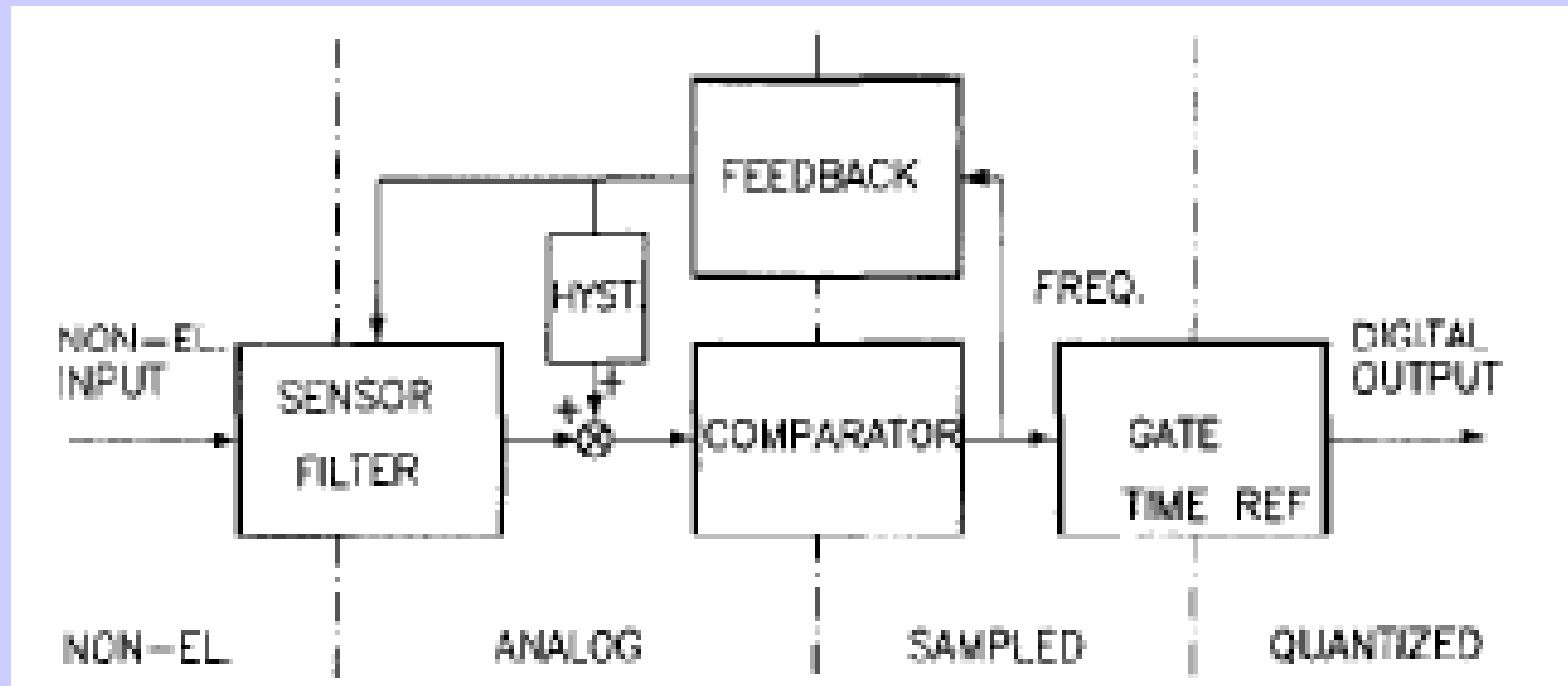
Interface com realimentação e saída alternada



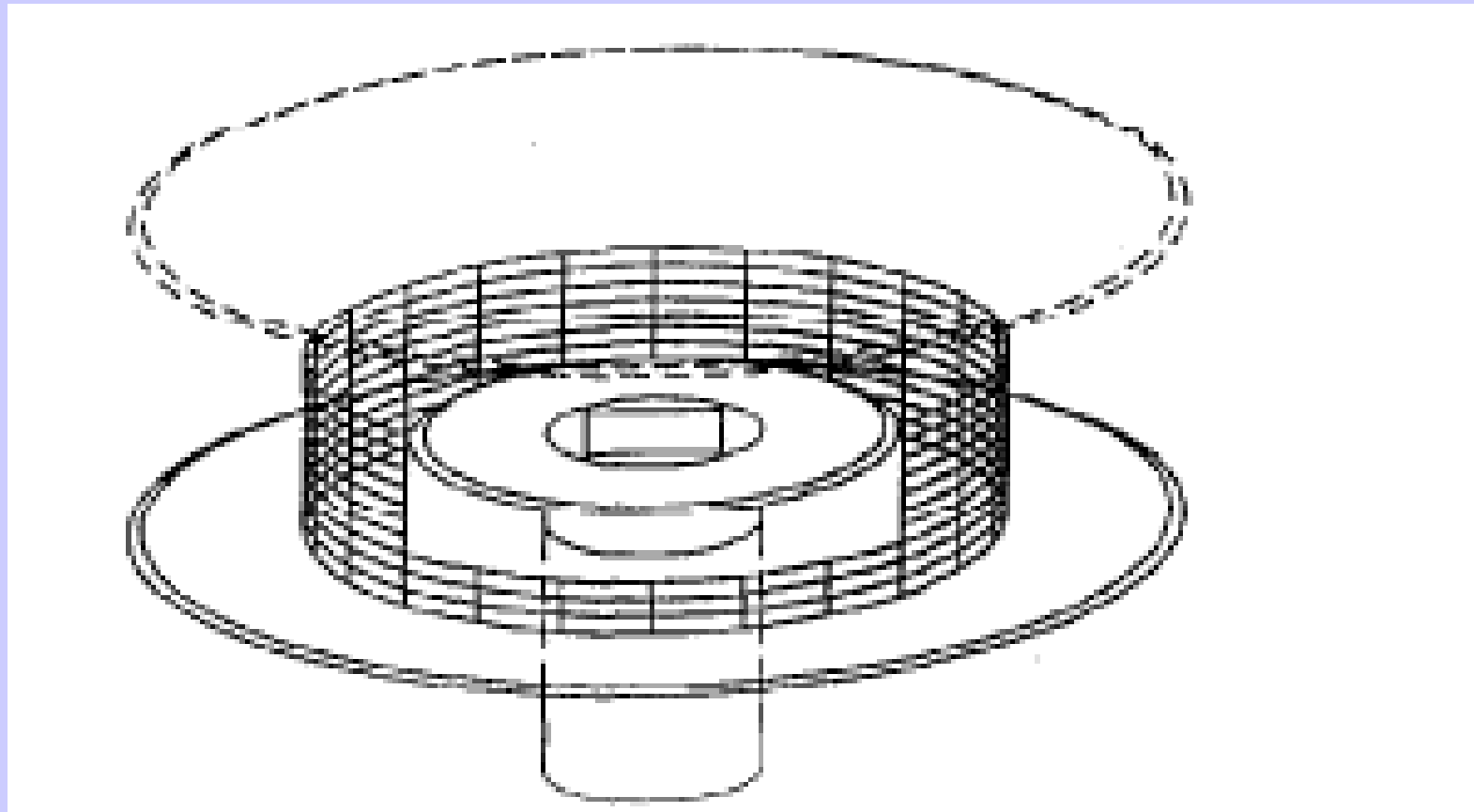
Interface com realimentação e saída alternada



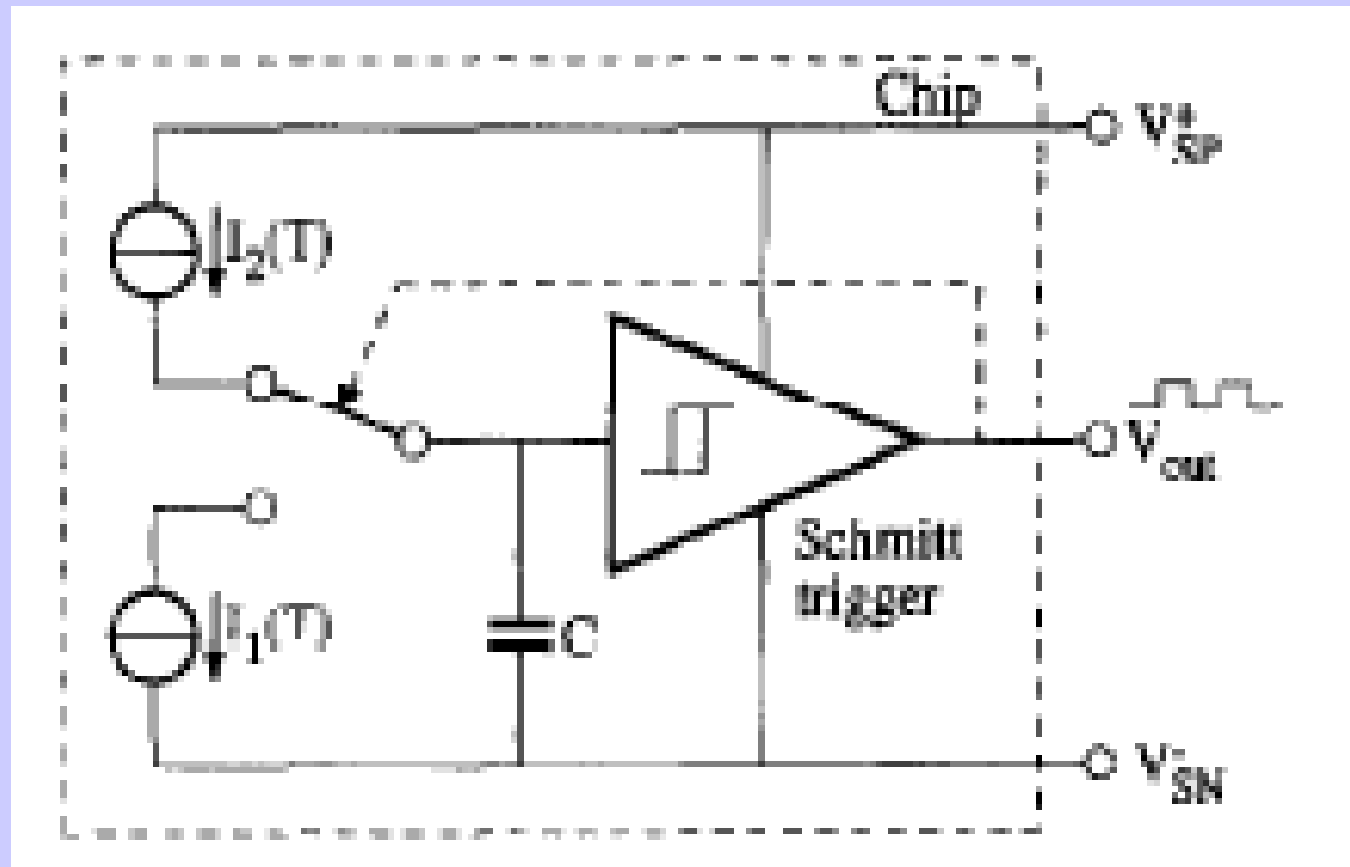
Interface com realimentação e saída alternada e comparador



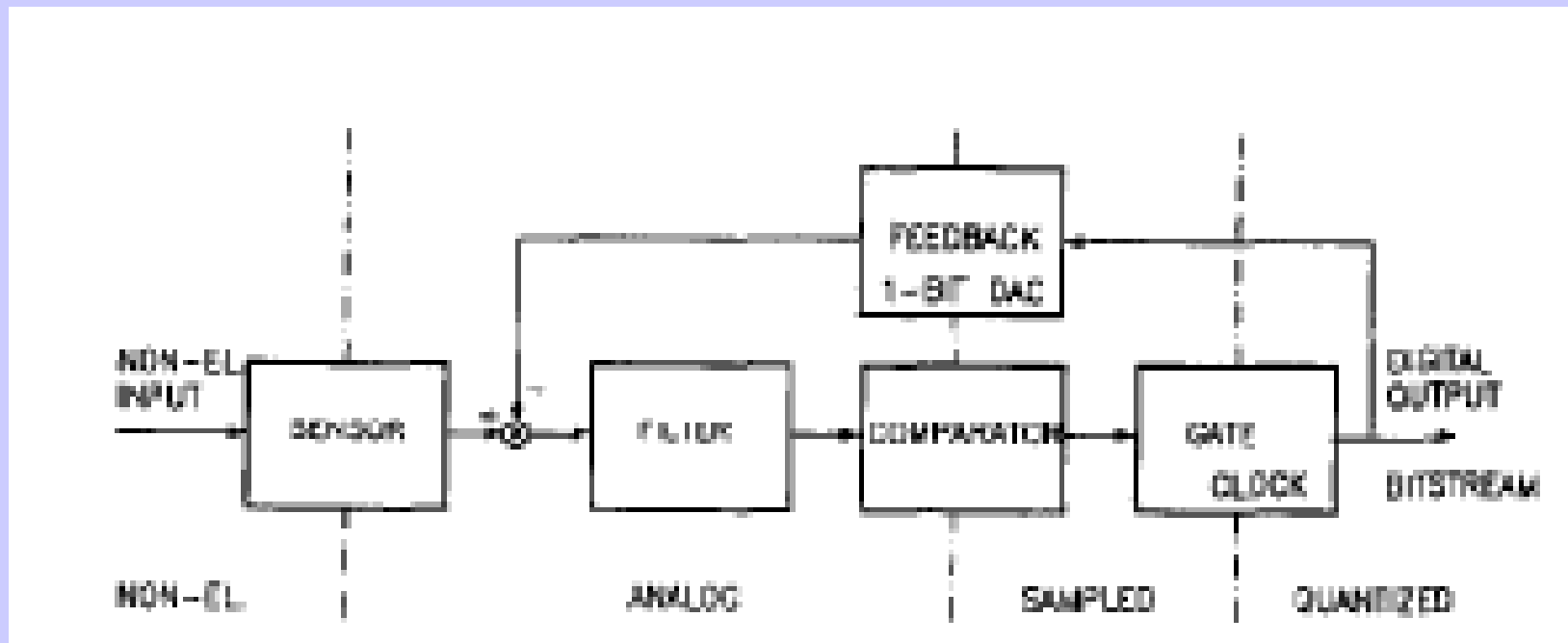
Interface com realimentação e saída alternada e comparador



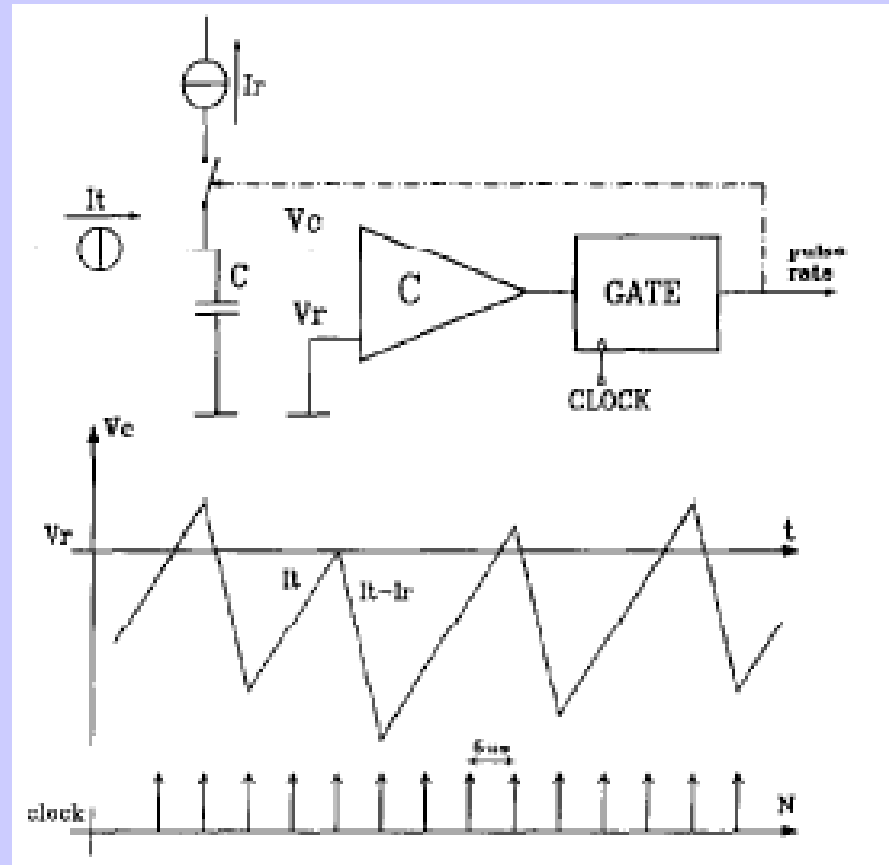
Interface com realimentação e saída alternada e comparador



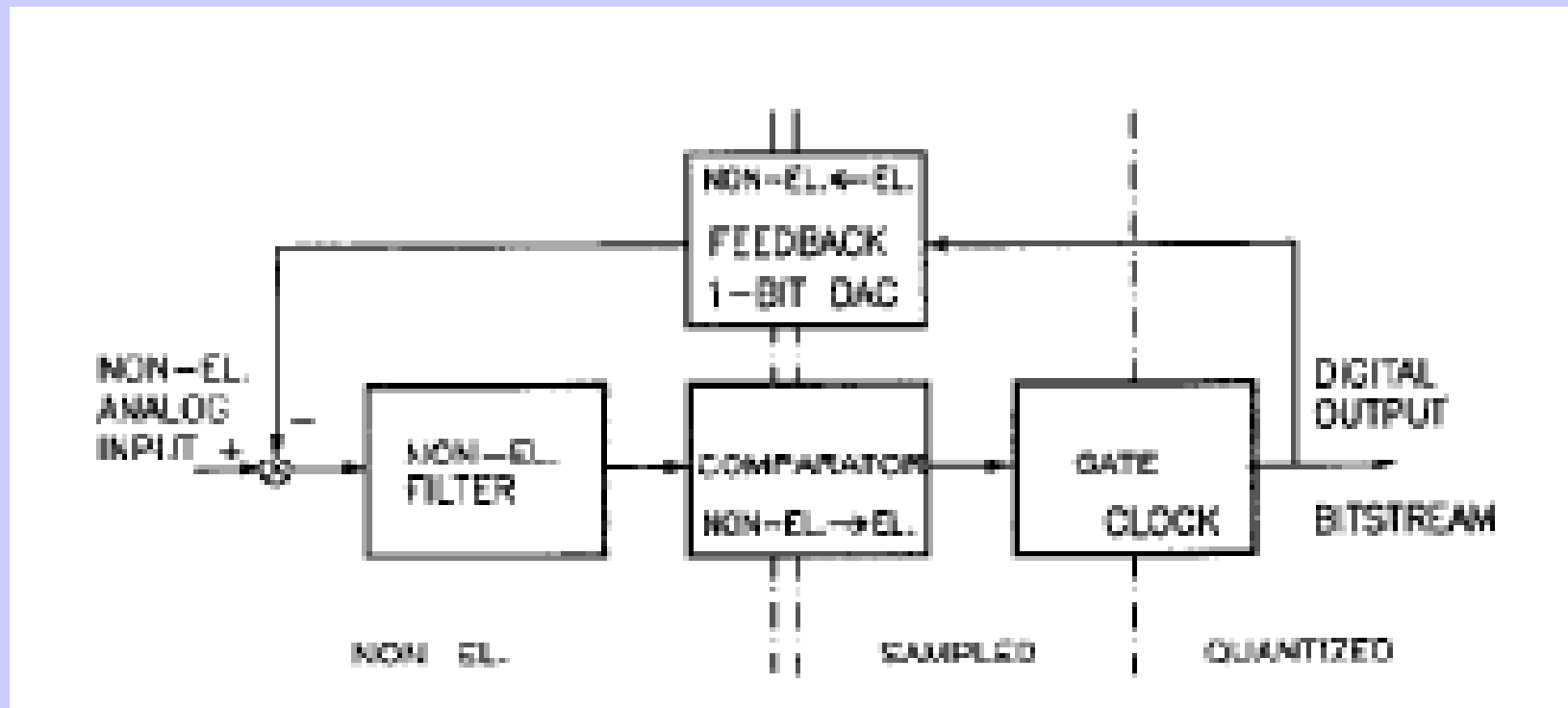
Interface com realimentação de interface do sensor



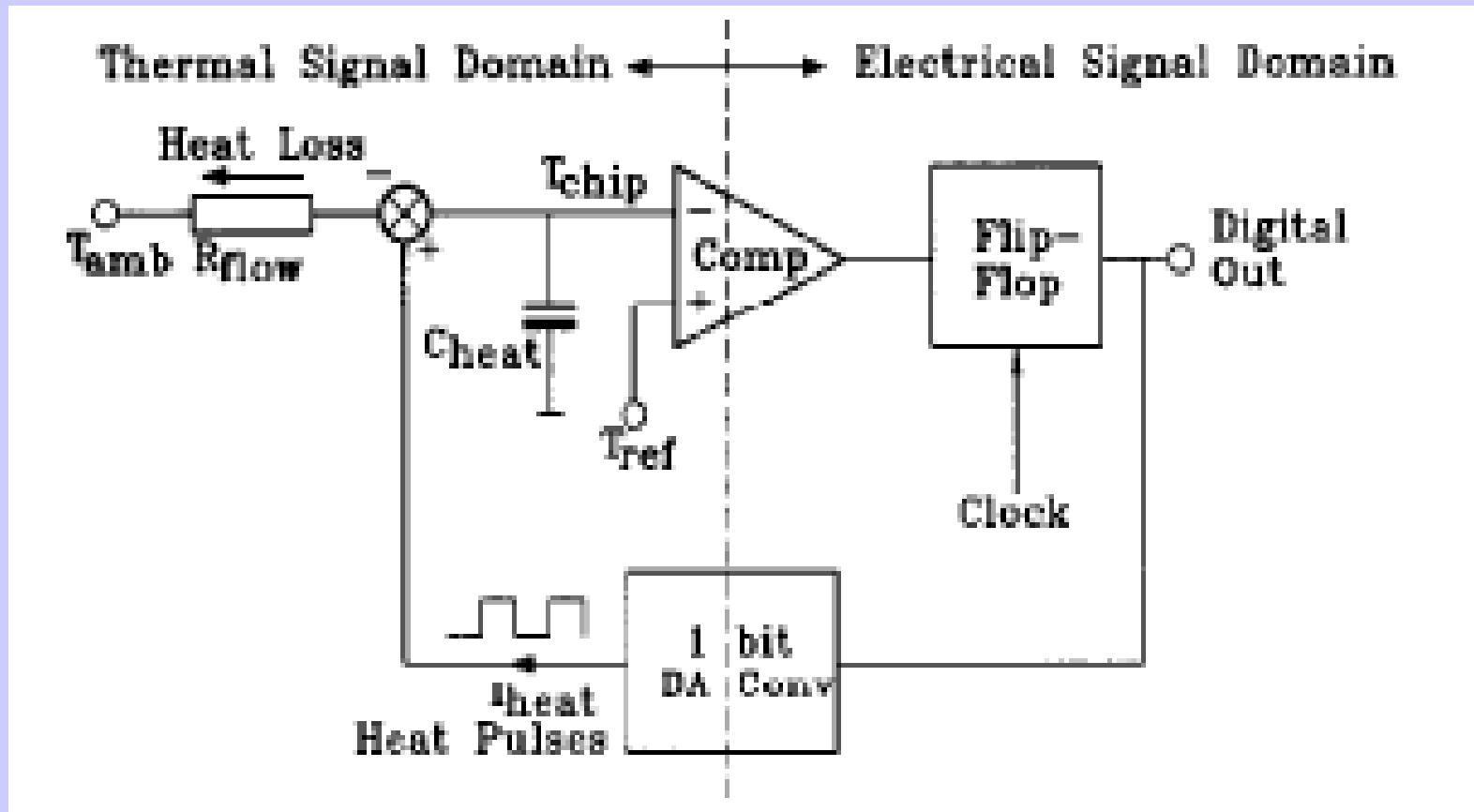
Interface com realimentação de interface do sensor



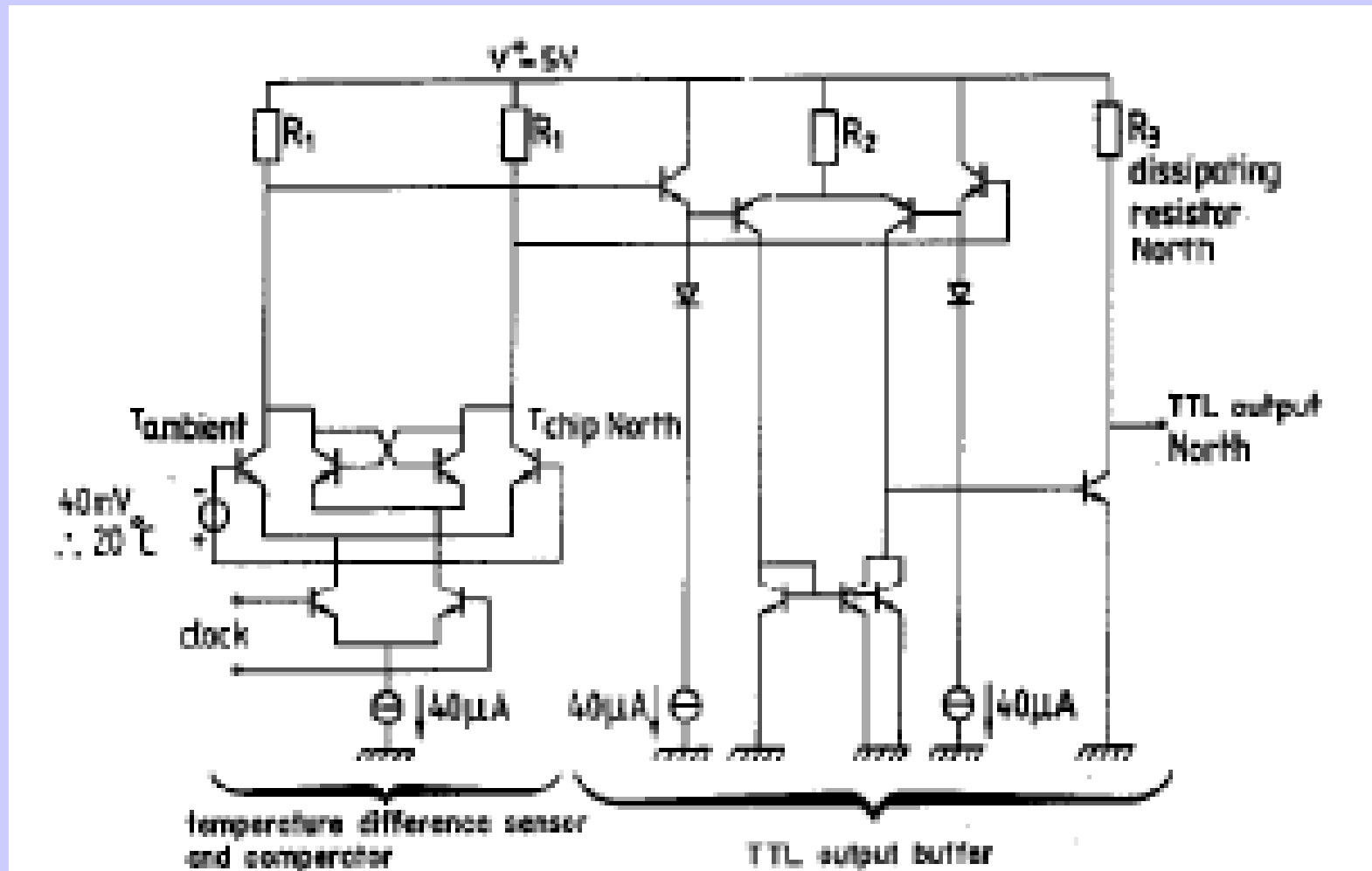
Interface com realimentação e comparador não elétrico



Interface com comparador não elétrico



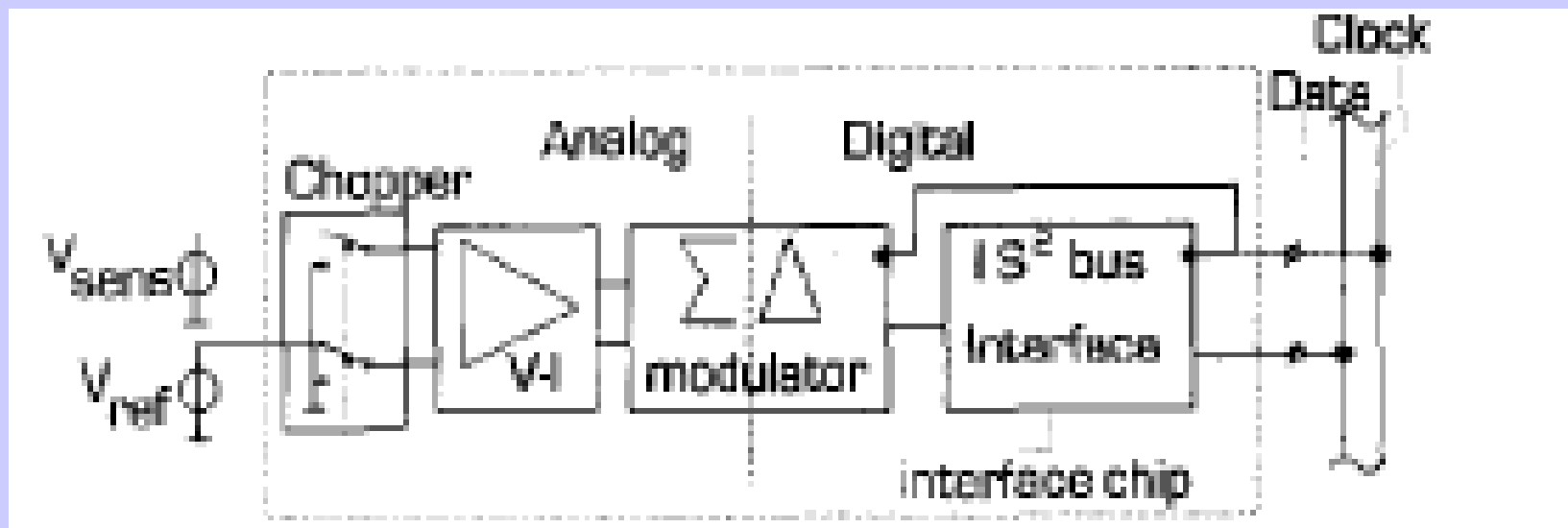
Interface com comparador não elétrico



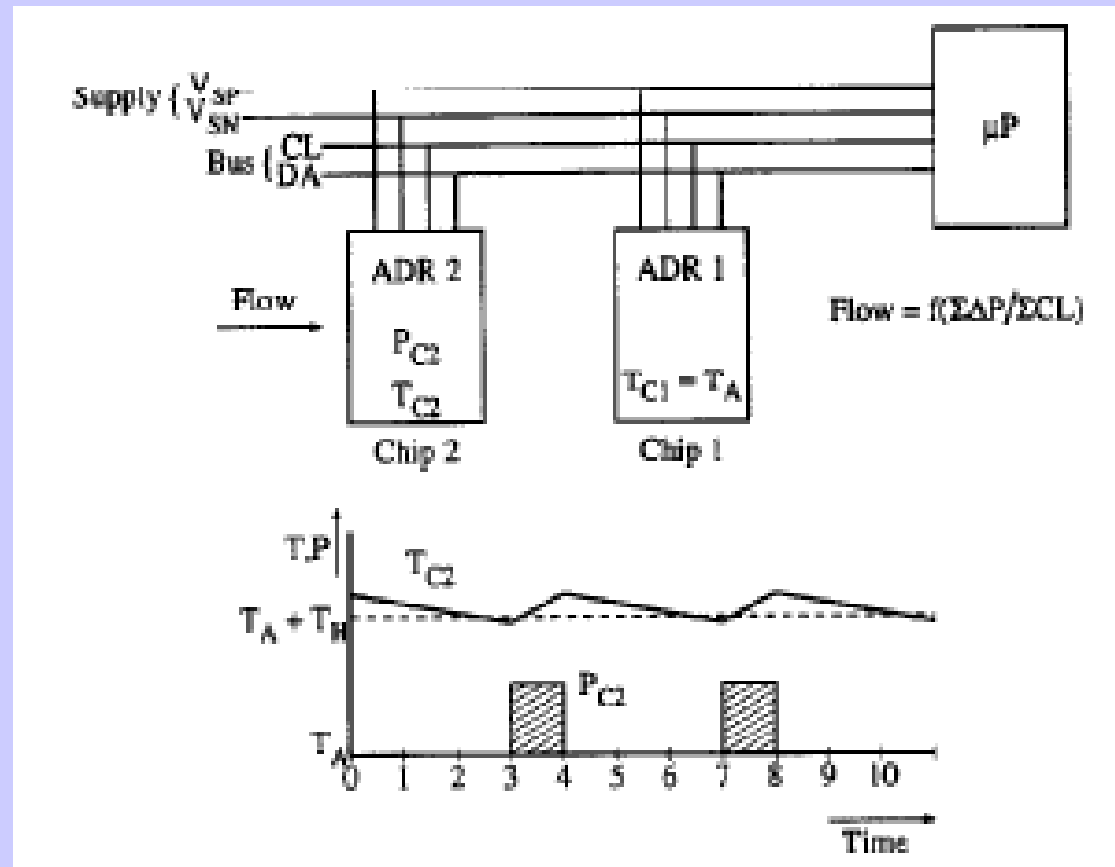
Microsistemas

- **Sensores e multifuncionalidade;**
- **Entrada de sinal analógico;**
- **Conversão de dados;**
- **Interface digital;**
- **Monitoramento e diagnóstico;**
- **Processador;**
- **Comunicação**

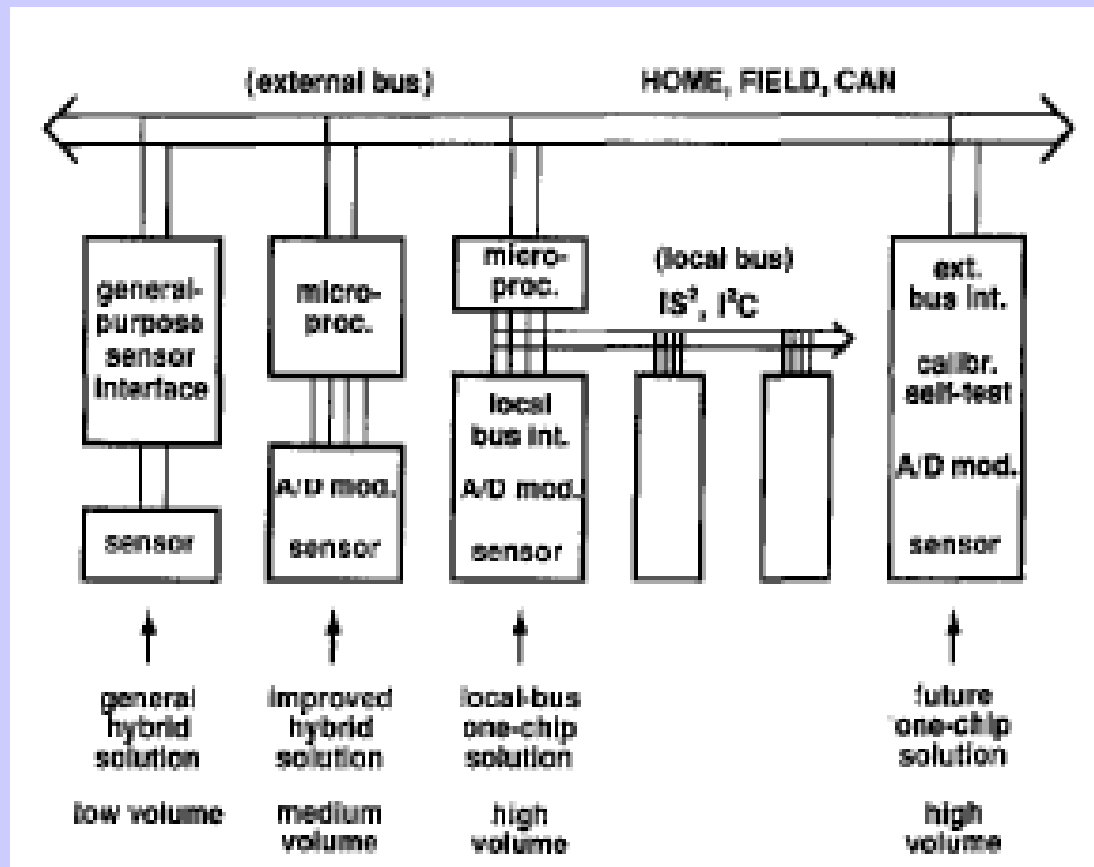
Interface de comunicação com barra de dados



Interface simples para sensores de vazão



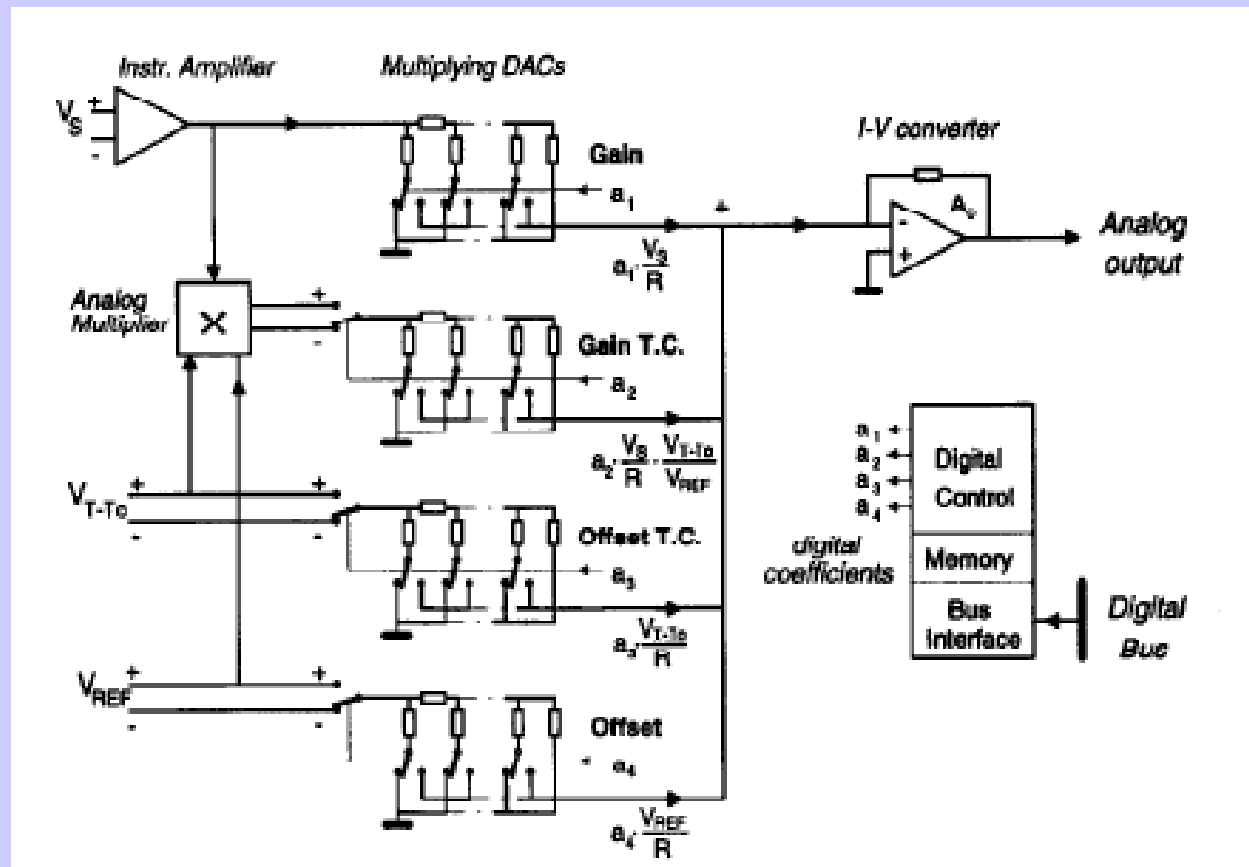
Interface híbrida de sensores



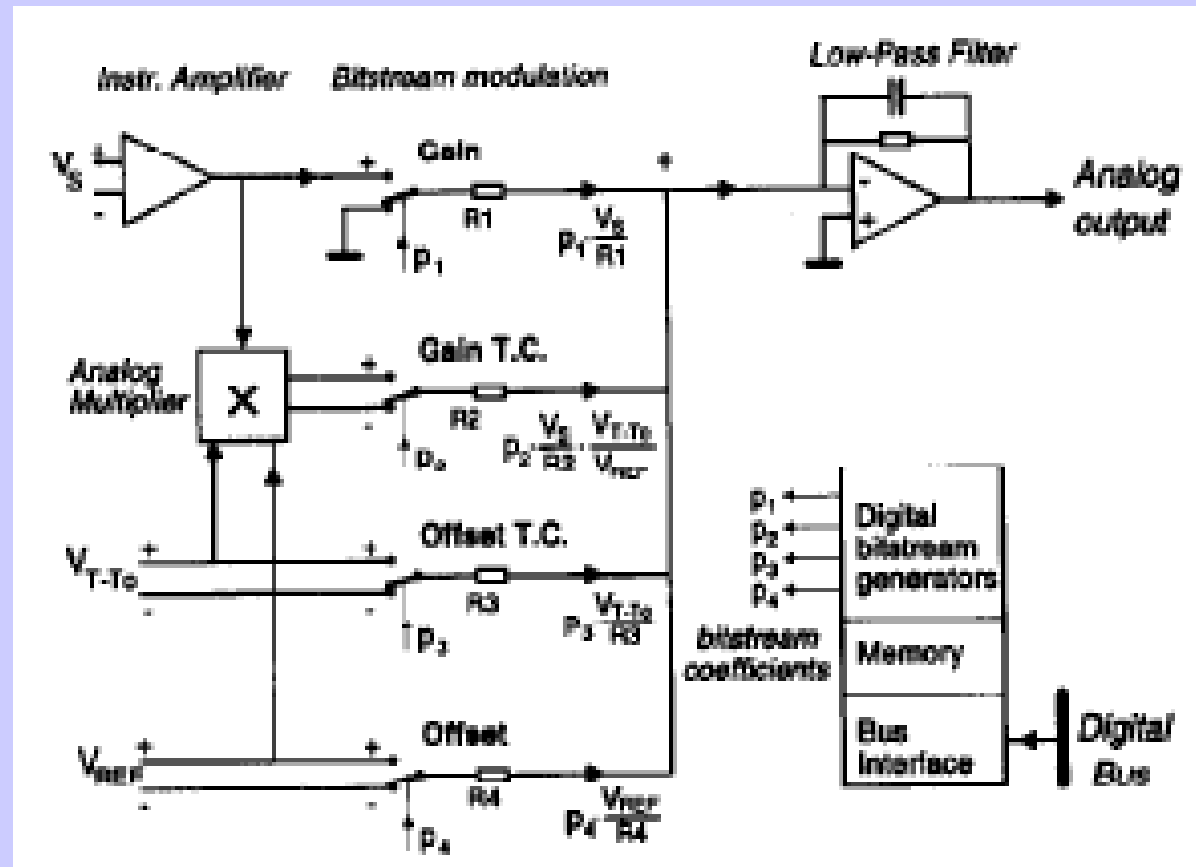
Microsistemas

- **Sensores e multifuncionalidade;**
- **Entrada de sinal analógico;**
- **Conversão de dados;**
- **Interface digital;**
- **Monitoramento e diagnóstico;**
- **Processador;**
- **Comunicação**

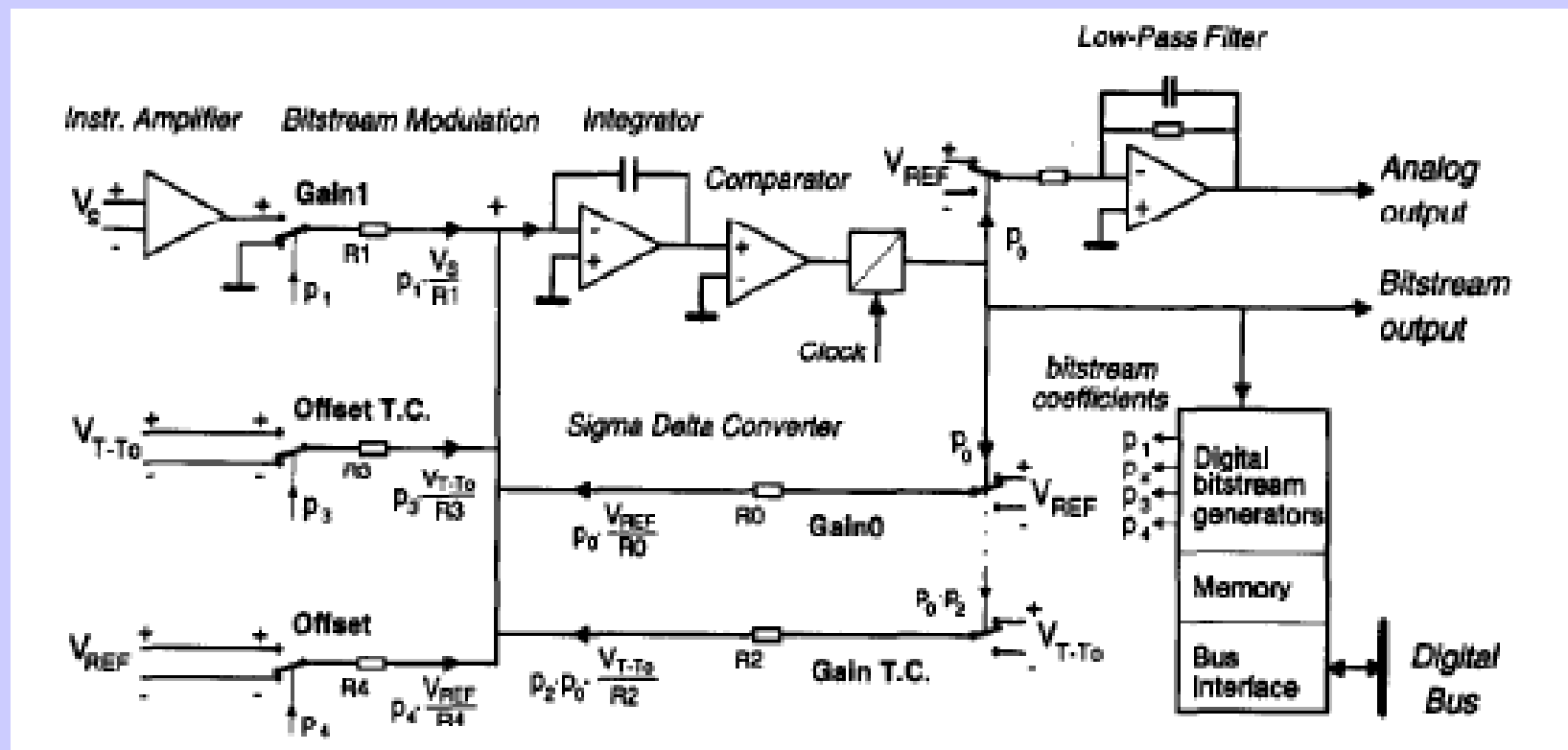
Sistemas de auto-calibração



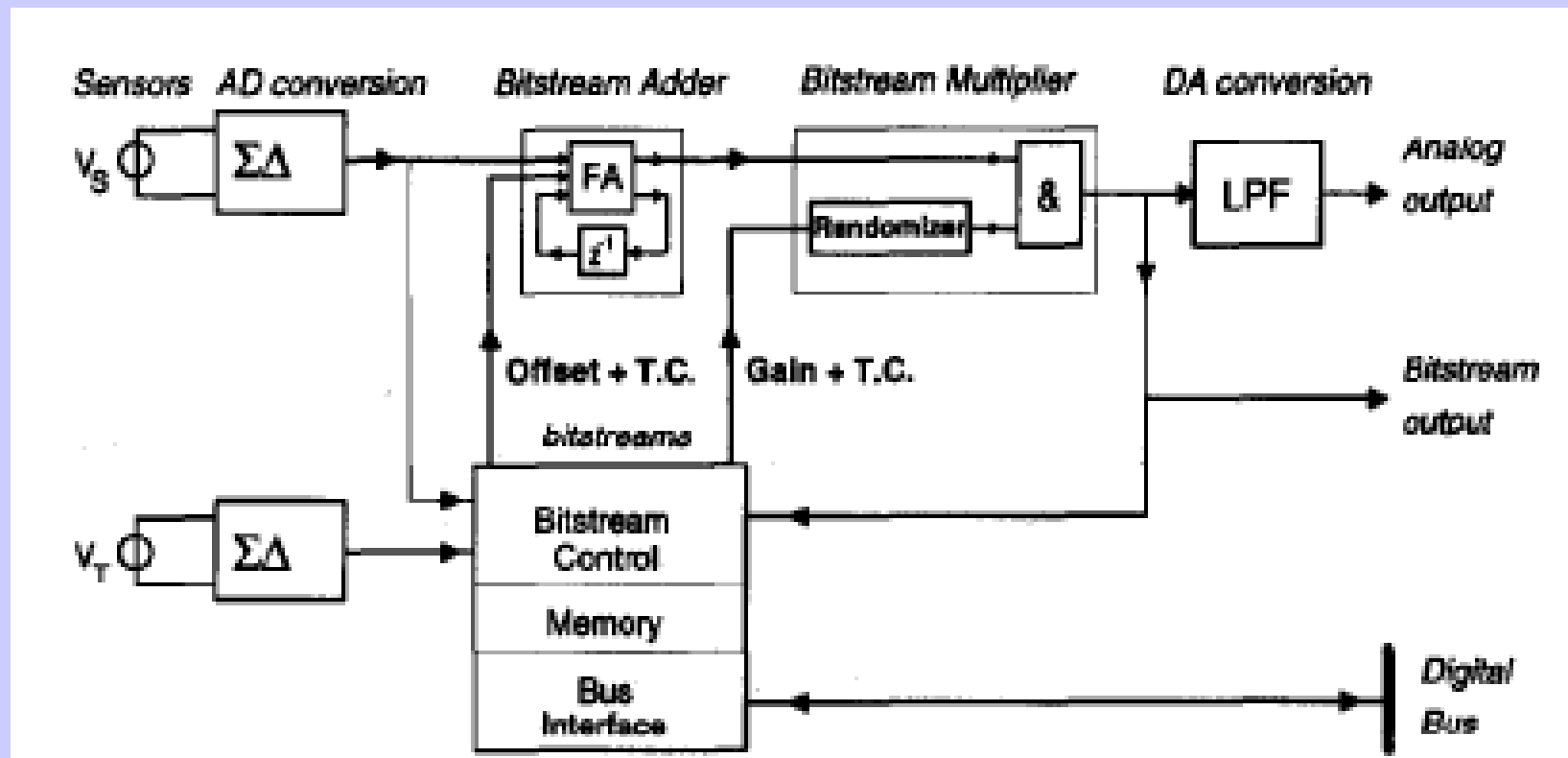
Auto-calibração analógica



Auto-calibração com saída analógica



Auto-calibração digital



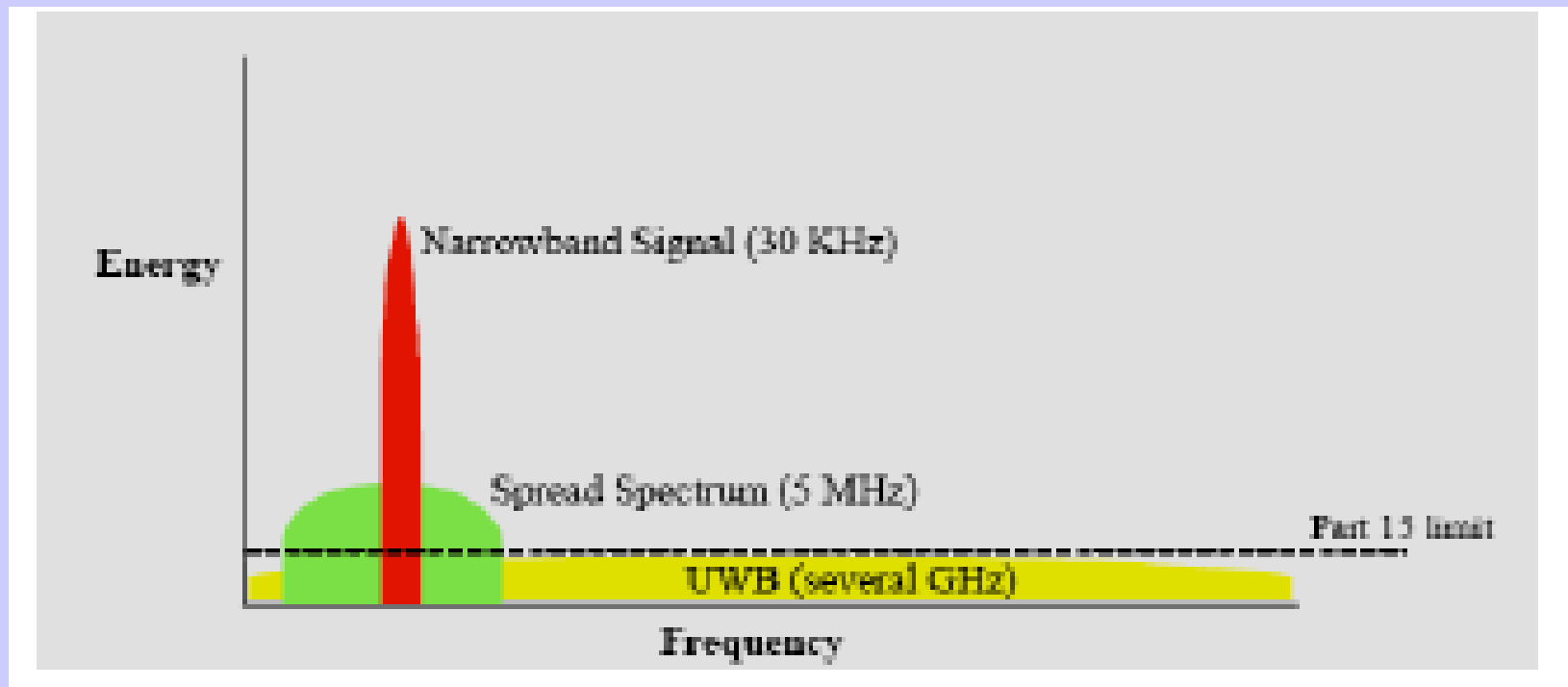
Microsistemas

- **Sensores e multifuncionalidade;**
- **Entrada de sinal analógico;**
- **Conversão de dados;**
- **Interface digital;**
- **Monitoramento e diagnóstico;**
- **Processador;**
- **Comunicação**

Comunicação

- **Com fio (By-wire)**
- **Óptica (By-light);**
- **Sem fio (Wireless)**

Distribuição de frequências



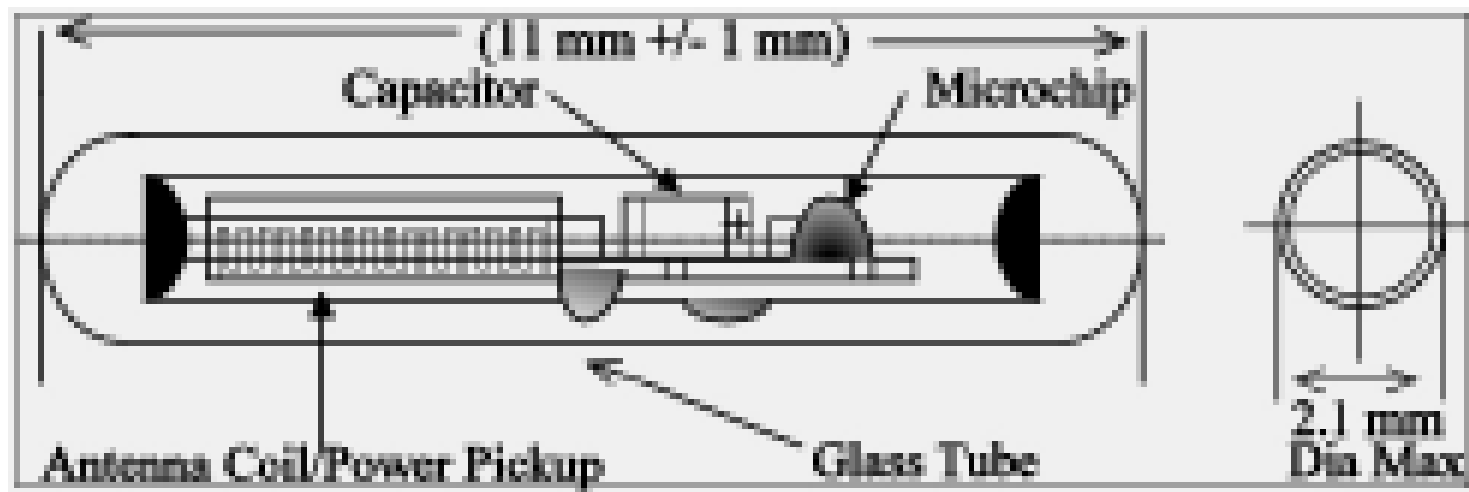
Comunicação sem fio - protocolos

- **Bluetooth;**
- **DECT – Digital Enhanced Cordless Telecommunications;**
- **EnOcean;**
- **Ensonation;**
- **IEEE P1902.1 (RuBee);**
- **Millennial Net;**
- **NFC (Near-field Communication)**
- **RFID – Radar;**
- **WiFi;**

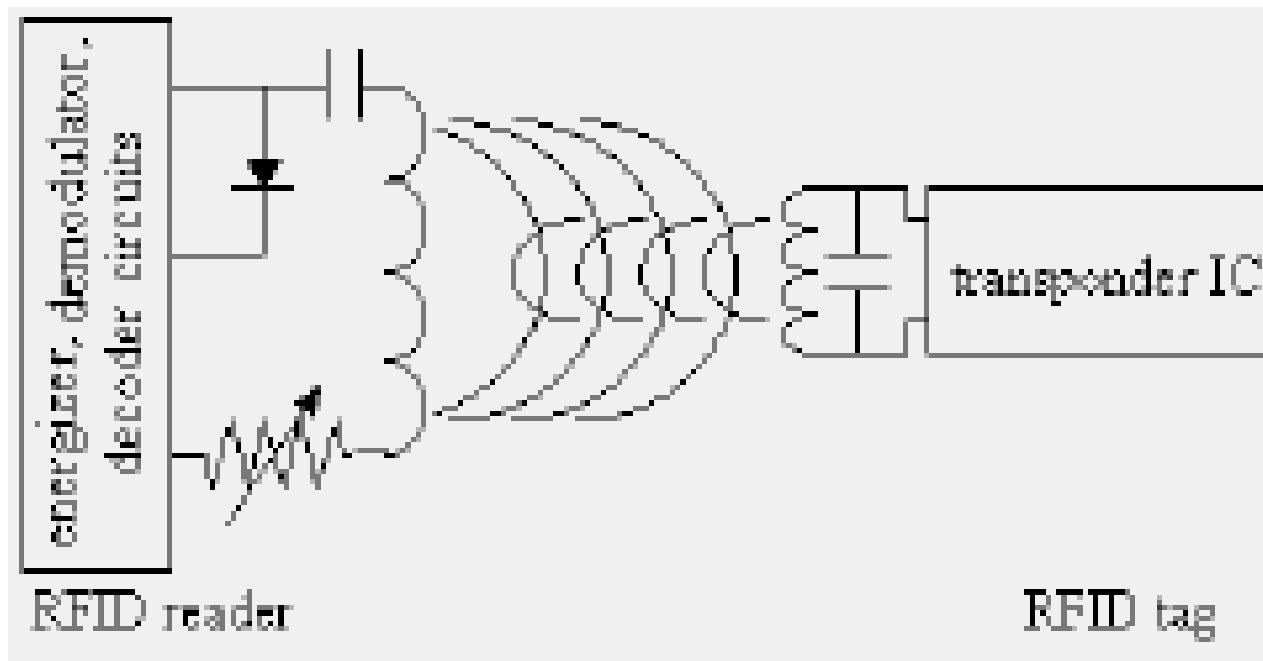
Comunicação sem fio - protocolos

- **WPAN – 802.15.4 (Wireless Personal Area Network);**
- **Wireless USB;**
- **WiMax (Worldwide interoperability for Microwave Access);**
- **ZigBee;**
- **Z-Wave.**

RF-ID (Pet - aplicação)



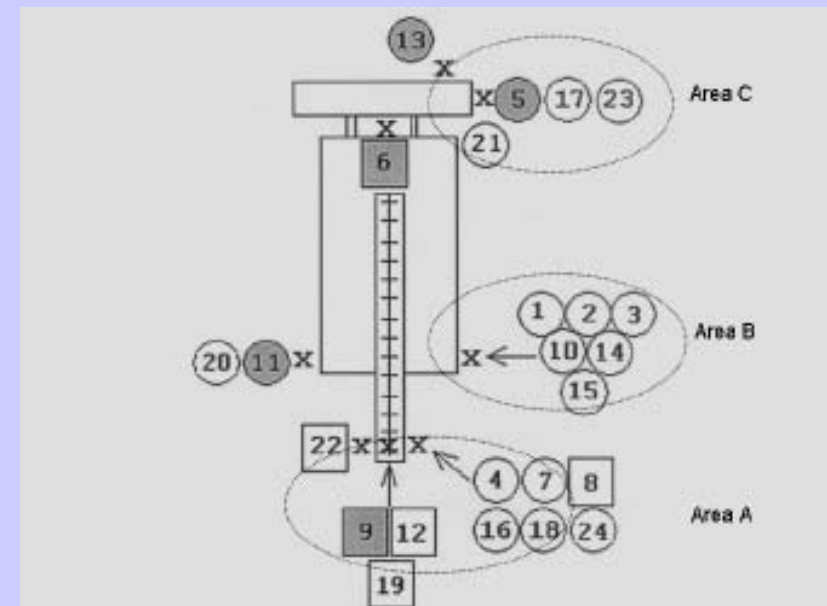
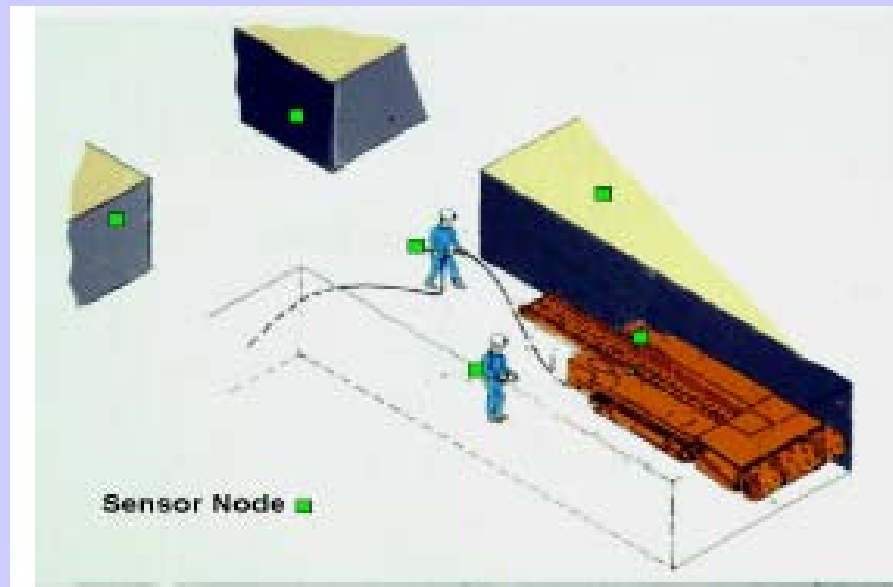
RF-ID (Pet - aplicação)



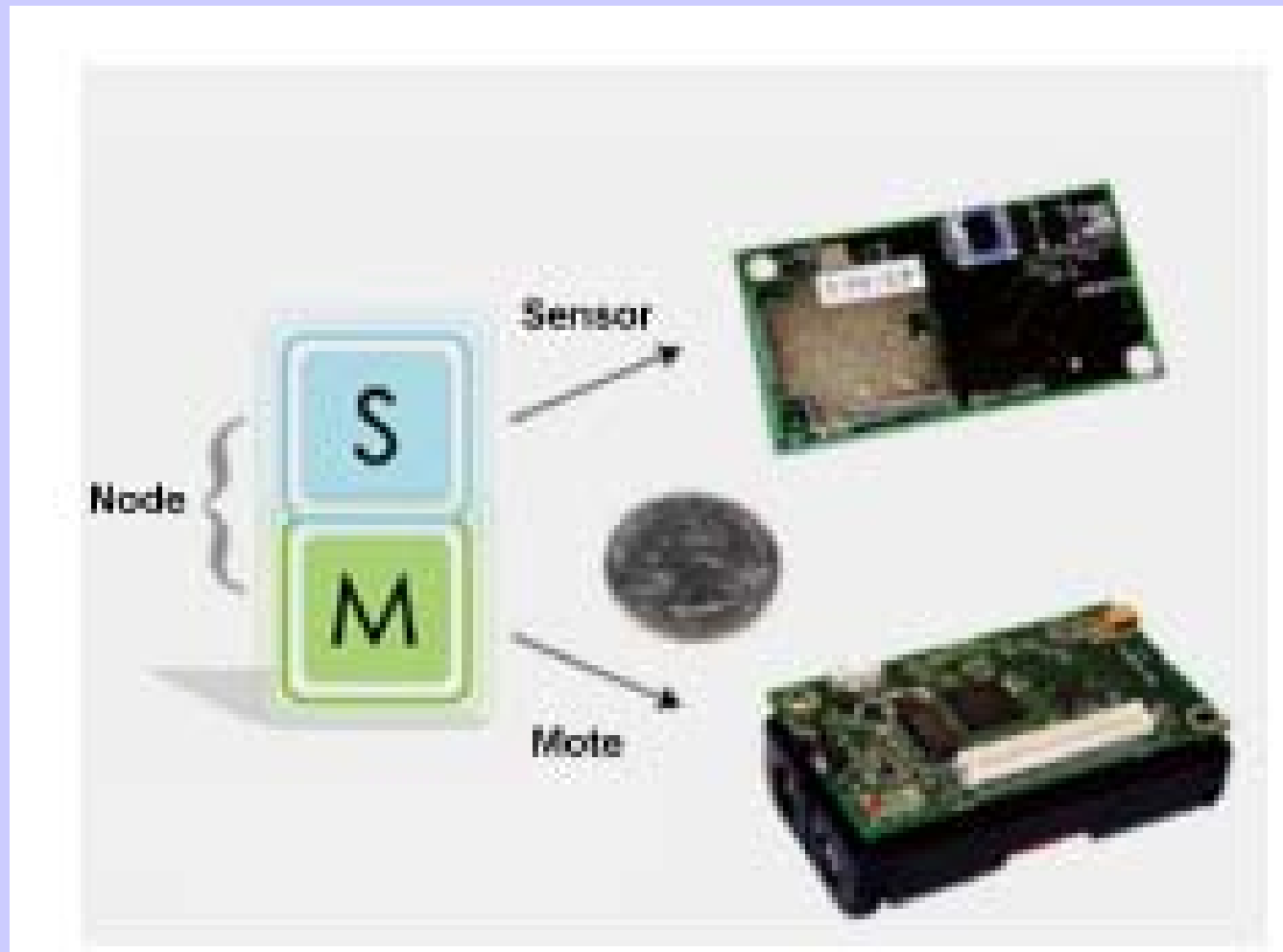
Aplicação

Ambiente agressivo e
perigoso

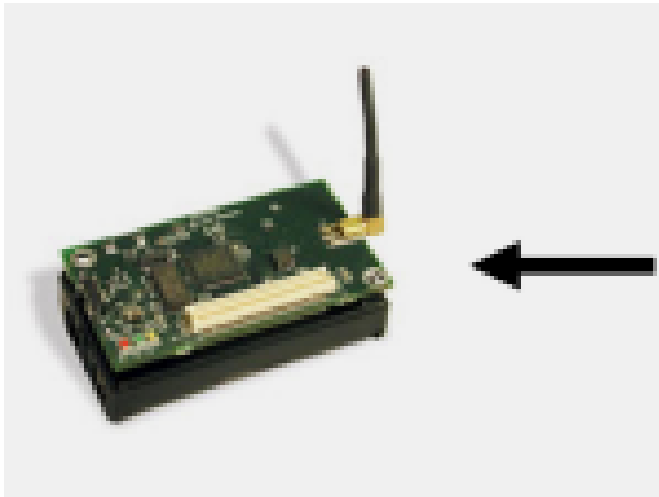
Pontos de Sensoriamento



Dimensões dos dispositivos

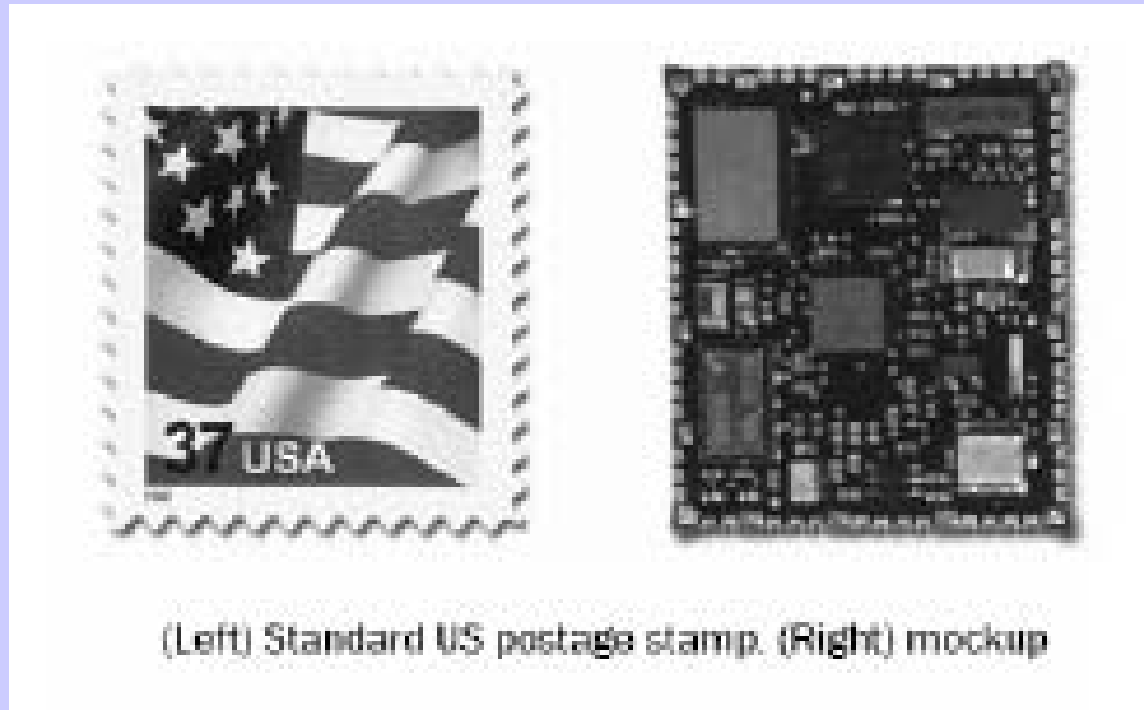


Transmissores comerciais



Name and size	MICAz, 1–10 cm ³
Applications	High bandwidth sensing such as image transfer, audio, and vibration
Radio data rate	<500 kbps
MIPS	<50
Flash	<10 MB
RAM	<128 kB
Energy usage (typ.)	3 V x 60 mA
Sleep energy (typ.)	3 V x 100 μ A
Duty cycle (typ.)	5%–10%

Detetores em projeto



(Left) Standard US postage stamp. (Right) mockup

Figure 8.—Highly specialized notes such as the "Spec" can be used as an advanced RFID tag. The small size makes wearable sensor nodes practical. (Image copyrighted by Crossbow Technology, Inc., and reprinted with permission.)

Detetores em projeto

Name and size	"Spec", mm ²
Applications	Specialized, single-purpose sensor, or advanced RFID tag
Radio data rate	<50 kbps
MIPS	<5
Flash	<0.1 MB
RAM	<4 kB
Energy usage (typ.)	1.8 V X 10 to 18 mA
Sleep energy (typ.)	1.8 V X 1 μ A
Duty cycle (typ.)	0.1%–0.5%

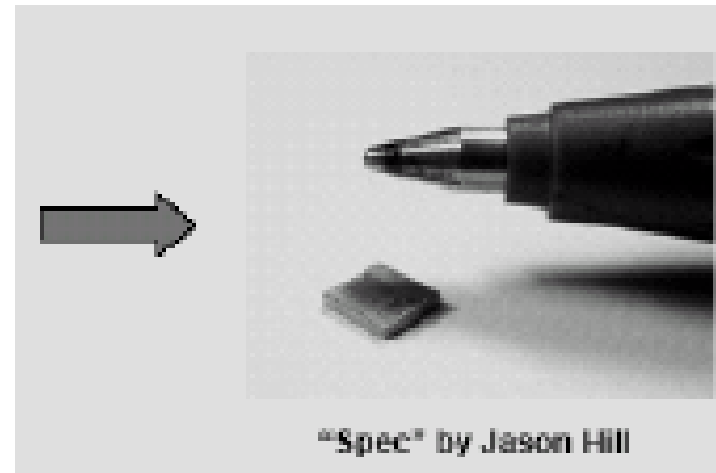
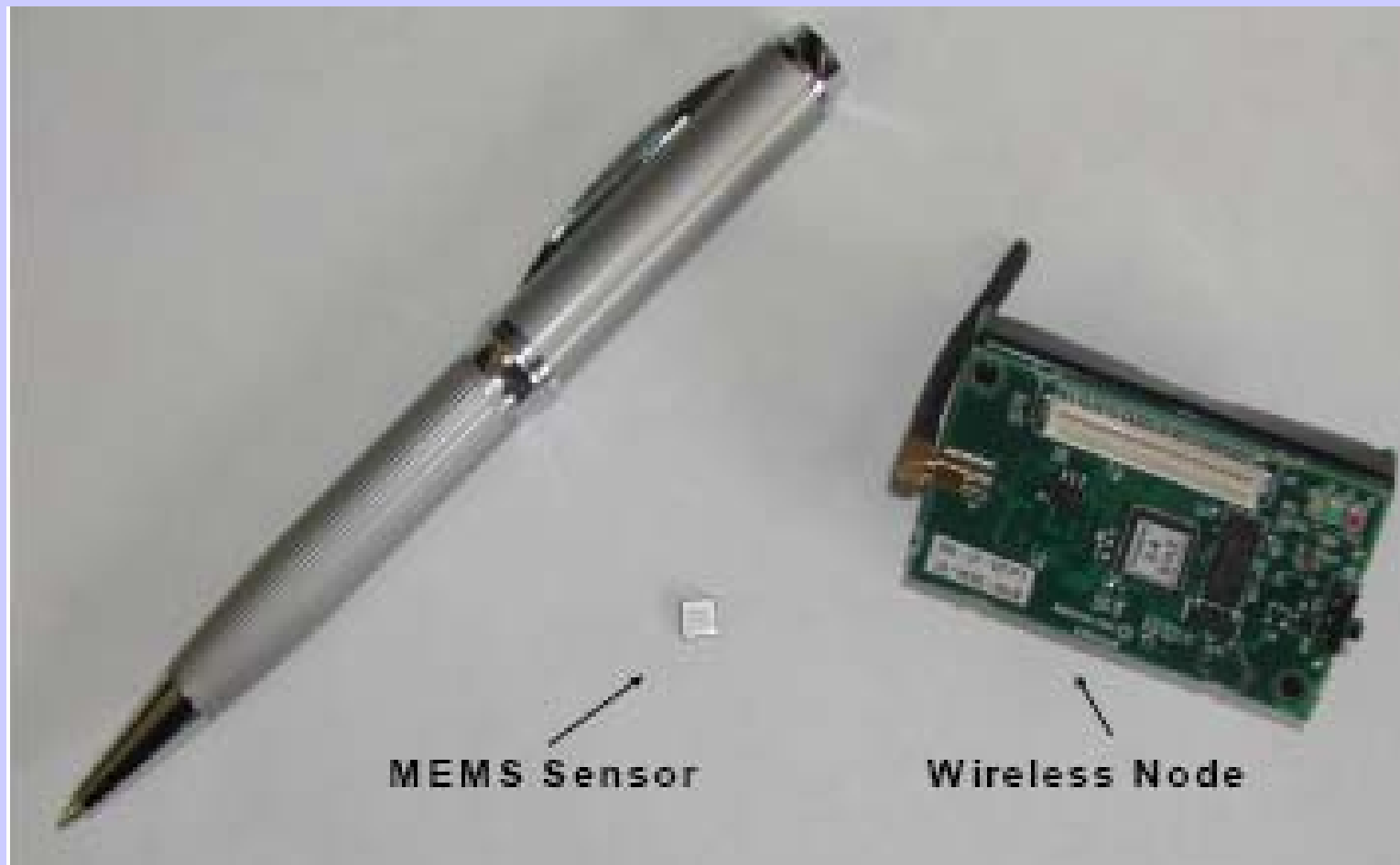


Figure 8.—Highly specialized notes such as the "Spec" can be used as an advanced RFID tag. The small size makes wearable sensor nodes practical. (Image copyrighted by Crossbow Technology, Inc., and reprinted with permission.)

Sistema com sensor e receptor



Acelerômetro

- Dual-axis accelerometer fabricated on a monolithic CMOS IC
- No moving parts
- Less than 2 milli-g resolution
- No sensitivity or zero g bias hysteresis
- 50,000-g shock survival rating
- 35-Hz bandwidth expandable to >100 Hz
- Low-height (2-mm) surface mount package
- Continuous self-test for failures
- Low cost (about \$5.00)



Sistema de recepção de dados



The SV-6 PC is a VGA viewer. The key specifications are as follows:

- Display:
 - VGA LCD panel
 - 640 × 480 resolution in true color
 - Field of view: 16° horizontal, 20° diagonal
 - Image appears as if projected at a distance of up to 15 ft
 - Independent focus of 2–15 ft
- Weight: 2.5 oz
- Display interfaces:
 - Compact Flash Type II
 - PCMCIA via optional adapter
 - Windows® Pocket PC® 2000–2003
- Video input formats:
 - VGA, SVGA, XVGA
 - 18-bit color

Sistema de recepção de dados

- Display:
 - VGA LCD panel (920,000 pixels)
 - 640 × 480 resolution in true color
 - 26° field of view
 - Image appears as if projected at a distance of 11 ft
 - Independent focus
- Weight: 3.5 oz
- Display interfaces:
 - Compact Flash Type II
 - PCMCIA Via optional adapter
 - Windows® Pocket PC® 2000–2003
- Video input formats:
 - VGA
 - 16-bit color



Sistema utilizando PDA



Sistema utilizando PDA

