Overview and Introduction to Embedded Systems

What is an Embedded System?

- Any electronic device that incorporates a computer in its implementation.

- The user of the device is often not even aware that a computer is present.

- The computer is used primarily to provide flexibility and to simplify the system design.

Some Interesting Examples of Embedded Systems...

Product: Sonicare Elite toothbrush.

Microprocessor: 8-bit

Has a programmable speed control, timer, and charge gauge

Product:Vendo Vue 40 vending machine.

Microprocessor: Two 16-bit Hitachi H8/300H Processors
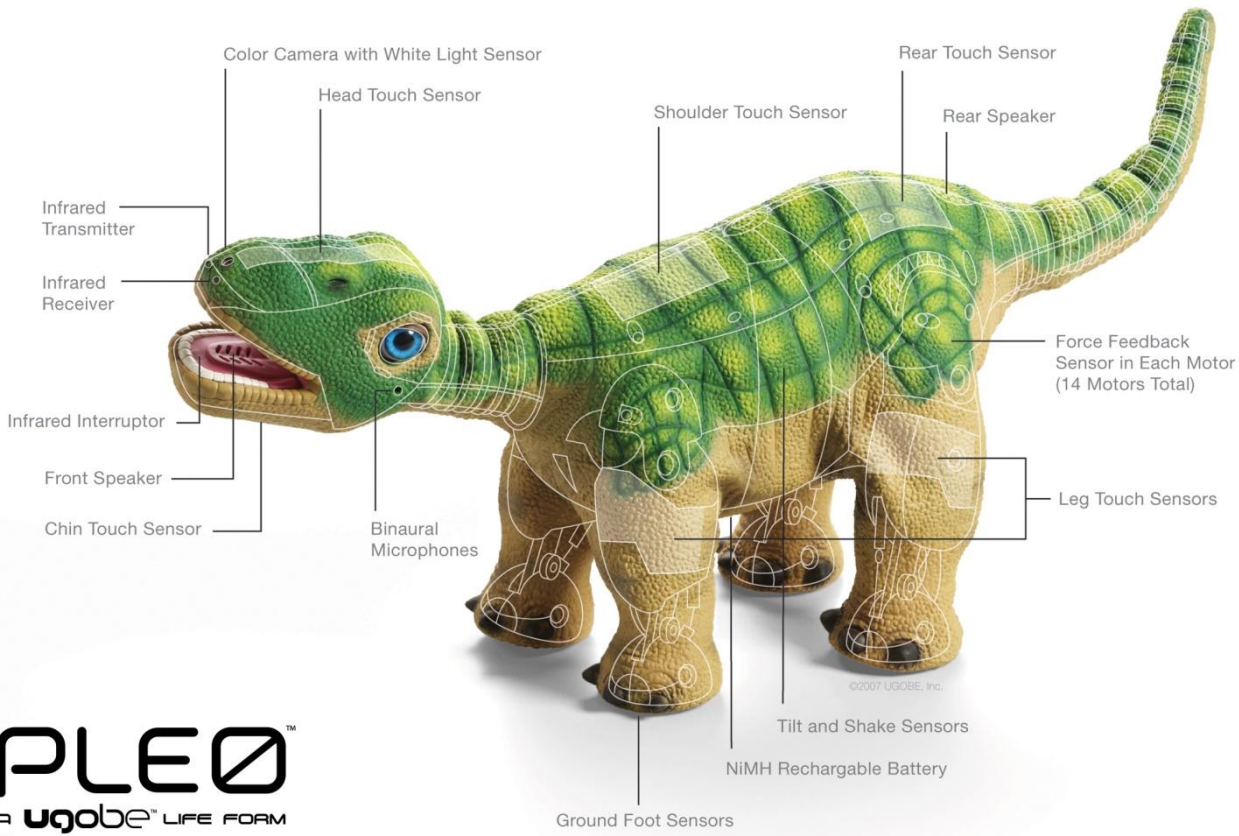
A robot hand dispenses items

Product: Sony Aibo Robotic Dog.

Microprocessor: 64-bit MIPS R7000.

OS: Aperios - Sony's Real Time OS

Used in Robocup Soccer Teams

Color Camera with White Light Sensor

Head Touch Sensor

Rear Touch Sensor

Shoulder Touch Sensor

Rear Speaker

Infrared Transmitter

Infrared Receiver

Force Feedback Sensor in Each Motor (14 Motors Total)

Infrared Interruptor

Front Speaker

Chin Touch Sensor

Binaural Microphones

Leg Touch Sensors

Tilt and Shake Sensors

NiMH Rechargable Battery

Ground Foot Sensors

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PLEO™

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Product: Pleo robotic toy dinosaur

Processors: two 32-bit (main is ARM) and four 8-bit microcontrollers

Product: Radiant Systems Point-of-Sale (POS) Terminal

Microprocessor: Intel X86 Celeron

OS: Windows XP Embedded

Look for one next time you order fast food!

Product: High End Systems DL2 Digital Media Server

Microprocessor: X86

OS: Windows XP Embedded

Used for lighting effects in shows and rock concerts

Product: Microsoft's Smart Personal Object Technology (SPOT) watch

Microprocessor: 32-bit ARM with FM Radio Chip

Downloads News using extra bandwidth on FM radio stations in major cities

Kuka robot arms welding a Mercedes

Product: Kuka Industrial Robot Arm

Microprocessor: X86

OS: Windows CE OS & Others

Product: IBM Self Checkout Station

Microprocessor: X86

OS: Windows Embedded Point of Service (XP)

Product: LagoTek Home Automation Controller

Microprocessor: ARM + DSP

OS: Windows CE

Product: Motorola MOTO Q9h Global Smartphone

Microprocessor: TI OMAP (ARM + DSP)

OS: Windows Mobile 6 (CE)

Product: Atronic Slot Machine

Microprocessor: X86

OS: Windows CE

Slots are networked to a casino's back office computer system. State Gaming agencies audit code and payoff odds.

Product: Dresser Wayne Ovation iX Gas Pump

Microprocessor:
Marvel Xscale (ARM)

OS: Windows CE

Displays video ads &
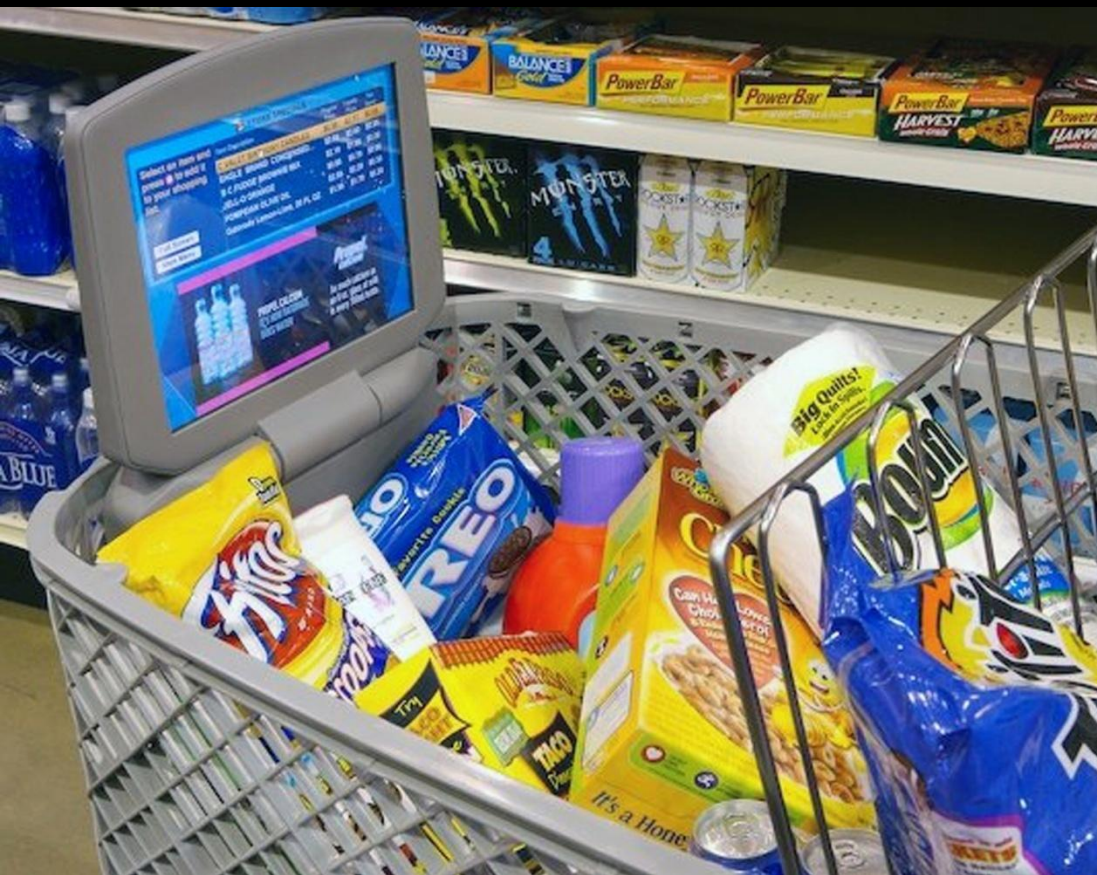**is networked to a gas station's back office computer system. Also has remote maintenance features.**

Product: Ford Sync

Microprocessor: ARM

OS: Windows Mobile (CE)

Product: MediaCart

OS: Windows CE

Product: Next Generation of Washers and Dryers

Whirlpool, HP, and Microsoft recently tested Wi-Fi enabled appliances that send alerts

Product: Toto Intelligence Toilet

It measures urine sugar, blood pressure, body fat and weight on a daily basis. This data can be transferred over the network.

Product: S class Mercedes

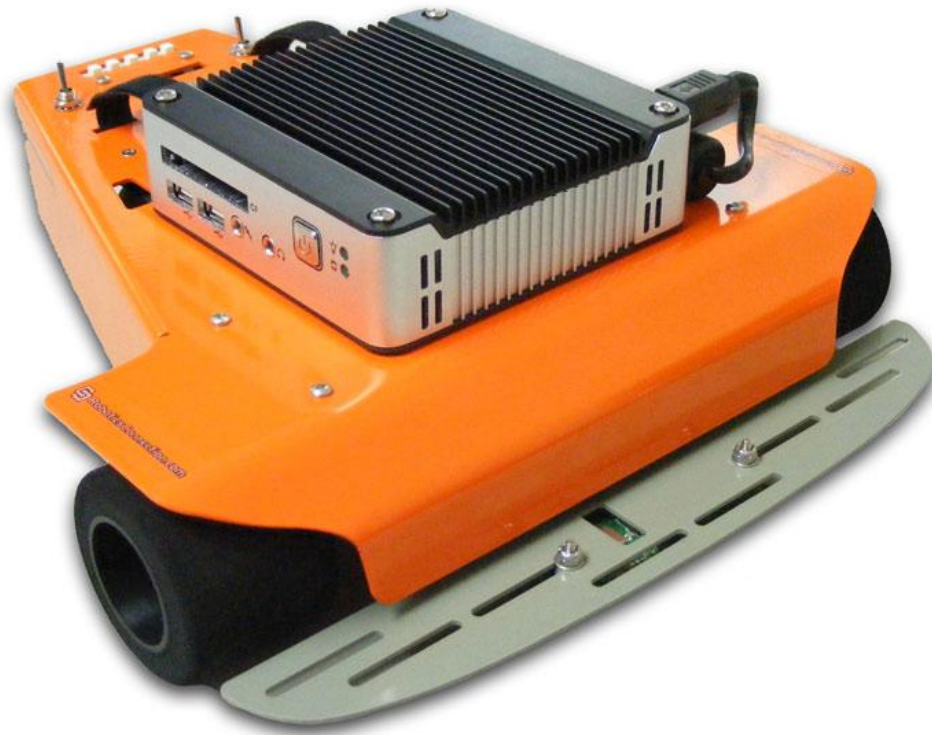**Microprocessors: around 100 embedded processors !**

Product: ICOP eBox 4300 PC
4.5 x 4.5 x 1.5 inches

Microprocessor:
500Mhz Via Eden (X86)

OS: Windows CE

Low-cost CE target board for
student projects

Product: Stinger Robot Kit from Robotics Connection

Microprocessor: X86 eBox

OS: Windows CE 6.0

More Examples of Embedded Systems

Aircraft & Military Systems	Aircraft autopilots, avionics and navigation systems, automatic landing systems, guidance systems, engine controls.
Biomedical	XRAY, MRI, and Ultrasound imaging systems, patient monitors, heart pacers.
Cars	Engine control, anti-lock braking systems, traction control systems, air bag controls, heating and air conditioning controls, GPS mapping, Satellite Radio, On-board Diagnostics.
Communications	Communication Satellites, network routers, switches, hubs.

Examples of Embedded Systems - Continued

Computer I/O devices	Keyboards, mice, printers, scanners, displays, modems, hard disk drives, DVD drives, graphics cards, USB devices.
Electronic Instrumentation	Data acquisition systems, oscilloscopes, voltmeters, signal generators, logic analyzers.
Home Electronics	Microwave ovens, dishwashers, DVD players, televisions, stereos, security systems, lawn sprinkler controls, thermostats, cameras, TVs, clock radios, answering machines, satellite or cable box, appliances.
Industrial Equipment	Elevator controls, surveillance systems, robots, CNC machines, Programmable Logic Controllers, industrial automation and control systems.

Examples of Embedded Systems - Continued

Office Machines	FAX machines, copiers, telephones, calculators, cash registers.
Personal Devices	Cell phones, portable MP3 players, Video players, Personal Digital Assistants (PDAs), electronic wrist watches, handheld video games, digital cameras, GPS systems.
Robots	Industrial robots, autonomous vehicles, space exploration robots (i.e. Mars robots)
Toys	Video Game systems, "Aibo", "Furby", "Elmo", and "Pleo" type robotic toys.