The Electronic (R)evolution

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e-Lab, October 10th 2009
Changed life?
Communication 100 years ago
Town meeting
or even before...
Today
Knowledge
papyrus
"On the Internet, nobody knows you're a dog."
Yes, but I came here today because I thought I was going to learn what is in my Gameboy, DS, Playstation 3, X-Box...
Computer
Got switch?
AND

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<th>A</th>
<th>B</th>
<th>Output</th>
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OR

Switch 1 Lamp

Switch

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A
B
20 transistors
Intel 4004
1st 4-bit Microprocessor
1971, 108kHz, 2300 transistors, PMOS
2300 transistors
6000 transistors

Intel 8080
NMOS 8-bit Microprocessor
1974, 2MHz, 6,000 transistors
130,000 transistors

Intel 80286, PC’s x286 chip

1982, ~10 MHz, 130,000 transistors
Intel 80386, PC’s x86 chip
1985, ~30 MHz, 275,000 transistors
Intel 80486, PC’s x486 chip
1989, 50 MHz, 1.2 million transistors
3.1M transistors

Pentium
1993, 66 MHz, 3.1 million transistors
7.5M transistors

Pentium II
1997, 300 MHz, 7.5 million transistors
28M transistors

Pentium III
1999, 733 MHz, 28 million transistors
Pentium 4
2000, 1.5 GHz, 42 million transistors
“Conroe” Core 2 Duo
2009, 3.16 GHz, 410 million transistors
2 Billion transistors

Intel “Tukwila”
2008, 2 billion transistors
CPU Transistor Counts 1971-2008 & Moore’s Law

Curve shows ‘Moore’s Law’: transistor count doubling every two years.
So many transistors... How is it possible?
Ok, but still not my DS, XBox, PS3...
Fig 1. Key Circuitry Clumped on One Side. The photo is close to the actual size – 141 x 76mm (longest area). The wireless module and microcontroller were covered by a metal shielding plate.
Chips in medicine
Chips in medicine: our Lab
Chips in robotics
Big Dog
http://www.youtube.com/watch?v=W1czBcnXlWw

Biped
http://www.youtube.com/watch?v=QWglowDOAzc

Asimo
http://www.youtube.com/watch?v=Q3C5sc8b3xM
Robotics Eyes: our Lab

Synthetic eyes: integrated smart image sensors

Bio-inspired vision algorithms

Vision systems

Applications
Robotics Eyes: our Lab
Robotics Eyes: our Lab
Robotics Eyes: our Lab
Robotics Eyes: our Lab
Thanksgiving

E-Lab current members:
Evan Park
Wei Tang
Brian Goldstein
Dongsoo Kim
Selcuk Talay
Berin Martini
Polina Askelrod
Hazael Montanaro

Past members:
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Pujitha Weerakoon
Shoushun Chen
Farah Laiwalla
Huang Chenxi

Visitors:
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Angelo Rottigni