

Intro to Microcontrollers or 'single chip' computers

self-contained computer on a chip

cpu, memory, clock, i/o (see slide)

some such as Arduino can be programmed + then plugged in to a device.

often 8 or 16, now some 32 bit

slow clock (some now up to 1 GHz)

small RAM + power use

BILLIONS sold every year

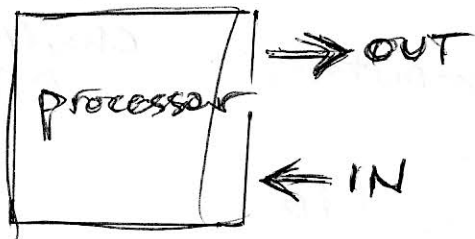
- registers 64 perhaps. enough
- SRAM very fast on chip as low as 1k ^{so no OS (or timing)}
- Flash / EEPROM : 16 - 64k for programs (maybe 1MB)

EMBEDDED usually preprogrammed and found on HD, mouse, some i/o ports + sound cards plus cars, phones, appliances, routers, RAID

i/o General Purpose "GPIO"

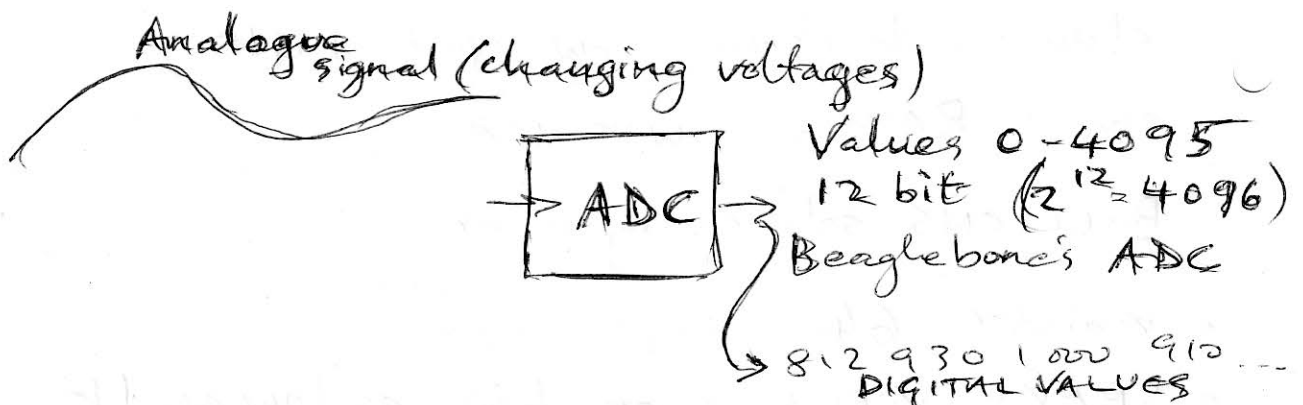
- timers, clocks, counters
- UARTs (serial devices) talk to USB controllers etc.
- PWM Pulse Width Modulation for controlling motors etc.

General purpose as can be input or output
useful for driving simple device or reading a switch



Analogue to Digital inputs

- convert analogue signals to numbers to capture audio etc.

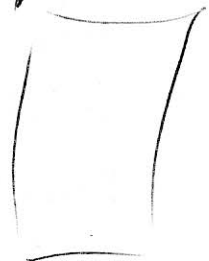


low power: perhaps 1mA (microamps) or standby even
fruit powered (view on YouTube)

/watch?v=8WSJeq87ezk
AVR with Lemon Power

Platforms: eg Arduino

ATMega 1280 easily accessible I/O
8k RAM 16MHz, 128k Flash
Not so great specs, but strong community, use C++



Arduino Uno has standard Pin-AT

ATMega 328P 2k SRAM
7.2

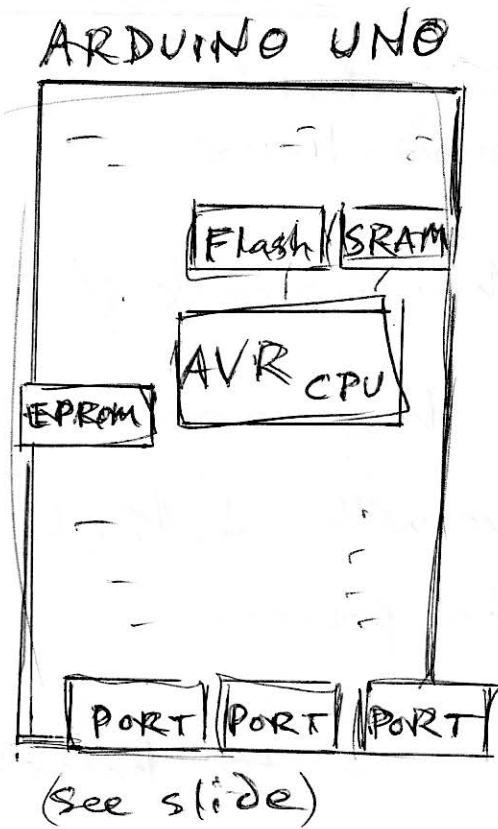
32KB
very popular Flash
has USB

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Microchips PIC family
used in Pic-Axe for
hobby electronics -
runs BASIC
6 Billion sold.

TEXAS INSTRUMENTS
TI MSP430

von Neumann architecture
CC430 onboard radio



ARM RISC family 1983

used in Acorn Archimedes RISC-OS

large memory for Windows mobile or Linux/Android
common in mobile phones 32 bit

A series can address 4GB 3-5 stage pipeline

0.5 nW/MHz used in tablets, phones + routers

ARM EMBEDDED 'CORTX' APPLICATION
A SERIES
CORTX
A-15

A8 includes 'NEON' unit for graphics, number-crunching
video decompression

arduino.cc/

COM(6) PUTTY

log-in - ubuntu
password - linux

python ; beagle i/o

top shows processes 256k RAM

move with J, K, L

sudo poweroff

↓
system halted

Lab on Tuesday