PYTHON AND ARDUINO: A TALE OF SNAKES AND KINGS

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Introduction

who
why
what
In the beginning

In the beginning was the abacus...
Technology started on real things you could touch
Being digital

From Big-Blue to Micro-Soft
Touching the Sky

Alice in Metaphorsland: desktops, trash-bins and wizards
Leaving Earth

Abstraction can be addictive
Unusable interfaces
It's all about Interactivity
Sniffing the stacktrace
Being real

Physical computing: low cost MCU's and electronic components
Here comes the King

Arduino's revolution

minimal
easy to use
cheap
from artists
Made in Italy
open hardware
What's inside?

hw: device: electronic prototyping board
sw: bootloader
sw: libraries
sw: IDE
community
lot of manuals
lot of examples
The board

Arduino UNO
MCU

Atmega 328

RAM 2 KB
ROM 32 KB
EEPROM 1 KB
14 digital pins
6 PWM capable
6 analog inputs
Up to 16 MHz
avr-gcc
Power to the people!

1982 – IBM 80286
Splitting the byte

Atmega 328
Registers and ports
Pins

Digital IO
PWM (digital)

Analog inputs
PWM (pulse width modulation)

<table>
<thead>
<tr>
<th>Logical 0</th>
<th>0% Duty Cycle - analogWrite(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25% Duty Cycle - analogWrite(64)</td>
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<tr>
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<td>50% Duty Cycle - analogWrite(127)</td>
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<td>75% Duty Cycle - analogWrite(191)</td>
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<tr>
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<td>100% Duty Cycle - analogWrite(255)</td>
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255 levels
C programming

```c
#define F_CPU 10000000UL
#include <avr/io.h>
#include <avr/delay.h>

void delayms(uint16_t millis) {
    uint16_t loop;
    while (millis) {
        _delay_ms(1);
        millis--;
    }
}

int main(void) {
    /* set PB5 (digital pin 13) to output */
    DDRB |= 1<<PB5;
    while(1) {
        PORTB &= ~(1<<PB5); /* pin off */
        delayms(100);
        PORTB |= 1<<PB5; /* pin on */
        delayms(900);
    }
    return 0;
}
```
Programming

setup
loop
blink!

/*
   Blink
   Turns on an LED on for one second, then off for one second, repe
   This example code is in the public domain.
*/

void setup() {
   // initialize the digital pin as an output.
   // Pin 13 has an LED connected on most Arduino boards:
   pinMode(13, OUTPUT);
}

void loop() {
   digitalWrite(13, HIGH); // set the LED on
   delay(1000);            // wait for a second
   digitalWrite(13, LOW);  // set the LED off
   delay(1000);            // wait for a second
}
King's audience

Arduino talks and listens

serial
sensors
RF
ethernet
At the king's court

shields
clones
DIY Arduino

< 10 €
Snake's attack

ASCII messages
compact protocols

>>> import pyfirmata
>>> print "yeah, it works!! :-D"
ASCII snake

```python
>>> import serial
>>> ser = serial.Serial('/dev/ttyACM0', 9600)
>>> while 1:
...     ser.readline()
'1 Hello world!
'2 Hello world!
'3 Hello world!

```
The firmata protocol

http://firmata.org/wiki/Main_Page

pyfirmata to the rescue

https://bitbucket.org/tino/pyfirmata/src
PyFirmata example

```python
import pyfirmata

PIN = 13  # Pin 13 is used
DELAY = 2  # A 2 seconds delay

PORT = '/dev/ttyACM0'

# Creates a new board
board = pyfirmata.Arduino(PORT)

# Loop for blinking the led
while True:
    # Set the LED pin to 1 (HIGH)
    board.digital[PIN].write(1)
    board.pass_time(DELAY)
    # Set the LED pin to 0 (LOW)
    board.digital[PIN].write(0)
    board.pass_time(DELAY)
```
Embedded snakes

Python on a chip

http://code.google.com/p/python-on-a-chip/
Other projects

Python Arduino Prototyping API
https://github.com/HashNuke/Python-Arduino-Prototyping-API

Python 2B (ASCII protocol)
http://arduino.cc/playground/Code/2B
OpenERP arduino controller

Demo

https://github.com/elpaso/arduinocontroller
http://www.youtube.com/watch?feature=player_embedded&v=MkxK9bHPZxQ
THANKS!

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