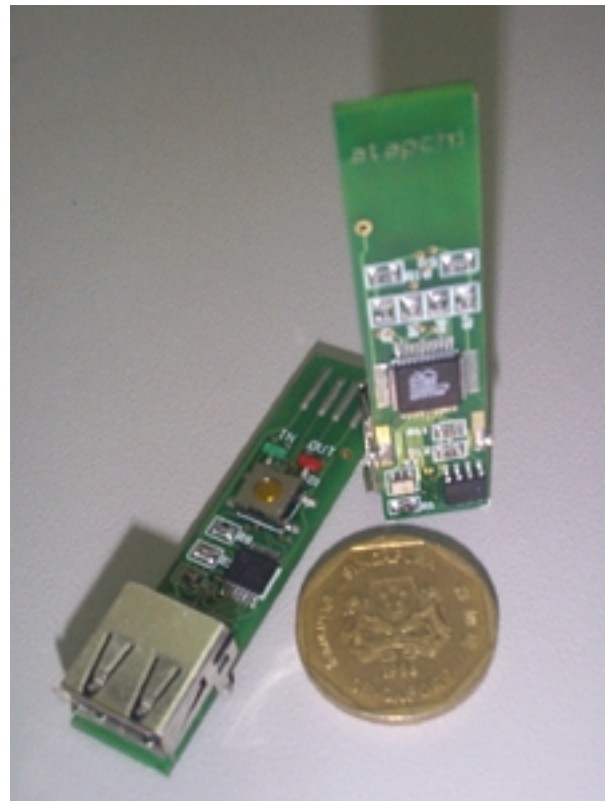


World's Smallest Low-speed USB Analyzer (Atapchi)

Idea is dead without a good application for it. So "California Dreamin'" USB virtual peripheral could be a very nice sample of academic research, but hardly anybody is going to build a keyboard or mouse using it. I have been thinking for a while what to do with it as well. First project that came to my mind was building a hardware key logger for USB keyboards, something like www.keyghost.com, built for PS2 protocol using PIC16F877. It was quite simple to implement USB part using SX, serial EEPROM and a few switching IC's. Furthermore I found out that built-in features of SX MCU would help to create a device able to work not only with pure low-speed USB keyboards, but also composite, built-in-hub, things, hence covering all existing systems (SUN, Mac, PC). Recording keystrokes is fun, but if we can do that, why not go further and try to record all low-speed USB traffic. No problem for SX again, problem for the memory. Serial EEPROM is just too slow to handle it. Solution was www.ramtron.com FRAM with 1MHz two-wire interface (let me pay credit here to www.svtehs.com, who happens to advertise it). Finally "California Dreamin'" found a real life application in the world's smallest low-speed USB analyzer "Atapchi" (stands for a small fruit in Singapore, tastes like apricot). I hope you find this project interesting (mail your questions to chinook@pacific.net.sg)

Atapchi Features

- 1) Full support for low-speed USB specifications
- 2) 500 transactions capacity in non-volatile memory
- 3) Signal quality checking
- 4) CRC match checking
- 5) Bit stuffing checking
- 6) Data overflow checking
- 7) One device dedicate capturing
- 8) External triggering
- 9) Bus powered



Atapchi Applications

- 1) Development of HID class low-speed USB peripheral devices
- 2) Development of small scale USB based networks

The list of MCUs you can use with Atapchi (not full)

- Cypress: CY7C630/1XX, CY7C3X/5XX, CY7C636XX, CY7C632XXA, CY7C637XX
- Microchip: PIC16C745, PIC16C765, PIC16F747, PIC16F767, PIC16F745, PIC16F765
- Motorola: MC68HC908BD48, MC68HC08JB1, MC68HC908JB8, MC68HC05JB3, MC68HC05JB4
- ST: ST7261X, ST7262X, ST7263

Atapchi Architecture

- 1) Ubicom SX48BD/TQ micro controller with 100% software implementation of USB (improved version of "California Dreamin")
- 2) Ramtron FM24C64-S 64Kb FRAM Serial Memory with 1MHz two wire interface
- 3) Murata CSTCW5000MX03-T 50 MHz small footprint ceramic resonator
- 4) Switching circuits (other manufacturers)
- 5) No USB interface (Atapchi is to be used with USB repeaters)

Atapchi Modes of Operation

Input, recording low-speed USB traffic. Atapchi is plugged into a USB self-powered hub, a USB repeater is plugged into Atapchi, device under development is plugged into the repeater. All traffic from/to the device is recorded.



Output, downloading the data. Atapchi is plugged into a USB repeater, the repeater is plugged into a self-powered hub. Atapchi enumerates as a generic USB keyboard and types memory content into any text editor.



Atapchi Output Listing

Device is the mouse you see on the picture above (Justy UMN-05 SG). MCU used is omnipresent Cypress CY7C63001A. Total listing length is 1083 lines.

reset			
	eop 060		eop 001
0001	00 0 setup		0013 00 0 in
0002	data0 [bb 29] 80 06 00 01 00 00 40 00		0014 data1 [00 00] zero-length
0003	ack		0015 ack
	eop 001		eop 014
0004	00 0 in		0016 05 0 setup
0005	data1 [c8 e7] 12 01 00 01 00 00 00 08		0017 data0 [07 2f] 80 06 00 01 00 00 12 00
0006	ack		0018 ack
	eop 002		eop 001
0007	00 0 out		0019 05 0 in
0008	data1 [00 00] zero-length		0020 data1 [c8 e7] 12 01 00 01 00 00 00 08
0009	ack		0021 ack
reset			eop 001
	eop 043		0022 05 0 in
0010	00 0 setup		0023 data0 [7e 33] 58 04 03 00 00 00 01 02
0011	data0 [57 85] 00 05 05 00 00 00 00 00		0024 ack
0012	ack		