AT89STK-03 Starter Kit

Software User's Guide

Section 1
Introduction

This document explains the functionnalities of the SCIB-USB application. This application reads the ATR from a Gemclub Memo smart card and displays it on any text editor such as notepad. This application is an implementation example of a HID keyboard which is USB Chapter 9 compliant.

An AT8XC5122 evaluation board may be used to run this application.

1.1 Abbreviations

- USB: Universal Serial Bus
- SCIB: Smart Card Interface Block
- HID: Human Interface Device
- ISP: In-System Programming
- DFU: Device Firmware Upgrade
- ATR: Answer to Reset

Section 2

Getting Started

2.1 Hardware Requirements

The demonstration application requires the following hardware:

- Atmel Evaluation Board
- Gemclub Memo Smart card
- AT8XC5122 microcontroller
- A-B USB cable
- PC running Windows® (98, Me, 2000 or XP) or Linux® with a 1.1 or 2.0 USB Host

2.2 Software Requirements

The following software is necessary to use the demonstration program. The software can be found in the accompanying CD-ROM. Updated FLIP software is available on the Atmel web site.

- Flexible In-System Programming (FLIP) software tool
- c5122-scib-usb-hid-X_X_X.hex file (X_X_X is the version number of the package).

2.3 Default Hardware Settings for AT8XC5122 evaluation board

Ensure that the AT8XC5122 board is in default hardware configuration (refer to Hardware Manual).

Section 3

SCIB-USB HID Demonstration Program

The purpose of the HID Keyboard demonstration program is to send digital data to a PC through USB interface.

The HID Keyboard demonstration program can be used with the AT8xC5122 board (Stand-alone Application).

3.1 Stand-alone Application

The microcontroller board can be used to transmit a message stored in the MCUs Flash memory and display the message on a PC text editor (Windows NotePad).

This demonstrates the smart card microcontrollers “Plug & Play” and “Hotplug” capability for any USB application.

1. Ensure the USB cable is connected between the AT8XC5132 evaluation board and the PC and start the application.
2. Open the Notepad application or any text editor on the PC.
3. Insert Smart Card Gemplus GemClubMemo. The ATR is read and data is sent to the host through Human Interface Device (HID) Keyboard USB device. The data received by the host is read by Notepad windows application.
   Or Click the INT1 button of the AT89C5122 evaluation board. The message “welcome to at8xc5122 hid demo” is displayed on the text editor.

3.1.1 Note on Windows Drivers

The HID keyboard example can directly interface with native drivers under Windows 98, Me, 2000 and XP. After initial USB connection, Windows *may* ask for drivers. Indicate the following path:

- <Windows hard drive>:\WINDOWS\inf (for Windows 98 and Me)
- <Windows hard drive>:\WINNT\inf (for Windows 2000 or XP)

Section 4

Software Architecture

4.1 Architecture Overview

The SCIB-USB HID keyboard demonstration firmware is based on a scheduler in free running mode.

The main program only enables the interrupts and launches the scheduler.

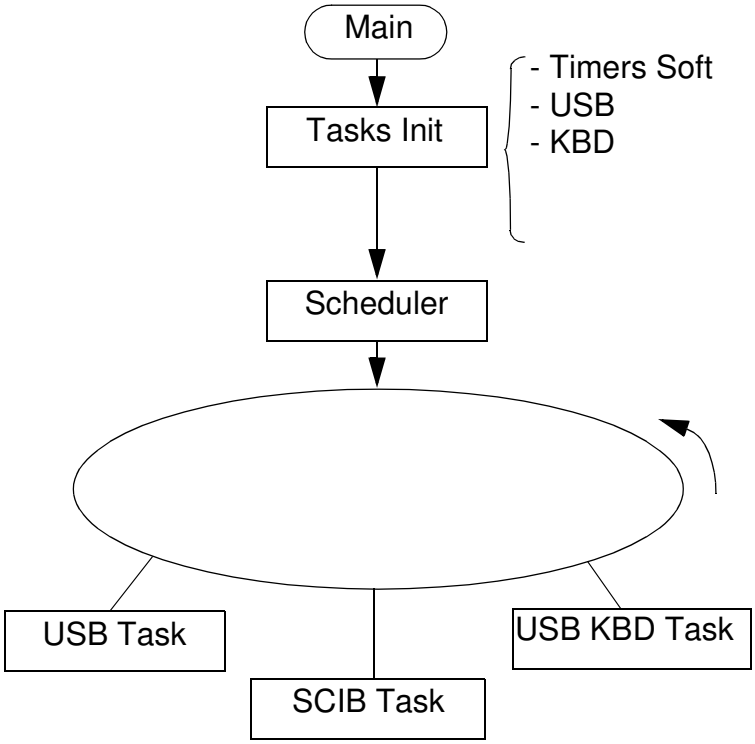
The first process of the scheduler is the initialization of all the peripherals and of the associated variables.

Once the initialization process is complete, the scheduler launches each task one after the other. The first task is the USB task. This task manages the Default Control Endpoint for the enumeration process and the HID keyboard control.

The second task called by the scheduler is the USB KBD task that transmits the keys pressed to the USB controller.

The third and last task called by the scheduler is the SCIB task. This task shows a simple demonstration to get the ATR from a GemclubMemo smart card.

Figure 4-1. USB HID Keyboard Firmware Architecture Overview



4.2 Application Description

4.2.1 Configuration

The USB HID keyboard configuration is performed according to the “USB Device Class Definition for Human Interface Device – Firmware Specification” version 1.1 (4/7/99).

4.2.2 Implementation

4.2.2.1 usb_task_init()

The usb_task_init() function is called during the initialization phase. It enables the USB controller, configures the PLL in order to generate the 48 MHz required by the USB controller, and enables and configures the Endpoint 0. In addition, this function performs a USB Detach/Attach in order to be re-enumerated by the Host. This could be necessary after a Start Application is performed by the bootloader.

4.2.2.2 usb_task()

The usb_task manages the USB events: Suspend, Resume, USB Reset and Start of frame.

When a SETUP token is detected on the Endpoint 0, the usb_task launches the enumeration process routine. Once the Control Transaction has been completed, the enumeration process routine exits.

A Transmit Complete flag (TXCMPL) detection on the Endpoint 1 (IN endpoint for HID keyboard) means that a HID report has been successfully transmitted to the Host. The

usb_task then clears the Transmit Complete flag in order for the USB keyboard application to send the next HID report.

4.2.2.3 usb_kbd_task()

This usb_kbd_task() determines if a new report has to be sent to the Host in function of the keyboard scan. This function is also in charge of translating the keyboard scan result into HID comprehensive bytes. The key codes sent correspond to the USB HID Usage Tables document for a QWERTY keyboard.

4.2.2.4 scib_task()

This scib_task() determines if smart card Gemclubmemo is inserted and report when the ATR is ready to the usb_task. The scib_task uses the SCIB drivers which contains all functions to start a SCIB transmission / reception.

4.2.3 Customization

4.2.3.1 Enumeration Customization

The developer can change the USB parameters of the descriptors that are sent during the enumeration process in order to personalize the application. Please refer to the enumeration process application note.

4.2.3.2 Keyboard Map

The developer can change the translation between the keyboard map and the HID comprehensive bytes. The values of the usb_geneb_keys list of the usb_task.c file must be replaced.

4.2.3.3 Additional Features

The developer can add other features by adding new tasks in the scheduler.

4.3 Libraries Description

4.3.1 USB

The USB management uses two different libraries:

- One for the USB enumeration process
- One for the low level of the USB controller

The enumeration process management is contained in the usb_hid_enum.c and usb_hid_enum.h files. As it is written in the file names, this enumeration process is specific for this application because some HID specific messages require the default control endpoint. However, this enumeration process management can easily be adapted for other applications.

The low level library gives an easy and comprehensive access to the USB controller. This library allows to manage USB events (USB Reset, Suspend/Resume, Start Of Frame), to configure the USB controller and the endpoints, and to send or receive messages over each endpoint. These drivers are contained in the usb_drv.c and usb_drv.h files.

4.3.2 SCIB

The library SCIB is used to control the data flow between a smart card reader and a smart card.

The SCIB management uses two different libraries:

- the SCIB driver (scib_lib) : contains low level functions (access to SFR bit, bytes).
- the SCIB api (scib_api) : contains API to control the SCIB.

The scib_task uses the SCIB drivers which contains all function to start a SCIB transmission / reception.

Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
Tel: (33) 2-40-18-18-18
Fax: (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards
Zone Industrielle
13106 Rousset Cedex, France
Tel: (33) 4-42-53-60-00
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

RF/Automotive
Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/
High Speed Converters/RF Datacom
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
Tel: (33) 4-76-58-30-00
Fax: (33) 4-76-58-34-80

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