Smart Tag Design for Blind-Accessible Conventions♦ Programmer Manual

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Overview

Smart Name-Tags are active RFID tags that enable sharing of professional information easier and more accessible for visually impaired people in convention centers. Tags carried by blind people would be accompanied with a text-to-speech device and an extra battery pack to enable audio feedback to the carrier. Basically, the smart Name-Tag system makes it easier for the blind person to meet new people in a social environment and exchange his or her information.

System Software Description

The tags are programmable using any language of preference that supports Microchip hardware architecture. The C-compilers chosen for this project is the CCS compiler due to its code efficiency, built-in functions, and low cost. The compiler comes with an IDE equipped with special features such as a project wizard that does most of the setup and starts out the user at the main( ) section of the code. The user may also use a free IDE provided by Microchip called MPLAB, which comes with a project manager tool and better in-circuit debugger options. Flashing the tag with the compiled HEX file is basically done using PICkit2 programmer and PICkit2.exe windows program.

More info on CCS compiler can be found here:
http://www.ccsinfo.com
More info of MPLAB IDE can be found here:
http://www.microchip.com

System Hardware Description

The hardware is composed of mainly two boards the active tag and the universal programmer. The active tag 35mm x 29mm and the universal programmer is 2inches x 2inches.

Features of the active tag:

1) 2.2volts to 3.0volts operating voltage.
2) 11-pin multipurpose header.
3) Low power 32KHz PIC16F690 microcontroller with nano-Watt technology
4) Low power Transceiver nRF24L01 from Nordic Semi
5) Remote trigger wakeup
6) Wireless power transfer

Features of the universal programmer:

1) Programmable using PICkit-2 from Microchip
2) Programmable using ICD-2 from MicroChip
3) Programmable using MeLabs programmer
4) Programmable using any ICSP header.
5) Low power RS232 driver for serial communication with PC.
6) DC-input regulated down to 3.3 volts necessary to program tag
7) Optional power bus
8) Optional interface to some I/Os of the tag

Active Tag

Header Pin Description

The picture seen below is the "bottom-view" of the tag Figure 2.1, considering the coin-battery side to be the top-side. As seen from below, on the right side of the board is an 11-pin header used for programming the tag (pin 1-5), recharging the battery (pin 4-5), serial communication (pin 5-7), and general purpose I/O (pin 8-11).
Another 2-pin header in Figure 2.1 is also seen on the upper-right side next to the 11-pin header. The upper pin is GND and lower pin is Vin. This 2-pin header is used as an external auxiliary power input, also could be used to measure the system power consumption, as well as charge the battery. On the upper-left side of the board is another 2-pin header used for wireless power charging, for future experiments.

Buttons and Switches

There are two buttons and one switch available on the tag and are located on the lower side of the tag. The lower right button is the reset button, which brings the entire system into a hardware reset when the button is pressed. The next button over, located in the lower middle area, is the select button, which is an external interrupt signal that brings the microcontroller out of deep sleep mode for lower power consumption purposes. On the lower left side of the board is a Power-Switch. The power switch turns the tag's entire power ON or OFF. Note that, technically, the power switch switches the negative terminal of the battery in or out of the system rather than the positive terminal for technical
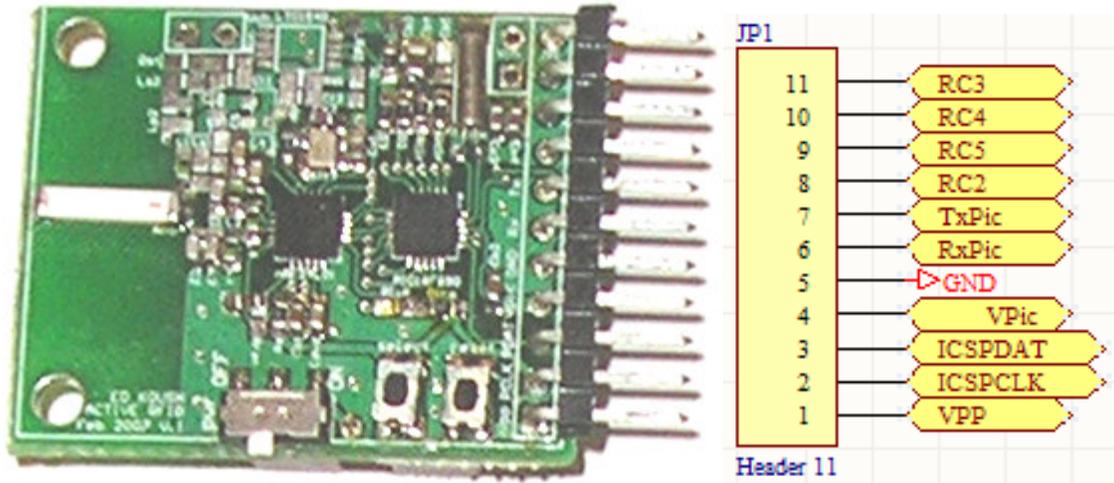
Figure 2.1 Bottom view of the Tag.

Universal Programmer

The universal programmer can be used to charge the battery on the active tag, provide power to the tag for power consumption monitoring purpose, allow access to serial port communication with PC via voltage shifter RS232 chip, extend the general purpose IO's available, and flash program the tag with new firmware.

Programming Headers

There are five headers that can be used to program the tag. Three of which are most popular ICSP_UC, EPIC_ICSP, and ICD2 header, as seen in Figure 2.2.

Figure 2.2 Universal Programmer
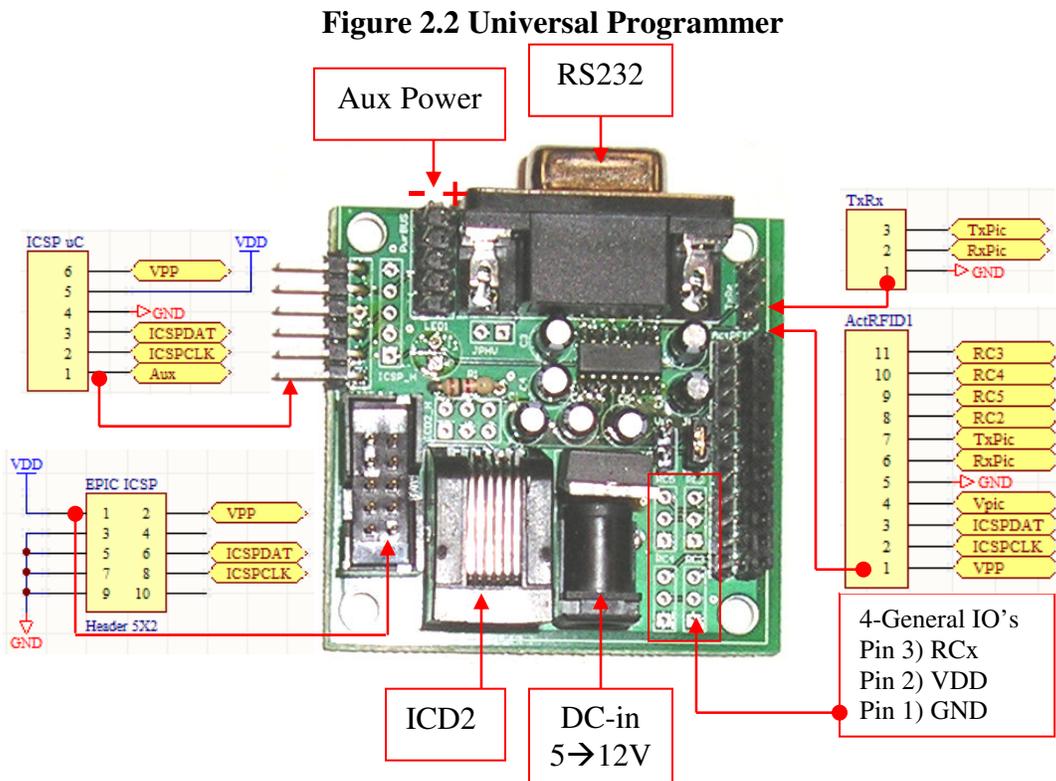
System Plug-In

The Tag must be plugged into the universal programmer with the antenna side facing into the board or battery facing out of the board, and the Microchip PICkit2 must be plugged into the board with the Logo facing up or arrow pointing to the corner of the board, as seen in Figure 2.3.
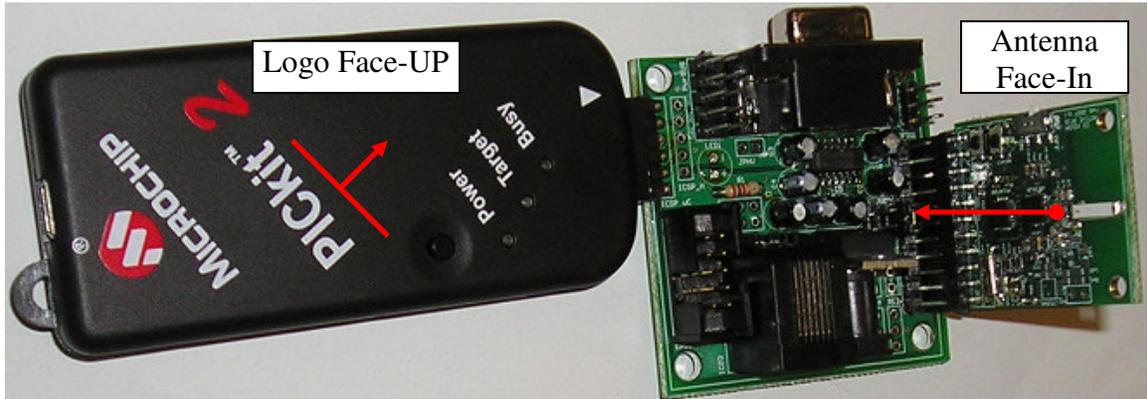

Figure 2.3 System Plug-In

WARNING: connecting the Tag or PICkit2 in the other direction might cause possible damage to either one and will fail to program Tag.