

The Silicon Wallet

...a device that reads information from the web!



Contest entry C2973

Forgot your password?

How do you manage your ever-increasing set of password, secret numbers and personal ID codes? My list is very long: passwords for Internet and Intranet access at home and office, credit cards and ATM, mobile phone, burglar alarm, insurance, SSN, tax number, safe lock... To make matters worse, new passwords are being generated everyday. Apparently, every useful site requires you to register for a better, customized service. Not surprisingly, problems related to stolen ID, hacked databases and loss of confidential information are becoming more and more common.

I'm conscious of the importance of preventing identity thefts, but admittedly it is very troublesome to follow even the most basic prevention rules, like "*never use the same password twice*" and "*avoid passwords that make sense in favour of abstract combinations of letters and numbers*". I understand that the intention is very reasonable, like limiting damage in case of stolen or lost passwords, or defeating automated scripts that programmatically try to login using the entire vocabulary (including popular pet names and plausible birthdates). But fact is that managing an ever-increasing crowd of passwords exceeds the skills of normal people like me. Actually, another popular rule states "*always keep password lists in a secure place*" (sic), implicitly admitting that no mere mortal can remember dozens of random alphanumeric sequences.

I have searched the *secure place* mentioned by the rule for a long time. I looked for something handy and dependable, something I can always carry with me, very user-friendly because I planned to use it often, and discreet enough to be comfortably used in situations like drawing cash from an ATM when travelling in a foreign country. I discarded common data-storage capable devices - like laptops, USB storage, mobile phones, data-bank calculators, palm computers - because they are ineffective when used for storing password lists (see table).

Realizing this, I have decided to design my own solution.

The Silicon Wallet

The Silicon Wallet fits a small plastic box, and can store hundreds of passwords, logins and secret codes. An alphanumeric LCD display fills the front side. It is battery operated and has no keyboards, just a wheel peeping out on one side, like the volume control in miniature radios. Turning the wheel (you can do it with one hand) you enter a secret 5-digit code. This number is the only one you have to remember from now on. It's like having a safe in your pocket: once it is opened, you can use the wheel to scroll through the information that's inside it.

THE MOST AMAZING FEATURE OF THE SILICON WALLET IS THE WAY YOU ENTER NEW INFORMATION: instead of awkward miniature keyboards like the ones found in Far-East gadgets, or uncomfortable input schemes based on invariably-too-few buttons, Wallet's input device is a single phototransistor.

How can you enter text using a phototransistor? Well, recognizing that whenever I get a new password I am also using a web browser, I have developed a JavaScript program capable of transforming ASCII text into encoded light flashes, changing the colour of screen objects. With this script I have built a nice web page, displaying a keyboard: thus, to enter fresh data into the Silicon Wallet, just direct your web browser to the keyboard page, place the Silicon Wallet on the PC screen so that it can see the flashes, and click whatever text you want to store. It's that easy!

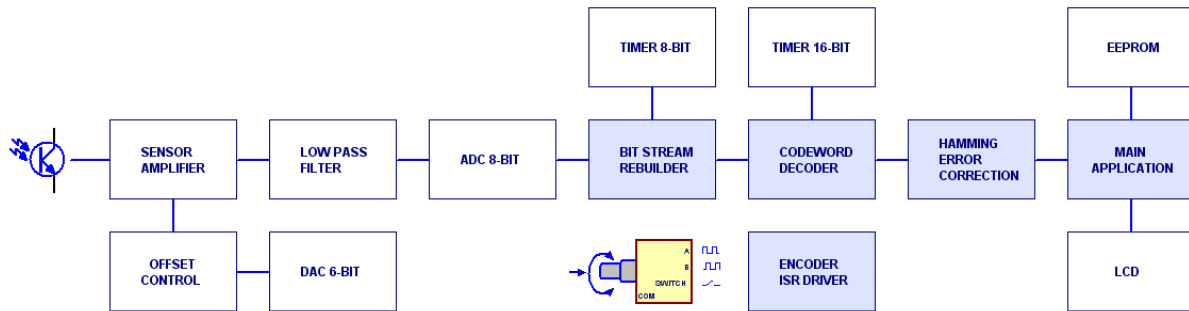
By design, this “wireless” input technology requires just a web browser, and works on any combination of platforms and operating systems. Remarkably, it doesn’t require you to install any specialized software and drivers. On the security side, the script encodes data on-the-fly, one character at a time, with the intention to defeat RAM and cache hacking. Once in the wallet, information is stored into processor’s on-chip FLASH, which is hardware-protected from reading. At last, I have found a fairly secure place for my password list!

In the following, I will unveil the details of Silicon Wallet’s hardware and software, which is an elegant, clean, inexpensive single-chip project, exploiting both the analog and digital qualities of the PSoC microcontroller. I will describe how I managed to adapt it to the different signals captured from CRT and LCD monitors, and how I designed the filters in order to get rid of the noise coming from ambient light and superposition of the video raster. I will cover briefly the use of Hamming ECC (Error Correction Code) in order to make the system more robust, and the tricks used for embedding a signal encoder into a web page using a general-purpose language like JavaScript. Finally, I’ll take some time to illustrate how, with the only addition of an inexpensive light sensor, a wide range of products - from toys to music players to industrial timers - can be configured, enabled or programmed using nothing more than web pages. My intent is to show you the enormous potential of the underlying technology, which, when considered as a more general mechanism capable to *transfer data from the web to electronic devices*, can lead to a whole class of cutting-edge products.



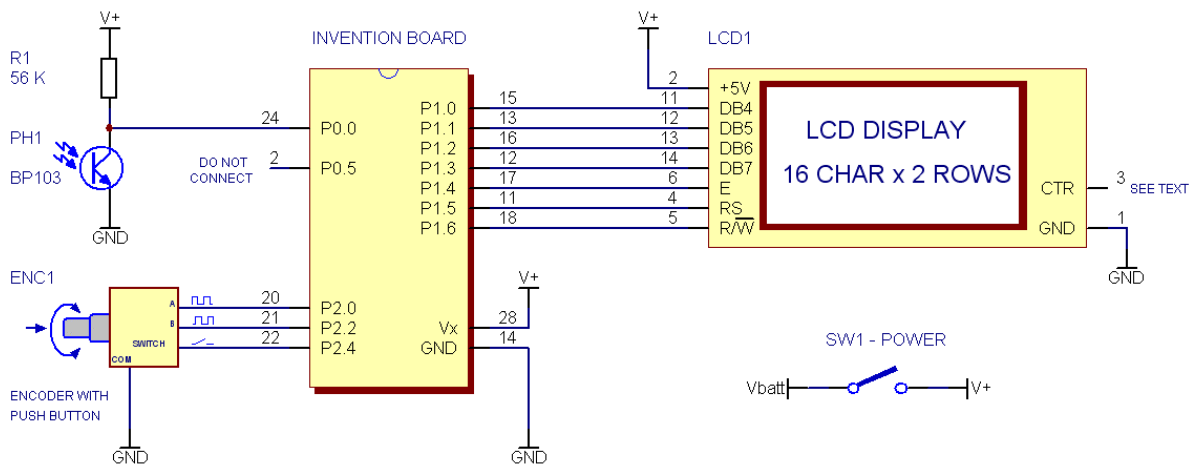
The Silicon Wallet can get text from a web browser by means of a phototransistor

Block diagram



Block diagram. White blocks are PSoC supported, blue ones are implemented by the software.

Hardware



Prototype

