

An Overview of Smart Quill

Deepika Maheshwari

M.Tech Scholar, Birla Institute of Technology, Mesra Ranchi,
(Noida Campus) 84 Pragati Apartments, SFS Flats, Paschim Vihar,
New Delhi-110063

Abstract - In the market there are various pen's available but none of them performs operations other than writing. This paper focuses on the extraordinary invention of a pen that performs operation more than writing. SmartQuill is a computer housed within a pen. This pen replaces the keyboard in the office, but it is highly convenient for people who takes notes by hand.

Keywords – Smart Quill, Accelerometer, Handwriting Transcription, Handwriting Recognition.

1. Introduction

Smart Quill was invented in Microsoft Research's Cambridge UK lab by Lynsday Williams. According to Lynsday Williams Smart Quill is the pen for the new millennium. The idea of Smart Quill came to the inventor in her dreams. It is an extraordinary pen that can remember the words it writes and then transfer them into the computer text. This pen is very classy and at the same time absolutely different from the pens that are available in the market as it performs various functions other than writing. It does not require any special surface and can write on any be it paper, tablet, air or any other screen. It contains sensors for recording the movements irrespective of platform, by using earth's gravity.

2. Architecture

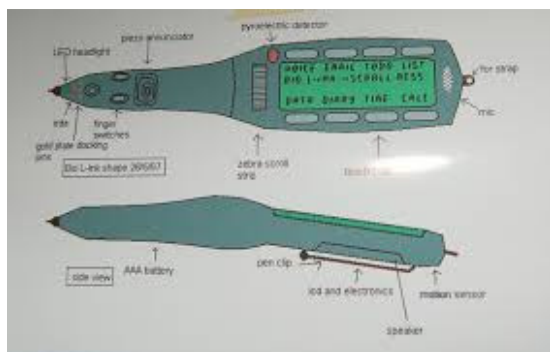


Figure 1 : Architecture of Smart Quill

The various components of SmartQuill are as follows :

- Accelerometer
- Microprocessor
- LED headlight
- Touch Button
- LCD
- AAA battery
- Speaker
- Mic

3. Working of Smart Quill

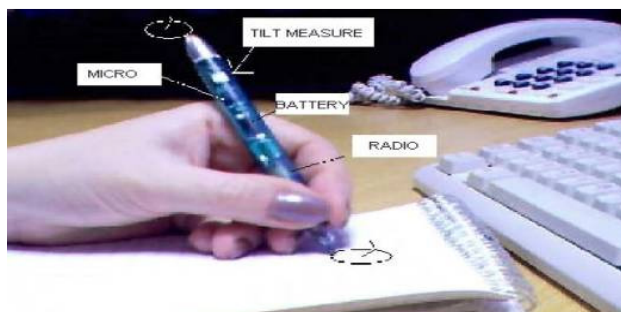


Figure 2: Smart Quill

Smart Quill measures the movement of pen and then matches them to the movements that produce the words and letters programmed into its memory. It is a bit larger than an ordinary fountain pen. By pushing a button on the pen and writing what the user would like to enter, users can enter information and it does not necessarily need a screen. This technology has the ability to read handwriting not only on paper but on any horizontal or vertical flat surface. There is a three-line screen for reading the information stored in the pen. The users might also scroll down the screen by slightly tilting the pen.

The user trains the pen to recognize a particular handwriting , as long as the handwriting is consistent. Even if the handwriting is quite messy the pen can recognize it. The notes are stored on the pen's hard disk

after which it is then plugged into an electronic inkwell. The text data is transmitted , for sending files electronically, onto a desktop, modem, printer or any mobile telephone. Upto ten pages can be stored on pen. The power gets off automatically when the pen is kept idle for some time.

4. Features and Technology Used

A. Display Technology

Kopin Corp's Cyber Display which is ¼ inch diagonal LCD display is used in SmartQuill. It uses circuitry built on a silicon wafer then removed and mounted to glass. Using its own backlight, optics, packaging and ICS, the displays are integrated to miniature monitors.

B. Handwriting Recognition and Signature Verification

Smart Quill works by measuring the pen's movements and matching them to the movements that produce letters. There are two techniques as follows:

- Accelerometer technology
- Handwriting recognition software

I. Accelerometer Technology

A device called Accelerometer is used for measuring motion in this technology. It can be used to detect the arcs and loops, starts and stops of handwriting. This information is transmitted to a small microprocessor that would make some sense of it as text. Also the invisible writing in air is achieved through this technology called accelerometer.

There are two types of accelerometer as follows:

- Two Axes Accelerometer – Two Axes Accelerometer measures acceleration in two axes. For example ADXL202.
- Three Axes Accelerometer – Three Axes Accelerometer measures acceleration in three axes. For example Tronics +/-2g accelerometer.

II. Handwriting Recognition Software

Handwriting recognition software is a software that is embedded in the microprocessor of the pen and is used to recognize the handwriting of the user. The users install specific handwriting recognition software on a regular PC and the pen works in conjunction with that PC. This software translates the movements into the text on screen.

This software constitutes two major phases;

- Handwriting Transcription
- Handwriting Recognition

Handwriting Transcription

In Handwriting Transcription phase the recorded acceleration signals are transcribed to its original form. Firstly, the pen's spatial orientation is found followed by a double integration to solve all derivation problems.

Handwriting Recognition

Handwriting Recognition is the phase in which the characters and signatures are recognized. In this Euclidian distance is used as the comparison process and the decision process is the smaller distance found.

III. Display Scrolls Using Tilt Sensors

User can choose applications and scroll without using scroll buttons by tilting the pen. By keeping the pen in left or right hand the text would get align. To measure tilt angle with earth Micro Electro-Mechanical Systems (MEMS) tilt sensors is used.

IV. Communication with Other Devices

The earlier models of SmartQuill that were developed by BT laboratories communicated with the PC via a radio transmitter. But the current prototype hooks up via a cable to PC. When SmartQuill is placed into a docking station, the data stored in memory is uploaded to PC. An electronic docking station is a small cabinet to which a laptop can be attached that has connector for external connected devices such as scanners, hard drives, ports that can be linked to components such as monitor, keyboard, printer.

V. Memory

SmartQuill has a memory 4MB EEPROM. At a time, the pen can store locally upto 10 pages of notes. Until the data is uploaded to the personal computer it is stored in the memory on the pen.

VI. Power

SmartQuill is powered by Antiaircraft Artillery Battery (AAA). With a single AAA battery SmartQuill can work 25 hrs continuously. It exhibits automatic on/off power system. The pen will automatically power down after a long period of no movement.

5. Advantages

- i. SmartQuill can read on any flat surface and not only on paper.
- ii. SmartQuill is protected by password.
- iii. It is portable and highly convenient.
- iv. With modems, printers etc it can be linked.

6. Disadvantages

- i. SmartQuill has accelerometer errors.
- ii. People with hand tremours have inconvenience with it.
- iii. It has a size bigger than a normal pen.
- iv. Due to the thermal variations in the spring errors are introduced in the system.

7. Conclusion

This paper concentrates on providing people with a pen that performs much more functionality than an ordinary

pen. We have discussed in detail about how SmartQuill works. It is a big support for people who takes notes on paper. This paper includes the various features and how they are useful. Also, in this paper we have discussed the various advantages and disadvantages of this extraordinary pen. This paper includes the details on how the idea that came to the inventor in her dreams work.

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