A Novel Survey on Smart Quill Technology

Sachin Singh [1], Parag Jain [2], Rachan Karmakar [3], Amit Kumar Tanwar[4], Lokesh Kumar[5]

[1]CCSIT, TMU, Moradabad, UP, India
[2,4]Roorkee institute of Technology, Roorkee, Uttarakhand, India
[3]NIMS University, Jaipur, Rajasthan, India
[4]Tula's Institute, Dehradun , India

Abstract

These days, handheld computers are much more famous than ever before, so an emerging innovation has begun to favour small computers in order to perform computations with offering a very suitable and handy computation as well as other computing services. Because of this, makers and developers are able to create gadgets like computers. There is a limit to how small a handheld computer can be before it becomes nearly unusable, resulting in tiny keyboards and screens that require numerous cursor movements just to read simple text. When the Smart-Quill was released, many of the problems were fixed. Microsoft employee Lyndsay Williams from the United Kingdom created the Smart-Quill. It is a pen with the capacity to memorise written words and translate them into computer text. This pen is much bigger than a typical pen and features a screen on the barrel. Users of these programmes can enter information by simply pressing a button, allowing them to enter it in their own handwriting. Any surface, including paper, a screen, a tablet, or even the air, is available for writing by the user. The data entered into the pen can also be read on a tiny three-line display. We presented a survey on the mentioned technology in this paper regarding benefits.

1. INTRODUCTION

In the Cambridge, UK, lab of Microsoft Research, a man by the name of Lyndsay Williams developed the Smart-quill technology, a pen that can remember the words it has written and then translate them into language that a computer can understand. The inventor mused to herself while she slept, "It would be cool to place all of a handheld-PDA the type computer in an extending pen." She said, "The pen is designed for the next millennium." Thanks to Nigel Ballard, the leading consultant in the mobile industry, Williams was swiftly engaged by Brits Telecommunications, where she received funding and institutional support for her idea. Leading facilities at Martlesham, eastern England, created the Smart-Quill prototype, which was then sent by BT (formerly British Telecom).Users do not need to jot down on a particular pad to record and recall what they write with this sleek and stylish prototype pen, which is radically different from other electronic pens on the market today. He can write on any surface, including paper, a tablet, a screen, or even the air. The Smart-Quill is equipped with a cartridge that allows users to see what they write on paper. It contains sensors that, regardless of the platform, can record movement utilising the earth's gravitational system. The data entered by the user is recorded by the pen. The actual miracle is that you may use the "digital inkwell" to transfer your wise words to your PC, while the files you might want to look at on the pen are also downloaded to Smart-Quill. This elegant and fashionable prototype pen, which is very different from other electronic pens already on the market, allows users to record and recall what they write without having to do so on a specific pad. Any surface, including paper, a tablet, a screen, or even the air, can be used by him to write on. A cartridge that comes with the Smart-Quill enables users to see what they write on paper. It has sensors that can use the earth's gravitational system to capture movement regardless of the platform. The pen captures the user's inputted data. The real wonder is that you can transmit your smart words to your PC using the "digital inkwell," while the files you might want to look at are still on your computer.

2. DESCRIPTION

It seems to be slightly bigger than a typical pen. Users can simply write down what they wish to enter on paper, a tablet, a screen, or even in the air while pushing a button on the pen to enter their information into various applications. The Smart-Quill can perform calculations without a screen. A particularly

clever element of the technology is its ability to recognise handwriting not only on paper but also on any flat surface, whether it is horizontal or vertical. Additionally, there is a tiny three-line screen where users may view the information contained in the pen; they can scroll along the screen by slightly tilting the pen..[2]

2.1 TECHNICAL SPECIFICATION

A. FEATURES

• The Smart Quill pen incorporates tilt sensors to scroll the display and display technologies for signature verification and identification. Additionally, it contains memory and can communicate with other gadgets.

B. DISPLAY TECHNOLOGY

The display on the Smart Quill is made possible by the Cyber Display technology from Kopin Corp. A 14-inch diagonal LCD Cyber Display has circuitry that was built on a silicon wafer, removed, and connected to glass. The integrated displays are tiny monitors that come with their own lighting, optics, packaging, and ICS. [3]

C. HANDWRITING RECOGNITION AND SIGNATURE VERIFICATION

An accelerometer on board tracks hand motion in two or three planes. DSP converts to ASCII characters so that pen apps can write on paper, a flat surface, a vertical wall, or the air. For cursive letter recording and download to a personal computer for biometric authentication password decoding, use single character recognition on a pen. When writing, the Smart-Quill mimics the actions of the pen to produce the identical letter and the words stored in its memory[4]. It recognises sound in a manner similar to that of a microphone. The essential criterion for correctness in handwriting is consistency, not neatness. Two methods are used for this purpose:
1. Accelerometer technology.
2. Software for handwriting recognition.

3. ACCELEROMETER TECHNOLOGY

A micro accelerometer may be used by a pen to detect starts, pauses, loops, and arcs in handwriting. The information is then sent to tiny microprocessors that translate it into text. A virtual screen with a special monocular magnification can be used at the pen's tip to display a whole page of text. Accelerometer technology, which records hand movements and may be used as a "Virtual Hinge" to browse the pen's small screen and determine whether the user is right- or left-handed, makes it possible to write in the air (Invisible Writing). A tiny microprocessor receives movement data from the Smart-Quill, decodes it, and displays the text on the tiny built-in screen. [5]

Furthermore, the accelerometer is divided into two categories:-
1. Accelerometer with Two Axes: This accelerometer measures acceleration in two axes. For example, ADXL20 Accelerometer is a Two Axes Accelerometer.
2. Accelerometer with Three Axes: This accelerometer measures acceleration in three axes. Tronics +/- 2G Accelerometer, for example, is a Two Axes Accelerometer.

4. HANDWRITING RECOGNITION SOFTWARE

It operates on the principle of "learning by doing," whereby the software built into the pen's microprocessor is used to recognise the user's handwriting by studying the user's handwriting style over time, samples of the user's writing are gathered, and the software learns the individual's writing style, which translates movements into text on the screen. The user must install specialised handwriting detection software on a regular computer in order to achieve this writing technique. [7]

It is divided into two key stages:
1. transcription of handwriting
2. Recognition of Handwriting

Handwriting Transcription
Retracing the movement of the pen's tip on paper is done using a "simple" double integration method, and the recorded acceleration signals are then translated back to their original form

Method
Two major issues need to be resolved in order to accomplish the goals just explained: We must first identify the spatial orientation of the pen in order to subtract the effect of earth gravity from the recorded accelerations. Second, in order to solve all derivation problems with this approach, double integration

must be accomplished well. The algorithm for the aforementioned issue is as follows:

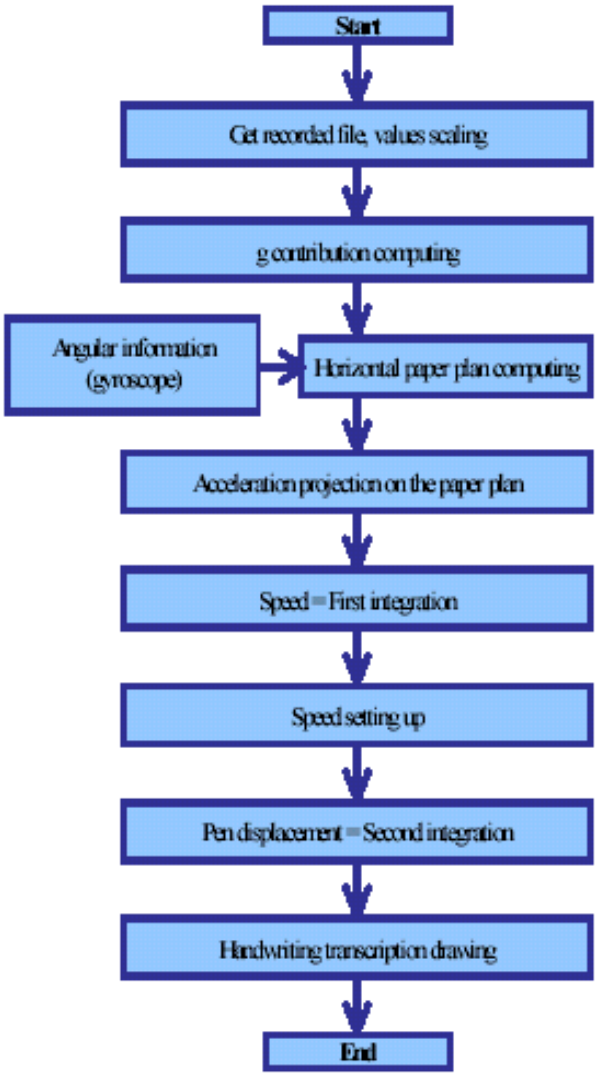

Fig-1 Handwriting transcription[8]

There are two images that we may see:
The acceleration signals captured while writing a little capital B are shown in Figure 2.

The transcription result produced using the technique provided is shown in Figure

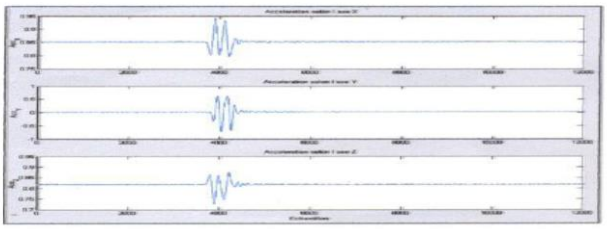

Figure: 1

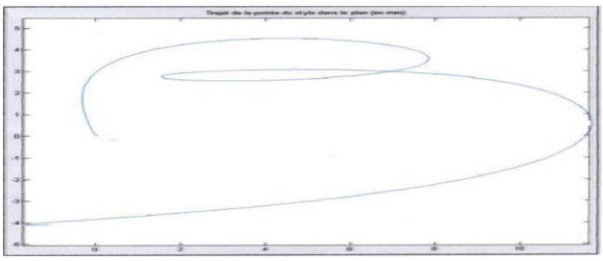

Figure:2

Fig-2 transcription results[4]

When a user is provided with a password field on a web page, they are meant to check the address bar to see if the domain name in the address bar is correct.
Another important feature is signatures and character recognition. The accelerometer and touch detector built in the pen's hardware have proven to be a highly effective combo for this application.

Method

The process is the same since it seeks to identify the characters entered by the user, ascertain who entered them, and identify them as belonging to a certain signature. We utilise a straightforward Euclidian distance because of the comparison process; in fact, the decision is made based on the smaller distance found. The first stage is to build a character reference database that is comparable to the signature database. Each recorded symbol is converted into a mean signal.
The second phase is the recognition process.
1. For the database, each symbol was replicated several times, and a mean normalised symbol was calculated.

Protocol

The process is the same since it seeks to identify the characters entered by the user, as well as to identify who entered them and to whose signature they belong. We employ a straightforward Euclidian distance because of the comparison process; in fact, the smaller distance found is what determines the outcome. The first step is to build a character reference database, similar to the one used for signatures. For every recorded symbol, a mean signal is calculated.
The second step in the process is recognition.

5. DISPLAY SCROLLS BY TILTING SCREEN

By tilting the pen, the user can select programmes, and there are scroll controls for navigation. Below is a picture of Lyndsay Williams' 1997 Smart-Quill

tilting Screen for BT Labs. The text was the right height for both right- and left-handed people since the pen aligns text whether it is held in the right or left hand.In order to live angle to the ground, tilt sensors from Micro Electromechanical Systems (MEMS) were used. The Smart-Quill microprocessor detects the orientation and converts the huge display to the smartfour-line display.

6. COMMUNICATION WITH OTHER DEVICES

The newest prototype Smart-Quill device from BT laboratories connects to a PC using a cable and a digital docking station called a "inkwell" as opposed to earlier incarnations that connected with a PC via a transmitter. The data stored in the memory component is copied to the non-public machine when the non-public desktop is docked. A laptop or other portable device can be attached to an electronic docking station to function as a desktop computer. It typically features ports that can be connected to components like the monitor, keyboard, and printer as well as a connector for external sources connected devices, including hard drives or scanners. By connecting to a printer, modem, or cellphone, it can also be used to deliver data digitally..[9]

7. MEMORY

The Smart-early Quill's models featured a 4MB EEPROM memory, allowing it to temporarily store 10 pages of notes in the pen before transferring them to a computer. The way Smart-Quill operates is by sensing the pen's movements and comparing them to movements that create letters and words in its memory. It functions similarly to how microphones interpret sound as an inpu

8. POWER

The Smart-Quill is driven by AAA batteries. It will perform for roughly 25 hours on a single AAA battery. The pen's power on/off system is electronically controlled. The pen will shut off after some downtime. It can therefore work with an instantaneous on/off mechanism..

9. PROTOTYPE OF SMART-QUILL

This Smart-Quill idea records handwriting on paper for transmission via radio to a portable computer, Windows computer, smartphone, or tablet computer. The computer screen displays these orientations as x/y coordinates after the analyzer captures the angular movement of the pen's peak at an angle in the air. In an early physical form, from left to right, there is a tilt sensor, a PIC 8 bit microcontroller, batteries, and a 433Mhz 1200 Baud sender. Currently, pen movement is recorded by a receiving set attached to a computer's RS232 port for computer analysis. There is no need for an on/off switch because the pen will automatically turn off after a certain amount of idleness. About 22 hours are covered by the battery..[10]

Fig-3 Smart pens[10]

10. APPLICATIONS

1. Smart-Quill isn't merely a technology for later. It has a cartridge that enables users to view their writing as it is being placed on the paper. As a result, using Smart-Quill to write notes on paper is a straightforward application. The information from the pen is subsequently sent to a computer.[10]

2. For use in a range of applications, the data captured in this pen is communicated to other devices such as mobile phones, printers, modems, desktop computers, and laptops..

3. It also includes software for mobile devices, such as calculators, contact lists, and electronic diaries.

4.Among other things, it is utilised to receive pager and email notifications. The most recent technology in Smart-Quill, a cellular communications system that allows two-way connectivity between devices, makes this possible.

5. Your PC can sync files, mails, and reminders with Smart-Quill.

6. The audio recorder Smart-Quill offers speech processing features as well. Voice recordings can be made using ADPCM speech compression.

11. ASSETS

1. The fact that Smart-Quill doesn't require a screen to operate is one of its best advantages. This is possible because to the revolutionary "Spatial Sensing" technology, which makes use of semiconductor accelerometers. Accelerometers pick up pen and hand motion rather than shapes. [11]

2. The computer programme Smart-Quill is simple to use.

3. Security - Security is yet another essential element. It is possible thanks to two resources:

a. It makes it possible to recognise handwriting.

It's possible to train the pen to recognise a specific handwriting style. Because the user uses the pen frequently, the symbols that they commonly employ are kept in memory. Because of this, the pen only recognises the owner's handwriting and ignores that of trespassers.

b. It enables the signatures to be verified. Passwords can therefore be typed in a signature style.

4. Another 3D mouse that lets you move around the screen by twisting it in the air in a particular way is the Ingenious- Quill.

5. Battery-saving measures: a. A small display uses less battery power.

c. The auto power is turned off if the pen is not moved.

6. Smart-Quill can be operated with one hand, is entirely mobile, and is small.

12. CONCLUSION

The potential compute power of the user will be met, according to Smart-Quill. Machine learning has the ability to improve technology as it develops, enabling it to give users better data. Additionally, Smart-Quill may be utilised by doctors to construct drugs that patients can read via an app, albeit there may not be many opportunities to do so. As a result, a widespread issue with reading doctoral writing may be resolved.

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