

DIGITAL PEN WITH ANOTO TECHNOLOGY AND TRAJECTORY RECOGNITION ALGORITHM

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ABSTRACT

An accelerometer-based digital pen used for handwritten digit and gesture trajectory recognition applications. The digital pen consists of a triaxial accelerometer, a microcontroller, trajectory recognition algorithm composes of the procedures of acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction. The proposed system compare trajectory recognition and Digital pen based on Anoto Technology The proposed trajectory recognition algorithm composes of the procedures of acceleration acquisition, signal preprocessing The algorithm is capable of translating time-series acceleration signals into important feature vectors and Anoto Technology proposed ability to transfer each subtle and dramatic impression while letting your designs unfold on multiple Anoto Live Surface. With the stroke of a pen, you can turn traditionally handwritten information into modern digital data

INTRODUCTION

1. Digital Smart pen:

Digital Smart pen is similar to an ordinary pen but it is a digital device with high technology writing tool that records spoken words and synchronizes them with notes written by a user on a special paper. The special paper used is known as dot paper notebook. The smart pen can be connected to a computer to upload the recorded data for saving and sharing. By tapping the pen's tip, students can replay back everything a care person has said in the home

There are so many applications available on the smart pen which consists of language applications to make translation easier, dictionary to assist in studying and learning, games to create entertainment etc. Indeed with these features of a smart pen, one can say authoritatively that it is a great and intelligent pen worth having as a companion [6].

2. Digital pen with Anoto Technology:

Digital pen based on embedded Anoto Technology gives you the ability to transfer each subtle and dramatic impression while letting your designs unfold on multiple Anoto Live™ Surface. With the stroke of a pen, you can turn traditionally handwritten information into modern digital data.

As you write, the Anoto Digital Pen's built-in camera automatically takes digital snapshots of the Anoto Pattern. This allows the Pen's image microprocessor to determine the exact position of the Pen, so that

everything you write or draw is accurately recorded in real time.

After your writing is captured by the Pen, you can send the digital data in real time via Bluetooth to different devices, such as computers and mobile phones. Or, the data can be stored in the Pen's memory and synched with your computer via USB at a later time.

When your handwriting is sent to your device, the data can be handled by an application locally or routed to an application server for further processing. Any application receiving the data extracts all information using an Application Programming Interface (API).[9]

BRIEF HISTORY ABOUT SMART PEN

Jim Margraff [7] was the inventor of Leapfrog FLY pen top computer and Leap PAD learning system, a trademark under the Leapfrog Company that was popular for its interactive children books which showed the capacity to link audio to paper at the touch of a pen.

In 2005, Margraff left his successful business (Leapfrog Company) and diversified into a new project which will later metamorphose into the livescribe company in January 2007. His vision was to invent an electronic pen that would record written and oral information at any time [7].

Today that pen is referred to as a smart pen; a trademark for which livescribe is noted for worldwide. Livescribe's headquarter is based in Oakland, California in United States of America and as at year 2011, [11].

Pictorial Representation of a Smart Pen



Figure A

1. Power button: The power button turns on the smart pen. It also allows the user to start recording audio files if it is held down for about two seconds. [13]
2. Headset jack: The headset contains an ear bud with an embedded microphone that enables the smart pen record quality sound in a noisy environment.
3. Built-in microphone: Each side of the OLED display has two microphones built in it; this allows the smart pen record sharp and clear sounds.
4. OLED display: It is referred to as an organic light emitting diode. This is the interface between the user and smart pen. It allows easy navigation of various applications on the device.
5. Built in speaker: It provides feedback in form of audio for the user during navigation of various applications on the smart pen, also the recorded sounds can be replayed through this medium. [13]
6. USB Connector: When connected to the computer, the USB connector transfers written notes and recorded audio to a PC. It can also serve as a platform to recharge the smart pen.
7. Infrared Camera: Everything you write, tap or draw on the dot paper notebook, the infrared camera keeps track of it. It operates at a very high speed.
8. Ink Cartridge: The ink cartridge of a smart pen is removable and can be replaced when the user realizes that the quality of written notes is becoming vague.
9. Rechargeable lithium battery: The lithium battery is rechargeable but non removable. The life span of the battery determines the continued usage of the smart pen. [13]

2.1 Block Diagram:
2.1.1 Pen section:

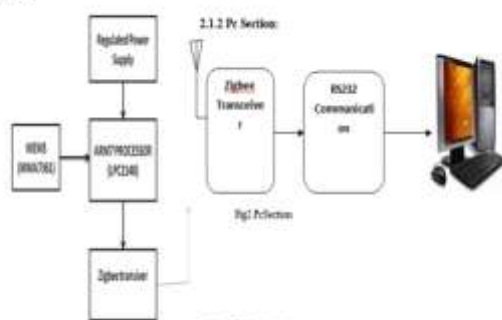


Fig2. PcSection
Fig1. Block Diagram of Pen section

Fig shows an accelerometer-based digital pen for handwritten digit and gesture trajectory recognition applications. The digital pen consists of a triaxial accelerometer, a microcontroller, and an Zigbee wireless transmission module for sensing and collecting accelerations of handwriting and gesture trajectories. with this project we can do human computer interaction. Users can utilize this pen to write digits or make hand gestures, and the accelerations of hand motions calculated by the accelerometer are wirelessly transmitted to a computer for online trajectory recognition. So, by varying the position of mems (micro electro mechanical systems) can capable to show the alphabetical characters in the PC. The acceleration signals calculated from the triaxial accelerometer are transmitted to a computer via the wireless module

BLUETOOTH DIGITAL PEN

When one writes or draws on a standard paper form, the pen's camera captures, stores and saves all handwritten information as snapshots and coordinates.

These snapshots are uploaded to the host server via Bluetooth pairing the digital pen to a compatible mobile or via a USB docking station connected to a PC.

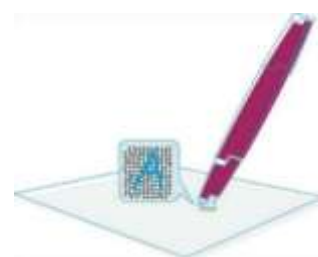
The information collected by the pen is converted into PDF format and integrated into database & workflow system.

The PC uses the internet to connect to the server while the mobile phone acts like a modem, sending the pen's captured electronic data.



COMPARISON ANOTO TECHNOLOGY AND TRAJECTORY RECOGNITION ANOTO TECHNOLOGY-BASED DIGITAL PEN

There are also additional benefits of using this approach: the tracking precision is independent of the board size as the dot pattern is always the same scale as compared to the digitizer and does not scale with the surface. Instead, we can just extend the pattern to cover a bigger surface. This solution can be used with any type of projector and projector image size; there is no need to adjust the projected image to precisely cover the full screen surface. Further, multiple digitizer pens can be connected at the same time, and a paper notebook with the dot pattern can be used as secondary input by teachers and students. Maintenance and shipping are easier and cost effective because all the devices and materials are small, inexpensive, and lightweight



TRAJECTORY RECOGNITION ALGORITHM

The trajectory recognition algorithm consists of acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction shown in Figure 6. The acceleration signals of hand motions are measured by the pen-type portable device. Signal preprocessing involves calibration, a moving average filter, a high-pass filter, and normalization. First, the accelerations are calibrated to remove drift errors and offsets from the raw signals. These two filters are applied to remove high-frequency noise and gravitational acceleration from the raw data, respectively. Feature generation signals of each axis (three axes) include mean, correlation among axes, interquartile range (IQR), mean absolute deviation (MAD), root mean square (RMS), VAR, standard deviation (STD), and energy.

Feature selection is carried out not only to ease the computational load but also to increase the classification accuracy. The reduced features are used as the inputs of the classifiers. Feature extraction is an effective feature extraction method that uses a linear transformation to transform the original feature sets into a lower-dimensional feature space. PNN is a probabilistic neural network used as a classifier for handwritten digit and hand gesture recognition.

CONCLUSION

This paper explores the comparative study, review and characteristics of a next-generation. Interactive blackboards for a smart education system ranging from study-purpose boards to commercial enterprise boards. Depending on the purpose, changes their functionality sets, allowing the use of different types of high technologies and modern opportunities to improve the performance of the digital pen using Anoto Technology and trajectory recognition.

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