A Survey on Digital Pen New Era of Digitalization

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Abstract-Now a day, people use digital devices for quick, easy and accurate work. The Digital pen provides use in Digitalization. A Digital Pen is an electronic computer invention device that transmits writing information into digital form. The Digital technology is entering today's learning environments and classrooms, which provide easy way to learning different things in different ways. The Digital pen and paper gives the platform to quick, easy and reliable way of capturing and sending information from one to another device. In this Digital Pen paper overprinted on a paper with a dot pattern and electronic pen strokes with tiny camera. It capture or take an image of the handwriting form it was written. A Digital Pen feel and look like a normal ballpoint pen, however it contains integrated digital camera, Bluetooth transmitter, microchip storage device and advanced image microprocessor. In this paper, I have done survey of how handwritten document is converted into Digital form with its advantages, disadvantages and its applications.

Keywords- Digitalization, Digital Pen-and-paper and tiny camera.

I. INTRODUCTION

Digital pen technology was first developed by the Swedish inventor [1]. The digital pen is a computer invention electronic pen that transmits writing on paper into digital form. A Digital pen feel and look like a normal ballpoint pen, however it contains integrated digital camera, Bluetooth transmitter or USB (Universal Serial Bus), microchip storage device and advanced image microprocessor. Now a day in real time usage the Digital things are mostly used for accurate, efficient and for quick working in less time where we can say everything is going to be digitalized.
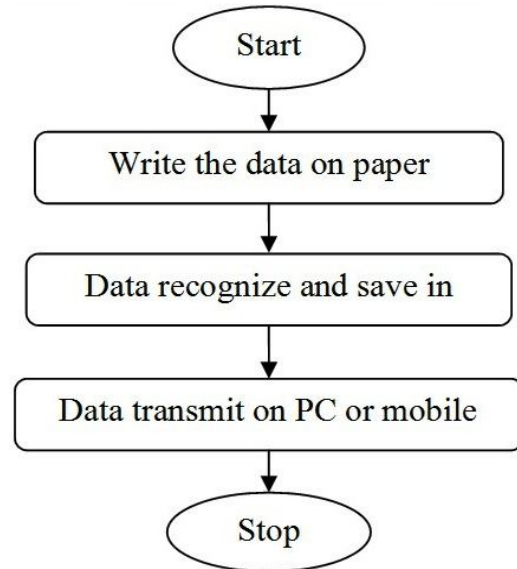

Fig.-1: Flowchart of digital pen

Digitalization is process of converting information into digital format or making digital everything for better accessibility. It is a crucial importance to data processing transmission and storage, because it allows information to store, transmit and process in all kinds of formats, to be carried with the same efficiency and also intermingled. Unlike handwritten or analog data which typically suffers from loss of quality each time, where digital data can be transmitted or copied in theory, be propagated indefinitely with no degradation. Digitalized information is usually made up of binary digits and can be processed on computers. The computer machine decodes the digits and generates information which is in human readable format [3]. A Digital Pen provides a cost effective way for traditional learning environments and office industry to enter the Digital world. A digital pen is a ballpoint ink pen which used on specially patterned paper. It is the new electronic instrument in the learning environment, office automation industry that may someday completely replace the computer keyboard. This new device aims to captures human drawing motions and handwriting in real time and store motion strokes for digit information retrieval at a later time [4].

The Digital pen uses off the shelf digital pen hardware and a custom software application that runs on the pen, It interact with the paper and form a digital images format by reading a pattern of 'Microdots'. Usually Digital pen look

like a normal fatter versions of ordinary pens which consist electronic circuit, optical device, storage memory chip, Bluetooth they can record the thing that you write as you write them and transmit them automatically to your computer using wireless technology or it may be transmit the digital information by USB connection for notes to be uploaded to the computer or other devices.

Usually Digital pens are comes equipped with USB (Universal Serial Bus). This is intended to transmit the stored digital information notes to a personal computer easily, some higher-end models of pens may not require USB ports at all, instead it use Bluetooth technology wirelessly download or transmit the notes onto cellophanes or personal computers. A Digital pen can be used to write on paper, and once done, the user can save what has been written on paper. The Pen usually vibrates or beeps as a sign of confirmation that recognize user has finished a page or the work has been saved. Most digital pen saves handwritten work whatever on paper as images in the commonly used GIF or JPEG format. The features of a digital pen may depend on the specific model purchased on market. There are various types of digital pens available on the market like cameramen (with camera attached), trackball pen (for detecting the motion of trackball while writing by sensor attached in pen), Positional pen (to detect the position of pen point tip), and active pen. Not everyone currently has a use for digital pens most people or users could think of a way to put it to work. For example, many people are faster at handwriting than typing on keyboard which makes quickly translate notes possible. Other users of digital pens include artist who want to post their work, ideas on the internet, web designers and those who need to transfer signatures or hand drawn graphs to the computers [5].

II. COMPONENTS IN DIGITAL PEN

The components in Digital pen are stacked vertically as well as horizontally. It has an Optical reader that used to records motions, images and co-ordinates [1]. A Digital pen also has a common refill that leaves an ink trail, just like a normal pen.
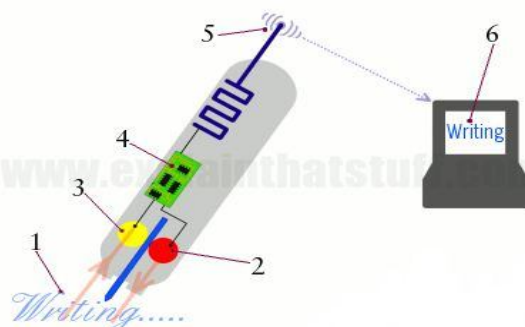

Fig.-2: Internal components of Digital Pen

1) **Ink refill:** The ink refill leaves an ink on the page while writing on paper, you can see this but pen can't. This is purely for user convenience writing.
2) **Infrared LED:** In the base of the pen shines on the page when user strokes the pen to the paper while writing. The user can't see it because the human eyes can't detect small infrared LED.
3) **Light detector:** Light detector also in the base of the pen picks up the infrared reflected off reorganization marks printed on the paper. It helps to recognize the motions over the paper.
4) **Microchip:** The microchip in the pen uses the pattern reflection of handwritten on the paper to store image words you are writing.
5) **Bluetooth Antenna:** Bluetooth antenna built into the pen transmission the transferred data wirelessly and invisibly through the air.
6) **Wireless receiver:** Wireless receiver in user's computer pick up the Bluetooth signals and stored what you have written for later use [6].

III. WORKING OF DIGITAL PEN

As the user write on the paper using standard ballpoint digital pen, a tiny camera inside the barrel of a pen Matrix digital pen records each stroke made on a paper.

Fig.-3: Working components of Digital Pen

These strokes are converted to co-ordinate that the pen tracks, records and stored. The pen knows what was written and who wrote it. Once the writing is completed the information is stored on a microchip in pen.

Steps how digital pen works:
1) The ink refill leaves an ink trail on the page while writing. User can see this but the pen can't.

2) The infrared LED of the pen shines onto the page while writing on a paper. You can't see it because human eyes can't detect small infrared LED.

3) The light detector picks up the infrared reflected on paper off recognition marks printed on the special paper.

4) The microchip is use to store images of the words you're writing on paper.

5) The Bluetooth antenna built into the pen transmits the stored data using USB or wirelessly which is invisibly through the air.

6) The wireless receiver in your computer picks up the Bluetooth signals and stores what you've written. Software in the PC converts this data into normal, editable text you can import into a word-processing program [1].

IV. TYPES OF DIGITAL PEN

If the user wants to bring their sketch sand handwriting notes into the twenty first century with a smart pen or digital pen, this list will help user to find best smart pen for them.

WACOM INKLING DIGITAL SKETCH PEN

WACOM is one of the well known names in stylus based computer, tablets. So, it makes sense for the company jump into the smart pen. This digital pen work on normal paper for writing and strictly design for drawing, sketching. No handwriting reorganization, no text conversion, no wireless connection is not available in this pen. User needs USB connection to offload their drawing. Once your sketch are on your Personnel computer, you can save them as vector or high resolution bitmap files and bring them into Photoshop or sketchbook pro.
Price: up to Rs. 10480.5534 INR.

Drawback: No handwriting reorganization, no text conversion, no wireless connection.

1) Neo Smart-pen N2

Neo Smart pen have priories getting as close to a normal pen as possible. In physical structure of this pen consist, it is thin 12 mm, length is 15 cm, made of aluminum and stainless steel. It gives features to writing and drawing in 8 different colors with 3 different thickness options. This smart pen stores 1000 pages of handwritten notes.
Cost: up to $USD 169 that is Rs. 11283.5385 INR.
Drawback: Expensive.

2) LiveScribe 3

Livescribe3 might take some getting used to store digital information as it's thicker than normal pens. This smart pen offers sharing, transcribing and organizing notes. This smart pen save your some money as it doesn't require special paper for writing with instant sharing. Additional features in livescribe smart pen are voice memos synchronize with writing. This smart pen is useful having maximum features and less amount of price than others.
Cost: up to $USD 129 that is Rs. 8621.7150 INR.

3) Blck ink

This digital pen unique for that the user concentrates on art. This is the best smart pen for drawing, sketching and produce truly beautiful result with generate accuracy and precision. The BLCK Ink pens offers much feature as sharing, instant transfer.
Cost: up to $USD 199 that is Rs. 13300.1650 INR.

4) Moleskine smart writing set

MOLESKINE is the maker of black notebooks and sketchbooks. MOLESKINE pen digitize your notes, your random sketch, your doodles and jottings in real time. Micro camera in this smart pen records every stroke once captured or digitalized your notes can be transcribed to text and you can change color of your drawing or sketch using MOLESKINE notes app. This app only available for IOS, Android users needs to NEO notes app for editing. MOLESKINE pen has 5 hours battery backup and it also captured audio or voice notes.
Cost: up to Rs. 13300.1650 INR.

5) Livescribe Sky Wifi Smart Pen

This is third line of series of smart pen from LINESCRIBE with wireless and audio recording technology. With this smart pen user can make digital notes of your sketch on paper synchronize with audio to your notes and download compatible numerous apps to increase productivity. There are 3 different models of sky WIFI smart pen to choose from 2GB, 4GB, and 8GB, Cost of pen varying according to storage capacity [8].

V. CONCLUSION

In this paper, I studied that the digital pen that convert handwritten notes into digital form. The system uses Digital pens camera to capture handwritten information, Handheld memory device that is microchip to store converted Digital notes, The main useful feature of Digital pen is Share digital documents in an instant, that's why this technology allow us to interact with our world anytime from anywhere.

We can get digital information where we want anything from anywhere within less time which is efficiently helps to get the information in an instant. In coming days, character recognition system via Digital Pen might serve as a key factor to create a paperless environment by digitizing and processing, transmitting existing paper documents.

- **ADVANTAGES OF DIGITAL PEN**

  - Digitalized your work.
  - Cost saving electronic device.
  - Fast to use.
  - Convert handwritten notes into digital notes.
  - Save cost and time to enter data manually in digital form.
  - Reduce maintaining of hardcopies papers while doing work to work as well as reduce faxing and mailing cost.
  - Save or captures data in real time.
  - Reduce outsources printing and forms of storage.
  - High data security, accuracy and efficiency [1].

- **DISADVANTAGES OF DIGITAL PEN**

  - Privacy.
  - Some types of smart pen require special paper.
  - Maximum features in pen may increase cost [1].

- **APPLICATION OF DIGITAL PEN**

  - Cherokee Indian Hospitals reports savings their insurance processing transaction using a digital pen and system. Also used for expanding billings and accounts receivable. It helps to simplify the paper processes for cost savings and better resource management
  - Healthcare Application: The Digital pen technology enables the notes collection in digitalized image form of written text, including sketches, which are incorporated into EMIR (include clinical documentation progress notes, surgery drawings, etc). As well as Billing and Back end utilities such as record achieving and access.
  - Now a day, in learning Environments and classrooms the Digital pen encourage to students learning different things in different ways. The interested student who wants to drawing, sketching as they want.
  - In office automation industry used Digital pen for efficient working in less time. Which is shared written document avoid hardcopies of the papers.

Hardcopy of papers is overhead to maintain anywhere [1].

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