DESIGN OF A PEN WHICH REMEMBERS WHAT IT WRITES

A THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

Bachelor of Technology

In

Mechanical Engineering

By

DIBYAJYOTI BEHERA AND ABINASH MOHAPATRA

Department of Mechanical Engineering

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Rourkela

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Under the Guidance of

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CERTIFICATE

This is to certify that the thesis entitled, "Design of a pen which remembers what it writes" submitted by Sri Dibyajyoti Behera and Sri Abinash Mohapatra in partial fulfillment of the requirements for the award of Bachelor of Technology Degree in Mechanical Engineering at the National Institute of Technology, Rourkela (Deemed University) is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University / Institute for the award of any Degree or Diploma.

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It is our pleasure to refer Microsoft word 2003 of which the compilation of this report would have been impossible.

An assemblage of this nature could never have been attempted without reference to and inspiration from the works of others whose details are mentioned in reference section. We acknowledge my indebtedness to all of them.

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Date

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ABSTRACT

Even in the current computer age, there are still many important application areas for a pen which remembers what it writes, such as early architectural design, entering letters in ideographic languages like Chinese- and Japanese; and non-letter entries like graphics, music and gestures ,and preparing a first draft of a document and concentrating on content creation where traditional tools like sketching on paper continue to be preferred by many professionals over computer-based tools. There is a growing awareness that there are often very good grounds for this preference. Hence, instead of trying to replace such traditional ways of working, it is now often considered more opportune to try and preserve the strengths of these traditional ways of working, while at the same time improving them by providing access to new media. This is one of the main objectives of the approach that we adopt here.

In this project we have given the conceptual design of a digital pen which can remember what it writes based on optical tracking technology by integrating the various subsystems which are commercially available. A special type of paper is required to make this technology work. Printed on it is pattern consisting of millions of tiny dots, making it possible to identify the exact location of the pen tip.

We have made a cost analysis for the fabrication of the pen based on the current market prices of the various components to be integrated and estimated the approximate dimensions of the pen.

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CHAPTER 1

INRODUCTION

1.1 INTRODUCTION

The idea is simple. Use your primary and best developed human skill - writing by hand on a sheet of paper. Man would not be able to exist without language and writing. Sharing written and drawn information is the most important means of cultural exchange. And today we're even better at exchanging information - we use computers. But computers do not understand the most simple strokes of our beloved gestures. Computers are actually illiterates when it comes to recognizing hand-drawn writing. During the time of evolving computer technology many different means for user input have been invented: keyboards, mice, trackballs, lightpens, etc., but none of these is really fitted the human way of communicating thoughts and ideas.

Human beings prefer to communicate via listening, speaking, reading, writing and even gestures. And we are accustomed to process these signals with high performance not yet technically achieved. So naturally we want to interact with computers in the same way. But for dialogue with computers at present we have to use formal languages and operate the system with the help of keyboard and mouse. Therefore, on the one hand, we have not only to learn at least one computer language but also to read voluminous manuals, on the other hand, the constrains will inevitably influence the efficiency of human computer interaction. While some computers using speech or other input modalities behave very well, some applications still call for a pen-only computer interface in that for one thing, speech does not provide enough privacy in a social environment. Another reason is that it might be annoying to us if someone sitting next to us in a train or room keeps speaking to his/her machine as well as the keyboard is too big for some hand-held devices.

This is where the motive - comes in: computer that are able to sense our drawings and interpret our handwriting would be a lot easier to use and much more useful than the currently known input devices. The ease of information manipulation would result in an intensified concentration on contents, with the user being freed from technical restrictions. An obvious and important merit of pen computers is that anyone who even has not computing experience can operate pen computers.

CHAPTER 2

HISTORY

2.1 HISTORY OF WRITTEN INFORMATION

2.2 HISTORY OF WRITING TOOLS

2.3 HISTORY OF PEN COMPUTING

2.1 HISTORY OF WRITTEN INFORMATION

Information needs to be written down to make it permanent, while the permanence of information is a requirement for making it communicable. The entire set of means for communicating information in a particular context is referred to as culture. The process of assigning a meaning to a signal (a signified to a signifying) makes up for the specifics of a certain culture, together with the selection of the signifying representations of information, i.e. what kind of visual expressions are accepted and understood.

Of all the means of cultural exchange, writing is the most specific and precise, as well as the most flexible. A pictorial representation leaves much more room for interpretation.Theodor W. Adorno explains .the relation like this: "What crackles in works of art is the sound of the friction of the antagonistic moments the work of art seeks to bring together; writing not atlast because, like in the signs of a language, its processuality is encrypted in its objectivation.". They are based on the same process, but the process works at different levels of consciousness.

Writing is a notation based on a language and therefore well defined. On the other hand, deciphering written information is more complicated and demanding.

Written information is useful and important only as long as it is understood correctly.As semantic systems vary over time and place, it is often difficult to understand the messages.This is also the reason for the difficulties encountered when texts are translated between languages. Therefore, languages are a very powerful as well as a very delicate means of expression.

2.2 HISTORY OF WRITING TOOLS

While in the beginning the letters were hammered in stone or pressed into wet clay with wedges and the appearance was rough, later cut wooden sticks and then bird's feathers were carefully prepared to write on papyrus and on parchment with ink. The use of feathers and brushes allowed for a more detailed writing face. Around 1800 metal "feathers" were used . Later again, pencils , pens , ball-point pens , and others were invented.

The substrate on which to write was also subject to many changes, Stones and clay were replaced by papyrus and later by parchment (around 1300 B.C.E.). Paper was invented in China in 105 C.E. but it became known only much later, due to Chinese secrecy- in Japan around 700 C.E. and brought to Spain by the Arabs in 711. But paper was widely used throughout Europe only after paper mills were built in the late 14^{th} century.

FIGURE 2.1 - WRITING TOOLS

Paper became the primary medium after another dramatic change took place: the invention of printing with replaceable wooden or metal letters by Johannes Gutenberg in 1436. Simpler kinds of printing, e.g. stamps with names, were used much earlier in China, but they did not find their way to Europe.

On the other hand, when printing could be automated, the process of text input later was also revolutionized, first by Henry Mill in England in 1714 with the invention of a typewriter, followed by many variations and improvements, e.g. daisy-wheel typewriters by IBM in 1961. Another major step forward was the separation of text input and printing. This could be achieved when the texts or graphics could be stored by use of computer memories.The text and graphics could then be entered by use of a keyboard or a mouse and printed later at any place with the right printing facilities.

2.3 HISTORY OF PEN COMPUTING

The first computer scientist who wrote down the vision of a computer that could be used effortlessly by untrained users was Alan Kay [Davidson], [Ryan 3]. In 1968 he envisioned the Dynabook, of which he fabricated a cardboard model. The Dynabook was a light-weight device n which one could take notes and work interactively with wireless communications.

A prototype similar to the Dynabook was presented by Apple in 1987: the Knowledge Navigator, which included the book design of the Dynabook and added speech recognition and intelligent information retrieval .

All of these visionaries share their concentration on contents and users instead of technological feasibility.

CHAPTER 3

SUBFUNCTIONS OF THE PEN

1.1 SUBFUNCTIONS OF THE PEN

In order to realistically think about design of such a pen it is necessary to consider the underlying technical problems that have to be solved for building a computer with the following capabilities: the intended machine should start at the lowest common denominator of writing- a block of paper and a pencil. A machine with the same capabilities must be able to

- track the position of a pen
- display the ink left on the writing surface
- overlay texts and drawings seamlessly.

The function of the pen input device is to convert pen tip position intoX.Y coordinates at a sufficient temporal and spatial resolution for handwriting recognition and visual presentation.Pen tip contact with paper also needs to be sensed to establish when ink is deposited on paper. A pen input systems consists of a combination of pen. paper. and pad. To digitize handwriting, at least one of these elements must contain electronics.

CHAPTER 4

VARIOUS METHODS THAT CAN BE USED TO TRACK THE PEN TIP

4.1 Electro-magnetic tracking

4.2 Electric Tracking

4.3 Ultrasonic tracking

4.4 Optical Tracking

4.1 Electro-magnetic tracking

Fig. 2 illustrates how an electromagnetic pen input device gets the position of the pen tip. First of all, a high frequency source energizes each antenna coil in turn.

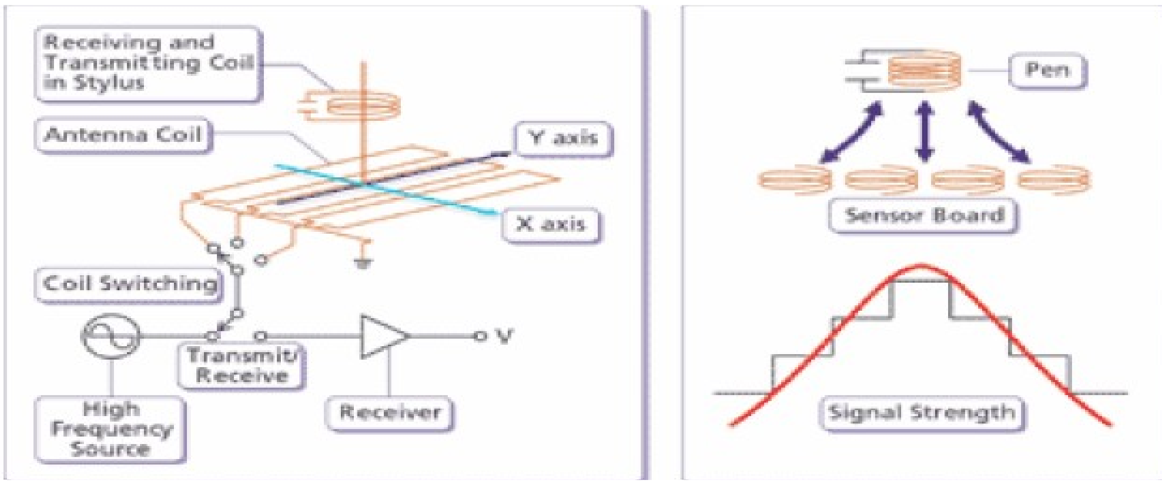


Fig. 4.1 Electromagnetic tracking

And this will generate a closed coupled field in the h-domain and resonant frequency. Meanwhile, if the inductance and capacitance values of a tank circuit (coil and capacitor) which is located in an EMR (Electro-Magnetic Resonance) pen matches the resonant frequency of the antenna coil, the coupled energy resonates with the tank circuit and reflects will back towards the sensor board by forming a shaped h-domain field at the tip of the pen. As this happens the same antenna coil is switched to receive this reflected energy and provide an analogue signal. This process is repeated in rapid succession with all antenna coils. All of the analogue data are then collected and converted into digital signals that can be post-processed to give x, y and z position information

4.2 Electric Tracking

Fig. illustrates how the conductive properties of a hand and normal pen can be used for tracking. A transmitter electrode in the pad couples a small displacement current through the paper to the hand, down through the pen, and back through the paper to array of receiver electrodes. Pen location is calculated as the "center of mass" of the received signal strengths .

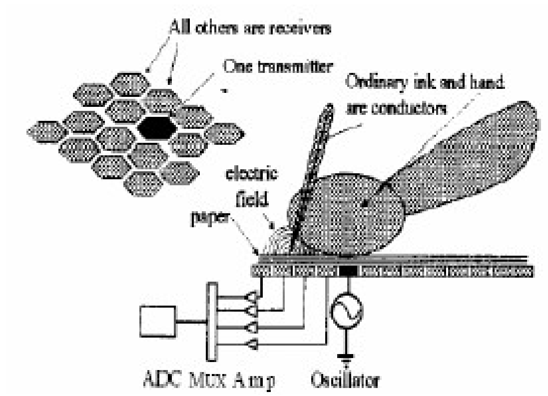


Figure 4.2 Schematic Diagram of Electric Tracking Pen-Computing Devices

4.3 Ultrasonic tracking

Ultrasound waves have frequencies above the upper limit of the normal range of human hearing, which is about20 kilohertz. Using an ultrasonic transmitter in a pen and two stationary ultrasonic receivers, people can establish a simple pen position tracking system. The working principle of the system is below. At the beginning, a pen with an ultrasonic transmitter sends ultrasound. And the two stationary receivers receive the ultrasound continuously. According to the arrival time to the two ultrasonic receivers, we can calculate the X,Y position of the pen. But it is noted that when the pen is in the air, people can acquire the positions of the pen all the same. However, the X, Y positions of the pen do not equal the X, Y positions of the projections of the pen. People often neglect the fact especially when people hold the pen but are thinking about something else. Because when people lift a pen and think, they possibly consider the calculated X, Y position of the pen is the position of the projection of the pen subconsciously. Fig shows why the co-ordinates of the pen that is in the air do not equal the coordinates of the pen when the pen contacts with the surface. two green balls denote ultrasonic receivers. The H denotes the vertical distance from the pen tip to the surface. L1 and L2 denote the distance from the pen tip to the two ultrasonic receivers respectively. S1 and S2 are their projections respectively. L1and L2 equal L1 and L2 respectively. Obviously the following formulas are correct:

$L1^2 = S1^2 + H$ (1)^2

$L2^2 = S2^2 + H$ (2)^2

According to (1) and (2), L1 (or L1) > S1 and L2 (or L2) > S2. Thus, if the pen is in the air, the coordinate of the pen tip is not the coordinate of the point P but O. So if people write, the script may overlap.

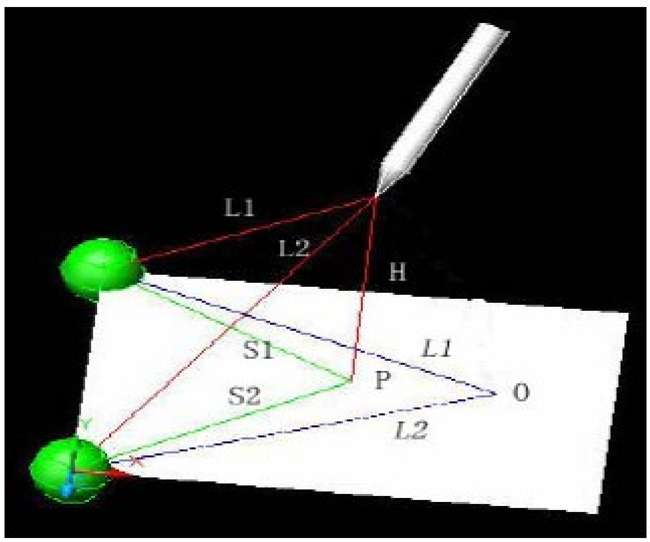


Figure 4.3 Schematic Diagram of Ultrasonic Tracking Pen-Computing Devices.

4.4. Optical Tracking

Commonly optical tracking pen input devices integrate optical sensors, infrared light emitters or other sensitive components into pens called digital pens. Digital pens can provides relative tracking or absolute position tracking. One method of relative tracking is to shines coherent light from a laser built-in a pen onto paper and tracks the resulting speckle pattern. Another method mixes the scattered laser light with the source to create optical “beating”(similar to a Michelson interferometer), detected by a quadrant detector. Note that some optical tracking pens must write on ordinary paper printed with a unique pattern that is almost invisible to the naked eye. When using the kind of pen and paper, a tiny camera in the pen registers the pen's movementacross the grid surface on the paper and stores it as series of map coordinates.

TABLE NO : 4.1

COMPARISION OF THE VARIOUS TRACKING TECHNOLOGY

TRACKING TECHNOLOGIES / PARAMETER	MAGNETIC TRACKING	ELECTRIC TRACKING	ULTRASONIC TRACKING	OPTICAL TRACKING
RESOLUTION	HIGH (>1000 DPI)	HIGH (>1000 DPI)	LOW (ABOUT 256 DPI)	HIGH (ABOUT 1250 DPI)
PAD ELECTRONICS	REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED
POWER REQUIREMENTS	LOW	HIGH	LOW	HIGH
COST	HIGH	LOW	HIGH	LOW
INTEGRATION	DOES NOT SUPPORT HIGH INTEGRATION	SUPPORTS INTEGRATION TO SOME DEGREE	DOES NOT SUPPORT HIGH INTEGRATION	SUPPORTS INTEGRATION TO A HIGH DEGREE

CONCLUSION-

Optical methods based on CMOS technology lend themselves to low-power, low-cost. And highly integrated designs. These features suggest that optical tracking will play a significant role in future pen systems. Can provide self contained pen that remembers everything written.

CHAPTER 5

SUBSYSTEMS REQUIRED FOR THE DIGITAL PEN

5.1 SUBSYSTEMS REQUIRED FOR THE DIGITAL PEN BASED ON OPTICAL TRACKING

The digital pen is the tool that, together with the patterned paper, enables you to store in memory chip what we write .

The main parts of the digital pen are a digital camera, an advanced image-processing unit and a Bluetooth radio transceiver. It also contains an ink cartridge so that you can actually see what you have written or drawn.

The digital pen does not have any buttons or display. It looks and feels like an ordinary ballpoint pen and you use it in the same way. You activate the pen by simply removing the cap and deactivate it by replacing the cap again.

1. The camera

The dots of the pattern are illuminated by infrared light, making them visible for the digital camera. Digital snapshots, at a rate of 100 per second, are taken of the pattern. (The ink from the pen is not visible to the camera. Therefore the pattern is not degraded by your writing.

2. The image processor

The image processor calculates, in real-time, the exact position in the entire pattern. During image processing, snapshots are compared and information about how the pen is held is also gathered and stored

3. The memory

All the data from the image processor is packaged and loaded into the pen memory, which can store several fully written pages.

4. The Bluetooth transceiver

The information is transmitted by the Bluetooth transceiver, either directly to your computer, or forwarded via a relay device (e.g. mobile phone, personal computer or handheld device).

5. Ink cartridge and force sensor

The pen holds an ordinary ink cartridge to make visible all that you have written or drawn. A force-sensing resistor measures the stylus tip force

6. Digital Paper

A special type of paper is required to make this technology work. Printed on it is pattern consisting of millions of tiny dots, making it possible to identify the exact location of your pen, as well as connect a set of unique functions to the pattern.

The paper consists of an ordinary paper, provided with a dot pattern invisible to the eye, that is either pre-printed or printed on a laser printer.The displacement of the dots, 0.1 millimetres in size, from the relative position enable them to be programmed to tell the pen the exact location on the page – or the whole pad of papers – one is writing on.

By registering the pen's movement across the paper, and also the pressure, the writing is interpreted and digitalised. Hence the technology is not based on characters having to be written in a special way, in contrast to various other applications such as hand-held computers. Even drawn sketches can be interpreted and transferred.

Since the pen's movements are stored as a series of map coordinates and the paper defines where on the paper one is writing, it is for example possible to go back and complete previous notes in a pad. The technology is capable of interpreting this correctly and putting it in the right context when transmitting it to the digital media.

CHAPTER 6

DETAILED DESIGN OF THE SUBSYSTEMS

6.1. PROCESSOR

6.1.1 Requirements

Processors for pen-driven devices are subject to some specific restrictions especially when they are supposed to be portable:

Low cost.

The pen-oriented user interfaces are suited for people who do not want to spend a lot of money for computers or who do not want to buy computers at all. Only low cost devices have a chance for success in the mass-consumer market. A price of about US$ 25 per chip set would be appropriate for building mass-consumer-oriented devices, assuming a price below US$ 500 for the whole unit.

Smallness.

If the chip set around which a hand-held device is built takes up too much space, there is no chance any person can actually take it along in a pocket. The size of the silicon chip influences the printed-circuit board space and the die size of the chip determines its price by the amount of silicon used.

Low power requirements.

There is a general trend to move from 5 V towards 3.3 V architectures as these low voltage designs have several advantages: lower voltage allows higher clock speeds (less heat is generated: heat ~ I - U2), lower energy consumption (by about a factor of S), and smaller and lighter silicon chips. State-of-the-art 64-bit, 100 MHz architectures are only feasible using voltages lower than 5 V because of the generate dheat and the required space. The standard for 3.3 V (_+10% tolerance) was publicized by Jedec (U.S. Joint Electron Device Engineering Council) already in 1984 and has gained general acceptance in the industry. By merely letting processors run at a lower voltage, there are no benefits at all - apart from saving energy. Running 5 V chips on 3.3 V reduces the clock speed and therefore the computing power. But architectures designed for lower voltages can use smaller transistors and run at higher clock speeds. The transition time from logic '0' to '1' is shorter and the channel length can be reduced from 0.5 btm toabout 0.4 btm for higher integration. The power consumption for desktop CPUs is about 3 to

5 W, for low-power CPUs it lies in the range of about 100 to 300 mW. In mobile devices where batteries are used as the energy source, power management is crucial. Battery life extends 3 to 4 times when operating at 3.3 V instead of 5 V. On the other hand, there is a 40% saving in weight for the same battery life using only 3 instead of 5 battery cells (cf. section 3.5 for more details on batteries). For architectures that require even less power (1-2.7 V) no standard has been proposed yet, but such architectures exist in many variations.

Sufficient computing power.

The feedback from a pen-driven machine must be immediate. No delay in ink representation is allowed. If handwriting recognition is desired, the real power must show up, because this is a very computation intensive task. With the use of several independent recognizers (e.g. for text and graphics) that work simultaneously, there is a need for parallel execution that demands high computational performance. Handwriting recognition should even work in the background without bothering the user at work and it must be fast for immediate response. The required computing power can be achieved by using fully 32-bit RISC 23 architectures with support for clever memory and power management.

• **High integration**.

High integration means that much functionality that is otherwise split up into a whole set of chips, e.g. peripheral drivers and controllers, should be put together on one single chip. This makes the design of a new device much easier and the extensive supported standard functionality allows for better customized solutions. Higher integration also satisfies demands for more processing power and more memory.

• **Compact code.**

Compact code saves both ROM and RAM memory by using shorter and more integrated instructions. There are several different concepts for using compact code: the use of 16-bit instructions in spite of or in conjunction with 32-bit instructions, variable-length instructions, complex instructions (e.g. test and branch, test and add, etc.) supporting the pipelining features of RISC processors.

• **(Non-) Compatibility**. Compatibility is not required for most pen-driven systems. The mobile pen-driven devices mostly do not replace desktop machines, but with their supreme ways of communicating, data can be exchanged without a need for explicit application or system software compatibility. Compatibility is of concern for exchanging data only. This enables designers to use leading-edge technology and to support more user-oriented features.

6.1.2 IMPLEMENTATION

Inte180x86 /Pentium

These processors are used for compatibility reasons. They do not meet any of the above mentioned criteria, but there are architectures such as the AMD Elan Am386SC that incorporate many of the mentioned features while remaining compatible. The Elan is said to run a mobile-oriented version of Microsoft Windows.

AT&T Hobbit 9201x/9202x

The Hobbit chip set [AT&T] consists of 5 chips: the ATT92010 is the central processor with a built-in memory management unit and on-chip stack, the ATT92011 (System Management Controller) controls the whole chip set including power management, interrupt control, address decoding and access to the local bus structure, the ATT92012 (PCMCIA Controller) controls up to 4 PCMCIA cards, the ATT92013 (Peripheral Controller) builds the interface between the Hobbit local bus and up to eight 8- or 16-bit peripheral devices compatible with the ISA bus standard .The Hobbit chip set is a complete solution caring about power management and with enough processing power, but future versions will be more integrated.

ARM610/710

Advanced RISC Machines, Ltd. (Cambridge, U.K, has designed the ARM6 architecture as a macro cell. The CPU kernel fits on the corner of a silicon chip and allows the rest of the silicon to be used for implementing other functionality. The ARM610 is a full-featured 32~bit RISC processor with 31 registers and a three-stage pipeline. It integrates a hardware multiplier and measures 22 x 22 x 1.4 mm, has 144 pins, and gives a performance of 15 MIPS. A sophisticated memory management unit is integrated on the ARM610 chip. The fully static implementation is responsible for the low power consumption.

Hitachi SH7034

The Hitachi CPU integrates 4 K Byte of RAM, 64 K Byte of PROM, a DRAM controller, DMA engine, serial ports, an eight-channel A/D converter, and several timers all together on a single chip. The CPU also features a 16 by 16 bit integer multiply and accumulate instruction suitable for fast digital signal processing. A second version, the SH7032, differs from it in the amount of on-chip memory: 8 KByte of RAM and no PROM. This chip alone could build up a mobile device, in conjunction with a display controller and a PCMCIA controller.

NEC V805/810/820

The V805 is a 16-bit version of the 32-bit V810. Both integrate a single precision FPU on-chip. The V820 additionally features DMA, serial ports, and timers. Hence, this architecture is not as integrated as the Hitachi chips, but it uses less power.

Motorola "Dragon"

The Motorola 68349 "Dragon I" is a 32-bit processor running at i6 MHz with 3.3 V. Together with the core microprocessor (CPU030), on-board system peripherals (DMA, serial communications, memory interface) are integrated.

Advanced power management allows the system to tune the clock rate and place the processor in a power-down mode where it consumes less than 1 mW (normal consumption is 300 mW at 16 MHz). This chip set is especially useful for Personal Communicators, because it provides many of the required interfaces and is used in Motorola's Envoy Personal Intelligent Communicator.

6.1.3(TABLE NO 6.1)MORPHOLOGICAL ANALYSIS FOR PROCESSORS

PROCESSORS FEATURES	INTEL 8086	AT&T HOBBIT 2019	ARM 60	HITACHI SH7304	NEC V805	MOTOROLA DRAGON
COST (source amazon.com)	$116.80	$ 143.99	Not available	$140.99	$230.45	Not available
FUNCTIONAL INTEGRATION	Not high	Very high	High level	High level	High level	Very high
RESPONSE TIME	Very fast	Acceptable	Fast	Fast	Fast	Slow
COMPACT PORTABLE DESIGN	No	Yes	Yes	Yes	Yes	Yes
BATTERY LIFE	Minimum	Maximum	Moderate	Moderate	Moderate	Low

CONCLUSION

The very high degree of functional integration coupled with demand for simple to use user interface and acceptable user response time requires a high performance microprocessor. Conversely , the high requirement for a computer portable design with maximum battery life demands low operating power dissipation and a very low standby mode for all the system components .Low cost translates to highly integrated microprocessor. The Hobbit microprocessor was designed with the explicit goal of optimizing the parameters outlined above.

6.2. CAMERA

Small digital cameras which can be used in a pen are given below.

A. Model TC309(IBM)

Features:

- Digital camera disguised as a working pen.
- 2MB built in memory.
- Auto focus , expose and balance.
- Compact size in shirt pocket.
- Size up to 36,160*120 pixel images.
- Voice function audibly tells user no. of picture taken.
- Battery life expentancy : over 500 picture.
- Auto shut off conserves battery power.

Product specification :

- Measures 6” * 6”.
- Operation system compatibility win 95/98/2000.
- Uses four botton cell.
- Include CDROM driver and serial cable for downloading images.
- Resolution 160*120 pixels.
- Exposure control – auto.
- Working current 10-30 Ma.
- Battery life – over 500 pictures.
- Power manager – automatic shutoff /electrically.

- Erase function – image erasable.
- Light distance – over 35mm.
- Angel – 40.
- Weight about 69g.
- Cost 5.7 dollars.

B. Colour Spy Cam

Features

- Tiny pin hole camera lens.
- Minimum illumination.
- Quality colour CCD camera.
- Built in transmitter (300ft range).
- GPA76 alkaline battery 1.5V batteries , battery life 10-20 minutes.
- Easily connects to a TV, VCR for easy recording or security moniter.
- 65mA power consumption.
- Transmitting range approx – 100ft indoors.

Transmitter Specification:

- Transmission frequency : 4 channels in 2400-2483.5MHZ.
- Rf output – 10MW.
- Power consumption 65A.
- Size 145 mm(L)*120mm(w)/14.5mm(diameter).
- Transmitting range : 60 in LOS.
- Weight 35gms.
- Video signal : color camera.

Receiver specification:

- Transmitting frequency – 2.4GHz.
- Antenna – 60 degree directional.
- Operating power – DC 130V.
- Power consumption – 180Ma.
- Size 150*88*40 mm.
- Cost - $6.7

C. Pen camera – black/white wired:

- High resolution black and white.
- 24GHz transmitter and 2.4GHz receiver.
- Resolution 400 lines(B/W) 380 lines color.
- Power required 12V.
- Consumption – 220mA maximum.
- Cost - $ 6.38.

MORPHOLOGICAL ANALYSIS FOR CAMERA(TABLE NO – 6.2)

MODELS / FEATURES	TC 309	COLOUR SPY CAM	B/ WIRED
Built in memory	2 mb of built in memory	Not present	Not present
Autofocus	Yes	No	No
Storage capacity	Stores upto 36 pages	No	No
Battery Life	Over 500 pictures battery life	10-20 minutes	Not mentioned
Wireless	Yes	Yes	No
Cost	$ 5.71	$ 6.7	$ 6.38

Conclusion – From the above comparision we find model TC-309 to be most suitable and cost effective. Hence we select this model to be used in the model.

6.3. MEMORY CARDS

It is critical that the memory card should have the following features.

- Smaller.
- Faster.
- Higher capacity.

It is most important that it should be compact as there are severe size restrictions for our design.

The latest advance in card size was announced in Hanover Germany unveiled a miniature version of secure memory card.

Feature of MiniSD :

- Volume 602 cubic millimeters.
- Smallest memory card.
- Capacity – card will be available in 16MB,42MB,64MB shortly.
- Storage speed – the company specified a minimum data write speed of 15 megabites per second to allow real time writing.
- Price – 256MB card will be priced at $ 190.

Conclusion : the currently available PCMCIA cards,version 1 and 2 are too large to fit in the pen. hence we have incorporated the latest technology in miniature data storage and we have only few options present.

6.4. BLUETOOTH TECHNOLOGY :

Blue tooth……..What is Bluetooth?

Bluetooth technology eliminates the need for numerous and inconvenient cable attachments for connecting fixed computers, mobile phones, mobile computers, handheld devices, digital cameras and even new breed of digital appliances. It will enable users to connect a wide range of computing and telecommunications devices easily and simply, without the need to buy, carry,or connect cable quite often proprietary to a specific device. It delivers opportunities for rapid ad hoc connections, and the possibility of automatic, unconscious, connections between devices. It creates the possibility of using mobile data in a variety of application. Bluetooth makes wireless communication and networking between devices in a small localized area of a room or a small office as easy as switching on the light. In Bluetooth all the connections between devices are instantaneous and invisible and the devices can talk even if they are not in line of sight because Bluetooth utilizes a radio-based link. Your laptop could send information to a printer in the next room, or your microwave could send a message to your mobile phone telling you that your meal is ready.

Bluetooth is actually a standard for wireless communications between devices in a personal area network (PAN) using radio frequency for a short range (around 10 meters). So any two devices that follow the standard can communicate and exchange data between each other without the need of any connection to be made between them. A group of Bluetooth devices like a mobile phone, a digital camera, a hand held device etc. can instantly form a network with each other as soon as they are switched on. You could have a mobile phone in your pocket and you could be sending e-mails using your laptop without making any connection between your laptop and the mobile. Your refrigerator could be placing an order with the supermarket if your milk supply has been exhausted using your mobile phone.

Briefly, Bluetooth technology

- uses radio waves in 2.4 GHz band - therefore, no line of sight is required
- supports multipoint, not just point to point
- works in a small confined area - 10 to 15 meters apart
- is able to support speeds of 1-2 Mbps today but will offer higher speeds in future
- chip sets are relatively inexpensive (though more expensive than IrDA)- $10 to $20 today in large quantities - will go down in future
- has significant industry support with over 1800 members in the industry consortium .

Applications:

Bluetooth has a tremendous potential in moving and synchronizing information in a localized setting. Potential for Bluetooth applications is huge, because we transact business and communicate more with people who are close by than with those who are far away - a natural phenomenon of human interaction. The following list represents only a small set of potential applications - in future many more imaginative applications will come along:

- By installing a Bluetooth network in your office you can do away with the complex and tedious task of networking between the computing devices, yet have the power of connected devices. No longer would you be bound to fixed locations where you can connect to the network. Each Bluetooth device could be connected to 200 other devices making the connection of every device with every other possible. Since it supports both point to point and point to multipoint it will virtually make the maximum number of simultaneously linked devices unlimited.
- The Bluetooth technology connects all your office peripherals wirelessly. Connect your PC or notebook to printers, scanners and faxes without the ugly and trouble some cable attachments. You can increase your freedom by connecting your mouse or the keyboard wirelessly to your computer.
- If your digital cameras in Bluetooth enabled, you can send still or video images from any location to any location without the hassle of connecting your camera to the mobile phone on the wire line phone.
- Bluetooth allows us to have three way phones. At home, your phone functions as a portable phone (fixed line charge). When you're on the move, it functions as a mobile phone (cellular charge). And when your phone comes within range of another mobile phone with built-in Bluetooth wireless technology it functions as a walkie-talkie (no telephony charge).
- In meetings and conferences you can transfer selected documents instantly with selected participants, and exchange electronic business cards automatically, without any wired connections.
- Connect your wireless headset to your mobile phone, mobile computer or any wired connection to keep your hands free for more important tasks when you're at the office or in your car.
- Have automatic synchronization of your desktop, mobile computer, notebook (PC-PDA and PC-HPC) and your mobile phone. For instance, as soon as you enter your office the address list and calendar in your notebook will automatically be updated to agree with the one in your desktop, or vice versa.

Cost - $20.

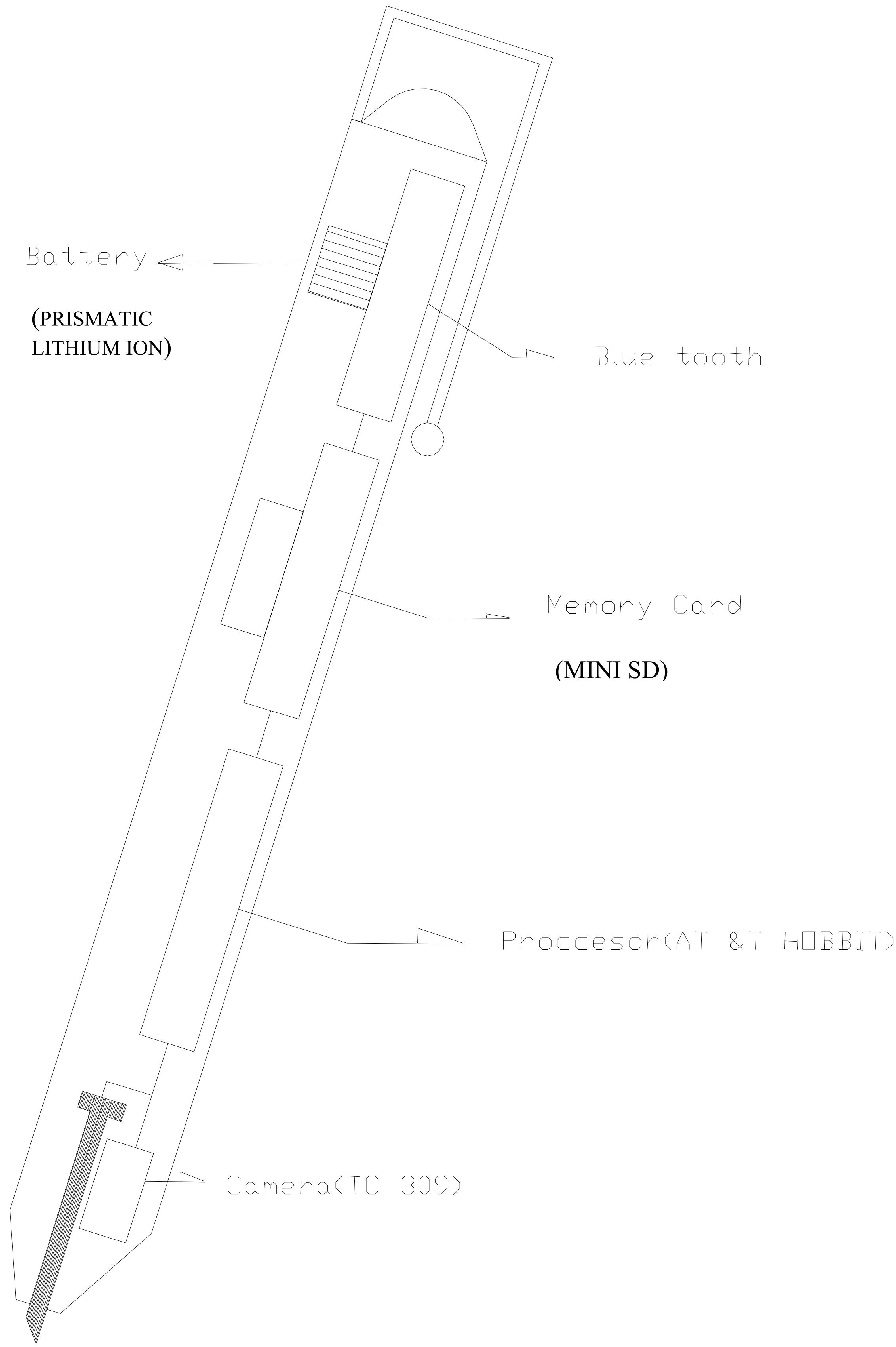
6.5. BATTERY:

In the past nickel cadmium had been the only suitable battery for portable equipments. However now nickel metal hybride and lithium ion battery have emerged which is the fasting growing and most promising battery chemistry.

Since we require a slim pack, the prismatic lithium ion cell is the best choice. these cells come at a higher cost in terms of stored energy.

Advantages:

- High energy density.
- Relatively low self discharge.
- Low maintainance.
- One regular charge is all that’s needed.
- Cost - $9.99 (Motorola V265 (2 packs)).



Battery
(PRISMATIC LITHIUM ION)
Blue tooth
Memory Card
(MINI SD)
Proccesor(AT &T H□BBIT)
Camera(TC 309)

DIMENSIONS- Approximately 153*19*17 cm

FIG NO 6.1 -AUTOCAD DIAGRAM OF THE DESIGNED DIGITAL PEN

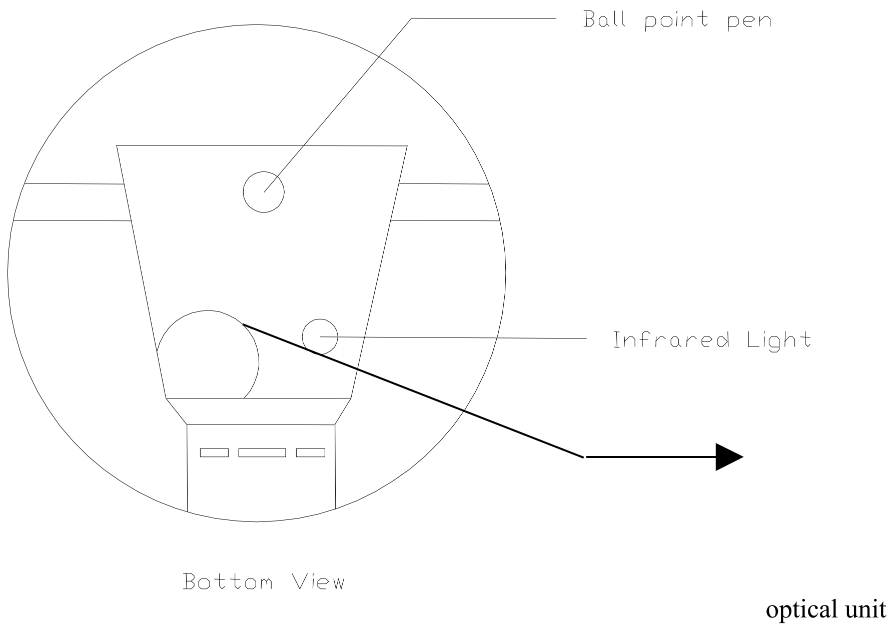


FIG NO 6.2 - BOTTOM VIEW

a

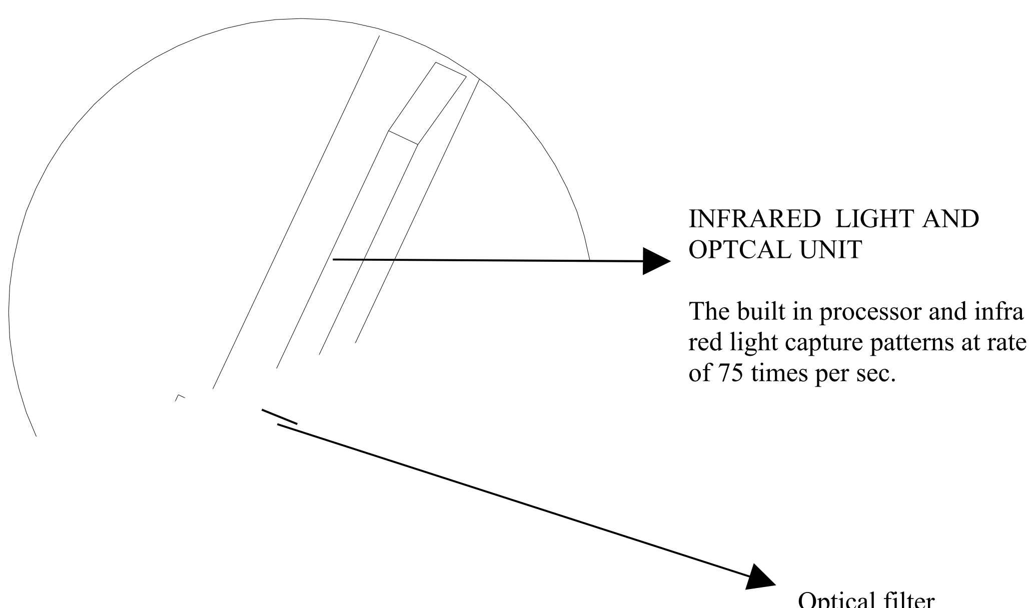


FIGURE NO 6.3 - OPTICAL UNIT

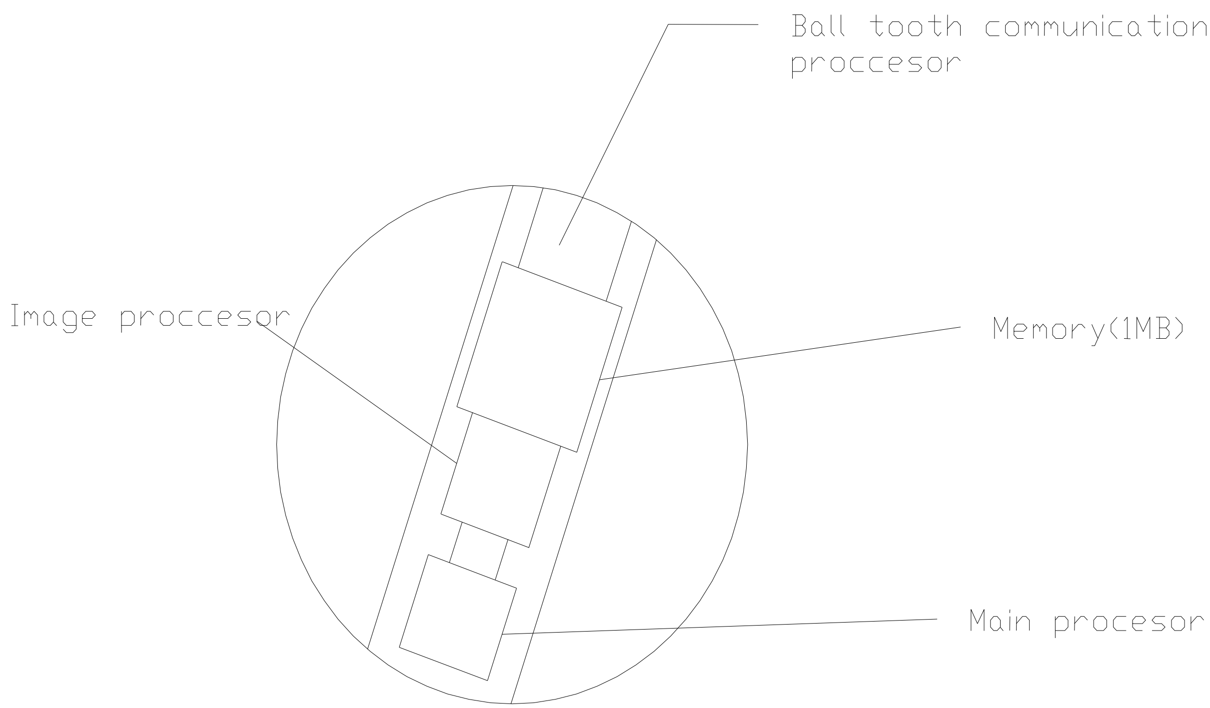


FIGURE NO 6.4 - ENLAGED VIEW OF THE COMPONENTS

CHAPTER 7

RESULTS AND DISCUSSION

7.1 RESULTS

The following components have been found to be most suitable for the implementation of the various subfunctions of the pen on the basis of the analysis done in the previous pages.

A.TC 309 Cameras - $5.71

B.AT&T Hobbit processor - $143.99

C. MiniSD memory card - $190.

D. lithium ion battery - $9.99

E. Bluetooth - $20.

Total estimated cost $370.

7.2DISCUSSION

Even in the current computer age, there are still many important application areas for a pen which remembers what it writes .Some of the most important applications of the pen are:

1 . Preparing a first draft of a document and concentrating on content creation.

2. A sociallv acceptable form of capturing information in meetings, that is quieter than typing and creates minimal visual barrier.

3. Applications that need privacy.

4. Entering letters in ideographic languages like Chinese- and Japanese; and non-letter entries like graphics music and gestures.

5. Interaction with multi-modal systems

CHAPTER 8

CONCLUSION

The key effect of all the advances in different technological fields will come into play when they are all together seamlessly integrated in a coherent and transparent way. Then, the user will not need to know any details of different technologies, but will understand them and make use of them immediately. Both kinds of freedom do not exist currently - not necessarily because it is impossible to consume and produce information, but because it is much too difficult as well as cost and time expensive even for skilled people. Such a pen will prove very helpful towards the need of creation and dissemination information without the usual impediments of technological know how .

Two main problems will have to be addressed to enable the resulting free exchange of information

- How will people live in an environment where they are reachable independent of time and place? Do people need constant information access? How will they cope with the mass of information available?
- What will happen when the devices that people rely on will have access to very personal data? How can security and privacy be preserved?

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