1. **INTRODUCTION**

Five pen pc shortly called as P-ISM (“Pen-style Personal Networking Gadget Package”), is nothing but the new discovery, which is under developing stage by NEC Corporation. P-ISM is a gadget package including five functions: a CPU pen, communication pen with a cellular phone function, virtual keyboard, a very small projector, and a camera. P-ISM’s are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone function. This personal gadget in a

minimalist pen style enables the ultimate ubiquitous computing.

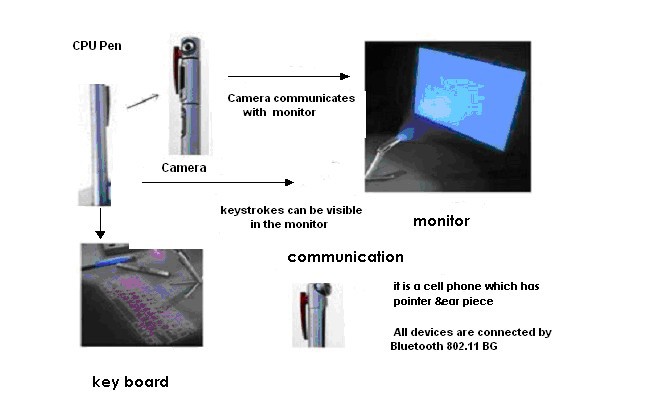


Fig: 1 diagram of 5 pen pc technology

**1.1 COMPONENTS NAME :**

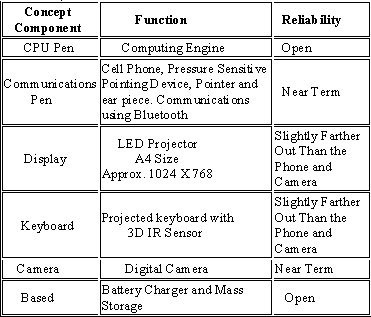


Fig: 2 table of components name

**1.2 HISTORY :**

The conceptual prototype of the "pen" computer was built in 2003. The prototype device, dubbed the "P-ISM", was a "Pen-style Personal Networking Gadget" created in 2003 by Japanese technology company NEC. The P-ISM was featured at the 2003 ITU Telecom World held in Geneva, Switzerland.

The designer of the 5 Pen Technology, ”Toru Ichihash*”* , said that” In developing this concept he asked himself – “What is the future of IT when it is small?” The pen was a logical choice. He also wanted a product that you could touch and feel. Further, the intent is to allow for an office anywhere.”

However, although a conceptual prototype of the "pen" computer was built in 2003, such devices are not yet available to consumers

An article about the device published on the Wave Report website in 2004 [explains](http://www.wave-report.com/other-html-files/P-ISM%202.htm): At ITU Telecom World we got a sample of another view by NEC. It is based on the pen and called P-ISM. This concept is so radical that we went to Tokyo to learn more*.*

“The design concept uses five different pens to make a computer. One pen is a CPU, another a camera, one creates a virtual keyboard, another projects the visual output and thus the display and another a communicator (a phone). All five pens can rest in a holding block which recharges the batteries and holds the mass storage. Each pen communicates wireless, possibly Bluetooth.”

A Pen-style Personal Networking Gadget Package

It seems that information terminals are infinitely getting smaller. However, we will continue to manipulate them with our hands for now. We have visualized the connection between the latest technology and the human, in a form of a pen. P-ISM is a gadget package including five functions: a pen-style cellular phone with a handwriting data input function, virtual keyboard, a very small projector, camera scanner, and personal ID key with cashless pass function. P-ISMs are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone function. This personal gadget in a minimalistic pen style enables the ultimate ubiquitous computing.

However, the prototype displayed at ITU Telecom World was apparently the only sample that was built and reportedly cost $30,000. Thus, while the prototype may have proved that such technology is feasible, it is currently unclear when - or even if - personal computers of this type will become available to the public. Several years on from the initial launch of the P- ISM conceptual prototype, there seems to be little information available about future plans.

**2.****CPU PEN**

The functionality of the CPU is done by one of the pen. It is also known as computing engine. It consists of dual core processor embedded in it and it works with WINDOWS operation system.

The central processing unit (CPU) is the portion of a computer system that carries out the instructions of a computer program, and is the primary element carrying out the computer's functions. The central processing unit carries out each instruction of the program in sequence, to perform the basic arithmetical, logical, and input/output operations of the system. This

term has been in use in the computer industry at least since the early 1960s. The form, design and implementation of CPUs have changed dramatically since the earliest examples, but their fundamental operation remains much the same.

Early CPUs were custom-designed as a part of a larger, sometimes one-of-a-kind, and computer. However, this costly method of designing custom CPUs for a particular application has largely given way to the development of mass-produced processors that are made for one or many purposes. This standardization trend generally began in the era of discrete transistor mainframes and mini computers and has rapidly accelerated with the popularization of the [integrated circuit](http://en.wikipedia.org/wiki/Integrated_circuit) (IC). The IC has allowed increasingly complex CPUs to be designed and manufactured to tolerances on the order of [nanometers](http://en.wikipedia.org/wiki/Nanometer). Both the miniaturization and standardization of CPUs have increased the presence of these digital devices in modern life far beyond the limited application of dedicated computing machines. Modern

microprocessors appear in everything from [automobiles](http://en.wikipedia.org/wiki/Automobile) to [cell phones](http://en.wikipedia.org/wiki/Cell_phone) and children's toys.

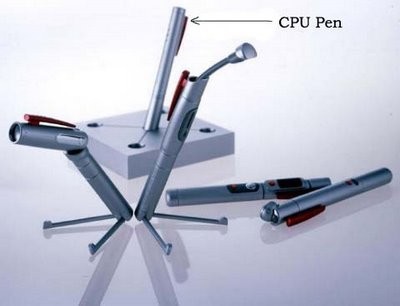


Fig:3 diagram of cpu pen

**2.1 CONTROL UNIT:-**

The control unit of the CPU contains circuitry that uses electrical signals to direct the entire computer system to carry out, stored program instructions. The control unit does not execute program instructions; rather, it directs other parts of the system to do so. The control unit must communicate with both the arithmetic/logic unit and memory.

CPU, [core memory](http://en.wikipedia.org/wiki/Magnetic_core_memory), and [external bus interface](http://en.wikipedia.org/wiki/External_bus_interface) of a DEC [PDP-8](http://en.wikipedia.org/wiki/PDP-8)/I. made of medium-scale integrated circuits.

The design complexity of CPUs increased as various technologies facilitated building smaller and more reliable electronic devices. The first such improvement came with the advent of the [transistor](http://en.wikipedia.org/wiki/Transistor). Transistorized CPUs during the 1950s and 1960s no longer had to be built out of bulky, unreliable, and fragile switching elements like [vacuum tubes](http://en.wikipedia.org/wiki/Vacuum_tube) and [electrical relays](http://en.wikipedia.org/wiki/Relay). With this improvement more complex and reliable CPUs were built onto one or several [printed circuit boards](http://en.wikipedia.org/wiki/Printed_circuit_board) containing discrete (individual) components.

During this period, a method of manufacturing many transistors in a compact space gained popularity. The [integrated circuit](http://en.wikipedia.org/wiki/Integrated_circuit) (IC) allowed a large number of transistors to be manufactured on a single [semiconductor](http://en.wikipedia.org/wiki/Semiconductor)-based [die](http://en.wikipedia.org/wiki/Die_(integrated_circuit)), or "chip." At first only very basic non- specialized digital circuits such as [NOR gates](http://en.wikipedia.org/wiki/NOR_gate) were miniaturized into ICs. CPUs based upon these "building block" ICs are generally referred to as "small-scale integration" (SSI) devices. SSI ICs, such as the ones used in the [Apollo guidance computer](http://en.wikipedia.org/wiki/Apollo_guidance_computer), usually contained transistor counts numbering in multiples of ten. To build an entire CPU out of SSI ICs required thousands of individual chips, but still consumed much less space and power than earlier discrete transistor designs. As microelectronic technology advanced, an increasing number of transistors were placed on ICs, thus decreasing the quantity of individual ICs needed for a complete CPU. MSI and LSI (medium- and large-scale integration) ICs increased transistor counts to hundreds, and then thousands.

In 1964 [IBM](http://en.wikipedia.org/wiki/IBM) introduced its [System/360](http://en.wikipedia.org/wiki/System/360) computer architecture which was used in a series of computers that could run the same programs with different speed and performance. This was significant at a time when most electronic computers were incompatible with one another, even those made by the same manufacturer. To facilitate this improvement, IBM utilized the

Concept of a [micro program](http://en.wikipedia.org/wiki/Microprogram) (often called "microcode"), which still sees widespread usage in modern CPUs. The System/360 architecture was so popular that it dominated the [mainframe computer](http://en.wikipedia.org/wiki/Mainframe_computer) market for decades and left a legacy that is still continued by similar modern computers like the IBM [zSeries](http://en.wikipedia.org/wiki/ZSeries). In the same year (1964), [Digital Equipment Corporation](http://en.wikipedia.org/wiki/Digital_Equipment_Corporation) (DEC) introduced another influential computer aimed at the scientific and research markets, the [PDP-8](http://en.wikipedia.org/wiki/PDP-8). DEC would later introduce the extremely popular [PDP-11](http://en.wikipedia.org/wiki/PDP-11) line that originally was built with SSI ICs but was eventually implemented with LSI components once these became

practical. In stark contrast with its SSI and MSI predecessors, the first LSI implementation of the PDP-11 contained a CPU composed of only four LSI integrated circuits.

Transistor-based computers had several distinct advantages over their predecessors. Aside from facilitating increased reliability and lower power consumption, transistors also allowed CPUs to operate at much higher speeds because of the short switching time of a transistor in comparison to a tube or relay. Thanks to both the increased reliability as well as the dramatically increased speed of the switching elements (which were almost exclusively transistors by this time), CPU clock rates in the tens of megahertz were obtained during this period. Additionally while discrete transistor and IC CPUs were in heavy usage, new high- performance designs like [SIMD](http://en.wikipedia.org/wiki/SIMD) (Single Instruction Multiple Data) [vector processors](http://en.wikipedia.org/wiki/Vector_processor) began to appear. These early experimental designs later gave rise to the era of specialized [supercomputers](http://en.wikipedia.org/wiki/Supercomputer) like those made by [Cray Inc.](http://en.wikipedia.org/wiki/Cray_Inc)

2.2 **MICROPROCESSOR:-**

The introduction of the [microprocessor](http://en.wikipedia.org/wiki/Microprocessor) in the 1970s significantly affected the design and implementation of CPUs. Since the introduction of the first commercially available microprocessor (the [Intel 4004](http://en.wikipedia.org/wiki/Intel_4004)) in 1970 and the first widely used microprocessor (the [Intel](http://en.wikipedia.org/wiki/Intel_8080)

[8080](http://en.wikipedia.org/wiki/Intel_8080)) in 1974, this class of CPUs has almost completely overtaken all other central processing unit implementation methods. Mainframe and minicomputer manufacturers of the time launched proprietary IC development programs to upgrade their older [computer architectures](http://en.wikipedia.org/wiki/Computer_architecture), and eventually produced [instruction set](http://en.wikipedia.org/wiki/Instruction_set) compatible microprocessors that were backward-compatible with their older hardware and software. Combined with the advent and eventual vast success of the now ubiquitous [personal computer](http://en.wikipedia.org/wiki/Personal_computer), the term CPU is now applied almost exclusively to microprocessors. Several CPUs can be combined in a single processing chip.

Previous generations of CPUs were implemented as discrete components and numerous small [integrated circuits](http://en.wikipedia.org/wiki/Integrated_circuit) (ICs) on one or more circuit boards. Microprocessors, on the other hand, are CPUs manufactured on a very small number of ICs; usually just one. The overall smaller CPU size as a result of being implemented on a single die means faster switching time because of physical factors like decreased gate [parasitic capacitance](http://en.wikipedia.org/wiki/Parasitic_capacitance). This has allowed synchronous microprocessors to have clock rates ranging from tens of megahertz to several gigahertz’s. Additionally, as the ability to construct exceedingly small transistors on an IC has increased, the complexity and number of transistors in a single CPU has increased dramatically. This widely observed trend is described by [Moore's law](http://en.wikipedia.org/wiki/Moore%27s_law), which has proven to be a fairly accurate predictor of the growth of CPU (and other IC) complexity to date.

While the complexity, size, construction, and general form of CPUs have changed drastically over the past sixty years, it is notable that the basic design and function has not changed much at all. Almost all common CPUs today can be very accurately described as von Neumann stored-program machines. As the aforementioned Moore's law continues to hold true, concerns have arisen about the limits of integrated circuit transistor technology. Extreme miniaturization of electronic gates is causing the effects of phenomena like [electro migration](http://en.wikipedia.org/wiki/Electromigration) and [sub threshold leakage](http://en.wikipedia.org/wiki/Subthreshold_leakage) to become much more significant. These newer concerns are among the many factors causing researchers to investigate new methods of computing such as the [quantum computer](http://en.wikipedia.org/wiki/Quantum_computer), as well as to expand the usage of [parallelism](http://en.wikipedia.org/wiki/Parallel_computing) and other methods that extend the usefulness of the classical von Neumann model.

**2.3 OPERATION:-**

The fundamental operation of most CPUs, regardless of the physical form they take, is to execute a sequence of stored instructions called a program. The program is represented by a series of numbers that are kept in some kind of [computer memory](http://en.wikipedia.org/wiki/Memory_(computers)). There are four steps that nearly all CPUs use in their operation: fetch, decode, execute, and write back.

The first step, fetch, involves retrieving an [instruction](http://en.wikipedia.org/wiki/Instruction_(computer_science)) (which is represented by a number or sequence of numbers) from program memory. The location in program memory is determined by a [program counter](http://en.wikipedia.org/wiki/Program_counter) (PC), which stores a number that identifies the current position in the program. After an instruction is fetched, the PC is incremented by the length of the instruction word in terms of memory units. Often, the instruction to be fetched must be retrieved from relatively slow memory, causing the CPU to stall while waiting for the instruction to be returned. This issue is largely addressed in modern processors by caches and pipeline architectures (see below).

The instruction that the CPU fetches from memory is used to determine what the CPU is to do. In the decode step, the instruction is broken up into parts that have significance to other portions of the CPU. The way in which the numerical instruction value is interpreted is defined by the CPU's instruction set architecture (ISA). Often, one group of numbers in the instruction, called the opcode, indicates which operation to perform. The remaining parts of the number usually provide information required for that instruction, such as operands for an addition operation. Such operands may be given as a constant value (called an immediate value), or as a place to locate a value: a [register](http://en.wikipedia.org/wiki/Processor_register) or a memory address, as determined by some [addressing mode](http://en.wikipedia.org/wiki/Addressing_mode). In older designs the portions of the CPU responsible for instruction decoding were unchangeable hardware devices. However, in more abstract and complicated CPUs and ISAs, a micro program is often used to assist in translating instructions into various

configuration signals for the CPU. This micro program is sometimes rewritable so that it can be modified to change the way the CPU decodes instructions even after it has been manufactured.

After the fetch and decode steps, the execute step is performed. During this step, various portions of the CPU are connected so they can perform the desired operation. If, for instance, an addition operation was requested, the [arithmetic logic unit](http://en.wikipedia.org/wiki/Arithmetic_logic_unit) (ALU) will be connected to a set of inputs and a set of outputs. The inputs provide the numbers to be added, and the outputs will contain the final sum. The ALU contains the circuitry to perform simple arithmetic and logical operations on the inputs (like addition and [bitwise operations](http://en.wikipedia.org/wiki/Bitwise_operations)). If the addition operation produces a result too large for the CPU to handle, an arithmetic overflow flag in a flags register may also be set.

The final step, write back, simply "writes back" the results of the execute step to some form of memory. Very often the results are written to some internal CPU register for quick access by subsequent instructions. In other cases results may be written to slower, but cheaper and larger, [main memory](http://en.wikipedia.org/wiki/Random_access_memory). Some types of instructions manipulate the program counter rather than directly produce result data. These are generally called "jumps" and facilitate behavior like loops, conditional program execution (through the use of a conditional jump), and [functions](http://en.wikipedia.org/wiki/Subroutine) in programs. Many instructions will also change the state of digits in a "flags" register. These flags can be used to influence how a program behaves, since they often indicate the outcome of various operations. For example, one type of "compare" instruction considers two values and sets a number in the flags register according to which one is greater. This flag could then be used by a later jump instruction to determine program flow.

After the execution of the instruction and write back of the resulting data, the entire process repeats, with the next instruction cycle normally fetching the next-in-sequence instruction because of the incremented value in the program counter. If the completed instruction was a jump, the program counter will be modified to contain the address of the instruction that was jumped to, and program execution continues normally. In more complex CPUs than the one described here, multiple instructions can be fetched, decoded, and executed simultaneously. This section describes what is generally referred to as the "Classic RISC pipeline", which in fact is quite common among the simple CPUs used in many electronic devices (often called microcontroller). It largely ignores the important role of [CPU cache](http://en.wikipedia.org/wiki/CPU_cache), and therefore the access stage of the pipeline.

**2.4 DESIGN AND IMPLEMENTATION:-**

The way a CPU represents numbers is a design choice that affects the most basic ways in which the device functions. Some early digital computers used an electrical model of the common [decimal](http://en.wikipedia.org/wiki/Decimal) (base ten) [numeral system](http://en.wikipedia.org/wiki/Numeral_system) to represent numbers internally. A few other computers have used more exotic numeral systems like [ternary](http://en.wikipedia.org/wiki/Balanced_ternary) (base three). Nearly all modern CPUs represent numbers in [binary](http://en.wikipedia.org/wiki/Binary_numeral_system) form, with each digit being represented by some two-valued physical quantity such as a "high" or "low" [voltage](http://en.wikipedia.org/wiki/Volt).

[MOS 6502](http://en.wikipedia.org/wiki/MOS_Technology_6502) microprocessor in a [dual in-line package](http://en.wikipedia.org/wiki/Dual_in-line_package), an extremely popular 8-bit design. Related to number representation is the size and precision of numbers that a CPU can represent. In the case of a binary CPU, a bit refers to one significant place in the numbers a CPU deals with. The number of bits (or numeral places) a CPU uses to represent numbers is often called "[word size](http://en.wikipedia.org/wiki/Word_(computer_science))", "bit width", "data path width", or "integer precision" when dealing with strictly integer numbers (as opposed to [Floating point](http://en.wikipedia.org/wiki/Floating_Point)). This number differs between architectures, and often within different parts of the very same CPU. For example, an [8-bit](http://en.wikipedia.org/wiki/8-bit) CPU deals with a range of numbers that can be represented by eight binary digits (each digit having two possible values), that is, 28 or 256 discrete numbers. In effect, integer size sets a hardware limit on the range of integers the software run by the CPU can utilize.

Integer range can also affect the number of locations in memory the CPU can address (locate). For example, if a binary CPU uses 32 bits to represent a memory address, and each memory address represents one [octet](http://en.wikipedia.org/wiki/Octet_(computing)) (8 bits), the maximum quantity of memory that CPU can address is 232 octets, or 4 [GiB](http://en.wikipedia.org/wiki/GiB). This is a very simple view of CPU [address space](http://en.wikipedia.org/wiki/Address_space), and many designs use more complex addressing methods like [paging](http://en.wikipedia.org/wiki/Bank_switching) in order to locate more memory than their integer range would allow with a flat address space.

Higher levels of integer range require more structures to deal with the additional digits, and therefore more complexity, size, power usage, and general expense. It is not at all uncommon, therefore, to see 4- or 8-bit [microcontrollers](http://en.wikipedia.org/wiki/Microcontroller) used in modern applications, even though CPUs with much higher range (such as 16, 32, 64, even 128-bit) are available. The simpler microcontrollers are usually cheaper, use less power, and therefore dissipate less heat, all of which can be major design considerations for electronic devices. However, in higher-end applications, the benefits afforded by the extra range (most often the additional address space) are more significant and often affect design choices. To gain some of the advantages afforded by both lower and higher bit lengths, many CPUs are designed with different bit widths for different portions of the device. For example, the IBM [System/370](http://en.wikipedia.org/wiki/System/370) used a CPU that was primarily 32 bit, but it used 128-bit precision inside its [floating point](http://en.wikipedia.org/wiki/Floating_point) units to facilitate greater accuracy and range in floating point numbers. Many later CPU

designs use similar mixed bit width, especially when the processor is meant for general- purpose usage where a reasonable balance of integer and floating point capability is required.

**2.5 CLOCK RATE:-**

The clock rate is the speed at which a microprocessor executes instructions. Every computer contains an internal clock that regulates the rate at which instructions are executed and synchronizes all the various computer components. The CPU requires a fixed number of clock ticks (or clock cycles) to execute each instruction. The faster the clock, the more instructions the CPU can execute per second.

Most CPUs, and indeed most [sequential logic](http://en.wikipedia.org/wiki/Sequential_logic) devices, are [synchronous](http://en.wikipedia.org/wiki/Synchronous_circuit) in nature.[10] That is, they are designed and operate on assumptions about a synchronization signal. This signal, known as a clock signal, usually takes the form of a periodic [square wave](http://en.wikipedia.org/wiki/Square_wave). By calculating the maximum time that electrical signals can move in various branches of a CPU's many circuits, the designers can select an appropriate [period](http://en.wikipedia.org/wiki/Frequency) for the clock signal.

This period must be longer than the amount of time it takes for a signal to move, or propagate, in the worst-case scenario. In setting the clock period to a value well above the worst-case [propagation delay](http://en.wikipedia.org/wiki/Propagation_delay), it is possible to design the entire CPU and the way it moves data around the "edges" of the rising and falling clock signal. This has the advantage of simplifying the CPU significantly, both from a design perspective and a component-count perspective. However, it also carries the disadvantage that the entire CPU must wait on its slowest elements, even though some portions of it are much faster. This limitation has largely been compensated for by various methods of increasing CPU parallelism. (see below)

However, architectural improvements alone do not solve all of the drawbacks of globally synchronous CPUs. For example, a clock signal is subject to the delays of any other electrical signal. Higher clock rates in increasingly complex CPUs make it more difficult to keep the clock signal in phase (synchronized) throughout the entire unit. This has led many modern CPUs to require multiple identical clock signals to be provided in order to avoid delaying a single signal significantly enough to cause the CPU to malfunction. Another major issue as clock rates increase dramatically is the amount of heat that is dissipated by the CPU. The constantly changing clock causes many components to switch regardless of whether they are being used at that time. In general, a component that is switching uses more energy than an element in a static state. Therefore, as clock rate increases, so does heat dissipation, causing the CPU to require more effective cooling solutions.

One method of dealing with the switching of unneeded components is called [clock gating](http://en.wikipedia.org/wiki/Clock_gating), which involves turning off the clock signal to unneeded components (effectively disabling

them). However, this is often regarded as difficult to implement and therefore does not see common usage outside of very low-power designs. One notable late CPU design that uses clock gating is that of the IBM [PowerPC](http://en.wikipedia.org/wiki/PowerPC)-based [Xbox 360](http://en.wikipedia.org/wiki/Xbox_360). It utilizes extensive clock gating in order to reduce the power requirements of the aforementioned videogame console in which it is used. Another method of addressing some of the problems with a global clock signal is the removal of the clock signal altogether. While removing the global clock signal makes the design process considerably more complex in many ways, asynchronous (or clock less) designs carry marked advantages in power consumption and heat dissipation in comparison with similar synchronous designs. While somewhat uncommon, entire asynchronous CPUs have been built without utilizing a global clock signal. Two notable examples of this are the [ARM](http://en.wikipedia.org/wiki/ARM_architecture) compliant [AMULET](http://en.wikipedia.org/wiki/AMULET_microprocessor) and the [MIPS](http://en.wikipedia.org/wiki/MIPS_architecture) R3000 compatible MiniMIPS. Rather than totally removing the clock signal, some CPU designs allow certain portions of the device to be asynchronous, such as using asynchronous [ALUs](http://en.wikipedia.org/wiki/Arithmetic_logic_unit) in conjunction with superscalar pipelining to achieve some arithmetic performance gains. While it is not altogether clear whether totally asynchronous designs can perform at a comparable or better level than their synchronous counterparts, it is evident that they do at least excel in simpler math operations. This, combined with their excellent power consumption and heat dissipation properties, makes them very suitable for [embedded computers](http://en.wikipedia.org/wiki/Embedded_computer).

**2.6 PERFORMANCE:-**

The performance or speed of a processor depends on the clock rate and the instructions per clock (IPC), which together are the factors, for the [instructions per second](http://en.wikipedia.org/wiki/Instructions_per_second) (IPS) that the CPU can perform. Many reported IPS values have represented "peak" execution rates on artificial instruction sequences with few branches, whereas realistic workloads consist of a mix of instructions and applications, some of which take longer to execute than others. The performance of the [memory hierarchy](http://en.wikipedia.org/wiki/Memory_hierarchy) also greatly affects processor performance, an issue barely considered in MIPS calculations. Because of these problems, various standardized tests such as [SPECint](http://en.wikipedia.org/wiki/SPECint) have been developed to attempt to measure the real effective performance in commonly used applications.

Processing performance of computers is increased by using [multi-core processors](http://en.wikipedia.org/wiki/Multi-core_processor), which essentially is plugging two or more individual processors (called cores in this sense) into one [integrated circuit](http://en.wikipedia.org/wiki/Integrated_circuit). Ideally, a dual core processor would be nearly twice as powerful as a single core processor. In practice, however, the performance gain is far less, only about fifty percent, due to imperfect software algorithms and implementation

**3. COMMUCATION PEN**

P-ISM’s are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone function. They are connected through Tri-wireless modes (Blue tooth, 802.11B/G, and terabytes of data, exceeding the capacity of today’s hard disks.

This is very effective because we can able to connect whenever we need without having wires. They are used at the frequency band of 2.4 GHz ISM (although they use different access mechanisms). Blue tooth mechanism is used for exchanging signal status information between two devices. This techniques have been developed that do not require communication between the two devices (such as Blue tooth’s Adaptive Frequency Hopping), the most efficient and comprehensive solution for the most serious problems can be accomplished by silicon vendors. They can implement information exchange capabilities within the designs of the Blue tooth.



Fig: diagram of communication pen

**3.1 BLUETOOTH:-**

Bluetooth uses a radio technology called [frequency-hopping spread spectrum](http://en.wikipedia.org/wiki/Frequency-hopping_spread_spectrum), which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz (allowing for guard bands). This range is in the globally unlicensed Industrial, Scientific and Medical ([ISM](http://en.wikipedia.org/wiki/ISM_band)) 2.4 GHz short- range [radio frequency](http://en.wikipedia.org/wiki/Radio_frequency) band.

Originally [Gaussian frequency-shift keying](http://en.wikipedia.org/wiki/Gaussian_frequency-shift_keying) (GFSK) modulation was the only modulation scheme available; subsequently, since the introduction of Bluetooth 2.0+EDR, π/4-[DQPSK](http://en.wikipedia.org/wiki/DQPSK) and 8DPSK modulation may also be used between compatible devices. Devices functioning with GFSK are said to be operating in basic rate (BR) mode where an instantaneous [data rate](http://en.wikipedia.org/wiki/Data_rate_units) of 1 [Mbit/s](http://en.wikipedia.org/wiki/Data_rate_units) is possible. The term Enhanced Data Rate (EDR) is used to describe π/4-DPSK and 8DPSK schemes, each giving 2 and 3 Mbit/s respectively. The combination of these (BR and EDR) modes in Bluetooth radio technology is classified as a "BR/EDR radio".

Bluetooth is a [packet-based protocol](http://en.wikipedia.org/wiki/Packet_based) with a [master-slave structure](http://en.wikipedia.org/wiki/Master-slave_(technology)). One master may communicate with up to 7 slaves in a [piconet](http://en.wikipedia.org/wiki/Piconet); all devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5 µs intervals. Two clock ticks make up a slot of 625 µs; two slots make up a slot pair of 1250 µs. In the simple case of single-slot packets the master transmits in even slots and receives in odd slots; the slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long but in all cases the master transmit will begin in even slots and the slave transmit in odd slots.

Bluetooth provides a secure way to connect and exchange information between devices such as [faxes](http://en.wikipedia.org/wiki/Fax), [mobile phones](http://en.wikipedia.org/wiki/Mobile_phone), [telephones](http://en.wikipedia.org/wiki/Telephone), [laptops](http://en.wikipedia.org/wiki/Laptop), [personal computers](http://en.wikipedia.org/wiki/Personal_computer), [printers](http://en.wikipedia.org/wiki/Computer_printer), [Global Positioning System](http://en.wikipedia.org/wiki/Global_Positioning_System) (GPS) receivers, [digital cameras](http://en.wikipedia.org/wiki/Digital_camera), and [video game consoles](http://en.wikipedia.org/wiki/Video_game_console).

A master Bluetooth device can communicate with up to seven devices in a [piconet](http://en.wikipedia.org/wiki/Piconet). (An ad- hoc computer network using Bluetooth technology) The devices can switch roles, by agreement, and the slave can become the master at any time.

At any given time, data can be transferred between the master and one other device (except for the little-used broadcast mode). The master chooses which slave device to address; typically, it switches rapidly from one device to another in a [round-robin](http://en.wikipedia.org/wiki/Round-robin_scheduling) fashion.

The Bluetooth Core Specification provides for the connection of two or more piconets to form a [scatter net](http://en.wikipedia.org/wiki/Scatternet), in which certain devices serve as bridges, simultaneously playing the master role in one piconet and the slave role in another.

Many USB Bluetooth [adapters](http://en.wikipedia.org/wiki/Adapter_(computing)) or "dongles" are available, some of which also include an [IrDA](http://en.wikipedia.org/wiki/IrDA) adapter. Older (pre-2003) Bluetooth dongles, however, have limited capabilities, offering only the Bluetooth Enumerator and a less-powerful Bluetooth Radio incarnation. Such devices can link computers with Bluetooth with a distance of 100 meters, but they do not offer as many services as modern adapters do.

Wireless control of and communication between a [mobile phone](http://en.wikipedia.org/wiki/Mobile_phone) and a [hands free](http://en.wikipedia.org/wiki/Handsfree) [headset](http://en.wikipedia.org/wiki/Headset_(telephone/computer)). This was one of the earliest applications to become popular.

Wireless networking between PCs in a confined space and where little bandwidth is required.

Wireless communication with PC input and output devices, the most common being the [mouse](http://en.wikipedia.org/wiki/Computer_mouse), [keyboard](http://en.wikipedia.org/wiki/Computer_keyboard) and [printer](http://en.wikipedia.org/wiki/Computer_printer).

Transfer of files, contact details, calendar appointments, and reminders between devices with [OBEX](http://en.wikipedia.org/wiki/OBEX).

Replacement of traditional wired [serial](http://en.wikipedia.org/wiki/RS-232) communications in test equipment, [GPS](http://en.wikipedia.org/wiki/Global_Positioning_System)

[receivers](http://en.wikipedia.org/wiki/Global_Positioning_System), medical equipment, bar code scanners, and traffic control devices. For controls where [infrared](http://en.wikipedia.org/wiki/Infrared) was traditionally used.

For low bandwidth applications where higher [USB](http://en.wikipedia.org/wiki/USB) bandwidth is not required and cable-free connection desired.

equivalents in Bluetooth are the DUN profile, which allows devices to act as modem interfaces, and the PAN profile, which allows for ad-hoc networking.

A [personal computer](http://en.wikipedia.org/wiki/Personal_computer) that does not have embedded Bluetooth can be used with a Bluetooth adapter that will enable the PC to communicate with other Bluetooth devices (such as [mobile phones](http://en.wikipedia.org/wiki/Mobile_phone), [mice](http://en.wikipedia.org/wiki/Mouse_(computing)) and [keyboards](http://en.wikipedia.org/wiki/Computer_keyboard)). While some [desktop computers](http://en.wikipedia.org/wiki/Desktop_computer) and most recent [laptops](http://en.wikipedia.org/wiki/Laptop) come with a built-in Bluetooth radio, others will require an external one in the form of a [dongle](http://en.wikipedia.org/wiki/Dongle).

Unlike its predecessor, [IrDA](http://en.wikipedia.org/wiki/Infrared_Data_Association), which requires a separate adapter for each device, Bluetooth allows multiple devices to communicate with a computer over a single adapter.

The Bluetooth SIG completed the Bluetooth Core Specification version 4.0, which includes Classic Bluetooth, Bluetooth high speed and [Bluetooth low energy](http://en.wikipedia.org/wiki/Bluetooth_low_energy) protocols. Bluetooth high speed is based on Wi-Fi, and Classic Bluetooth consists of legacy Bluetooth protocols. This version has been adopted as of June 30, 2010.

Cost-reduced single-mode chips, which will enable highly integrated and compact devices, will feature a lightweight Link Layer providing ultra-low power idle mode operation, simple device discovery, and reliable point-to-multipoint data transfer with advanced power-save and secure encrypted connections at the lowest possible cost. The Link Layer in these controllers will enable Internet connected sensors to schedule Bluetooth low energy traffic between Bluetooth transmissions.

Many of the services offered over Bluetooth can expose private data or allow the connecting party to control the Bluetooth device. For security reasons it is therefore necessary to control which devices are allowed to connect to a given Bluetooth device. At the same time, it is useful for Bluetooth devices to automatically establish a connection without user intervention as soon as they are in range.

To resolve this conflict, Bluetooth uses a process called pairing. Two devices need to be paired to communicate with each other. The pairing process is typically triggered automatically the first time a device receives a connection request from a device with which it is not yet paired (in some cases the device user may need to make the device's Bluetooth link visible to other devices first). Once a pairing has been established it is remembered by the devices, which can then connect to each without user intervention. When desired, the pairing relationship can later be removed by the user.

**3.2 IEEE 802.11:-**

IEEE 802.11 is a set of standards for implementing [wireless local area network](http://en.wikipedia.org/wiki/Wireless_LAN) (WLAN)

computer communication in the 2.4, 3.6 and 5 GHz frequency bands. They are created and

maintained by the [IEEE](http://en.wikipedia.org/wiki/Institute_of_Electrical_and_Electronics_Engineers) [LAN](http://en.wikipedia.org/wiki/Local_area_network)/[MAN](http://en.wikipedia.org/wiki/Metropolitan_area_network) Standards Committee ([IEEE 802](http://en.wikipedia.org/wiki/IEEE_802)). The base current version of the standard is IEEE 802.11-2007.

The 802.11 family consists of a series of over-the-air [modulation](http://en.wikipedia.org/wiki/Modulation) techniques that use the same basic protocol. The most popular are those defined by the 802.11b and 802.11g protocols, which are amendments to the original standard. 802.11-1997 was the first wireless networking standard, but 802.11b was the first widely accepted one, followed by 802.11g and

802.11n. Security was originally purposefully weak due to export requirements of some governments, and was later enhanced via the 802.11i amendment after governmental and legislative changes. 802.11n is a new multi-streaming modulation technique. Other standards in the family (c–f, h, j) are service amendments and extensions or corrections to the previous specifications.

802.11b and 802.11g use the 2.4 [GHz](http://en.wikipedia.org/wiki/Hertz) [ISM band](http://en.wikipedia.org/wiki/ISM_band), operating in the [United States](http://en.wikipedia.org/wiki/United_States) under [Part 15](http://en.wikipedia.org/wiki/Part_15_(FCC_rules)) of the US [Federal Communications Commission](http://en.wikipedia.org/wiki/Federal_Communications_Commission) Rules and Regulations. Because of this choice of frequency band, 802.11b and g equipment may occasionally suffer [interference](http://en.wikipedia.org/wiki/Interference_(communication)) from [microwave ovens](http://en.wikipedia.org/wiki/Microwave_oven), [cordless telephones](http://en.wikipedia.org/wiki/Cordless_telephone) and [Bluetooth](http://en.wikipedia.org/wiki/Bluetooth) devices. 802.11b and 802.11g control their interference and susceptibility to interference by using [direct-sequence spread spectrum](http://en.wikipedia.org/wiki/Direct-sequence_spread_spectrum) (DSSS) and [orthogonal frequency-division multiplexing](http://en.wikipedia.org/wiki/Orthogonal_frequency-division_multiplexing) (OFDM) signalling methods, respectively. 802.11a uses the [5 GHz U-NII band](http://en.wikipedia.org/wiki/U-NII), which, for much of the world, offers at least 23 non-overlapping channels rather than the 2.4 GHz ISM frequency band, where all channels overlap.[2] Better or worse performance with higher or lower frequencies (channels) may be realized, depending on the environment.

The segment of the [radio frequency](http://en.wikipedia.org/wiki/Radio_frequency) spectrum used by 802.11 varies between countries. In the US, 802.11a and 802.11g devices may be operated without a license, as allowed in Part 15 of the FCC Rules and Regulations. Frequencies used by channels one through six of 802.11b and 802.11g fall within the 2.4 GHz [amateur radio](http://en.wikipedia.org/wiki/Amateur_radio) band. Licensed [amateur radio operators](http://en.wikipedia.org/wiki/Amateur_radio_operator) may operate 802.11b/g devices under [Part 97](http://en.wikipedia.org/wiki/Part_97_(FCC_rules)) of the FCC Rules and Regulations, allowing increased power output but not commercial content or encryption.

Current 802.11 standards define "frame" types for use in transmission of data as well as management and control of wireless links.

Frames are divided into very specific and standardized sections. Each frame consists of a MAC header, payload and [frame check sequence](http://en.wikipedia.org/wiki/Frame_check_sequence) (FCS). Some frames may not have the payload. The first two bytes of the MAC header form a frame control field specifying the form and function of the frame. The frame control field is further subdivided into the following sub-fields:

Protocol Version: two bits representing the protocol version. Currently used protocol version is zero. Other values are reserved for future use.

Type: two bits identifying the type of WLAN frame. Control, Data and Management are various frame types defined in IEEE 802.11.

Sub Type: Four bits providing addition discrimination between frames. Type and Sub type together to identify the exact frame.

ToDS and FromDS: Each is one bit in size. They indicate whether a data frame is headed for a distributed system. Control and management frames set these values to zero. All the data frames will have one of these bits set. However communication within an IBSS network always set these bits to zero.

More Fragments: The More Fragments bit is set when a packet is divided into multiple frames for transmission. Every frame except the last frame of a packet will have this bit set.

Retry: Sometimes frames require retransmission, and for this there is a Retry bit which is set to one when a frame is resent. This aids in the elimination of duplicate frames.

Power Management: This bit indicates the power management state of the sender after the completion of a frame exchange. Access points are required to manage the connection and will never set the power saver bit.

More Data: The More Data bit is used to buffer frames received in a distributed system. The access point uses this bit to facilitate stations in power saver mode. It indicates that at least one frame is available and addresses all stations connected.

WEP: The WEP bit is modified after processing a frame. It is toggled to one after a frame has been decrypted or if no encryption is set it will have already been one.

Order: This bit is only set when the "strict ordering" delivery method is employed. Frames and fragments are not always sent in order as it causes a transmission performance penalty.

The next two bytes are reserved for the Duration ID field. This field can take one of three forms: Duration, Contention-Free Period (CFP), and Association ID (AID).

An 802.11 frame can have up to four address fields. Each field can carry a [MAC address](http://en.wikipedia.org/wiki/MAC_address). Address 1 is the receiver, Address 2 is the transmitter, and Address 3 is used for filtering purposes by the receiver.

The Sequence Control field is a two-byte section used for identifying message order as well as eliminating duplicate frames. The first 4 bits are used for the fragmentation number and the last 12 bits are the sequence number.

An optional two-byte Quality of Service control field which was added with [802.11e](http://en.wikipedia.org/wiki/802.11e).

The Frame Body field is variable in size, from 0 to 2304 bytes plus any overhead from security encapsulation and contains information from higher layers.

The Frame Check Sequence (FCS) is the last four bytes in the standard 802.11 frame. Often referred to as the Cyclic Redundancy Check (CRC), it allows for integrity check of retrieved frames. As frames are about to be sent the FCS is calculated and appended. When a station receives a frame it can calculate the FCS of the frame and compare it to the one received. If they match, it is assumed that the frame was not

distorted during transmission.[18]

Management Frames allow for the maintenance of communication. Some common 802.11 subtypes include:

Authentication frame: 802.11 authentications begins with the [WNIC](http://en.wikipedia.org/wiki/Wireless_network_interface_card) sending an authentication frame to the access point containing its identity. With an open system authentication the WNIC only sends a single authentication frame and the access point responds with an authentication frame of its own indicating acceptance or rejection. With shared key authentication, after the WNIC sends its initial authentication request it will receive an authentication frame from the access point containing challenge text. The WNIC sends an authentication frame containing the encrypted version of the challenge text to the access point. The access point ensures the text was encrypted with the correct key by decrypting it with its own key. The result of this process determines the WNIC's authentication status.

Association request frame: sent from a station it enables the access point to allocate resources and synchronize. The frame carries information about the WNIC including supported data rates and the [SSID](http://en.wikipedia.org/wiki/SSID) of the network the station wishes to associate with. If the request is accepted, the access point reserves memory and establishes an association ID for the WNIC.

Association response frame: sent from an access point to a station containing the acceptance or rejection to an association request. If it is an acceptance, the frame will contain information such an association ID and supported data rates.

[Beacon frame](http://en.wikipedia.org/wiki/Beacon_frame): Sent periodically from an access point to announce its presence and provide the [SSID](http://en.wikipedia.org/wiki/SSID), and other parameters for WNICs within range.

Deauthentication frame: Sent from a station wishing to terminate connection from another station.

Disassociation frame: Sent from a station wishing to terminate connection. It's an elegant way to allow the access point to relinquish memory allocation and remove the WNIC from the association table.

Probe request frame: Sent from a station when it requires information from another station.

Probe response frame: Sent from an access point containing capability information, supported data rates, etc., after receiving a probe request frame.

Reassociation request frame: A WNIC sends a reassociation request when it drops from range of the currently associated access point and finds another access point with a stronger signal. The new access point coordinates the forwarding of any information that may still be contained in the buffer of the previous access point.

Reassociation response frame: Sent from an access point containing the acceptance or rejection to a WNIC reassociation request frame. The frame includes information required for association such as the association ID and supported data rates.

Control frames facilitate in the exchange of data frames between stations. Some common

802.11 control frames include:

Acknowledgement (ACK) frame: After receiving a data frame, the receiving station will send an ACK frame to the sending station if no errors are found. If the sending station doesn't receive an ACK frame within a predetermined period of time, the sending station will resend the frame.

Request to Send (RTS) frame: The RTS and CTS frames provide an optional collision reduction scheme for access point with hidden stations. A station sends a RTS frame to as the first step in a two-way handshake required before sending data frames.

Clear to Send (CTS) frame: A station responds to an RTS frame with a CTS frame. It provides clearance for the requesting station to send a data frame. The CTS provides collision control management by including a time value for which all other stations are to hold off transmission while the requesting stations transmits.

In 2001, a group from the [University of California, Berkeley](http://en.wikipedia.org/wiki/University_of_California%2C_Berkeley) presented a paper describing weaknesses in the [802.11](http://en.wikipedia.org/wiki/802.11) [Wired Equivalent Privacy](http://en.wikipedia.org/wiki/Wired_Equivalent_Privacy) (WEP) security mechanism defined in the original standard; they were followed by [Fluhrer, Mantin, and Shamir](http://en.wikipedia.org/wiki/Fluhrer%2C_Mantin_and_Shamir_attack)'s paper titled "Weaknesses in the Key Scheduling Algorithm of [RC4](http://en.wikipedia.org/wiki/RC4)". Not long after, Adam Stubblefield and [AT&T](http://en.wikipedia.org/wiki/AT%26T) publicly announced the first verification of the attack. In the attack, they were able to intercept transmissions and gain unauthorized access to wireless networks.

The IEEE set up a dedicated task group to create a replacement security solution, 802.11i (previously this work was handled as part of a broader 802.11e effort to enhance the [MAC](http://en.wikipedia.org/wiki/Media_Access_Control) layer). The [Wi-Fi Alliance](http://en.wikipedia.org/wiki/Wi-Fi_Alliance) announced an interim specification called [Wi-Fi Protected Access](http://en.wikipedia.org/wiki/Wi-Fi_Protected_Access) ([WPA](http://en.wikipedia.org/wiki/Wi-Fi_Protected_Access)) based on a subset of the then current IEEE 802.11i draft. These started to appear in products in mid-2003. [IEEE 802.11i](http://en.wikipedia.org/wiki/IEEE_802.11i) (also known as [WPA2](http://en.wikipedia.org/wiki/WPA2)) itself was ratified in June 2004, and uses government strength encryption in the [Advanced Encryption Standard](http://en.wikipedia.org/wiki/Advanced_Encryption_Standard) AES, instead of [RC4](http://en.wikipedia.org/wiki/RC4), which was used in WEP. The modern recommended encryption for the home/consumer space is WPA2 (AES Pre-Shared Key) and for the Enterprise space is WPA2 along with a [RADIUS](http://en.wikipedia.org/wiki/RADIUS) authentication server (or another type of authentication server) and a strong authentication method such as EAP-TLS.

In January 2005, [IEEE](http://en.wikipedia.org/wiki/IEEE) set up yet another task group, TGw, to protect management and broadcast frames, which previously were sent unsecured.

**3.3 CELLULAR NETWORK:-**

A cellular network is a [radio](http://en.wikipedia.org/wiki/Radio) network distributed over land areas called cells, each served by at least one fixed-location [transceiver](http://en.wikipedia.org/wiki/Transceiver) known as a [cell site](http://en.wikipedia.org/wiki/Cell_site) or [base station](http://en.wikipedia.org/wiki/Base_station). When joined together these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., [mobile phones](http://en.wikipedia.org/wiki/Mobile_phone), [pagers](http://en.wikipedia.org/wiki/Pager), etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Cellular networks offer a number of advantages over alternative solutions:

increased capacity reduced power use larger coverage area

reduced interference from other signals

An example of a simple non-telephone cellular system is an old [taxi](http://en.wikipedia.org/wiki/Taxicab) driver's radio system where the taxi company has several transmitters based around a city that can communicate directly with each taxi.

In a [cellular radio](http://en.wikipedia.org/wiki/Cellular_radio) system, a land area to be supplied with radio service is divided into regular shaped cells, which can be hexagonal, square, circular or some other irregular shapes, although hexagonal cells are conventional. Each of these cells is assigned multiple frequencies (f1 - f6) which have corresponding [radio base stations](http://en.wikipedia.org/wiki/Radio_base_station). The group of frequencies can be reused in other cells, provided that the same frequencies are not reused in adjacent neighboring cells as that would cause [co-channel interference](http://en.wikipedia.org/wiki/Co-channel_interference).

The increased [capacity](http://en.wikipedia.org/wiki/Channel_capacity) in a cellular network, compared with a network with a single transmitter, comes from the fact that the same radio frequency can be reused in a different area for a completely different transmission. If there is a single plain transmitter, only one transmission can be used on any given frequency. Unfortunately, there is inevitably some level of [interference](http://en.wikipedia.org/wiki/Co-channel_interference) from the signal from the other cells which use the same frequency. This means that, in a standard FDMA system, there must be at least a one cell gap between cells which reuse the same frequency.

In the simple case of the taxi company, each radio had a manually operated channel selector knob to tune to different frequencies. As the drivers moved around, they would change from channel to channel. The drivers know which [frequency](http://en.wikipedia.org/wiki/Frequency) covers approximately what area. When they do not receive a signal from the transmitter, they will try other channels until they find one that works. The taxi drivers only speak one at a time, when invited by the base station operator (in a sense [TDMA](http://en.wikipedia.org/wiki/Time_division_multiple_access)).

To distinguish signals from several different transmitters, [frequency division multiple access](http://en.wikipedia.org/wiki/Frequency_division_multiple_access)

(FDMA) and [code division multiple access](http://en.wikipedia.org/wiki/Code_division_multiple_access) (CDMA) were developed.

With FDMA, the transmitting and receiving frequencies used in each cell are different from the frequencies used in each neighbouring cell. In a simple taxi system, the taxi driver manually tuned to a frequency of a chosen cell to obtain a strong signal and to avoid interference from signals from other cells.

The principle of CDMA is more complex, but achieves the same result; the distributed [transceivers](http://en.wikipedia.org/wiki/Transceiver) can select one cell and listen to it.

Other available methods of multiplexing such as [polarization division multiple access](http://en.wikipedia.org/wiki/Polarization_division_multiple_access) (PDMA) and [time division multiple access](http://en.wikipedia.org/wiki/Time_division_multiple_access) (TDMA) cannot be used to separate signals from one cell to the next since the effects of both vary with position and this would make signal separation practically impossible. [Time division multiple access](http://en.wikipedia.org/wiki/Time_division_multiple_access), however, is used in combination with either FDMA or CDMA in a number of systems to give multiple channels within the coverage area of a single cell.

The key characteristic of a cellular network is the ability to re-use frequencies to increase both coverage and capacity. As described above, adjacent cells must utilize different frequencies, however there is no problem with two cells sufficiently far apart operating on the

same frequency. The elements that determine frequency reuse are the reuse distance and the reuse factor.

The reuse distance, D is calculated as



where R is the cell radius and N is the number of cells per cluster. Cells may vary in radius in the ranges (1 km to 30 km). The boundaries of the cells can also overlap between adjacent cells and large cells can be divided into smaller cells.

The frequency reuse factor is the rate at which the same frequency can be used in the network. It is 1/K (or K according to some books) where K is the number of cells which cannot use the same frequencies for transmission. Common values for the frequency reuse factor are 1/3, 1/4, 1/7, 1/9 and 1/12 (or 3, 4, 7, 9 and 12 depending on notation).

In case of N sector antennas on the same base station site, each with different direction, the base station site can serve N different sectors. N is typically 3. A reuse pattern of N/K denotes a further division in frequency among N sector antennas per site. Some current and historical reuse patterns are 3/7 (North American AMPS), 6/4 (Motorola NAMPS), and 3/4 (GSM).

If the total available [bandwidth](http://en.wikipedia.org/wiki/Bandwidth_(signal_processing)) is B, each cell can only utilize a number of frequency channels corresponding to a bandwidth of B/K, and each sector can use a bandwidth of B/NK.

[Code division multiple access](http://en.wikipedia.org/wiki/Code_division_multiple_access)-based systems use a wider frequency band to achieve the same rate of transmission as FDMA, but this is compensated for by the ability to use a frequency reuse factor of 1, for example using a reuse pattern of 1/1. In other words, adjacent base station sites use the same frequencies, and the different base stations and users are separated by codes rather than frequencies. While N is shown as 1 in this example, that does not mean the CDMA cell has only one sector, but rather that the entire cell bandwidth is also available to each sector individually.

Depending on the size of the city, a taxi system may not have any frequency-reuse in its own city, but certainly in other nearby cities, the same frequency can be used. In a big city, on the other hand, frequency-reuse could certainly be in use.

Recently also [orthogonal frequency-division multiple access](http://en.wikipedia.org/wiki/Orthogonal_frequency-division_multiple_access) based systems such as [LTE](http://en.wikipedia.org/wiki/3GPP_Long_Term_Evolution) are being deployed with a frequency reuse of 1. Since such systems do not spread the signal across the frequency band, inter-cell radio resource management is important to coordinates resource allocation between different cell sites and to limit the inter-cell interference. There are various means of Inter-cell Interference Coordination (ICIC) already defined in the standard. Coordinated scheduling, multi-site MIMO or multi-site beam forming are other examples for inter-cell radio resource management that might be standardized in the future.

Although the original 2-way-radio cell towers were at the centers of the cells and were omni- directional, a cellular map can be redrawn with the cellular telephone towers located at the corners of the hexagons where three cells converge.[3] Each tower has three sets of directional antennas aimed in three different directions with 120 degrees for each cell (totaling 360 degrees) and receiving/transmitting into three different cells at different frequencies. This provides a minimum of three channels (from three towers) for each cell. The numbers in the illustration are channel numbers, which repeat every 3 cells. Large cells can be subdivided into smaller cells for high volume areas.

A simple view of the cellular mobile-radio network consists of the following: A network of [Radio base stations](http://en.wikipedia.org/wiki/Radio_base_station) forming the [Base station subsystem](http://en.wikipedia.org/wiki/Base_station_subsystem). The [core circuit switched network](http://en.wikipedia.org/wiki/Network_switching_subsystem) for handling voice calls and text

A [packet switched network](http://en.wikipedia.org/wiki/GPRS) for handling mobile data

The [Public switched telephone network](http://en.wikipedia.org/wiki/Public_switched_telephone_network) to connect subscribers to the wider telephony network

This network is the foundation of the [GSM](http://en.wikipedia.org/wiki/GSM) system network. There are many functions that are performed by this network in order to make sure customers get the desired service including mobility management, registration, call set up, and [handover](http://en.wikipedia.org/wiki/Handoff).

Any phone connects to the network via an RBS in the corresponding cell which in turn connects to the MSC. The MSC allows the onward connection to the PSTN. The link from a phone to the RBS is called an uplink while the other way is termed downlink.

Radio channels effectively use the transmission medium through the use of the following multiplexing schemes: [frequency division multiplex](http://en.wikipedia.org/wiki/Frequency_division_multiplex) (FDM), [time division multiplex](http://en.wikipedia.org/wiki/Time_division_multiplex) (TDM), [code division multiplex](http://en.wikipedia.org/wiki/Code_division_multiplex) (CDM), and [space division multiplex](http://en.wikipedia.org/w/index.php?title=Space_division_multiplex&amp;action=edit&amp;redlink=1) (SDM). Corresponding to these multiplexing schemes are the following access techniques: [frequency division multiple access](http://en.wikipedia.org/wiki/Frequency_division_multiple_access) (FDMA), [time division multiple access](http://en.wikipedia.org/wiki/Time_division_multiple_access) (TDMA), [code division multiple access](http://en.wikipedia.org/wiki/Code_division_multiple_access) (CDMA), and [space division multiple access](http://en.wikipedia.org/wiki/Space_division_multiple_access) (SDMA).

**4. VIRTUAL KEYBOARD**

The Virtual Laser Keyboard (VKB) is the ULTIMATE new gadget for PC users. The VKB emits laser on to the desk where it looks like the keyboard having QWERTY arrangement of keys i.e., it uses a laser beam to generate a full-size perfectly operating laser keyboard that smoothly connects to of PC and most of the handheld devices. As we type on the laser

projection, it analyses what we are typing according to the co-ordinates of the location.



Fig: diagram of virtual keyboard

A virtual keyboard is a software component that allows a user to enter characters. A virtual keyboard can usually be operated with multiple input devices, which may include a [touchscreen](http://en.wikipedia.org/wiki/Touchscreen), an actual [keyboard](http://en.wikipedia.org/wiki/Computer_keyboard), a [computer mouse](http://en.wikipedia.org/wiki/Computer_mouse), a [headmouse](http://en.wiktionary.org/wiki/headmouse) and an [eyemouse](http://en.wiktionary.org/wiki/eyemouse).

**4.1 TYPES:-**

On a desktop PC, one purpose of a virtual keyboard is to provide an alternative input mechanism for users with disabilities who cannot use a physical keyboard. Another major use for an on-screen keyboard is for bi- or multi-lingual users who switch frequently between different character sets or alphabets. Although hardware keyboards are available with dual [keyboard layouts](http://en.wikipedia.org/wiki/Keyboard_layout) (for example Cyrillic/Latin letters in various national layouts), the on- screen keyboard provides a handy substitute while working at different stations or on laptops, which seldom come with dual layouts.

The standard on-screen keyboard utility on most [windowing systems](http://en.wikipedia.org/wiki/Windowing_system) allows [hot key](http://en.wikipedia.org/wiki/Hot_key) switching between layouts from the physical keyboard (typically alt-shift but this is user configurable), simultaneously changing both the hardware and the software keyboard layout. In addition, a symbol in the systray alerts the user to the currently active layout.

Although [Linux](http://en.wikipedia.org/wiki/Linux) supports this fast manual keyboard-layout switching function, many popular Linux on-screen keyboards such as gtkeyboard, Matchbox-keyboard or Kvkbd do not react correctly. Kvkbd for example defines its visible layout according to the first defined layout in Keyboard Preferences rather than the default layout, causing the application to output incorrect characters if the first layout on the list is not the default. Activating a hot-key layout switch will cause the application to change its output according to another keyboard layout, but the visible on-screen layout doesn't change, leaving the user blind as to which keyboard layout he is using. Multi-lingual, multi-alphabet users should choose a linux on-screen keyboard that support this feature instead, like Florence.

Virtual keyboards are commonly used as an on-screen input method in devices with no physical keyboard, where there is no room for one, such as a [pocket computer](http://en.wikipedia.org/wiki/Pocket_computer), [personal digital assistant](http://en.wikipedia.org/wiki/Personal_digital_assistant) (PDA), [tablet computer](http://en.wikipedia.org/wiki/Tablet_computer) or [touch screen](http://en.wikipedia.org/wiki/Touchscreen) equipped [mobile phone](http://en.wikipedia.org/wiki/Mobile_phone). It is common for the user to input text by tapping a virtual keyboard built into the [operating system](http://en.wikipedia.org/wiki/Operating_system) of the device. Virtual keyboards are also used as features of [emulation software](http://en.wikipedia.org/wiki/Virtual_machine) for systems that have fewer buttons than a computer keyboard would have.

Virtual keyboards can be categorized by the following aspects:

Physical keyboards with distinct keys comprising electronically changeable displays integrated in the keypads .

Virtual keyboards with touch screen keyboard layouts or sensing areas.

[optically projected keyboard](http://en.wikipedia.org/wiki/Projection_keyboard) layouts or similar arrangements of "keys" or sensing areas.

Optically detected human hand and finger motions.

Virtual keyboards to allow input from a variety of input devices, such as a [computer mouse](http://en.wikipedia.org/wiki/Mouse_(computing)), [switch](http://en.wikipedia.org/wiki/Switch_access) or other [assistive technology](http://en.wikipedia.org/wiki/Assistive_technology) device.

An [optical](http://en.wikipedia.org/wiki/Optical) virtual keyboard has been invented and patented by [IBM](http://en.wikipedia.org/wiki/IBM) engineers in 2008.[4] It optically detects and analyses human hand and finger motions and interprets them as operations on a physically non-existent input device like a surface having painted keys. In that way it allows to emulate unlimited types of manually operated input devices such as a mouse or keyboard. All mechanical input units can be replaced by such virtual devices, optimized for the current application and for the user's physiology maintaining speed, simplicity and unambiguity of manual data input.

On the Internet, various JavaScript virtual keyboards have been created, allowing users to type their own languages on foreign keyboards, particularly in Internet cafes.

**4.2 SECURITY CONSIDERATIONS:-**

Virtual keyboards may be used in some cases to reduce the risk of [keystroke logging](http://en.wikipedia.org/wiki/Keystroke_logging). For example, [Westpac](http://en.wikipedia.org/wiki/Westpac)’s [online banking service](https://olb.westpac.com.au/esis/Login/SrvPage) uses a virtual keyboard for the password entry, as does [TreasuryDirect](http://en.wikipedia.org/wiki/TreasuryDirect) (see picture). It is more difficult for malware to monitor the display and mouse to obtain the data entered via the virtual keyboard, than it is to monitor real keystrokes. However it is possible, for example by recording [screenshots](http://en.wikipedia.org/wiki/Screenshots) at regular intervals or upon each mouse click.

The use of an on-screen keyboard on which the user "types" with mouse clicks can increase the risk of password disclosure by [shoulder surfing](http://en.wikipedia.org/wiki/Shoulder_surfing_(computer_security)), because:

An observer can typically watch the screen more easily (and less suspiciously) than the keyboard, and see which characters the mouse moves to.

Some implementations of the on-screen keyboard may give visual feedback of the "key" clicked, e.g. by changing its colour briefly. This makes it much easier for an observer to read the data from the screen.

A user may not be able to "point and click" as fast as they could type on a keyboard, thus making it easier for the observer.

**5. DIGITAL CAMERA**

The digital camera is in the shape of pen .It is useful in video recording, video conferencing, simply it is called as web cam. It is also connected with other devices through Blue tooth. It is a 360 degrees visual communication device. This terminal will enable us to know about the surrounding atmosphere and group to group communication with a round display and a central super wide angle camera.



Fig: diagram of digital camera

A digital camera (or digicam) is a [camera](http://en.wikipedia.org/wiki/Camera) that takes [video](http://en.wikipedia.org/wiki/Video) or still [photographs](http://en.wikipedia.org/wiki/Photograph), or both, [digitally](http://en.wikipedia.org/wiki/Digital) by recording [images](http://en.wikipedia.org/wiki/Digital_image) via an [electronic](http://en.wikipedia.org/wiki/Electronics) [image sensor](http://en.wikipedia.org/wiki/Image_sensor). Most 21st century cameras are digital.

Front and back of [Canon PowerShot A](http://en.wikipedia.org/wiki/Canon_PowerShot_A)95

Digital cameras can do things film cameras cannot: displaying images on a screen immediately after they are recorded, storing thousands of images on a single small memory device, and deleting images to free storage space. The majority, including most compact cameras, can record moving [video](http://en.wikipedia.org/wiki/Video) with [sound](http://en.wikipedia.org/wiki/Sound_recording_and_reproduction) as well as still [photographs](http://en.wikipedia.org/wiki/Photograph). Some can [crop](http://en.wikipedia.org/wiki/Cropping_(image)) and [stitch](http://en.wikipedia.org/wiki/Image_stitching) pictures and perform other elementary [image editing](http://en.wikipedia.org/wiki/Image_editing). Some have a [GPS](http://en.wikipedia.org/wiki/GPS) receiver built in, and can produce [Geotagged photographs](http://en.wikipedia.org/wiki/Geotagged_photograph).

The optical system works the same as in [film cameras](http://en.wikipedia.org/wiki/Film_camera), typically using a lens with a variable [diaphragm](http://en.wikipedia.org/wiki/Diaphragm_(optics)) to focus light onto an image pickup device. The diaphragm and shutter admit the correct amount of light to the imager, just as with film but the image pickup device is electronic rather than chemical. Most digicams, apart from camera phones and a few specialized types, have a standard tripod screw.

Digital cameras are incorporated into many devices ranging from [PDAs](http://en.wikipedia.org/wiki/Personal_digital_assistant) and [mobile phones](http://en.wikipedia.org/wiki/Mobile_phone) (called [camera phones](http://en.wikipedia.org/wiki/Camera_phone)) to vehicles. The [Hubble Space Telescope](http://en.wikipedia.org/wiki/Hubble_Space_Telescope) and other [astronomical](http://en.wikipedia.org/wiki/Astronomy) devices are essentially specialized digital cameras.

**5.1TYPES OF DIGITAL CAMERA:-**

Digital cameras are made in a wide range of sizes, prices and capabilities. The majority are [camera phones](http://en.wikipedia.org/wiki/Camera_phone), operated as a [mobile application](http://en.wikipedia.org/wiki/Mobile_application) through the cellphone menu. Professional [photographers](http://en.wikipedia.org/wiki/Photographer) and many amateurs use larger, more expensive [digital single-lens reflex](http://en.wikipedia.org/wiki/Digital_single-lens_reflex_camera) [cameras](http://en.wikipedia.org/wiki/Digital_single-lens_reflex_camera) (DSLR) for their greater versatility. Between these extremes lie digital [compact cameras](http://en.wikipedia.org/wiki/Compact_camera) and [bridge digital cameras](http://en.wikipedia.org/wiki/Bridge_digital_camera) that "bridge" the gap between amateur and professional cameras. Specialized cameras including [multispectral imaging](http://en.wikipedia.org/wiki/Multispectral_imaging) equipment and [astrographs](http://en.wikipedia.org/wiki/Astrograph) continue to serve the scientific, military, medical and other special purposes for which [digital photography](http://en.wikipedia.org/wiki/Digital_photography) was invented.

**5.2COMPACTS DIGITAL CAMERA:-**

Compact cameras are designed to be tiny and portable and are particularly suitable for casual and "[snapshot](http://en.wikipedia.org/wiki/Snapshot)" use, thus are also called [point-and-shoot cameras](http://en.wikipedia.org/wiki/Point-and-shoot_camera). The smallest, generally less than 20 mm thick, are described as [subcompacts](http://en.wikipedia.org/wiki/Subminiature_photography) or "ultra-compacts" and some are nearly credit card size.

Most, apart from ruggedized or water-resistant models, incorporate a retractable lens assembly allowing a thin camera to have a moderately long [focal length](http://en.wikipedia.org/wiki/Focal_length) and thus fully exploit an image sensor larger than that on a camera phone, and a mechanized [lens cap](http://en.wikipedia.org/wiki/Lens_cap) to cover the lens when retracted. The retracted and capped lens is protected from keys, coins and other hard objects, thus making a thin, pocket able package. Subcompacts commonly have one lug and a short [wrist strap](http://en.wikipedia.org/wiki/Wrist_strap) which aids extraction from a pocket, while thicker compacts may have two lugs for attaching a neck strap.

Compact cameras are usually designed to be [easy to use](http://en.wikipedia.org/wiki/Usability), sacrificing advanced features and picture quality for compactness and simplicity; images can usually only be stored using [lossy compression](http://en.wikipedia.org/wiki/Lossy_compression) ([JPEG](http://en.wikipedia.org/wiki/JPEG)). Most have a built-in [flash](http://en.wikipedia.org/wiki/Flash_(photography)) usually of low power, sufficient for nearby subjects. [Live preview](http://en.wikipedia.org/wiki/Live_preview) is almost always used to frame the photo. Most have limited [motion picture](http://en.wikipedia.org/wiki/Motion_picture) capability. Compacts often have [macro](http://en.wikipedia.org/wiki/Macro_photography) capability and [zoom lenses](http://en.wikipedia.org/wiki/Zoom_lens) but the zoom range is usually less than for [bridge](http://en.wikipedia.org/wiki/Bridge_digital_camera) and [DSLR](http://en.wikipedia.org/wiki/Digital_single-lens_reflex_camera) cameras. Generally a contrast-detect [autofocus](http://en.wikipedia.org/wiki/Autofocus) system, using the image data from the live preview feed of the main imager, focuses the lens.

Typically, these cameras incorporate a nearly-silent [leaf shutter](http://en.wikipedia.org/wiki/Leaf_shutter) into their lenses.

For lower cost and smaller size, these cameras typically use [image sensors](http://en.wikipedia.org/wiki/Image_sensor) with a diagonal of approximately 6 mm, corresponding to a [crop factor](http://en.wikipedia.org/wiki/Crop_factor) around 6. This gives them weaker low- light performance, greater [depth of field](http://en.wikipedia.org/wiki/Depth_of_field), generally closer focusing ability, and smaller components than cameras using larger sensors.

**5.3 BRIDGE CAMERA**:-

Bridge are higher-end digital cameras that physically and [ergonomically](http://en.wikipedia.org/wiki/Ergonomic) resemble [DSLRs](http://en.wikipedia.org/wiki/DSLR) and share with them some advanced features, but share with compacts the use of a fixed lens and a small sensor. Like compacts, most use [live preview](http://en.wikipedia.org/wiki/Live_preview) to frame the image. Their [autofocus](http://en.wikipedia.org/wiki/Autofocus) uses the same contrast-detect mechanism, but many bridge cameras have a [manual focus](http://en.wikipedia.org/wiki/Manual_focus) mode, in some cases using a separate focus ring, for greater control.

Due to the combination of big physical size but a small sensor, many of these cameras have very highly specified lenses with large zoom range and fast [aperture](http://en.wikipedia.org/wiki/Aperture), partially compensating for the inability to change lenses. To compensate for the lesser sensitivity of their small sensors, these cameras almost always include an [image stabilization](http://en.wikipedia.org/wiki/Image_stabilization) system to enable longer handheld exposures. The highest zoom lens so far on a bridge camera is on the Nikon Coolpix P500 digital camera, which encompasses an [equivalent of](http://en.wikipedia.org/wiki/35_mm_equivalent_focal_length) a super wide to ultra-telephoto

22.5-810 mm (36x).

These cameras are sometimes marketed as and confused with digital SLR cameras since the appearance is similar. Bridge cameras lack the reflex viewing system of DSLRs, are usually fitted with fixed (non-interchangeable) lenses (although some have a lens thread to attach accessory wide-angle or [telephoto converters](http://en.wikipedia.org/wiki/Teleconverter)), and can usually take movies with sound. The scene is composed by viewing either the liquid crystal display or the [electronic viewfinder](http://en.wikipedia.org/wiki/Electronic_viewfinder) (EVF). Most have a longer [shutter lag](http://en.wikipedia.org/wiki/Shutter_lag) than a true dSLR, but they are capable of good image quality (with sufficient light) while being more compact and lighter than DSLRs. High-end models of this type have comparable resolutions to low and mid-range DSLRs. Many of these cameras can store images in a [Raw image format](http://en.wikipedia.org/wiki/Raw_image_format), or processed and [JPEG](http://en.wikipedia.org/wiki/JPEG) compressed, or both. The majority have a built-in flash similar to those found in DSLRs.

In bright sun, the quality difference between a good compact camera minimal but bridge cams are more portable, cost less and have similar zoom ability to DSLR. Thus a [Bridge camera](http://en.wikipedia.org/wiki/Bridge_camera) may better suit outdoor daytime activities, except when seeking professional-quality photos.

In low light conditions and/or at [ISO equivalents](http://en.wikipedia.org/wiki/Film_speed) above 800, most bridge cameras (or mega

and a digital SLR is zooms) lack in image quality when compared to

even entry level DSLRs.

The first New 3D Photo Mode of [Bridge camera](http://en.wikipedia.org/wiki/Bridge_camera) has announced by Olympus. Olympus SZ-

30MR can take 3D photo in any mode from macro to landscape by release the shutter for the first shot, slowly pan until camera automatically takes a second image from a slightly different perspective. Due to 3D processing is in-built in camera, so an .MPO file will easily display on

3D televisions or laptops.

**5.4 MIRRORLESS INTERCHANGABLE LENS CAMERA:-**

In late 2008 a new type of camera emerged, combining the larger sensors and interchangeable lenses of DSLRs with the [live preview](http://en.wikipedia.org/wiki/Live_preview) viewing system of compact cameras, either through an [electronic viewfinder](http://en.wikipedia.org/wiki/Electronic_viewfinder) or on the rear LCD. These are simpler and more compact than DSLRs due to the removal of the mirror box, and typically emulate the handling and ergonomics of either DSLRs or compacts. The system is use by [Micro Four Thirds](http://en.wikipedia.org/wiki/Micro_Four_Thirds), borrowing components from the [Four Thirds](http://en.wikipedia.org/wiki/Four_Thirds) DSLR systems. The [Ricoh GXR](http://en.wikipedia.org/wiki/Ricoh_GXR) of 2009 puts the sensor and other electronic components in the interchangeable sensor lens unit rather than in the camera body.

The first interchangeable 3D lens Lumix G 12.5mm/F12 (H-FT012) has been announced by

Panasonic. It use two lenses quite close together in one lens module adaptor and record both

3D and 2D pictures altogether. The lens module is compatible with Panasonic Lumix DMC- GH2.

**5.5 IMAGE RESOLUTION:-**

The [resolution](http://en.wikipedia.org/wiki/Image_resolution) of a digital camera is often limited by the [image sensor](http://en.wikipedia.org/wiki/Image_sensor) (typically a [CCD](http://en.wikipedia.org/wiki/Charge-coupled_device) or [CMOS sensor](http://en.wikipedia.org/wiki/CMOS_sensor) chip) that turns light into discrete signals, replacing the job of film in traditional photography. The sensor is made up of millions of "buckets" that essentially count the number of [photons](http://en.wikipedia.org/wiki/Photon) that strike the sensor. This means that the brighter the image at a given point on the sensor, the larger the value that is read for that [pixel](http://en.wikipedia.org/wiki/Pixel). Depending on the physical structure of the sensor, a [colour filter array](http://en.wikipedia.org/wiki/Color_filter_array) may be used which requires a [demosaicing](http://en.wikipedia.org/wiki/Demosaicing)/interpolation algorithm. The number of resulting pixels in the image determines its "pixel count".

The pixel count alone is commonly presumed to indicate the resolution of a camera, but this simple [figure of merit](http://en.wikipedia.org/wiki/Figure_of_merit) is a misconception. Other factors impact a sensor's resolution, including sensor size, lens quality, and the organization of the pixels (for example, a monochrome camera without a [Bayer filter](http://en.wikipedia.org/wiki/Bayer_filter) mosaic has a higher resolution than a typical color camera). Many digital compact cameras are criticized for having excessive pixels. Sensors can be so small that their 'buckets' can easily overfill; again, resolution of a sensor can become greater than the camera lens could possibly deliver.

As the technology has improved, costs have decreased dramatically. Counting the "pixels per dollar" as a basic measure of value for a digital camera, there has been a continuous and steady increase in the number of pixels each dollar buys in a new camera, in accord with the principles of [Moore's Law](http://en.wikipedia.org/wiki/Moore%27s_Law). This predictability of camera prices was first presented in 1998 at the Australian [PMA](http://en.wikipedia.org/wiki/Photo_Marketing_Association) DIMA conference by Barry Hendy and since referred to as "Hendy's Law".

Since only a few [aspect ratios](http://en.wikipedia.org/wiki/Aspect_ratio_(image)) are commonly used (mainly 4:3 and 3:2), the number of sensor sizes that are useful is limited. Furthermore, sensor manufacturers do not produce every possible sensor size, but take incremental steps in sizes. For example, in 2007 the three largest sensors (in terms of pixel count) used by [Canon](http://en.wikipedia.org/wiki/Canon_(company)) were the 21.1, 17.9, and 16.6 megapixel CMOS sensors.

Since the first digital backs were introduced, there have been three main methods of capturing the image, each based on the hardware configuration of the sensor and color filters.

The first method is often called single-shot, in reference to the number of times the camera's sensor is exposed to the light passing through the camera lens. Single-shot capture systems use either one CCD with a [Bayer filter](http://en.wikipedia.org/wiki/Bayer_filter) mosaic, or three separate [image sensors](http://en.wikipedia.org/wiki/Image_sensor) (one each for the [primary additive colours](http://en.wikipedia.org/wiki/Primary_additive_colors) red, green, and blue) which are exposed to the same image via a beam splitter.

The second method is referred to as multi-shot because the sensor is exposed to the image in a sequence of three or more openings of the lens aperture. There are several methods of application of the multi-shot technique. The most common originally was to use a single [image sensor](http://en.wikipedia.org/wiki/Image_sensor) with three filters (once again red, green and blue) passed in front of the sensor in sequence to obtain the additive colour information. Another multiple shot method is called [Micro scanning](http://en.wikipedia.org/wiki/Microscanning). This technique utilizes a single CCD with a Bayer filter but actually moved the physical location of the sensor chip on the focus plane of the lens to "stitch" together a higher resolution image than the CCD would allow otherwise. A third version combined the two methods without a Bayer filter on the chip.

The third method is called scanning because the sensor moves across the focal plane much like the sensor of a desktop scanner. Their linear or tri-linear sensors utilize only a single line of photo sensors, or three lines for the three colours. In some cases, scanning is accomplished by moving the sensor e.g. when using [Colour co-site sampling](http://en.wikipedia.org/wiki/Color_co-site_sampling) or rotate the whole camera; a digital [rotating line camera](http://en.wikipedia.org/wiki/Rotating_line_camera) offers images of very high total resolution.

The choice of method for a given capture is determined largely by the subject matter. It is usually inappropriate to attempt to capture a subject that moves with anything but a single- shot system. However, the higher color fidelity and larger file sizes and resolutions available with multi-shot and scanning backs make them attractive for commercial photographers working with stationary subjects and large-format photographs.

Dramatic improvements in single-shot cameras and [raw image file](http://en.wikipedia.org/wiki/Raw_image_format) processing at the beginning of the 21st century made single shot, CCD-based cameras almost completely dominant, even in high-end commercial photography. CMOS-based single shot cameras remained somewhat

common.

**6. LED PROJECTOR**

The role of monitor is taken by LED Projector which projects on the screen. The size of the projector is of A4 size. It has the approximate resolution capacity of 1024 X 768. Thus it is gives more clarity and good picture.



Fig: diagram of led projector

A video projector is a device that receives a [vide](http://en.wikipedia.org/wiki/Video)[o signal](http://en.wikipedia.org/wiki/Signalling_(telecommunication)) and projects the corresponding image on a [projection screen](http://en.wikipedia.org/wiki/Projection_screen) using a [lens](http://en.wikipedia.org/wiki/Lens_(optics)) system. All video projectors use a very bright light to project the image, and most modern ones can correct any curves, blurriness, and other inconsistencies through manual settings. Video projectors are widely used for conference room presentations, classroom training, [home theatre](http://en.wikipedia.org/wiki/Home_cinema) and [live events](http://en.wikipedia.org/wiki/Video_design) applications. Projectors

are widely used in many schools and other educational settings, connected to an [interactive whiteboard](http://en.wikipedia.org/wiki/Interactive_whiteboard) to interactively teach pupils.

**6.1 OVERVIEW:**

A video projector, also known as a digital projector, may be built into a cabinet with a rear- projection screen ([rear-projection television](http://en.wikipedia.org/wiki/Rear-projection_television), or RPTV) to form a single unified display device, now popular for “home theatre” applications.

Common [display resolutions](http://en.wikipedia.org/wiki/Display_resolution) for a portable projector include [SVGA](http://en.wikipedia.org/wiki/SVGA) (800×600 [pixels](http://en.wikipedia.org/wiki/Pixel)), [XGA](http://en.wikipedia.org/wiki/XGA) (1024×768 pixels), [720p](http://en.wikipedia.org/wiki/720p) (1280×720 pixels), and [1080p](http://en.wikipedia.org/wiki/1080p) (1920×1080 pixels).

The cost of a device is not only determined by its resolution, but also by its brightness. A projector with a higher [light output](http://en.wikipedia.org/wiki/Luminous_flux) (measured in [lumens](http://en.wikipedia.org/wiki/Lumen_(unit)), symbol “lm”) is required for a larger screen or a room with a high amount of ambient light.[2] A rating of 1500 to 2500 [ANSI](http://en.wikipedia.org/wiki/American_National_Standards_Institute) lumens or lower is suitable for smaller screens with controlled lighting or low ambient light. Between 2500 and 4000 lm is suitable for medium-sized screens with some ambient light or dimmed light. Over 4000 lm is appropriate for very large screens in a large room with no lighting control (for example, a conference room). Projected image size is important; because the total amount of light does not change, as size increases, brightness decreases. Image sizes are typically measured in linear terms, diagonally, obscuring the fact that larger images require much more light (proportional to the image area, not just the length of a side). Increasing the diagonal measure of the image by 25% reduces the image brightness by more than one-third (35%); an increase of 41% reduces brightness by half.

**6.2 PROJECTION TECHNOLOGIES:**

[CRT projector](http://en.wikipedia.org/wiki/CRT_projector) using [cathode ray tubes](http://en.wikipedia.org/wiki/Cathode_ray_tube). This typically involves a blue, a green, and a red tube. This is the oldest system still in regular use, but falling out of favor largely because of the bulky cabinet. However, it does provide the largest screen size for a given cost. This also covers three tube home models, which, while bulky, can be moved (but then usually require complex picture adjustments to get the three images to line up correctly).

[LCD projector](http://en.wikipedia.org/wiki/LCD_projector) using [LCD](http://en.wikipedia.org/wiki/LCD) light gates. This is the simplest system, making it one of the most common and affordable for home theaters and business use. Its most common problem is a visible [“screen door” or pixelation effect](http://en.wikipedia.org/wiki/Screen-door_effect), although recent advances have minimized this.

The most common problem with the single- or two-DMD varieties is a visible “rainbow” which some people perceive when moving their eyes. More recent projectors with higher speed (2x or 4x) and otherwise optimised color wheels have lessened this artifact. Systems with 3 DMDs never have this problem, as they display each [primary color](http://en.wikipedia.org/wiki/Primary_color) simultaneously.

[LCoS projector](http://en.wikipedia.org/wiki/Liquid_crystal_on_silicon) using [Liquid crystal on silicon](http://en.wikipedia.org/wiki/Liquid_crystal_on_silicon).

○ [D-ILA](http://en.wikipedia.org/wiki/D-ILA) JVC’s Direct-drive Image Light Amplifier based on LCoS technology.

○ [SXRD](http://en.wikipedia.org/wiki/SXRD) Sony’s proprietary variant of LCoS technology.

[LED](http://en.wikipedia.org/wiki/LED) projectors use one of the above mentioned technologies for image creation, with a difference that they use an array of Light Emitting Diodes as the light source, negating the need for lamp replacement.

Hybrid [LED](http://en.wikipedia.org/wiki/LED) and [Laser diode](http://en.wikipedia.org/wiki/Laser_diode) system developed by [Casio](http://en.wikipedia.org/wiki/Casio). Uses a combination of Light Emitting Diodes and 445nm [laser diodes](http://en.wikipedia.org/wiki/Laser_diode) as the light source, while image is processed with DLP (DMD) chip.

[Laser diode](http://en.wikipedia.org/wiki/Laser_diode) projectors have been developed by Microvision and Aaxa Technologies. Microvision laser projectors use Microvision's patented laser beam-steering technology, whereas Aaxa Technologies uses laser diodes + LCoS.

**6.3 TYPES OF LED DISPLAY:**

There are two types of LED panels: conventional (using discrete LEDs) and [surface-mounted device](http://en.wikipedia.org/wiki/Surface-mount_technology) (SMD) panels. Most outdoor screens and some indoor screens are built around discrete LEDs, also known as individually mounted LEDs. A cluster of red, green, and blue diodes is driven together to form a full-color [pixel](http://en.wikipedia.org/wiki/Pixel), usually square in shape. These pixels are spaced evenly apart and are measured from center to center for absolute pixel resolution. The largest LED display in the world is over 1,500 ft (457.2 m) long and is located in [Las Vegas](http://en.wikipedia.org/wiki/Las_Vegas%2C_Nevada), [Nevada](http://en.wikipedia.org/wiki/Nevada) covering the [Fremont Street Experience](http://en.wikipedia.org/wiki/Fremont_Street_Experience). The largest LED television in the world is the Center Hung Video Display at Cowboys Stadium, which is 160 × 72 ft (49 × 22 m), 11,520 square feet (1,070 m2).

Most indoor screens on the market are built using SMD technology—a trend that is now extending to the outdoor market. An SMD pixel consists of red, green, and blue diodes mounted in a single package, which is then mounted on the driver PC board. The individual

diodes are smaller than a pinhead and are set very close together. The difference is that the

maximum viewing distance is reduced by 25% from the discrete diode screen with the same

resolution.

Indoor use generally requires a screen that is based on SMD technology and has a minimum [brightness](http://en.wikipedia.org/wiki/Brightness) of 600 [candelas](http://en.wikipedia.org/wiki/Candela) per square meter (cd/m², sometimes informally called [nits](http://en.wikipedia.org/wiki/Nit_(unit))). This will usually be more than sufficient for corporate and retail applications, but under high ambient-brightness conditions, higher brightness may be required for visibility. Fashion and auto shows are two examples of high-brightness stage lighting that may require higher LED brightness. Conversely, when a screen may appear in a shot on a [television studio](http://en.wikipedia.org/wiki/Television_studio) set, the requirement will often be for lower brightness levels with lower [color temperatures](http://en.wikipedia.org/wiki/Color_temperature); common displays have a [white point](http://en.wikipedia.org/wiki/White_point) of 6500–9000 [K](http://en.wikipedia.org/wiki/Kelvin), which is much bluer than the common lighting on a television production set.

For outdoor use, at least 2,000 cd/m² is required for most situations, whereas higher- brightness types of up to 5,000 cd/m² cope even better with direct sunlight on the screen. (The brightness of LED panels can be reduced from the designed maximum, if required.)

Suitable locations for large display panels are identified by factors such as line of sight, local authority planning requirements (if the installation is to become semi-permanent), vehicular access (trucks carrying the screen, truck-mounted screens, or cranes), cable runs for power and video (accounting for both distance and health and safety requirements), power, suitability of the ground for the location of the screen (if there are no pipes, shallow drains, caves, or tunnels that may not be able to support heavy loads), and overhead obstructions.

**Battery**

The most important part in portable type of computer is battery and storage capacity. Usually batteries must be small in size and work for longer time. For normal use it can be used for 2 weeks. The type of battery used here is lithium ion battery. The storage device is of the type tubular holographic which is capable of storing. The use of lithium ion battery in this gadget will reduce energy density, durability and cost factor.

By making Five Pen PC feasible, it will enable ubiquitous computing therefore it is easier for people to use. Many applications can be imagined with this new technology. As it makes use of E-fingerprinting the gadget will be more secure, which allows only owner to activate the Pc. So even if we loose it, no one else cal access the gadget. All PC’s communicate each other with the help of Bluetooth technology and the entire gadget is connected to internet (Wi-fi). This technology is very portable, feasible and efficient. Every body can use this technology in very efficient manner. Some prototypes have been already developed in 2003 which are very feasible, but currently unclear. The enhancement in this technology can be expected in coming years.

**7. REMARK**

**7.1 ADVANTAGES:-**

Portable Feasible Ubiquitous

Makes use of Wi-Fi technology

**7.2 DISADVANTAGES:-**

Currently unclear

Cost

Keyboard concept is not new

Easily misplaced

As the gadget is very costly the consumer cannot afford to purchase them.

The virtual keyboards are already present in various companies like Lumio and Virtual

Devices Inc.