Chapter Two

Computer Transactions and Right to Privacy: An Overview

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2.1 Introduction

Human life evolved from primary functions and developed into complicated transactions in social and economic life. Society is collection of people who have banded together to achieve some common ends. Technology has brought physical power to humanity. It began, probably with discovery of fire and then wheel. Afterwards simple machines were made which were developed in to complex machinery. With fire came the steam. Steam drove machinery on large scale. Later this energy was obtained through other sources and used in more compact forms.

Intellectual power- i.e. the ability to investigate, to understand, to quantify, to predict and to simulate has always been present in one form or another in history of humanity. Verbal and symbolic communications are the two ways in which human race has developed its ability. By signalling and talking we can verify common purpose with others. We can pass along what we know and want and we can receive what others know and want. Human societies had helped their own intellectual efforts with mechanical devices. Technology has taken two major forms. In first, it has been applied for development through machines to do work, to shorten distance etc. In second, it has been applied for development of useful means of communication and calculation. Physical power is required to achieve economic survival. Intellectual power is required for organisational survival.[1]

2.1.1 History of Computing

For thousands of years, various tools were used by humans to aid counting and computation. At first humans used their fingers as the 'calculator' to count their possessions. But to calculate for more things, fingers were felt insufficient. Then man started using pebbles or sticks to count. These were the first devices to count and keep track on the possessions. But counting only was felt inadequate as the information about the counted items was to be preserved for the future use. Therefore, record keeping devices like clay shapers or cones were used by men to represent probably live stocks or grain. Not only the counting in numbers

[1] Edward J. Laurie, "Computers, Automation and Society", Richard Irwin, INC; 1979

but while transacting commercial activity, addition and subtraction were also essential. Therefore, the device had to have the facility to these calculations. Simple additions and subtraction were possible with the simple forms of tools but bit advance calculations could not be performed without advanced tools.

Abacus was used for the arithmetic tasks in simple and advanced forms. In 1642, the first mechanical calculating machine was developed by Blaise Pascal, a Frenchman. About 30 years later, Leibniz, German Mathematician, improved on Pascal's invention by producing a machine which could add, subtract, multiply, divide and extract roots. But no one knew how to manufacture such precision machines. Many forms of boards or tables were invented.

Even in 1880s, data processing in United States was still done with pencils, pens, and rulers. The volume of records was expanding rapidly but the processing by handwritten methods was inaccurate. By this time, electro-magnetically punched card equipment was invented. In 1801, a French weaver named J.M. Jacquard invented them to control his mechanical looms[2]. But the problem of Census count led to use these cards in USA. A statistician Hollerith developed his machine readable card concept and designed a device known as the 'census machine'.[3]

2.1.2 Development of Computing Machine to Computer

After 1890, Hollerith converted this equipment to commercial use and set up freight statistics system. He also founded the company to make and sell his invention. Later it was merged with other companies and known as 'International Business Machines (IBM) Corporation. Punched card processing was based on simple idea: input data were first recorded in a coded form by punching holes in cards. These cards were then fed to the electro-mechanical machines that performed processing steps. This method was much faster and more accurate than manual method.

[2] www.computerhistory.org/strageengine (Last visited on April 6, 2018)
[3] www.computerhistory.org/strageengine (Last visited on April 6, 2018)

At Cambridge University in England, 50 years before Hollerith, Charles Babbage, Lucasian Professor of Mathematics, proposed a machine which he named 'analytical engine' and he dreamt to incorporate a punch card input, a memory unit, or store, an arithmetic unit, automatic printout, sequential programme control and 20-place accuracy.[4] In his efforts Lady Augusta Ada Lovelace was assisting him. After the death of Babbage the development of computer was stalled till 1937. In 1937, Harvard professor, Howard Aiken with the help of his students and using Hollerith's punched card techniques tried to prepare computer. The project was finished in 1944[5]. The complete device was known as Mark I digital computer. Internal operations were controlled automatically with electromagnetic relays; arithmetic counters were mechanical. John Atanas off and his graduate assistant began to build first electronic computer. They used vacuum tubes for storage and arithmetic-logic functions. This computer was known as ABC-Atanasoff-Berry Computer. Mauchly teamed up with Presper Eckeret, Jr., a graduate engineering student at Moore school and organised the construction on ENICAC-the first electronic general purpose computer. It could do 300 multiplications per second making it 300 times faster than any other device of the day.

In mid 1940s John von Newmann suggested in a paper that binary numbering system be used in building computers and computer instructions as well as the data being manipulated could be stored internally in the machine. These changes were not incorporated immediately in ENIAC but after several years in EDVAC. In 1951 UNIVAC-1 became operational at Census Bureau. The full potential of computer was underestimated. The word 'computer' means the person or thing which 'computes' i.e. counts.

The second generation computers began to appear in 1959. They were made smaller and faster and had greater computing capacity. The practice of writing applications programs in machine languages facilitated the use of higher-level programming languages. Second Generation systems were specialized as they

[4] www.computerhistory.org/babbage/history (Last visited on April 6, 2018)
[5] www.computinghistory.org.uk (Last visited on April 6, 2018)

were designed to process either scientific or non-scientific applications. In 1964, the Third Generation computing was developed by IBM, its system/360 family of mainframe computers. The computers built in the early 1960s were mainframes, designed to provide at a central site all the processing power needed by an organisation. But not all afforded the large systems. Clearly a need occurred for low-cost minimal computers to fill the gaps by large computers. The first processor called minicomputers were developed and built in 1965 by Digital Equipment Corporation (DEC).

In 1970s, personal computers were developed using single microprocessor by many hobbyists –Bill Gates and Steve Jobs were two of them. With the progressing the years, cost of the computer was reduced and capacity of the computers increased. Then started the era of 'internet', which began with development of electronic computer in 1950s. Initial concept was of Packet networking. It was originated in several computer science labs in United States of America, U.K and France. The US Defence Department awarded contracts for packet network systems in early 1960s, including development of ARPANET (Advanced Research Project Agency NET). Its primary aim was to enable transmission of data files and long distance computing, including accessing data and research files at distant sites. This led to development of protocol for internetworking, in which multiple separate networks could be joined into network of networks. Access to ARPANET expanded in 1981.

In 1982, the internet protocol suit (TCP/IP) was introduced as standard networking protocol on ARPANET. National Science Foundation (NSF) funded for many development projects for interconnectivity. Commercial Internet Service Providers began to emerge in the very late 1980s. ARPANET was decommissioned in 1990. British Computer scientist Tim Berners- Lee linked protocols to hypertext documents into working system. After 1980s Internet has radical impact on culture and commerce, which was providing services like e-mails, instant messaging, voice over internet protocol, two way interactive video calls and World Wide Web, after 1991, with its discussion forums, blogs, social networking and online shopping sites. Thus it goes on developing. Archie, the first Internet search engine for locating and retrieving computer files, was

developed at McGill University (Montreal) in 1990.[6]Search engines such as Altavista, Infoseek, HotBot, and Google were the later developments for sifting the vast quantity of information on any available subjects on the Internet.

In India, development of computer started in 1954 at Tata Institute of Fundamental Research, where design of pilot model general purpose computer became operational in 1956. Its full scape version had operational in 1960. This machine TIFRAC was in practice till 1964. Computer division of Electronic group of Trombay Atomic Energy Establishment now known as Bhabha Atomic Research Centre (BARC) developed general purpose Analogue computer in 1960. These computers were connected to plant machinery and satellite tracking and communication. BARC commissioned Trombay Digital Computer (TDC) 12 computers in 1969 with the indigenous technology and parts produced in the country itself by Electronics Corporation of India in 1971.

Software for the computer was developed at Indian Institute of Technology (IIT), Kanpur, which had computer engineering course, with the help of team from IBM, a leading company in computers and TIFR. India started a programme to develop indigenous super computer and super computer technology. It can be used in assisting in development of nuclear weapons. Centre for Development of Advanced Computing (C-DAC) was set up in 1988 by then Department of Electronics under the headship of Dr. Vijay Bhatkar. In 1990, the first super computer was produced which was named as 'Param'.

Modern life is better explained with the use of computer. For better or worse, computers have occupied every aspect of society. Today computers do more tasks than simply compute. Supermarket scanners calculate our grocery bill while keeping store inventory. Computerised telephone switching centres manage millions of calls and keep lines of communication untangled. Automatic Teller Machines help us to conduct banking transactions from virtually anywhere in the world. But where did all this technology come from and where

[6]R.T.Griffiths Internet for Historians: History of the Internet, at http://www.let.ieidenuniv.nl/history/ivh/INTERNET.HTM> (Last visited on April 6, 2018)

it is heading? To understand it fully and appreciate the impact computer has on our lives and promises it holds for the future, it is important to understand its uses in day to day life.

2.2 Transactions using computer and Information Technology

2.2.1 Education

Use of computers in education means two things. One is -Teaching with technology and other is -Teaching about technology. If we want to evaluate the importance of computer in achieving new information, knowledge and technology then we have to concentrate on the first one i.e. teaching with technology. Here technology is a tool to get knowledge and computers and information technology help society greatly.

Teaching with technology

Use of computer in imparting education helps at three levels.

i) One from the student's point of view: It is helpful as it facilitate him at entry level as well as while learning and getting knowledge. It starts from the admission in the educational institution which is made online. This online admission procedure is helpful for the aspiring students who wanted to seek admission in the institution in whatever the area he may be staying. Every information about the admission procedure and list of required of documents for the admission is also available on simple click of the computer on web page of the institution. Students staying in remote areas are benefited by it. Web pages of the foreign universities are also available, by which students in other countries are benefited. The greatest advantage of this is the student gets the necessary information without moving from the place.

Students take on line courses, distance learning, researching, project work given, and video conferencing with the teacher or other students if needed, communication on social networking sites etc. Students can seek information about availability of books in the library and they can renew the book earlier issued without visiting library. Library management is an area through which the demand of students, researchers and faculty members for study, reference and exploration can be satisfied.

Information and Library Network is also helpful in getting the literary resources to aspirants. University libraries are connected with information centres in country through nationwide high speed data network using the state of architectural technology for optimum utilisation of information. It promotes scholarly communication among academicians and researchers in country. It promotes information access, transfer and support scholarships. Eg. The INFLIBNET programme of UGC, link the libraries of institutions of higher education through network.

Secondly, with introduction of computer, the age old system of imparting education in class rooms has changed. Entrance examination is conducted centrally on computer and allotment of the seats in various colleges is also done using computers. Universities run distance education programme and impart education by providing instructions on computers. Even the evaluation and grading is done through computers. Teacher or professor uses audio-visual aids for teaching for better presentation. New technologies like Interactive White Boards where display is connected to computer and projector for better presentations. Scanner Highlighter makes it easier to copy text from books and it can be stored in computer for future use. This copied text can be stored in word or excel for editing or as PDF for searching.[7]

It is also useful for research and studying. This saves time of copying by writing or photocopying the text from the book. Tablets, netbooks or smartphones are portable devices that enable users to share and work anytime anywhere. Teaching about technology is the need of this era. Teachers use multi-media resources like simulation, games etc. to clarify the basic concepts and to give practice. Internet is the tool for getting information about any subject under the sun. Technology is used for interactivity, for content delivery and for doing revision of the subject taught. It is also used for collaboration with experts to get the necessary information and knowledge. It creates sense of cohort. It provides variety of teaching and learning preferences. It is also used for formative and

[7]"Role of computers in education," http:// wikieducator.org/Computer_in_Edu (Last visited on June 30, 2018)

summative assessment. Audio visual aids help to present the information is better way. It helps quick communication between students-teachers-and parents. It helps the disabled students also.

Internet provides opportunity to gain up-to-date information on different aspects of health and disease and to discuss with colleagues in different continents via net conferencing. Free access to medicine, medical journals, online textbooks and latest information on new development in medical field also encourages learning and research.[8] The same is true for engineering and architectural field also.

ii) From the point of view of administration of educational institutions: It is helpful for managing the institution efficiently and successfully. Universities started this process in late 1980s. They are used to make lists, to maintain and assess educational progress etc. Computers are used in administrative purposes. Administration of the schools starts from delivering admission forms by registering the names of students. Sometimes the admission process starts by filling the admission form online. Admissions in Medical and Engineering field are most sought out by the students. The admission process is made centralised by the Ministry of Higher and Technical Education to ensure transparency and fair allotment by ruling out malpractices.

Educational institutions use computers for many purposes such as a) Students registration and record, b) their examinations and evaluation, c) for accounting i.e. managing funds, grants and fees accumulated from the students. This ensures the generation of confidence in the institution, d) pay roll of the faculties and office personnel which help management in accounting process and for steady disbursement of salaries and other benefits, e) for inventory record i.e. management of materials and store, f) for cost analysis, g) scheduling like examination or admission schedule, or room allocation, h) integrated information system etc. These are the broad areas where computer is used by institutions. Separate programme is developed to facilitate the admission and administrative process of that particular institution. For giving scholarships this data is processed and the names of the beneficiaries are declared.

[8] www.asianhhm.com/articles/role-information-technology-medical-sciences.(Last visited on June 30, 2018).

2.2.2 Simulation

Before introduction of the computer and computer technology, traditional simulation was done by role playing. Simulation in simple form is used in businesses suing spread sheet, financial and statistical software program for analysis and planning for the future tasks. Technology based simulation is introduced in high risk jobs and where practical experience is needed to complete the task successfully in first go. Simulation uses a mathematical description or model of a real system in the form of computer programme.

Simulation means something which imitates a system or environment in order to predict actual behaviour, or assuming an appearance which is feigned or not true.[9] Computer simulation is use of computers to represent the dynamic responses of one system by the behaviour of another system modelled after it. In the late 1950s and 1960s, it was generally used by the large corporations that required substantial investments. The use of simulation we know it today began during the 1970s and early 1980s. During the late 1980s, it was frequently used in business because of use of personal computer and introduction of animation. But it was used still to analyse failed systems.

During 1990s, many smaller firms started using it in early stages of their projects. Better animation, greater ease of use, faster computers, easy integration with other packages, and the emergence of simulators have all helped. The manner, in which the simulation was used was changed. It is employed earlier in the design phase and is often being updated as changes are made to operating systems. This provides a living simulating model that can be used for systems analysis on very short notice.[10]

Simulation is a tool for learning a skill to improve safety in industries like aviation, medical, defence or nuclear sector. It is the process of creating and analysing a digital prototype of physical model to predict its performance in real world. It helps to designers and engineers to understand whether, under what

[9]Oxford dictionary.

[10] David, Kelton, W., Randall Sadowski, Nancy Swets "Simulation with Arena", , McGraw Hill Education(India) Pvt. Ltd; 2013

conditions and in which ways a part could fail and what loads it can withstands. The simulation can also take the form of computer graphics image that represents dynamic processes in animated sequence.

Computer simulations are used to study dynamic behaviour of objects or systems in response to conditions that cannot be easily or safely applied in real life. E.g. a nuclear blast can be described by a mathematical model that incorporates such variables as heat, velocity and radioactive emissions. Simulations are useful in enabling observers to measure and predict how the functioning of entire system may be affected by altering individual components within that system.[11] For the purposes of learning skills which are essential for practice in reality, where it is dangerous to experiment for a beginner or where it is important to train the student for some future risk without endangering any body's life, this technique is used. Advanced technology is used for this type of simulation which is done on mainframe computers. E.g. weather patterns or behaviour of macro-economic systems.

In Medical field

Medical education need both traditional as well as technology based simulation. Traditional role playing (operating room team of anaesthesiologist, surgeons and nurses), is supported by technical simulation-which is provided by software program that mimic real world medical emergencies. Mannequin patient hooked up to anaesthesia machine and various other hospital monitors that are programmed to signal cardiac arrest or another medical emergency. Screen based computer simulators and virtual reality devices are also used in medical simulation. Computer assisted molecular modelling has been used to construct working of 3-D models of lens alpha-crystalline. This is basic to our understanding of molecular mechanisms involved in lens fibre cell maturation, stabilisation of inner nuclear region, maintenance of lens transparency and cataract genesis.[12]

[11] Encyclopaedia Britannica

[12] www.asianhhm.com/articles/role-information-technology-medical-sciences. (Lastly visited on 30/06/2018).

Another development of "Advanced life support" (ACLS) simulators and Haptic, "the science of touch" simulators are used in medical education to develop clinical skills as ECG interpretation, appropriate intervention such as drugs, injections, defibrillation without working on real patients. Medical simulators can emulate various clinical procedures such as catheterisation, laparoscopy, bronchoscopy etc. With new technology, students can virtually go inside each and every organ and see how they actually look from outside as well as from inside.

Engineering field

In engineering, computer model of newly designed structures undergo simulated tests to determine their responses to stress and other physical variables. Simulation of river system can be used to determine potential effects of dams and irrigation networks before any actual construction.

In aviation

The flight simulation is used to create a near-realistic flying environment to train the pilots safely. Earlier pilots were trained by sitting in glider of a plane while facing strong winds, thus allowing the pilot to get a feel for a plane in realistic setting. Modern flight simulation incorporates advanced technologies e.g. sensors and ritual reality displays t better simulate the real experience of flying including emergency situations that may arrive. It is a training tool used by military and certain high risk industries. It allows students to engage in virtual situations that would otherwise be difficult, dangerous or impossible to engage with. It provides safe environment for making mistakes and after the response which is not proper as per the rules or procedures such mistakes can be corrected without harming the person or the system involved.

In Weather forecasting

It is used in weather forecasting and specifically rainfall forecasting. In India, Council of Scientific and Industrial Research (CSIR) was established in 1988 at Belur. It has centre for Mathematical Modelling and computer simulation, Bangalore, which is a unit of CSIR Fourth Paradigm Institute (CSIR-4PI). This is engaged in mathematical modelling and simulation.

In other fields

Simulation is useful in day to day operation where it is not advisable to invest money only to experiment. It is also convenient to create model and try to visualise the future situations when moving the infrastructure is a huge job. People often study a system to measure its performance, improve its operation, or design it if it does not exist. It can be used in making the life much easier by improving the facilities. E.g. a) entrance-ramp traffic lights on their freeway systems to experiment with different sequencing to find settings that make rush hour as smooth and safe as possible. b) A supermarket manager might try different policies for inventory control and checkout personnel assignment to see what combinations seem to be most profitable and provide best service. c) An airline could test the expanded use of automated check-in kiosks (and employees to urge passengers to use them) to see if this speeds check-in. But trying a new check-in procedure at an airport might initially cause lot of people to miss their flights if there are unforeseen problems with the new procedure. So model is necessary through simulation. d) A computer facility can experiment with different network layouts and job priorities to see how they affect machine utilisation and turnaround where actual changing might be very costly to change the experimental layout. In such situations, it is necessary to build a model for studying the system. Nobody gets hurt, and your freedom to try wide-ranging ideas with the model could uncover attractive alternatives that you might not have been able to try with real system.

2.2.3 Defence

Army and Air Force

Some of the earliest computers were used for military purposes. Requirements of military computer are portability and ruggedness. Military computers are more robust than the industrial one as they have more structure inside to support the components, the plug-in cards will be individually supported and secure.

Computers are used in tanks and planes. They are also used as gateways between different computer networks and to host security functions i.e. crypto systems. It helps in design and to test new systems developed. It allows satellite to obtain spectacular images of enemy territory for transmission to the ground

where the images will be processed by another computer and analysed by intelligence personnel. Modern fighter aircraft depend heavily on computer for their operation. Secure and efficient communication is essential to success of any military campaign.

Powerful computers allow for strong encryption techniques to be used to keep valuable information from falling into wrong hands. Today fast computers can use large keys to encrypt data using sophisticated algorithms. It is also easy to decipher the code set by an enemy with computers.

Satellite ground control systems are utilized in military environments to collate extra planetary information from satellite stationed in orbits so that data is then able to be relayed to military personnel for tactical application. There is increased need for systems operating in remote areas to have mobile capabilities to maximise the volume of information being extrapolated from satellites and consequentially benefit the overall aims of the operation. The system must sustain power fluctuation and power failures. The ruggedness of computer plays a crucial role in ensuring the deliverance of defence grade systems.

Mobile satellite ground control system will as a result of their intended environment and purpose require managed Uninterrupted Power Supply. Functionalities complete with battery packs to ensure maximum uptime and safe shutdown of computers. In addition, there are also pressing needs for systems to wide ranging temperature scales to be fully operational in spite of challenges related to heat issues imposed by their intended environment. The satellite ground control system is also shock proof and vibration sustainable as it has ability to operate in unclean environment.

Navy Data terminals are integral part of communication system on board of ships to external location including air, land and to other ships. In Navy it is vital that information is relayed from one point to another seamlessly. The end environment dictates that it is paramount to the functionality of machine messaging system to survive shock and vibration which are present on the ships. Its process of integration and configurability shall be simple which saves time.

Computers are designed to sustain the need to run them on low power or minimal power as sometimes ships air conditioner is to be switched off to assist military aims. These computers are tested for thermal and EMC issues to ensure their dependable operation throughout their life. It helps to track incoming missiles and helps weapon system to target and destroy them. It is also used to find out where all their assets are situated and after communicating it helps in battle management system. It is used in logistic and ordering functions of getting equipment to and around battlefield. Computers are used in tanks and planes and ships to target enemy forces, it provides then to run the platform. Computers are used to test new systems.

2.2.4 Internal security and Control

In computer, security, general access control includes identification, authorisation, authentication, access approval and audit. The system makes decision to grant or reject an access request from an already authenticated subject, based on what the subject is authorised to access. Authentication and access control are often combined in to single operation, so that access is approved based on successful authentication, or based on an anonymous access token. Authentication methods and token include passwords, biometric scans, physical keys, electric keys and devices, hidden paths, social barriers and monitoring by humans and automated systems.

This control system is used to get things done without monitoring them physically. Central air conditioning and heating system in large buildings, security system and burglar alarms are some of the kinds. Manufacturing processes are also monitored and completed without human presence. Traffic light and pedestrian crossing are the commonly used things in public life. Sensors are used to measure physical qualities as temperature, light, pressure, sound and humidity. They send signals to processor e.g. security alarm where infrared sensor sends signal when beam is broken, heat sensitive sensor in corner of a room may detect presence of a person, temperature sensors control the heating in large building, magnetic sensor detect metal and can be placed in roads to monitor traffic flow. Other physical quantities that can be transmitted directly to computer's processor include—a) rainfall or water level-oxygen level

b) radiation level c) pH level. This type of data is analogue data and computer work on digital data. An interface box or analogue to digital converter (ADC) is needed to convert the analogue data from the sensors in to digital data the computer can process.

Many countries like Israel made use of such functions in computer controlled green house to help plant growing. In this green house, temperature and humidity (moisture in the air) are controlled. It has temperature and humidity sensors linked to computers and computer has a control program storing details of correct temperature and humidity settings. The green house is fitted with heater, sprinkler and window motor also linked to computer. If humidity decreases below stored value, computer activates sprinkler and closes the windows. In this way heat is also regulated.

Closed Circuit Television Cameras (CCTV) are used for surveillance and security applications. However they are controlled and their images are recorded and analysed. Every establishment, institution or company even the government offices also use this type of cameras for security purposes. They are mostly used to get information of the persons visiting the establishment, institution or office. In case of the need to check and verify the presence of the individual the footage can be checked.

2.2.5. Health and Medicine

Health Information Technology (HIT) is application of information processing involving computer hardware and software that deals with storage, retrieval, sharing and use of healthcare information, data and knowledge for communication and decision making. Worldwide use of communication technology in medicine began in early 1950s. Gustav Wagner established first professional organisation for health informatics in Germany. Earlier low cost devices like thermometer to stethoscope were used which were not using software technology. But they were used to diagnose the disease. Medical software was used in 1980s, when software progress made it possible to software-driven medical devices.

The early software programs used to switch on and off the device and displayed readings like temperature and pressure. It also plays vital role in conducting various clinical and biological laboratory tests in hospitals that help in correct diagnosis of diseases. In medical field, computer and computer technology is used to diagnose the diseases which are difficult to detect with simple technology. This includes the diseases of internal organs like respiratory tract or of intestine. Diseases of respiratory tract can be detected using the Bronchoscope- which is made up of flexible fibre-optic material and has light source and camera on the end. It is inserted from nose and throat to reach lungs. This procedure is called Bronchoscopy.

In the same way Endoscope –flexible tube with light and camera attached to it- is used to examine person's digestive tract. Doctors can view the digestive tract on colour television monitor and see the obstruction or unnatural growth if any. This procedure is called Endoscopy. Computers help in performing surgeries like laparoscopic in which doctors insert medical tools and small camera is attached to them and conducts an operation with the help of computers and monitors on which images on the inside organs are visible. Many high-tech surgical machines and instruments are endowed with small computer system so that surgical process is recorded and monitored to avoid complications. Many clinical imaging processes are conducted and examined with the help of computers e.g. X-rays, CT Scanners, MRI etc. They project what is happening inside the body of patient. The complex signals that come back from these huge machines are picked up by sensors and fed into the computer. Computer processes the data, and then provides output in colour images in full, sometimes in 3-D for doctors for giving views of patient's body. Many critical patients, whose heart rate and brain readings are needed to be recorded and monitored continuously, are observed through computers.

It is virtually impossible for humans to note down every movement of internal organs of patients but computers do it with ease. Even life support systems are also governed by special computerised systems. In this system, sensors are attached to patients. This can be done for the purposes like for measuring pulse rate, temperature, breathing rate (breaths per minute), blood oxygen level, blood

pressure etc. Sensors send this information to computer which processes the data. This data is checked for any problems (pulse rate too high/low) by the doctors. This data is logged so that it can be checked later also.

Several outputs from computer system let the hospital staff be aware of the patient's condition. Large display/monitor shows graphs of pulse, or breathing etc. A loud buzzer/alarm can be sounded if there is a problem to attract the attention of doctor or nurse. Data from several patients can be fed back to central nursing station so that the nursing staff can see exactly what is happening in the ward.

Various functions are achieved with the help of computers and information technology. Today's medical devices embrace wireless communication technology as Bluetooth, Smart and IrDA, through which they are capable to connect to computers, tablets, smartphones, and other medical devices and exchange information, either in real time or asynchronously. It processes the information and displays it to the various users. Software also made possible to connect diverse devices with one another and therefore doctors can diagnose the patient remotely. Examples of integration of wireless technology in medical devices include, Remote Patient Monitoring (RPM) and Medical Body Area Networks (MBAN).

Remote Patient Monitoring are wearable sensors that collect data and send it directly to doctor. These devices are driven by software application that allows them to talk to other wireless enabled devices and transmit data over internet using internet protocol. They are becoming independent of hardware. This means that same application can run several devices that perform the same functions. In Medical software, accuracy and consistence of data is more important than any other feature.[13] When it is connected to computer for storing and processing data, the possibility of error is reduced significantly.

[13] Pathfindersoftware.com/2015/09 (Last visited on 30/06/2018).

Mental health researchers are using computers to screen troubled persons in need of psychotherapy.

Patients paralysed by stroke, implant is done that allows communication between brain and computers by thoughts of such persons and they can convey their needs to the care takers. Handicapped persons find it difficult to type the keyboard of the computer. Being able to speak directly in to the computer certainly simplify the things. Voice design system is introduced to enable disabled people. They communicate with others with the help of custom-designed computers. They could communicate to the general purpose computer system in corporate with the help of various devices.

Such devices are speech synthesiser, braille printers, and large print screens and printers, talking software, text scanners and speech recognition system. Speech synthesisers are designed to work with software by verbalising words appearing on the screen and any changes typed in by the user.

Speech drivers are operating systems that work by verbalising words and symbols that are displayed on the screen. These drivers enable the handicapped to use this software as their sighted co-worker.

Optical character recognition systems provide computers with the power to read printed words by scanning text. It can be combined with voice synthesisers they can provide with voiced, braille, or large print versions of the text that has been scanned. Products with speech recognition system are developed which provide facility to reply to spoken words. Sophisticated and more developed product is able to distinguish any voice including unclear sounds produced by users with limited muscle control. All these products help to disabled person to lead productive life.

2.2.6 Business and Economic Transactions

The Internet and intranets have had a tremendous impact on the business modes of the corporations. Cash registers are just personal computers with special interface. Business to business and web based transactions are more powerful due to direct connection to data base. Original interest was just account but computer mediated transactions enable better contracts, data extraction and

analysis, controlled experimentation and personalisation and customisation. With the use of computer it is possible to verify contractual performance. It allows us to structure more elaborate contracts and potentially improve economic efficiency.

Communication within and outside business- Computers facilitate communication sending and receiving electronic correspondence. Online e-mail also enables voice chat with others over internet. Companies use application like Outlook to manage business mail, track events, and help employee schedule meetings. Computers are used for Data mining. Businesses often acquire and store massive amount of information in relational databases, spread sheets, XML files and other repositories. Data mining software can help businesses to identify patterns and discover new relationship in historical data. Businesses using data mining can boost sakes, acquire new customers, improve production, increase customer satisfaction and predict future business trends.

Customer service- By using computers businesses find, serve and retain customers. It includes contact management, customer service and sales force automation.

Design and Graphic- Professional graphic artist can be substituted by use of tools as image editors and desk top publishing applications. Banners, logos marketing materials can be created in novel form. It may be used to enhance photos and produce newsletters. Power point, Coral draw soft wares can help to create perfect and powerful or impressive business presentations by only clicking buttons or by dragging mouse. Video editing programs also help to produce videos for the company which can be used for advertising and marketing. Computers connect to customised graphics on internet which are used freely to create images and videos.

Marketing and Advertisements- Big businesses give contracts for advertising the product or services they produce. But small or medium businesses use social media sites e.g. Facebook or twitter. These sites can be used to design and manage e-mail marketing campaigns that target potential customers.

Management of People- Employee data is fed to computer and central repository which makes easier for Human resource personnel to track employee performance, maintaining information about benefits and communicate with employees efficiently. Human resource reports of specific employee can also be generated.

Office management- Earlier days of file cabinets or warehouses are replaced by computer and data management has become easy. Thousands of manuscripts, files, charts, and other documents are stored in tiny microchip. The whole data can be stored on hard drives of the computer. It can be copied on diskettes, or now on pen drives for moving them physically. The data can be shared on other computers or can be transferred also.

E-Commerce- E-commerce involves everything from ordering 'digital' content for immediate online consumption, to ordering conventional goods and services, to 'meta' services to facilitate other types of e-commerce. Business i.e. sale, purchase, trading of product or services using electronic devices through internet-computer network is simple type of e-commerce. But it includes Mobile commerce, electronic funds transfer, supply chain management, internet marketing, online transaction processing, electronic data interchange, inventory management system and automated data collection systems.

E-commerce business may employ online shopping providing or participating in online marketplaces, which process 3rd party business to consumer or consumer to consumer sales. It also provide business to business buying and selling e.g. electronic data interchange, and also marketing to prospective and established customers by e-mail fax (with newsletters). It also engage in pre-tail for launching new products and services. Development of e-commerce can be traced broadly from 1990, when Barness Lee wrote first web browser World Wide Web using NEXT computer. In 1992, BookStacks Ltd. opened commercial sales website selling books online with credit card punching. In 1993, first App store The Electronic App wrapper was launched by Paget Press. In 1994, First software was for sale and immediate download IPswitch IMail

server-by IPswitch and Open market. In 1995, Amazon.com was started by Jeff Bezos, which has become a leading retailer company for online purchase and sale. Also in the same year commercial free 24 hour internet radio stations Radio HK and Net Radio by eBay founded by Pierre Omidyar. In 1996, India MART, business to business marketplace was started in India. In 1996, E postal stamps can be purchased and down loaded. In 1999, Alibaba group is established in China. ATG stores launched sale of decorative items for home online.

In 2007-08, Payment system in virtual currency, 'Bitcoin' was invented by Satoshi Nakamoto[14]. It is peer-to-peer transaction system. These transactions are verified by Network Nodes and recorded in public distributed ledger called the block chain, which uses Bitcoin as unit. It is first decentralised digital currency. It may be rightly called crypto-currency. There are some common applications in e-commerce e.g. automation of documents in supply chain and logistics, payment systems are available for domestic and international transactions, group buying is possible, online shopping and order tracking is possible, online banking is available, automated online assistance, availability of shopping cart software, teleconferencing, social networking, electronic tickets, instant messaging, social networking is possible, digital wallet and pre-tail is also included.

Pre-tail- Pre-tail is also known as pre-retail, pre-launch or pre-commerce.[15] It is a sub category of e-commerce and online retail for introducing new products, services, and brands to market by pre-launching online, from creating interest waitlist before launch or pre orders in limited quantity before release, realisation or commercial availability.[16] It includes pre-launch marketing services. It is used to test, promote, and monetise consumer demand in initial phase of new commerce pipeline as first introduced in 2012[17]. This is used in sale of electronic goods, movies, music, videogames, books, fashion, software apps, cars, toys, cosmetics etc.

[14] https://en.wikipedia.org/wiki/Bitcoin (Last visited on April 6, 2018)
[15] https://en.wikipedia.org (Last visited on April 6, 2018)
[16] https://en.wikipedia.org (Last visited on April 6, 2018)
[17] https://findwords.info/term/pretail (Last visited on April 6, 2018)

Digital wallet- It is electronic device. It is used in purchasing items online with computer or using smart phone to purchase in a store. Individual's bank account need not be linked to digital wallet[18]. They might also have driver's license, health-card, loyalty cards[19] and other ID documents stored on the phone. The credentials can be passed to a merchant's terminal wirelessly via Near Field Communication. Digital wallets are being made not just for basic financial transactions but to also authenticate the holder's credentials. For accessing this facility, the consumer does not have to fill the forms. Their information is encrypted or protected by private software code. Payment card details are not passed to website but unique transaction identifier or token is issued. For matching the checkout system of website and consumer wallet, software uses Electronic Commerce Modelling language. It is a protocol that dictates how online retail structure and set up their check out forms. Use of this gives freedom to carry leather wallets to consumers. On mobile application it securely stores credit cards, offers, gift cards and more on the phone. Customers have only to "tap and go" to make payments with their mobile device. Eg. Google wallet.

Crowd funding- It is a practice of funding a project or venture by raising monetary contribution form large number of people.[20] Nowadays it is performed via internet mediated registries. It is also known as alternative financing. In earlier times war bonds are the type of crowd funding.

Sale and purchase- In India, online shopping's most common form, business to consumer is prevalent. Business to business e-commerce includes transactions among manufacturer to wholesaler, and wholesaler to retailers. Third type of e-commerce is consumer to consumer transactions e.g. eBay or other similar websites. Most successful e-retailer in India is Jabong.com, a fashion and lifestyle company, specialised in apparel, footwear, fashion accessories, beauty products, and home accessories and other fashion and lifestyle products. Indian e-commerce market has some characteristics like most

[18] https://www.investopedia.com/terms/d/digital-wallet.asp (Last visited on April 12, 2018)
[19] https://www.investopedia.com/terms/d/digital-wallet.asp (Last visited on April 12, 2018)
[20] www.merriam-webster.com (Last visited on April 12, 2018)

customers prefer cash on delivery as mode of payment. Direct imports from international retailers for sales and purchases for international customer products have made and increased.

The basic cause for increase in this share is the increase in Internet users in India. In January 2016 there are 375 million internet users, as China is leading with 680 million internet users.[21] Retail purchases, credit card transfer, automatic debits are the examples of e-commerce. Tools facilitating e-commerce are e-mails, video conferencing, electronic shopping etc. Electronic banking is also the part of e-commerce. Electronic payment system enables customers of a financial institution to conduct financial transactions on website operated by institutions. E.g. retail bank, virtual bank, credit union or building society.

Industry- Use of software as CAD –Computer Aided Design is the use of computer systems to assist in creation, modification analysis or optimisation of design. CAD is used to increase productivity of designer, improve quality of design, and improves communication through documentation and to create data base for manufacturing. Its output is generally in the form of e-files for print, machining or other manufacturing operations. The other software is CAM-Computer Aided Manufacturing, which is the use of computer software to control machine tools and related machinery in manufacturing work pieces. Primary purpose is to create faster production process and components and tooling with more precise dimensions and material consistency, which is some cases uses only the required amount of raw material (thus minimising waste) while simultaneously reducing energy consumption. Jobs which are difficult to fulfil for humans and which are too much technical can be done with the machines which are computer operated e.g. cranes, robots.

Stock Exchange- Stock markets launched computerised system that makes it possible for stockbrokers to do all their trading electronically. Brokers submit and receive bids using their computer workstations or inter connected computer

[21] www.statista.com (Last visited on April 12, 2018)

display screens, where brokers match buyers with sellers, so that neither trading floor nor slips of paper are necessary.

2.2.7 Banks and Post Office

Banks: Computers perform complex analysis of constantly changing financial markets. It keeps track of the bank's entire product offerings and their associated interest rates and earnings. They communicate with other mainframe computer at branch located around the world. Midrange and client/server hardware configurations can run an entire bank in addition to receiving transactions form affiliated bank branches. New hardware technology can process more transactions than systems using earlier old technology. It also enabled wireless banking- direct deposit of money by e-transaction- computer processing the e-transaction much have hardware and software encryption capabilities to keep data from being compromised during transactions. After that computer performs e-transmission, which transfers the information to main computer system for processing and updating. Cheques are read by MICR (Magnetic Ink Character Reader, a device used to allow data on cheques to be read by machines.) They can easily maintain their customer accounts by using mainframe computers.

Automated teller machines which are popularly known as ATMs were widely used after 1970[22]. ATM means electronic banking outlets that allow customers to complete basic transactions without the aid of the branch representative or teller.[23] After their installation, the customer has achieved freedom as he does not have to worry about working hours of the banks. Moreover, money could be withdrawn from any branch wherever the ATM was installed, also money is delivered instantly eradicating the time for encashing the cheques. Web based banking use dedicated server through which the information and other services are given. Customer uses web portal of bank. A customer's credentials, user ID and password pass through several check points before it enters in main system to perform web based transaction. This facility enhances the possibility of increase in business as customers are now free to deposit and withdraw cash at

[22] www.wikipedia.org (Last visited on April 13, 2018)
[23] www.investopedia.com/terms/atm.asp (Last visited on April 14, 2018)

any time and from any place without jeopardising their time and security of money.

Post Offices

Now computerised post offices are not the distant reality. Sending of money orders and sending money from one account with the post office in one city to the account in another post office in other city is easily possible with the help of computerisation. Even tracking of the delivery of object or thing sent by Speed Post or Registered Post is possible as customer can see it on the website of the Indian Post. This is more facilitating for the people in remote areas as post is the institution which is available in small villages also. It was available even before the independence for communication and for saving money. It requires smaller amount for opening an account. Retailers send goods using postal services. Indian consumer prefers the mode of payment as Cash on Delivery.

2.2.8 Judiciary

National Information Centre (NIC) took up computerisation in Supreme Court of India in 1990. Information is uploaded regarding working of the court as well as various other aspects of the court work.

List of Business information: Scheduling of the cases to be heard by the Court on following day. Registries of Supreme Court and High Court databases also contain details of fresh cases, disposed of and pending cases.

Filing Counter Computer: Supreme Court and High Court fresh cases are filed only before computerised filing counters. Data entry operator enter preliminary details required for registration, such as party's names, advocate details etc. The computer terminal at query counter is used to attend to queries of litigants on the spot. The defects, if any, are listed out and handed over to litigants or advocates for rectification. Time limitation is also checked by system automatically.

COURTNIC: Supreme Court pending case status information to litigants and advocates on any node of NICNET. Primarily COURTNIC information is

available in all NIC-High court computer cells and in some district court. It has been in use since 1993.

JUDIS: It is judgement information system. Complete text of all reported judgements of Supreme Court from 1950 to date is available[24].

Cause lists on internet: Cause lists are scheduling of cases to be heard by courts on following day. Supreme Court and High court lists are available on NIC web service. Supreme Court and all High courts and their benches are fully computerised by the work of NIC. All these courts generate daily and weekly cause lists from computer servers installed by NIC. It is receiving more than 10,000 hits per day.

Computerisation of District Courts: In 1997, NIC took up computerisation of all 430+ district courts in country. NIC provided 3 level training programs to district court official for this facility. A) Computer awareness program –for district judges. B) Supervisory level training at NIC state centres C) In house hands on training- to district court for want of interest from District court officers.[25]

2.2.9 E-Government

E-Government: Digitalisation of functions of the government is popularly known as 'E-Government'. It means employment of Internet and World Wide Web for delivering government information and services to the citizens.[26] Utilisation of information technology and other web based telecommunication technologies is done to improve and or enhance on efficiency and effectiveness of service delivery in public sector. It promotes and improves broad stakeholders' contribution to national and community development as well as deepen the governance process.

World Bank has defined E-government as "use of information technology (Wide Area Network, internet and mobile computing) by government that have ability

[24] http://judis.nic.in (Last visited on April 13, 2018)
[25] www.indiancourts.nic.in/courts (Last visited on August 5, 2019)
[26] UN, 2006 AOEMA, 2005

to transform relations with citizens, businesses and other arms of government"[27] In 2002, in the publication 'E-government: Analysis, Framework and Methodology' by OECD, it is defined as "It focuses on use of new information and communication technology by government as applied to full range of government function".[28]Moreover it uses information and communication technology as a tool to achieve better government.

United Nation's Public administration Network conducts a bi-annual e-government survey, which includes a section titled e-government readiness. Ranking was given as countries were compared on two criteria, a) state of e-government readiness b) extent of e-participation. Survey of 193 members about e-government readiness was calculated on website assessment, telecommunication infrastructure and human resource endowment. The UN e-Government Development Index (EGDI)[29] asses e-Government development at national level which is derived from three indices –Online Service Index, Telecommunication Index, and Human Capital Index. These indices assess the national online presence of all 193 UN member states. According to it, it is reported that for the year 2018, India's rank has improved by 22places and occupies the 96th position in ranking.

In e-participation, there are stages like a) e-information- It is about finance, health, education, labour, environment, social welfare, b) e-consultation- with the citizens, stakeholders, experts, and c) e-decision making is done- i) in public policies with the contribution of citizens, ii) in co-producing the public services. Governance is complex process requiring provision of hardware, software, networking and re-engineering of procedures for better delivery of services.

Traditionally, the interaction between citizens or businesses and government agency took place in government. In e-governance, the interaction takes place virtually using internet based technology, reducing time and cost involved. Even

[27] http://go.worldbank.org/MIJHEOZ280(Last visited on August 5, 2019)
[28] http://stats.oecd.org/glossary/detail.asp?ID=47 (Last visited on February 9, 2019)
[29] https://publicadministration.un.org/en/Research/UN-e-Government-surveys. (Last visited on February 9, 2019)

better e-governance enhances the citizen and business access to government information and services and provides new ways to increase citizen participation in the democratic process. E-governance generally includes very broad range of services for almost all segments of society. The most common are e-commerce and business regulation, taxation and revenue, law enforcement and courts, education, health and transport. But e-governance is not change of medium i.e. paper to paperless. It has to be transparent and efficient. The motto of e-governance is 'SMARRT' (Simple, Moral, Accountable, Responsive, Responsible and Transparent) government.[30]

Number of initiatives has been undertaken by various state governments and cabinet ministries to drive in era of e-government. Sustained efforts have been made at multiple levels to improve delivery of public services and simplify the process of accessing them. For this, computerisation of Government departments was done which promoted good governance, e.g. keeping the citizens in focus, services are oriented and transparency is achieved. For computerisation and for achieving the transparency, previous experiences proved valuable for shaping up of e-government strategy of the country. This holistic view of e-government was taken National e-Government Plan (NeGP)[31] in collective vision and a shared cause.

Government has developed massive countrywide infrastructure reaching to the most remote villages. Large scale digitization of records is done to enable easy, reliable access over the internet. The motive was to bring public services closure to home of citizen. The Government of India approved National e-Government Plan, comprising of 27Mission Mode Projects and 8 components, on May 16, 2006. In the year 2011, 4 projects- Health, Education, PDS and Posts were introduced to make a list of 31 Mission Mode Projects. The government accorded approval to vision, approach, strategy, key components, and implementation methodology and maintenance structure for NeGP. But

[30] htpps://nisg.wordpress.com/2006/06/28/smart-is-acronym-for-simple-moral-accountable-responsive-transperant (Last visited on February 9, 2019)

[31] https://webarchive.org/web/20140725161401. https://negp.gov.in/templets/pdf/compilation (Last visited on February 9, 2019)

financial approval for all MMPs was not included.[32] Information related to various departments of Government and facility to upload various information, and innovative projects and complaints regarding them if any. Crime and Criminal Tracking Network and Systems Scheme was approved by Cabinet Committee on Economic Affairs in June, 2009.[33]

E-government enables anyone who is visiting a website to communicate and interact with employees via internet by instant messaging, email to the address provided at the site. It is with the motive to enhance access to and delivery of government services to benefit citizens, business partners and employees. It renders service a) Government to Citizen (G2C)-Publishing information over internet, website about regulatory services, general information, holidays, public hearing schedules, issue notices, circulars, notifications etc. Users can engage in dialogue with agencies and post their problems, comments/requests to the department or agency. Transactions are also conducted like lodging tax returns, applying for grants, tenders, or for services provided by the government. It initiates the good governance by enabling the citizen from passive information gatherer to his active participation by giving information, providing opportunity to represent himself, encouraging the citizen to vote, consulting him and while making the decision involving the citizen.

Digilocker -This service is launched by Government of India, to provide secure, dedicated, personal electronic space for storing the documents of resident Indian citizens. The Digilocker aims at 'Digital Empowerment' of citizen by providing access to authentic digital documents to citizen's digital document wallet. The objectives for providing this facility are to enable e-signing, for minimum use of physical documents, to enhance authenticity and to curb the menace of fake documents, to provide secure access to government issued documents, to minimise the overhead of government and to provide easy services to the residents[34]. It also has benefit of accessing the documents anytime from

[32] www.deity.gov.in/content/national e-governance-plan (Last visited on February 9, 2019)
[33] http://india.gov.in/e-governance (Last visited on February 9, 2019)
[34] https://digilocker.gov.in/about.html (Last visited on February 9, 2019)

anywhere. To sign up the user must possess an Aadhaar card and mobile number linked to it. [35]

It is explained on the website that "It has created Repository- where collection of e-documents which are uploaded by issuer in a standard format and exposing a set of standard APIs for secure real time search and access is made possible. Access Gateway-It provides a secure online mechanism for requesters to access e-documents from various repositories in real time using e-document's URI (Uniform Resource Indicator or Identifier). The storage space (maximum 10 MB-Government is intending to increase it up to 1 GB) is linked to Unique Identification Authority of India (Aadhaar) number of the user. The space can be utilised for keeping vital documents like university certificates, Permanent Account Number, Voter ID cards, and URIs(Uniform Resource Identifier or Indicator-to identify the resource) of the e-documents are issued by various issuer departments. Facility of e-signing of the document is also available." [36]

This facility is initiated by Department of Electronics and Information Technology, Government of India. Each locker has many sections:

A) My certificate: i) Digital Document- It contains Uniform Resource Identifiers of documents issued to user by government departments or other agencies. ii) Uploaded documents: This section lists all documents which are uploaded by user. Each file should not be more than 10MB in size. Only pdf; jpg; png; bmp; and gif files types can be uploaded[37].

B) My Profile: It displays complete profile of the user as available in Unique Identification Authority of India database[38].

C) My Issuer: Issuers names and number of documents issued to the user by issuer.[39]

D) My Requester: It displays requester's name and number of documents requested from the user by requesters.[40]

[35] www.wickipedia.org/wiki/Digilocker (Last visited on February 9, 2019)
[36] www.india.gov.in/spotlight/digilocker-online-document-storage-facility (Last visited on February 9, 2019) (Last visited on February 9, 2019)
[37] "Frequently Asked Questions", Digilocker www.wikipedia.org (Last visited on February 9, 2019)
[38] "Frequently Asked Questions", Digilocker www.wikipedia.org (Last visited on February 9, 2019)
[39] "Frequently Asked Questions", Digilocker www.wikipedia.org (Last visited on February 9, 2019)
[40] "Frequently Asked Questions", Digilocker www.wikipedia.org (Last visited on February 9, 2019)

E) Directories: It displays complete list of registered issuers and requesters along with their Uniform Resource Locators (URLs)[41].

Many states also provided this facility by allowing the users to deposit their vital documents in lockers. Documents provided by Gram Punchayat, tehsildar or any local government can also be deposited and then easily accessed by the depositor.

Government of India is providing services on various fronts under the concept of e-governance. It has portal for e-governance with the initiative from Department of Administrative Reforms and Public Grievances, Government of India. It has started MCA-21 Mission Mode Project initiated by Ministry of Corporate affairs, e-filing of income tax returns-initiated by Income Tax Department, in Railways- booking of tickets and information about availability of reservation, information regarding time schedule of the trains at glance etc.

These services were enhanced by providing terminal for Travelling Ticket Examiners (TTEs), paperless unreserved ticketing mobile application and facility for e-booking for disposable linen on trains were newly launched services. E-catering services at all major stations in country are available for travelling passengers to order food of their choice from leading railways and private caterers to be delivered at stations. Many state governments are also providing such services at the local place. Services like application for water connection ration card, declaration of results on Higher Secondary Board of the State, electric bill collection. Haryana became the first state to implement Aadhaar enabled birth registration in all districts.[42]

2.2.10 Social media

There is no clear definition as what the social media is. The orthodox meaning of social media is the media which facilitate the communication among the

[41] "Frequently Asked Questions", Digilocker www.wikipedia.org (Last visited on February 9, 2019)
[42] www.indianexpress.com/articles/cities/chandigarh/digital-ind-intitiative-software-technology-park-of-india-software-technology-part-in-panchkula (Last visited on February 9, 2019)

society which includes newspapers and after that television. But this media has very limited exposure for the individuals.

But after the emergence of computer and information technology, it can be defined as-computer mediated tools that allow people, companies and other organisations to create, share or exchange information, carer interests, ideas and pictures/videos in virtual communities and networks. It is defined by Kaplan and Haenlein as "It is group of internet based applications that build on ideological and technological foundations of web 2.0 and that allow the creation and exchange of user-generated content."[43]

Social media sites are also known as social networking sites. They help people to connect with each other or with some entities. They are defined as "Social networking sites are web-based services that allow individuals to 1) construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection and 3) View and traverse their list of connections and those made by others within the system."[44]

Some of the characteristics of social media are: a) they are Web 2.0 internet based services/applications. b) It is user generated content and this is the base of social media. c) The operation of social media is in the form of many sources to reach many receivers. Media like Newspaper is one source to many receivers. d) Users create their own profiles for website or app, which is designed and maintained by social media organisations. e) It facilitates the development of online social Networks by connecting users' profile with those of other individuals and/or groups. f) It creates high interactive platform through which individual and community share, co-create, discuss and modify user generated content. g) It can be frequently used and its reach is vast.

[43] Andreas,Kaplan M.; Haenlein, Michael (2010). "Users of the world, unite! The challenges and opportunities of social media". Business Horizons.

[44],Danah Boyd M; Ellison, Nicole B.(2007). "Social Network Sites: Definition, History and Scholarship." Journal of Computer Mediated Communication Vol. 13, issue 1 p.210-213.

Social media includes fields like social networking- like Facebook or LinkedIn, micro blogging- like Twitter, photo sharing like Flickr, Picasa, news aggregation like Google reader, video sharing like YouTube, Metacafe, social gaming like World of Warcraft, social search like Google, Bing or Ask.com, and instant messaging like Google Talk, Skype or Yahoo! messenger. This list is suggestive and not exhaustive. Business networks, enterprise, social networks, forums, product/services review, social book marking are also included in social media. Most famous websites on social media are Facebook, WhatsApp, Twitter, Instagram, Snapchat etc.

Many tasks are done and completed using computer as a tool efficiently and speedily as compared to the tasks done by human efforts. The development of different techniques and with use of new technology in various fields of day to day life of an individual, the computers are used to reduce the physical efforts of an individual substantially. But now they are used to replace the individual in his decision making process also. The Internet of Things (IoT) is used for reducing physical efforts. But technology in Machine Learning and Artificial Intelligence is used to carry out cognitive functions which humans use in decision making.

2.2.11 Internet of things (IoT)

It is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with Unique Identifiers (UIDs) and the ability to transfer data over a network without requiring human –to-human or human-to-computer interaction. It is network of devices connected via the internet that can interact directly with each other without the need of any human intervention. It is often referred as machine-to-machine communication, or M2M. Physical objects that feature an IP address for internet connectivity and communication that occurs between these objects and other internet abled devices. They can be operated manually or automatically on a specific time by timer. Day to day examples are lights in household, electronic appliances, vending machines etc.

The Industrial Internet of Things, IIoT refers to use and management of domain of IoT into transportation, energy, health care and similar industrial sectors. It provides operational efficiency and intelligent technology insight for significant improvements in efficiency, productivity and revenue.

Data collection is the primary requirement for functioning of IoT technology. These devices are able to communicate with consumers, collect and transmit data to companies and compile large amount of data for the third parties. With innumerable devices communicating with each other through the internet, the possibility of data breach is high and as more devices are introduced, this issue will only complicate further.

2.2.12 Machine Learning

The new development in technology of Machine Learning and Artificial intelligence in computer transactions harm the privacy of the person. Machine learning is the technique used in predicting the trends by using algorithms from the data of the data subjects. This term is coined by Arthur Samuel in 1959. It started to flourish after 1990. Machine learning is scientific study of algorithms and statistical models that computer systems use to perform a specific tasks without using instruction and relying on patterns and inference.

In machine learning, algorithms build a mathematical model based on sample data, in order to make predictions and decisions without being explicitly programmed to perform the task. Machine Learning is the technique used in variety of application including email filtering and computer vision. It is closely related to computational statistics which focuses on predictions using computers. Machine learning focuses on predictions based on known properties learned from training data.

Data mining is the technique which again harm the data privacy of the individual. It also uses algorithm to predict the fact which is unknown earlier from the known variables. Input for this data mining is information of data which predicts the trends of the consumers. More data is generated by processing of this personal data which is used for processing.

2.2.13 Artificial Intelligence (AI)

Artificial Intelligence is the technique which uses the computer to perform tasks as humans do in those particular tasks. They copy the cognitive functions of human minds as learning and problem solving. Machine becomes increasingly capable for tasks considering the requirement of 'intelligence'. It is used in understanding the human speech, competing in games like Chess, in autonomously operated cars, and military simulation.

There are three types of Artificial Intelligence, a) Analytical- it has characteristics consistent with cognitive intelligence, b) Human inspired- elements only from cognitive and emotional intelligence, understanding human emotions, c) Humanised AI- characteristics of all types of competencies (cognitive, emotional, and social intelligence) used in search and mathematical optimization, and artificial neural networks. AI uses methods based on statistics, probabilities and economics. The information provide is disseminated and processed by machine learning and data processing and computer takes the decision as human works in that particular situation. It is used in fields of computer science, Information Engineering, mathematics, psychology, linguistics, philosophy etc.

Robots are the example of use of Artificial Intelligence. Development of AI raised many questions as computers are becoming 'intelligent' as humans are and may replace them in completion of complicated tasks. It will be more dangerous when they will be used to take decisions (automated decisions) for humans in various situations.

2.2.14 Cloud Computing

Cloud computing means on demand delivery of different Information technology services through internet tools and applications with pay-as-you go like data storage, servers, data bases and networking and software on an as-needed basis from cloud provider instead of buying them.[45]

[45] https://aws.amazon.com/what-is-cloud-computing/? (Last visited on February 20, 2019)

Earlier in 1960s, computer bureaus used to allow companies to rent a time on a main frame computer, rather than owning or buying it themselves. It was mostly associated with the large companies as IBM. In 1990s, telecommunication companies started offering Virtual Private Network (VPN) services at lower costs. Services on renting time was overtaken by personal computers (PC). This gave rise to data centres where companies store vast amount of data. Information is stored not on hard drive or local storage device but stored in cluster. It allows the companies to avoid or minimise the IT infrastructure costs and complexity of owning and maintain their own IT infrastructure. The use the services provided by paying for what they use and when they use.

In 2006, Amazon created its subsidiary Amazon Web Services and introduced Elastic Compute Cloud. After that many companies like Google, Microsoft Azure etc. started working as cloud service providers. National Information Centre (NIC), Government of India has also initiated National Cloud named "MeghRaj"[46] to facilitate the cloud computing services for India. It provides services like the Infrastructure as a Service (IaaS), Software as a Service (SaaS), and Platform as a Service (PaaS) and other services as Data Analysis, Resource Monitoring as a service, Vulnerability Assessment Service etc.

There are mainly three types of Cloud Computing services.[47]

1. Software as a Service (**SaaS**)-This provide on demand software service. The server infrastructure, Operating System and Software are managed by Cloud services. E.g. Microsoft.[48]
2. Infrastructure as a Service (**IaaS**)- In this basic virtual computer infrastructure resources like CPU, Memory, Disk storage etc. are provided by cloud. Clients can avoid purchasing software or servers and on demand get these resources outsourced. E.g. IBM [49]
3. Platform as a service (**PaaS**)- In this the Web and data base servers are pre-installed. It focuses on deployment and management of the applications of

[46] https://cloud.gov.in/ (Last visited on September 17, 2019)
[47] https://aws.amazon.com/what-is-cloud-computing/? (Last visited on September 17, 2019)
[48] https://aws.amazon.com/what-is-cloud-computing/? (Last visited on September 17, 2019)
[49] https://aws.amazon.com/what-is-cloud-computing/? (Last visited on September 17, 2019)

user, so he does not have to worry about resource procurement, capacity building, software management etc.[50]

There are different types of cloud. Main types are Public cloud, private cloud and hybrid cloud.

Public cloud- It provides services on servers and storage on internet. It is operated by third party companies. It handle and control all hardware, software and general infrastructure. The users receive services by accessing their own account with the cloud[51].

Private cloud- It is reserved for specific clientele, operated for single organisation. It may be managed internally or by third party. It has more specific security controls than public cloud[52].

Hybrid cloud -It is a combination of both public and private cloud. This type allows more flexibility to users. This is more complex cloud solution in that the organisation must manage multiple platforms and determine where data is stored. It also helps to optimise the user's infrastructure and security[53].

Cloud service providers, which are the third parties, provide services to small/large companies, individuals, government which are known as users. The cloud services can be used in two ways: i) It hosts a user's application which is typically provided as a web service accessible to anyone with Internet connection. ii) secondly, user transfers large amount of data over the cloud cluster along with associated application code for manipulating the data. The application codes are executed by cloud and results are returned to user. In both these situations, the data and application of the user remains, at least for some time, on cloud owned by third party.

[50] https://aws.amazon.com/what-is-cloud-computing/?(Last visited on September 17, 2019)
[51] https://cloud.liionis.edu/types-of-cloud-computing-private-public-and-hybrid-clouds (Last visited on September 17, 2019)
[52] https://cloud.liionis.edu/types-of-cloud-computing-private-public-and-hybrid-clouds (Last visited on September 17, 2019)
[53] https://cloud.liionis.edu/types-of-cloud-computing-private-public-and-hybrid-clouds (Last visited on September 17, 2019)

2.3 Encroachment on Right to Privacy

The legislature and judiciary find it very difficult to control the wrong behaviour of man due to technology. Science and technology have expanded the boundaries and therefore have shaken the foundations of normative, social and legal perceptions. Modern life cannot be imagined and complete without computer transactions. But these interfaces with the computer result many times in encroachment on personal space of an individual. They harm the personal life as well as the public life by disclosing the personal information of an individual. The privacy of the person is also endangered by this encroachment.

As transactions are facilitated by computers in various ways, attacks on the privacy, security and confidentiality of the information contained in the messages sent through computers are also increased. The security and confidentiality of the matter sent is compromised when the information technology is used by third party with wrong motives. Some scholars divide the criminal behaviour concerning computers and information technology into the categories like- a) computer crimes in proper form- for these offences like hacking computer and network is essential to the feasibility of the offence. b) Computer assisted crime-computer is used as medium to assist in the activity that is already prohibited by law. E.g. cyber-porn. c) Criminal activity where computer is contingent or accidental. E.g. fraud.[54]

The much needed space of a person is divided in three major and most important aspects. The first one is territorial privacy. A person wants his territory i.e. his property or place without interference of any third party, be it an individual or state. The second aspect is concerned with individual's ability to make choices without interference. This can be termed as 'decisional privacy'. This choice is not regarding the boundaries of the territory, but boundaries defined by him for choosing anything for him or his family. The third aspect of privacy is regarding protection of personal information. A person wants the information about him shall not be disclosed or processed or used without his knowledge or without his

[54] Paul Cullen computer crime, Lillian Edwards & Charlotte Waelde (Eds.), Law and the Internet: Regulating Cyberspace, (1997), Hart Publishing, Oxford, p.210.

prior permission by any other person or by any entity. He even wants to control the decision to give access to his personal information to others.

Some of the crimes which result in loss of privacy in any one or more aspects are -

Cyber stalking- "It is technology based attack on one person who has been targeted specifically for such attack for reasons of anger, revenge, or control. It may take forms, inter alia, like harassment, embarrassment and humiliation of victim, emptying his bank accounts, harassing family, friends, and employers to isolate victim, scare tactics to instil fear and more."[55] This list is not exhaustive. It may expand.

Crimes like stalking-which refers to harassing or threatening behaviour that an individual engages in repeatedly or continuingly towards another person by using information technology. This continuing harassment actually causes the victim to feel terrorised, frightened, intimidated, threatened, harassed, or molested and that would cause a reasonable to feel so. In cyber stalking, actions that usually leave no physical abuse or wounds.

Cyber stalking generally does not require the perpetrator and victim to stay in same territory. Even third parties can be instigated to harass and/or threaten a victim –impersonating the victim and posting inflammatory messages to bulletin boards and in chat rooms, causing viewers of that message to send threatening messages back to the victim.

Person's private life is threatened by disclosure of his personal information. This can be done by committing many offences. Some of them are:

Hacking- It means accessing computer illegally via internet. Data stored on the computer is stolen or damaged by such attacks. There are various kinds of 'hackers'. 'Code hackers' are the persons who know the computer inside out

[55], Alexis, Moore A, "What is cyber stalking?" http//www.womenissues.about.com/od/violenceagainstwomen/a/CyperPersonlln.html (Last visited on September 17, 2019)

and they can do anything they want from the computer. 'Crackers' break into computer systems and they circumvent any computer system. 'Cyber Punks' are masters of cryptography. Hacking is the menace and it has become so uncontrollable that even the largest companies find it difficult to cope up with it. Hacker may not commit any crime at that point of time but he makes copies of the data he accessed and he makes use of such information or data at later point of time.

Packet sniffer is a software application that uses a network adapter card in promiscuous mode-in which the network adapter card sends all packets received on the physical network wire to an application for processing- to capture all network packets that are sent across a local area network. Many freeware and shareware packet sniffers are available nowadays. These packet sniffers provide its user meaningful and sensitive information such as account names and passwords. Many users employ a single password for access to all accounts and applications. It is easy for the network sniffers to access the accounts and gather the sensitive information by applying single password.

Spoofing Attack- IP (Internet Protocol) **spoofing attack** means "act of disguising a communication from an unknown source as being from a known, trusted one.[56]" It occurs when an attacker outside the network pretends to be a trusted computer wither by using IP address that is within the range of IP addresses for the network or by using an authorised external IP address that you trust and to which you wish to provide access to specified resources on your network. This type of attack is limited to the injection of data or commands into an existing stream of data passed between a client and server application or peer-to-peer network connection. If he manages to change the routing tables to the spoofed IP address, he can receive all the information which is delivered to the original address and he can reply just as any trusted user can reply.

Physical access- Laptop theft is common. Any person can steal the computer or its components. But data stored in the computer and its theft is more valuable and therefore more harmful.

[56] www.forcepoint.com/cyber-edu/spoofing (Last visited on August 5, 2019)

Identity theft- Any person steals the personally identifiable information in order to assume the identity of the person.[57] Then he gains access to your finances or carry out illegal activities such as spamming.

Software piracy- It involves theft and unauthorised distribution of computer program often via internet. Pirated programs often fail to operate correctly and may contain viruses or other malicious program.

Virus- Type of malicious code or program written to alter the way a computer operates and is designed to spread from one computer to another.[58] They are computer programmes that can damage data or software stored on the computer or steal information. They infect the computer via internet or through storage devices e.g. USB drives and CD ROMs. Computer viruses replicate and make copies of them using host computer's resources by attaching to host computer or computer program. When an infected file is activated, or executed, or when the computer is started from an infected disk, the virus itself is also executed. Often it lurks in computer memory, waiting to infect the next program that is activated, or next disc that is accessed. They spread from computer to computer and from computer programme to program.

Most viruses attack personal computer. There are many types of personal computer viruses. Some of them are a) File infectors- they infect files by using applications such as spreadsheet programmes or games. When a user runs an infected application, the virus code executes first and installs itself independently in the computer's memory so that it can copy itself into subsequent applications that the user runs. Once in place, the virus returns control to the infected applications, the user remains unaware of its existence. b) boot-sector viruses- they reside in special part of diskette or hard disk that is read into memory and executed when a computer first starts. The boot sector normally contains the programme code for loading the rest of computer's

[57] https://searchsecurity.techtarget.com/definition/identitytheft (Last visited on August 5, 2019)
[58] https://us.norton.com/internetsecurity-malware-what-is-a-compter-virus.html (Last visited on August 5, 2019)

operating system. Once loaded, a boot sector virus can infect any diskette that is placed in the drive. It also infects hard disk, so that virus will be loaded into memory whenever the system is restarted. Boot viruses are highly effective. c) macro viruses- macro viruses are independent of operating systems and infect files that are usually regarded as data rather than programmes.

Worms- It is a programme that propagates itself over a network, reproducing itself as it goes. Computer worms can arrive as attachments in spam emails or instant messages.[59]

Trojan horse- They are type of virus disguised as useful software[60] e.g. Game or utility. After infecting, it can corrupt or steal data. It is malicious, security breaking programme that is disguised as something benign, such as a directory lister, archiver, game or even a programme to find and destroy viruses. Those who receive the Trojan are tricked to open because they appear to be receiving legitimate software or files from legitimate sources. Some Trojans are more annoying than malicious (like changing your desktop or madly behaving icons). Some do serious damage by deleting files and destroying information on your system. Trojans are also known to create a 'backdoor' on your computer that gives malicious users access to your computer system, possibly allowing confidential or personal information to be compromised. Unlike viruses and worms, Trojans do not reproduce by infecting other files nor do they self-replicate.[61]

Cookies- These are small files that website put on your personal computer to store information about you and your preferences and cookies can make your browsing experience better by letting sites remember your preferences or letting you avoid signing in each time you visit certain sites[62]. But this may be used to track the person because of his browsing history on computer. With the use of cookies, personal information can be collected and may be misused.

[59] https://us.norton.com/internetsecurity-what-is-a-computer-worm.html (Last visited on August 5, 2019)
[60] www.kaspersky.com/resource-centre/threats/trojens (Last visited on August 5, 2019)
[61] www.kaspersky.com/resource-centre/threats/trojens (Last visited on August 5, 2019)
[62] www.kaspersky.com/resource-centre/definitions/cookies (Last visited on August 5, 2019)

Spyware programs- They can be defined as "software designed to gather data from computer or other device and forward it to third party without consent or knowledge of the user. This usually includes confidential information like password, PINs and credit card numbers, tracking browsing habits etc.[63]

Ransomeware- It is a type of malicious software (malware) designed to block access to computer system until sum of money is paid.[64] It typically propagates as Trojan, entering a system through, e.g. a downloaded file or vulnerability in network service. The program then runs a payload, which typically takes the form of scareware program. It displays fake warning by an entity such as law enforcement agency under the pretext that here some unlawful activities are conducted[65]. Some payloads consist simply of application designed to lock or restrict the system until payment is made. It also uses the strong encryption to lock the system.

Spam messages are **t**hreats to person's own space and his **information and decisional privacy.** It means "unsolicited usually commercial messages (such as e-mails, text messages or internet posting) sent to number of recipients or posted in large number of persons."[66] They are very common while accessing any site through internet. These threats affect any person in three ways. One is by sending spams or unwarranted communication, person's privacy is threatened. Secondly, because of unwarranted communication like advertisements for sale of various consumer products, his decisional privacy is also affected and threatened. A person wants to make decision without any influence or any thought which is not his own. But advertisements or communication regarding any options which may not be as per his requirements but influenced by the opinion of advertiser. Thirdly, by using the communication technology or accessing internet, person's informational privacy is lost. His web browsing history is followed by the firms sorting out his tastes; his medical information is also used. His personal information may be

[63] www.kaspersky.com/resource-centre/threats/spyware (Last visited on August 5, 2019)
[64] www.us.norton.com/internetsecurity-malware-ransomware (Last visited on August 5, 2019)
[65] www.wickipedia.org (Last visited on August 5, 2019)
[66] https://merriam-webster.com/dictionary/spam (Last visited on August 5, 2019)

disseminated for the benefit of any other purpose for which it is not gathered. Sometimes it is exposed or disclosed in public, which is disadvantageous to him. This way a person loses control over his personal information and his privacy.

All the above are termed as computer contaminants, which are inserted in the computer by using information technology and internet. They corrupt the data or information in the computer. This encroachment may result in to loss of useful data and ultimately result into loss of informational and data privacy.

Pornography- Here the 'obscene' material is published online. There is explicit depiction of sexual subject matter, or display of material of erotic nature is done. Depiction of erotic behaviour (as in pictures or video tapes) is intended to cause sexual excitement. Subject matter is for sexual arousal.[67] Sexual material is often termed as 'obscene' in many cultures. 'Obscene' is relative term. What decides the taste of the person and society? It depends upon the social and moral norms of the society. Therefore what is 'obscene' in India may not be 'obscene' in Europe. In England, it is provided as "material that depraves and corrupts persons"[68]. In India, the Information Technology Act, 2000, covers the matter which is "lascivious and of prurient nature[69]". Again within the same national territory, the subject matter of 'lascivious' and 'of prurient nature' is also varying. No fixed boundaries can be set to catch the wrongdoer. Publishing the obscene material is violation and breach of physical privacy of person.

Threats on cloud computing- Because of increase in e-commerce transactions and personal transactions, computers are built with large data centres to handle ever growing load. These data centres consolidate more number of servers with the facility of infrastructure like storage, networking etc. The threats are explained by Younis et el "Number of inside threats and outside attacks have emerged for privacy, security and confidentiality of data stored or processed by cloud service providers. Inside threats like weak access control, flaw in designing system which is complex may result into improper configurations.

[67] Webster's Dictionary.
[68] Obscene Publication Act, 1959, S.1 at www.legislation.gov.uk/ (Last visited on August 5, 2019)
[69] The Information Technology Act, 2000 S.67

Outside attacks like TCP high jacking password guessing, data breaches and loss of data due to leakages are the highest threats"[70]. The users must have access and shall able to use the cloud without hindrance from government or any third party. Services of the cloud must be reliable.

It is expected that cloud service provider shall prevent unauthorised access to both data and application code and sensitive data will remain private. If cloud service provider does not act diligently and the personal data or information or sensitive information is leaked and misused, what is the liability of the cloud service provider? Many data protection laws are not providing the liability of cloud service provider. It is pertinent to note that General Data Protection Regulation by European Union provides for the liability of cloud service provider.

Today's information technology age has merged the otherwise distinct realms of the offline world and the virtual world. Cyberspace signifies digital revolution, high speed and limitless borderless expanse. The role of information technology in today's e-world is remarkable. It has extended efficiency, cost-effectiveness and accelerated productivity at individual and business and governmental level.

The traditional uses of computer and information technology are diminishing very fast. The cognitive functions in decision making which made the human being distinct and incomparable are intended to be replaced by new inventions in science and technology. The privacy threats which may result from the use of such technology which is used in IoT, Machine Learning, Data mining and Artificial Intelligence are not visible yet. In this situation, the privacy, security and confidentiality of the personal information or data is very difficult to maintain. On backdrop of this multi-potent technological advancement, the protection of privacy of any person is serious issue faced by the various legal

[70] Younis A.Younis, Kifayat Kashif & Merabti Majid, "Cloud Computing Security and Privacy Challenges" (2014) doi.10.13140/2.1.1779.6809 at https://www.researchgate.net.publication/268445145_Cloud_Computing_Security_Privacy-Challenges (Last visited on August 5, 2019)

systems. This critical issue can be effectively dealt with if the scope and nature of privacy is clearly defined. The researcher shall deal with the origin and development of right to privacy and the legislative treatment in different legal systems in the next chapter.