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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIT – IV - DISTRIBUTED DATABASE AND INFORMATION SYSTEMS- SCSA3008

UNIT 4

FUNDAMENTALS OF INFORMATION SYSTEMS

Defining information – Classification of information – Presentation of information systems – Basics of Information systems – Functions of information systems – Components of Information systems- Limitations of Information systems – Information System Design.

INTRODUCTION

A Distributed Database (DDB) is a collection of multiple, logically interrelated databases distributed over a computer network. It is often observed that term information system and information technology are used interchangeably. In a literal sense, information technology is a subset of information systems. Information systems consist of people, processes, machines and information technology. The great advancement in information systems is due to development in information technology and introduction of computers.

Information System

An information system can be defined as set of coordinated network of components, which act together towards producing, distributing and or processing information. An important characteristic of computer-based information systems information is precision, which may not apply to other types.

In any given organization information system can be classified based on the usage of the information. Therefore, information systems in business can be divided into operations support system and management support system.

Information Technology

Everyday knowingly or unknowingly, everyone is utilizing information technology. It has grown rapidly and covers many areas of our day to day life like movies, mobile phones, the internet, etc.

Information technology can be broadly defined as integration of computer with telecommunication equipment for storing, retrieving, manipulating and storage of data. According to Information Technology Association of America, information technology is defined as “the study, design, development, application, implementation, support or management of computer-based information systems.”

Information technology greatly enhances the performance of economy; it provides edge in solving social issues as well as making information system affordable and user friendly.

Information technology has brought big change in our daily life be it education, life at home, work place, communication and even in function of government.

Comparison of Information System and Information Technology

Information system and information technology are similar in many ways but at the same time they are different. Following are some aspects about information system as

well as information technology.

- Origin: Information systems have been in existence since pre-mechanical era in form of books, drawings, etc. However, the origin of information technology is mostly associated with invention of computers.
- Development: Information systems have undergone great deal of evolution, i.e. from manual record keeping to the current cloud storage system. Similarly, information technology is seeing constant changes with evermore faster processor and constantly shrinking size of storage devices.
- Business Application: Businesses have been using information systems for example in form of manual books of accounts to modern TALLY. The mode of communication has also gone under big change, for example, from a letter to email. Information technology has helped drive efficiency across organization with improved productivity and precision manufacturing.

Future of Information System and Information Technology

Information technology has shown exponential growth in the last decade, leading to more sophisticated information systems. Today's information technology has tremendously improved quality of life. Modern medicine has benefited the most with better information system using the latest information technology.
Information systems have been known to mankind in one form or the other as a resource for decision making. However, with the

CLASSIFICATION OF INFORMATION SYSTEM

In any given organization information system can be classified based on the usage of the information. Therefore, an information system in an organization can be divided into operations support system and management support system.

- **Operations support system**

In an organization, data input is done by the end user which is processed to generate information products i.e. reports, which are utilized by internal and or external users. Such a system is called operation support system.
The purpose of the operation support system is to facilitate business transaction, control production, support internal as well as external communication and update organization central database. The operation support system is further divided into a transaction-processing system, processing control system and enterprise collaboration system.

- **Transaction Processing System (TPS)**

In manufacturing organization, there are several types of transaction across department. Typical organizational departments are Sales, Account, Finance, Plant, Engineering, Human Resource and Marketing. Across which following transaction may occur sales order, sales return, cash receipts, credit sales; credit slips, material accounting, inventory management, depreciation accounting, etc.
These transactions can be categorized into batch transaction processing, single transaction processing and real time transaction processing.

- **Process Control System**

In a manufacturing organization, certain decisions are made by a computer system without any manual intervention. In this type of system, critical information is fed to the system on a real-time basis thereby enabling process control. This kind of systems is referred as process control systems.

- **Enterprise Collaboration System**

In recent times, there is more stress on team effort or collaboration across different functional teams. A system which enables collaborative effort by improving communication and sharing of data is referred to as an enterprise collaboration system.

- **Management Support System**

Managers require precise information in a specific format to undertake an organizational decision. A system which facilitates an efficient decision making process for managers is called management support system.

Management support systems are essentially categorized as management information system, decision support system, expert system and accounting information system.

Management information system provides information to manager facilitating the routine decision-making process. Decision support system provides information to manager facilitating specific issue related solution.

PRESENTATION OF INFORMATION SYSTEMS

There are various information systems, and the type of information system a business uses depends on its goal and objective. Here are the four main types of information systems:

Operations support systems – The first type of information system is the operation support system. Such type of information system mainly supports a specific type of operation in a business. An example is the transaction processing system used in all banks worldwide. This type of information system enables the service provider to assess a specific process of business.

Management information systems – This is the second category of information systems, consisting of hardware and software integration allowing the organisation to perform its core functions. They help in obtaining data from various online systems. The data thus obtained is not stored by the system; rather, it is analysed in a productive manner to help in the management of an organisation.

Decision support systems – An organisation can make an informed decision about its operations using decision support systems. It analyses the rapidly changing information that cannot be determined in advance. It can be used in completely automated systems and human-operated systems. However, for maximum efficiency combination of human and computer-operated systems is recommended.

Executive information systems – EIS or executive support system is the last category that serves as management support systems. They help in making senior-level decisions for an organisation.

Facts of information systems

The products of information technology are part of our daily lives. Here are some of the facts about information systems.

• Necessary for businesses to growEvery organisation has computer-related operations that are critical to getting the job done. In a business, there may be a need for computer software, implementation of network architecture to achieve the company's objectives or designing apps, websites, or games. So, any company that is looking to secure its future needs to integrate a well-designed information system.

•Better data storage and accessSuch a system is also useful for storing operational data, documents, communication records, and histories. As manual data may cost a lot of time, information systems can be very helpful in it. Information system stores data in a sophisticated manner, making the process of finding the data much easier.

•Better decision making Information system helps a business in its decision-making process. With an information system, delivering all the important information is easier to make better decisions. In addition, an information system allows employees to communicate effectively. As the documents are stored in folders, it is easier to share and access them with the employees.

BASICS OF INFORMATION SYSTEMS

Information is data that has been processed into a form that is meaningful to the user. An information system (IS) is an organized combination of people, hardware, software, communications network, and data resources that collects, transforms and disseminates information in an organization. Information systems and technologies have become a vital component of businesses and organizations. People rely on information systems to communicate with each other using a variety of physical devices (hardware), information processing instructions and procedures (software), communication channels (networks), and stored data (data resources). Information can be classified into facts, opinions, concepts, procedures, processes, principles, primary information, and secondary information. Apart from this, it can also be classified into several types based on its nature, usage, creation, application, structure, and form.

In order to present the information in a proper manner to the user, the data can be collected through two main methods - primary and secondary. Primary data collection refers to collecting original data or collecting data directly from the source. Secondary data collection refers to collecting data from secondary sources such as books, journals, research reports, online databases, Internet, etc. The user should check whether this data has been updated before analyzing the data and drawing conclusions.

The transmission of information between one person and another, takes place with the help of the communications system. Summarization and message routing are the two methods that increase the sending and receiving efficiency of the system. Individuals tend to exercise discretion over the content or distribution of information by message delay, message modification or filtering, inference or uncertainty absorption, and presentation bias.

The benefits of information in organizations include – it helps in management control, it helps in decision-making, and it helps to build models, backgrounds, and motivation. Quality of information is also a vital issue. The term 'quality' is subjective in nature and hence its parameters should be clearly defined in order to judge the quality of information. The various parameters of quality are validity, consistency, reliability, impartiality, and age.

Errors and bias occur as a result of giving too much importance and preference to the quantity of information rather than the quality. An IS accepts data resources as input and

processes it and delivers information products as output. Information systems consist of people resources (end users and IS specialists), hardware resources (machines and media), software (programs and procedures), data (data and knowledge bases), and networks (communications media and network support) to perform input, processing, output, storage, and control activities that convert data resources into information products.

Some of the important activities performed by an IS are processing of data into information, storage of data resources and control of system performance. Information systems perform three vital roles in any type of organization. They support business operations, support managerial decision- making, and provide strategic competitive advantage to the organization.

FEATURES AND FUNCTIONS OF INFORMATION SYSTEMS

The features and functions of information systems play a key role in helping businesses to make better, more informed decisions. Information systems aren't merely computers, instead they involve a combination of data, technology and people.

Features of information systems

Data
When data is entered in to an information system, it has to be entered in a way that can be managed and processed. When the data is processed it turns data into information which is then output to end users of the system. The data is generated from various sources such as different departments of a business as well as external sources. The data must be accurate or else the information output can be inaccurate or misleading.
People
Getting data and processing it involves the use of people in order to create information for specific uses or purposes that are relevant to a business. Staff training and skills in relation to information systems are important so that a business can get the most out of its information system.
Hardware
The hardware that IT systems use has to be capable of running the software required by the business and also be capable of handling a large amount of data and information processing. The hardware should be kept up to date which enables the fast capture, storage and use of data.
Software
The software that is used by businesses and the staff has to have the necessary features and functionality so that it can produce and use the information created by a business. The software should also have the features necessary for staff to carry out their work efficiently, for example: to analyse and process data and reports.
Telecommunications
The information that is produced by various departments in a business needs to be shared around a business as it will be used for different purposes. For doing this the telecommunications in a business needs to be effective so that the information shared and distributed goes to the correct destination after being processed.

Functions of information systems

There are various functions of information systems like the collection of input data, storage, processing, and producing the output information. The functions also control the information flow as well as the feedback loop. The systems can be also open and closed systems.

Input

The input in an information system has two types:

- Output is created with detailed data which is stored and processed
- The specification of what type of analysis is done must be specified by the user

Storage

The storage of Data should be done at the most detailed level possible. Regular backups and various summaries should be completed to avoid losing any important data due to errors. The backups should also be stored in a geographically different location to avoid any major disasters such as flooding or fires etc.. which could impact on both the original data storage and the backup data storage.

Processing

A process is a function which transforms data into information. A simple process would be adding up a number of items that is sold by a business by a variable such as the location of a store or the product or the time and date. More complex processes are the functions that perform calculations and can make assumptions about missing data in order to create information from the data available.

Feedback / control loops

A feedback / control loop is what happens to output when it is processed and produced. The system continuously repeats the same processes depending on the output of the last loop which can then impact on the input of the next data in to the loop. For example if a business might want to buy stock from a supplier if the stock level reaches 10. The system might check stock levels every hour (in a loop) and if the stock level is above 10, the loop continues without action until the point it hits 10 or under at which stage the command gets executed and new stock is ordered.

Output

There are two types of output in this context, graphical and textual:

- Graphical output is usually used to look at information on a larger scale which is then presented as charts, graphs, diagrams and pictures.
- Textual output is information on a smaller scale which is presented as charters, text or numbers.

Open and closed systems

The type of information systems can be defined as open or closed systems depending on how they react and interact with their environments:

- An open system will interact fully with its environment and is capable of handling any unexpected event as it monitors the environment which means that it can adapt the output depending on the circumstances.
- A closed system is separated and secluded from the environment which means they do not interact with it much. A closed system only interacts with the environment

when it is planned and predicted beforehand or as a part of an automated process. It works when it is triggered and only acts according to events. Closed systems do not have any effect on external environments. An automatic payroll calculator would be triggered by an event such as payroll day.

COMPONENTS OF INFORMATION SYSTEM

An Information system is a combination of hardware and software and telecommunication networks that people build to collect, create and distribute useful data, typically in an organization. It defines the flow of information within the system. The objective of an information system is to provide appropriate information to the user, to gather the data, process the data and communicate information to the user of the system.

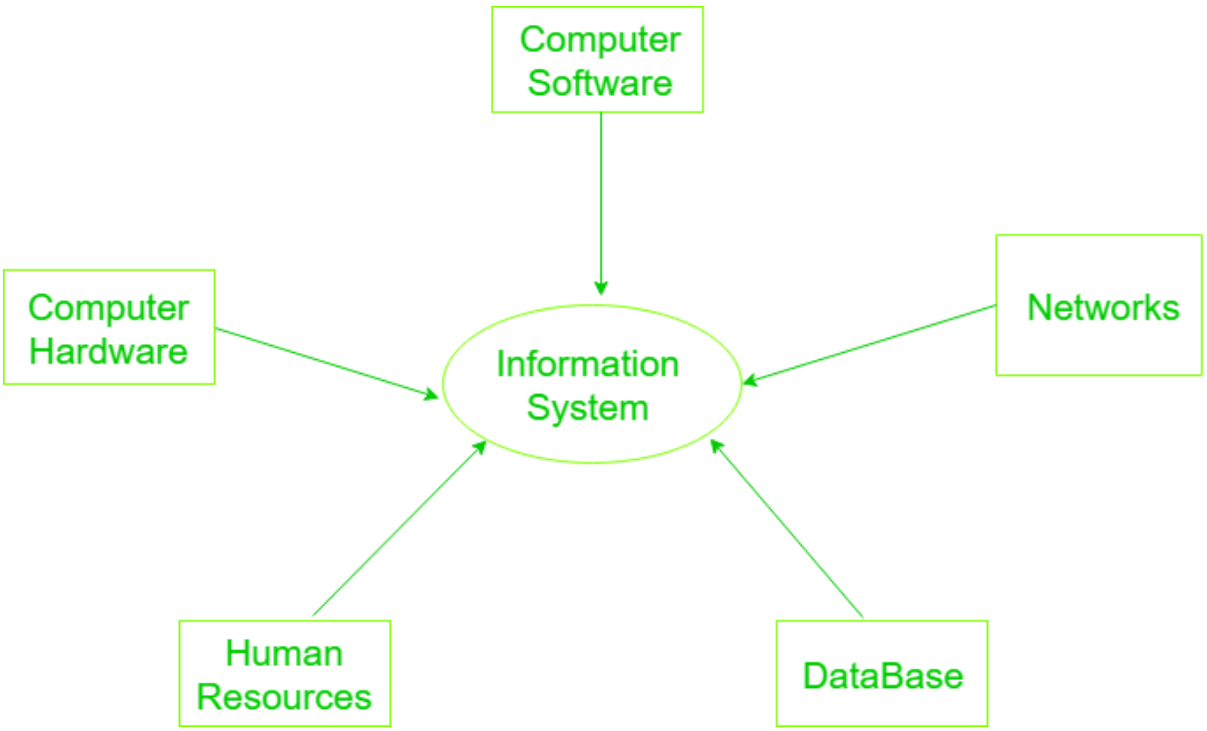

Fig 4.1 Classification of Information Systems

Components of the information system are as follows:

1.Computer Hardware:
Physical equipment used for input, output and processing. The hardware structure depends upon the type and size of the organization. It consists of an input and an output device, operating system, processor, and media devices. This also includes computer peripheral devices.

2. Computer Software:

The programs/ application program used to control and coordinate the hardware components. It is used for analysing and processing of the data. These programs include a set of instruction used for processing information.

Software is further classified into 3 types:

1. System Software
2. Application Software
3. Procedures

3. Databases:

Data are the raw facts and figures that are unorganized that are later processed to generate information. Softwares are used for organizing and serving data to the user, managing physical storage of media and virtual resources. As the hardware can't work without software the same as software needs data for processing. Data are managed using Database management system. Database software is used for efficient access for required data, and to manage knowledge bases.

4. Network:

- Networks resources refer to the telecommunication networks like the intranet, extranet and the internet.
- These resources facilitate the flow of information in the organization.
- Networks consists of both the physicals devices such as networks cards, routers, hubs and cables and software such as operating systems, web servers, data servers and application servers.
- Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by software.
- Networks include communication media, and Network Support.

5. Human Resources:

It is associated with the manpower required to run and manage the system. People are the end user of the information system, end-user use information produced for their own purpose, the main purpose of the information system is to benefit the end user. The end user can be accountants, engineers, salespersons, customers, clerks, or managers etc. People are also responsible to develop and operate information systems. They include systems analysts, computer operators, programmers, and other clerical IS personnel, and managerial techniques.

LIMITATIONS OF INFORMATION SYSTEM

Though information systems play a very important role in an organization, they also have certain limitations or drawbacks. Following are some of these limitations:

- Development of useful information is a very difficult task. It involves lot of money, time, and effort.
- The technology standards change much too often. This results in non-standardized systems.

- The companies that manufacture the hardware components of information systems do not follow a specific standard. Each manufacturer has a different set of standards and they change it from time to time.
- Though information systems are capable of performing a variety of tasks, they fail to present all types of information especially those that are linked to human beings. For instance, one of the aspects involved in evaluating employees is employee counseling. This process requires to be undertaken on a personal basis and an IS cannot be used to carry out this evaluation. Certain aspects can be well understood and interpreted by conducting a human analysis.
- Change in the hardware components make it difficult to enable sharing of information between systems. For instance, a computer system (or peripheral device) may not be compatible with another system or peripheral device to share data.
- The decision to use information systems in an organization might result in some amount of resistance from the employees. This resistance could be due to the fear of not understanding the use of systems, the fear of being laid off, etc.
- Information systems bring about a drastic change in the way information flows within the organization. Some employees, especially those at the managerial level, may feel threatened because of this.

In order to avoid resistance from the employees in the organization, it is important to set the goals of the organization, conduct training sessions for the employees, involve employees in building the system, and to counsel them from time to time to avoid any sort of resistance.

INFORMATION SYSTEM DESIGN

Different people use the word design in different contexts. When IS professionals speak of design, they are referring to business processes. Problems must be analyzed and requirements documented before solutions are designed, developed, and implemented. After all if the design does not satisfy the business need, then what's the point? However, satisfying the business need is really a baseline standard. The vilified hospital system described earlier meets the business need of registering patients. And yet its design is in other ways lacking. Similarly, fast food meets the need for feeding one's hunger. However, we want to be metaphorically better than fast food in our designs.

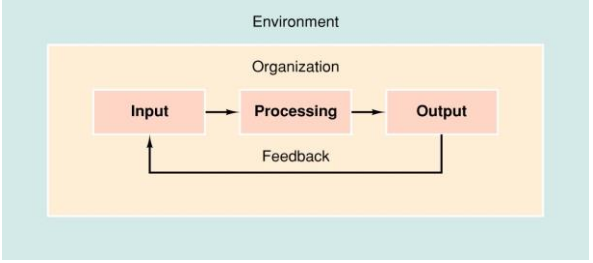

Fig 4.2 Elements of Information System

Usability describes how easy the system is to navigate. The easier the system is to navigate, the less time a user will need to spend learning to use the system. A more usable system also leaves less room for error. Usability theory provides rules of thumb (heuristics) that document best practice conventions for designing a user interface. Amazon.com has one of the most usable online systems because they follow established conventions. Following conventions tremendously increases the potential acceptance of your website or app.

Graphic design refers to the visual appeal and organization of the user interface. There is obviously some overlap here with usability. Usable systems typically adhere to at least some graphic design rules. However, a usable system could be bland and uninteresting. Employing graphic design principles helps ensure that the system will have visual appeal. Designs also need to fit with the overall brand of the client. Existing colors, fonts, and logos are all a part of the brand for which the system is being created.

Analytical Design describes how to best represent information—especially quantitative information—to communicate clearly and truthfully. Every information systems project has quantitative dimensions associated with project management. These include estimating costs, time schedules, and so forth.

Systems Development Life Cycle (SDLC)

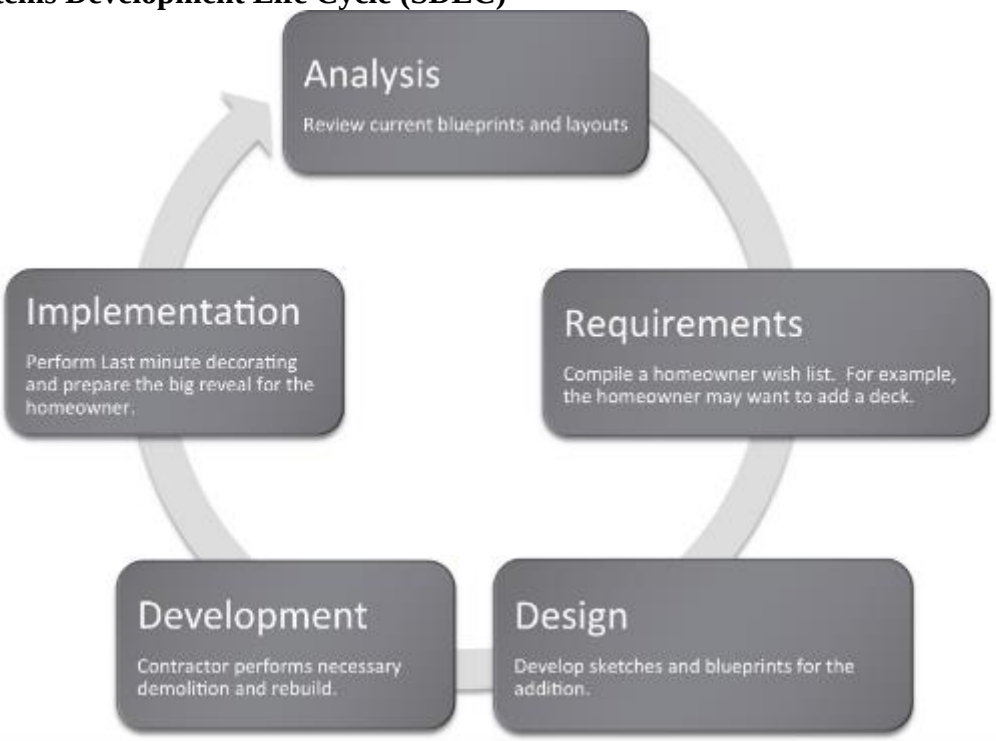

Fig 4.3 Architecture of SDLC

Information systems are designed using the systems development life cycle (SDLC). The SDLC is to a large extent common sense spelled out in stages. First, analyze the current situation. Then specify the requirements that a solution should embody. The next stage is to design a solution (no programming yet). Then the system is developed (programmed) and tested. Finally, the system goes live for the end users as it is implemented in the business setting. To review, the five phases are:

1. Analysis
2. Requirements (vision of future state)
3. Design
4. Development
5. Implementation

In this course we will cover all five stages. However we will focus most heavily on the first three stages for two reasons. First, because that is where IS professionals tend to spend most of their time and second because it is much easier to make changes to a system when in the planning stages, than after code has already been generated.

It is good to frequently interact with the end user and show them screen mockups and a systems architecture diagram of what the final system will look like. The systems architecture is a hierarchy diagram of the flow of the website or app—what the relationship between the pages of the system will be. It is sometimes called a site map. Ideally the systems architecture is done on paper with sticky notes that can be moved around at will by multiple users. A final systems architecture can be represented as a hierarchy chart in PowerPoint.

Once the systems architecture is complete, wireframes or mockups of the individual pages may be constructed. Mockups are non-functioning pages generated in a drawing program such as PhotoShop, Omnigraffle (Mac), or even PowerPoint. PowerPoint turns out to be a fairly respectable mockup tool—especially when working off of some predefined templates.