

Unit 1 Introduction to Contemporary Technology

1.1 Contemporary Technology

Contemporary technology refers to the latest advancements and innovations that are currently in use and significantly impacting various aspects of life, including business, communication, and daily routines. The present day digital world has gifted us with many innovation and sophisticated tools, techniques, and the means that have simplified our lives to much greater extent. Today, everybody relies on technology that has embraced all the fields of human lives. The contemporary technologies include a variety of technologies such as 3D printing, biotechnology, cloud computing, machine learning, artificial intelligence, robotics, big data, the internet of things(IOT), etc.

1.2 Need and effectiveness of contemporary Technology

Contemporary technologies are essential to modern society and have become an integral part of our daily lives. They have transformed the way we live, work, communicate, and interact with the world around us. Here are some of the needs and effectiveness of contemporary technology:

1. Efficiency:

Contemporary technologies are designed to improve efficiency and productivity in various fields and industries. For example, automation and robotics have revolutionized manufacturing processes, making them faster, more precise, and cost-effective.

2. Accessibility

Contemporary technologies have made it easier for people to access information, products, and services from anywhere in the world. For example, e-commerce platforms allow people to shop online and have products delivered to their doorstep, while telemedicine allows people to consult with doctors remotely.

3. Innovation:

Contemporary technologies have opened up new avenues for innovation, enabling people to create new products, services, and business models that were not possible before. For example, block-chain technology has enabled the creation of new forms of digital currency, while artificial intelligence has enabled the development of new applications and services.

4. Personalization:

Contemporary technologies have made it possible to personalize products and services to meet the unique needs and preferences of individuals. For example, machine learning algorithms can be used to personalize recommendations on e-commerce platforms, while augmented reality can be used to create personalized shopping experiences.

5. Sustainability:

Contemporary technologies have the potential to support sustainable development by reducing resource consumption, improving energy efficiency, and reducing carbon emissions. For example, smart grid technologies can be used to optimize energy consumption, while electric vehicles can reduce carbon emissions from transportation.

1.3 Applications of Contemporary technology

1. Communication
2. Office Productivity
3. Record Keeping
4. Internet and Search
5. Cloud Computing
6. Automation and Robotics
7. Virtual and Augmented Reality
8. Healthcare
9. Education
10. Business

1. Communication

Long distance communication is one of the area where technology has made a great impact on work place. Today email, fax, SMS, telephone, and various chat software tools have become the principle mode of communication. Also use of video conferencing is on rise, thus reducing the need for physical travel.

2. Office productivity

Word processing software, spreadsheet, digital presentation and other office productivity software have become so familiar in our daily activities. Their use has become routine, and this has completely transformed office work.

3. Record keeping

Business have switched to electronic database rather than paper files to store and access their records. This has become essential and every day part of our work environment.

4. Internet and search

Information retrieval and research using internet tools such as google has become essential tool for all work.

5. Cloud computing

Cloud computing is a technology that provides on-demand access to a shared pool of computing resources, such as servers, storage, and applications, over the internet. It is being used in various fields such as e-commerce, healthcare, and education.

6. Automation and Robotics

Many workers, especially in manufacturing sector, already work alongside autonomous robots.

7. Virtual Reality

Sales and marketing using Augmented reality (AR) and virtual Reality (VR) are becoming popular nowadays. For instance, Autocad “CAD software” which is often used by Architect Engineer to create blueprints and floor plans for houses and commercial buildings.

1.4 Advantages and Disadvantage of Contemporary Technology

Advantages

1. Ease of access to information

The www has made the world a social village. This is because information from all around the world is widely available on the internet.

2.It save a lot of time

Contemporary technology saves time by automating routine tasks, speeds up communication, and allows instant access to information and services. Whether at home, in the workplace technology reduces the time needed to perform everyday activities.

3.Ease of Mobility

Ease of Mobility is a key advantage of contemporary technology. Tools like online work platforms, cloud storage (e.g., Google Drive), and communication apps allow people to work and access important files from anywhere. his means you don't need to be tied to a specific location, whether you're traveling, at home, or in a different country, you can stay productive and connected.

4.Improve communication

Modern technology has blessed us with advanced communication technology tools such as Email, Mobile Phone, instant text messaging, WhatsApp etc.

5. Business Analysis

Business Analysis has greatly improved with the use of AI, making it more effective in the market. AI can quickly analyze large amounts of data, identify trends, predict customer behavior, and provide insights for better decision-making. This helps businesses create smarter marketing strategies, personalize customer experiences, and respond faster to market changes. As a result, companies become more competitive and efficient in reaching their goals.

6. Better learning Techniques

Better Learning Techniques are another major advantage of contemporary technology. Digital tools like educational apps, online courses, and interactive platforms make learning more engaging and accessible. Technologies such as AI tutors, virtual classrooms, and multimedia content help students understand complex topics more easily and at their own pace. This personalized and flexible approach improves retention, encourages self-directed learning, and supports learners of all ages and abilities.

7. Robotics helps to save human load by working 24/7 at any condition

Robots helps to reduce human workload by operating 24/7 in almost any condition. Robots can perform repetitive, dangerous, or physically demanding tasks without fatigue, improving efficiency and safety in industries like manufacturing, healthcare, and logistics. This allows human workers to focus on more complex or creative tasks while increasing overall productivity.

Disadvantages

1. Adoption of any new technology based devices may be hard
2. Technology has replaced human powers and make the human jobless
3. Some of the modern technology based devices need technical skills to operate them
4. It requires higher maintenance cost
5. Unskilled labors have lost their jobs due to arrival of modern technology based devices or equipment
6. It can be a huge waste of time due to addiction to modern gadgets
7. Increase in cybercrime.

1.5 Changes brought by present used contemporary technologies.

Contemporary technologies have brought about significant changes to the way we live, work, and interact with the world around us. Here are some of the key changes that have been brought about by present used contemporary technologies:

1.Communication:

Contemporary technologies have transformed the way we communicate with each other. Social media platforms like Facebook, Twitter, and Instagram have enabled people to connect and share information with others around the world.

2.Business:

Contemporary technologies have revolutionized the way businesses operate. E-commerce platforms like Amazon and Alibaba have made it possible for people to buy and sell products online, while cloud computing has enabled businesses to access a range of computing resources over the internet.

3.Entertainment:

Contemporary technologies have transformed the entertainment industry. Streaming platforms like Netflix and YouTube have made it possible for people to watch movies, TV Shows, and other content on demand, while virtual and augmented reality technologies have enabled new forms of immersive entertainment.

4. Healthcare:

Contemporary technologies have improved healthcare outcomes by enabling new forms of diagnosis, treatment, and patient care. Telemedicine has enabled people to consult with doctors remotely, while wearables and other digital health technologies have enabled people to monitor their health and fitness in real time.

5.Education:

Contemporary technologies have transformed the way we learn and access education. E-learning platforms like Coursera and edX have made it possible for people to access courses and educational resources from anywhere in the world, while virtual and augmented reality technologies have enabled new forms of immersive and interactive learning experiences.

Unit 2 E-commerce

2.1 Introduction to E-Commerce

E-commerce stands for “Electronic Commerce” which refers to the buying and selling of goods and services over the internet. E-commerce is often used to refer the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet. It is a paperless exchange of business information. Transaction of money, funds and data are also considered as e-commerce. Amazon is the world largest e-commerce site. An estimated 2 billion people worldwide buy goods and services online through Amazon. Some e-commerce sites are: Amazon, Flipkart, Alibaba, Daraz, Ebay, etc.

2.2 Components of E-commerce

E-Commerce involves various components that work together to enable online buying and selling of goods and services. Some of the components of e-commerce of e-commerce are described below

1. User
2. E-commerce vendor
3. Internet
4. Website/Marketplace
5. Web servers
6. Database servers
7. Payment gateway

1. User

The user is the person who visits an e-commerce website to buy or sell goods and services. The users are **customer or consumer** who browses, selects, and purchases products or services online. They interact with the e-commerce platform through websites or apps.

2. E-Commerce Vendor

The e-commerce vendor is the **seller or business** that offers goods or services online. They manage the product listings, pricing, inventory, and customer service.

3. Internet

The internet is the **backbone** of e-commerce. It provides the platform for communication between users, vendors, and systems like payment gateways. Internet enables user to access e-commerce website and connect with vendors,

4. Website/Marketplace

This is the **online storefront** where users can view and purchase products. Examples include Amazon, Flipkart, or a company's own website. It provides a user interface for searching, viewing, and buying products.

5. Web Servers

Web servers **host the e-commerce website** and handle requests from users like opening a webpage or adding a product to cart. They ensure that the website is available 24/7 to customers.

6. Database Servers

These store all the **data related to products, customers, orders, and inventory**. They help in retrieving product information, user details, and order history during transactions.

7. Payment Gateway

A payment gateway is a **secure system** that processes online payments. It connects the e-commerce site with banks or digital wallets to approve and complete payments.

2.3.1 Types/Models of E-commerce

E-commerce encompasses various types of online commercial transactions and interactions. There are many types of e-commerce. It depends on who the final consumer is. Some of types of e-commerce are as follows.

1. Business-to-Consumer

2. Business-to- Business

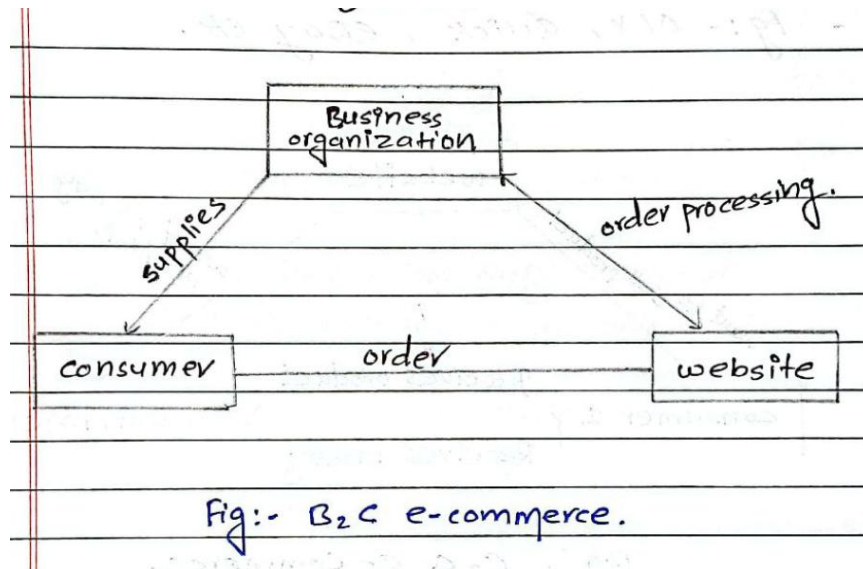
3. Consumer-to-Consumer

4. Consumer-to-Business

5. Mobile Commerce(M-commerce)

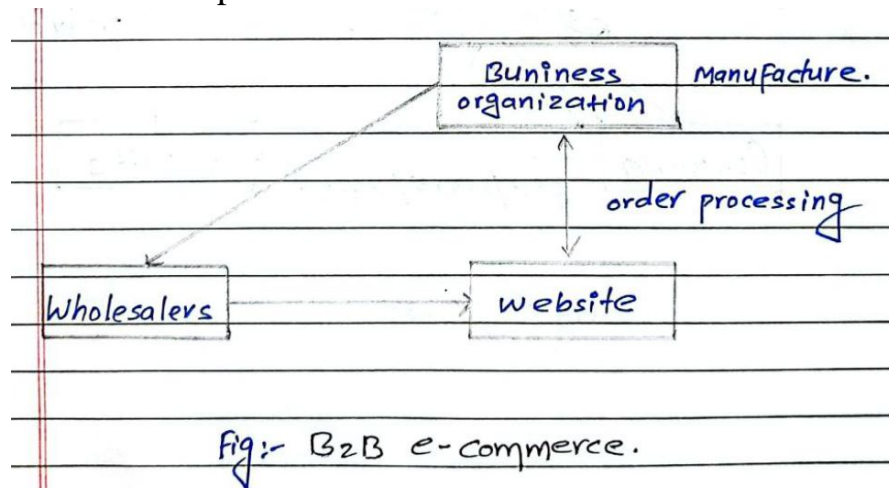
1. Business-to-Consumer

Business-to-Consumer (B2C) is the most common type of e-commerce, where businesses sell products or services directly to individual consumers. This model is widely used by online retailers, service providers, and marketplaces. Customers can browse products, compare prices, place orders, and make payments all through an online platform. Examples of B2C e-commerce include shopping on websites like Amazon, Flipkart, Daraz, etc. This model focuses on convenience, competitive pricing, and customer satisfaction.



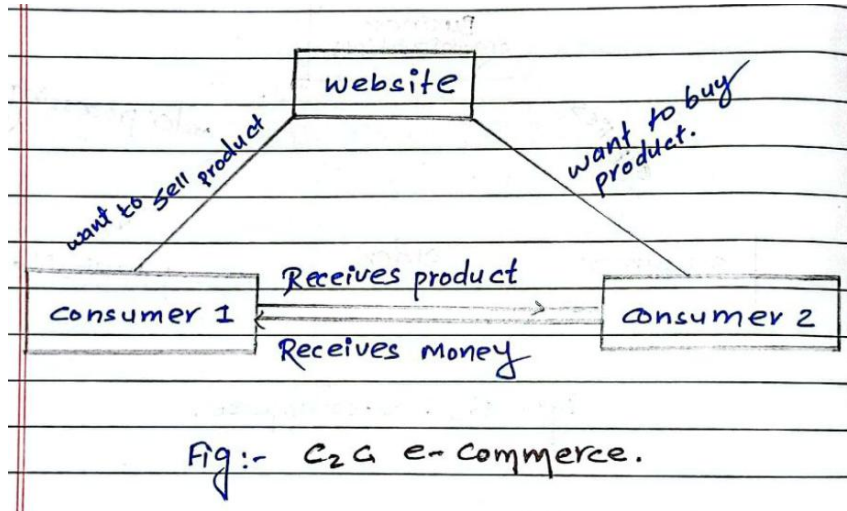
2. Business-to-Business (B2B)

Business-to-Business (B2B) e-commerce involves transactions between two businesses. One business sells goods or services to another business, often in large quantities. These platforms are used by wholesalers, manufacturers, and suppliers who deal with retailers or other companies. The B2B model usually involves bulk orders, long-term contracts, and negotiated pricing, making it different from direct consumer sales. Examples: Alibaba



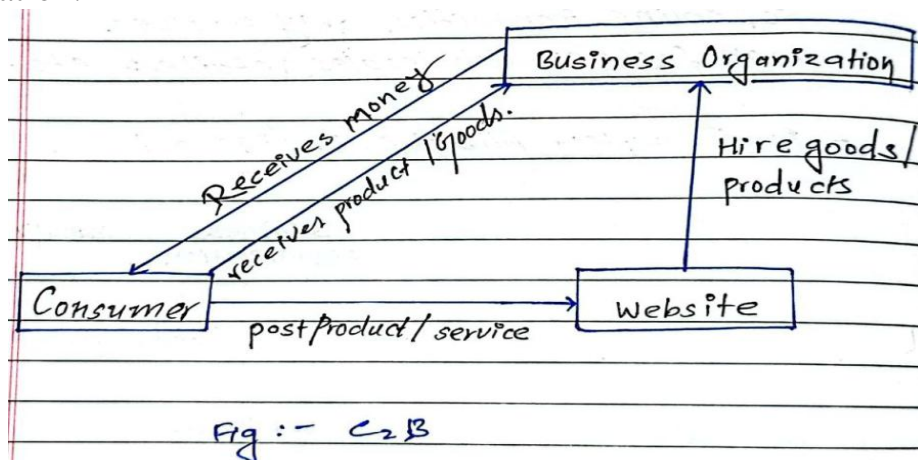
3. Consumer-to-Consumer (C2C)

Consumer-to-Consumer (C2C) e-commerce allows individuals to sell products or services directly to other individuals. These transactions are typically facilitated by third-party platforms that connect sellers and buyers. This model is popular for selling used or second-hand items, such as electronics, furniture, and clothing. C2C e-commerce is peer-to-peer in nature and often involves personal negotiation between the parties.



4. Consumer-to-Business (C2B)

Consumer-to-Business (C2B) e-commerce is a reverse model where individuals offer products or services to companies. In this model, freelancers or individuals sell their skills, content, or services to businesses. It is commonly used in areas like graphic design, content writing, and digital marketing. Platforms such as Freelancer, and Fiverr are examples of C2B e-commerce. This type of e-commerce provides flexibility to both individuals and businesses in terms of pricing and service customization.



5.Mobile Commerce (M-Commerce)

Mobile Commerce (M-Commerce) refers to buying and selling of goods and services through mobile devices like smartphones and tablets. It is a growing segment of e-commerce due to the widespread use of mobile technology and internet access. M-commerce enables users to shop, pay bills, book tickets, and conduct financial transactions using mobile apps. The key features of M-commerce include portability, convenience, and speed. Examples: Amazon, Flipkart, etc.

2.3.2 Applications of E-commerce

1. Online retail
2. Online marketplace
3. Food delivery
4. Online banking and finance
5. Education and E-learning
6. Digital advertising
7. E-government services
8. Healthcare
9. (go through internet or book and write yourself for other applications area)

1. Online Retail

E-commerce has revolutionized the retail industry, allowing consumers to shop online for vast array of products from clothing and electronics to groceries and furniture. E-commerce has enabled business to sell products and services. It includes platforms like amazon, ebay, shopify, etc.

2. Online marketplace

E-commerce platforms such as Daraz, Amazon has provided an ecosystem for individual and business to sell products, often connecting buyers and sellers directly.

3. Food Delivery

E-commerce has revolutionized the food industry by enabling online food ordering and delivery. Users can order food from their favorite restaurants using apps or

websites like foodMandu and pathaoFood. These platforms offer live tracking, digital payments, and access to a wide range of cuisines, making the process quick and convenient.

4. Online banking and finance

E-commerce is widely used in the banking and finance sector. Services like online banking, mobile wallets, digital payments, and online investment platforms make financial transactions easier and faster. Apps like Khalti, e-sewa, and mobile banking provide users with 24/7 access to their accounts, bill payments, and even loan applications, without visiting the bank.

5. Education and E-learning

Students can access courses, study materials, and lectures from anywhere using platforms like Coursera, Udemy, etc. These services offer interactive content, video tutorials, online tests, and certifications, making education more accessible and flexible.

6. Digital Advertising

Digital advertising is a key e-commerce application where businesses promote their products or services online. This includes ads on search engines, social media, websites, and video platforms. Companies like Google and Facebook offer tools for targeted advertising based on user interests and behavior, allowing businesses to reach the right audience effectively.

7. E-Government

Governments use e-commerce to provide public services online, improving efficiency and accessibility. E-government services include online tax filing, passport applications and utility bill payments. These platforms save time for citizens and increase transparency in public services.

8. Healthcare

In the healthcare sector, e-commerce enables online consultations, medicine delivery, appointment booking, and access to health records. Online health Platforms allow users to consult doctors remotely, order medicines, and manage their health digitally. This is especially useful for patients in remote areas during emergencies.

2.3.3 Advantage and Disadvantage of E-commerce

Advantages of E-commerce

1. Global Reach
2. Convenience
3. Personalization
4. Ease of Comparison
5. Cost Saving
6. Time Saving
7. Convenient Payment
8. Scalability

1. Global Reach:

E-commerce allows businesses to reach customers across the globe, breaking geographical barriers that limit traditional business market. This global access helps even small businesses tap into international markets, increase brand visibility, and boost sales. Customers from different countries can browse and purchase products anytime, without being physically present.

2. Convenience

One of the most significant advantages of e-commerce is its convenience. Customers can shop 24/7, without the constraints of store hours or long travel distances. This ease of access is especially valuable for people with busy schedules, those living in remote areas, or individuals with limited mobility.

3. Personalization

E-commerce platforms can offer personalized experiences by using customer data and browsing history. This allows businesses to recommend products, offer special deals, and tailor marketing messages to individual preferences. Personalization not only improves customer satisfaction but also increases the likelihood of repeat purchases.

4. Ease of Comparison

With e-commerce, customers can easily compare products, prices, and reviews across multiple sellers. This transparency helps shoppers make informed decisions and find the best value for their money. Unlike physical shopping, where comparison requires visiting multiple stores, online platforms offer comparison tools at the click of a button.

5. Cost Saving

E-commerce reduces costs for both businesses and consumers. Businesses save on expenses related to rent, utilities, and staff needed for physical stores, while consumers often benefit from lower prices and exclusive online discounts. Additionally, the reduced need for intermediaries in the supply chain can lead to further savings.

6. Time Saving

Shopping online saves significant time. Customers can find, compare, and order products quickly without physically moving between stores. E-commerce also allows for faster transactions and delivery options, which is ideal for busy individuals or those looking to avoid long queues and crowds.

7. Convenient Payment

E-commerce offers multiple secure payment options, including credit/debit cards, digital wallets, UPI, and even cash on delivery. This flexibility makes transactions smoother and accommodates a wide range of customer preferences. The automation of payment processes also adds to the overall ease and efficiency of online shopping.

8. Scalability

E-commerce platforms are highly scalable, allowing businesses to grow rapidly with minimal extra investment. As demand increases, companies can easily expand their product offerings, serve more customers, and handle higher transaction volumes without significant changes to their infrastructure. This scalability supports long-term growth and market adaptability.

Disadvantage of E-commerce

- 1.Security Concerns
- 2.Lack of Tangibility
- 3.Delivery Challenges

4.Customer Trust

5.Return Issues

1. Security Concerns

One of the major disadvantages of e-commerce is the risk of security breaches. Customers share sensitive information like credit card details and personal data, which can be vulnerable to hacking, phishing, or fraud if not properly protected. Businesses must invest heavily in cybersecurity measures, and any data breach can damage their reputation and lead to legal consequences.

2. Lack of Tangibility

In e-commerce, customers cannot physically touch, try, or examine products before purchase. This lack of tangibility can lead to uncertainty about the product's quality, fit, or appearance. As a result, some customers may hesitate to buy certain items online, especially clothes, furniture, or other products where physical inspection is important.

3. Delivery Challenges

Shipping and delivery pose logistical challenges in e-commerce. Delays, damaged goods, high shipping costs, or incorrect deliveries can negatively affect the customer experience. In some regions, limited access to reliable delivery services further complicates order fulfillment, making it difficult to maintain customer satisfaction.

4. Customer Trust

Building trust in an online environment can be difficult, especially for new or lesser-known businesses. Customers may be wary of scams, poor service, or fake products. Unlike physical stores where buyers can directly interact with staff, e-commerce relies on virtual communication, which may not always reassure customers effectively.

5. Return Issues

Returning products in e-commerce can be more complicated and time-consuming than in physical stores. Customers may face unclear return policies, shipping costs, or delays in refunds. These return-related hassles can discourage future purchases and impact customer loyalty, especially if the process is not straightforward or customer-friendly.

2.4.1 Scope of E-commerce in Nepal

Some of the key aspects that illustrates the potential and scope of e-commerce in Nepal

1. Increase internet penetration
2. Young and tech-savvy population
3. Rise in Smartphone usage
4. Diverse Product Demand
5. Cross border E-commerce
6. Entrepreneurship
7. Improving Payment infrastructure
8. Government initiatives

(Homework: explain above points by yourself, you can follow your book)

2.4.2 Governments policy and steps in implementation of E-Commerce

1. E-commerce policy
2. Digital payment promotion
3. Cyber security measures
4. Ease of Doing Business
5. Digital literacy program
6. Infrastructure development
7. Awareness and promotion program

(Homework: explain above points by yourself, you can follow your book)

Unit 3 E-governance

3.1 Introduction to E-Governance

E-governance is the application of information technology to the processes of government functioning to bring about smart, moral, accountable, responsive, and transparent governance. **In another words**, E-governance is the utilization of information and communication technologies (ICTs) by government authorities to enhance the efficiency, transparency, accessibility and overall qualities of public services and interactions with citizens, businesses and other entities.

Examples of e-governance include online tax filing systems, electronic voting systems, online portals for citizen engagement and feedback, and digital government service delivery platforms. These initiatives are designed to improve efficiency, reduce costs, enhance transparency and accountability, and promote citizen participation in the democratic process.

3.2 Components of E-governance

1. ICT Infrastructure
2. Government Portals
3. Digital Services
4. Secure Authentication
5. Data Management
6. Capacity Building
7. Cyber Security Measures
8. Legal and Regulatory Frameworks
9. Interoperability Standards

1. ICT Infrastructure

Infrastructure and information infrastructure is the backbone of E-governance. The development of e-governance requires a strong information and communication technology (ICT) infrastructure, including internet connectivity, hardware, software, and databases.

2. Government Portals

Government portals serve as centralized online platforms where citizens and business can access a wide range of government services, information and resources. E-governance also involves the development and maintenance of government websites that provide citizens with access to information and services, such as online forms and payment systems.

3.Digital Services

E-governance enables the delivery of government services online, including applications for permits and licenses, tax payments, and citizen complaints and feedback. These services are accessible through government websites, mobile apps and other digital channels.

4.Secure Authentication

Secure authentication is one of the most important component of E-governance. Secure mechanism such as digital IDs, biometrics, and two-factor authentication are critical for verifying the identity of users and ensuring the security of online transaction and data.

5.Data Management

Effective data management involves the collection, storage, processing, and analysis of large volumes of government data. It ensures data accuracy, consistency, and availability for informed decision-making and service delivery. Proper data governance policies are crucial for maintaining privacy, securing personal data, and ensuring compliance with data protection regulations.

6. Capacity Building

Capacity building focuses on developing the technical and managerial skills of government employees and stakeholders involved in implementing e-governance. This includes training programs, workshops, and continuous learning to ensure staff can efficiently use digital tools and adapt to evolving technologies. A well-trained workforce is essential for the sustainability and success of e-governance initiatives.

7. Cyber Security Measures

Cyber security is critical for protecting digital government systems from cyber threats, data breaches, and malicious attacks. It involves implementing firewalls, encryption, intrusion detection systems, regular audits, and security protocols to safeguard sensitive government and citizen data. Ensuring robust cyber security builds public trust and keeps digital infrastructure safe and resilient.

8. Legal and Regulatory Frameworks

Legal and regulatory frameworks provide the legal backing for e-governance activities. These include laws on electronic transactions, data protection, privacy, cybercrime, and digital signatures. A strong legal foundation ensures accountability, protects user rights, and provides the framework for resolving disputes arising from digital governance services.

9. Interoperability Standards

Interoperability standards enable different government systems and platforms to work together seamlessly. These standards ensure that data and services can be shared across departments and levels of government without technical barriers. Interoperability enhances coordination, reduces duplication of efforts, and allows for integrated service delivery to citizens.

3.2 Advantages of E-governance

1. Increased Accessibility
2. Improved Efficiency
3. Cost Saving
4. Transparency
5. Citizen Engagement
6. Better Service Quality
7. Accountability

Disadvantage

1. Digital Divide
2. Security Concerns
3. Privacy Issues
4. Digital illiteracy
5. Resistance to Change
6. Complexity

(Explain above points by yourself)

3.4 Scope of E-governance and Government policy and steps in implementation of E-governance

(Write yourself from your book)

Unit 4 Cloud Computing and the Internet of Things

4.1 Introduction to Cloud Computing

Cloud computing is a kind of **outsourcing of software**, data storage, and processing. Users access applications and files by **logging in from any device** that has an internet connection. Information and programs are **hosted by outside parties** and reside on a global network of secure data centers instead of on the user's hard drive. This frees up processing power, facilitates sharing and collaboration, and allows secure mobile access regardless of where the user is or what device is being used.

Cloud computing is a more efficient way of delivering computing resources. With cloud computing, software and service environments are **subscription-based** i.e. users pay a monthly fee instead of buying licenses. Software and platforms are managed by the providers and are updated continuously for maximum performance and security. **Computing power is remote** instead of centralized, so users can tap into extra capacity if business spikes. Multiple people can access a shared program or file and **collaborate in real time** from different locations.

“Cloud computing is the on-demand availability of computing resources as services over the internet. It eliminates the need for enterprises to procure, configure, or manage resources themselves, and they only pay for what they use.”

4.2.1 Features of cloud computing

Cloud computing offers several key features and characteristics. Some of them are described below

- 1.On-demand self service
- 2.Broad network Access
- 3.Resource pooling
- 4.Rapid elasticity
- 5.Measured service

1. On-demand self-service

Cloud computing resources can be **provisioned without human interaction from the service provider**. In other words, a manufacturing organization can provision additional computing resources as needed without going through the cloud service provider. This can be a storage space, virtual machine instances, database instances, and so on. Manufacturing organizations

can use a **web self-service portal as an interface to access their cloud accounts to see their cloud services**, their usage, and also to provision and de-provision services as they need to.

2. Broad network access

Cloud computing resources are available over the network and can be **accessed by diverse customer platforms**. In other words, cloud services are available over a network ideally high broadband communication link such as the internet, or in the case of a private cloud it could be a local area network (LAN).

Network bandwidth and latency are very important aspects of cloud computing and broad network access, because they relate to the quality of service (QoS) on the network. This is particularly important for serving time sensitive manufacturing applications.

3. Resource pooling

Resource pooling means that multiple customers are serviced from the same physical resources. Providers' resource pool should be very large and flexible enough to service multiple client requirements and to provide for economy of scale. When it comes to resource pooling, resource allocation must not impact performances of critical manufacturing applications.

4. Rapid elasticity

One of the great things about cloud computing is the availability of resources in the cloud as service users need them. And then to remove them when they don't need them. Cloud computing resources can scale up or down rapidly and, in some cases, automatically, in response to business demands. It is a key feature of cloud computing. The usage, capacity, and therefore cost, can be scaled up or down with no additional contract or penalties.

5. Measured service

Cloud computing resources usage is metered and manufacturing organizations pay accordingly for what they have used. The cloud resource usage gets monitored, measured and reported by the cloud service provider. The cost model is based on "pay for what you use" i.e. the payment is variable based on the actual consumption by the manufacturing organization.

4.2.2 Components of Cloud Computing

The fundamental components of the cloud computing architecture are:

- Front-end cloud Component
- Back-end cloud Component

Front End Cloud Architecture

The front-end infrastructure includes everything that the end-user interacts with. It forms an essential part of how the end-user connects to the cloud computing infrastructure. The front-end cloud infrastructure includes components like local networks, web browsers, and web applications.

The main front-end cloud components are described below:

- **User Interface:** The user interface refers to all the things that end-user access to send requests or perform any task on the Cloud. Some of the popular cloud-based user interfaces are Google Doc, Gmail, etc.
- **Software:** The software architecture in the front end is the software that runs on the user's end. Frontend software architecture primarily comprises client-side applications or browsers.
- **Client Device or Network:** Being a crucial part of the frontend architecture, Client Device or Network refers to the hardware at the end user's side. It can be any input device or PC. In cloud computing, the client-side device doesn't require extraordinary ability to process the heavy load. The cloud can take the entire heavy load and processes the same.

Back End Cloud Component

The backend architecture in the cloud empowers the frontend architecture. It comprises hardware & storage and they are located on a remote server. The cloud service provider controls and handles this backend cloud architecture.

Ideal backend cloud architecture always should be robust as it holds the whole infrastructure on the cloud. The prime components of backend cloud architecture are:

- **Application:** The Application is a substantial part of the backend architecture. It refers to the user interface that the backend offers to the end-user to send queries. This layer of the backend takes care of the client's requests and requirements.
- **Service:** This is a magical area of the backend cloud architecture. It adds utility to the entire backend architecture. The service handles every task that runs on the cloud computing system. Some of the cloud services are application development environment, storage, and web services. Besides, service can execute a wide array of tasks on the cloud runtime.
- **Cloud Runtime:** The term 'Cloud Runtime' is the concept where the services run. It's like a cloud operating system where technology like virtualization is used. *Virtualization* as a key technology on the cloud which allows multiple runtimes on the same server. For instance, virtualization is a way via which we can create a base of

software. In simple words, it's the virtual representation of apps, servers, storage as well as networks. When we create runtimes with the support of virtualization software, they are called as Hypervisors. Some of the leading hypervisors are Oracle Virtual Box, Oracle VM for x86, VMWare Fusion, etc.

- **Storage:** Storage in the cloud is where the data resides of a cloud application. The data storage varies as per different cloud service providers. However, all of them have a common dedicated segment for cloud storage. Some of the examples of storage are solid-state drives, hard drives, Intel Optane DC Persistent storage, etc.
- **Infrastructure:** The engine that steers all the cloud software services is called infrastructure. It includes CPU, Motherboard, Graphics Processing Unit (GPU), network cards, accelerator cards, etc. The infrastructure models always depend on the workloads of the clients.
- **Management:** The management software allocates specific resources to specific tasks and is responsible for the flawless functioning of any cloud environment. In technical terms, management is the 'middleware' and it coordinates between the frontend and backend architecture in a cloud computing system.
- **Security:** Security is an integral and critical part of any cloud computing infrastructure. We create security infrastructure by keeping the debugging process in mind. In case of any issue, debugging should be easy. Regular storage backup is the first step to ensure security in a cloud computing system. And virtual firewalls are other crucial elements of the cloud security infrastructure.

4.3 Classification of Cloud Computing

Cloud computing can be classified into several categories based on service models, deployment models, and specific functionalities. The main classification of cloud computing are as follows

1. Service models

2. Deployment Model

3. Specialized Cloud types

4. Functionality based classifications

1. Service models

Cloud computing service models represent different layers of cloud offerings, each with varying levels of control and responsibility for the cloud service and the cloud consumer.

The primary cloud service models are:

- i. Infrastructure as a service (IaaS)
- ii. Platform as a service (PaaS)

iii. Software as a service (SaaS)

i. Infrastructure as a service (IaaS)

Infrastructure as a Service (IaaS) is a type of cloud computing that gives people access to IT tools like virtual computers, storage, and networks through the internet. You don't need to buy or manage physical hardware. Instead, you pay only for what you use.

Here are some key benefits of using IaaS:

- **Flexibility and Control:** IaaS comes up with providing virtualized computing resources such as VMs, Storage, and networks facilitating users with control over the Operating system and applications.
- **Reducing Expenses of Hardware:** IaaS provides business cost savings with the elimination of physical infrastructure investments making it cost-effective.
- **Scalability of Resources:** The cloud provides in scaling of hardware resources up or down as per demand facilitating optimal performance with cost efficiency.

ii. Platform as a service (PaaS)

Platform as a Service (PaaS) is a cloud computing model where a third-party provider offers the software and hardware tools needed to develop, test, and run applications. This allows users to focus on building their applications without worrying about managing servers or infrastructure.

Here are some key benefits of using PaaS:

- **Simplifying the Development:** Platform as a Service offers application development by keeping the underlying Infrastructure as an Abstraction. It helps the developers to completely focus on application logic (Code) and background operations are completely managed by the AWS platform.
- **Enhancing Efficiency and Productivity:** PaaS lowers the Management of Infrastructure complexity, speeding up the Execution time and bringing the updates quickly to market by streamlining the development process.
- **Automation of Scaling:** Management of resource scaling, guaranteeing the program's workload efficiency is ensured by PaaS.

- **For example,** AWS Elastic Beanstalk is a PaaS offered by Amazon Web Services that helps developers quickly deploy and manage applications while AWS takes care of the needed resources like servers, load balancing, and scaling.

iii. **Software as a service (SaaS)**

Software as a Service (SaaS) is a way of using software over the internet instead of installing it on your computer. The software is hosted by a company, and you can use it just by logging in through a web browser. You don't need to worry about updates, maintenance, or storage the provider takes care of all that.

A common example is Google Docs. You can write and share documents online without downloading any software.

Here are some key benefits of using SaaS:

- **Collaboration And Accessibility:** Software as a Service (SaaS) helps users to easily access applications without having the requirement of local installations. It is fully managed by the AWS Software working as a service over the internet encouraging effortless cooperation and ease of access.
- **Automation of Updates:** SaaS providers manage the handling of software maintenance with automatic latest updates ensuring users gain experience with the latest features and security patches.
- **Cost Efficiency:** SaaS acts as a cost-effective solution by reducing the overhead of IT support by eliminating the need for individual software licenses.

2. Deployment model

On the basis of Deployment model, cloud computing can be classified into following types

1. public cloud
2. private cloud
3. hybrid Cloud
4. Community Cloud

1. Public Cloud

- ❖ Public cloud is open to all users to store and access information via internet
- ❖ User pays as per the service use

- ❖ It managed by third parties (cloud service provider)
- ❖ Fundamental characteristics of public cloud is multi-tenancy i.e. all the cloud user use same or common infrastructure that is provided by third parties.
- ❖ Example: Google drive, drop box, etc.

Advantage

- ❖ Managed by cloud service provider so we not need to maintain it by ourselves (cloud user).
- ❖ Services are location independent
- ❖ Cost effective

Disadvantage

- ❖ less secured as resources shared publicly.
- ❖ Less customized as compared to private cloud

2. Private Cloud

- ❖ In private cloud, services are accessible within an organization i.e. it belongs to specific organization.
- ❖ Sometime it is also called internal or corporate cloud.
- ❖ It can be managed by organization itself

Advantage

- ❖ high Security as cloud is managed by organization itself.
- ❖ high data privacy.
- ❖ Improved reliability

Disadvantage

- ❖ High cost
- ❖ Limited scalability

3. Hybrid Cloud

- ❖ Hybrid cloud is combination of public and private cloud
- ❖ Critical activities performed by private cloud and non- critical activities by public cloud

Advantage

- ❖ Scalability
- ❖ Low cost compared to private cloud
- ❖ Flexibility

Disadvantage

- ❖ Managing is difficult and complex as there are more than one type of deployment model
- ❖ Dependency on infrastructure

4. Community Cloud

- ❖ It is the type of cloud which is accessible by a group of several organization to share the information between the organization and a specific community.
- ❖ It is owned, managed and operated by one or more organization in the community or third party.

Advantage

- ❖ it is cost effective than private
- ❖ resources are shared among companies.
- ❖ More secure than public cloud but less secure than private cloud.

Disadvantage

- ❖ Data is shared among the organization so there is privacy concerns.
- ❖ Consistent maintenance cost

Scope of Cloud Computing in Nepal

- ❖ Cloud computing has a huge opportunity in Nepal due to the large number of small and medium market.
- ❖ E-Governance can be implemented on rural areas using cloud computing
- ❖ Outsourcing of job is possible with the help of cloud computing
- ❖ When we start a new business it removes the requirement of a company to invest in storage hardware and servers.
- ❖ Most of the leading companies are already on cloud such as Alibaba, Flipkart, etc.

Introduction to Internet of Things (IOT)

- ❖ The interconnectedness of physical devices, such as appliances and vehicles, that are embedded with software, sensors, and connectivity which enables these objects to connect and exchange data is called IOT.
- ❖ It is technology which is used to communicate between humans and machine or a machine to machine with the help of internet.
- ❖ This technology may include smartwatches, home appliances, security cameras, and even cars.
- ❖ For example, a smart Air Conditioner (AC) can be controlled by smart phones using internet.
- ❖ You can turn it on or off, change the temperature, or set a timer even when you are not at home.

Features of IOT

1. Connectivity
2. Automation
3. Data collection
4. Real time monitoring
5. Efficient resource management
6. Intelligence
7. Integration with other devices

1. Connectivity

- ❖ Connectivity is the most important feature of IoT.
- ❖ It allows devices to **connect with each other** and to the internet using technologies like Wi-Fi, Bluetooth, 4G, or 5G. Through this connection, IoT devices can send and receive data.
- ❖ For example, a smart AC can be connected to your home Wi-Fi so you can **control it from your mobile phone**. Without connectivity, IoT would not be possible.

2. Automation

- ❖ IoT systems can perform tasks **automatically** without the need for **human actions**.
- ❖ This means that once the devices are set up, they can **work on** their own based on **certain conditions**.
- ❖ For example, smart lights can automatically turn on when someone enters a room and turn off when the room is empty. Automation makes life easier and more efficient.

3. Data Collection

- ❖ One of the key roles of IoT devices is to **collect data using sensors**.
- ❖ These sensors can measure things like **temperature, humidity, motion, light, or location**.
- ❖ The data collected helps in **understanding the environment or behavior of the user**.
- ❖ For instance, a fitness tracker collects data about your steps, heart rate, and sleep, which can help you stay healthy.

4. Real-Time Monitoring

- ❖ IoT allows you to monitor devices and data in real time.
- ❖ This means you can **see live updates on what the device is doing** or what is happening in the environment.
- ❖ For example, a smart security camera sends real-time video to your phone so you can see what's happening at home when you're away. This feature is very useful for safety and fast response.

5. Efficient Resource Usage

- ❖ IoT helps in **saving energy and resources** by using them only when needed.
- ❖ For example, a smart irrigation system in farming can water the crops only when the soil is dry. This avoids wastage and improves productivity.

6. Intelligence

- ❖ IoT systems often use artificial intelligence (AI) and machine learning to become smarter over time.
- ❖ They can analyze the data they **collect and learn** from user habits.
- ❖ For example, a smart thermostat can learn when you usually come home and adjust the temperature in advance. This intelligence helps make decisions automatically and improves user experience.

7. Integration with Other Devices

- ❖ IoT devices can work together as a system. This means different devices can **talk to each other** and perform tasks in coordination.
- ❖ For example, a smart speaker like Alexa can control smart lights, AC, or TV all at once with a voice command. This integration makes smart homes more powerful and user-friendly.

Components of IOT

1. Hardware component
2. Software component

1. Hardware component

Hardware components are the physical devices that collect, transmit, and sometimes process data. These components are essential for enabling communication between the physical world and digital systems. There are several hardware components of IoT. Some of them are described below:

i. Sensors

- ❖ Sensors are the most essential part of any IoT system because they are responsible for collecting data from the environment.
- ❖ These devices can detect changes in temperature, humidity, light, motion, sound, gas, and many other physical conditions.
- ❖ For example, a DHT11 or DHT22 sensor is commonly used to measure temperature and humidity, while a PIR (Passive Infrared) sensor can detect motion in a room.
- ❖ Without sensors, an IoT device would not be able to sense or interact with its surroundings.

ii. Actuators

- ❖ Actuators are devices that perform physical actions in response to instructions given by the microcontroller or processor in an IoT system.
- ❖ They convert electrical signals into real-world mechanical movements.
- ❖ Common examples include servo motors, which rotate to specific angles; DC motors, which provide continuous rotation; and relays, which can act like switches to turn high-power devices on or off.
- ❖ Actuators help IoT devices to not just sense but also respond to their environment, making them useful in automation and control systems.

iii. Microcontrollers / Microprocessors

- ❖ Microcontrollers and microprocessors serve as the "brain" of an IoT device.
- ❖ They are responsible for processing data received from sensors, making decisions based on that data, and sending commands to actuators or communication modules.
- ❖ Microcontrollers like Arduino, ESP8266, and ESP32 are widely used in small to medium IoT projects. They have built-in memory and processing power suitable for handling real-time tasks.
- ❖ Microprocessors ensure that the IoT system works intelligently and autonomously.

iv. Communication Modules

- ❖ Communication modules enable IoT devices to share data with other devices, networks, or cloud servers.
- ❖ They are essential for enabling remote monitoring and control.
- ❖ Different technologies are used depending on the application, such as Wi-Fi for high-speed internet connectivity, Bluetooth for short-range wireless communication, GSM modules like SIM800L for sending data through cellular networks.
- ❖ These modules help IoT systems remain connected, which is one of the core features of IoT enabling communication and control from anywhere in the world.

v. Power Supply

- ❖ A reliable power supply is crucial for any IoT device to function effectively.
- ❖ Depending on the application, devices can be powered using batteries, USB cables, or renewable sources like solar panels.
- ❖ Rechargeable lithium-ion or lithium-polymer batteries are often used in portable or outdoor IoT devices.
- ❖ The choice of power supply depends on the energy requirements of the components and the desired operating time. Ensuring consistent power allows the IoT system to run smoothly and without interruption.

vi. Memory and Storage

- ❖ Memory and storage components are used to store both temporary and permanent data in an IoT system.
- ❖ Microcontrollers typically have onboard EEPROM or flash memory to store firmware and small amounts of sensor data. For more complex tasks, external storage devices like SD cards can be used to save larger datasets.
- ❖ Sufficient memory ensures that the IoT device can perform its tasks without lag or data loss, especially in data logging and real-time processing applications.

vi. User Interface Devices

- ❖ User interface devices allow humans to interact with the IoT system directly.
- ❖ These include displays, buttons, buzzers, and touchscreens. For example, an LCD or OLED display can show sensor readings or system status, while buttons or keypads can be used to input commands or adjust settings.
- ❖ LEDs are often used to indicate power status or errors, and buzzers can provide audible alerts. smartphone.

2. Software component

Software components are a crucial part of any IoT (Internet of Things) system. hardware components collect and act on data whereas software component processes, manages, and interprets that data to make the system functional and intelligent. Some of the software components of IoT are described below:

i. Firmware

- ❖ Firmware is the low-level software that is programmed into the microcontroller or microprocessor of an IoT device.
- ❖ Firmware directly controls the hardware components such as sensors, actuators, and communication modules.
- ❖ Firmware is responsible for reading sensor data, executing logic, and sending or receiving signals to and from other devices.
- ❖ It is usually written in languages like C or C++ and is stored in the flash memory of the device.
- ❖ Without firmware, the hardware components would not be able to function, making it a critical part of any IoT system.

ii. Operating Systems (OS)

- ❖ Some advanced IoT devices, especially those using microprocessors like Raspberry Pi, require an operating system to function.
- ❖ These operating systems manage resources, run applications, and provide a platform for software development.
- ❖ Common IoT operating systems include lightweight versions like RIOT OS, Contiki, FreeRTOS, and full systems like Raspbian for Raspberry Pi.
- ❖ These operating systems support multitasking, networking, and hardware management, making it easier for developers to build complex IoT applications.

iii. Middleware

- ❖ Middleware is a software layer that connects the hardware and the application layer in an IoT system.
- ❖ It handles tasks such as data formatting, communication between devices, protocol translation, and system management.
- ❖ Middleware acts as a bridge, enabling devices to talk to each other and to cloud platforms regardless of differences in protocols or hardware.
- ❖ It simplifies application development by providing reusable services like device registration, authentication, and data routing.

iv. Network Protocols

- ❖ Network protocols are essential software components that define how data is transmitted and received over a network.
- ❖ In IoT systems, common communication protocols include MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol), HTTP, and WebSockets.
- ❖ These protocols ensure secure, efficient, and reliable data exchange between devices and cloud platforms.
- ❖ For example, MQTT is widely used because it is lightweight and ideal for devices with limited processing power and bandwidth.

v. Cloud Platforms

- ❖ Cloud platforms provide services for storing, processing, analyzing, and visualizing data collected by IoT devices.
- ❖ Examples include Amazon Web Services (AWS IoT), Microsoft Azure IoT, Google Cloud IoT, etc.
- ❖ These platforms allow developers to manage thousands of devices remotely, collect real-time data, and so on.
- ❖ The cloud also supports integration with mobile apps, alert systems, and third-party services, making it an important part of the IoT ecosystem.

vi. Data Analytics and Processing Software

- ❖ This software is used to analyze the large volumes of data generated by IoT devices.
- ❖ It helps in extracting meaningful insights and patterns from raw data.
- ❖ This processing can happen locally on the edge device (edge computing) or on the cloud.
- ❖ Techniques like filtering, aggregation, anomaly detection, and predictive analytics are often used.
- ❖ Programming languages such as Python, R, and software tools like Apache Kafka, Spark, and TensorFlow may be involved in analytics depending on the complexity of the system.

vii. Security Software

- ❖ Security is one of the most important aspects of any IoT system.
- ❖ Security software ensures that data and devices are protected from unauthorized access, cyberattacks, and data breaches.
- ❖ Security includes encryption algorithms, firewalls, authentication systems, intrusion detection systems, and secure boot mechanisms.
- ❖ Without proper security software, IoT systems become vulnerable, especially when connected to the internet.

viii. Application Software

- ❖ Application software is the user-facing part of an IoT system, often presented as mobile apps, web dashboards, or desktop interfaces.
- ❖ It allows users to monitor device data, control devices remotely, set alerts, and manage settings.
- ❖ For example, a smart home app lets users control lights, security cameras, and thermostats from their phone.
- ❖ Application software is developed using programming languages like JavaScript, Java, Python, and frameworks like React, Flutter, or Android Studio, depending on the platform.

Scope of IoT in Nepal

- ❖ The use of IoT (Internet of Things) is growing steadily in Nepal.
- ❖ Even though it is still in the early stages, IoT has the potential to improve many important areas like farming, healthcare, electricity, education, and cities.
- ❖ In agriculture, IoT devices can help farmers by providing real-time data on soil moisture, temperature, and weather conditions. This helps them grow crops more efficiently and reduce waste.
- ❖ In the healthcare sector, IoT can be used in hospitals and clinics for remote patient monitoring and telemedicine, which is very helpful in Nepal's remote and mountain regions.
- ❖ Similarly, in the energy sector, smart meters and connected grids can help people use electricity more efficiently and reduce power loss.
- ❖ IoT is used for traffic management, smart streetlights, and waste control.
- ❖ In education, IoT can be used to monitor classroom environments and improve learning using smart tools. These examples show that IoT has a lot of potential to make life easier and services better in Nepal.

Government policies and implementation steps of IoT

- ❖ The Government of Nepal is supporting the growth of IoT through various digital policies and plans.
- ❖ One of the main steps is the **Digital Nepal Framework**, introduced in 2019. This plan focuses on using digital technology, including IoT, in areas like agriculture, health, education, energy, finance, and urban development.
- ❖ The government has also introduced policies like the **ICT Policy** and **Broadband Policy** to improve internet access and digital services across the country.
- ❖ To control and manage IoT use, the **Nepal Telecommunications Authority (NTA)** has made several rules to enhance the use of IoT.

Unit 5 AI

5.1 AI Introduction

- ❖ The capability of machine or computer systems to imitate intelligent human behavior is referred to as Artificial Intelligence (AI).
- ❖ It involves the development of algorithms, software and the system that enables machines to perform tasks that require human intelligence.
- ❖ AI technology aims to simulate human cognitive functions such as reasoning, learning, and problem-solving to perform specific tasks autonomously.
- ❖ Self-driving cars, email spam filters, robots, are some of the examples of AI.

5.2 Area of AI

AI is used in different fields to make human life simpler. Some of the areas that use AI are described below.

1. Machine learning (ML)
2. Natural language processing (NLP)
3. Computer Vision
4. Robotics
5. Expert System
6. Speech recognition
7. Knowledge representation and reasoning
8. Healthcare
9. Autonomous Vehicles
10. Finance
11. Education
12. Cyber security

1. Machine learning (ML)

Machine Learning is a core area of AI that enables systems to learn from data and improve their performance over time without being explicitly programmed. It uses algorithms to identify patterns, make predictions, and automate decision-making processes. Applications include spam detection, recommendation systems, and fraud detection.

2. Natural language processing (NLP)

NLP enables machines to understand, interpret, and generate human language. It helps computers read text, hear speech, understand meaning, and respond in a way that is natural to humans. Common uses of NLP include chatbots, language translation, sentiment analysis, and voice assistants like Siri or Alexa.

3. Computer Vision

Computer Vision allows machines to interpret and make decisions based on visual data such as images or videos. It is used in facial recognition, object detection, medical imaging, and surveillance systems. The goal is to give computers the ability to see and understand visual input just like humans do.

4. Robotics

AI in robotics enables robots to perform tasks that require decision-making and adaptability. These robots can operate in environments that are dangerous, repetitive, or difficult for humans, such as manufacturing, space exploration, and disaster response. AI allows robots to navigate, recognize objects, and even interact with people.

5. Expert System

Expert systems are AI programs that simulate the decision-making ability of a human expert. They use a knowledge base and set of rules to solve complex problems in specific domains like medical diagnosis or engineering. These systems are especially useful in areas where consistent decision-making is required.

6. Speech recognition

Speech recognition allows computers to convert spoken language into text. It is widely used in voice-controlled applications such as virtual assistants, dictation software, and voice-activated customer service systems. AI enables these systems to understand different accents, languages, and speaking styles.

7. Knowledge representation and reasoning

Knowledge Representation and Reasoning involves how machines store information about the world and use it to solve problems and make decisions. It allows AI systems to reason about facts, draw conclusions, and learn from past experiences. This is crucial in domains like legal reasoning, diagnostics, and planning.

8. Healthcare

AI is transforming healthcare by improving diagnostics, personalizing treatment, and optimizing hospital operations. AI-powered tools can analyze medical images, predict patient outcomes, and even assist in surgeries. It helps doctors make better decisions and improves patient care.

9. Autonomous Vehicles

AI plays a key role in the development of self-driving cars and drones. It helps vehicles perceive their environment, make decisions, and navigate safely without human input. AI integrates data from sensors, GPS, and cameras to enable real-time decision-making on the road.

10. Finance

In finance, AI is used for fraud detection, credit scoring, algorithmic trading, and customer service automation. AI systems analyze large volumes of data quickly and accurately, identifying trends and anomalies that help in making smarter investment decisions and risk assessments.

11. Education

AI is being used to personalize learning, automate administrative tasks, and support teachers. Intelligent tutoring systems adapt to individual students' needs, while AI chatbots answer questions and provide feedback. It helps make education more accessible and efficient.

12. Cyber security

AI enhances cybersecurity by identifying and responding to threats faster than traditional methods. It can detect unusual network activity, prevent cyber attacks, and adapt to new types of threats in real-time. AI systems continuously learn from past incidents to improve their defense mechanisms.

5.3.1 Advantages of AI

The advantages of AI are as follows.

1. Accuracy
2. Efficient
3. Personalization
4. Decision making
5. Cost saving
6. Automation
7. Error Reduction

1. Accuracy

AI can do tasks with very high precision. For example, in hospitals, AI can help doctors detect diseases like cancer by carefully looking at medical images and spotting things the human eye might miss.

2. Efficient

AI can complete tasks much faster than humans. It doesn't need breaks or sleep, so it can work all the time without getting tired. For example, AI can search through thousands of files or records in seconds, something that would take a human many hours or even days to do.

3. Personalization

AI can learn your likes, interests, and habits to give you a more personalized experience. For example, when you watch videos on YouTube or use Spotify, AI suggests content based on what you've watched or listened to before. In education, AI-based learning apps can give students different exercises depending on their skill level.

4. Decision making

AI can help in making smart and fast decisions by analyzing data and comparing many options quickly. For example, in games, AI decides the best move to make to win. In real life, AI can help doctors choose the best treatment or help businesses decide which products to sell more of.

5. Cost saving

AI helps save money. Even though it might cost a lot to build or set up at first, AI can do the work of many people, reducing the need to pay large teams. For example, customer service chatbots can answer thousands of questions without needing a human operator for each one.

6. Automation

AI can do repetitive and boring tasks automatically. This is useful in factories where machines, controlled by AI, can build cars or pack products without needing people to do each step. In homes, smart devices can turn on lights or adjust the temperature without anyone pressing a button.

7. Error Reduction

Since AI follows exact rules and calculations, it makes fewer mistakes than humans, especially in routine tasks. For example, in scientific experiments or space missions, AI can perform complex operations without error, where even a small human mistake could be dangerous.

5.3.2 Disadvantages of AI

1. Job displacement: AI can replace human workers, especially in repetitive tasks, leading to unemployment.

2. Bias and fairness: If AI is trained on biased data, it can make unfair or incorrect decisions.

- 3. Lack of creativity:** AI can follow patterns but cannot think creatively like humans.
- 4. Security concerns:** AI can be misused for hacking, cyberattacks, or creating deepfakes.
- 5. Dependency:** Too much use of AI can make people overly dependent and reduce human thinking skills.

Application of AI

Refer Areas of AI from earlier topic.

5.4 Scope of AI In Nepal

The use of Artificial Intelligence (AI) in Nepal is growing. Some key areas where AI can make a significant difference in Nepal include:

1. Agriculture
2. Healthcare
3. Education
4. Tourism
5. Finance
6. Infrastructure and urban development
7. Disaster management
8. E-governance

1. Agriculture:

AI can help farmers by predicting weather, detecting plant diseases, and giving advice on the best time to plant or harvest crops. Smart tools and sensors can help increase crop production and reduce loss, which is very helpful for Nepal's large farming community.

2. Healthcare:

AI can support doctors by helping with faster and more accurate diagnosis. It can be used to check medical reports, suggest treatments, and manage patient data. In remote areas of Nepal, AI tools like telemedicine can help patients get health services without going far.

3. Education: AI can personalize learning for students based on their level and speed. It can help teachers by checking homework, giving instant feedback, and offering smart learning apps. This can improve the quality of education, even in rural schools.

4. Tourism:

AI can be used in chatbots to answer tourist questions, give travel suggestions, or guide visitors. It can also help promote Nepal's tourism spots by analyzing data to understand what tourists like and improving their travel experience.

5. Finance:

In banks and financial institutions, AI can detect fraud, manage accounts, and help with digital payments. AI chatbots can also answer customer questions 24/7, improving service and safety in financial systems.

6. Infrastructure and Urban Development:

AI can help plan better roads, smart traffic systems, and improve city planning. In growing cities like Kathmandu, AI can reduce traffic jams, manage waste, and support smart city projects.

7. Disaster Management:

Nepal is at high risk of earthquakes, floods, and landslides. AI can help predict disasters early and warn people in time. It can also help in rescue operations and resource planning during emergencies.

8. E-Governance:

AI can improve government services by making them faster and more transparent. Online systems using AI can help with things like applying for documents, paying taxes, or getting public information easily.

5.5 Government's steps in promotion of AI in robotics and technology.

The Government of Nepal is promoting AI through policies, and partnerships helping the country move towards a smarter, digital future.

Some of the strategies that governments often adopt to promote the adoption of AI are described below:

1. Digital Nepal Framework: The Government of Nepal launched the *Digital Nepal Framework* to develop the country through digital technology. It includes plans to use AI in sectors like agriculture, health, education, and energy.

2. Support for Startups and Innovation: The government has started encouraging young innovators and startups in the field of AI and robotics. Events like *Tech fairs*, *Innovation challenges*, and *robotics competitions* are supported to promote new ideas.

3. ICT Policies and Programs: The government is updating its Information and Communication Technology (ICT) policies to include AI and robotics. These policies aim to build smart cities, digital learning systems, and tech-friendly infrastructure.

4. Technical Education and Training: Through institutions like *CTEVT* and universities, the government is promoting technical education in AI, robotics, and computer science. Scholarships and training programs are being offered to build skilled manpower.

5. Smart City Projects: The government is planning smart city projects in major cities like Kathmandu and Pokhara, where AI can help manage traffic, waste, and energy efficiently.

6. Collaboration with Private Sector and International Organizations: Nepal is working with private tech companies and international organizations to bring in advanced technologies and AI knowledge through partnership and investment.

7. Research and Development Support: Government bodies are starting to fund research projects related to AI and robotics in universities and colleges to encourage innovation and local development.

Unit 6 Multimedia

Introduction to multimedia

- ❖ **Multimedia** is the integration of different media forms, such as text, graphics, audio, video, and animation, to create interactive and engaging content.
- ❖ It provides interaction between users and digital information.
- ❖ Some of the sectors where multimedia is used extensively are education, training, reference material, business presentations, advertising and documentaries.

Features of multimedia

1. Multisensory Experience

Multimedia provides a multisensory experience by engaging in more than one sense at a time, mainly by sight and hearing. By combining elements like images, text, video, and audio, it helps users understand information more deeply and understand it better. As a result, learning, communication, and entertainment become more immersive and memorable.

2. Interactivity

A key feature of multimedia is interactivity, which allows users to participate actively in the communication process. Instead of simply receiving information, users can click, navigate, choose responses, and control the pace of their experience. This makes multimedia more dynamic and user-centered, encouraging engagement and personalization.

3. Integration of Multiple Media Elements

Multimedia integrates different media components such as text, graphics, audio, video, and animation into a single unified system. This combination enhances the quality of communication by presenting information in various forms simultaneously.

5. User Engagement

Multimedia significantly increases user engagement by combining appealing visuals, sound, motion, and interactive elements. These features capture attention more effectively than plain text or static images. The mixture of media creates a stimulating environment that keeps users focused and interested for longer periods.

6. Digital Storage and Retrieval

Multimedia content can be stored digitally, allowing for easy access, retrieval, and sharing across different devices and platforms. Digital storage supports large amounts of diverse media. This

feature enables quick distribution of videos, images, animations, and interactive files over networks.

Advantages of multimedia

1. Enhances Understanding

Multimedia helps people understand information better by using visuals, audio, and text together, making concepts easier to grasp.

2. Increases Engagement

It captures attention and keeps users interested through attractive visuals, sounds, and animations.

3. Supports Interactive Learning

Multimedia allows users to interact with content through quizzes, buttons, and simulations, making learning more active.

4. Caters to Different Learning Styles

It suits all types of learners i.e. visual, auditory, etc. by offering different forms of content.

5. Easy to Store and Share

Digital multimedia can be stored easily and shared quickly through computers, phones, or the internet.

6. Improves Communication

It makes messages clearer and more impactful by combining text, images, and sound.

7. Encourages Creativity

Multimedia tools allow creative expression through animations, graphics, music, and videos.

Components of Multimedia

1. Text

Text is the most basic and essential component of multimedia. It is used to present information in the form of words, sentences, and paragraphs. Text provides structure, meaning, instructions, and explanations in multimedia applications.

2. Images (Graphics)

Images or graphics are visual elements such as photographs, drawings, logos, icons, and illustrations. They make content attractive and help users understand information more quickly than text alone.

3. Audio

Audio refers to all sound elements used in multimedia, including music, voice narration, sound effects, and dialogues. Audio adds life to multimedia presentations by creating an emotional tone, guiding the user, or explaining information. It helps catch attention and supports people who prefer auditory learning.

4. Video

Video is a powerful multimedia component that combines moving images with sound to show real-life action or storytelling. Videos can demonstrate processes, events, or instructions more effectively than text or images alone. Due to use of motion of pictures and audio together, video provides an attractive experience.

5. Animation

Animation involves creating the illusion of movement using drawings, graphics, or computer-generated objects. It helps explain complex ideas, demonstrate steps, or show objects in motion. Animations can be simple 2D visuals or advanced 3D models which are used in games and movies.

Standard Formats of Representation in Multimedia

- ❖ Each multimedia component is stored and represented using standard digital formats to ensure compatibility, quality, and easy sharing.
- ❖ **Text** is commonly stored in formats like TXT, DOCX, HTML, and PDF. **Images** use formats such as JPEG, PNG, GIF, and TIFF depending on quality or compression needs.
- ❖ **Audio** is represented using formats like MP3, WAV, and AAC, which differ in file size and sound clarity.
- ❖ **Video** is stored in formats such as MP4, AVI, MOV, and MKV, which combine both audio and video streams.
- ❖ **Animation** may be saved as GIF, SWF, or modern 2D/3D animation formats.
- ❖ These standard formats allow multimedia files to be displayed properly across different devices, software, and platforms, ensuring smooth viewing and effective communication.

Application of Multimedia

1. Education

Multimedia makes learning more engaging and interactive using text, images, videos, animations, and audio. It helps explain complex concepts, supports different learning styles, and makes lessons understand easily.

2. Entertainment

Multimedia is widely used in movies, music, video games, and online content. It combines visuals, audio, and animation to create attractive and enjoyable experiences for audiences.

3. Marketing and Advertising

In marketing, multimedia is used to attract customers through videos, animations, graphics, and interactive ads. It makes advertisements more appealing, memorable, and effective in promoting products and services.

4. Technology and Science

Multimedia helps visualize complex scientific and technological concepts through animations, videos, and simulations. It is used in experiments, research, and presentations to explain abstract ideas clearly.

5. Engineering

In engineering, multimedia is used for 3D modeling, CAD designs, animations, and virtual simulations. It helps design prototypes, test performance, train engineers, and present projects effectively.

Note:

Disadvantages of multimedia do yourself

Unit 7 Big data

Introduction to Big Data

- ❖ Big data refers to massive volumes of structured and unstructured data sets that are difficult to process using traditional tools and methods.
- ❖ The term “big data” does not just encompass the size of data but also the technologies used to analyze and extract meaningful insights or data from it.
- ❖ The data are characterized by its volume, velocity, variety, and complexity, presenting challenges for traditional data processing methods.

Characteristics of big data

1. volume
2. velocity
3. variety
4. veracity
5. value
6. variability
7. volatility
8. visualization

1. Volume

Volume refers to the huge amount of data generated every second ranging from terabytes to petabytes. Example: YouTube uploads 500+ hours of video every minute.

2. Velocity:

Velocity refers to the speed at which data is created, shared, and processed. Data streams may be generated from sensors, social media, and transactions in real-time.

3. Variety:

Variety of data refers to the diversity of data types and sources. Data comes in multiple formats-text, audio, images, videos, logs, sensor data, etc. Handling all these types together is complex

4. Veracity:

Veracity refers to the trustworthiness and accuracy of the data. Inconsistent, duplicated, or noisy data can lead to wrong insights.

5. Value:

Value represents the ultimate goal of big data analytics i.e. extracting valuable insights and making informed decisions.

6. Variability

Variability of data refers to changing structure of data i.e. data meaning may change over time or context

7. volatility

Volatility refers to the temporal nature of data. Big data may have time sensitive characteristics, and the value of certain data elements may change rapidly over time.

8. visualization

Visualization refers to making complex data understandable through visual tools such as charts, graphics, etc.

Challenges of big data

1. Data privacy
2. Data quality
3. Data governance
4. Scalability
5. Complexity of data integration
6. Lack of skilled professionals
7. cost management
8. Real-time processing
9. Legal and ethical concerns
10. Cultural and organizational change
11. Data ownership and collaboration

1. Data Privacy

Data privacy is one of the biggest challenges of big data. When large amounts of personal or sensitive information are collected from users, it becomes difficult to ensure that this data is kept safe and not misused. Companies must protect user information from hackers, leaks, or unauthorized access. If privacy is not maintained, it can lead to identity theft, loss of trust, and legal problems for organizations.

2. Data Quality

The usefulness of big data depends on its quality. Data may come from different sources, and sometimes it may be incomplete, duplicated, or inaccurate. Poor-quality data can lead to wrong conclusions and poor decision-making. Therefore, organizations must clean, verify, and maintain their data regularly to ensure accuracy and reliability.

3. Data Governance

Data governance refers to managing data properly by setting rules and standards for how it is collected, stored, and used. Without strong governance, data may become inconsistent or mismanaged across departments. A clear governance policy helps maintain data integrity, ensures compliance with laws, and improves accountability in data handling.

4. Scalability

As the volume of data continues to grow rapidly, organizations need systems that can scale up to handle this massive amount of information. Scalability means the ability of a system to handle more data or users without slowing down. Many companies face challenges upgrading their infrastructure or software to manage large-scale data efficiently.

5. Complexity of Data Integration

Big data comes from many sources such as social media, sensors, websites, and business transactions. Integrating all these different types of data into one system is very complex. The data may be in different formats (text, video, numbers), making it hard to combine and analyze. Effective tools and techniques are needed to integrate data properly.

6. Lack of Skilled Professionals

Handling big data requires experts who understand data analytics, data science, and advanced technologies. However, there is a shortage of such skilled professionals in many organizations. This makes it difficult to analyze data effectively and extract useful insights. Training programs and education in data analytics are needed to fill this gap.

7. Cost Management

Storing, processing, and analyzing big data can be very expensive. Organizations need to invest in high-performance hardware, software, and skilled employees. Managing these costs while ensuring efficient data processing is a major challenge. Businesses must plan budgets carefully and use cost-effective technologies like cloud computing to reduce expenses.

8. Real-Time Processing

In today's world, data is generated continuously, and businesses often need to analyze it in real-time to make quick decisions. For example, banks need to detect fraud instantly. However, processing such fast and large data streams in real time requires advanced systems and technologies, which can be difficult and costly to implement.

9. Legal and Ethical Concerns

Using big data raises many legal and ethical issues. Organizations must follow laws about how data is collected and used, especially when dealing with personal information. There are also ethical concerns about surveillance, discrimination, or using data without consent. Companies must act responsibly and follow data protection laws to maintain trust.

10. Cultural and Organizational Change

Introducing big data technologies often requires changes in how an organization works. Employees must adapt to new systems, tools, and data-driven decision-making. Some people may resist these changes due to fear or lack of understanding. Therefore, companies must promote a data-friendly culture and train employees to adapt to new technologies.

11. Data Ownership and Collaboration

When multiple organizations or departments share data, it can be unclear who owns it and who has the right to use it. This issue of data ownership can lead to conflicts and limit collaboration. Clear policies and agreements are needed to define data ownership and encourage safe and fair data sharing among partners.

Advantages of Big Data:

Informed Decision-Making:

Big Data analytics provide valuable insights and patterns, enabling organizations to make data-driven decisions. This helps in understanding customer behavior, market trends, and operational efficiency.

Improved Customer Experience:

Big Data allows businesses to analyze customer interactions and feedback, leading to the enhancement of products, services, and overall customer experience.

Efficient Operations:

Organizations can optimize their operations by analyzing large datasets, identifying inefficiencies, and streamlining processes. This can lead to cost savings and increased productivity.

Innovation and Product Development:

Big Data facilitates innovation by providing insights into emerging trends and customer preferences. It aids in the development of new products and services that better align with market demands.

Personalized Marketing:

Companies can use Big Data to create personalized marketing campaigns based on individual preferences and behaviors, resulting in more targeted and effective advertising.

Risk Management:

Big Data analytics helps in identifying potential risks and fraud by analyzing patterns and anomalies in data. This is particularly crucial in industries like finance and insurance.

Scientific Discovery and Research:

In fields such as healthcare and scientific research, Big Data supports advanced analysis, leading to breakthroughs in disease diagnosis, treatment, and other areas of research.

Real-time Insights:

Big Data technologies enable the processing and analysis of data in real-time, allowing organizations to respond quickly to changing conditions and emerging opportunities.

Disadvantages of Big Data:**Privacy Concerns:**

Collecting and analyzing large volumes of data can raise privacy issues, especially when it involves personal information. Striking a balance between data utilization and individual privacy is a significant challenge.

Security Challenges:

The more data is collected and stored, the more attractive it becomes to cyber threats. Big Data systems must implement robust security measures to protect sensitive information from unauthorized access.

Costs of Implementation:

Implementing and maintaining Big Data infrastructure can be expensive. This includes the costs of acquiring advanced analytics tools, storage systems, and skilled personnel to manage and analyze the data.

Complexity and Integration:

Managing and integrating diverse data sources, formats, and structures can be complex. Ensuring compatibility and consistency across different data sets can pose challenges.

Lack of Skilled Personnel:

The demand for data scientists, analysts, and professionals with expertise in Big Data technologies often outpaces the availability of skilled personnel. This shortage can hinder the effective implementation of Big Data initiatives.

Ethical Concerns:

As data is used to make decisions that impact individuals and communities, ethical considerations arise. Questions about the responsible and fair use of data become important in Big Data applications.

Data Quality and Accuracy:

Big Data is only valuable when the data being analyzed is accurate and of high quality. Inaccurate or incomplete data can lead to flawed analyses and unreliable insights.

Resistance to Change:

Introducing Big Data technologies often requires significant organizational change. Resistance from employees, who may be accustomed to traditional methods, can impede the adoption of Big Data solutions.

Types of Big data

Structured Data

Structured data refers to information that is organized and formatted in a fixed way, making it easy to store, manage, and analyze. This type of data usually resides in tables with rows and columns, where each column represents a specific attribute and each row holds a record. For example, student records with fields like name, roll number, and marks, or banking data with account numbers and balances. Structured data is stored in relational databases such as MySQL, Oracle, or SQL Server. It can be easily searched using query languages like SQL. Structured data is the most straightforward type to analyze and process using traditional data tools.

Unstructured Data

Unstructured data has no predefined format or structure. It cannot be stored neatly in tables like structured data. Instead, it exists in forms such as images, videos, audio files, social media posts, documents, or emails. This kind of data makes up the majority of today's digital information. For example, Facebook posts, YouTube videos, or PDF reports. Since unstructured data doesn't follow a fixed model, it's difficult to organize, store, and analyze using traditional database systems. Special tools such as Hadoop or cloud-based storage systems are often used to handle unstructured data.

Semi-Structured Data

Semi-structured data is a blend of structured and unstructured data. It doesn't fit neatly into a database table but still has some organizational elements, such as tags or markers, that separate data fields. Common examples include XML, JSON, and HTML files. Semi-structured data is very common in web technologies and APIs because it provides flexibility in storing complex information. Although it's not as easy to manage as structured data, it's more organized than unstructured data, allowing for better analysis and integration.

Temporal or Time Series Data

Temporal or time series data refers to data that is recorded over time to show trends, changes, or patterns. Each record in this type of data is linked with a specific timestamp. Examples may include daily temperature readings, stock prices, rainfall measurements, or traffic flow data. Time series data is important because it helps to understand how values evolve over time, which supports forecasting and trend analysis. Businesses use time series data to predict sales, economists use it to analyze market behavior, and scientists use it to study environmental changes. The key characteristic of this data is that time is a critical component of analysis.

Geographical (Geospatial) Data

Geographical or geospatial data is data that represents the location, shape, and size of objects on Earth's surface. It often contains coordinates such as latitude and longitude and may be linked to maps or satellite images. For Example, GPS data can be used in Google Maps, and location information from mobile phones. This type of data is essential for fields like navigation, transportation planning, disaster management, and environmental studies. Modern technologies like Geographic Information Systems (GIS) are widely used to collect, store, and analyze this type of data.

Machine-Generated Data

Machine-generated data is created automatically by machines, sensors, or software systems without any human involvement. It includes data from devices such as surveillance cameras, industrial sensors, ATM machines, or network logs. For example, an aircraft engine or a smart vehicle continuously produces data about its performance and condition. This data helps in monitoring systems, improving efficiency, and detecting faults early.

Human-Generated Data

Human-generated data comes directly from human activities and interactions. It includes written content, images, videos, comments, and other forms of input created by people. For example, human-generated data can be generated by humans via emails, social media posts, blogs, and online reviews. This data is rich in opinions, preferences, and emotions, which makes it extremely valuable for businesses, especially in marketing and customer experience. Business companies can analyze social media posts to understand customer satisfaction or identify new market trends.

Transactional Data

Transactional data records information about daily business transactions and financial activities. Every time a sale, purchase, booking, or payment occurs, a transaction record is created. For example, transaction data may include online shopping receipts, bank deposits, and flight reservations. This type of data typically contains details like the time, amount, product, and customer involved. Transactional data is crucial for businesses to track performance, detect fraud, and make informed decisions.

Social Media Data

Social media data is produced through interactions on social networking platforms such as Facebook, Instagram, X (Twitter), YouTube, and TikTok. It includes posts, comments, likes, shares, videos, and other activities of users. This data provides deep insights into public opinion, trends, and behaviors. For example, companies use social media analytics to understand customer preferences, track brand reputation, or design targeted advertising campaigns.

Web Data

Web data comes from the internet and websites. It includes information collected from web pages, server logs, cookies, search histories, and clickstream data (the sequence of pages a user visits). For instance, e-commerce websites collect web data to track what products users view or buy. This helps in improving website design, performance, and marketing strategies. Web data analysis is a key part of digital marketing and e-commerce, helping companies personalize content and understand user behavior.

Biometric Data

Biometric data consists of measurable physical or biological characteristics that identify a person. Examples include fingerprints, facial recognition, iris scans, voice patterns, and DNA sequences. Biometric data is widely used in security systems, attendance tracking, healthcare, and forensic investigations. For example, smartphones use fingerprints or face recognition for unlocking devices securely. However, it also raises privacy and security concerns, so it must be handled with strict data protection measures.

Dark Data

Dark data refers to data that an organization collects and stores during regular operations but never uses for analysis or decision-making. Examples include old emails, unused log files, and archived documents. Although this data often remains hidden and unutilized, it still consumes storage space and resources. If analyzed properly, dark data can reveal valuable insights about operations or customer behavior.

Open Data

Open data is data that is freely available for anyone to access, use, and share without restrictions. Governments, organizations, and research institutions often release open data to promote transparency, innovation, and collaboration. Examples include census data, weather information, and public health records published by government websites. Open data helps researchers, developers, and citizens create useful applications and studies. developers use open traffic data to design navigation apps

Streaming Data

Streaming data refers to information that is generated continuously and delivered in real time from various sources. It is collected and processed later, streaming data flows instantly. Examples include live video feeds, online gaming data, financial transactions, and sensor data from IoT devices.

Sensor Data

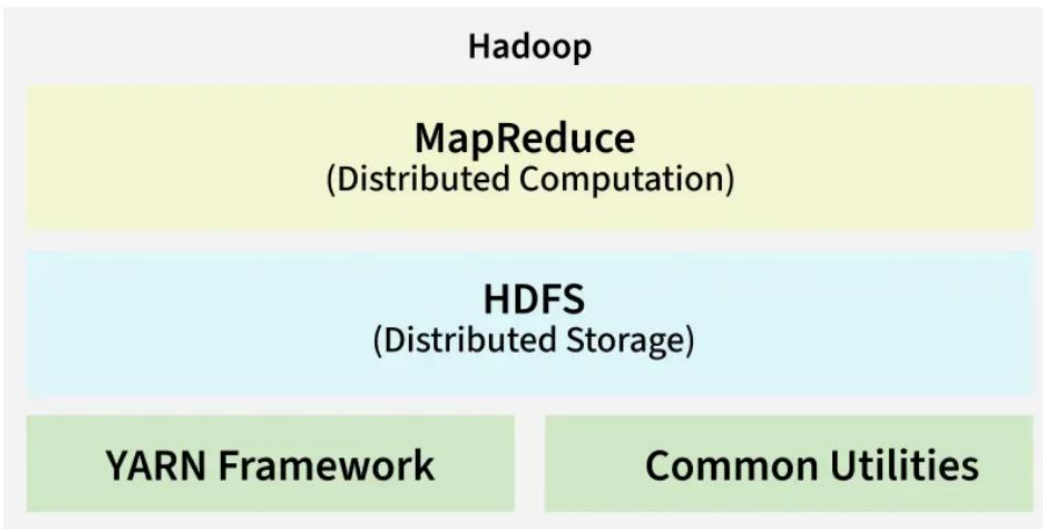
Sensor data is the information collected by sensors that detect physical or environmental conditions such as temperature, pressure, motion, or humidity. These sensors are commonly used in weather stations, smart homes, healthcare devices, and vehicles. For example, temperature sensors in AC (Air Conditioner) generate continuous data related to temperature. It plays an important role in the Internet of Things (IoT), helping devices communicate and respond intelligently to environmental changes.

Introduction to Hadoop

Hadoop is an open-source software framework that is used for storing and processing large amounts of data in a distributed computing environment. It is designed to handle big data and is based on the MapReduce programming model, which allows for the parallel processing of large datasets.

Hadoop is designed to process large volumes of data (Big Data) across many machines without relying on a single machine. It is built to be scalable, fault-tolerant and cost-effective. Instead of relying on expensive high-end hardware, Hadoop works by connecting many inexpensive computers (called nodes) in a cluster.

Hadoop Architecture



Hadoop has following main components:

- **Hadoop Distributed File System (HDFS):** HDFS is the storage layer of Hadoop. It breaks large files into smaller blocks (usually 128 MB or 256 MB) and stores them across multiple Data Nodes. Each block is replicated to ensure that the data remains available and easily accessible even if some node fails.
- **MapReduce:** MapReduce is the computing engine that processes data in a distributed manner. It splits large tasks into smaller chunks (map) and then merges the results (reduce), allowing Hadoop to quickly process massive datasets.
- **YARN (Yet Another Resource Negotiator):** It is a framework for job scheduling and cluster resource management.
- **Common utilities:** These are Java libraries and utilities required by other Hadoop modules

Advantages of Hadoop

Scalability: Hadoop can easily scale from a single server to thousands of machines, each offering local computation and storage.

Cost-Effective: It uses low-cost commodity hardware to store and process large volumes of data, making it a very economical solution for big data processing.

Fault Tolerance: Hadoop automatically detects and recovers from node failures, ensuring that data processing continues without interruption.

High Availability: Data is replicated across multiple nodes, ensuring that even if one node fails, the data remains available and safe.

Flexibility: Hadoop can process all types of data i.e. structured, semi-structured, and unstructured data making it suitable for diverse data sources.

Open-Source and Community-Driven: Being open-source, Hadoop is freely available and continuously improved by a large and active global community.

Use cases of Hadoop

Data Warehousing: Hadoop is used for storing and processing large volumes of data in data warehousing environments.

Log Processing: It is employed for analyzing and processing log files generated by web servers and applications.

Machine Learning: Hadoop can be used for distributed machine learning tasks, handling large datasets for training models.

Genomic Data Analysis: In bioinformatics, Hadoop is used to analyze and process vast genomic datasets.

Image Processing: Hadoop can process and analyze large sets of images, making it valuable in applications like satellite image analysis.

Banking: It is used for fraud detection to identify suspicious transactions and risk modeling to assess credit and financial risks.

Retail: It is Applied for customer behavior analysis to understand buying patterns and inventory management to maintain optimal stock levels.

Healthcare: It is used for disease prediction to identify potential health risks early and patient record analysis to improve diagnosis and treatment.

Social Media: It is used for trend analysis to identify popular topics and user recommendation engines to suggest relevant content to users.

Note:

Example of Big Data(Do yourself)