1. Artificial Intelligence

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience.

Artificial Intelligence is composed of two words Artificial **and** Intelligence**, where Artificial defines "*man-made,*" and intelligence defines "*thinking power*", hence AI means "*a man-made thinking power.*"**

> *"It is a branch of computer science by which we can create intelligent machines which can behave like a human, think like humans, and able to make decisions."*

AI programming focuses on three cognitive skills: learning, reasoning and self-correction.

Learning processes. This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.

Reasoning processes. This aspect of AI programming focuses on choosing the right algorithm to reach a desired outcome.

Self-correction processes. This aspect of AI programming is designed to continually fine-tune algorithms and ensure they provide the most accurate results possible.

2. Application of AI

Artificial Intelligence has various applications in today's society. It is becoming essential for today's time because it can solve complex problems with an efficient way in multiple industries, such as Healthcare, entertainment, finance, education, etc. AI is making our daily life more comfortable and fast.

Following are some sectors which have the application of Artificial Intelligence:

1. AI in Astronomy

Artificial Intelligence can be very useful to solve complex universe problems. AI technology can be helpful for understanding the universe such as how it works, origin, etc.

2. AI in Healthcare

In the last, five to ten years, AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry.

Healthcare Industries are applying AI to make a better and faster diagnosis than humans. AI can help doctors with diagnoses and can inform when patients are worsening so that medical help can reach to the patient before hospitalization.

3. AI in Gaming

AI can be used for gaming purpose. The AI machines can play strategic games like chess, where the machine needs to think of a large number of possible places.

4. AI in Finance

AI and finance industries are the best matches for each other. The finance industry is implementing automation, chatbot, adaptive intelligence, algorithm trading, and machine learning into financial processes.

5. AI in Data Security

The security of data is crucial for every company and cyber-attacks are growing very rapidly in the digital world. AI can be used to make your data more safe and secure. Some examples such as AEG bot, AI2 Platform are used to determine software bug and cyber-attacks in a better way.

6. AI in Social Media

Social Media sites such as Facebook, Twitter, and Snap chat contain billions of user profiles, which need to be stored and managed in a very efficient way. AI can organize and manage massive amounts of data. AI can analyze lots of data to identify the latest trends, hashtag, and requirement of different users.

7. AI in Travel & Transport

AI is becoming highly demanding for travel industries. AI is capable of doing various travel related works such as from making travel arrangement to suggesting the hotels, flights, and best routes to the customers. Travel industries are using AI-powered chatbots which can make human-like interaction with customers for better and fast response.

8. AI in Automotive Industry

Some Automotive industries are using AI to provide virtual assistant to their user for better performance. Such as Tesla has introduced TeslaBot, an intelligent virtual assistant.

Various Industries are currently working for developing self-driven cars which can make your journey more safe and secure.

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

9. AI in Robotics:

Artificial Intelligence has a remarkable role in Robotics. Usually, general robots are programmed such that they can perform some repetitive task, but with the help of AI, we can create intelligent robots which can perform tasks with their own experiences without pre-programmed.

Humanoid Robots are best examples for AI in robotics, recently the intelligent Humanoid robot named as Erica and Sophia has been developed which can talk and behave like humans.

10. AI in Entertainment

We are currently using some AI based applications in our daily life with some entertainment services such as Netflix or Amazon. With the help of ML/AI algorithms, these services show the recommendations for programs or shows.

11. AI in Agriculture

Agriculture is an area which requires various resources, labor, money, and time for best result. Now a day's agriculture is becoming digital, and AI is emerging in this field. Agriculture is applying AI as agriculture robotics, solid and crop monitoring, predictive analysis. AI in agriculture can be very helpful for farmers.

12. AI in E-commerce

AI is providing a competitive edge to the e-commerce industry, and it is becoming more demanding in the e-commerce business. AI is helping shoppers to discover associated products with recommended size, color, or even brand.

13. AI in education:

AI can automate grading so that the tutor can have more time to teach. AI Chabot can communicate with students as a teaching assistant.

AI in the future can be work as a personal virtual tutor for students, which will be accessible easily at any time and any place.

<u>Advantages of Artificial Intelligence</u>

Following are some main advantages of Artificial Intelligence:

- **High Accuracy with less errors:** AI machines or systems are prone to less errors and high accuracy as it takes decisions as per pre-experience or information.
- **High-Speed:** AI systems can be of very high-speed and fast-decision making, because of that AI systems can beat a chess champion in the Chess game.
- **High reliability:** AI machines are highly reliable and can perform the same action multiple times with high accuracy.
- **Useful for risky areas:** AI machines can be helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.
- **Digital Assistant:** AI can be very useful to provide digital assistant to the users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirement.
- **Useful as a public utility:** AI can be very useful for public utilities such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

purpose, Natural language processing to communicate with the human in human-language, etc.

Disadvantages of Artificial Intelligence

Every technology has some disadvantages, and the same goes for Artificial intelligence. Being so advantageous technology still, it has some disadvantages which we need to keep in our mind while creating an AI system. Following are the disadvantages of AI:

- **High Cost:** The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.
- **Can't think out of the box:** Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.
- **No feelings and emotions:** AI machines can be an outstanding performer, but still it does not have the feeling so it cannot make any kind of emotional attachment with human, and may sometime be harmful for users if the proper care is not taken.
- **Increase dependency on machines:** With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.
- **No Original Creativity:** As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

3. Robotics

Robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways. Robotics can take on a number of forms. A robot may resemble a human, or it may be in the form of a robotic application, such as robotic process automation (RPA), which simulates how humans engage with software to perform repetitive, rules-based tasks.

Robotics is a branch of Artificial Intelligence (AI), it is mainly composed of electrical engineering, mechanical engineering and computer science engineering for construction, designing and application of robots. Robotics is science of building or designing an application of robots. The aim of robotics is to design an efficient robot.

Advantages of Robotics

- In many situations robots can increase productivity, efficiency, quality and consistency of products:
- Unlike humans, robots don't get bored.
- Until they wear out, they can do the same thing again and again.
- They can be very accurate – to fractions of an inch (as is needed for example in manufacturing of microelectronics).
- Robots can work in environments which are unsafe for humans – in the nuclear or chemical industries for example.

- Robots don't have the same environmental requirements that humans do – such as lighting, air conditioning or noise protection.
- Robots have some sensors/actuators which are more capable than humans.

Disadvantages of Robotics

- The use of robots can create economic problems if they replace human jobs
- Robots can only do what they are told to do – they can't improvise
- This means that safety procedures are needed to protect humans and other robots
- Although robots can be superior to humans in some ways, they are less dexterous than humans, they don't have such powerful brains, and cannot compete with a human's ability to understand what they can see.
- Often robots are very costly – in terms of the initial cost, maintenance, the need for extra components and the need to be programmed to do the task.

4. Application of Robotics
- **Space Exploration**

There are many things in space that are very dangerous for astronauts to do. In these situations, robots are a great choice because there are no chances for the loss of human life then. So space institutions like NASA frequently use robots and autonomous vehicles to do things that humans can't.

- **Entertainment**

Robots are also a big draw in the entertainment industry. While they cannot exactly become actors and actresses, they can be used behind the sets in movies and serials to manage the camera, provide special effects, etc. Robots can also be used to do stunt work that is very dangerous for humans but looks pretty cool in an action movie. Theme parks like Disney World are also using autonomous robots to enhance the magical experience of their customers.

- **Agriculture**

Agriculture is the sector that is the basis of human civilization. However, agriculture is also a seasonal sector that is dependent on ideal weather conditions optimal soil, etc. Moreover, there are many repetitive tasks in agriculture that are just a waste of farmer's time and can be performed more suitable by robots. These include seeding, weed control, harvesting, etc. Robots are usually used for harvesting the crops which allow farmers to be more efficient.

- **Health Care**

Robots have changed healthcare a lot. And all for the better! They can help doctors in performing operations more precisely, be used as prosthetic limbs, provide therapy to patients, etc. The possibilities are limitless. One example of this is the da Vinci robot that can help surgeons in performing complex surgeries relating to the heart, head, neck, and other.

- **Underwater Exploration**

Robots are a great option for exploring places that humans cannot reach easily, like the depths of the ocean! There is a lot of water pressure deep in the ocean which means humans cannot go that down and machines such as submarines can only go to a certain depth as well. A deep underwater is a mysterious place that can finally be explored using specially designed robots.

- **Manufacturing**

There are many repetitive and common tasks in the manufacturing industry that don't require any usage of the mind like welding, assembly, packing, etc. These tasks can be easily done by robots while leaving the mentally challenging and creative tasks to humans. These robots can be trained to perform these repetitive and monotonous tasks with precision under the guidance and supervision of a human. This option is also best for the manufacturing processes that are dangerous and may be harmful to humans.

- **Military**

Robots also have many applications in the military. They can be used as drones to keep surveillance on the enemy, they can also be used as armed systems to attack the opposing forces or as Medicare agents to help friendly forces. Some of the popular robots used in the Military sector include MAARS (Modular Advanced Armed Robotic System) which looks like a tank and contains tear gas and lasers to confuse enemies and even grenade launcher for desperate situations.

- **Customer Service**

There are robots that are developed to look exactly like humans for cosmetic purposes. These robots are primarily used in the field of customer service in high visibility areas to promote robotics. One such example is Nadine, a humanoid robot in Singapore that can recognize people from previous visits, make eye contact, shake hands, continue chatting based on previous meetings, etc. Another such customer service robot is Junko Chihira in Japan, a humanoid robot working at the tourist information center in Aqua City Odaiba, a shopping center on Tokyo's waterfront.

5. Cloud Computing

The term cloud refers to a network or the internet. It is a technology that uses remote servers on the internet to store, manage, and access data online rather than local drives. The data can be anything such as files, images, documents, audio, video, and more.

There are the following operations that we can do using cloud computing:

- Developing new applications and services
- Storage, back up, and recovery of data
- Hosting blogs and websites
- Delivery of software on demand
- Analysis of data
- Streaming videos and audios
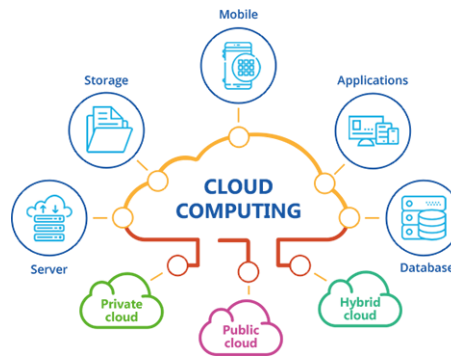
6. Type of cloud computing

- **Public clouds**

Public clouds are cloud environments typically created from IT infrastructure not owned by the end user. Some of the largest public cloud providers include Alibaba Cloud, Amazon Web Services (AWS), Google Cloud, IBM Cloud, and Microsoft Azure. Traditional public clouds always ran off-premises, but today's public cloud providers have started offering cloud services on clients' on-premise data centers. This has made location and ownership distinctions obsolete.

- **Private clouds**

Private clouds are loosely defined as cloud environments solely dedicated to a single end user or group, where the environment usually runs behind that user or group's firewall. All clouds become private clouds when the underlying IT infrastructure is dedicated to a single customer with completely isolated access. But private clouds no longer have to be sourced from on-premise IT infrastructure. Organizations are now building private clouds on rented, vendor-owned data centers located off-premises, which makes any location and ownership rules obsolete.

7. Types of Cloud Services

- **Infrastructure as a service (Iaas)**

IaaS means a cloud service provider manages the infrastructure for you—the actual servers, network, virtualization, and data storage—through an internet connection. The user has access through an API or dashboard, and essentially rents the infrastructure. The user manages things like the operating system, apps while the provider takes care of any hardware, networking, hard drives, data storage, and servers; and has the responsibility of taking care of outages, repairs, and hardware issues. This is the typical deployment model of cloud storage providers.

- **Platform as a service (Paas)**

PaaS means the hardware and an application-software platform are provided and managed by an outside cloud service provider, but the user handles the apps running on top of the platform and the data the app relies on. Primarily for developers and programmers, PaaS gives users a shared cloud platform for application development and management (an important DevOps component) without having to build and maintain the infrastructure usually associated with the process.

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

- **Software as a service (Saas)**

SaaS is a service that delivers a software application—which the cloud service provider manages—to its users. Typically, SaaS apps are web applications or mobile apps that users can access via a web browser. Software updates, bug fixes, and other general software maintenance are taken care of for the user, and they connect to the cloud applications via a dashboard or API.

Cloud Service Models
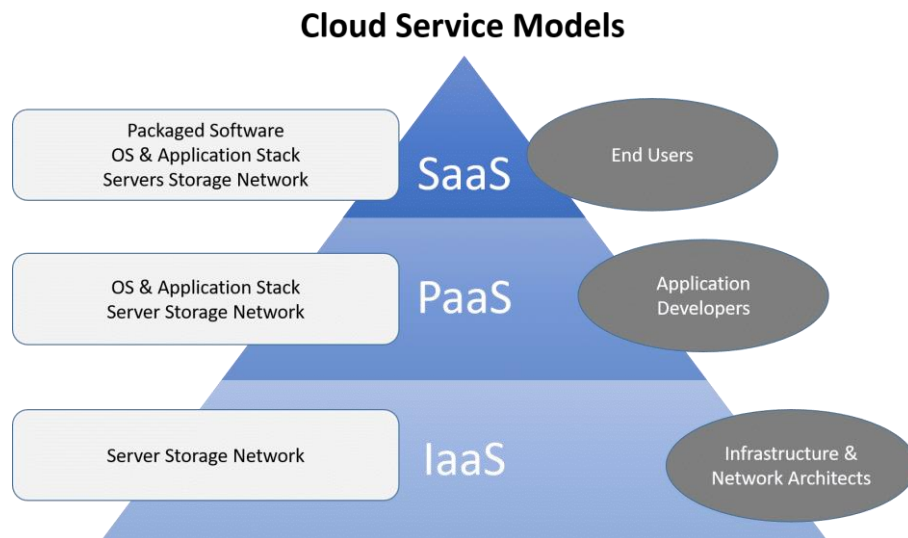
Advantage of Cloud computing

- **Cost Optimization**

One of the most significant advantages of Cloud Computing is cost savings. It allows you to save a lot of money because it doesn't require any actual hardware. In addition, maintaining the hardware does not necessitate the use of skilled employees. The cloud service provider is in charge of purchasing and managing equipment.

- **2. Competitive Advantage**

Cloud computing gives you a leg up on your competition. One of the biggest features of Cloud services is that you may access the most up-to-date programs at any time without having to spend time or money on installation.

- **3. Rapid Deployment**

Cloud computing allows you to deploy applications quickly. As a result, if you want to use the cloud, your complete system may be up and running in a matter of minutes. However, the length of time required is dependent on the technology employed in your company.

- **4. Data backup and Restoration**

Once data is saved on the Cloud, it is much easier to back it up and restore it, which is a time-consuming procedure on-premise.

- **5. Automatic Integration**

Software integration is something that happens automatically on the cloud. As a result, you won't have to put in any extra work to personalize and integrate your apps according to your preferences.

- **6. Reliable Support**

One of the most important advantages of Cloud hosting is its reliability. You will always be kept up to date on any changes. With Cloud Computing you will always have reliable access to advanced online security and support.

- **Easier Accessibility and Collaboration**

Employees working on-site or in remote locations may quickly access all of the company's services. All they require is access to the Internet. Employees in various countries may interact in a more easy and safe manner thanks to the cloud computing platform.

- **Infinite Storage Capacity**

The cloud provides nearly infinite storage space. With relatively low monthly rates, you may simply enlarge your storage space at any moment.

8. Concept of Big Data

Big data is the study of data analysis by advanced technology (Machine Learning, Artificial Intelligence). It processes a huge amount of structured, semi-structured, and unstructured data to extract insight meaning, from which one pattern can be designed that will be useful to take a decision for grabbing the new business opportunity, the betterment of product/service, and ultimately business growth. Data science process to make sense of big data/huge amount of data that is used in business. It include data mining, data storage, data analysis, data sharing and data visualization. The database of social media such as Facebook, twitter, tiktok etc. are example of big data.

Characteristics of Big data

a) Volume
b) Variety
c) Velocity
d) Value
e) Veracity
f) Volatility

Volume: the size and amounts of big data that companies manage and analyze

Value: the most important "V" from the perspective of the business, the value of big data usually comes from insight discovery and pattern recognition that lead to more effective operations, stronger customer relationships and other clear and quantifiable business benefits

Variety: the diversity and range of different data types, including unstructured data, semi-structured data and raw data

Velocity: the speed at which companies receive, store and manage data – e.g., the specific number of social media posts or search queries received within a day, hour or other unit of time

Veracity: the "truth" or accuracy of data and information assets, which often determines executive-level confidence

The additional characteristic of variability can also be considered:

Variability: the changing nature of the data companies seek to capture, manage and analyze – e.g., in sentiment or text analytics, changes in the meaning of key words or phrases.

9. Concept of Virtual Reality

Virtual reality is a simulated 3D environment that enables users to explore and interact with a virtual surrounding in a way that approximates reality, as it is perceived through the users' senses. The environment is created with computer hardware and software, although users might also need to wear devices such as helmets or goggles to interact with the environment. The more deeply users can immerse themselves in a VR environment -- and block out their physical surroundings -- the more they are able to suspend their belief and accept it as real, even if it is fantastical in nature.

Application of Virtual Reality

Virtual reality is often associated with gaming because the industry has been at the forefront of the VR effort, as evidenced by the popularity of products such as Beat Saber, Minecraft VR and Skyrim VR. Even so, there has been a growing interest in the potential of VR across a number of other areas:

Training: - VR makes it possible to train personnel safely, efficiently and cost-effectively. It can be especially beneficial to those in high-risk or highly specialized positions, such as firefighters, EMTs, police officers, soldiers, surgeons or other medical personnel.

Education:- VR offers educational institutions new methods for teaching and learning. It can provide students with intimate insights into environments that are typically inaccessible, while keeping them engaged in the learning process. For example, a history teacher might use VR to show students firsthand what life was like in ancient Greece or China.

Healthcare: - VR has the potential to benefit individuals across the healthcare industry, including patients, practitioners and researchers. For example, VR shows promise in treating disorders such as anorexia, anxiety or post-traumatic stress disorder (PTSD). On the other hand, doctors might be able to use VR when working with the patients to explain diagnoses or treatment options. VR could also benefit individuals who are physically limited in some way.

Retail:- VR has already made some inroads into retail, but the industry has only scratched the surface. With the right apps, customers will be able to try on clothes, decorate their homes, experiment with hair styles, test eye glasses and in general make more informed decisions about products and services.

Real estate:- VR can benefit real estate in a number of ways. For example, architects can show detailed plans in 3D; home buyers can tour homes virtually; building engineers can tour HVAC systems; and home owners can see what their remodels would look like.

Entertainment:- VR has already had an impact on gaming, but it also promises to transform the film and television industries, providing viewers with an immersive experience that puts them right into the scene. VR could also lead to an entire industry in virtual tourism, making it possible for people to experience places that they might never be able to see in-person.

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

10. Concept of E-Commerce, E-Government
a) E-Commerce

Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions. Ecommerce is often used to refer to the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet. The transaction of money has to be performed through a debit card, smart card, electronic fund transfer (EFT) via bank website or mobile banking. daraz.com.np, sastodeal.com, bitarak.com are some popular e commerce site in Nepal.

There are basically three type of e-commerce business model. They are:-

   a) Business to Business (B2B)
   b) Business to consumer (B2C)
   c) Consumer to consumer (C2C)

a) Business to Business : -
B2B business model sells its products to an intermediate buyer who then sells the product to the final customer. As an example, a wholesaler places an order from a company's website and after receiving the consignment, sells the end product to the final customer who comes to buy the product at one of its retail outlets.
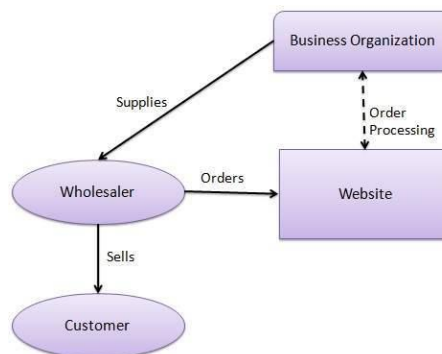

Fig. Business to Business model

b) Business to Consumer:-

B2C business model sells its products directly to a customer. A customer can view the products shown on the website. The customer can choose a product and order the same. The website will then send a notification to the business organization via email and the organization will dispatch the product/goods to the customer.
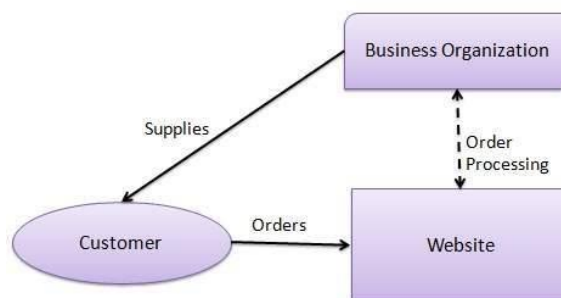

Fig. Business to Consumer Model

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

c) Consumer to Consumer:-

C2C business model helps consumers to sell their assets like residential property, cars, motorcycles, etc., or rent a room by publishing their information on the website. Website may or may not charge the consumer for its services. Another consumer may opt to buy the product of the first customer by viewing the post/advertisement on the website.
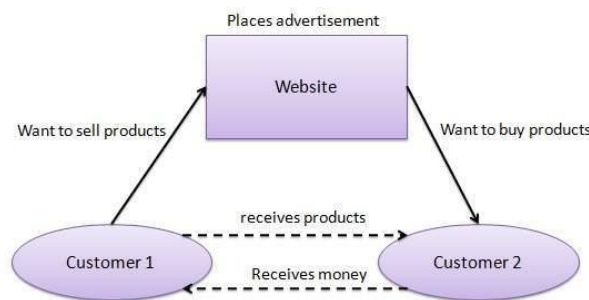

Fig. Consumer to consumer

E-Governance

Electronic Governance is the application of Information and Communication Technologies (ICTs) for delivering government services through integration of various stand-alone systems between Government-to-Citizens (G2C), Government-to-Business (G2B), and Government-to-Government (G2G) services. It is often linked with back office processes and interactions within the entire government framework. Through e-Governance, the government services are made available to the citizens in a convenient, efficient, and transparent manner. E-Government can be defined as the use of ICTs to more effectively and efficiently deliver government services to citizens and businesses. It is the application of ICT in government operations, achieving public ends by digital means. In another word it can be defined as "A *public administration approach which uses information and communication technologies to share information with citizens and make public administration more efficient through self-service electronic services".*

There are four types of E-Governance

i) Government to citizen (G2C)
ii) Government to Business (G2B)
iii) Government to government (G2G)
iv) Government to Employee (G2E)

• Government to Citizen:-

The Government-to-citizen refers to the government services that are accessed by the familiar people. And Most of the government services fall under G2C. Likewise, the primary goal of Government-to-citizen is to provide facilities to the citizen. It helps the ordinary people to reduce the time and cost to conduct a transaction. A citizen can have access to the services anytime from anywhere.

Furthermore, many services like license renewals, and paying tax are essential in G2C. Likewise, spending the administrative fee online is also possible due to G2C. The facility of Government-to-Citizen enables the ordinary citizen to overcome time limitation. It also focuses on geographic land barriers.
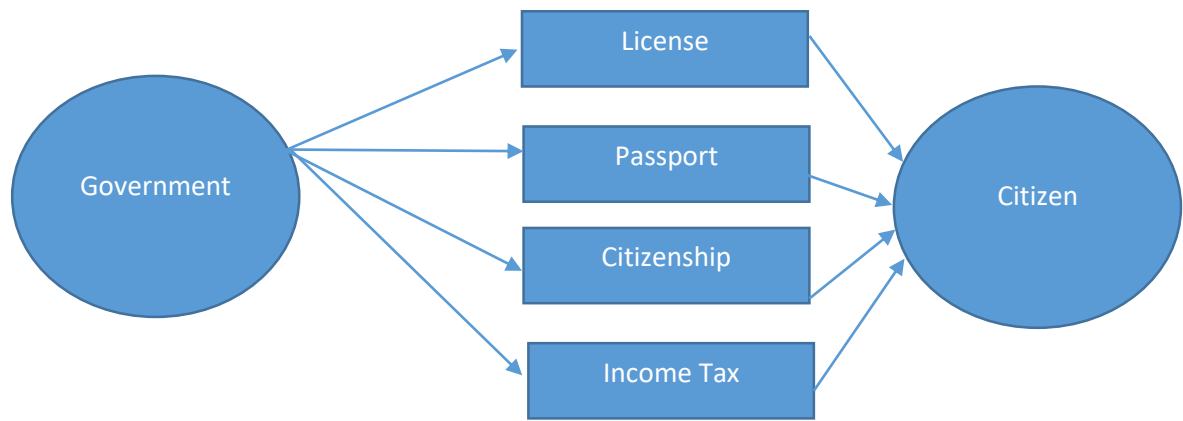
- **Government-to-business (G2B)**

The Government to business is the exchange of services between Government and Business organizations. It is efficient for both government and business organizations. G2B provides access to relevant forms needed to comply. The G2B also consists of many services exchanged between business sectors and government.

Similarly, the Government to business provides Timely business information. And A business organization can have easy and convenient online access to government agencies. G2B plays a crucial role in business development. It enhances the efficiency and quality of communication and transparency of government projects.

- **Government-to-Government (G2G)**

The Government-to-Government refers to the interaction between different government department, organizations, and agencies. This increases the efficiency of government processes. In G2G, government agencies can share the same database using online communication. The government departments can work together. This service can increase international diplomacy and relations.

In conclusion, G2G services can be at the local level or the international level. It can communicate with global government and local government as well. Likewise, it provides safe and secure inter-relationship between domestic or foreign government. G2G constructs a universal database for all member states to enhance service.

- **Government-to-Employee (G2E)**

The Government-to-Employee is the internal part of G2G sector. Furthermore, G2E aims to bring employees together and improvise knowledge sharing.

Similarly, G2E provides online facilities to the employees. Likewise, applying for leave, reviewing salary payment record. And checking the balance of holiday. The G2E sector provides human resource training and development. So, G2E is also the relationship between employees, government institutions, and their management.

11. Concept of Internet of Things

The Internet of Things (IoT) is a name for the aggregate collection of network-enabled devices, excluding traditional computers like laptops and servers. Types of network connections can include Wi-Fi connections, Bluetooth connections, and near-field communication (NFC). The IoT includes devices such as "smart" appliances, like refrigerators and thermostats; home security systems; computer peripherals, like webcams and printers; wearable technology, such as Apple Watches and Fitbits; routers; and smart speaker devices, like Amazon Echo and Google Home.

How does IoT work?

A typical IoT system works through the real-time collection and exchange of data. An IoT system has three components:

- **Smart devices**

This is a device, like a television, security camera, or exercise equipment that has been given computing capabilities. It collects data from its environment, user inputs, or usage patterns and communicates data over the internet to and from its IoT application.

- **IoT application**

An IoT application is a collection of services and software that integrates data received from various IoT devices. It uses machine learning or artificial intelligence (AI) technology to analyze this data and make informed decisions. These decisions are communicated back to the IoT device and the IoT device then responds intelligently to inputs.

- **A graphical user interface**

The IoT device or fleet of devices can be managed through a graphical user interface. Common examples include a mobile application or website that can be used to register and control smart devices.

Component of IoT

Many Elements Make IoT Communication Possible, But Mainly It Consists Of The Following Components, Which Helps Devices Communicate Are:-

- Sensors
- Gateway
- Cloud
- Connectivity
- Data Processing
- User Interface

Let Us Understand This Briefly:

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com

- **SENSORS:**

IoT Is Like A Sweet Without Sweetness When Sensors Are Not A Part Of It. However, Sensors Are The Devices That Respond To The Changes (Inputs Like Pressure, Touch, Light, Sound, Etc) And Send The Appropriate Output To Those Changes.

- **GATEWAY:**

Gateway Suggests The Bridge Of Communication Between Two Devices. IoT Gateway Follows The Same Principle. It Is Also The Bridge Of Communication Between Devices/Sensors And The Internet(Connection Point Between Cloud And Controllers). It Is Also Refer As An Intelligent Gateway.

- **CLOUD:**

Sensors In IoT Devices Collect Billions Of Data!! To Store And Secure The Data, Thus, Sensors Talk To The Cloud Through Connectivity. Cloud Allows Easy Access To Huge Data Whenever Required. Once Data Gets Into The Cloud, It Is Processed And The Required Action Is Performed.

- **CONNECTIVITY:**

Connecting Is No Doubt An Essential Thing In IoT. Connecting Things To Sensors/Devices Has Many Options Like Bluetooth, Satellite, Cellular, Ethernet, Etc. If A Perfect Connection Is Establish Then The Power Consumption Of The Device Will Be Very Less And Bandwidth Will Be Huge.

- **DATA PROCESSING:**

The Data We Receive From The Sensors Has To Make Sense To Us, Right!!. In Simple Words, Converting Collected Data Into Some Useful, Thus, Readable Information Is Data Processing.

- **USER INTERFACE:**

This Is Essential For Users To Interact With Devices. As The Name Suggests, The User Uses Computer Applications, Software To Communicate With IoT Devices.

Feature of IoT

The most important features of IoT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

Connectivity: Connectivity refers to establish a proper connection between all the things of IoT to IoT platform it may be server or cloud. After connecting the IoT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication.

Analyzing: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

Integrating: IoT integrating the various models to improve the user experience as well.

Artificial Intelligence: IoT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine itself order the coffee beans of your choice from the retailer.

Sensing: The sensor devices used in IoT technologies detect and measure any change in the environment and report on their status. IoT technology brings passive networks to active networks. Without sensors, there could not hold an effective or true IoT environment.

Active Engagement: IoT makes the connected technology, product, or services to active engagement between each other.

Endpoint Management: It is important to be the endpoint management of all the IoT system otherwise, it makes the complete failure of the system. For example, if a coffee machine itself order the coffee beans when it goes to end but what happens when it orders the beans from a retailer and we are not present at home for a few days, it leads to the failure of the IoT system. So, there must be a need for endpoint management.

Uses of IoT

Manufacturing Industry

IoT has been changing the industry landscape for manufacturing sectors in scale. Smart sensory data are used to prevent abnormal breakdowns, requirement analysis, and resource optimization. IoT solutions help organizations in smart asset management, performance monitoring, which reduces asset downtime and increases hardware longevity. It also enables manufacturers with a lower time to marketability and large-scale customizations. For example, IoT helped bike manufacturer Harley Davidson to reduce the time to produce a complete bike from days to hours.

Agriculture Industry

As industry agriculture follows the traditional experience-based operations, which are heavily dependent on human intervention. But with the changing economic landscape and the population increment, the supply-demand gap is huge. Changing environmental conditions, global warming are also a part of the challenge. IoT is probably the most powerful weapon for the agriculture and farming industry to fight this. IoT enables farm managers with real-time corp monitoring, precision farming, livestock management, smart greenhouse management, etc. Industry-grade drones also have multiple use cases in smart farming. On the one hand, drones are used to monitor air, soil, moisture quality; and the other hand; they can help with physical activities like automated spraying of fertilizers, preventing physical breakouts in farms, etc.

Healthcare

One of the important sectors that will get benefit mostly from Industry grade IoT is healthcare. The popularity of smart devices, wearables are increasing day by day. This enables researchers with more and more data to incorporate IoT solutions. Data from wearables are used to prevent heart attacks, constantly monitoring the heart rate, steps taken, tracking sleep, sitting postures, etc. IoT based solutions with nano-technology are even used to

monitor cancerous cells inside the body. IoT, along with machine learning, is changing the industry at a rapid scale.

Insurance

As an Industry, Insurance generally follows structured data. But it has the potential to optimize the resources and claim settlement process using IoT. Recently Insurers have slowly started adhering to IoT in their industry solutions. IoT solutions can be used for automated claims processing as a factor of premium calculation, automated reserve setting, damage assessment, etc.

Home Automation

Controlling electronic instruments remotely is no longer science fiction, It's already commercially available. IoT is used in our daily life to make decisions and optimize power consumption automatically. Google Home, Amazon echo, etc., are examples of some of the IoT based home automation devices where IoT and machine learning are used heavily.

Automobile and Transportation

In the internet era, automobiles are also considered gadgets where upgrades can be made on-demand. Modern cars are equipped with IoT based smart sensors that help in real-time car tracking, speed control, fuel consumption control, car renting solutions, etc. IoT and deep learning help develop automated parking systems, semi autopilots, and even self-driving cars.

Energy Sector

IoT solutions bringing changes in energy sectors with valuable insights on power consumption, hardware maintenance, forecasting dynamic pricing, etc. The traditional power and energy sources and comparatively newer sectors like solar energy, wind energy, and waste recycling are getting benefited from the use cases of IoT.

Sandip Bastola
Computer Science
email:sandip.bastola699@gmail.com