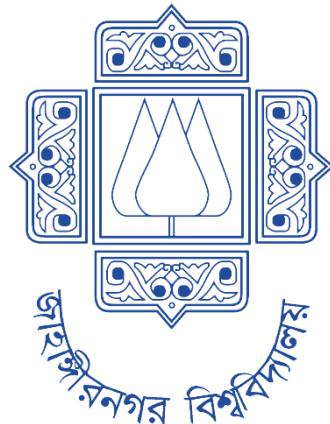


Institute of Information Technology (IIT) Jahangirnagar University



Course Code: MICT 5306
Course Title: Internet of Things

Assignment - 01

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Question 1: what is IOT ? what are the benefits of IOT ?

Answer: The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

The benefits of IoT are :

- i) It enables the physical object to collect and exchange data.
- ii) IoT analyze the collected data to extract new insight and respond accordingly.

Question 2: Benefits of IOT ?

Answer: Benefits of IoT are given below:

i) Automation:

■ machines can assemble parts with more precision and speed, resulting in fewer errors during assembly .

■ Robots can very rapidly detect faults that may not be detected by the human eye.

ii) Predictive Maintenance:

■ continuous monitoring of systems and processes to identify key indicators of problems before they result in downtime or system failure.

iii) Process/Efficiency Improvement:

■ process improvement affects every aspect of an operation's bottom line.

iv) Improved/New Insights:

■ IoT systems often act as the eyes and ears on remote, hard to reach or widely distributed equipment and processes.

v) Adaptability:

■ The ability to adapt to new business requirements, customer needs and changing conditions or scale the deployment in response to business growth or customer requirements.

vi) Cost Reduction:

■ when an organization can improve system uptime, automate processes, reduce the risk of failure and gain insights that support

better decision making and reduce resource usage, the result is efficiency and cost savings.

Question 3: Explain wSN. How to convert it to IoT?

Answer: wSN stands for wireless sensor network.

■ wSN refers to a group of specialized dedicated sensors with a communication infrastructure.

■ wSN is primarily used for monitoring and recording the physical environment conditions like temperature, sound, pollution levels, humidity, wind and so on.

■ It is designed to acquire, process, transfer and provide data/information extracted from the physical world.

■ In a wSN, there is no direct connection to the internet. Instead, the various sensors connect to a some kind of route or central node.

We can convert "wSN" to IoT by the following process:

wSN + Internet + APP + Cloud computing + Data Analytics.

Then it converted to IoT.

Question 7: Difference between IOT vs M2M using table.

Answer: Difference between IOT vs M2M using a table is given below:

Basis of	IOT	M2M
connection type	via (IP) Network and using various communication types.	mainly point to point.
communication protocol	IP based protocol.	proprietary protocols.
Internet	Internet connection is required.	not dependent on the Internet.
Data sharing	Data is shared with other application (if required).	Data is shared with only the communicating parties.
open API	supports open API integration.	There is no support for open API's.
scalability	more devices, more scalable due to cloud based architecture.	Limited devices, less scalable than IOT.
pp. Example	smart home, smart wearables etc.	sensor telemetry, ATMs in Bank.

Question 5: Explain main challenges in IoT?

Answer: Main challenges in IoT are:

i. Sensors:

□ Limited resources.

□ Limited types of sensors.

ii. scale:

□ Millions of devices are connected to from IoT.

iii. privacy:

□ which personal data to share with whom.

□ how to control.

iv. security:

□ 'things' becomes connected, so security becomes complex.

v. Low power Network:

□ Devices should remain connected to the Internet for years.

□ High network latency.

vi. Big data and data analytics:

□ massive amount of sensor data

□ different sources and various forms.

□ extract intelligence from the leaps of data.

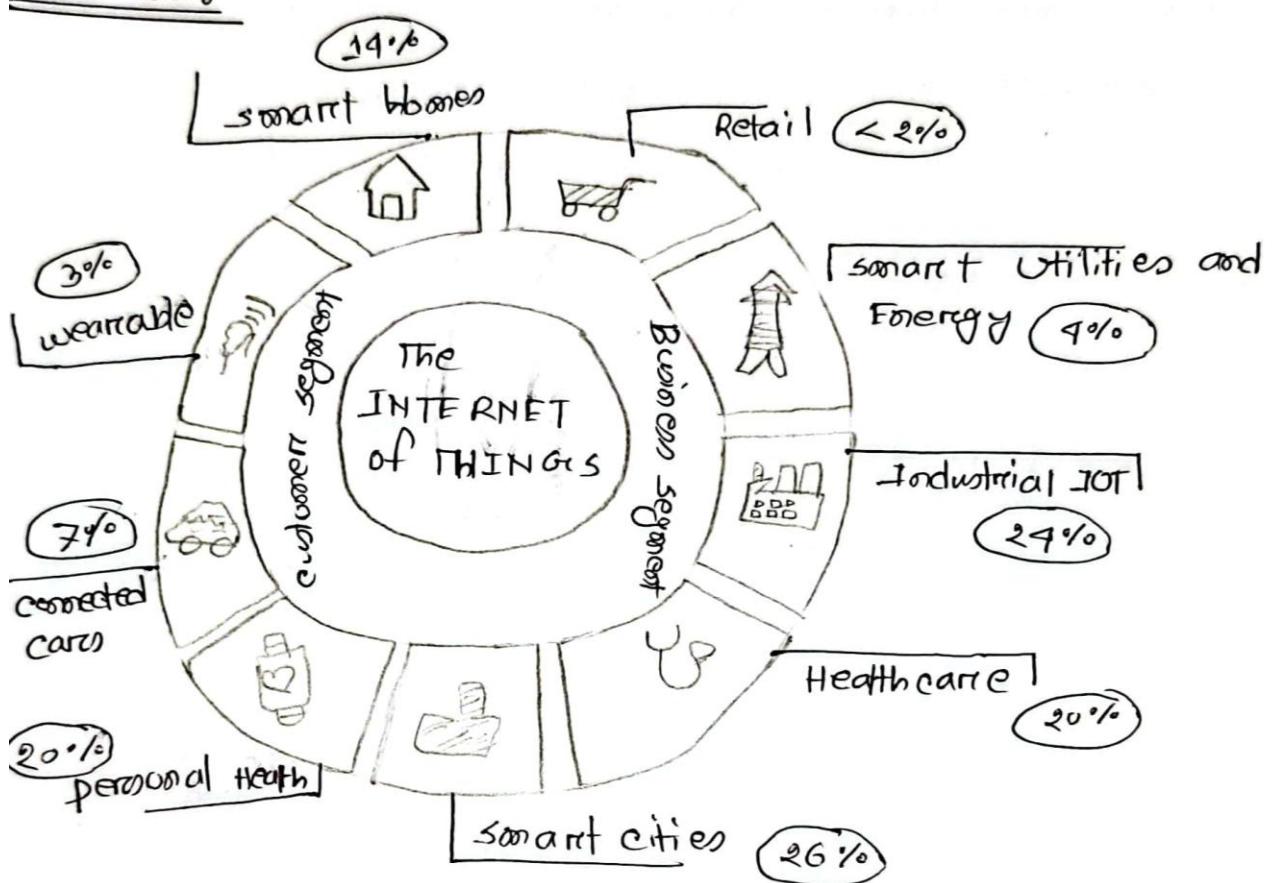
vii. Interoperability:

□ various protocol, various architecture.

- unavailability of standardized platforms.
- different technology leads to interoperability issue.
- Recent IoT standards are minimizing this problem.

Question 6: Global IoT market share.

Answer:



Question 7: what is the IoT Ecosystem?

Answer: The Internet of Things (IoT) ecosystem is a network of devices, people, processes and other components that exchange and collect data.

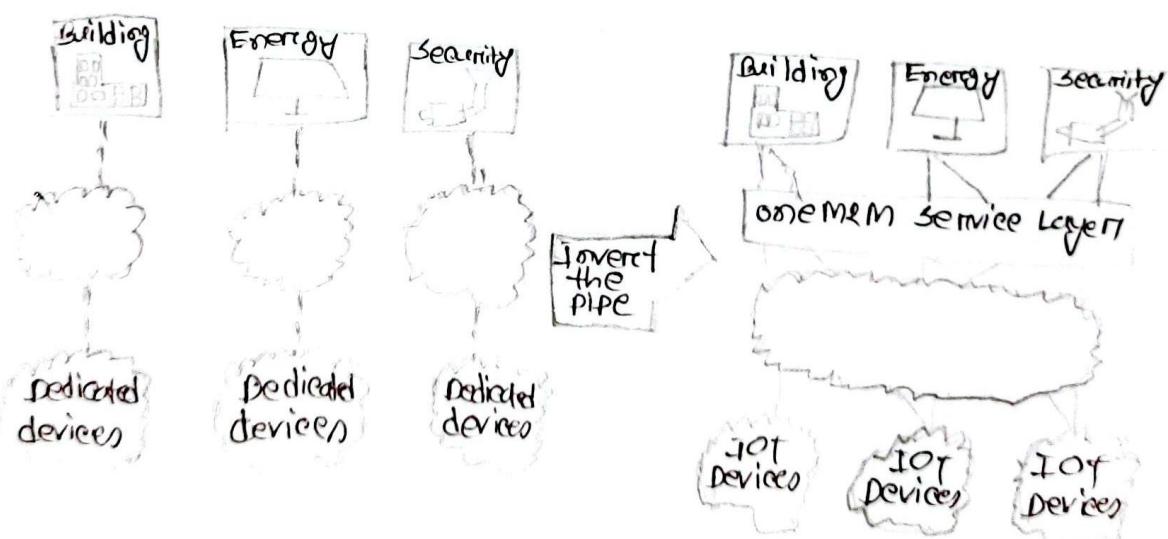
Question 8: what is IoT Framework?

Answer: IoT framework can be defined as a set of protocols, tools and standards that provide a specific structure for developing and deploying IoT application.

Question 9: IoT Network Architecture.

Answer:

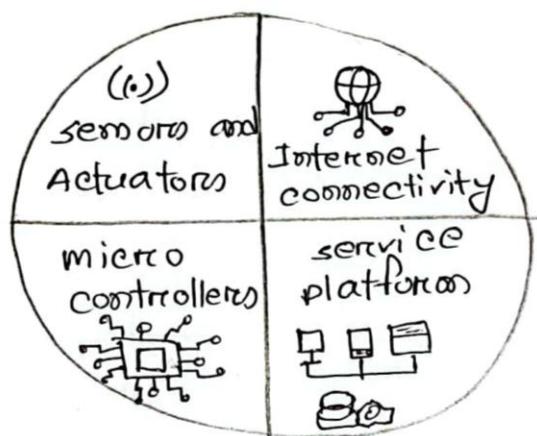
- Network and its application should never be built without careful planning.
- Architecture is how you design your application or should solution.



- The practice of building single purpose "vertical" domain applications leads to isolated silos.
- Using the smart building use case, a security application can detect when nobody is in the building.
- It could trigger lights to be switched off and for the air conditioning system to operate on a reduced setting.

Question 10: Explain core components of IoT?

Answer:



sensors - to gather data and events.

Actuators - responsible for moving and controlling a mechanism or system.

microcontrollers - automatically controls sensors and actuators, makes them smart.

Internet connectivity - responsible for sharing information and control command.

service platform - ability to deploy the IoT devices and application management, data analytics and all aspect of security.

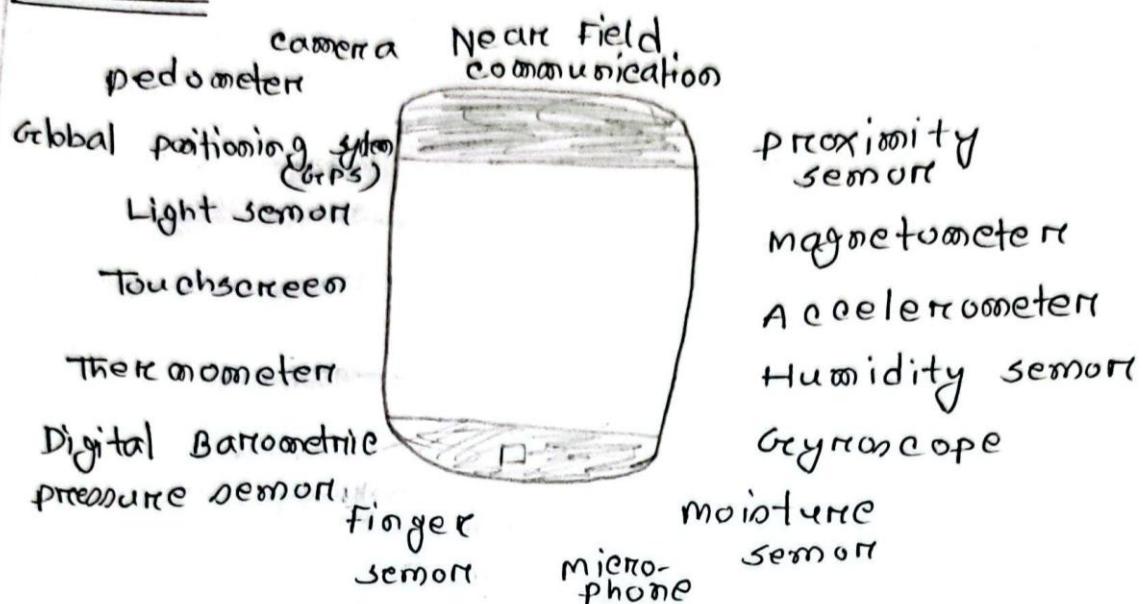
Question 11: write the sensor type with an example:

Answer: The sensor type with an example is given below:

sensor type	Description	Example
position	<ul style="list-style-type: none"> 1. measures the position of an object. 2. position could be relative. 3. position sensor could be linear, angular or multi-axis. 	<ul style="list-style-type: none"> 1. proximity sensor 2. potentiometer 3. Inclinometer.
occupancy	<ul style="list-style-type: none"> 1. Detects the presence of people and animals in a surveillance area 2. generates signal even when a person is stationary 	<ul style="list-style-type: none"> • Radar sensor
motion	Detects the movement of people and objects	<ul style="list-style-type: none"> passive Infrared (PIR) sensor.
force	Detects whether a physical force is applied and the magnitude of the force	<ul style="list-style-type: none"> 1. Tactile sensor 2. viscometer

Question 12: write the name of the smart phone sensors.

Answer:



Question 13: what are the classifications of actuators.

- Answer: common ways to classify actuators.
- i. Type of motion they produce: linear, rotary, one/two/three axes.
 - ii. power output: high power, low power, micro power.
 - iii. Binary / continuous output: Based on number of stable-state outputs.
 - iv. Area of application: specific industry or vertical where they used.
 - v. Type of energy: mechanical energy, electrical energy, hydraulic energy etc.

Question 19: what are the classifications of actuators based on the type of energy?

Answer: Actuators by Energy type are:

Type	Examples
mechanical actuators	Lever, screw jack, Hand crank.
Electrical actuators	Thyristor, Bipolar transistor, Diode.
Electromechanical actuators.	AC motor, DC motor, step motor.
Electromagnetic actuators.	Electromagnet, Linear solenoid.
Hydraulic and pneumatic actuators.	Hydraulic cylinder, pneumatic cylinder, piston, pressure control valve, Air motor.
smart material actuator	Magnetoresistive material, Bimetallic strip, piezoelectric bimorph.

Question 15: what are the characteristics of smart objects?

Answer: smart object has the following five characteristics:

- i. Sensor and Actuators.
- ii. processing units:
 - for acquiring sensed data from sensors.
 - processing and analysing sensing data .
- iii. memory:
 - mostly on chip flash memory .
 - user memory used for storing application related data .
- iv. communication unit:
 - Responsible for connecting a smart object with other smart objects and the outside world .
- v. power source.
 - To powered all components of the smart object.

Question 16: what are the current Trends in smart objects?

Answer: The current Trends in smart objects are given below:

- i. size is decreasing.
- ii. power consumption is decreasing.
- iii. processing power is increasing.
- iv. communication capabilities are improving.
- v. communication is being increasingly standardized.

Question 17: what are the different types of Arduino boards and when should you use each one?

Answer: There are different types of Arduino boards. They are:

Entry level: easy to use and ready to power your first creative projects.

Example: i. Arduino Uno
ii. Arduino Nano.
iii. Arduino Micro.

↳ Enhanced Features boards with advanced functionalities or faster performances.

- i. Arduino zero.
- ii. Arduino mega 2560.
- iii. Arduino motor shield.

Internet of Things: make connections devices easily with one these IOT products.

- i. Arduino Nano 33 IOT.
- ii. Arduino Nano 22 BLE.
- iii. UNO WiFi REV2.

I should use each one when it requires following characteristics.

- i. Inexpensive.
- ii. cross platform - run on windows, mac os, and Linux os.
- iii. Easy to use hardware and software environment.
- iv. open source hardware and software IDE
- v. capable to interact with other boards and computers.
- vi. can interact with sensors and actuators
- vii. facilitate serial communication.

Question 18: what does UART stands for? with a description.

Answer: UART stands for Universal Asynchronous Receiver Transmitter.

It is one of the earliest modes of communication applied to computers.

Its origin goes back at least as far as the 1960s.

It is called universal because its parameters speed, data size and so on are not fixed and can be configured. However, both sides should agree.

It is used for asynchronous serial communication. Serial communication stands for the process of sending data one bit at a time sequentially. And asynchronous means there is no clock signalling line to synchronize and transmitter and receiver might turn on at different time instant.

Two devices do not necessarily share a common clock. Both systems might for example agree on some fixed baud rate.

Question 19: what type of communication -
UART supports?

Answer: UART supports asynchronous serial communication.

Serial communication stands for the process of sending data one bit at a time sequentially. Asynchronous means there is no clock signalling to synchronize and transmitter and receiver might turn on at different time instant.

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Question 20: what are the problems with the data line based communication synchronization scheme in UART? what are used to solve these problems?

Answer: There are two problems with the data line based synchronization scheme in UART. They are:

- i. The single high to low transition is not enough to synchronize timing over

a long period of time. so they need periodic re-synchronization.

ii. If the first bit of data it wants to send is also represented by a high level then there are no transition and vice versa. so, they need some way to distinguish the first bit.

Both of these problems are solved in UART by using start and stop bits.

Question 21: what is UART communication?

Answer: UART communication can be simplex (data is sent in one direction only), half-duplex (each side speaks but only one at a time) or full duplex (both sides can transmit simultaneously).

Question 22: write the steps of UART communication mechanism?

Answer: steps of UART communication mechanism are :

i. The transmitting UART receives data in parallel from the data bus.

2. The transmitting UART adds the start bit parity (even) bit and stop bit to the data frame.
3. The entire packet is sent serially from the transmitting UART to the receiving UART, in most cases, the data is sent with the least significant bit first.
4. The receiving UART discards the start bit, parity bit and stop bit from the data frame.
5. The receiving UART converts the serial data back into parallel and transfers it to the data bus on the receiving end.

Question 23: what is the purpose of parity in UART communications?

Answer: The purpose of parity in UART communication is given below:

- i. It is an optional bit.
- ii. It is used to detect the wrong packets.

Question 24: what are the two types of parity used in UART?

Answer: The two types of parity used in UART are -

- i. Even parity
- ii. odd parity.

Question 25: List two advantages and two disadvantages of UART communication.

Answer: Two advantages:

- i. only uses two wires.
- ii. No clock signal is necessary.

Two disadvantages:

- i. The size of the data frame is limited to max 9 bits.
- ii. Doesn't support multiple master-slave systems.

Question 26: write down zigbee applications.

Answer: zigbee Applications are -

1. Industrial and commercial automation, measuring temperature and humidity and tracking assets.

2. smart home applications: control lighting, thermostats and security function.
3. smart energy or utility applications : monitor and control the use and delivery of utilities such as electricity and water.
4. Monitors sensor Automation control.
5. TV VCR DVD/CD Remote control .

Question 27: what is zigbee Alliance?

Answer: The zigbee alliance was created to develop a set of standards for IoT devices or wireless home automation devices that use the zigbee communication protocol. Its mission is to help simplify, harmonize and build global open standards for the Internet of things (IoT).

Question 28: what type of topologies that zigbee supports ?

Answer: Three types of topologies that zigbee supports . They are :

- i. star topology:

- Communication is established between devices and a single central controller.
 - each star network has an unique PAN identifier.
- ii. peer to peer topology:
- there is also one PAN coordinator.
 - unlike star, any device can communicate with any other device if they are in range of one another.

iii. cluster tree:

- cluster tree network is a special case of a peer to peer network.
- The PAN coordinator forms the first cluster by establishing itself as the cluster head.

Question 29: what is Big data? characteristic of Big data.

Answer: Big data refers to extremely large and diverse collections of structured, unstructured and semi-structured data that continues to grow exponentially over time

Characteristics of Big data:

- i. Machine data or sensor data.
generated by IoT devices and is typically unstructured data.
- ii. Transactional data:
from the sources that produce data from transaction on the system, and have high volume and structured.
- iii. Social data:
which are typically high volume and structured.
- iv. Enterprise data:
data that is lower in volume and very much structured.

Question 30: Explain different types of ML?

Answer: There are 4 types of ML. They are:

- i. Supervised ML: Data has known labels or outputs. Example: Insurance underwriting, Fraud detection etc.

i. unsupervised ML: Labels are output unknown.
Focuses on finding patterns and gaining
insight from the data. Example: customer
clustering, associate rule mining.

iii. semi supervised ML: Labels are output
known for a subset of data.

A blend of supervised and unsupervised
learning.

Example: medical predictions.

iv. Reinforcement: Focuses on making
decisions based on previous experience
and also policy making with feedback

Example: game AI, reward systems
and complex decision problem.

The End