UNIT 4

IoT- A Practical Approach – 16IS665

Notes

IoT − Key Features

1. **AI** − IoT makes virtually anything “smart”, with the power of data collection, artificial intelligence algorithms, and networks. enhancing your refrigerator and cabinets to ***detect when milk*** *and your favorite cereal run low*, and to then ***place an order with your preferred grocer***.
2. **Connectivity** − no longer exclusively tied to major providers. Networks can exist on a ***much smaller and cheaper scale*** while still being practical. IoT creates these small networks between its system devices.
3. **Sensors** − IoT loses its distinction without sensors. They ***act as defining instruments*** which transform IoT from a standard passive network of devices into an active system capable of real-world integration.
4. **Active Engagement** − Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for ***active content, product, or service engagement***.
5. **Small Devices** − Devices, as predicted, have ***become smaller, cheaper, and more powerful over time***. IoT exploits purpose-built small devices to deliver its ***precision, scalability, and versatility***.

IoT − Advantages

1. **Improved Customer Engagement** − Current ***analytics*** suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more ***effective engagement with audiences***.
2. **Technology Optimization** − The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.
3. **Reduced Waste** − IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.
4. **Enhanced Data Collection** − Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

IoT – Disadvantages

Security − users exposed to various kinds of attackers.

Privacy − personal data in extreme detail without the user's active participation.

Complexity − Complicated as use of multiple

Flexibility − integrate easily with another.

Compliance − in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging

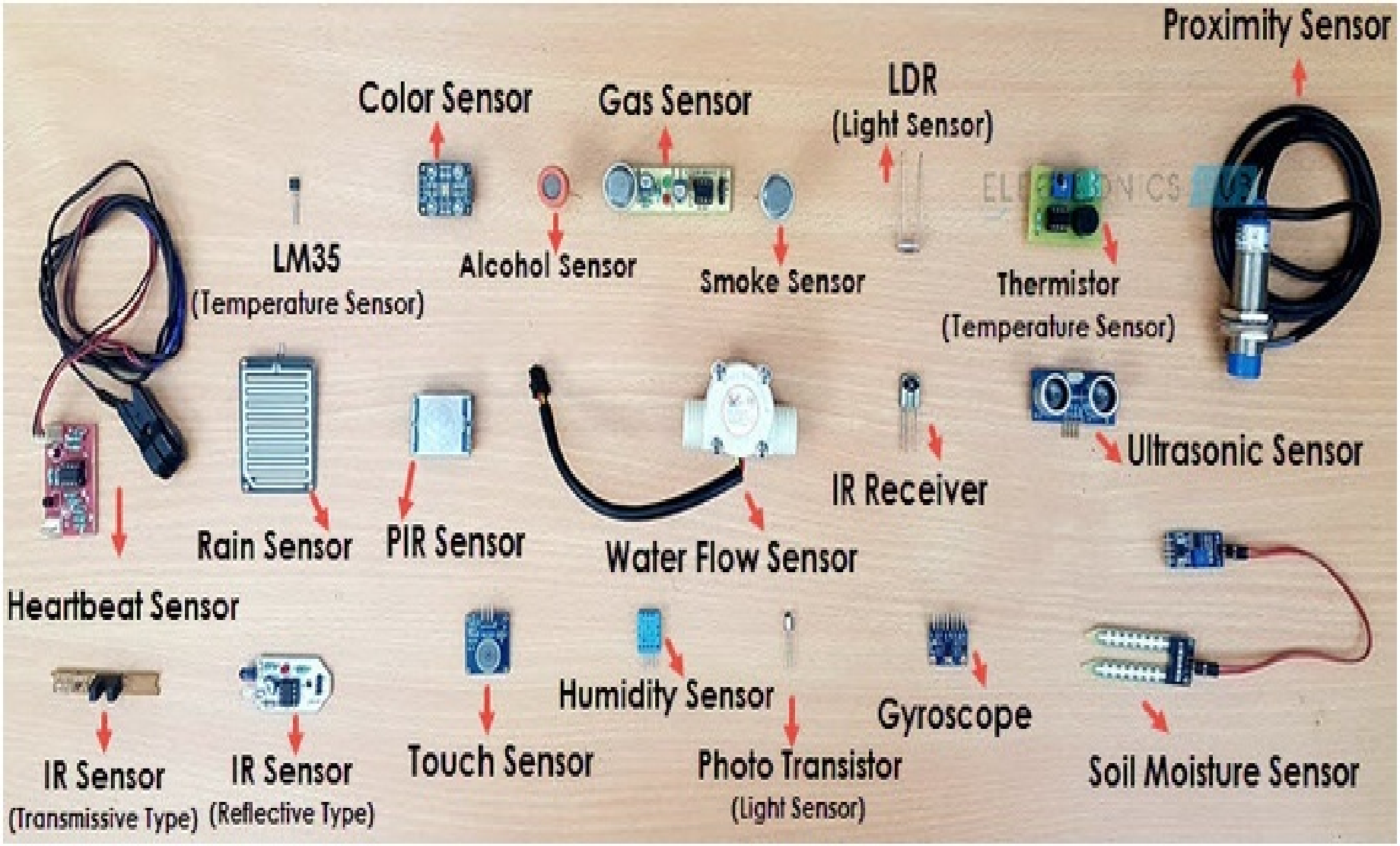
IOT-HARDWARE

- IoT − Sensors
- Wearable Electronics
- Standard Devices

IoT – Sensors

- Sensor is an input device which provides an output (signal) with respect to a specific physical quantity (input).

- It is a device that converts signals from one energy domain to electrical domain.


Proximity Sensor
Color Sensor
Gas Sensor
LDR
(Light Sensor)
LM35
(Temperature Sensor)
Alcohol Sensor
Smoke Sensor
Thermistor
(Temperature Sensor)
Ultrasonic Sensor
IR Receiver
Rain Sensor
PIR Sensor
Water Flow Sensor
Heartbeat Sensor
Humidity Sensor
Gyroscope
IR Sensor
(Transmissive Type)
IR Sensor
(Reflective Type)
Touch Sensor
Photo Transistor
(Light Sensor)
Soil Moisture Sensor

Classification of sensors

- Active: Sensors that **require power** supply are called as Active Sensors.

ex: LiDAR (Light detection and ranging),

- Passive: Sensors that **do not require power** supply.

ex: Radiometers, film photography

EXTRA INFO

LIDAR, which stands for *Light Detection and Ranging*, is a **remote sensing method** that uses light in the form of a pulsed laser to measure ranges (variable **distances**) to the Earth.

Other classification of sensors

- Analog and Digital Sensors.

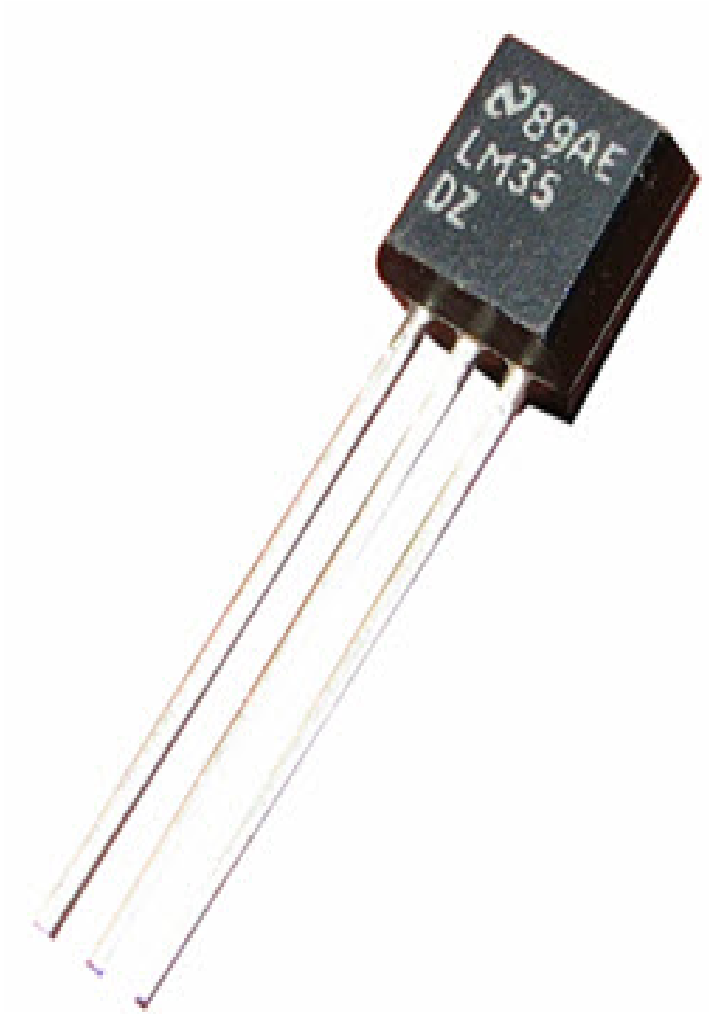
Analog Sensors produce an **analog output** i.e. a **continuous** output signal with respect to the quantity being measured.

Digital Sensors produce an **Digital output** i.e. a **discrete** output signal with respect to the quantity being measured

Different Types of Sensors

- Temperature Sensor
- Proximity Sensor
- Accelerometer
- IR Sensor (Infrared Sensor)
- Pressure Sensor
- Light Sensor
- Ultrasonic Sensor
- Smoke, Gas and Alcohol Sensor
- Touch Sensor
- Color Sensor
- Humidity Sensor
- Tilt Sensor
- Flow and Level Sensor

Temperature Sensor



Temperature Sensor

- the changes in the Temperature correspond to change in its physical property like **resistance or voltage**

- Temperature Sensors are used everywhere like computers, mobile phones, automobiles, air conditioning systems, industries etc

Proximity Sensors

- A Proximity Sensor is a non-contact type sensor that detects the presence of an object.
- Some of the applications of Proximity Sensors are Mobile Phones, Cars (Parking Sensors), industries (object alignment), Ground Proximity in Aircrafts, etc
- Proximity Sensors can be implemented using different techniques like Optical (like Infrared or Laser), Ultrasonic, Hall Effect, Capacitive, etc.


Inductive Proximity Sensor

Infrared Sensor (IR Sensor)

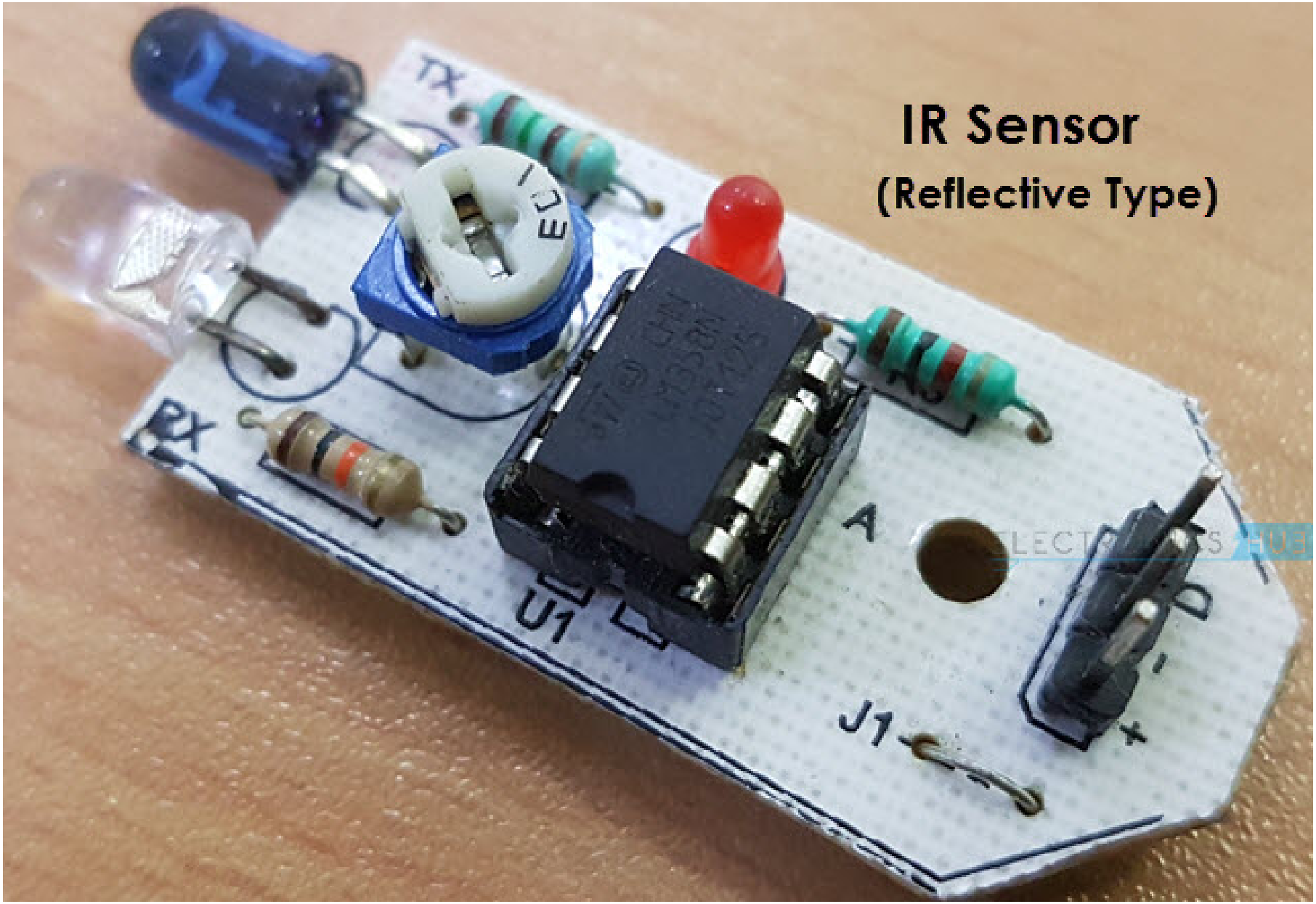
- IR Sensors or Infrared Sensor are light based sensor that are used in various applications like Proximity and Object Detection.

- In Transmissive Type IR Sensor, the IR Transmitter (usually an IR LED) and the IR Detector (usually a Photo Diode) are positioned facing each other so that when an object passes between them, the sensor detects the object.

Reflective Type IR Sensor.

In this, the transmitter and the detector are positioned adjacent to each other facing the object.

When an object comes in front of the sensor, the sensor detects the object.


IR Sensor
(Reflective Type)
TX
RX
U1
J1
A
K
+
-

Ultrasonic Sensor

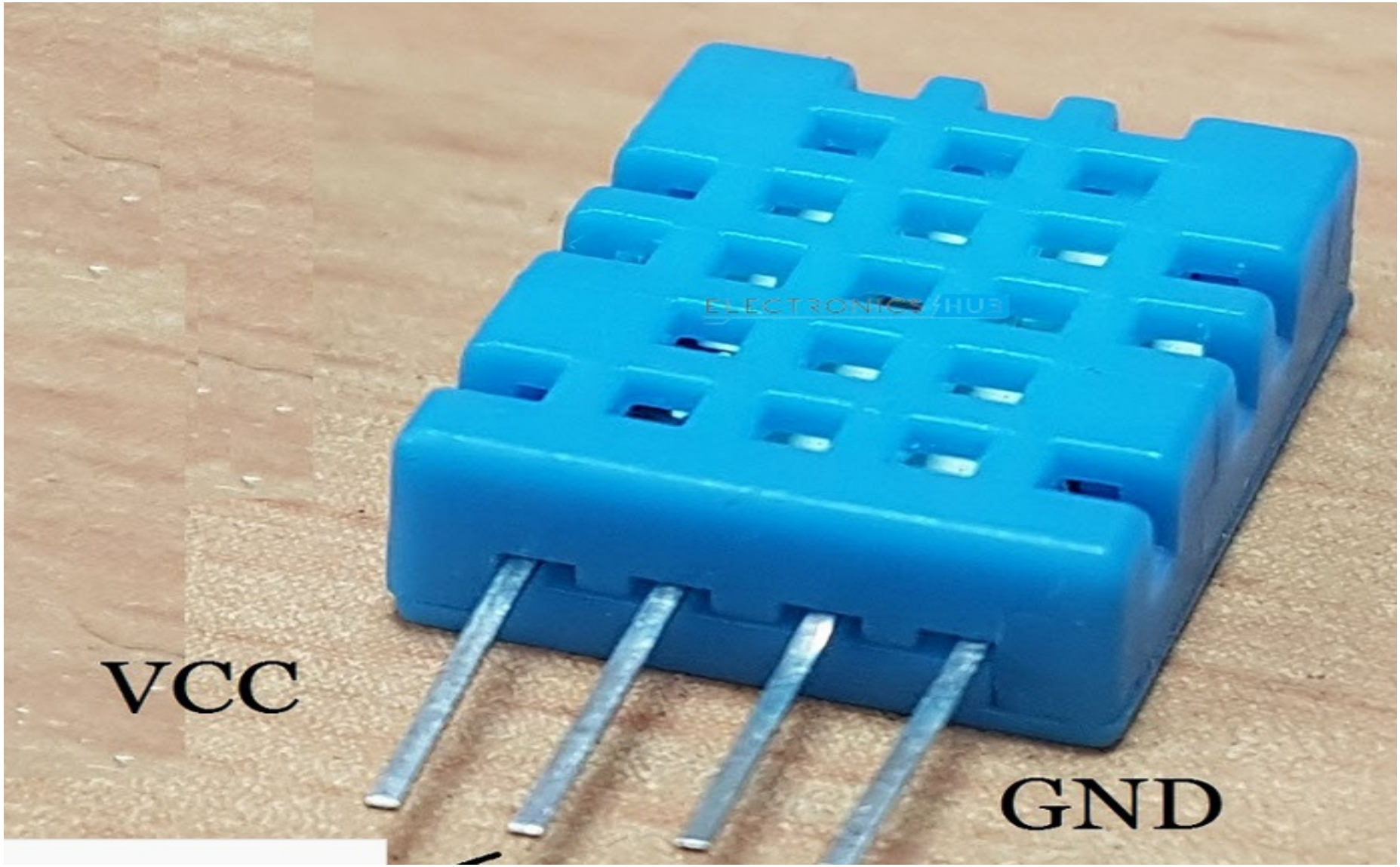
- used to measure **distance** as well as **velocity** of an object.

- An Ultrasonic Sensor works based on the properties of the sound waves with frequency **greater** than that of the **human audible range**.

ELECTRONICS HUB

Ultrasonic Sensor

Humidity sensors



Wearable Electronics

- **Head** − Helmets, glasses
- **Neck** − Jewelry, collars
- **Arm** − Watches, wristbands, rings
- **Torso** − Clothing, backpacks
- **Feet** − Socks, shoes

Standard Devices

- The **desktop** provides the user with the **highest level of control** over the system and its settings.
- The **tablet** provides access to the **key features of the system** in a way resembling the desktop, and also acts as a remote.
- The **cellphone** allows some **essential settings modification** and also provides **remote functionality.**

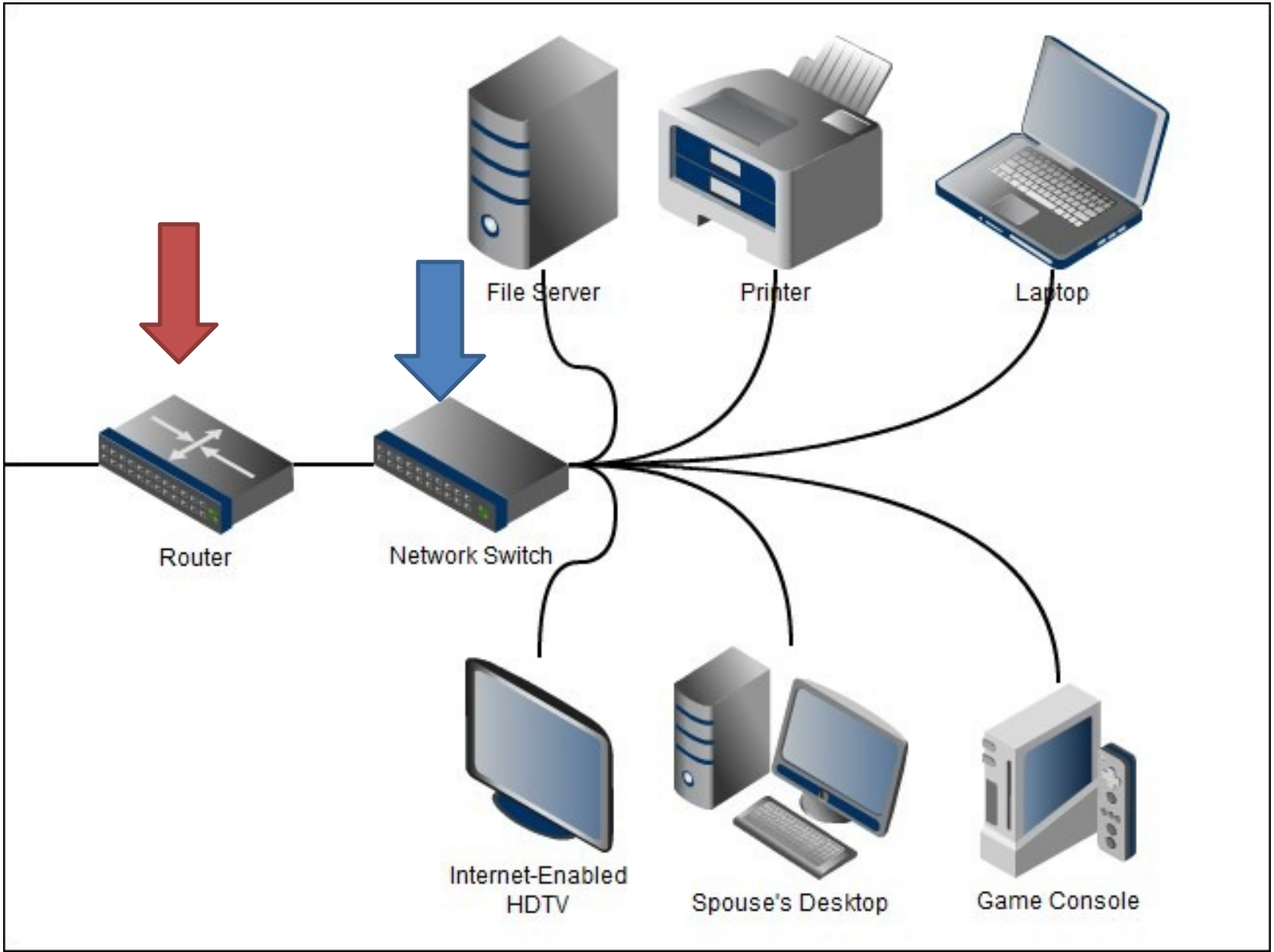
Additional Standard Devices

routers and **switches**

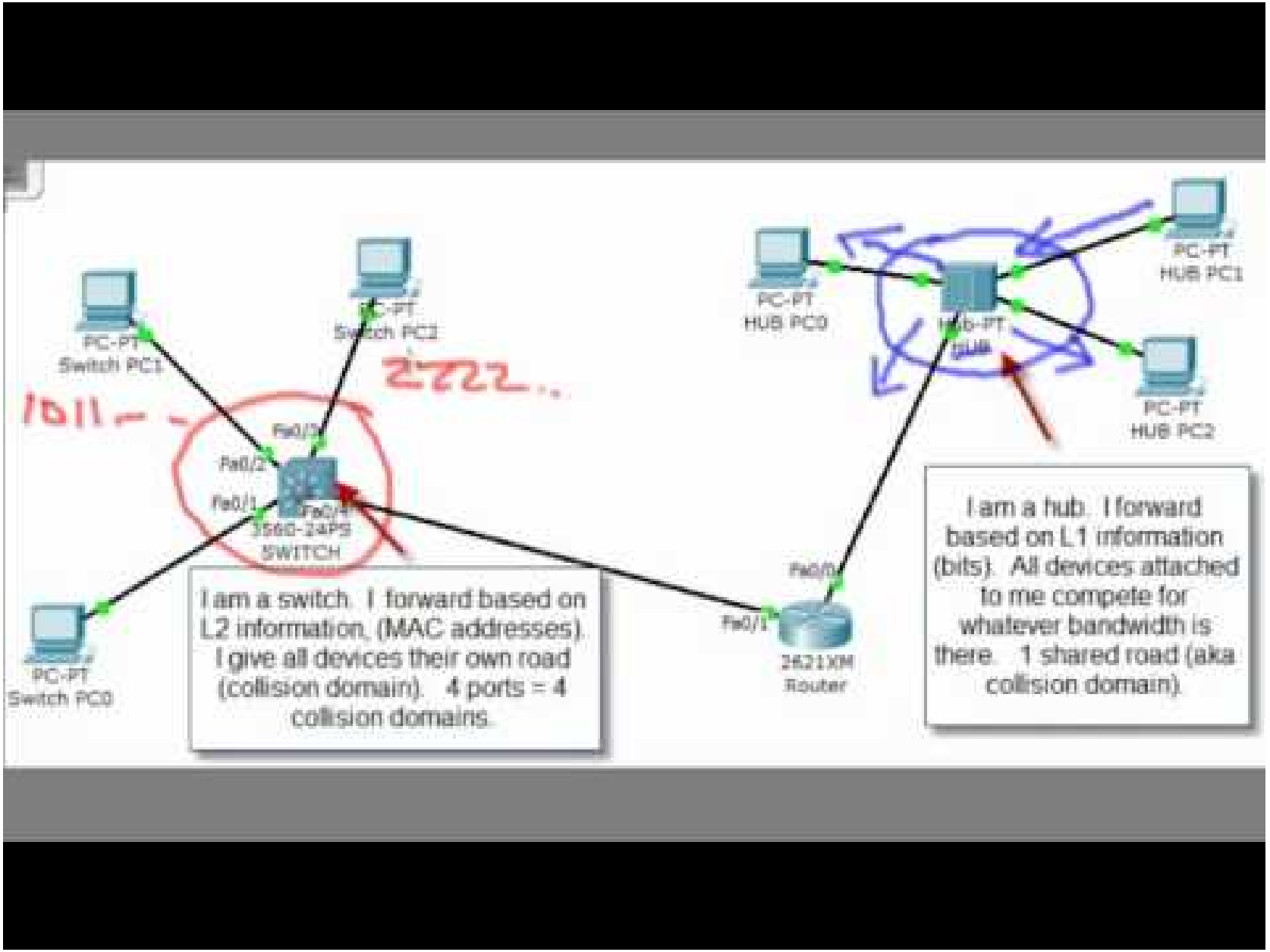
a **switch** is designed to connect computers **within** a network,

while a **router** is designed to connect **multiple networks** together.

switch


File Server
Printer
Laptop
Router
Network Switch
Internet-Enabled HDTV
Spouse's Desktop
Game Console

router


PC-PT
Switch PC1
PC-PT
Switch PC2
PC-PT
Switch PC0
Fa0/2
Fa0/1
Fa0/4
3560-24PS
SWITCH
I am a switch. I forward based on L2 information. (MAC addresses). I give all devices their own road (collision domain). 4 ports = 4 collision domains.
PC-PT
HUB PC0
PC-PT
HUB PC1
PC-PT
HUB PC2
Fa0/0
Fa0/1
2621XM
Router
I am a hub. I forward based on L1 information (bits). All devices attached to me compete for whatever bandwidth is there. 1 shared road (aka collision domain).

IoT - Software

Data Collection

manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machine-to-machine networks.

Device Integration

Software supporting integration binds (dependent relationships) all system devices to create the body of the IoT system.

Real-Time Analytics

take data or input from various devices and convert it into viable actions or clear patterns for human analysis.

Application and Process Extension

These applications extend the reach of existing systems and software to allow a wider, more effective system.

IoT – Technology and Protocols

NFC and RFID

RFID (radio-frequency identification) and NFC (near-field communication) provide simple, low energy, and versatile options for identity and access Tokens.

RFID technology employs 2-way radio transmitter-receivers to identify and track **tags** associated with objects.

NFC consists of communication protocols for electronic devices, typically **a mobile device and a standard device.**

Low-Energy Bluetooth

low-power, long-use need of IoT function

Low-Energy Wireless

replaces the most power hungry aspect of an IoT system. Though sensors and other elements can power down over long periods,

Radio Protocols

LTE-A (Long Term Evolution = 4G)

LTE-A, or LTE Advanced coverage, but also reducing its latency and raising its throughput. expanding its range, with its most significant applications being vehicle, UAV, and similar communication.

WiFi-Direct

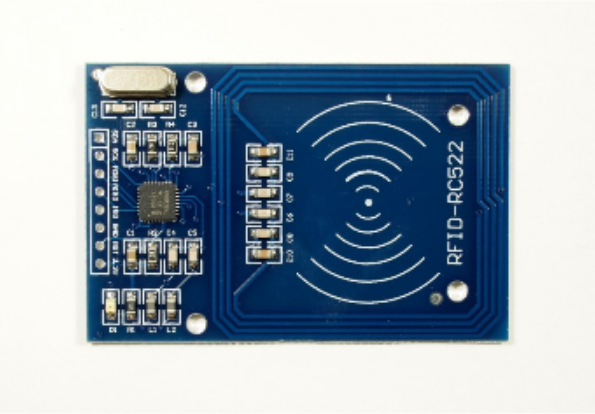
WiFi-Direct eliminates the need for an access point. It allows P2P (peer-to-peer) connections with the speed of WiFi, lower latency. WiFi-Direct eliminates an element of a network that often bogs it down, and it does not compromise on speed or throughput.

Protocol Definition

A **protocol** is a standard **set of rules** that allow electronic devices to communicate with each other.

RFID

Radio-frequency identification (**RFID**) uses electromagnetic fields to automatically identify and track **tags** attached to objects. An **RFID** tag consists of a tiny radio transponder; a radio receiver and transmitter.



NFC

Near-field communication is a set of communication protocols by which **two electronic devices** communicate when they are brought within **4 cm of each other**.

Purpose of NFC

- Transfer Contacts
- Send Documents
- App / online content
- Contactless payment
- Read NFC Tag

ZigBee

ZigBee is a IEEE 802.15.4 based, low power, low data rate supporting wireless networking standard, which is basically used for two-way communication between **sensors and control system**. It is a short-range communication standard like Bluetooth and Wi-Fi, covering range of **10 to 100 meters**.

IoT – Common Uses

Engineering, Industry, and Infrastructure – improving production, marketing, service delivery, and safety

Example Joan runs a manufacturing facility that makes shields for manufacturing equipment.

Government and Safety – improved law enforcement, defense, city planning, and economic management. Ex. Area monitoring devices havedetected suspicious behavior

Home and Office – personalized experience from the home to the office Ex. Joan works in advertising. She enters her office, and it recognizes her face. It adjusts the lighting and temperature to her preference. It turns on her devices and opens applications to her last working points.

Health and Medicine –sophisticated medical devices Ex. system recognized the patient and pulls his records

IoT – Media, Marketing & Advertisation

in which the system analyzes and responds to the **needs and interests** of each customer, includes their general behavior patterns, buying habits, preferences, culture, and other characteristics.

Marketing and Content Delivery

- leads to more information and detail, which delivers more **reliable metrics and patterns**
- allows organizations to **better analyze** and respond to **customer needs** or preferences.
- improves business productivity and strategy, and improves the consumer experience