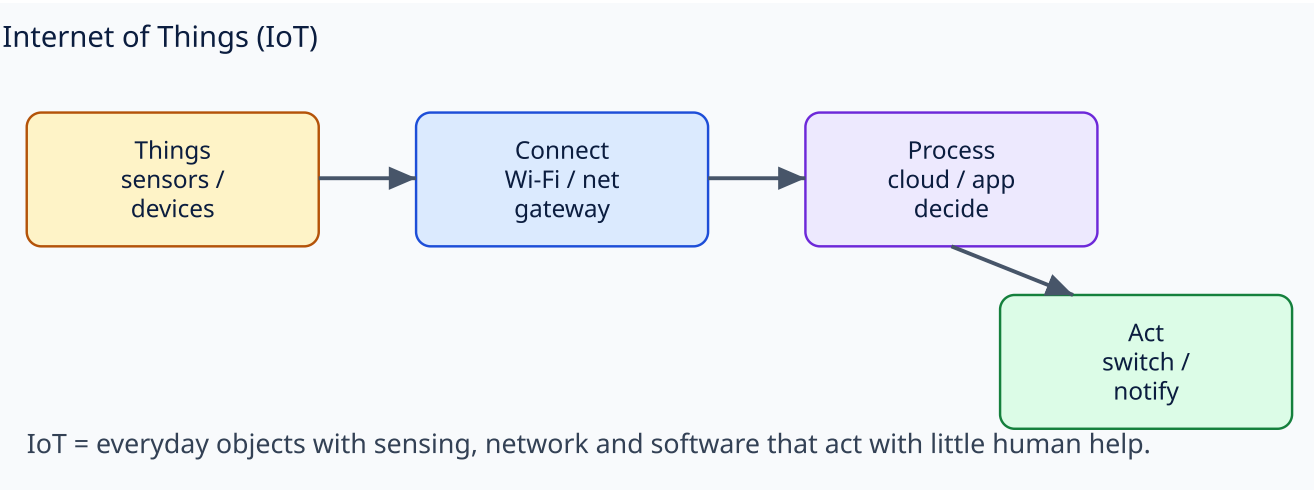
Grade 13 A/L ICT · Lesson 11

11.2 Internet of Things (IoT)

Syllabus 11.2. The **Internet of Things (IoT)** connects everyday **things** (sensors, appliances, meters) to the **Internet** so they can be monitored and controlled with little human help. You learn the **definition**, the **needs** it meets, typical **applications**, the **enabling technologies**, and you design a simple **remote switch** that turns a device such as a television ON or OFF through the Internet.

1. What is IoT?



Things, connect, process, act

- **Definition**: a network of physical objects (“things”) that sense, connect to the Internet and act – often automatically.
- **Needs**: remote control, continuous monitoring, automation, energy saving, safety and convenience.
- Without IoT you must be next to the device; with IoT you use a phone or web page from anywhere.

2. Applications

Smart home
Lights, fans, TVs and locks controlled from a phone.

Smart farm
Soil moisture and weather guide irrigation pumps.

Health care
Wearables report heart rate to a clinic.

Transport & cities
Traffic lights, parking sensors, fleet tracking.

Industry
Machines report faults before they break.

Environment
Air and water quality monitored online.

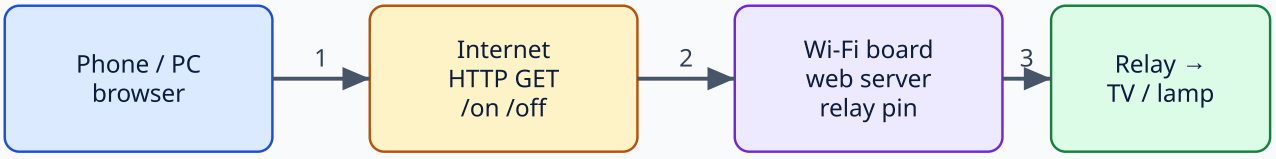
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3. Enabling technologies

Technology	Role in IoT
Microcontrollers / MDS	Run the local sensing and control program
Sensors and actuators	Measure the world and change it
Connectivity (Wi-Fi, cellular, LPWAN)	Link things to the Internet
Cloud and databases	Store readings and run logic
Mobile / web apps	Human interface to watch and command

4. Simple IoT application – remote ON/OFF switch

Simple IoT remote switch



Enabling technologies: microcontrollers, sensors, actuators, Wi-Fi/Internet, cloud, mobile apps.

Needs: remote control, monitoring, automation, energy saving, safety.

Applications: smart home, farm, health, transport, industry, cities.

Browser → Internet → Wi-Fi board → relay → TV

🔌 Remote ON/OFF switch over the Internet

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```
// Simple IoT remote switch (ESP8266 / WiFi board style)
// Browser → http://device-ip/on  or  /off  → relay on pin 5
#include <ESP8266WiFi.h>
#include <ESP8266WebServer.h>

const char* ssid = "SchoolWiFi";
const char* password = "secret123";
const int RELAY = 5;
ESP8266WebServer server(80);

void handleOn() {
  digitalWrite(RELAY, HIGH);
  server.send(200, "text/plain", "TV ON");
}
void handleOff() {
  digitalWrite(RELAY, LOW);
  server.send(200, "text/plain", "TV OFF");
}

void setup() {
  pinMode(RELAY, OUTPUT);
  digitalWrite(RELAY, LOW);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) { delay(500); }
  server.on("/on", handleOn);
  server.on("/off", handleOff);
  server.begin();
}

void loop() {
  server.handleClient();   // wait for HTTP requests
}
```

▶ Simulated run

```
WiFi connected
Server listening on port 80
HTTP GET /on
RELAY 5 = HIGH
Reply: TV ON
HTTP GET /off
RELAY 5 = LOW
Reply: TV OFF
```

🧱 Worked example: A student opens http://192.168.1.50/on on a phone. What happens step by step?
The phone sends an **HTTP GET /on** over Wi-Fi/Internet. The board's tiny **web server** runs handleOn(), drives the **relay pin HIGH**, and replies "TV ON". The relay closes and the television (or lamp) receives power. /off does the opposite.

- Design: list the thing (TV), the actuator (relay), the MDS with Wi-Fi, the network and the user interface (browser links /on and /off).

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- Security note (interest): use a password or HTTPS on a real deployment – open switches on a public network are unsafe.
- The same idea works for a lamp, a fan or a school lab power socket.

💡 Build and test the relay on the desk with a lamp first; only then put the board on the school Wi-Fi.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* In 2026 many school IoT kits use MQTT and free brokers instead of raw HTTP, and phone apps are built with no-code tools – the syllabus idea (sense → connect → act) is unchanged.

Key Words

IoT – Internet of Things – networked sensing and control of everyday objects.	**Thing** – Physical object with sensing and/or actuation.
Remote control – Operating a device from another place over a network.	**Monitoring** – Watching sensor readings continuously.
Automation – Acting on sensor data without a person each time.	**Enabling technology** – Hardware or software that makes IoT possible.
Wi-Fi board – MDS with a wireless network interface (e.g. ESP8266).	**HTTP request** – Message such as GET /on sent by a browser.
Web server (on device) – Tiny program on the board that answers HTTP.	**Relay** – Electrically controlled switch that can drive a TV or lamp.
Smart home – Home where appliances are monitored and controlled over a network.	**Cloud** – Remote servers that store IoT data and run logic.

Sample Q&A

1. Define IoT in one sentence.

> **Answer:** Networked things that sense, connect and act, often automatically.

2. Name three needs that IoT meets.

> **Answer:** Remote control, monitoring, automation (also energy saving, safety).

3. Give three IoT application areas.

> **Answer:** Smart home, farm, health, transport, industry, environment.

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4. List three enabling technologies.

> **Answer:** MDS/microcontrollers, sensors/actuators, Wi-Fi/Internet, cloud, apps.

5. What does GET /on do in the remote switch?

> **Answer:** Sets the relay HIGH and replies TV ON.

6. Why test the relay with a lamp first?

> **Answer:** Safer and easier debugging before going on the school network.

MCQ

1. IoT stands for

A. Internet of Things
B. Internal Office Tools
C. Internet of Televisions
D. Input of Transistors
E. Index of Tables

2. Turning a TV on from a phone over the Internet is mainly

A. formatting a disk
B. remote control
C. compiling
D. printing
E. word processing

3. Soil-moisture pumps on a farm are an IoT application in

A. agriculture / smart farm
B. only gaming
C. only CD-ROM
D. only cable TV
E. only desktop publishing

4. Which is an enabling technology for IoT?

A. CRT televisions only
B. vinyl records
C. Wi-Fi connectivity
D. punched cards
E. fountain pens

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5. In the remote-switch sketch the actuator is the

A. LM35
B. relay (to the TV)
C. reed switch
D. LDR
E. USB cable

6. The browser command that turns the device on is

A. FTP PUT /off
B. DNS lookup only
C. SMTP MAIL
D. HTTP GET /on
E. CSS hover

7. The board program that answers /on and /off is a

A. web server
B. spreadsheet
C. compiler only
D. word processor
E. paint program

8. A need met by IoT is

A. removing all sensors
B. avoiding all networks
C. writing novels by hand
D. banning mobile phones
E. automation of routine actions

9. Which term means: “Internet of Things – networked sensing and control of everyday objects”?

A. IoT
B. Enabling technology
C. Smart home
D. HTTP request
E. Remote control

10. Which term means: “Physical object with sensing and/or actuation”?

A. Cloud
B. Thing
C. Monitoring
D. Wi-Fi board
E. Web server (on device)

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11. Which term means: “Operating a device from another place over a network”?

A. HTTP request
B. Relay
C. Automation
D. Remote control
E. IoT

12. Which term means: “Watching sensor readings continuously”?

A. Web server (on device)
B. Thing
C. Enabling technology
D. Smart home
E. Monitoring

13. Which term means: “Acting on sensor data without a person each time”?

A. Remote control
B. Relay
C. Cloud
D. Wi-Fi board
E. Automation

14. Which term means: “Hardware or software that makes IoT possible”?

A. Smart home
B. Enabling technology
C. Monitoring
D. IoT
E. HTTP request

15. Which term means: “MDS with a wireless network interface (e.g. ESP8266)”?

A. Web server (on device)
B. Thing
C. Automation
D. Wi-Fi board
E. Cloud

16. Which term means: “Message such as GET /on sent by a browser”?

A. Relay
B. IoT
C. HTTP request
D. Enabling technology
E. Remote control

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17. Which term means: “Tiny program on the board that answers HTTP”?

A. Wi-Fi board
B. Thing
C. Monitoring
D. Web server (on device)
E. Smart home

18. Which term means: “Electrically controlled switch that can drive a TV or lamp”?

A. HTTP request
B. Cloud
C. Relay
D. Automation
E. Remote control

19. Which term means: “Home where appliances are monitored and controlled over a network”?

A. IoT
B. Web server (on device)
C. Smart home
D. Enabling technology
E. Monitoring

20. Which term means: “Remote servers that store IoT data and run logic”?

A. Relay
B. Thing
C. Automation
D. Wi-Fi board
E. Cloud

Structured Questions

1. Define IoT and state three needs it addresses. *(2 marks)*

> Definition (1); three needs (2).

2. Describe four IoT application areas with one example each. *(2 marks)*

> Home, farm, health, transport/industry/environment.

3. Explain five enabling technologies for IoT. *(5 marks)*

> MDS; sensors/actuators; connectivity; cloud; apps.

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4. Design a remote ON/OFF switch for a classroom lamp. *(4 marks)*

> Wi-Fi MDS; relay; /on /off; block diagram.

5. Trace what happens when a user opens /off in a browser. *(5 marks)*

> HTTP GET; handleOff; relay LOW; reply TV OFF; lamp off.

Summary

- IoT connects sensing things to the Internet to act.
- Needs: remote control, monitoring, automation, saving, safety.
- Applications: home, farm, health, transport, industry, environment.
- Enablers: MDS, sensors, networks, cloud, apps.
- A remote switch: browser → HTTP → Wi-Fi board → relay.

MCQ answer key – 11.2

1. **A** – Internet of Things.
2. **B** – Remote control.
3. **A** – Smart farm.
4. **C** – Connectivity.
5. **B** – Relay.
6. **D** – GET /on.
7. **A** – Tiny web server.
8. **E** – Automation.
9. **A** – IoT – Internet of Things – networked sensing and control of everyday objects.
10. **B** – Thing – Physical object with sensing and/or actuation.
11. **D** – Remote control – Operating a device from another place over a network.
12. **E** – Monitoring – Watching sensor readings continuously.
13. **E** – Automation – Acting on sensor data without a person each time.
14. **B** – Enabling technology – Hardware or software that makes IoT possible.
15. **D** – Wi-Fi board – MDS with a wireless network interface (e.g. ESP8266).
16. **C** – HTTP request – Message such as GET /on sent by a browser.
17. **D** – Web server (on device) – Tiny program on the board that answers HTTP.
18. **C** – Relay – Electrically controlled switch that can drive a TV or lamp.
19. **C** – Smart home – Home where appliances are monitored and controlled over a network.
20. **E** – Cloud – Remote servers that store IoT data and run logic.

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