



Computer Science

Grade 11 - Term 1 – Revision Notes
2017 - 2018

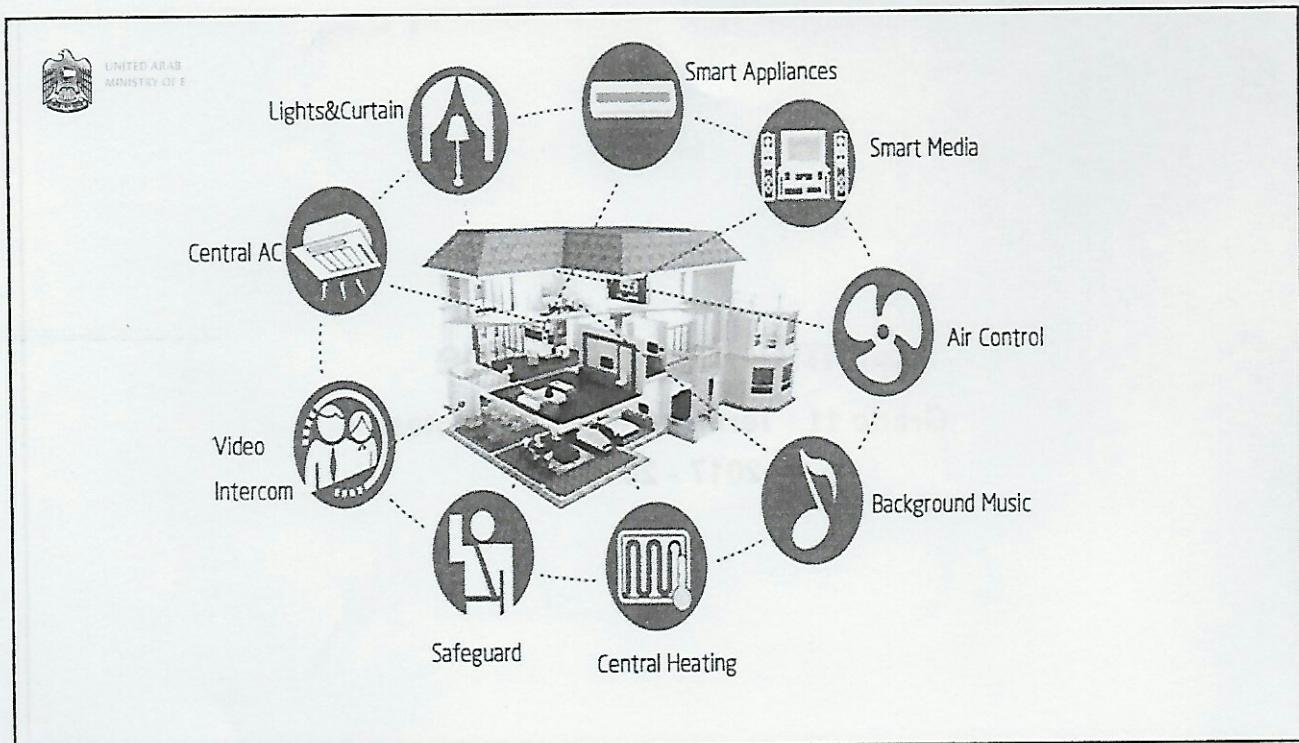


Unit 1 – What is the internet of things?

- Innovation and communication are happening at a remarkable rate.
- The Advanced Research Projects Agency Network (ARPANET) in 1969, when it interconnected a few sites, it is now predicted that the Internet will interconnect 50 billion things by 2020.
- The Internet now provides global connections that make web surfing, social media, and smart mobile devices possible.
- The internet has undergone a huge transformation, from being technology driven to being market and opportunity driven.
- The bio sensors you are wearing or the sensors on your smartphone detect levels of stress and may decide to adapt the music or even rearrange the office furniture.

Internet of Things is changing industries – Industry 4.0

- We live in a world where devices connect everything together. This will change different areas such as your home, the emirate you live, your and the industry you may work in in the future.



Place	Use of sensor
Your Home	<ul style="list-style-type: none"> Wi-Fi Plant Watering Sensor System. Sensors that can monitor Smart sockets allow you water pressure
Industry	<ul style="list-style-type: none"> Save in bills for resources. Find things more easily. Give customers what they need before they even know it themselves. Smart systems can be used to monitor when safety equipment is used and needs replacing.
Your Emirate	<ul style="list-style-type: none"> Understand pollution and ways to keep your emirate clean and running smooth in a smart way By embedding smart sensors in bins With a number of sensors connected together, systems can let you know where there are parking spaces in the Emirates. Sensors inside the streetlights can adjust the brightness of the light depending on the time of day or weather.
Health and well being	<ul style="list-style-type: none"> Sensors can be used to keep you safe and healthy. Sensors in the clothing of babies can monitor their sleeping pattern, breathing and temperature to ensure they are safe during the night. It could alert you to call an ambulance, or provide some advice before you leave the house. With a world of smart sensors built into a common device such as your phone, you will be able to monitor your activity during the day, the number of steps you make, your heart rate, even blood sugar levels.



IoT

- Devices have built-in wireless connectivity so that they can connect to the internet.
- This kind of network built with modern technology is known as the Internet of Things.

Four basic parts form a part of the Internet of Things:

1. sensors that can detect signals from the environment
2. software to read the Data from the sensors; the software will use the data to make decisions
3. software to manage the device that contains the sensors
4. an internet connection that allows the device to transmit its data.



The IoT affects five core priorities of an organization

IoT in an organization is advantages in following areas.

1. Customer experience

IoT in an organization, improves customer relationships to get more of the market.

2. Innovation

IoT in an organization, reduces time to market products and improving product development to meet the needs of the customers.

3. Employee productivity

IoT in an organization, provides the ability to be more productive and saleable.

4. Use of resources

IoT in an organization, lowers costs.

5. Supply

IoT in an organization, identifies areas of waste and delay, whole increasing logistical efficiency.



Some more examples of how the IoT is likely to impact business and society in the coming years:

1. Drive the IoT
2. Wear the IoT
3. Become tomorrow's Roger Federer
4. Making light of the IoT
5. Smart cities
6. Making farming more friendly
7. Flying high
8. Looking after the elderly
9. Looking after your property
10. Never be late again...possibly



The evolution and transformation of the Internet of Things

- The Internet of Things is going to change society as a whole.
- The IoT has mainly been driven by engineers and technologists thinking about how hardware and data and bits and so on can coordinate the physical flows of the city.

Investing in a high-quality technology infrastructure and tools - a secure and reliable network infrastructure is required to support the IoT.

Adopting and following inclusive practices - an inclusive environment is one in which the employees of that environment feel as though they are part of the change.

Developing effective information-management practices - management must be able to embrace and promote change. Information sharing and management must be supported, and data-extracting techniques must be developed.



Unit 3. Connecting the Unconnected & Control Systems

- The IoT is focused on connecting the unconnected “things” of the IoT.
- Operational Technology (OT) is defined as an organisation's industrial control and automation infrastructure.
- This includes the hardware (such as sensors and end devices) and the software that is used to control and monitor the manufacturing equipment and processes.
- There are many different types of IoT-enabled devices available.
- Most IoT devices use sensors, controllers and actuators to perform functions.



Controlled System

- Feedback loops are used by the IoT device to provide real-time information to its controller based on current behaviour.
- A closed loop exists when the feedback is continuously being received by the controller from its sensors.
- The controller analyses and processes information, and if necessary, it can use actuators to change conditions.
- This process is continuously repeated and adjusted.
- The controller can also communicate wirelessly with the user to enhance the IoT experience.
- For example, when you leave the house it will turn itself down to change the energy.



Sensors

- A sensor is a device that can be used to measure a physical property by detecting some type of information from the physical world.
- This information could be light, moisture, motion, pressure, temperature, or any other environmental condition.
- A sensor may be connected to a **controller** either directly or remotely.
- Sensors and controllers are usually connected by means of analogue or digital circuits.
- Sensors send data to a controller. That controller could react to the sensor data immediately and change the sensor settings.

For example, most new cars are equipped with backup cameras or anticollision sensors



Controller

- The controller may also act as a gateway to an IP network and pass the sensor data to be stored or analysed on servers on the internet.
- The collected data and analyses can be used to trigger actions by people, systems or machines.
- The analysis of birth rates in different counties may cause a government to build a new school in a different location
- Controllers are responsible for collecting data from sensors and providing network or Internet connectivity.
- Controllers may have the ability to make immediate decisions, or they may send data to a more powerful computer for analysis.
- This more powerful computer might be on the same LAN as the controller or might only be accessible through an Internet connection.
- The controller may also act as a gateway to an IP network and pass the sensor data to be stored or analysed on servers on the internet.
- The collected data and analyses can be used to trigger actions by people, systems or machines.



Actuators

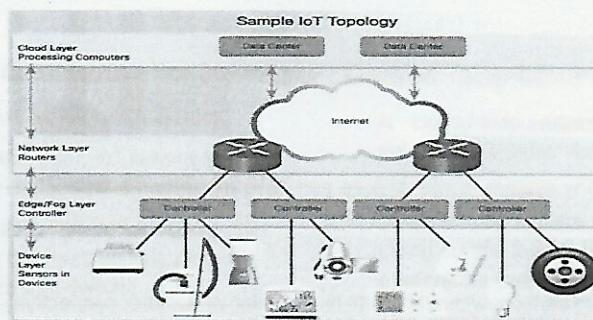
An actuator is a basic motor that can be used to move or control a mechanism or system, based on a specific set of instructions.

Typically, in the industrial IoT, there are three types of actuators:

- Electrical - powered by a motor that converts electrical energy into mechanical operations
- Hydraulic - uses fluid pressure to perform mechanical movement
- Pneumatic - uses compressed air to enable mechanical operations



IoT network



- This image shows a sample IoT network that has sensors, controllers, routers and data centres.
- To reach the more powerful computers in the data centre, the controller will first send data to a local router.
- This router is the interface between the local network and internet. It can send data back and forth between them.



Microcontrollers

- The Arduino microcontroller and the Raspberry Pi are both types of controllers.
- They can both operate without the internet and are used by hobbyists and professionals.
- The key difference between the two is physical size, available processing power, memory and OS.
- Typically, the Arduino requires less power than the Raspberry Pi. The application should dictate which controller is the best to use.
- The two controllers are commonly used together.



IoT Process Flow

- Key components of some of the simplest IoT systems include sensors connecting, through a wireless or wired connection, to actuators or controllers.
- As with many components in any system, some devices can have more than one function. This is the case for the controller in an IoT System.
- A controller can collect data from sensors without human intervention or network connectivity.
- A controller may also act as a gateway to the local network.
- The controller may pass the data up to be stored or analysed on servers in the local or edge network. Where the data is processed will impact the speed in which change can take place in the system.
- Data can be stored and processed on devices that are near the edge of the network or even closer to the sensors.



Process

- A process uses inputs to execute the right actions to achieve the desired output.
- A system is a set of rules that govern the series of steps or actions in a process.

Control Systems

- A control system includes a controller that uses inputs and outputs to manage and regulate the behaviour of the system in an attempt to achieve a desired state.
- The input specifies what the output should be for the whole process.
- The controller indicates what specific changes are needed to achieve the desired output based on the input.
- The controlled portion of the system, the process and the actuator, is often called the plant.
- The input is used by the plant to produce the desired output.



Control Systems

Open-Loop Control Systems

- Open-loop control systems do not use feedback.
- The controller instructs the plant to perform a set action without any check of the desired results.
- Open-loop control systems are often used for simple processes where the relationships between the input and the plant are well-defined.

Closed-loop control systems

- A closed-loop control system uses feedback to determine whether the collected output is the desired output.
- A closed-loop system measures output using a sensor. Using control theory, this measurement is compared to a reference that represents the desired state (input).
- The result is then "feedback" into a controller. This feedback is used by the controller to adjust the controls into the plant for the next iteration of output, and the process repeats.

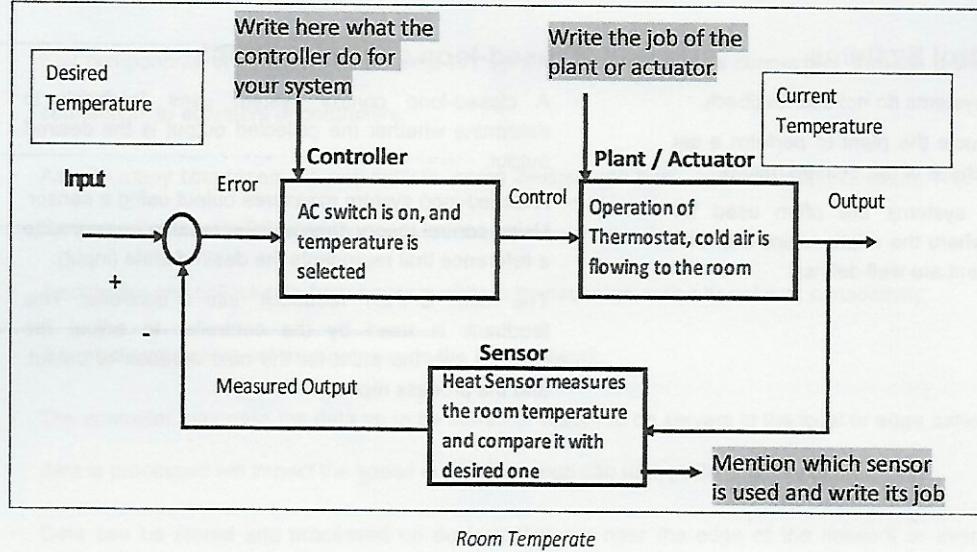


Flow Chart

- Flowcharts are drawn using standard symbols.
- Terminator symbols are used at the beginning and end of each flowchart.
- Process symbols are used to show a process such as assigning a variable or running a process.
- Decision symbols are used to decide which action is to be taken next.
- These can be used for selection and repetition/iteration.



Draw and Label – An example





Few Examination Tips

- You are given 35 minutes to complete the exam.
- Allocate time according to the sections.
- Read the questions carefully.
- Look for key words in the question like define, explain, list, describe. Answer accordingly.
- Do not forget to Label your drawings.
- See the marks allotted and answer accordingly.
- Do not leave any answer blank. Try to attempt all questions.

ALL THE BEST ☺