



KIIT Deemed to be University
Online End Semester Examination(Autumn Semester-2020)

Subject Name & Code: Internet of Things & IT-4021

Applicable to Courses:B.Tech(CSE,IT,CSCE,CSSE)

Full Marks=50

Time:2 Hours

SECTION-A(Answer All Questions. Each question carries 2 Marks)

Time:30 Minutes

(7×2=14 Marks)

<u>Question No</u>	<u>Question Type(MCQ/SAT)</u>	<u>Question</u>	<u>CO Mapping</u>	<u>Answer Key (For MCQ Questions only)</u>
<u>Q.No:1</u>	<u>SAT</u>	Which IoT layer protocol determines how data is physically sent over the physical medium in the network?	1	Data Link Layer. (ethernet, wifi) are some of the examples.
	<u>SAT</u>	Why do IoT Systems have to be self-adapting and self-configuring?	1	Since iot devices are deployed in various places where humans intervention is quite difficult. Devices should be smart and designed in such a way they adapt to the environment(W SN) and also have to upgrade incase there is software update.
	<u>MCQ</u>	Which of the following in not a data link layer technology? a) UART b) Bluetooth c) HTTP d) WiFi	2	C
	<u>MCQ</u>	Which of the following is not a Network Device?	1	B

		a) Switch b) Traffic Analyzer c) Router d) Bridge		
Q.No:2	<u>SAT</u>	What is purpose of digitalRead() and digitalWrite() functions?	1	
	<u>SAT</u>	What is purpose of setup() and loop() functions?	1	
	<u>SAT</u>	What is the purpose of PinMode() and delay() function	2	
	<u>MCQ</u>	Which language is preferred for IoT Analytics a) C++ b) Python c) HTML d) PHP	2	B
Q.No:3	<u>SAT</u>	Write any two differences between Raspberry pi and Desktop Computer	3	
	<u>SAT</u>	What is the importance role of Zigbee in IOT.	3	
	<u>MCQ</u>	MQTT stands for _____ a) MQ Telemetry Things b) MQ Transport Telemetry c) MQ Transport Things d) MQ Telemetry Transport	2	D
	<u>SAT</u>	Name few services offered by Cloud Computing.	3	
Q.No:4	<u>SAT</u>	Which protocol is used to operate over REST Services?	4	
	<u>SAT</u>	What is UART? What is its purpose?	1	
	<u>SAT</u>	Name few sensors which are used in Weather Monitoring system of IOT?	2	
	<u>SAT</u>	What are the entities present in Domain Model Specification in IoT design methodology?	3	
Q.No:5	<u>SAT</u>	What is the role of Operational view	2	

		specification in IoT design methodology?		
	<u>SAT</u>	Name few sensors which are used in Pollution Monitoring system of IOT?	1	
	<u>SAT</u>	Explain the role of 6LoWPAN?	3	
	<u>SAT</u>	Name few sensors which are used in Forest fire Detection system of IOT?	2	
Q.No:6	<u>SAT</u>	Write in short differences between web socket and HTTP.	1	
	<u>SAT</u>	What is 802.15.4 in Link layer of IoT Protocols?	2	
	<u>SAT</u>	What is Dweet? What is its role in IoT?	3	
	<u>SAT</u>	Name few server side web technologies Used for IoT.	2	
Q.No:7	<u>SAT</u>	What is LDR? What is its purpose?	2	
	<u>SAT</u>	What is the role of Namenode in HDFS Architecture?	4	
	<u>SAT</u>	Write any two differences between Wireless Sensor Network and Internet of Things network sensor?	2	
	<u>MCQ</u>	Which of the following is Raspbian? a) OS b) Assembler c) Language d) Compiler	1	A

SECTION-B(Answer Any Three Questions. Each Question carries 12 Marks)

Time: 1 Hour and 30 Minutes
(3×12=36 Marks)

<u>Question No</u>	<u>Question</u>	<u>CO Mapping</u> <u>(Each question should be from</u>
---------------------------	------------------------	---

		<u>the same CO(s)</u>
<u>Q.No:8</u>	Explain any four Communication models in IOT with diagram?	1,2,3
	Define IOT? Explain the logical design of IOT with diagram?	
	Explain different layers in IOT Protocols with diagram?	
<u>Q.No:9</u>	What are the benefits of an IoT oriented approach over M2M by considering a Health band as the real world use case example? Compare the Main characteristics of M2M and IoT.	2,3,4
	What is the role of Thinkspeak in IOT. Explain differences and similarities between M2M and IOT?	
	Explain the components of IOT Device with diagram?	
<u>Q.No:10</u>	Write the IoT Design Methodology steps for Weather Monitoring IOT system.	2,3,1
	Write the IoT Design Methodology steps for Home Automation IOT System.	
	a) Name and Explain few Cloud Storage Models & Communication APIs in IOT? b) Explain Client-Server model and MVC in IOT?	
<u>Q.No:11</u>	Draw block diagram of Arduino Uno. Explain the working principle of interfacing an LED with switch using Arduino Uno.	2,3,4
	How Data Analytics and Big data plays important role in IOT? Explain few Wireless IoT Network Protocols?	
	Explain different IoT Levels & Deployment Templates?	

Scheme of Evaluation

1.DIGITALREAD-Reads the value from a specified digital pin, either HIGH or LOW.

Syntax

`digitalRead(pin)`

DIGITAL WRITE-Write a HIGH or a LOW value to a digital pin.

If the pin has been configured as an OUTPUT with `pinMode()`, its voltage will be set to the corresponding value: 5V (or 3.3V on 3.3V boards) for HIGH, 0V (ground) for LOW.

If the pin is configured as an INPUT, `digitalWrite()` will enable (HIGH) or disable (LOW) the internal pullup on the input pin. It is recommended to set the `pinMode()` to `INPUT_PULLUP` to enable the internal pull-up resistor. See the [Digital Pins](#) tutorial for more information.

Syntax

`digitalWrite(pin, value)`

2.setup()

Description

The `setup()` function is called when a sketch starts. Use it to initialize variables, pin modes, start using libraries, etc. The `setup()` function will only run once, after each powerup or reset of the Arduino board.

Example Code

```
int buttonPin = 3;

void setup() {
  Serial.begin(9600);
  pinMode(buttonPin, INPUT);
}

void loop() {
  // ...
}
```

loop()

Description

After creating a [setup\(\)](#) function, which initializes and sets the initial values, the `loop()` function does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Arduino board.

Example Code

```
int buttonPin = 3;

// setup initializes serial and the button pin
void setup() {
  Serial.begin(9600);
  pinMode(buttonPin, INPUT);
}

// loop checks the button pin each time,
// and will send serial if it is pressed
void loop() {
  if (digitalRead(buttonPin) == HIGH) {
    Serial.write('H');
  }
  else {
    Serial.write('L');
  }

  delay(1000);
}
```

3.pinMode() Function

The pinMode() function is used to configure a specific pin to behave either as an input or an output. It is possible to enable the internal pull-up resistors with the mode INPUT_PULLUP. Additionally, the INPUT mode explicitly disables the internal pull-ups.

pinMode() Function Syntax

```
Void setup () {  
    pinMode (pin , mode);  
}
```

Delay()

The way the **delay()** function works is pretty simple. It accepts a single integer (or number) argument. This number represents the time (measured in milliseconds). The program should wait until moving on to the next line of code when it encounters this function. However, the problem is, the delay() function is not a good way to make your program wait, because it is known as a “blocking” function.

[delay\(\) function Syntax](#)

delay (ms) ;

3.

a) Write any two differences between Raspberry pi and Desktop Computer

The main difference between the raspberry pi and an average desktop PC is the processor architecture, speed, and computing power

b) What is the importance role of Zigbee in IOT.

Zigbee PRO aims to provide the foundation for IoT with features to support low-cost, highly reliable networks for device-to-device communication

c) MCQ

d) Name few services offered by Cloud Computing.

There are three main service models of cloud computing – Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS)

Q4.

● **Which protocol is used to operate over REST Services?**

[4

Mark]

REST stands for REpresentational State Transfer. REST is web standards based architecture and uses HTTP Protocol. It revolves around resource where every component is a resource and a resource is accessed by a common interface using HTTP standard methods.

● **What is UART? What is its purpose?**

[1 Mark]

A universal asynchronous receiver-transmitter is a computer hardware device for asynchronous serial communication in which the data format and transmission speeds are configurable. It sends data bits one by one, from the least significant to the most significant, framed by start and stop bits so that precise timing is handled by the communication channel.

In UART communication, two UARTs communicate directly with each other. The transmitting UART converts parallel data from a controlling device like a CPU into serial form, transmits it in serial to the receiving UART, which then converts the serial data back into parallel data for the receiving device.

● **Name few sensors which are used in Weather Monitoring system of IOT?**

[2 Mark]

In this system Arduino can be used and sound sensor, gas sensor, temperature sensor, moisture sensor, pressure sensor, IOT module. The humidity and temperature sensor will track climate change and provide information.

● **What are the entities present in Domain Model Specification in IoT design methodology?**

[3 Mark]

Information Model Specification • The fourth step in the IoT design methodology is to define the Information Model. Information Model defines the structure of all the information in the IoT system, for example, attributes of Virtual Entities, relations,

5.

i. The Operational View Specifications in IoT design is that, various options pertaining to the IoT system deployment and operation are defined, such as, service hosting options, storage options, device options, application hosting options.

ii. air pollution sensor - photo ionization detector,
Optical particle counters, Optical sensors

Water pollution - Turbidity sensors

In general – gas, smoke, humidity, temperature, pressure

iii. 6LowPAN. A key IP (Internet Protocol)-based technology is 6LowPAN (IPv6 Low-power wireless Personal Area Network). Rather than being an IoT application protocols technology like Bluetooth or ZigBee, 6LowPAN is a network protocol that defines encapsulation and header compression mechanisms.

iv. MWIR infrared (IR) cameras can be used to detect heat and with particular algorithms can detect hot-spots within a scene as well as flames for both detection and prevention of fire and risks of fire.

IOT QUESTION - 6

1. Write in short differences between web socket and HTTP.

- WebSocket is a protocol providing full-duplex communication channels over a single TCP connection. Where as, HTTP providing half-duplex communication.
- Information exchange mode of WebSocket is bidirectional. Means, server can push information to the client (which does not allow direct HTTP).

- The contents of each stream are HTTP requests and responses, just encoded and packed up differently. Where as, WebSocket adds a number of features to manage the streams, but leaves old semantics untouched.

2. What is 802.15.4 in Link layer of IoT Protocols?

IEEE 802.15.4 is a technical standard which defines the operation of low-rate wireless personal area networks (LR-WPANs). It specifies the physical layer and media access control for LR-WPANs, and is maintained by the IEEE 802.15 working group, which defined the standard in 2003. It is the basis for the Zigbee, ISA100.11a, WirelessHART, MiWi, 6LoWPAN, Thread and SNAP specifications, each of which further extends the standard by developing the upper layers which are not defined in IEEE 802.15.4. In particular, 6LoWPAN defines a binding for the IPv6 version of the Internet Protocol (IP) over WPANs, and is itself used by upper layers like Thread.

3. What is Dweet? What is its role in IoT?

Dweet is incredibly useful for quickly building messaging infrastructures for constellations of IoT devices. dweet is simple publishing and subscribing for machines, sensors, devices, robots, and gadgets (we just call them things). dweet enables your machine and sensor data to become easily accessible through a web based RESTful API, allowing you to quickly make apps or simply share data.

4. Name few server side web technologies Used for IoT.

HTTP, REST

<u>Q.No:7</u>	<u>SAT</u>	What is LDR? What is its purpose?	2	An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.
	<u>SAT</u>	What is the role of Namenode in HDFS Architecture?	4	<p>Namenode</p> <p>NameNode is the centerpiece of HDFS.</p> <p>NameNode is also known as the Master</p> <p>NameNode only stores the metadata of HDFS – the directory tree of all files in the file system, and tracks the files across the cluster.</p> <p>NameNode does not store the actual data or the dataset. The data itself is actually stored in the DataNodes.</p> <p>NameNode knows the list of the blocks and its location for any given file in HDFS. With this information NameNode knows how to construct the file from blocks.</p> <p>NameNode is so critical to HDFS and when the NameNode is down, HDFS/Hadoop cluster is inaccessible and considered down.</p> <p>NameNode is a single point of failure in Hadoop cluster.</p>

				NameNode is usually configured with a lot of memory (RAM). Because the block locations are help in main memory.
	<u>SAT</u>	Write any two differences between Wireless Senor Network and Internet of Things network sensor?	2	<p>In an IoT system, all of the sensors directly send their information to the internet. Conversely, in a WSN, there is no direct connection to the internet. Instead, the various sensors connect to some kind of router or central node. A person may then route the data from the router or central node as they see fit.</p> <p>Internet-of-Things - The connection of devices, generally not including smartphones, laptops, or PCs, to the internet. Additionally, as Business Insider puts it, "[a]ny stand-alone internet-connected device that can be monitored and/or controlled from a remote location is considered an IoT device." (source)</p> <p>Wireless Sensor Network - A collection of wireless sensors that may or may not be connected to the internet.</p>
	<u>MCQ</u>	Which of the following is Raspbian? a) OS b) Assembler c) Language d) Compiler	1	A

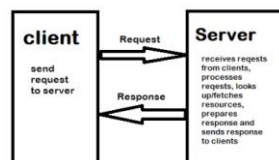
Q.No:8

Explain any four Communication models in IOT with diagram?

ANS:

IOT Communication models

- **Request response model:** The client is the IOT device that sends a request to the server. The request maybe for transfer of data or upload of data. The server maybe remote or local and can handle requests of multiple clients. The Request response model is stateless and hence each request is independently handled. Server can receive the request, decide its response and fetch the data.



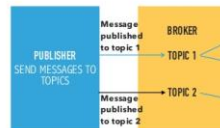
Request-Response Communication

- **Publish subscribe model:** There are three entities publisher, broker and consumers. Publishers send the data to the brokers on topics managed by the brokers. Consumers subscribe to topics and brokers send the data on the topics to the consumers.

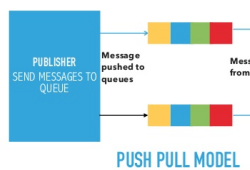
Hence, brokers responsibility is to accept data from publishers and send it to the appropriate consumer

COMMUNICATION MODELS

PUBLISH SUBSCRIBE MODEL



- **Push-pull:** Data producer push data to queues and consumer pull data from queues. Producers and consumers are not aware of each other. Queues act as buffers and are useful when producers produce data at a rate at which is faster than rate at which consumers can download.



-
- **Exclusive pair:** It is a bi-directional, full duplex communication model that uses a persistent connection between client and server. The connection is persistent and remains open till client sends a

request to close the connection. This is a stateful connection model and server is aware of all open connections.

COMMUNICATION MODELS

EXCLUSIVE PAIR COMMUNICATION MODEL



Define IOT? Explain the logical design of IOT with diagram?

ANS:

The Internet of Things (IoT) refers to a system of interrelated, internet-connected objects that are able to collect and transfer data over a wireless network without human intervention.

or

The **Internet of things (IoT)** describes the network of physical objects—“things”—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over

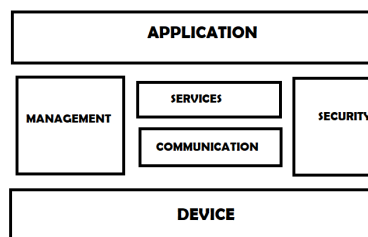
	<p>the Internet.</p> <p>The logical design of the IoT system refers to an abstract representation of the entities & processes without going into the low-level specifics of the implementation. For understanding the Logical Design of IoT, we describe the given below terms.</p> <ul style="list-style-type: none"> ❖ IoT Functional Blocks ❖ IoT Communication Models ❖ IoT Communication APIs <p>❖ <u>IoT Functional Blocks:</u></p> <p>An IoT system comprises of a number of functional blocks that provide the system the capabilities for identification, sensing, actuation, communication and management.</p> <p>functional blocks are:</p> <p>Device: An IoT system comprises of devices that provide sensing, actuation, monitoring and control functions.</p> <p>Communication: Handles the communication for the IoT system.</p> <p>Services: services for device monitoring, device control service, data publishing services and services for device</p>
--	---

discovery.

Management: this blocks provides various functions to govern the IoT system.

Security: this block secures the IoT system and by providing functions such as authentication , authorization, message and content integrity, and data security.

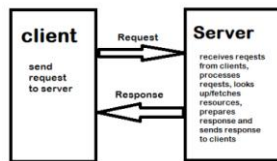
Application: This is an interface that the users can use to control and monitor various aspects of the IoT system. Application also allow users to view the system status and view or analyze the processed data.



❖ IoT Communication Models:

❖ **Request response model:** The client is the IOT device that sends a request to the server. The request maybe for transfer of data or upload of data. The server maybe remote or local and can handle requests of multiple clients. The Request response model is stateless and hence each request is independently

handled. Server can receive the request, decide its response and fetch the data.

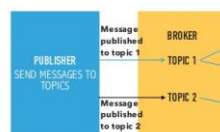


Request-Response Communication

- ❖ **Publish subscribe model:** There are three entities publisher, broker and consumers. Publishers send the data to the brokers on topics managed by the brokers. Consumers subscribe to topics and brokers send the data on the topics to the consumers. Hence, brokers responsibility is to accept data from publishers and send it to the appropriate consumer

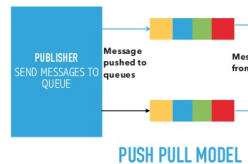
COMMUNICATION MODELS

PUBLISH SUBSCRIBE MODEL



- ❖ **Push-pull:** Data producer push data to queues and consumer pull data from queues. Producers and consumers are not aware of each other. Queues act as buffers and are useful when

producers produce data at a rate at which is faster than rate at which consumers can download.



- ❖ . **Exclusive pair:** It is a bi-directional, full duplex communication model that uses a persistent connection between client and server. The connection is persistent and remains open till client sends a request to close the connection. This is a stateful connection model and server is aware of all open connections.

❖ IoT Communication APIs

These IoT Communication APIs are:

- REST-based Communication APIs
- WebSocket-based Communication APIs

REST-based Communication APIs

Representational state transfer (REST) is a set of

	<p>architectural principles by which you can design Web services the Web APIs that focus on systems's resources and how resource states are addressed and transferred. REST APIs that follow the request response communication model, the rest architectural constraint apply to the components, connector and data elements, within a distributed hypermedia system.</p> <p>WebSocket based communication API</p> <p>Websocket APIs allow bi-directional, full duplex communication between clients and servers. Websocket APIs follow the exclusive pair communication model. Unlike request-response model such as REST, the WebSocket APIs allow full duplex communication and do not require new coonnection to be setup for each message to be sent. Websocket communication begins with a connection setup request sent by the client to the server. The request (called websocket handshake) is sent over HTTP and the server interprets it is an upgrade request. If the server supports websocket protocol, the server responds to the websocket handshake response. After the connection setup client and server can send data/mesages to each other in full duplex mode.</p>
--	--

Websocket API reduce the network traffic and letency as there is no overhead for connection setup and termination requests for each message. Websocket suitable for IoT applications that have low latency or high throughput requirements. So Web socket is most suitable IoT Communication APIs for IoT System.

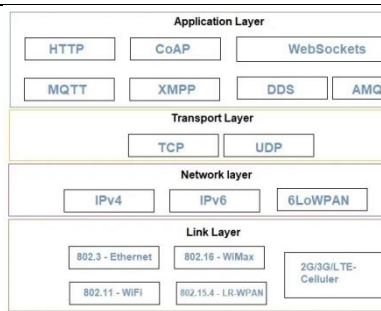


Explain different layers in IOT Protocols with diagram?

ANS:

The protocol is defined as a set of rules and regulation guidelines having how to react for commands from another device. These protocols are very important while in communication devices.

IoT protocols help to establish Communication between IoT Device (Node Device) and Cloud based Server over the Internet. It help to send commands to IoT Device and received data from an IoT device over the Internet.



Link Layer

Link layer protocols determine how data is physically sent over the network's physical layer or medium (Coaxial cable or other or radio wave). Link Layer determines how the packets are coded and signaled by the hardware device over the medium to which the host is attached . some Link Layer Protocols: ,802.3 – Ethernet, **802.11 – WiFi, 802.16 – Wi-Max**

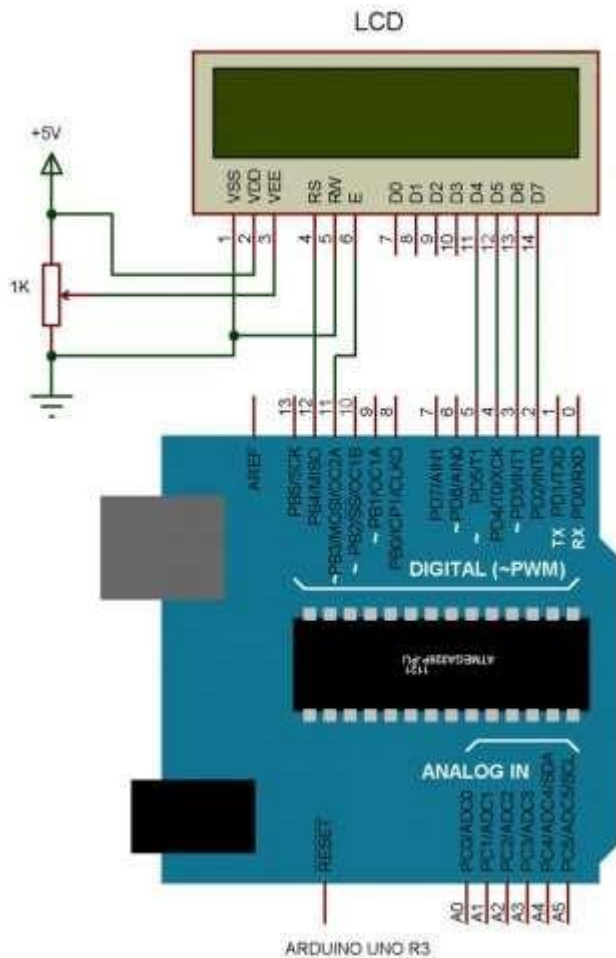
Network Layer

Responsible for sending IP datagrams from the source network to the destination network. Network layer performs the host addressing and packet routing. We used IPv4 and IPv6 for Host identification. IPv4 and IPv6 are hierarchical IP addressing schemes.

Transport Layer

This layer provides

	<p>functions such as error control, segmentation, flow control and congestion control. So these layer protocols provide end-to-end message transfer capability independent of the underlying network.</p> <p>protocols: TCP, UDP</p> <p>Application Layer</p> <hr/> <p>Application layer protocols define how the applications interface with the lower layer protocols to send over the network.</p> <p>Protocols: HTTP, CoAP, MQTT, XMPP</p>
--	--



The main component of Arduino interfacing is 16x2 LCD Module. The 16x2 LCD contains two inbuilt registers: Command Register and Data Register

Command Register-Used to insert a special command in the LCD, which in turn is used to give internal command to the LCD.

Data Register-Used to enter the line in the LCD.

- Connections between the LCD and arduino pins are established.
- Only four of the digital input lines are used
- The arduino can be powered through the external power jack provided on the board or from the PC through the USB board
- This method is very simple, requires less connection and one can almost utilise the full potential of LCD module.

OR

B)The explosive growth in the number of devices connected to the Internet of Things (IoT) and the exponential increase in data consumption only reflect how the growth of big data perfectly overlaps with that of IoT. The management of big data in a continuously expanding network gives rise to non-trivial concerns regarding data collection efficiency, data processing, analytics, and security. To address these concerns, researchers have examined the challenges associated with the successful deployment of IoT.

Despite the large number of studies on big data, analytics, and IoT, the convergence of these areas creates several opportunities for flourishing big data and analytics for IoT systems. In this paper, we explore the recent advances in big data analytics for IoT systems as well as the key requirements for managing big data and for enabling

analytics in an IoT environment. We taxonomized the literature based on important parameters. We identify the opportunities resulting from the convergence of biG data, analytics, and IoT as well as discuss the role of big data analytics in IoT applications. Finally, several open challenges are presented as future research directions

OR

C)The different IOT levels and Deployments templates are as follows:-

IoT Level-1

A level-1 IoT system has a single node/device that performs sensing and/or actuation, stores data, performs analysis and hosts the application

Level-1 IoT systems are suitable for modeling low- cost and low-complexity solutions where the data involved is not big and the analysis requirements are not computationally intensive.

IoT Level-2

A level-2 IoT system has a single node that performs sensing and/or actuation and local analysis. Data is stored in the cloud and application is usually cloud- based.

Level-2 IoT systems are suitable for solutions where the data involved is big, however, the primary analysis requirement is not computationally intensive and can be done locally itself.

IoT Level-3

A level-3 IoT system has a single node. Data is stored and analyzed in the cloud and application is cloud- based.

Level-3 IoT systems are suitable for solutions where the data involved is big and the analysis requirements are computationally intensive.

IoT Level-4

A level-4 IoT system has multiple nodes that perform local analysis. Data is stored in the cloud and application is cloud-based.

Level-4 contains local and cloud- based observer nodes which can subscribe to and receive information collected in the cloud from IoT devices.

Level-4 IoT systems are suitable for solutions where multiple nodes are required, the data involved is big and the analysis requirements are computationally intensive.

IoT Level-5

A level-5 IoT system has multiple end nodes and one coordinator node.

The end nodes that perform sensing and/or actuation.

Coordinator node collects data from the end nodes and sends to the cloud.

Data is stored and analyzed in the cloud and application is cloud-based.

Level-5 IoT systems are suitable for solutions based on wireless sensor networks, in which the data involved is big and the analysis requirements are computationally intensive.

IoT Level-6

A level-6 IoT system has multiple independent end nodes that perform sensing and/or actuation and send data to the cloud.

Data is stored in the cloud and application is cloud-based. The analytics component analyzes the data and stores the results in the cloud database.

The results are visualized with the cloud-based application.

The centralized controller is aware of the status of all the end nodes and sends control commands to the nodes.