INTERNAL ASSESSMENT TEST 3 – MAY 2019

Sub:	**Internet of Things Technology**					Sub Code:	**15CS81**	Branch: **ISE**
Date:	16-05-19	Duration:	90 min's	Max Marks:	50	Sem / Sec:	VIII SEM ISE A & B	OBE
Handled By **Dr.R.Chinnaiyan,** Associate Professor , ISE								

SCHEME AND SOLUTIONS

1.What is IoT Data Analytics?. List the Challenges of IoT Data Analytics [10]

The true importance of IoT data from smart objects is realized only when the analysis of the data leads to actionable business intelligence and insights. Data analysis is typically broken down by the types of results that are produced. As shown in Figure 7-3, there are four types of data analysis results

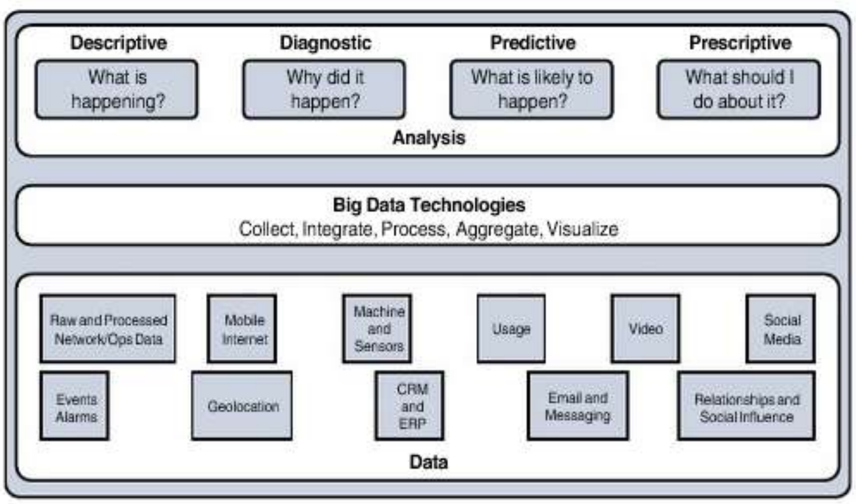


Figure 7-3 *Types of Data Analysis Results*

■ Descriptive:

Descriptive data analysis tells you what is happening, either now or in the past. For example, a thermometer in a truck engine reports temperature values every second. From a descriptive analysis perspective, you can pull this data at any moment to gain insight into the current operating condition of the truck engine. If the temperature value is too high, then there may be a cooling problem or the engine may be experiencing too much load.

■ Diagnostic:

When you are interested in the "why," diagnostic data analysis can provide the answer. Continuing with the example of the temperature sensor in the truck engine, you might wonder why the truck engine failed. Diagnostic analysis might show that the temperature of the engine was too high, and the engine overheated. Applying diagnostic analysis across the data generated by a wide range of smart objects can provide a clear picture of why a problem or an event occurred.

■ Predictive:

Predictive analysis aims to foretell problems or issues before they occur. For example, with historical values of temperatures for the truck engine, predictive analysis could provide an estimate on the remaining life of certain components in the engine. These components could then be proactively replaced before failure occurs. Or perhaps if temperature values of the truck engine start to rise slowly over time, this could indicate the need for an oil change or some other sort of engine cooling maintenance.

■ Prescriptive:

Prescriptive analysis goes a step beyond predictive and recommends solutions for upcoming problems. A prescriptive analysis of the temperature data from a truck engine might calculate various alternatives to cost-effectively main-tain our truck. These calculations could range from the cost necessary for more frequent oil changes and cooling maintenance to installing new cooling equipment on the engine or upgrading to a lease on a model with a more powerful engine. Prescriptive analysis looks at a variety of factors and makes the appropriate recommendation

2. Explain in detail about the various Big Data Analytics Tools [10]

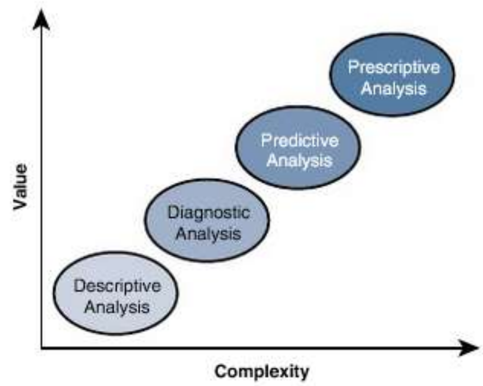


Figure 7-4 *Application of Value and Complexity Factors to the Types of Data Analysis*

1.NoSQL Databases
2. Hadoop
3.YARN
4. Apache Kafka
5.Apache Spark
6. Apache Strom and Flink

3. Compare Structured, Unstructured Data and Supervised , Unsupervised Learning[10]

Structured Data

Structured data usually resides in relational databases (RDBMS). Fields store length-delineated data phone numbers, Social Security numbers, or ZIP codes. Even text strings of variable length like names are contained in records, making it a simple matter to search. Data may be human- or machine-generated as long as the data is created within an RDBMS structure. This format is eminently searchable both with human generated queries and via algorithms using type of data and field names, such as alphabetical or numeric, currency or date. Common relational database applications with structured data include airline reservation systems, inventory control, sales transactions, and ATM activity. Structured Query Language (SQL) enables queries on this type of structured data within relational databases. Some relational databases do store or point to unstructured data such as customer relationship management (CRM) applications. The integration can be awkward at best since memo fields do not loan themselves to traditional database queries. Still, most of the CRM data is structured.

Unstructured Data

Unstructured data is essentially everything else. Unstructured data has internal structure but is not structured via pre-defined data models or schema. It may be textual or non-textual, and human- or machine-generated. It may also be stored within a non-relational database like NoSQL.

Typical human-generated unstructured data includes:

- **Text files:** Word processing, spreadsheets, presentations, email, logs.
- **Email:** Email has some internal structure thanks to its metadata, and we sometimes refer to it as semi-structured. However, its message field is unstructured and traditional analytics tools cannot parse it.
- **Social Media:** Data from Facebook, Twitter, LinkedIn.
- **Website:** YouTube, Instagram, photo sharing sites.
- **Mobile data:** Text messages, locations.
- **Communications:** Chat, IM, phone recordings, collaboration software.
- **Media:** MP3, digital photos, audio and video files.
- **Business applications:** MS Office documents, productivity applications.

Typical machine-generated unstructured data includes:

- **Satellite imagery:** Weather data, land forms, military movements.
- **Scientific data:** Oil and gas exploration, space exploration, seismic imagery, atmospheric data.
- **Digital surveillance:** Surveillance photos and video.
- **Sensor data:** Traffic, weather, oceanographic sensors.

Supervised machine learning is the more commonly used between the two. It includes such algorithms as linear and logistic regression, multi-class classification, and support vector machines. Supervised learning is so named because the data scientist acts as a guide to teach the algorithm what conclusions it should come up with. It's similar to the way a child might learn arithmetic from a teacher. Supervised learning requires that the algorithm's possible outputs are already known and that the data used to train the algorithm is already labeled with correct answers. For example, a classification algorithm will learn to identify animals after being trained on a dataset of images that are properly labeled with the species of the animal and some identifying characteristics.

On the other hand, unsupervised machine learning is more closely aligned with what some call true artificial intelligence — the idea that a computer can learn to identify complex processes and patterns without a human to provide guidance along the way. Although unsupervised learning is prohibitively complex for some simpler enterprise use cases, it opens the doors to solving problems that humans normally would not tackle. Some examples of unsupervised machine learning algorithms include k-means clustering, principal and independent component analysis, and association rules.

4.List the Challenges of IoT Security.
Explain the Phased Application of Security in Operational Environment [10]

. IoT data places two specific challenges on a relational database:

■ Scaling problems:

Due to the large number of smart objects in most IoT networks that continually send data, relational databases can grow incredibly large very quickly. This can result in performance issues that can be costly to resolve, often requiring more hardware and architecture changes.

■ Volatility of data:

With relational databases, it is critical that the schema be designed correctly from the beginning. Changing it later can slow or stop the data-base from operating. Due to the lack of flexibility, revisions to the schema must be kept at a minimum. IoT data, however, is volatile in the sense that the data model is likely to change and evolve over time. A dynamic schema is often required so that data model changes can be made daily or even hourly.To deal with challenges like scaling and data volatility, a different type of database, known as NoSQL, is being used. Structured Query Language (SQL) is the computer lan-guage used to communicate with an RDBMS. As the name implies, a NoSQL database is a database that does not use SQL. It is not set up in the traditional tabular form of a relational database. NoSQL databases do not enforce a strict schema, and they support a complex, evolving data model. These databases are also inherently much more scalable. (For more information on NoSQL, see the section "NoSQL Databases" later in the chapter.)In addition to the relational database challenges that IoT imposes, with its high volume of smart object data that frequently changes, IoT also brings challenges with the live streaming nature of its data and with managing data at the network level. Streaming data,

5. Write Short notes on Arduino UNO and Raspberry Pi [10]

SL	Raspberry Pi	Arduino
1	It is a mini computer with Raspbian OS.It can run multiple programs at a time.	Arduino is a microcontroller, which is a part of the computer. It runs only one program again and again.
2	It is difficult to power using a battery pack.	Arduino can be powered using a battery pack.
3	It requires complex tasks like installing libraries and software for interfacing sensors and other components	It is very simple to interface sensors and other electronic components to Arduino.
4	It is expensive	It is available for low cost.
5	Raspberry Pi can be easily connected to the internet using Ethernet port and USB Wi-Fi dongles.	Arduino requires external hardware to connect to the internet and this hardware is addressed properly using code.
6	Raspberry Pi did not have storage on board. It provides an SD card port.	Arduino can provide onboard storage.
7	Raspberry Pi has 4 USB ports to connect different devices.	Arduino has only one USB port to connect to the computer.
8	The processor used is from ARM family.	Processor used in Arduino is from AVR family Atmega328P
9	This should be properly shutdown otherwise there is a risk of files corruption and software problems.	This is a just plug and play device. If power is connected it starts running the program and if disconnected it simply stops.
10	The Recommended programming language is python but C, C++, Python, ruby are pre-installed.	Arduino uses Arduino, C/C++.

6. Explain in detail about the Smart City Use-Case Examples. [10]

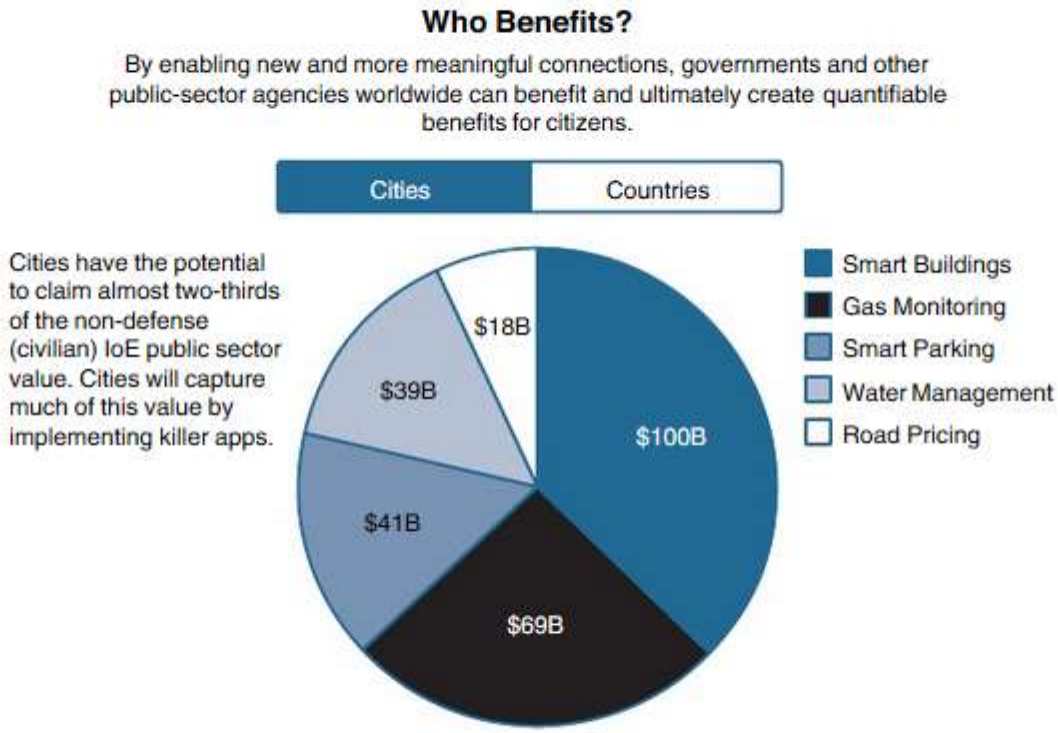
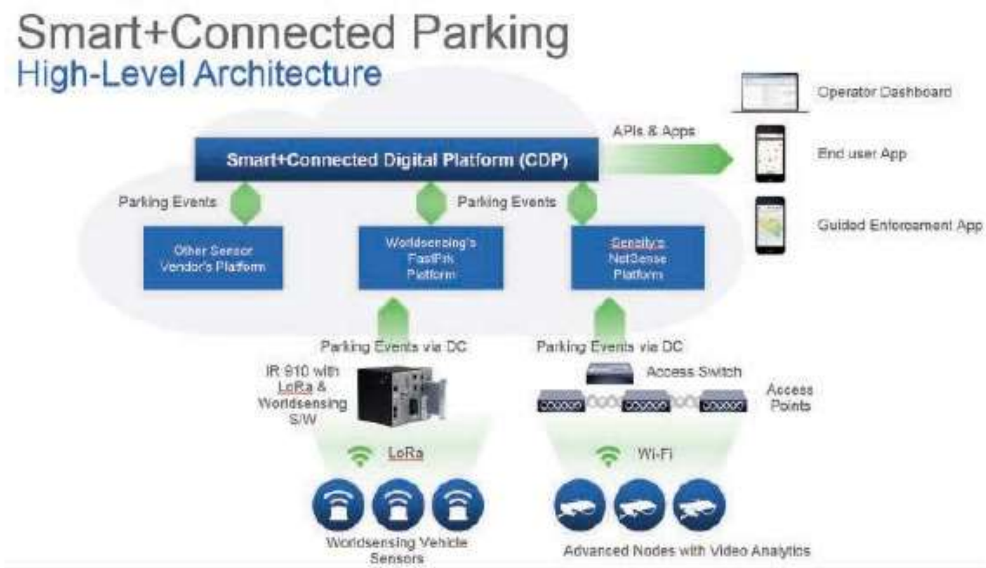


Figure 12-1 *Key Use Cases for Smart Cities*

7. Explain the Smart Connected Parking, Smart City Traffic and Security Architecture [10]

A variety of parking sensors are available on the market, and they take different approaches to sensing occupancy for parking spots. Examples include in-ground magnetic sensors, which use embedded sensors to create a magnetic detection field in a parking spot; video-based sensors, which detect events based on video computing (vehicle movements or presence); and radar sensors that sense the presence of vehicles (volumetric detection). Most sensors installed in the ground must rely on battery power, since running a power line is typically too expensive. These sensors commonly react to changes, such as a change in the magnetic field, triggering a sensor to awaken and send an event report. Because these events are not too frequent, the battery can last a very long time.
Based on the energy consumed by each report, a life span of 600,000 reports is not uncommon for a typical parking sensor. A very busy parking spot, where a car enters or leaves every 10 minutes, would allow

a 10-year battery span—and it is unusual to see parking spots with usage that heavy. In high-density environments (for example, indoor parking, parking decks), one or several gateways per floor may connect to the parking sensors, using shorter-range protocols such as ZigBee or Wi-Fi. The gateway may then use another protocol (wired or wireless) to connect to the control station. In larger (for example, outdoor) environments, a longer-range Low Power Wide Area (LPWA) protocol is common, as shown in Figure 12-8



Technology innovations are happening all the time, making the holistic ICT connectivity architecture even more important. For example, new detection technologies rely on sensing the radio emissions (Bluetooth and others) coming from a vehicle. The adoption of such new technologies implies that the communication architecture is open enough to accommodate the needs of these new systems

8. Explain in detail about Four Layered Smart City Connected Environment Architecture[10]

Figure 12-10 shows an architecture in which all connected environment elements overlay on the generalized four-layer smart city IoT architecture

As shown in Figure 12-10, at the street layer there are a variety of multivendor sensor offerings, using a variety of communication protocols. Connected environment sensors might measure different gases, depending on a city's particular air quality issues, and may include weather and noise sensors. These sensors may be located in a variety of urban fixtures, such as in street lights, as explained earlier. They may also be embedded in the ground or in other structures or smart city infrastructure. Even mobile sources of information can be included through connected wearables that citizens might choose to purchase and carry with them to understand the air quality around them at any given moment. Crowdsourcing may make this information available to the global system ommunication technologies depend on the location of the sensors. Wearables typically communicate via a short-range technology (such as Bluetooth) with a nearby collecting device (such as a phone). That device, in turn, forwards the collected data to the infrastructure (for example, through cellular data). Sensors that are installed in urban fixtures also use a variety of communication technologies. Sensors included in street lighting systems may utilize the same communication infrastructure as the street light control application.Independent and standalone sensors typically use wireless technologies. In dense urban environments, ZigBee and Wi-Fi are common. However, Wi-Fi is not very well adapted for networks where reports are sporadic because Wi-Fi requires an 802.11 connection to be maintained, which consumes battery resources. (However, new implementations of Wi-Fi, such as Wi-Fi Alliance IoT Low Power and 802.11ah can alleviate this issue.) In larger environments, LPWA technologies, such as NB-IoT and LoRaWAN, are used, unless the sensor is able to use a wired technology (for example, when connecting to the wired lighting infrastructure), but this is much rarer because of the cost

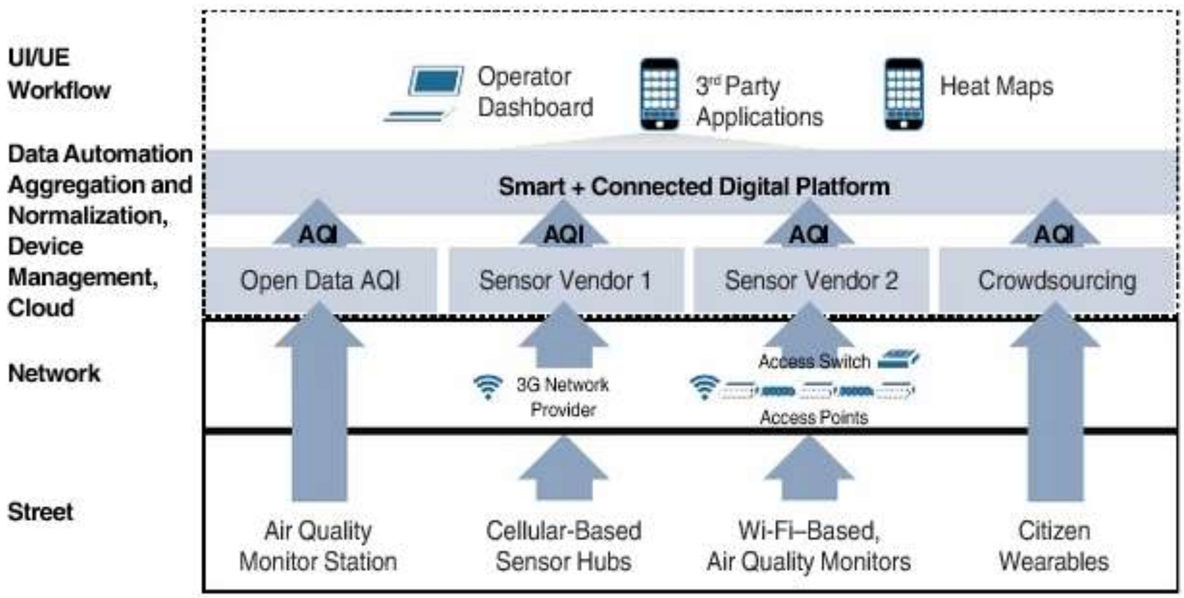


Figure 12-10 *Connected Environment Architecture*