5MCAEC32 : Internet Of Things
Unit - 1

V-Sem MCA Elective Paper

Mount Carmel College

Bengaluru

1.5 IoT Levels & Deployment Templates

Components of IoT System

- Device
- Resource
- Controller Service
- Database
- Web Service
- Analysis Component
- Application

Components of IoT System

- **Device** – allows
  - ✓Identification
  - ✓Remote sensing
  - ✓Actuating and remote monitoring
- **Resource** – software components on the IoT device for
  - ✓Accessing
  - ✓Processing
  - ✓Storing sensor information
  - ✓Controlling actuators
  - ✓Enable network access

Components of IoT System

- **Controller Service** – native service on device
  - ✓Sends data from the device to web service
  - ✓Receives commands from application via web services
- **Database** – generated by IoT device
  - ✓Local
  - ✓Cloud
- **Web Service** – link b/w IoT device, application, database and analysis component
  - ✓HTTP & REST
  - ✓WebSocket

Compare REST & WebSocket

- Self Study

Components of IoT System

- **Analysis Component** – for analyzing IoT data and generate results – to understand
  - ✓Local
  - ✓Cloud
- **Application** – interface b/w the users to control and monitor, allows the users to view system status and processed data

IoT Level - 1

- Single node/device – sensing/actuating
- Stores data
- Performs Analysis
- Hosts the application
- Suitable for modeling low-cost and low-complexity solutions
- Data not big & analysis – not computationally intensive

IoT Level - 1

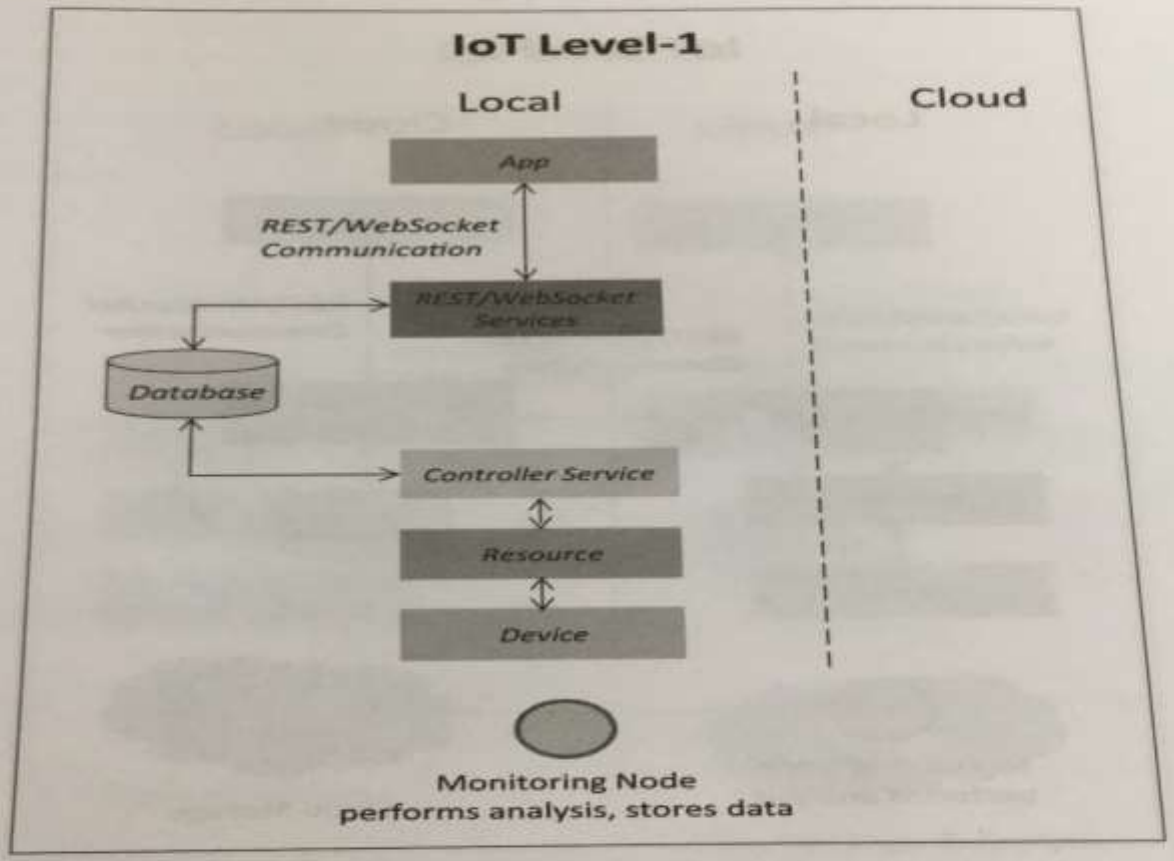
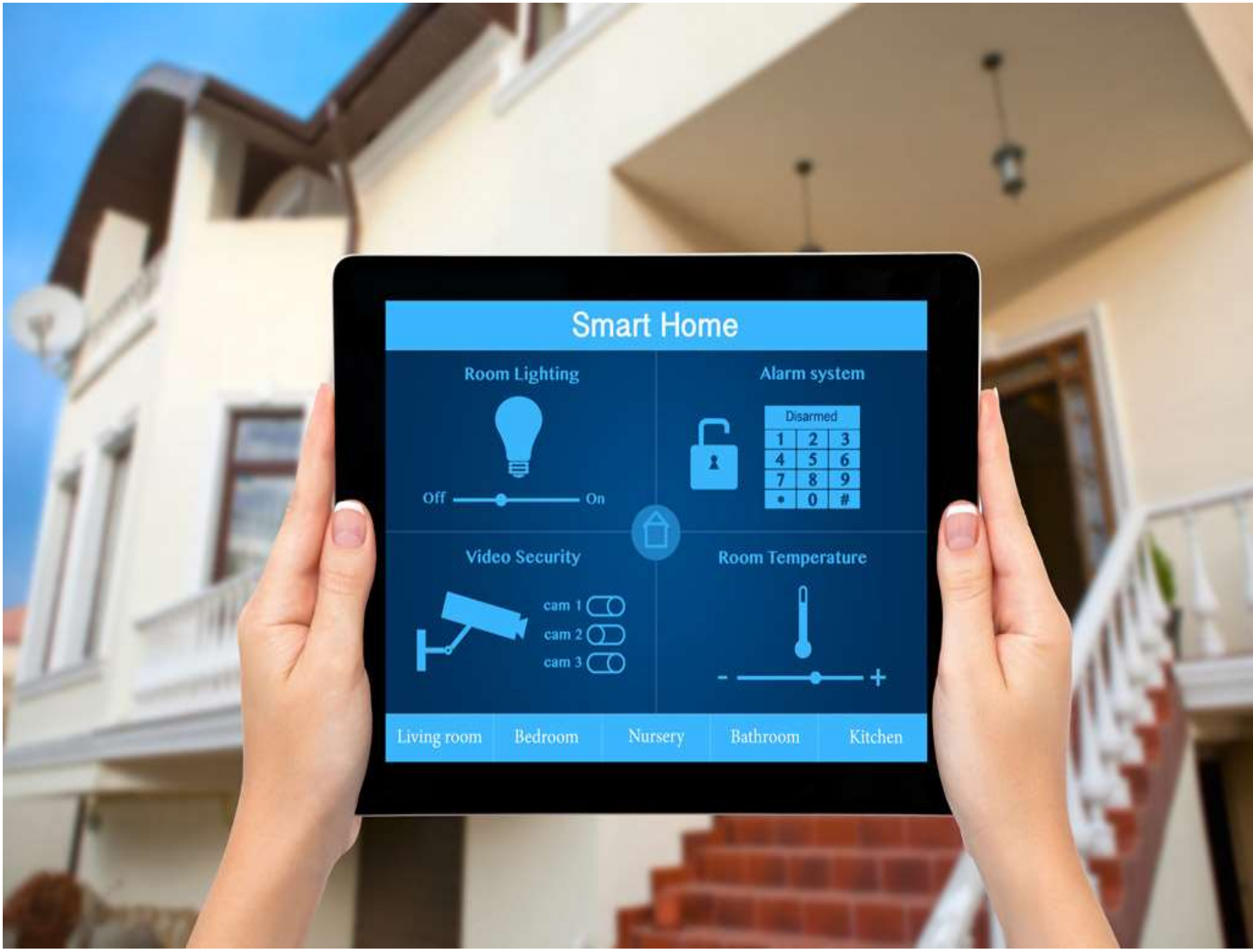


Figure 1.14: IoT Level-1

lutions where the data involved is big and the analysis requirements are computati
tensive.


Windows 10 +
ARDUINO
+
=
Awesome
Home


Smart Home
Room Lighting
Off
On
Alarm system
Disarmed
1 2 3
4 5 6
7 8 9
* 0 #
Video Security
cam 1
cam 2
cam 3
Room Temperature
- +
Living room
Bedroom
Nursery
Bathroom
Kitchen

IoT Level – 1 Examples/Applications

- Self Study

IoT Level - 2

- Single node/device – sensing/actuating – local analysis
- Stores data – Cloud
- Application – Cloud based
- Suitable for modeling solutions where data - big & primary analysis – not computationally intensive – done locally

IoT Level - 2

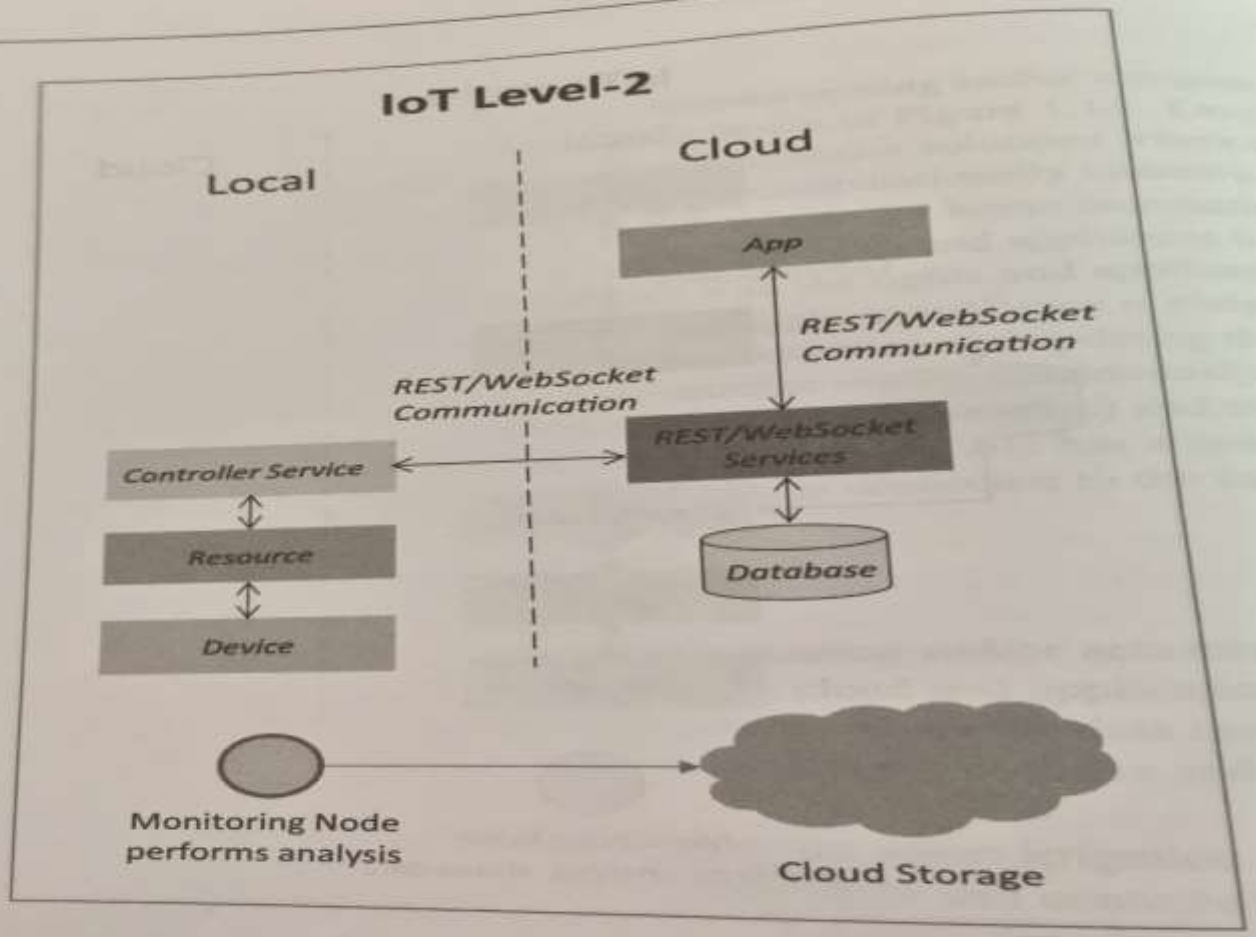
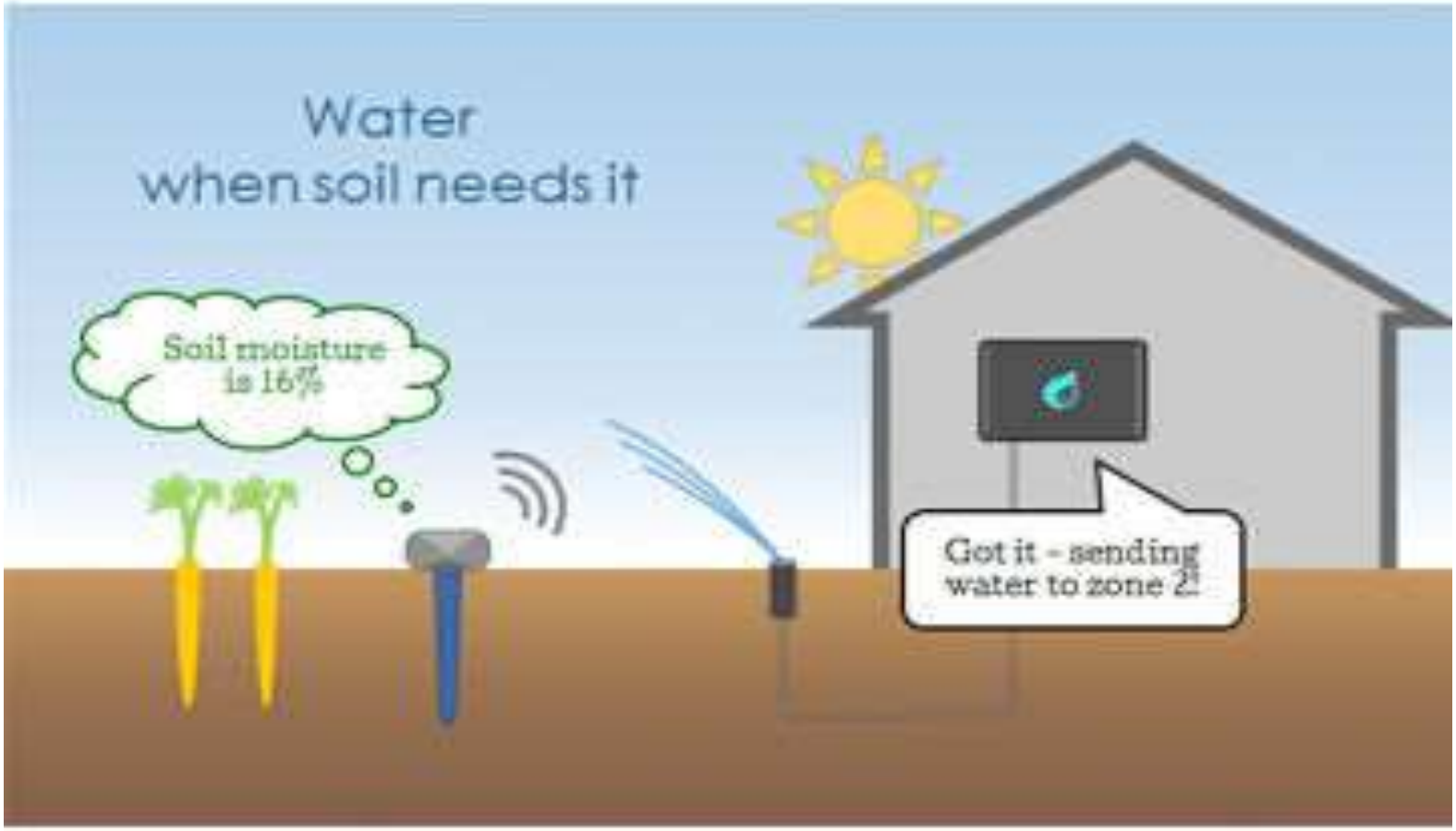
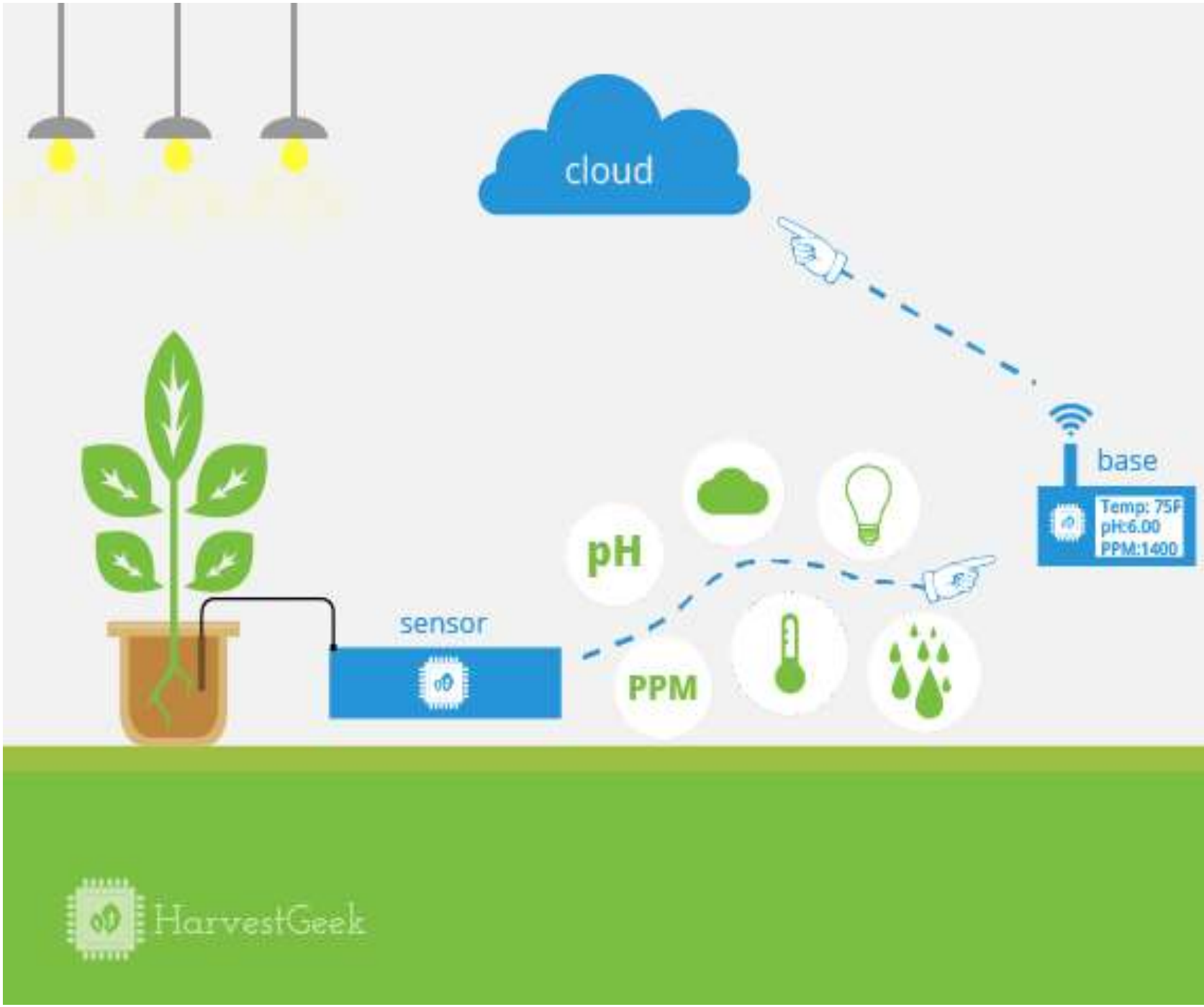


Figure 1.15: IoT Level-2

e vibration levels become greater than a th


Water
when soil needs it
Soil moisture
is 16%
Got it - sending
water to zone 2


cloud
base
Temp: 75F
pH:6.00
PPM:1400
pH
sensor
PPM
HarvestGeek


high-efficiency solar cell
cloud connection
embedded weather sensor
universal coupling
wireless technology
no plugs/cables
4 independent irrigation lines

IoT Level - 3

- Single node/device – sensing/actuating – cloud analysis
- Stores data – Cloud
- Application – Cloud based
- Suitable for modeling solutions where data - big & analysis – computationally intensive

IoT Level - 3

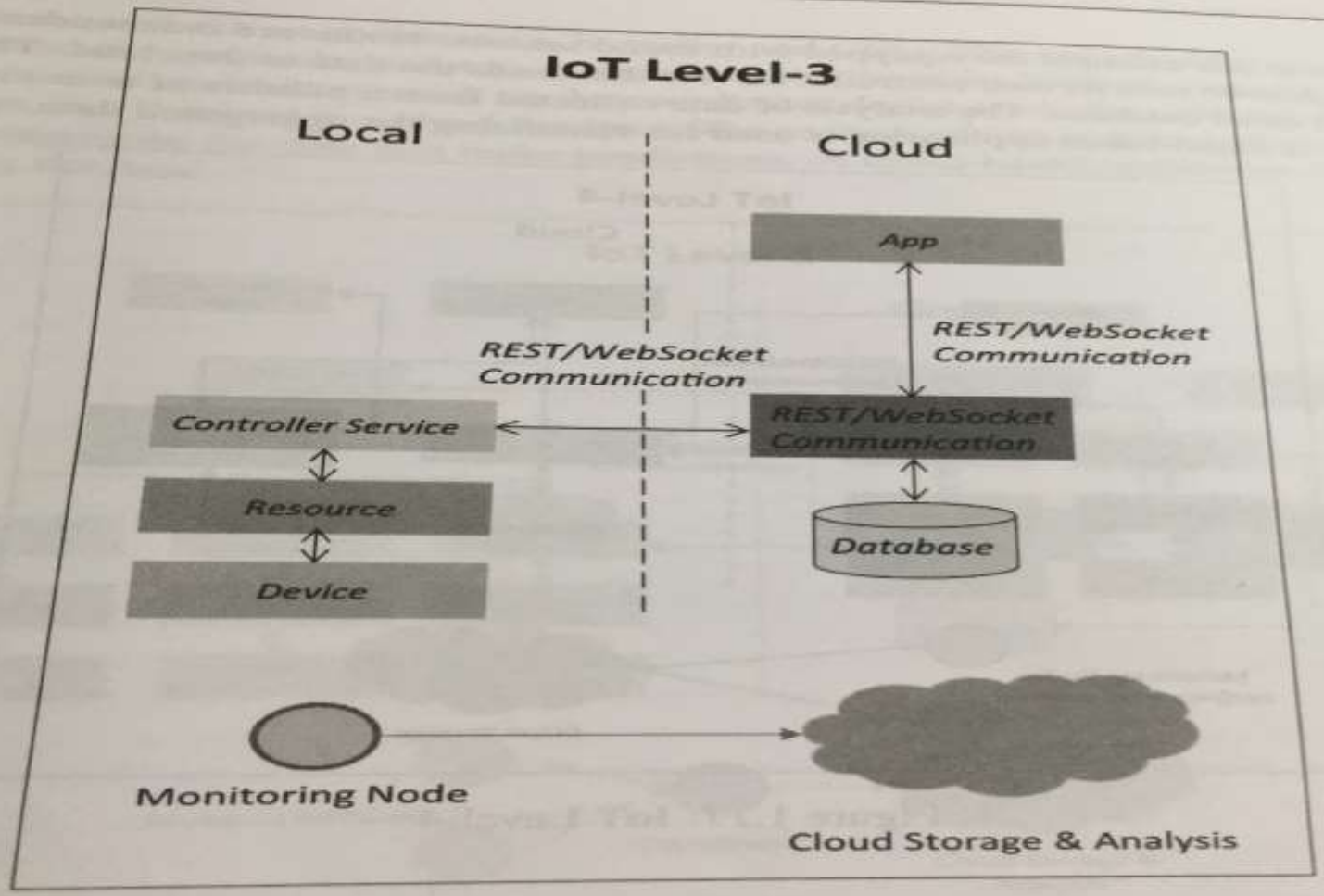
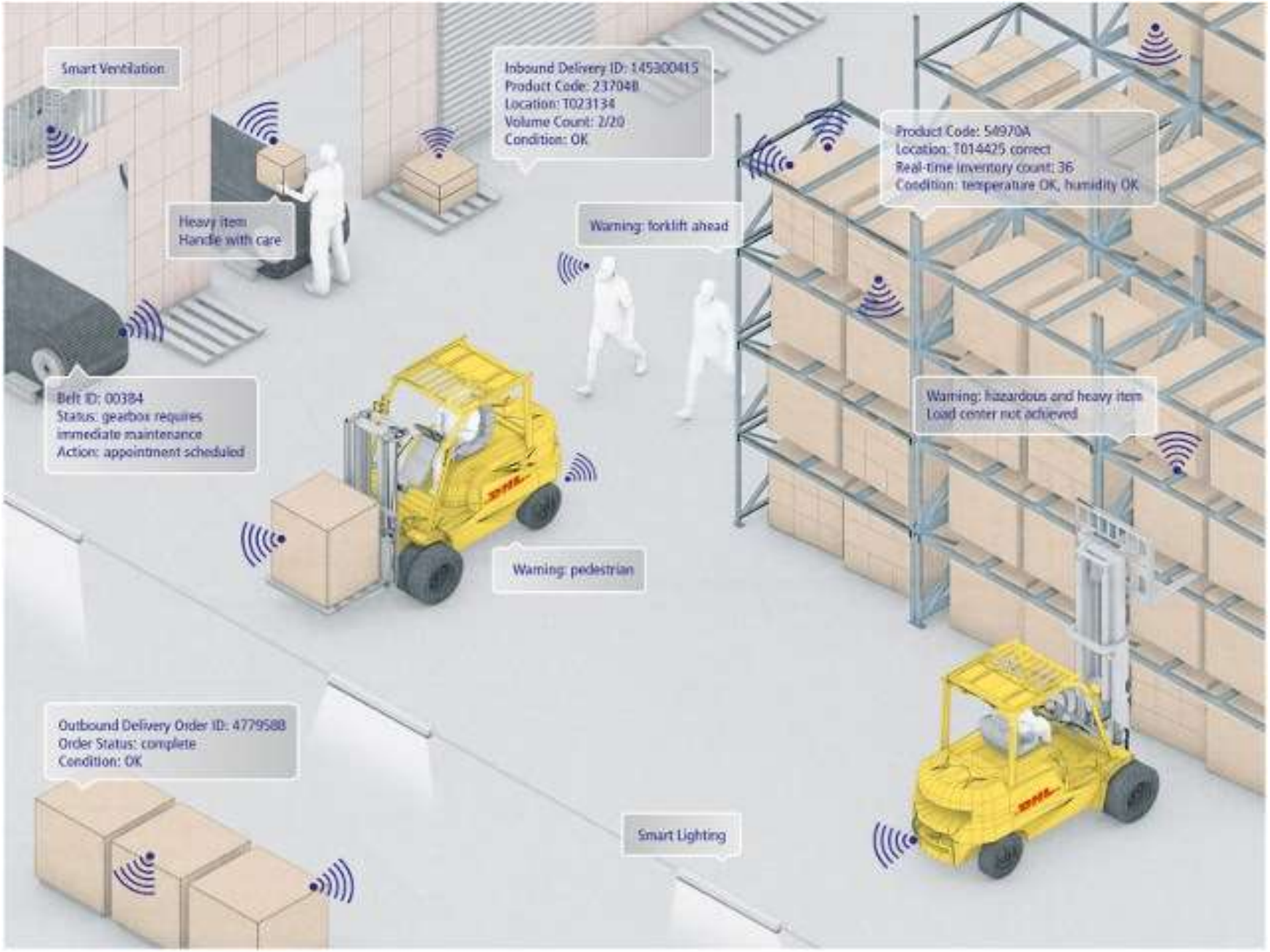
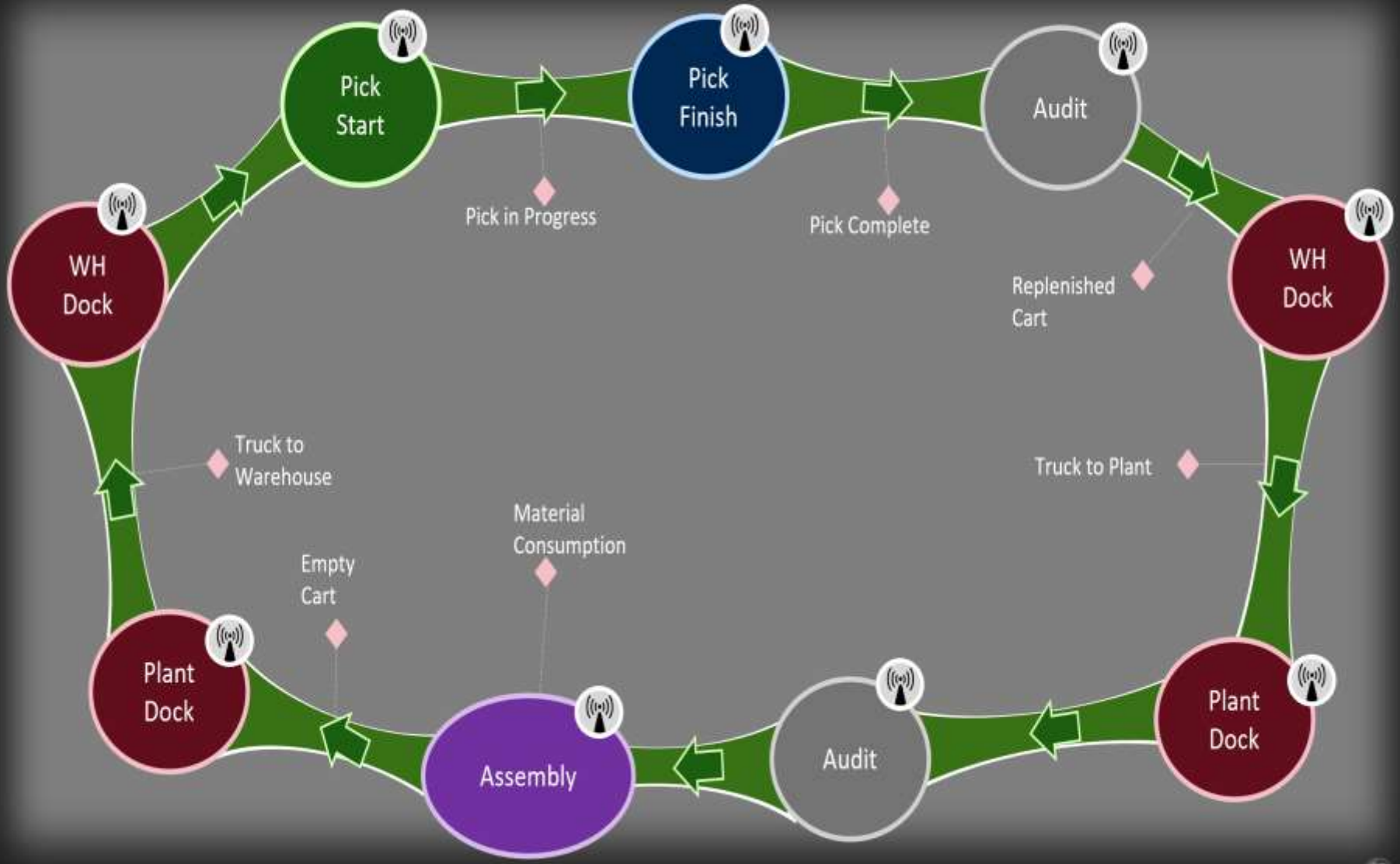


Figure 1.16: IoT Level-3


Smart Ventilation
Inbound Delivery ID: 145300415
Product Code: 237048
Location: T023134
Volume Count: 2/20
Condition: OK
Product Code: 54970A
Location: T014425 correct
Real-time inventory count: 36
Condition: temperature OK, humidity OK
Heavy item
Handle with care
Warning: forklift ahead
Belt ID: 00384
Status: gearbox requires
immediate maintenance
Action: appointment scheduled
Warning: hazardous and heavy item
Load center not achieved
Warning: pedestrian
Outbound Delivery Order ID: 4779588
Order Status: complete
Condition: OK
Smart Lighting

Material flow - Pattern



#IndustrialInternet

state machine for carts

powered by

IoT Level - 4

- multiple nodes/device – sensing/actuating – Local and cloud based observer nodes
- Observer nodes – process information/do not perform control functions
- Stores data – Cloud
- Application – Cloud based
- Suitable for modeling solutions where multiple nodes -data big & analysis – computationally intensive

The nodes in this example are equipped
other. Each node runs its own controller service that sends the data to the cloud.
stored in a cloud database. The analysis of data collected from a number of nodes
the cloud. A cloud-based application is used for visualizing the aggregated data.

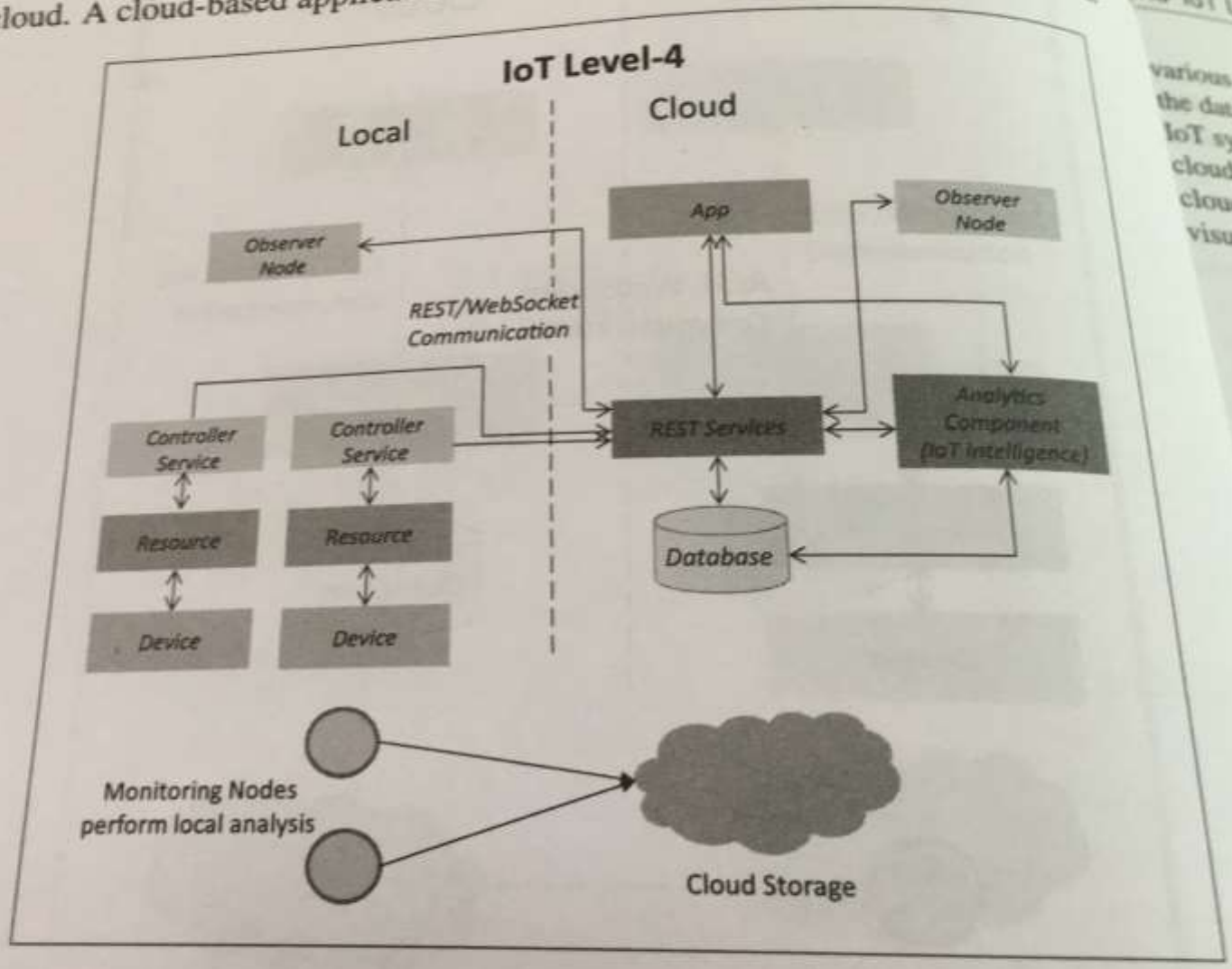
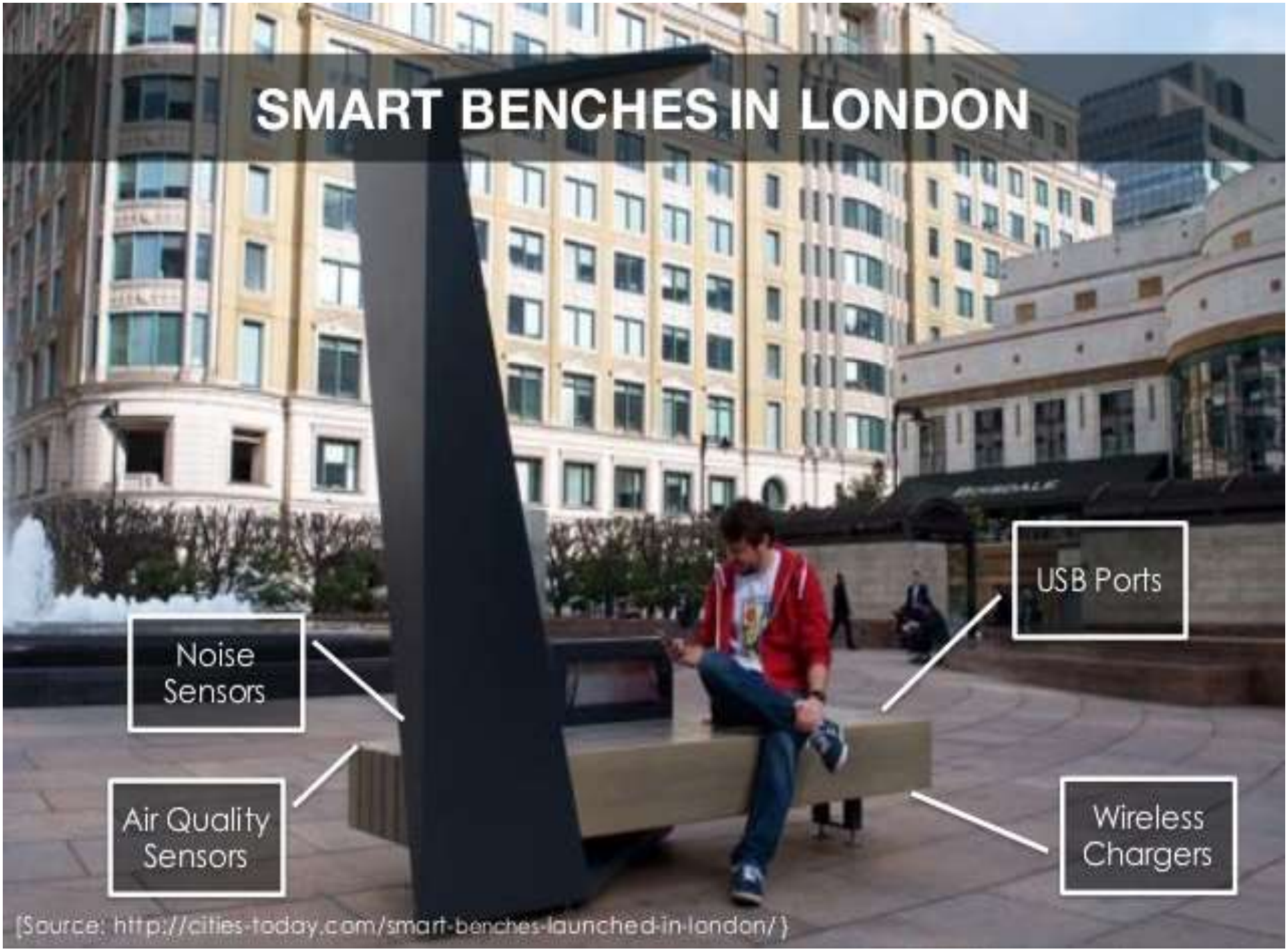


Figure 1.17: IoT Level-4

IoT

THE INTERNET OF THINGS


SMART BENCHES IN LONDON
USB Ports
Noise Sensors
Air Quality Sensors
Wireless Chargers
(Source: http://cities-today.com/smart-benches-launched-in-london/)

IoT Level - 5

- multiple nodes/device
- End nodes - sensing/actuating
- Coordinator nodes – collects data from end nodes & send it to cloud
- Local and cloud based observer nodes
- Stores data – Cloud
- Application – Cloud based
- Suitable for solutions based on WSN - data big & analysis – computationally intensive

IoT system. The controller service on the coordinator device sends the collected data to the cloud. The data is stored in a cloud database. The analysis of data is done in the computing cloud to aggregate the data and make predictions. A cloud-based application is used for visualizing the data.

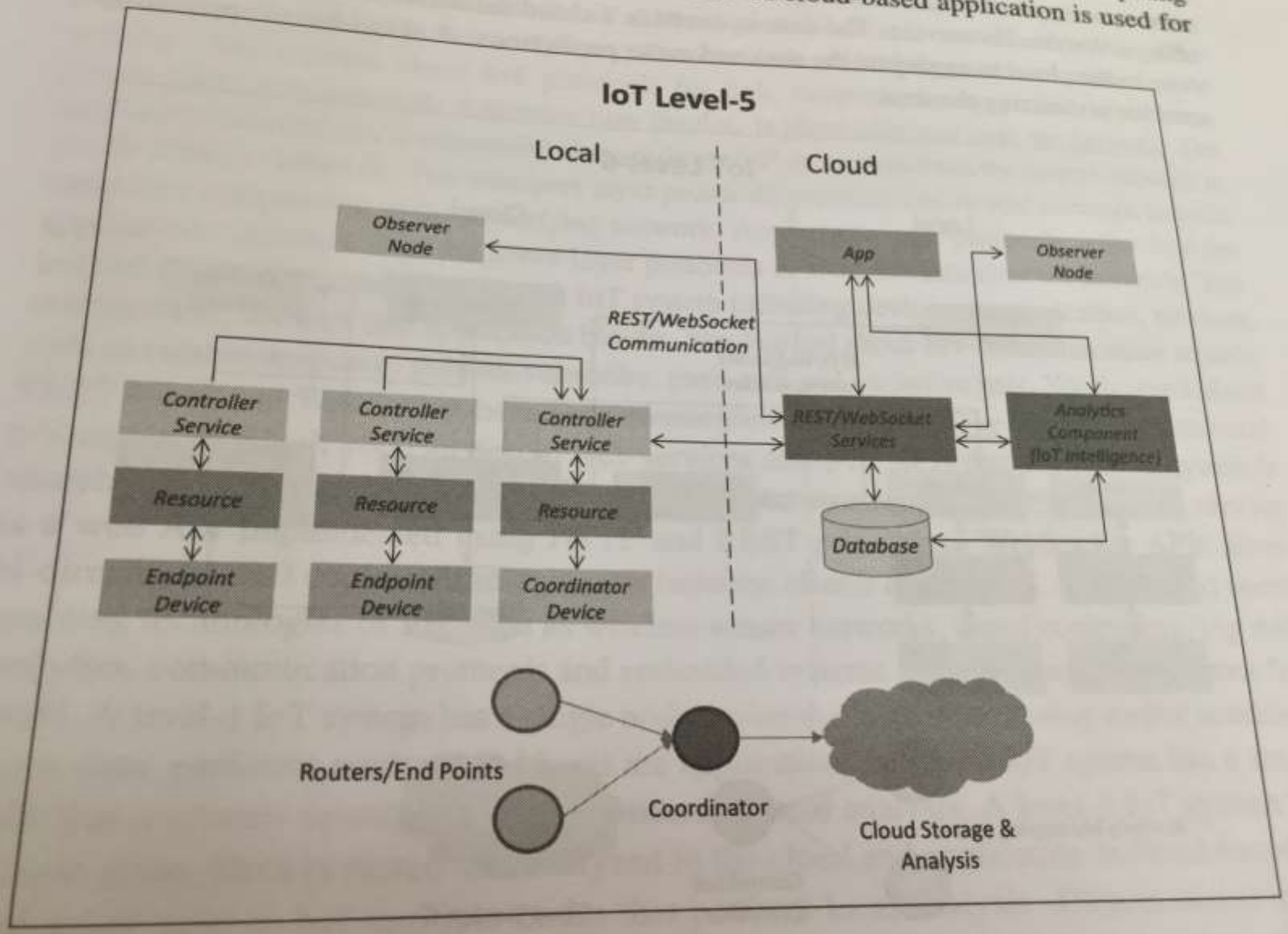


Figure 1.18: IoT Level-5

Environment

Forest Fire Detection

- IoT based forest fire detection system use a number of monitoring nodes deployed at different location in a forest.
- Each monitoring node collects measurements on ambient condition including temperature, humidity, light levels, etc.
- Early detection of forest fires can help in minimizing the damage.
- Papers:
  - *A novel accurate forest fire detection system using wireless sensor networks* [International Conference on Mobile Ad-hoc and Sensor Networks, 2011] →Presented a forest fire detection system based on wireless sensor network. The system uses multi-criteria detection which is implemented by the artificial neural network. The ANN fuses sensing data corresponding to ,multiple attributes of a forest fire such as temperature, humidity, infrared and visible light to detect forest fires.


IOT Based Forest Fire Monitoring

IoT Level - 6

- Multiple independent end nodes – sensing and/or actuation – send data to cloud
- Stores data – Cloud
- Application – Cloud based
- Analysis component – analyze – results visualized with cloud based applications
- Centralized controller – status- all end nodes sends control commands to nodes

nodes send the data to the cloud in
data is stored in a cloud database. The analysis of
aggregate the data and make predictions. A cloud-based applica
nizing the data.

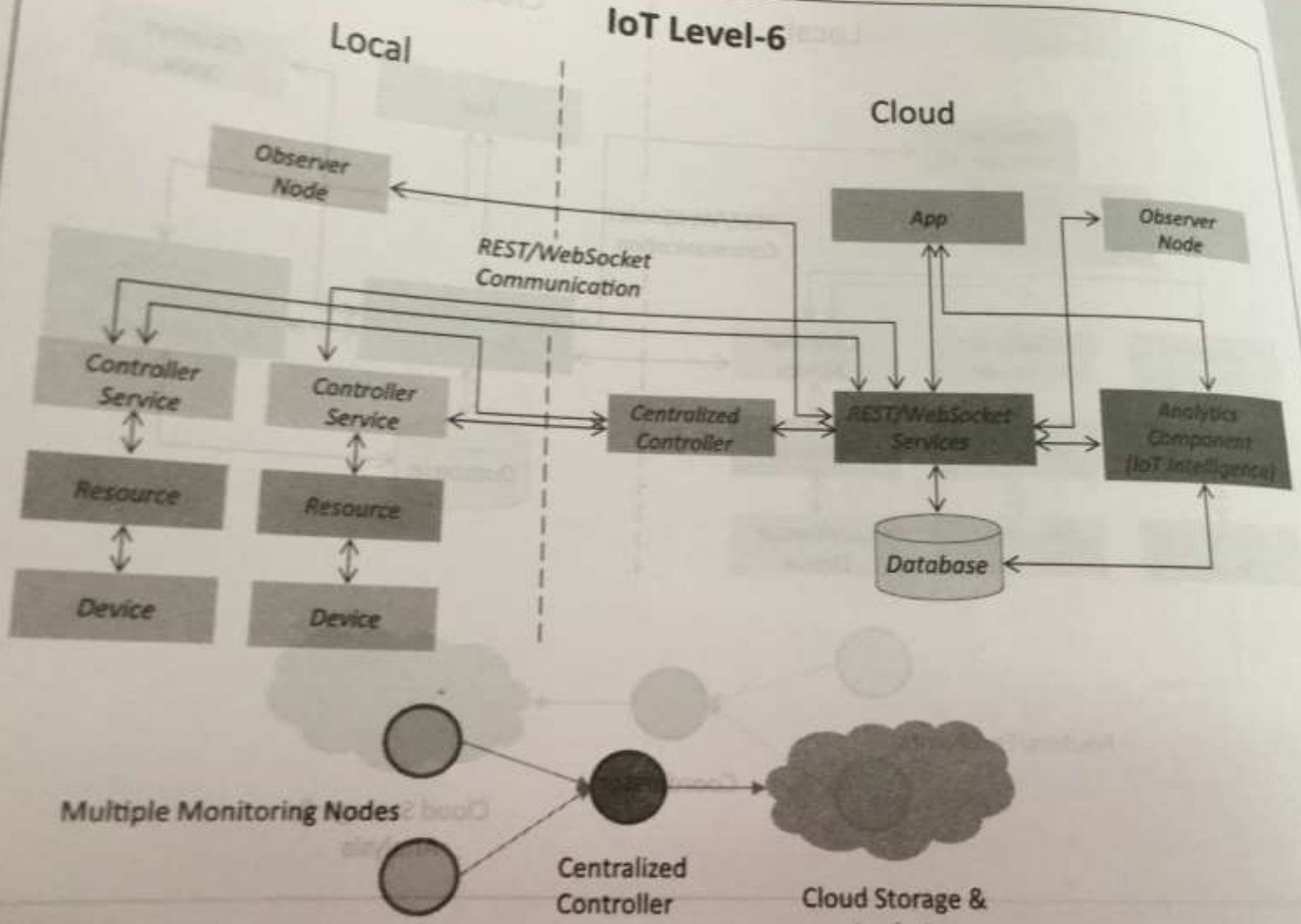


Figure 1.19: IoT Level-6

IoT Level - 6

Applications – Self Study