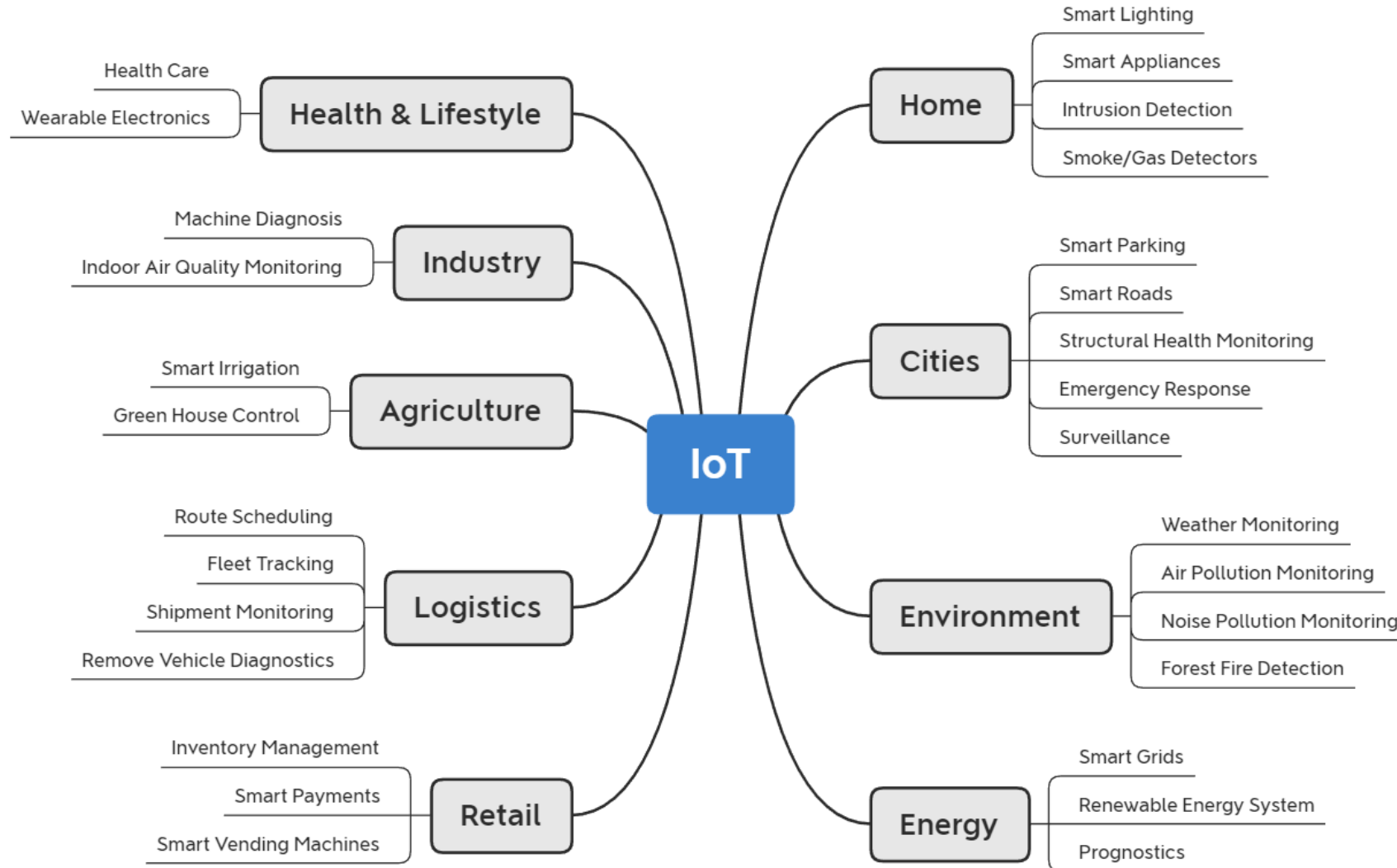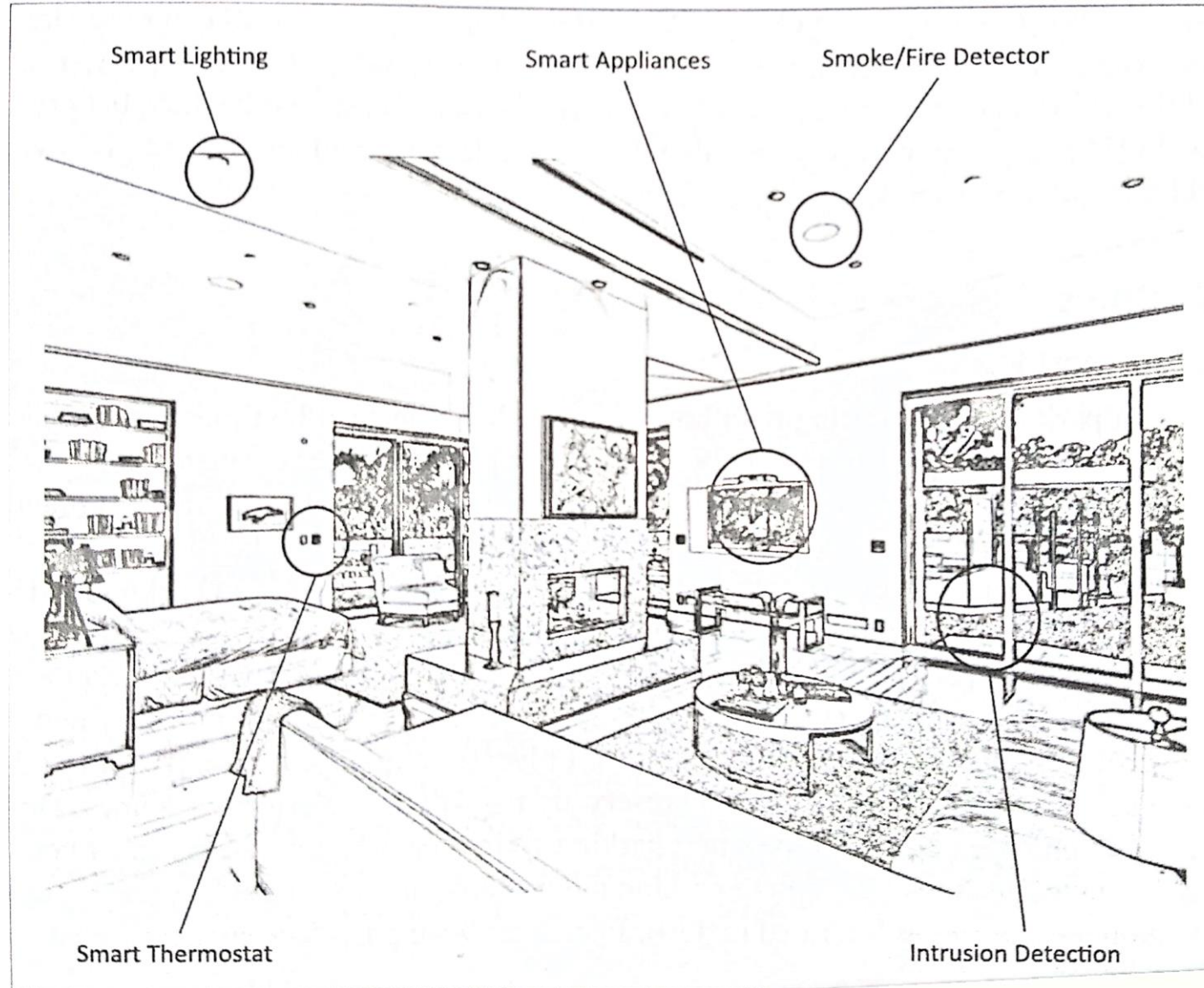# Chapter 2

Domain Specific IoTs

Outline

- Introduction
- Home Automation
- Cities
- Environment
- Energy

- Retail
- Logistics
- Agriculture
- Industry
- Health & Lifestyle
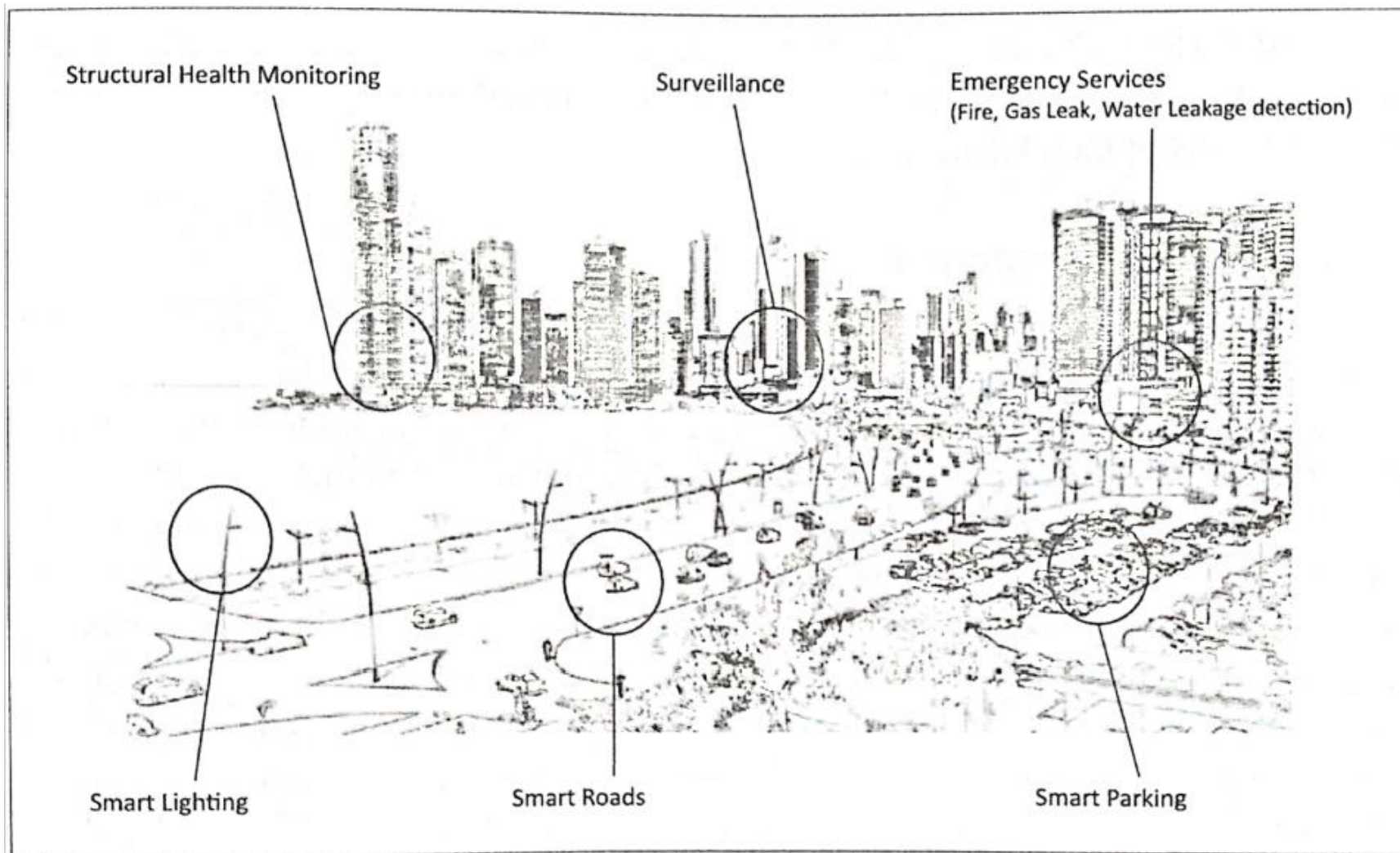
Introduction – Applications of IoT

Home Automation

Smart Lighting

Smart Appliances

Smoke/Fire Detector

Smart Thermostat

Intrusion Detection

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Home Automation (2/2)

- Smart Lighting
  - Control lighting by remotely (mobile or web applications)
- Smart Appliances
  - Provide status information to the users remotely
- Intrusion Detection
  - Use security cameras and sensors (PIR sensors and door sensors)
  - Detect intrusions and raise alerts
  - The alerts form: an SMS or an email sent to the user
- Smoke/Gas Detectors
  - Use optical detection, ionization, or air sampling techniques to detect the smoke
  - Gas detectors can detect harmful gases
    - Carbon monoxide (CO)
    - Liquid petroleum gas (LPG)
 - Raise alerts to the user or local fire safety department

Cities (1/2)

Structural Health Monitoring

Surveillance

Emergency Services
(Fire, Gas Leak, Water Leakage detection)

Smart Lighting

Smart Roads

Smart Parking

Cities (2/2)

- Smart Parking
  - Detect the number of empty parking slots
  - Send the information over the internet and accessed by smartphones
- Smart Roads
  - Provide information on driving conditions, traffic congestions, accidents
  - Alert for poor driving conditions
- Structural Health Monitoring
  - Monitor the vibration levels in the structures (bridges and buildings)
  - Advance warning for imminent failure of the structure
- Surveillance
  - Use the large number of distributed and internet connected video surveillance cameras
  - Aggregate the video in cloud-based scalable storage solutions
- Emergency Response
  - Used for critical infrastructure monitoring
 - Detect adverse events

Environment (1/2)
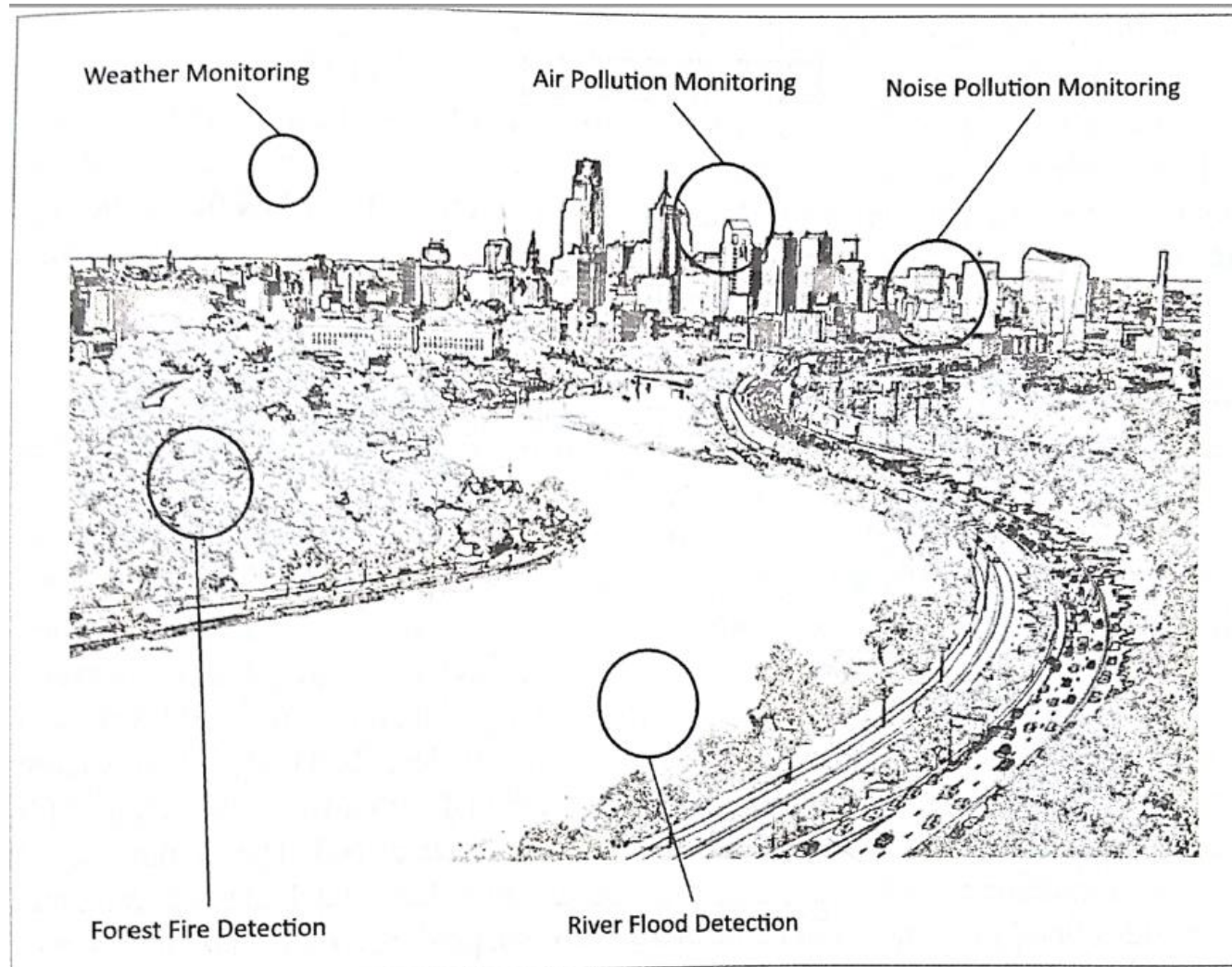
Environment (2/2)

- Weather Monitoring
  - Collect data from several sensors (temperature, humidity, pressure, etc.)
  - Send the data to cloud-based applications and storage back-ends
- Air Pollution Monitoring
  - Monitor emission of harmful gases (CO_2, CO, NO, NO_2, etc.)
  - Factories and automobiles use gaseous and meteorological sensors
  - Integration with a single-chip microcontroller, several air pollution sensors, GPRS-modem, and a GPS module
- Noise Pollution Monitoring
  - Use a number of noise monitoring stations
  - Generate noise maps from data collected
- Forest Fire Detection
  - Use a number of monitoring nodes deployed at different locations in a forests
    - Use temperature, humidity, light levels, etc.
  - Provide early warning of potential forest fire
  - Estimates the scale and intensity
- River Floods Detection
  - Monitoring the water level (using ultrasonic sensors) and flow rate (using the flow velocity sensors)
  - Raise alerts when rapid increase in water level and flow rate is detected

Energy (1/2)

Smart Grid

Renewable Energy Integration

Prognostic Health Management
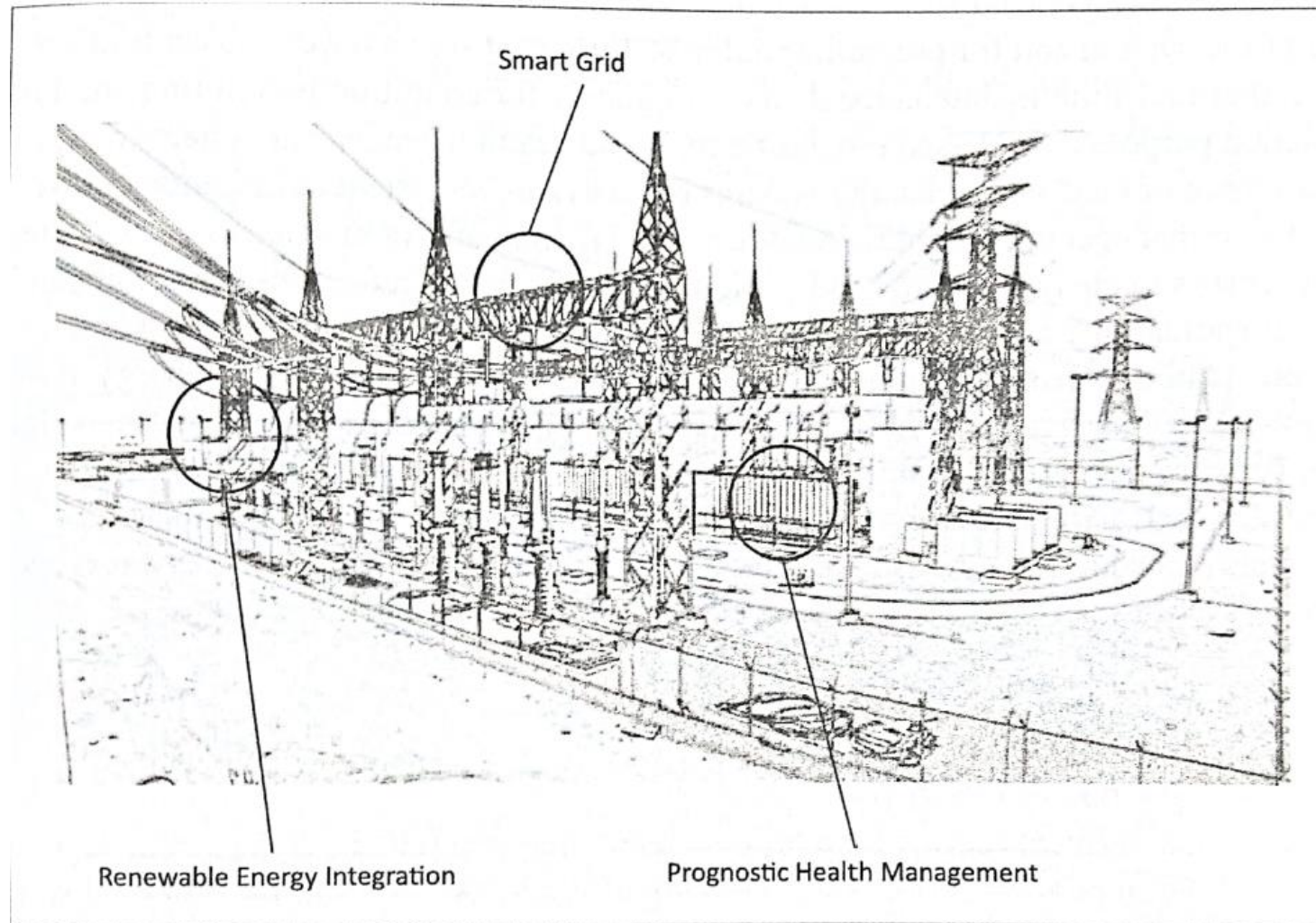
Energy (2/2)

- Smart Grids
  - Collect data regarding electricity generation, consumption, storage (conversion of energy into other forms), distribution, equipment health data
  - Control the consumption of electricity
  - Remotely switch off supply

- Renewable Energy Systems
  - Measure the electrical variables
  - Measure how much the power is fed into the grid

- Prognostics
  - Predict performance of machines or energy systems
   - By collect and analyze the data from sensors

Retail (1/2)

Inventory Monitoring

Smart Shopping Applications
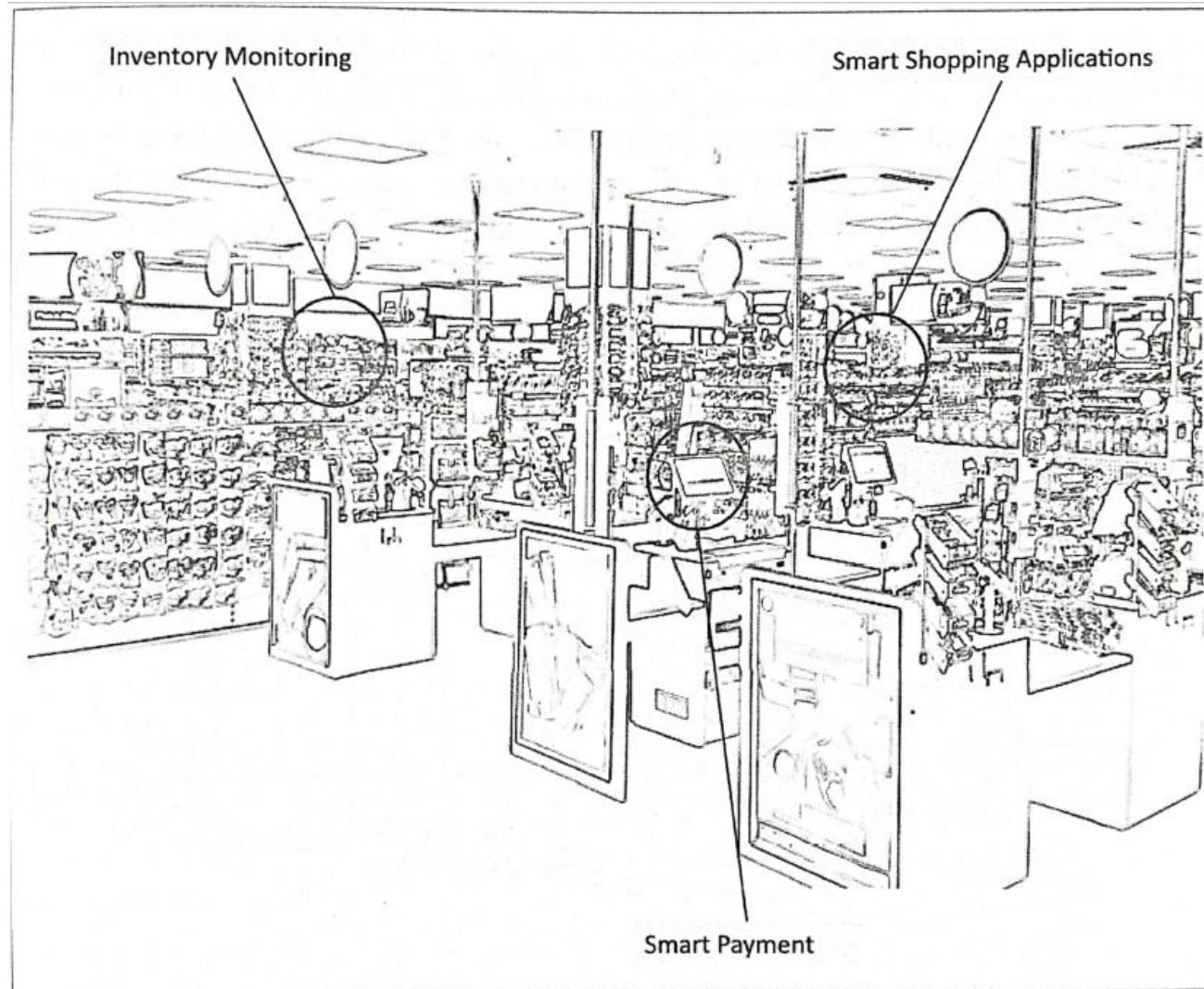
Smart Payment

Retail (2/2)

- Inventory Management
  - Monitoring the inventory by the RFID readers
  - Tracking the products
- Smart Payments
  - Use the NFC
    - Customers store the credit card information in their NFC-enabled
- Smart Vending Machines
  - Allow remote monitoring of inventory levels
  - Elastic pricing of products
  - Contact-less payment using NFC
  - Send the data to the cloud for predictive maintenance
    - The information of inventory levels
   - The information of the nearest machine in case a product goes out of stock in a machine

Logistics (1/2)
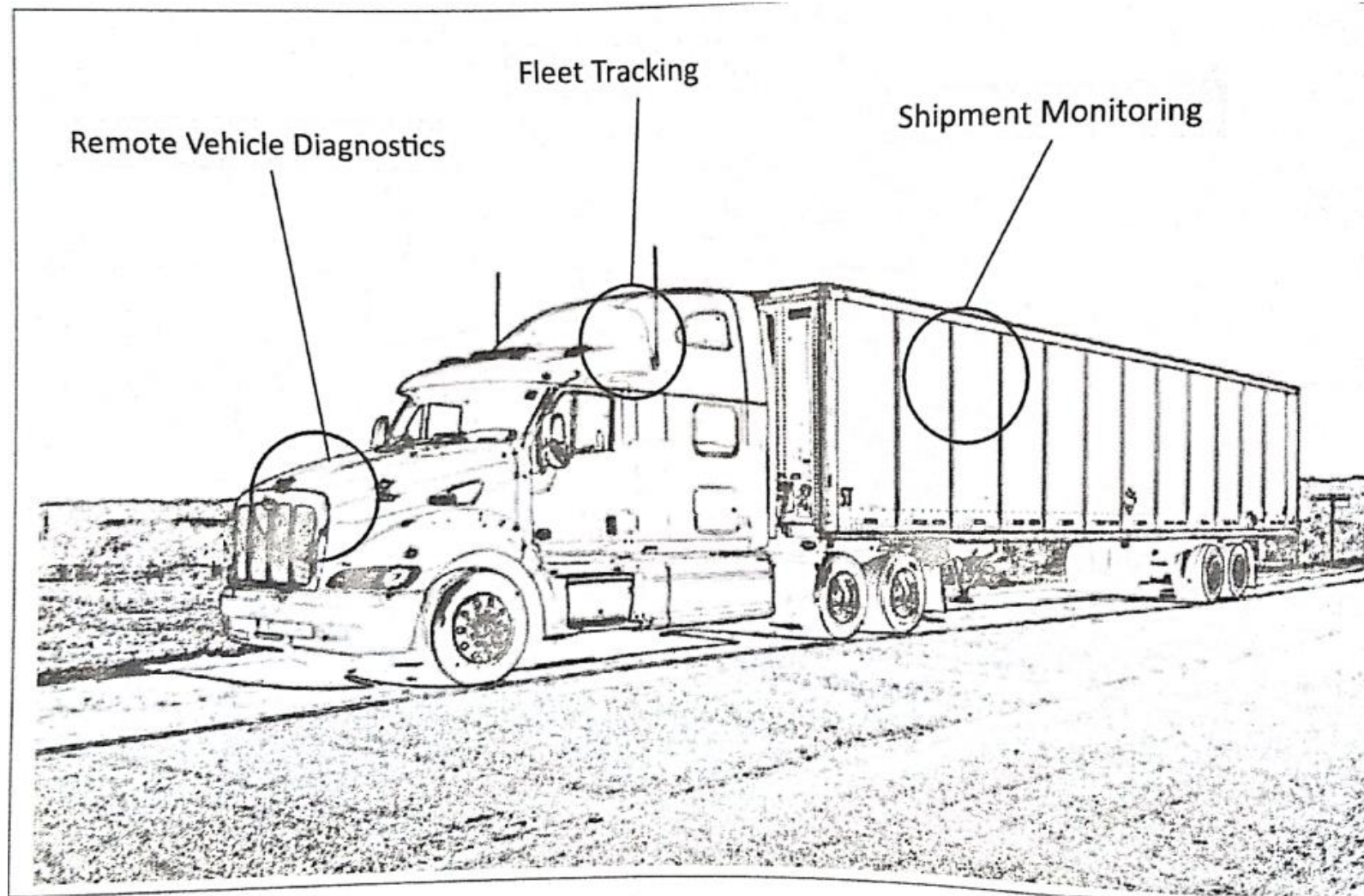
Logistics (2/2)

- Route Generation & Scheduling
  - Generate end-to-end routes using combination of route patterns
  - Provide route generation queries
  - Can be scale up to serve a large transportation network
- Fleet Tracking
  - Track the locations of the vehicles in real-time
  - Generate alerts for deviations in planned routes
- Shipment monitoring
  - Monitoring the conditions inside containers
  - Using sensors (temperature, pressure, humidity)
  - Detecting food spoilage
- Remote Vehicle Diagnostics
  - Detect faults in the vehicle
  - Warn of impending faults
  - IoT collects the data on vehicle (speed, engine RPM, coolant temperature)
 - Generate alerts and suggest remedial actions

Agriculture (1/2)
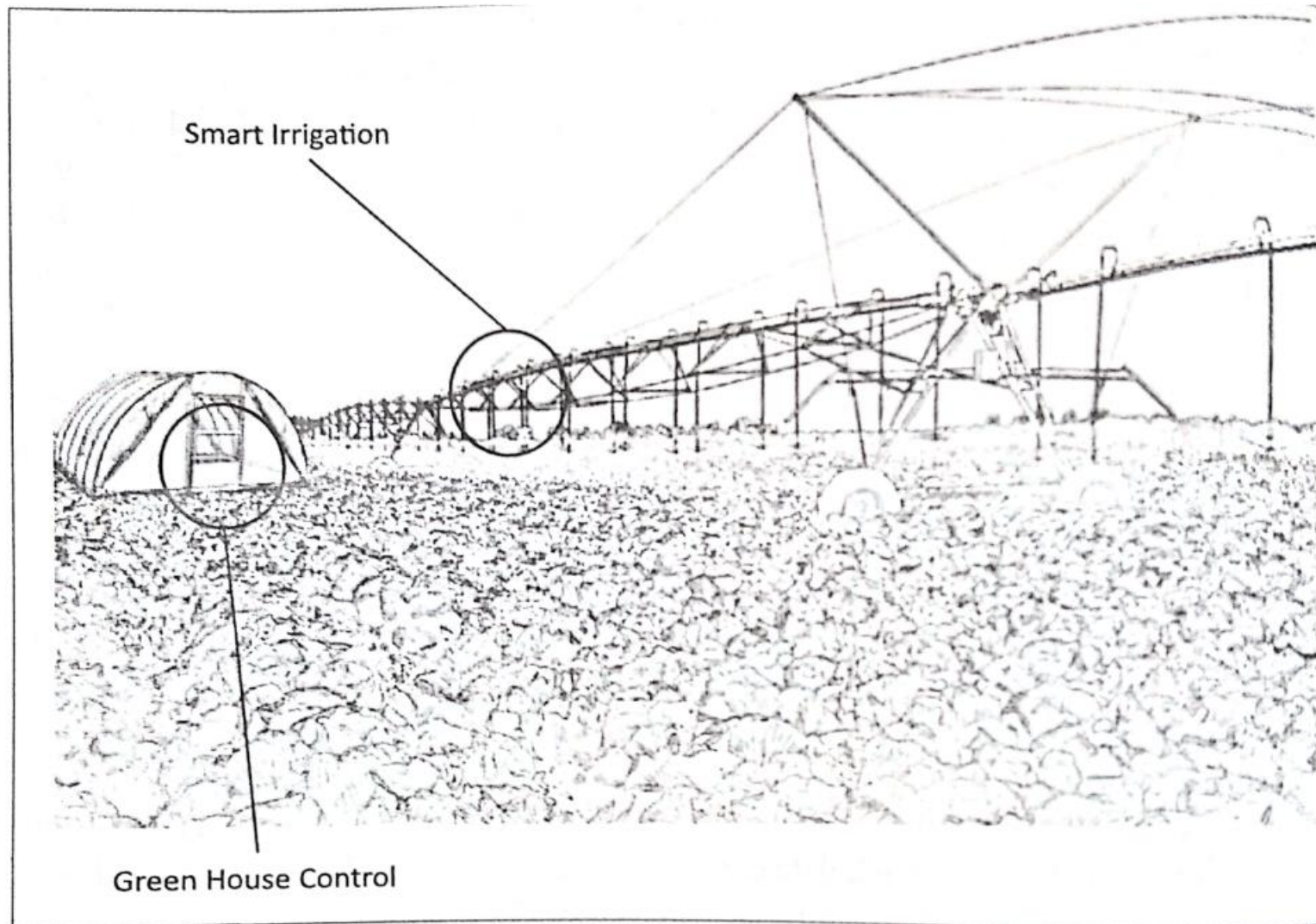
Agriculture (2/2)

- Smart Irrigation
  - Use sensors to determine the amount of moisture in the soil
  - Release the flow of water
    - Using predefined moisture levels
  - Water Scheduling

- Green House Control
  - Automatically control the climatological conditions inside a green house
    - Using several sensors to monitor
    - Using actuation devices to control
      - Valves for releasing water and switches for controlling fans
  - Maintenance of agricultural production

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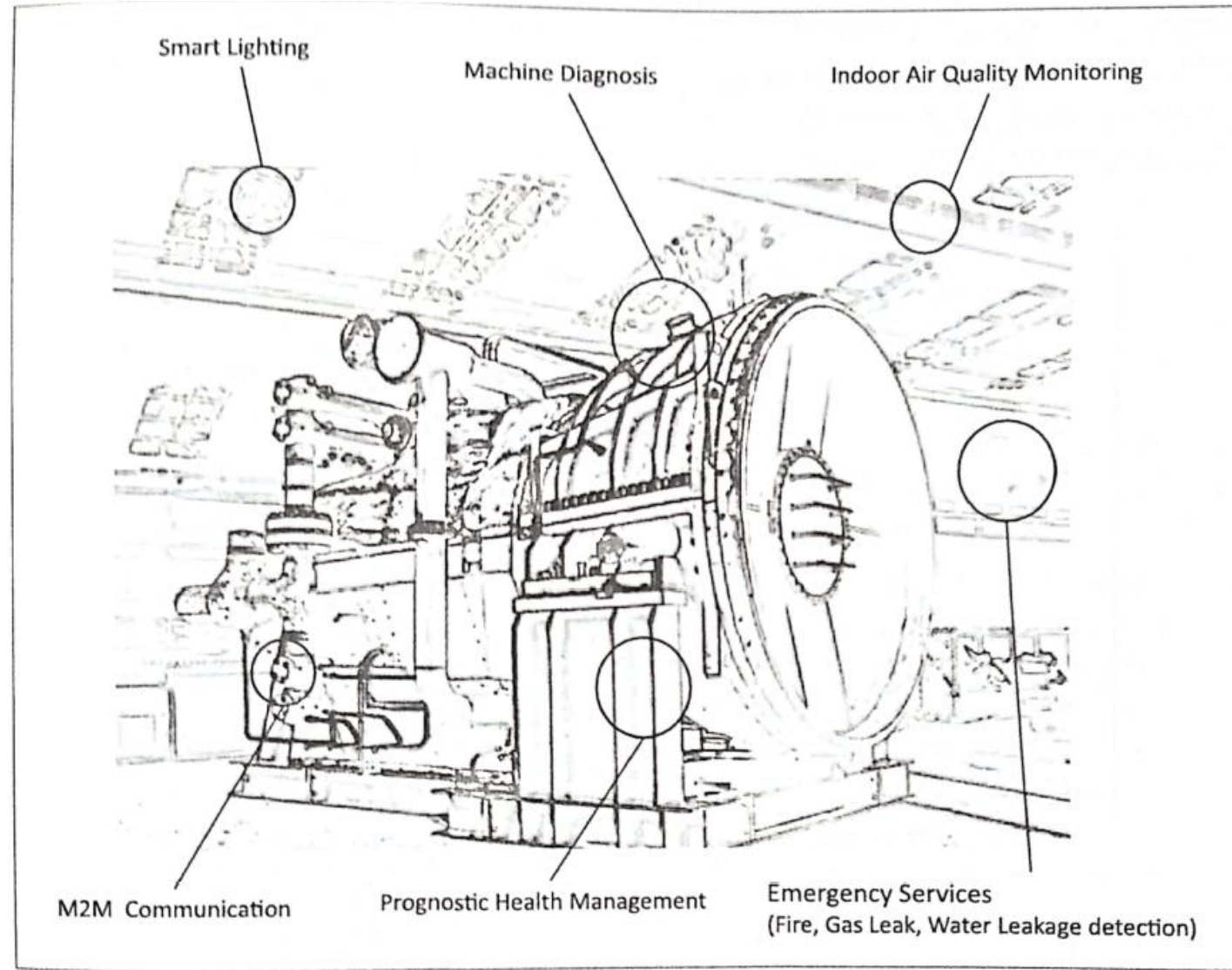
Industry (1/2)

Industry (2/2)

- Machine Diagnosis
  - Sensors in machine monitor the operating conditions
    - For example: temperature & vibration levels
  - Collecting and analyzing massive scale machine sensor data
    - For reliability analysis and fault prediction in machines
- Indoor Air Quality Monitoring
  - Use various gas sensors
    - To monitor the harmful and toxic gases (CO, NO, NO_2, etc.)
  - Measure the environmental parameters to determine the indoor air quality
    - Temperature, humidity, gaseous pollutants, aerosol

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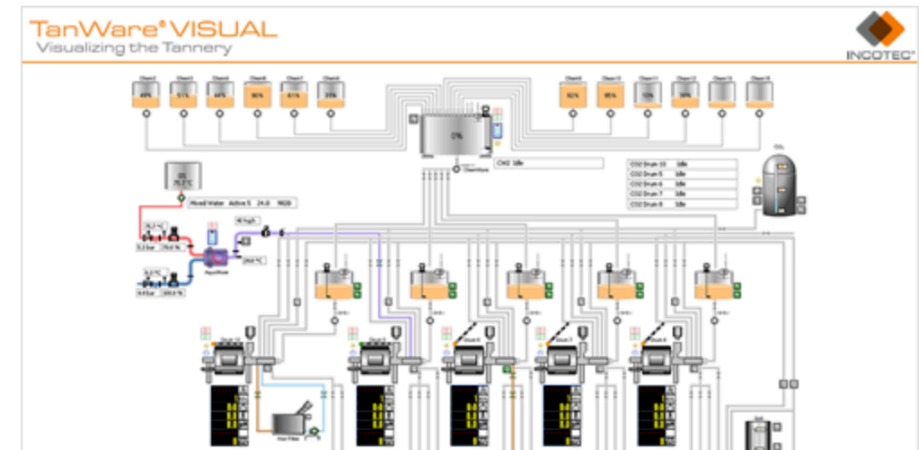
Health & Lifestyle

- Health & Fitness Monitoring
  - Collect the health-care data
    - Using some sensors: body temperature, heart rate, movement (with accelerometers), etc.
  - Various forms : belts and wrist-bands

- Wearable electronic
  - Assists the daily activities
    - Smart watch
    - Smart shoes
    - Smart wristbands