Lesson 2

Design Complexity Levels of IoT Applications and Service

Design Complexity Level 1

Design stages 1 to 3 for a simple IoT system

1. Layer 1: Physical object(s), sensor(s) and/or actuators (s)

2. Layer 2: Intranet, Internet or mobile service provider

3. Layer 3: Controller/monitor
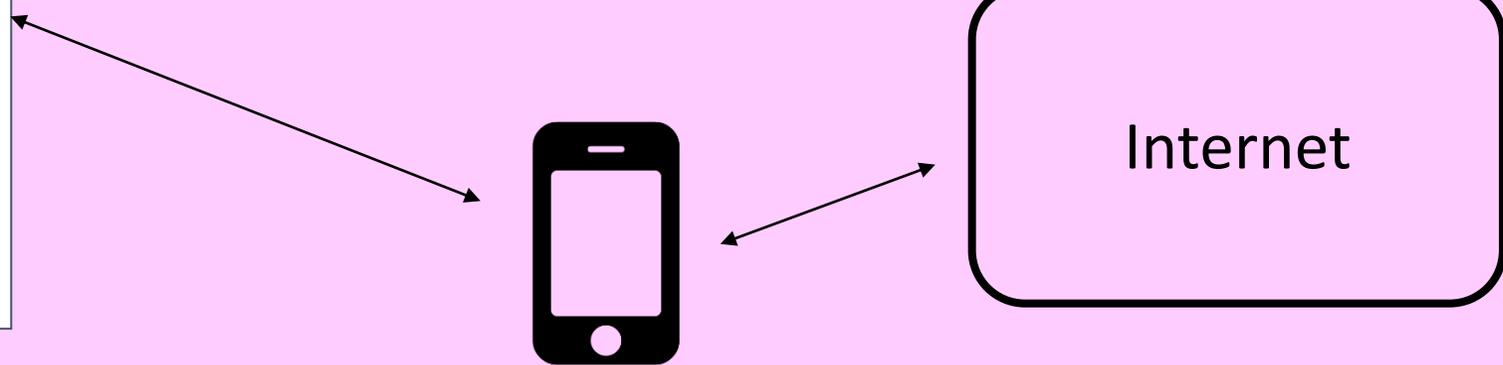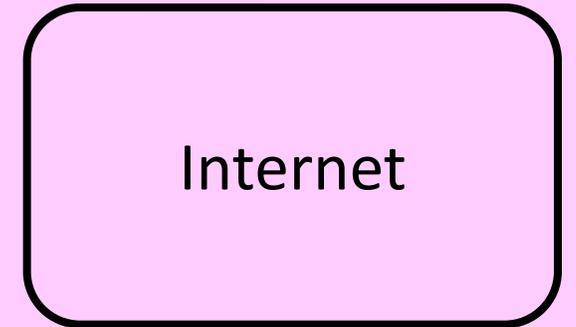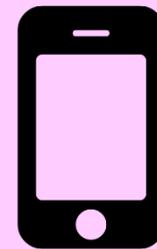
Complexity Level 1 Examples

- Internet of Umbrella (Example 1.1) least complexity in the design as it consists of single physical object, and depends on single weather web-service.

- Internet of other home items in smart homes, such as refrigerator and home lighting networks also have the least complexity in design

A Smart Umbrella

Flashing LED

Circuit
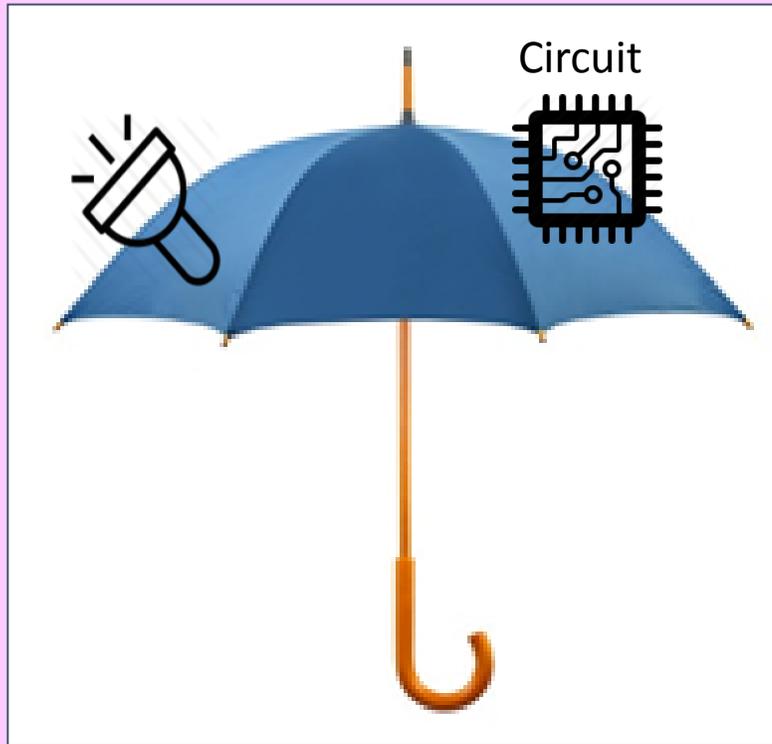
Weather Website

Internet

Complexity Level 2:

- Uses the cloud or server database platform for acquiring and organising

- An application or service program such as controlling and monitoring used

Complexity Level 2 Examples

- Internet of Streetlights (Examples 1.2 and 2.1,, Figure 1.1)

- 'Internet of drip irrigation points in channels'

- A group of streetlights connect to a group-controller using intranet

- The group controllers coordinates and connects to Internet and applications and services of a central coordinating server.

Complexity Level 3

- Uses a cloud or server platform for acquiring and organising enriched data points

- Event triggers and alerts at a database

- Uses analytics

- Visualisation of the analysed data.

Complexity Level 3 Examples

- Internet of RFIDs
- Provisions for a number of applications and services, such as tracking, security, inventory control and supply chain management
- IoT system can be conceptualised by equation 1.2 or 1.3 with additional complex analytics and an additional stage for visualisation
- Internet of ATMs (Example 2.3) also similar design complexity

Complexity Level 4

- The system requires server platform for acquire and organise

- Analysing and visualising the multiple sources data

- Connects to number of networks

Complexity Level 4 Examples

- 'Internet of WSNs' design complexity

- Smart home and city systems

- Internet of rail track sensors in rail track fault prediction and detection,

- Internet of oil pipeline sensors

Complexity Level 4 Examples

- Internet of waste management

- Internet of road faults

- Internet of individual and group of people health

- Information of Traffic congestions and then mapping traffic densities using number of networks

Complexity Level 5

- Uses multi-input data sources and a cloud platform. The
- system cloud server platform acquires, organises, performs data, events, triggers and
- streams processing and OLAP, visualises multiple sources analysed data and provisions
- for applications and services. The system extracts intelligence, may deploy machine
- learning and may perform knowledge discovery and knowledge-management.

Complexity Level 5 Example

- Internet of ACVMs (Example 5.1) which gathers multiple ACVMs data has complexity level 5.

- Internet of automotive components and predictive automotive maintenance application and service (ACPAMS)' also have this complexity level.

Complexity Level 6

- Industrial IIoT systems and products involve the integration of complex physical machinery M2M and IoT communication.

Complexity Level 6 Example

- Bicycle manufacturing operations coordination and synchronisation

- Refining the operations for manufacturing or maintenance and refining the business model of an industry.

- Real-time monitoring scenario in maintenance scheduling, predictive maintenance, or in fault or anomaly detection in real-time
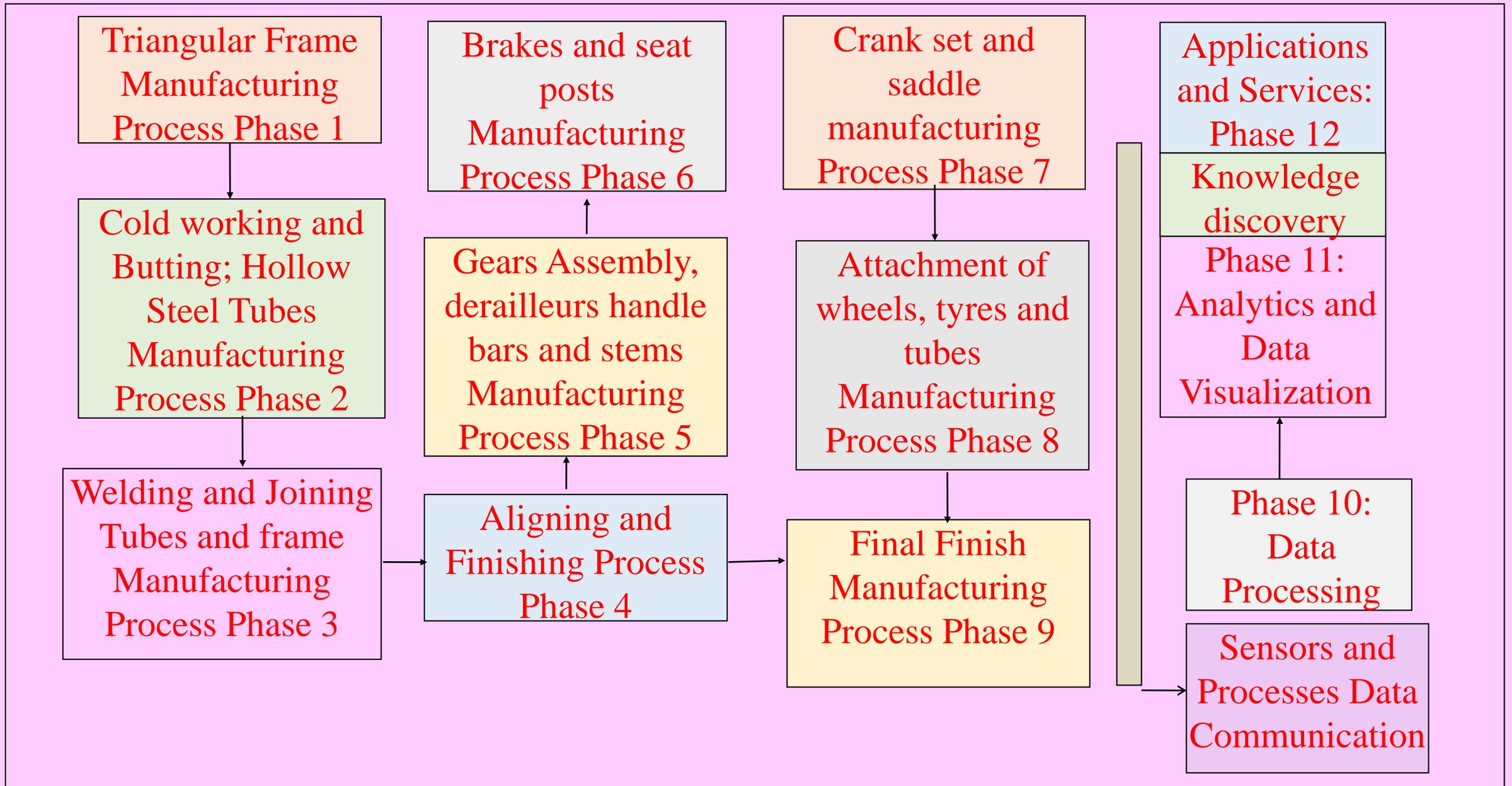
Fig. 7.10 IIoT phases in bicycle manufacturing process

Summary

We learnt

- Six design complexity levels in IoT prototypes development and deployment

End of Lesson 2 on
Design Complexity Levels of IoT Applications and Service