A Context-Aware Internet of Things Framework for Remote Monitoring Services
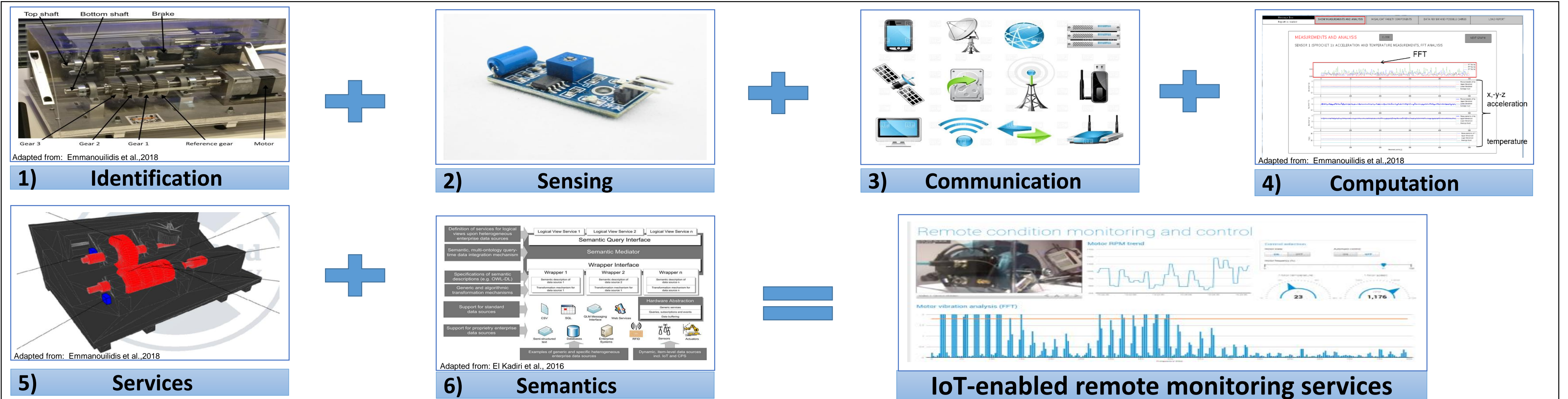
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1- Introduction

Adapted from: Emmanouilidis et al.,2018
1) **Identification**

2) **Sensing**

3) **Communication**

Adapted from: Emmanouilidis et al.,2018
4) **Computation**

Adapted from: Emmanouilidis et al.,2018
5) **Services**

Adapted from: El Kadiri et al., 2016
6) **Semantics**

IoT-enabled remote monitoring services

2- Project Aim

The aim of this research is to design and develop a context-aware framework for the integration of IoT and Cloud computing for remote monitoring services.
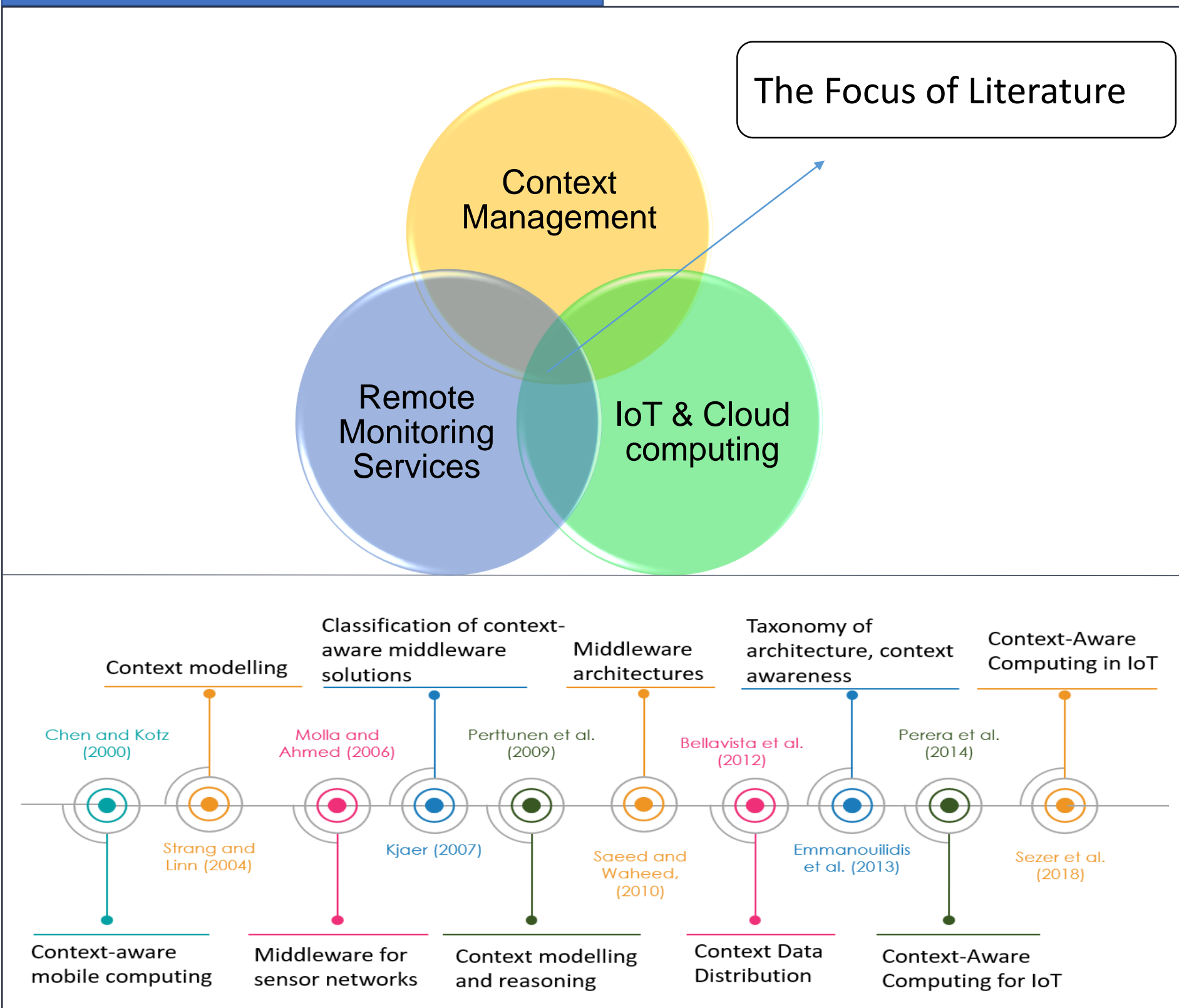
3- Project Objectives

1. To define the factors contributing to context acquisition, modelling, reasoning and dissemination for IoT-enabled remote monitoring services.
2. To develop a framework and a context-aware monitoring architecture for employing IoT and cloud computing to address monitoring service challenges.
3. To validate the proposed framework through experiments, case study, and expert judgment.
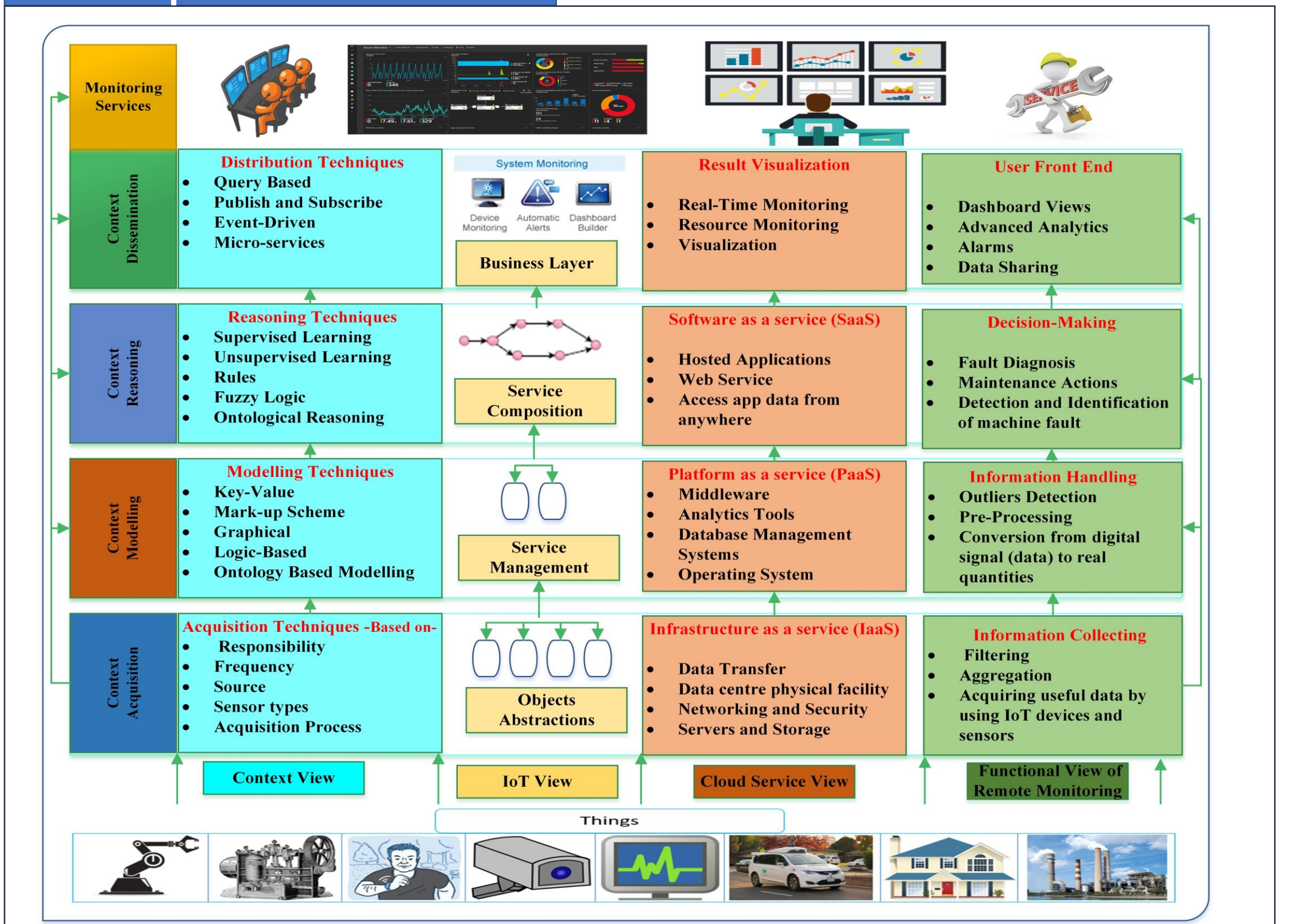
4- Research Methodology

Comprehending the Context → **Design and Develop a Framework** → **Experimentation Materials and Methods** → **Framework Validation**

5- Literature Review

The Focus of Literature

Context Management

Remote Monitoring Services

IoT & Cloud computing

Context modelling

Classification of context-aware middleware solutions

Middleware architectures

Taxonomy of architecture, context awareness

Context-Aware Computing in IoT

Chen and Kotz (2000)

Strang and Linn (2004)

Molla and Ahmed (2006)

Kjaer (2007)

Perttunen et al. (2009)

Saeed and Waheed (2010)

Bellavista et al. (2012)

Emmanouilidis et al. (2013)

Perera et al. (2014)

Sezer et al. (2018)

Context-aware mobile computing

Middleware for sensor networks

Context modelling and reasoning

Context Data Distribution

Context-Aware Computing for IoT

6- Conceptual framework

Monitoring Services

Context Dissemination
- Distribution Techniques
  - Query Based
  - Publish and Subscribe
  - Event-Driven
  - Micro-services
- System Monitoring (Device Monitoring, Automatic Alerts, Dashboard Builder) — Business Layer
- Result Visualization
  - Real-Time Monitoring
  - Resource Monitoring
  - Visualization
- User Front End
  - Dashboard Views
  - Advanced Analytics
  - Alarms
  - Data Sharing

Context Reasoning
- Reasoning Techniques
  - Supervised Learning
  - Unsupervised Learning
  - Rules
  - Fuzzy Logic
  - Ontological Reasoning
- Service Composition
- Software as a service (SaaS)
  - Hosted Applications
  - Web Service
  - Access app data from anywhere
- Decision-Making
  - Fault Diagnosis
  - Maintenance Actions
  - Detection and Identification of machine fault

Context Modelling
- Modelling Techniques
  - Key-Value
  - Mark-up Scheme
  - Graphical
  - Logic-Based
  - Ontology Based Modelling
- Service Management
- Platform as a service (PaaS)
  - Middleware
  - Analytics Tools
  - Database Management Systems
  - Operating System
- Information Handling
  - Outliers Detection
  - Pre-Processing
  - Conversion from digital signal (data) to real quantities

Context Acquisition
- Acquisition Techniques -Based on-
  - Responsibility
  - Frequency
  - Source
  - Sensor types
  - Acquisition Process
- Objects Abstractions
- Infrastructure as a service (IaaS)
  - Data Transfer
  - Data centre physical facility
  - Networking and Security
  - Servers and Storage
- Information Collecting
  - Filtering
  - Aggregation
  - Acquiring useful data by using IoT devices and sensors

Context View | **IoT View** | **Cloud Service View** | **Functional View of Remote Monitoring**

Things

7- Research Gaps

❖ While substantial research efforts have been devoted to context lifecycle management in IoT-enabled computing, little attention has been given to translate these advances to tangible progress in remote monitoring services.

❖ Recent research has presented several solutions that are used in specific scenarios, therefore, difficult to apply in other situations.

8- Conclusions

❖ The integration of context management in the development of remote monitoring services is vital and important for handling some of the well known Big Data 'V' Challenges (Volume, Veracity, Variety), and incorporate both data and domain knowledge.

❖ This framework will directly help companies to leverage the value of IoT and Big Data to provide new maintenance services capabilities.

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