11-20

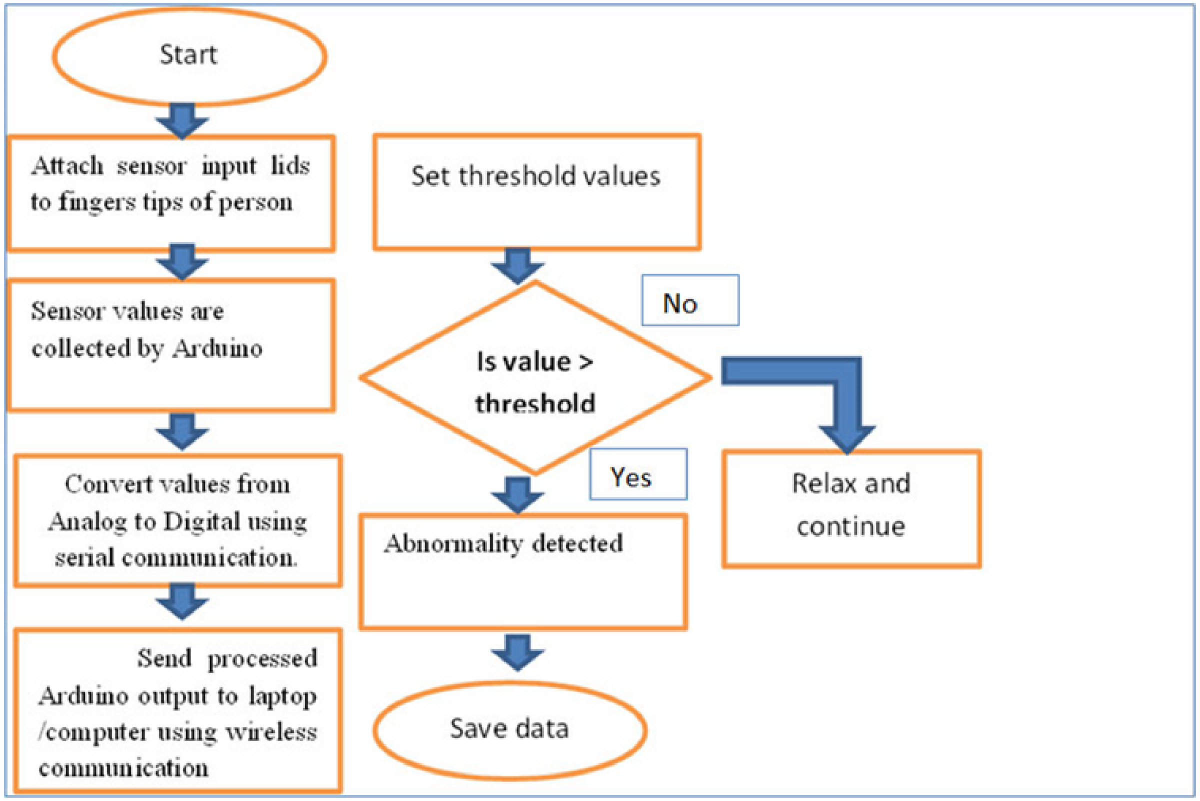
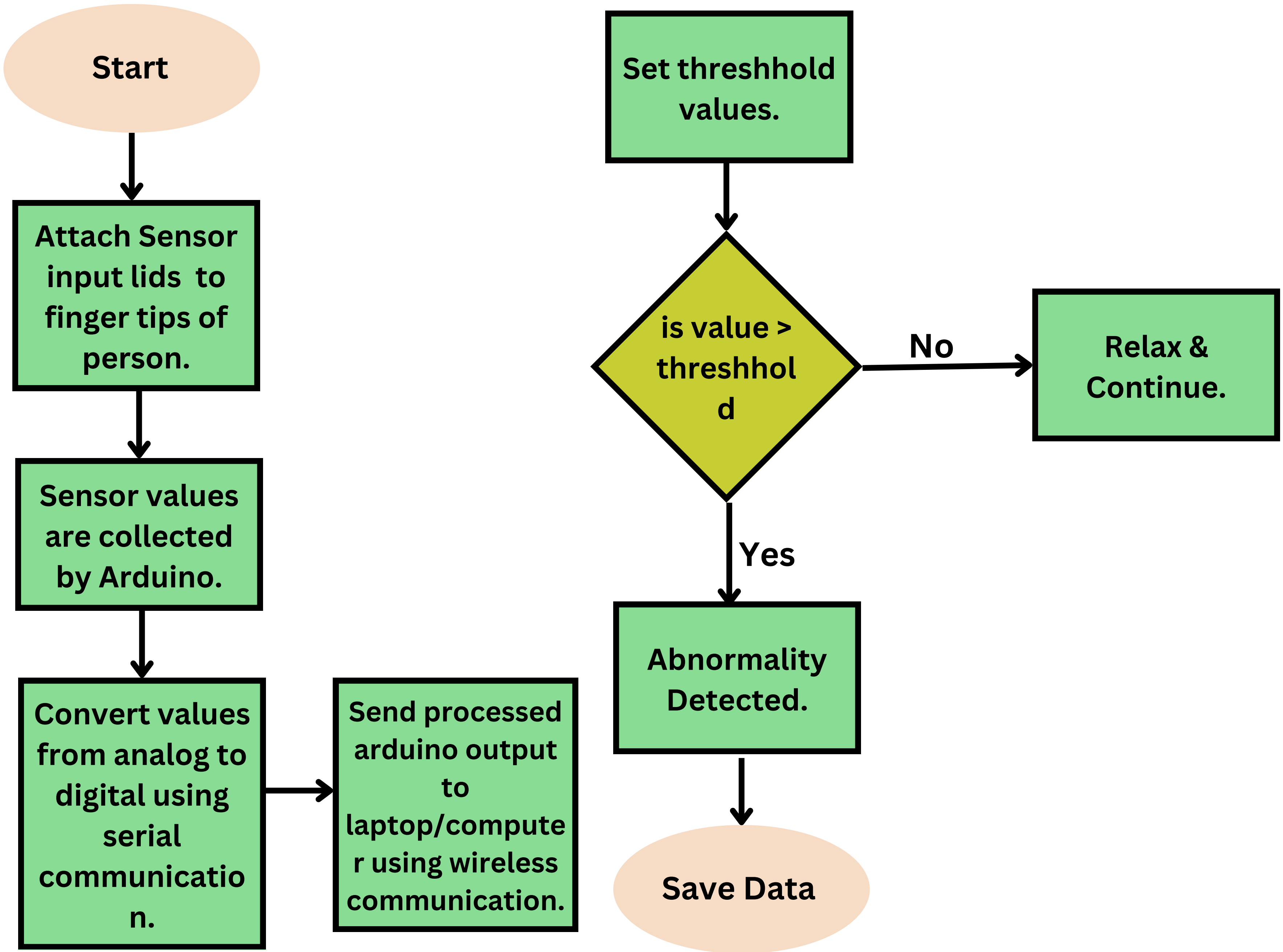
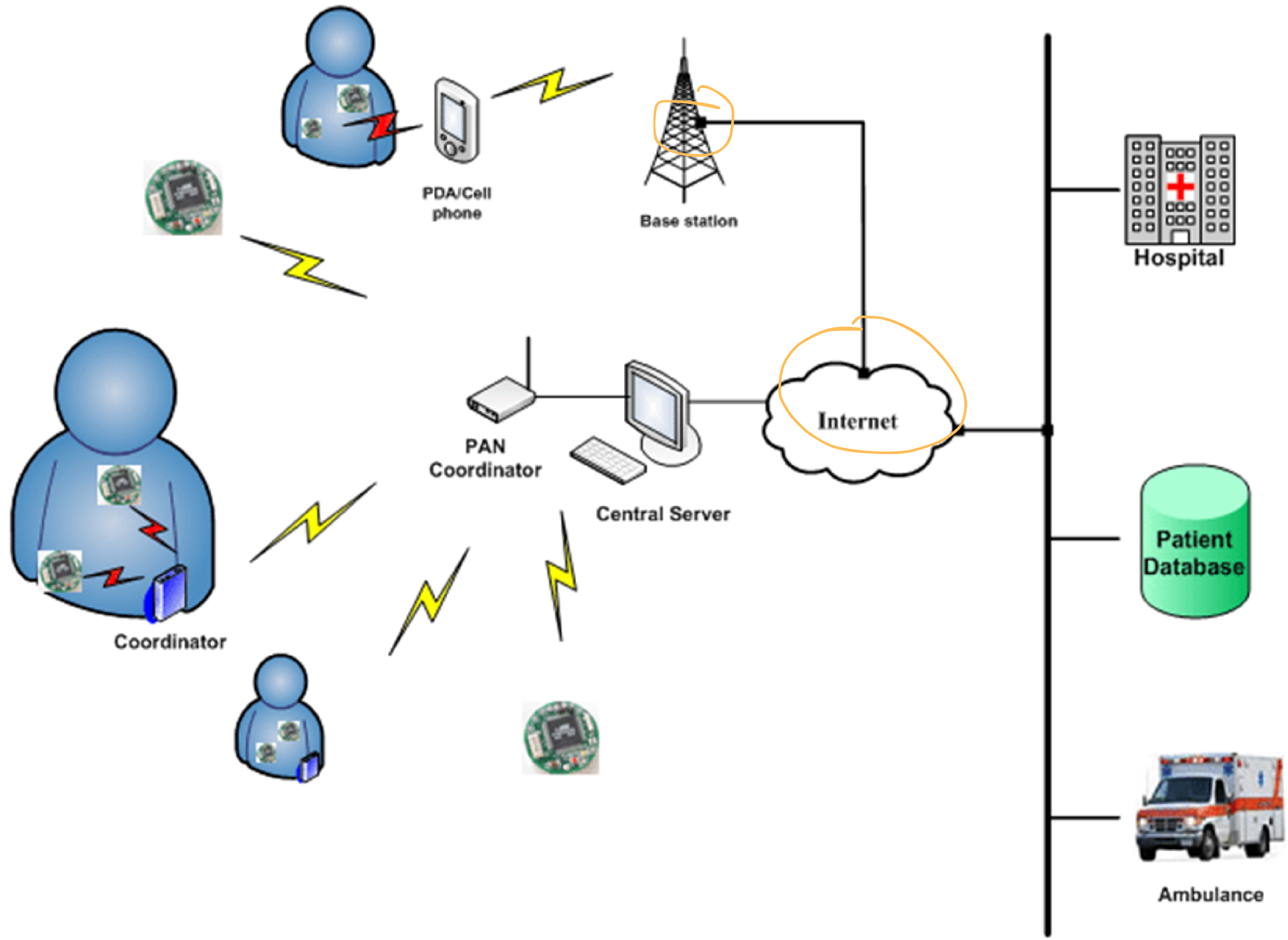
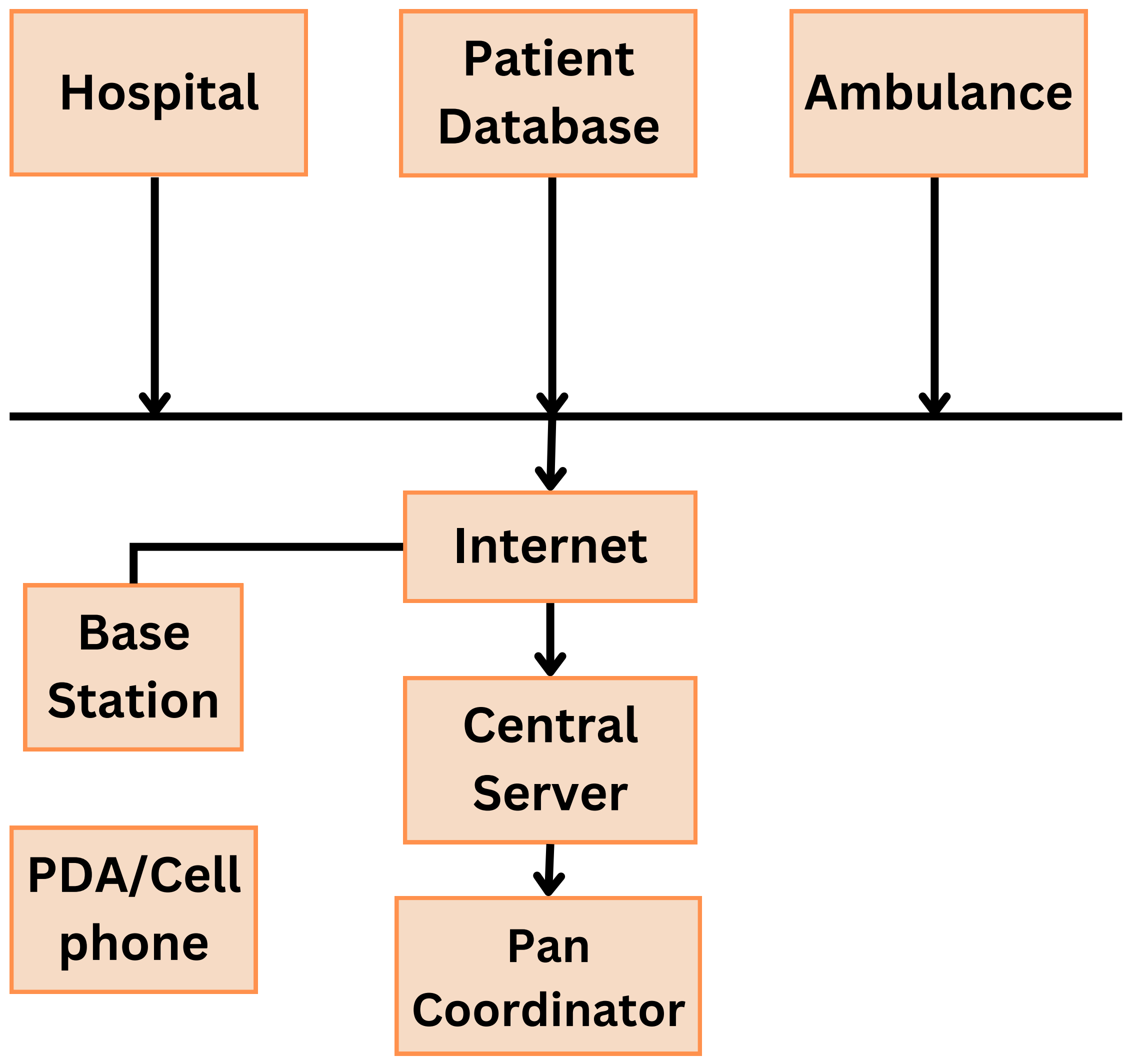


Figure 3: Flowchart of proposed system


Start
Attach Sensor input lids to finger tips of person.
Sensor values are collected by Arduino.
Convert values from analog to digital using serial communicatio n.
Send processed arduino output to laptop/compute r using wireless communication.
Set threshhold values.
is value > threshhol d
No
Relax & Continue.
Yes
Abnormality Detected.
Save Data


PDA/Cell phone
Base station
Hospital
Internet
PAN Coordinator
Central Server
Patient Database
Coordinator
Ambulance


Hospital
Patient Database
Ambulance
Internet
Base Station
Central Server
PDA/Cell phone
Pan Coordinator

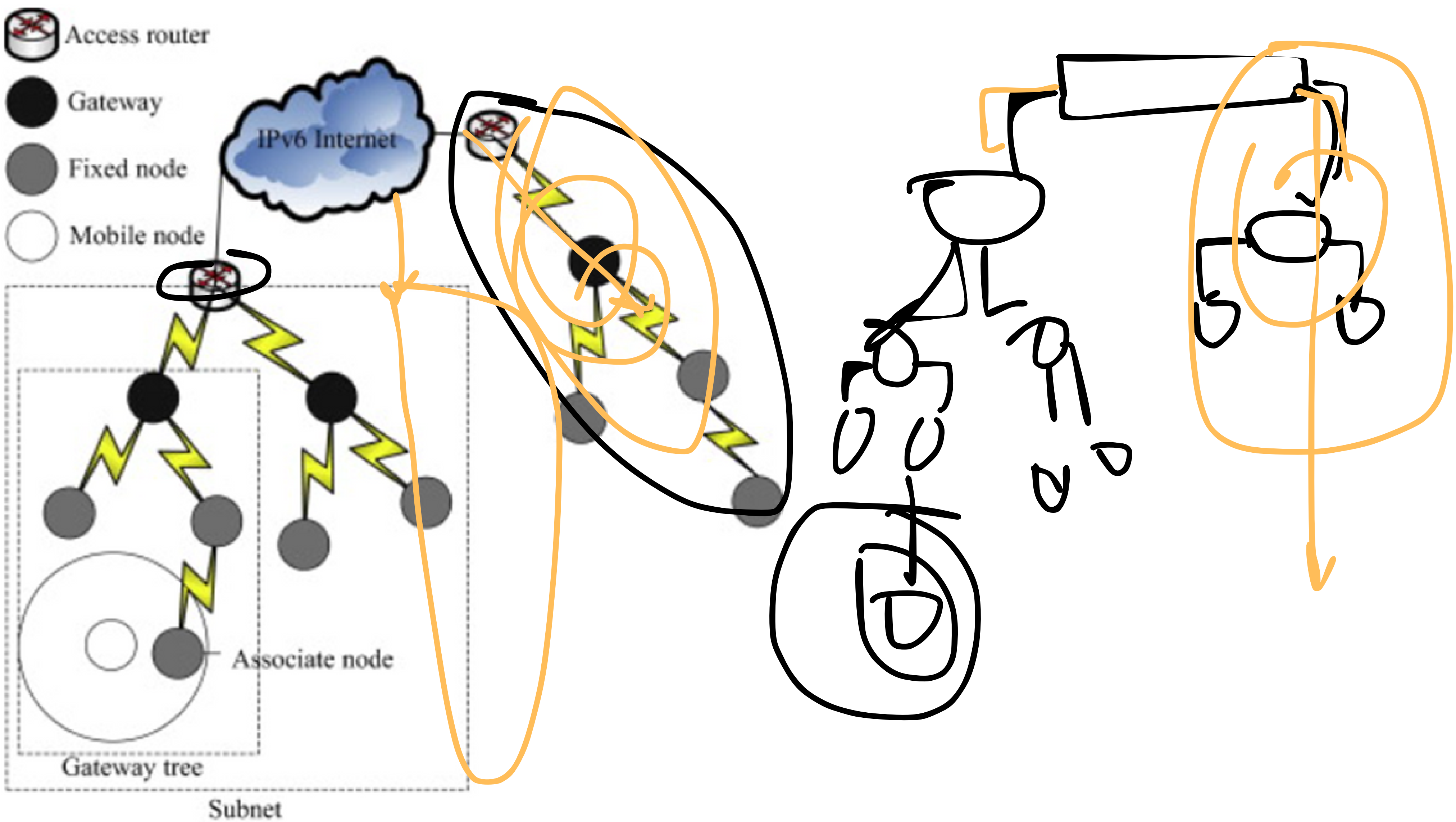
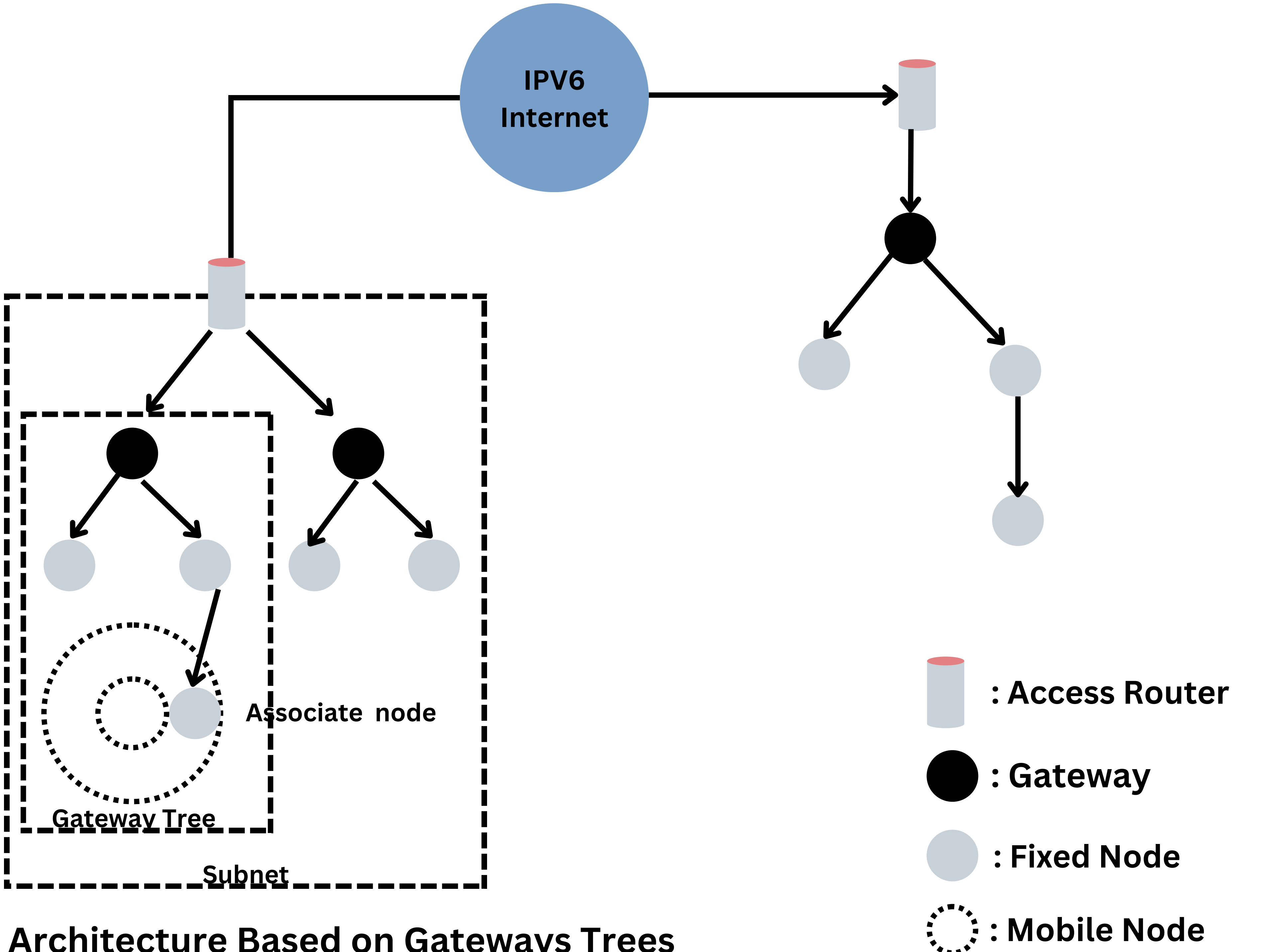


Fig. 1. Architecture based on gateway trees.



Architecture Based on Gateways Trees

Feature	Description
All-IP Wireless Sensor Networks	A networking architecture that utilizes Internet Protocol (IP) to enable seamless communication and data exchange between sensor nodes and healthcare monitoring systems.
IP-Enabled Sensor Nodes	Sensor nodes equipped with IP capabilities can directly connect to the internet, eliminating the need for gateways or intermediaries.
Simplified Network Management	All-IP WSNs simplify network management by providing a unified IP-based addressing scheme, reducing configuration complexity.
Enhanced Scalability	The IP-based architecture facilitates seamless integration of new sensor nodes and devices, enabling the network to scale with increasing patient volumes and monitoring requirements.
Improved Interoperability	All-IP WSNs promote interoperability with existing IP-based healthcare networks, enabling seamless data exchange and integration with electronic health records (EHRs) and other clinical systems.
Real-time Data Transmission	Real-time data transmission enables continuous monitoring of patients' vital signs and health parameters, allowing for timely interventions and improved patient care.
Security	All-IP WSNs incorporate IP-based security protocols to safeguard sensitive patient data and protect the network from unauthorized access and cyberattacks.
Applications	All-IP WSNs are applicable in various healthcare settings, including hospitals, clinics, remote patient monitoring scenarios, and wearable health devices.

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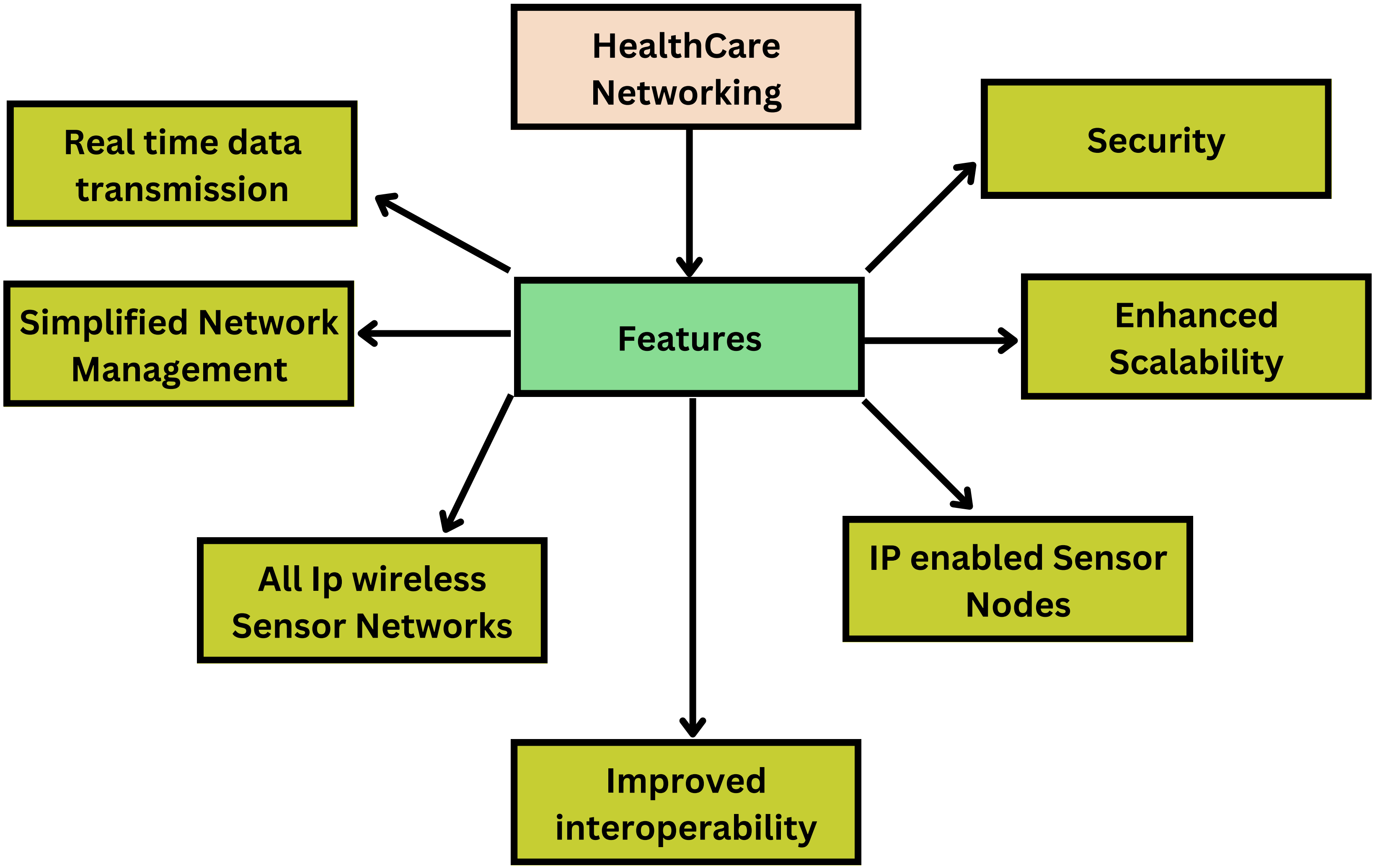
HealthCare Networking
Real time data transmission
Security
Simplified Network Management
Features
Enhanced Scalability
All Ip wireless Sensor Networks
IP enabled Sensor Nodes
Improved interoperability

Feature	Description
Fuzzy Logic	A methodology that employs fuzzy sets and membership functions to represent uncertainty and make decisions based on imprecise or incomplete information.
Shuffled Frog-Leaping Algorithm (SFLA)	A metaheuristic optimization algorithm inspired by the foraging behavior of frogs.
Heterogeneous Wireless Sensor Networks (WSNs)	Networks composed of sensor nodes with varying capabilities, such as energy levels, sensing ranges, and communication abilities.
Area Coverage	The ability of a WSN to monitor a given area effectively.
Efficient Energy Consumption	Fuzzy logic can be used to dynamically adjust sensor node activation schedules based on factors such as energy levels, distance to the base station, and overlap between sensing ranges. This helps to optimize energy consumption.
Maximized Coverage	SFLA can be used to find optimal sensor node placements to maximize coverage and minimize energy consumption.
Network Connectivity	The proposed area coverage scheme can maintain network connectivity in heterogeneous WSNs.

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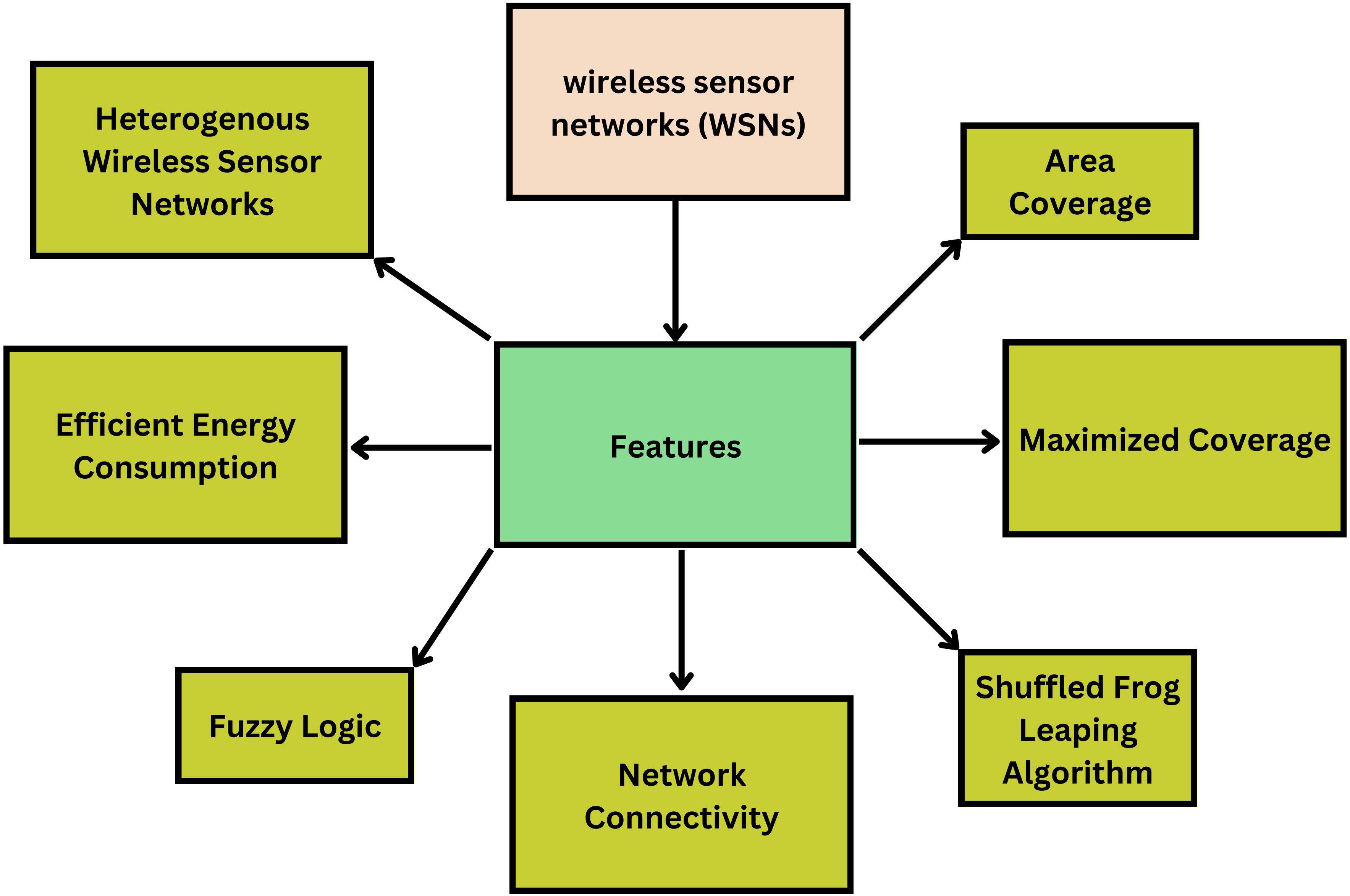
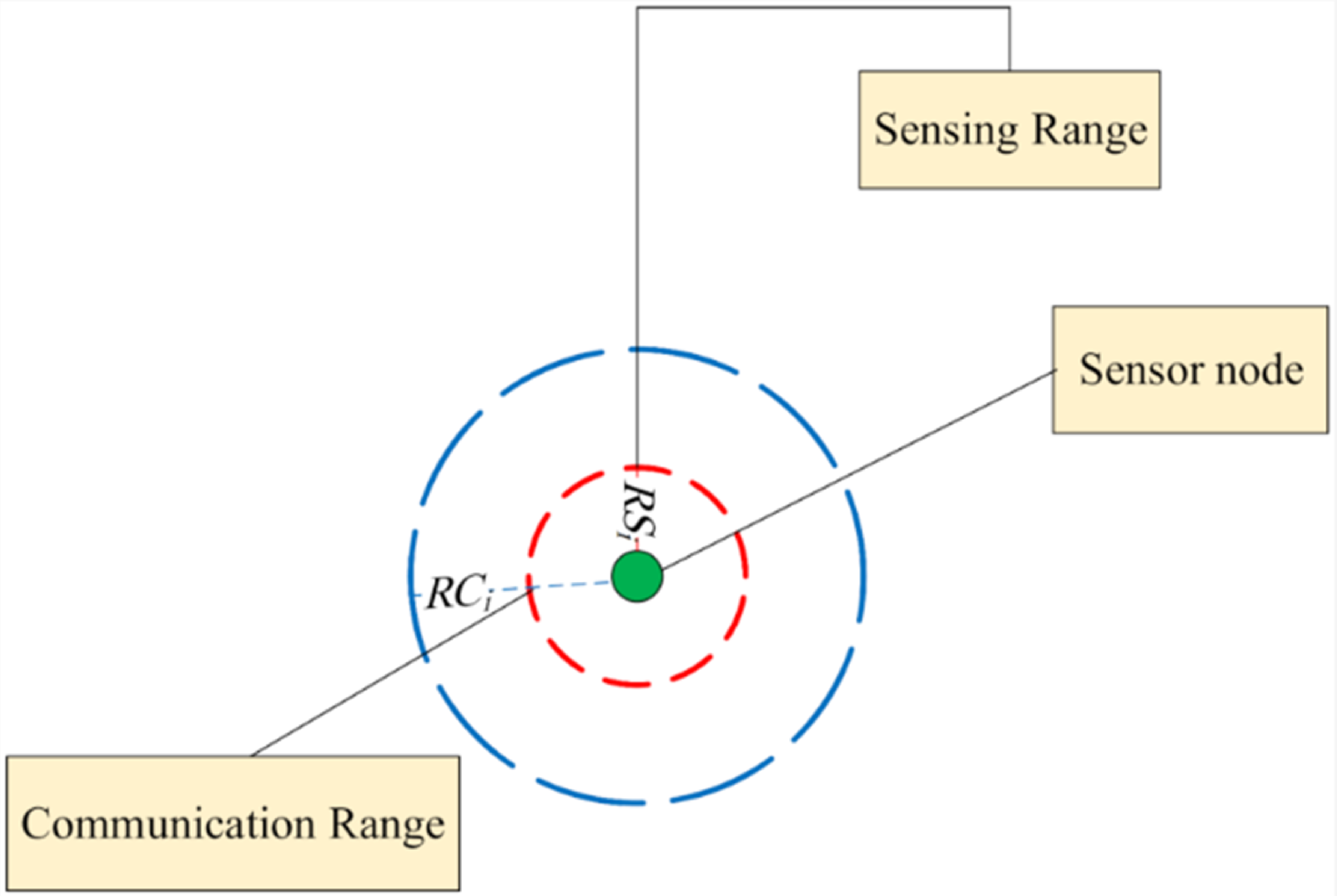
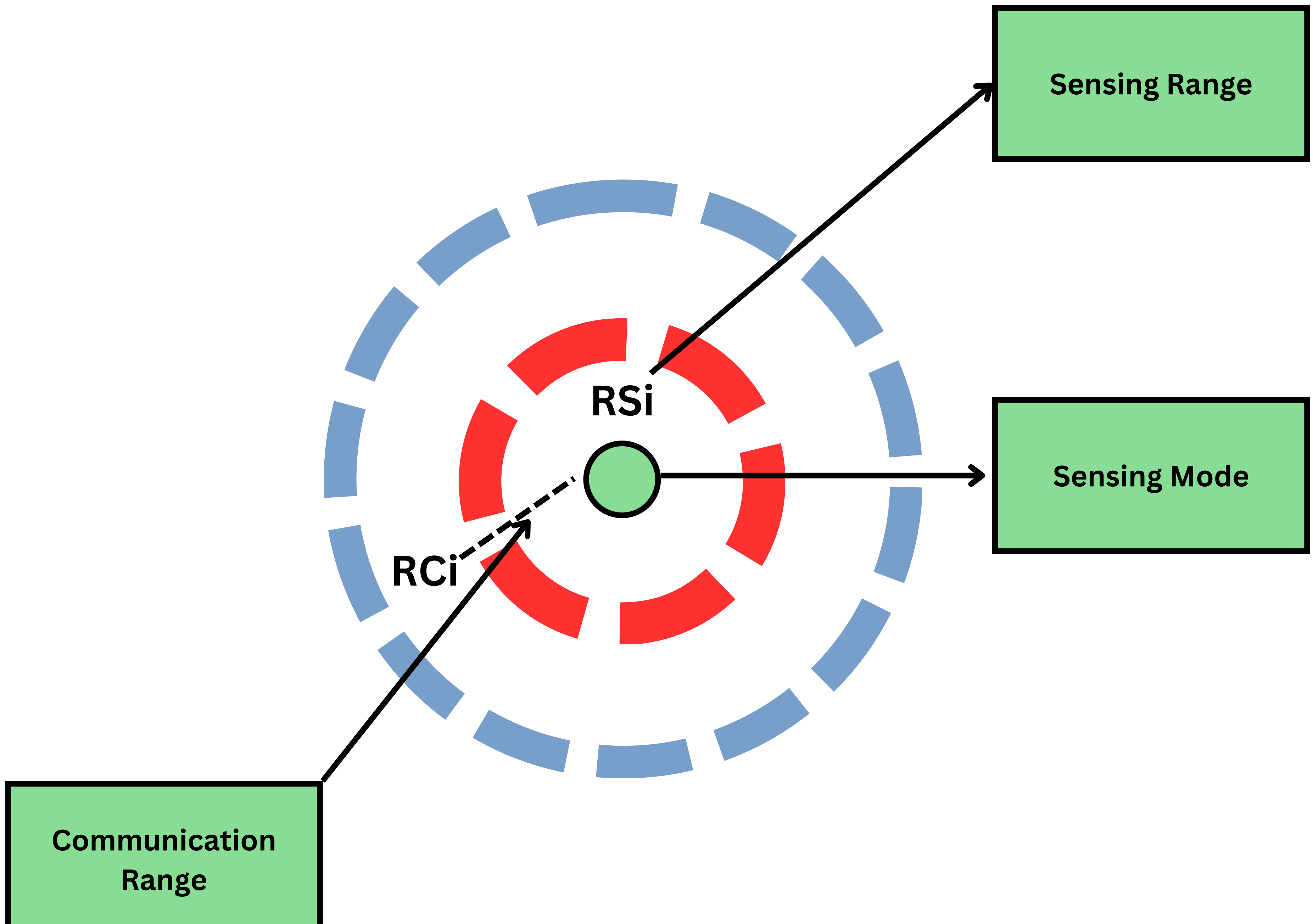
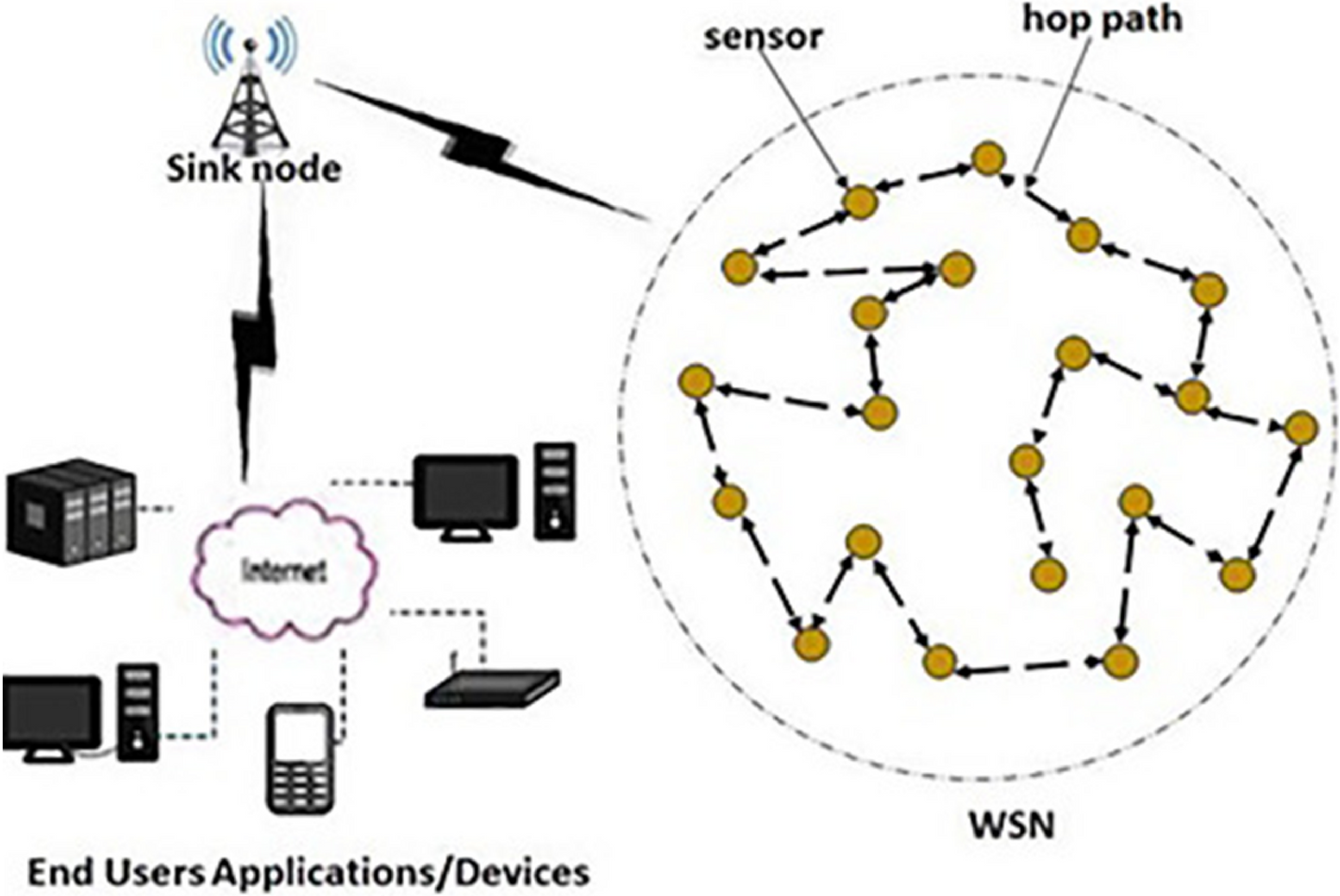

wireless sensor networks (WSNs)
Features
Heterogenous Wireless Sensor Networks
Area Coverage
Efficient Energy Consumption
Maximized Coverage
Fuzzy Logic
Network Connectivity
Shuffled Frog Leaping Algorithm

Figure 7. Sensing model in the proposed scheme.




Sensing Range
Sensing Mode
RSi
RCi
Communication Range


sensor
hop path
Sink node
Internet
WSN
End Users Applications/Devices

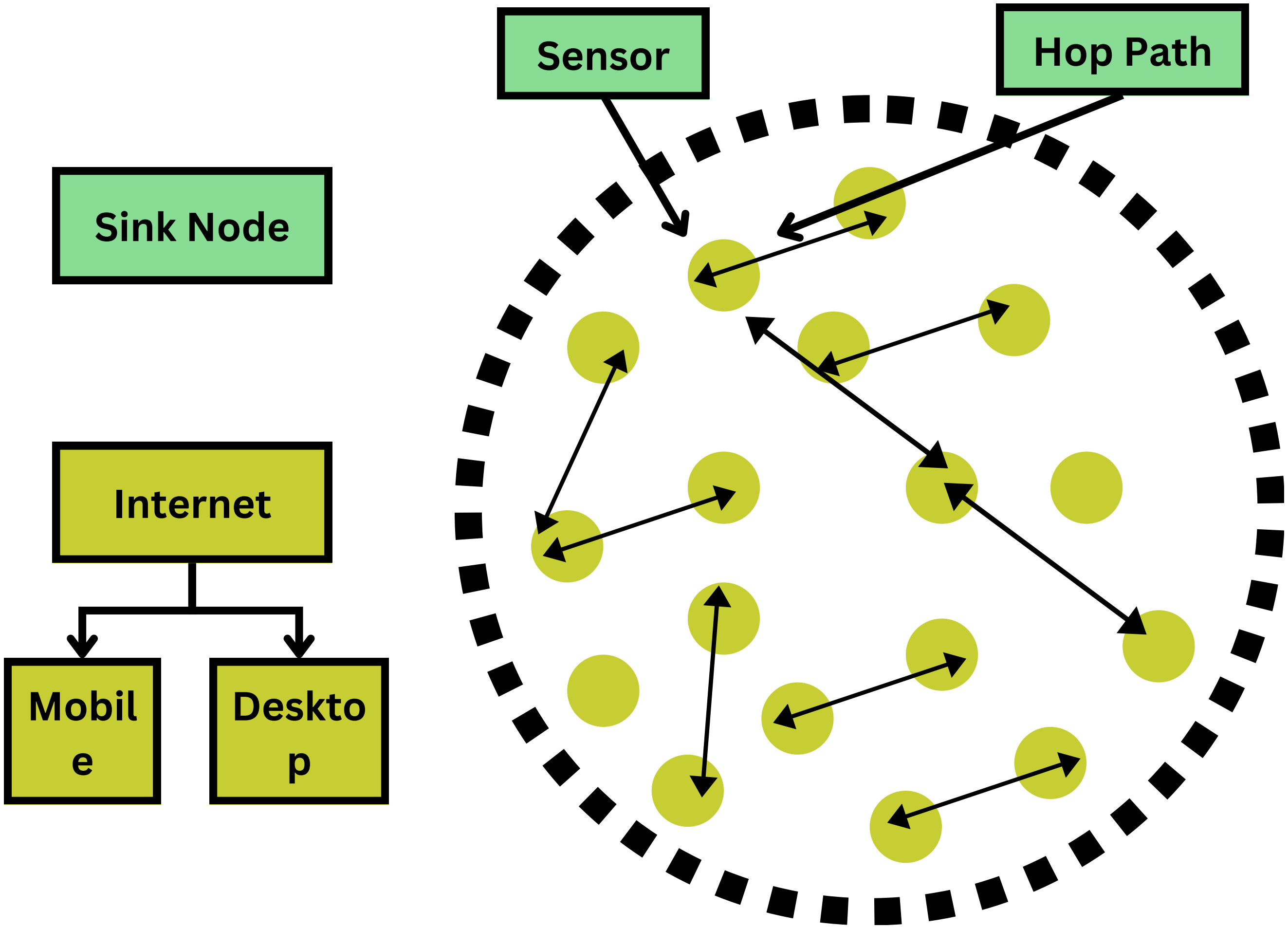
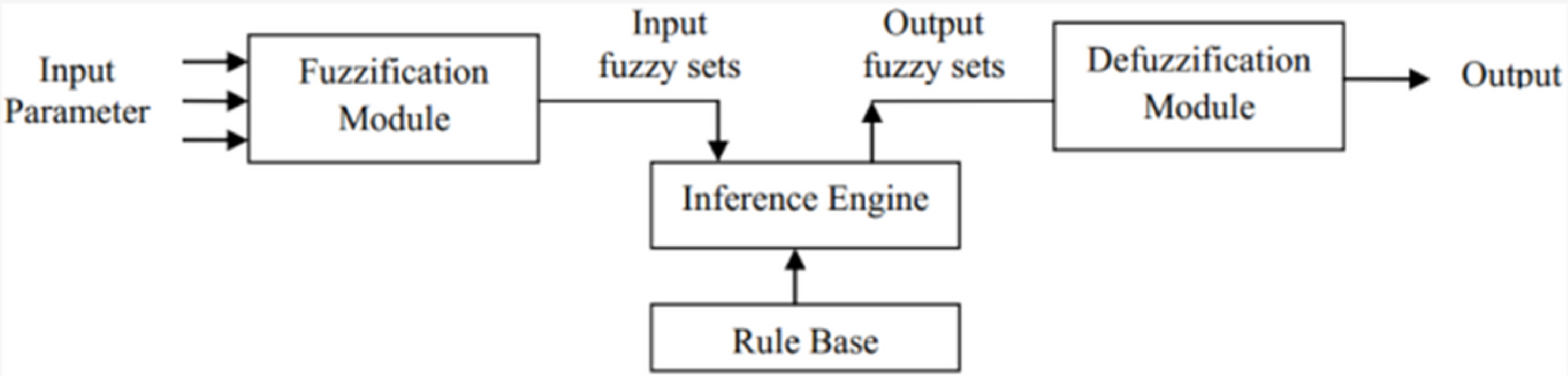
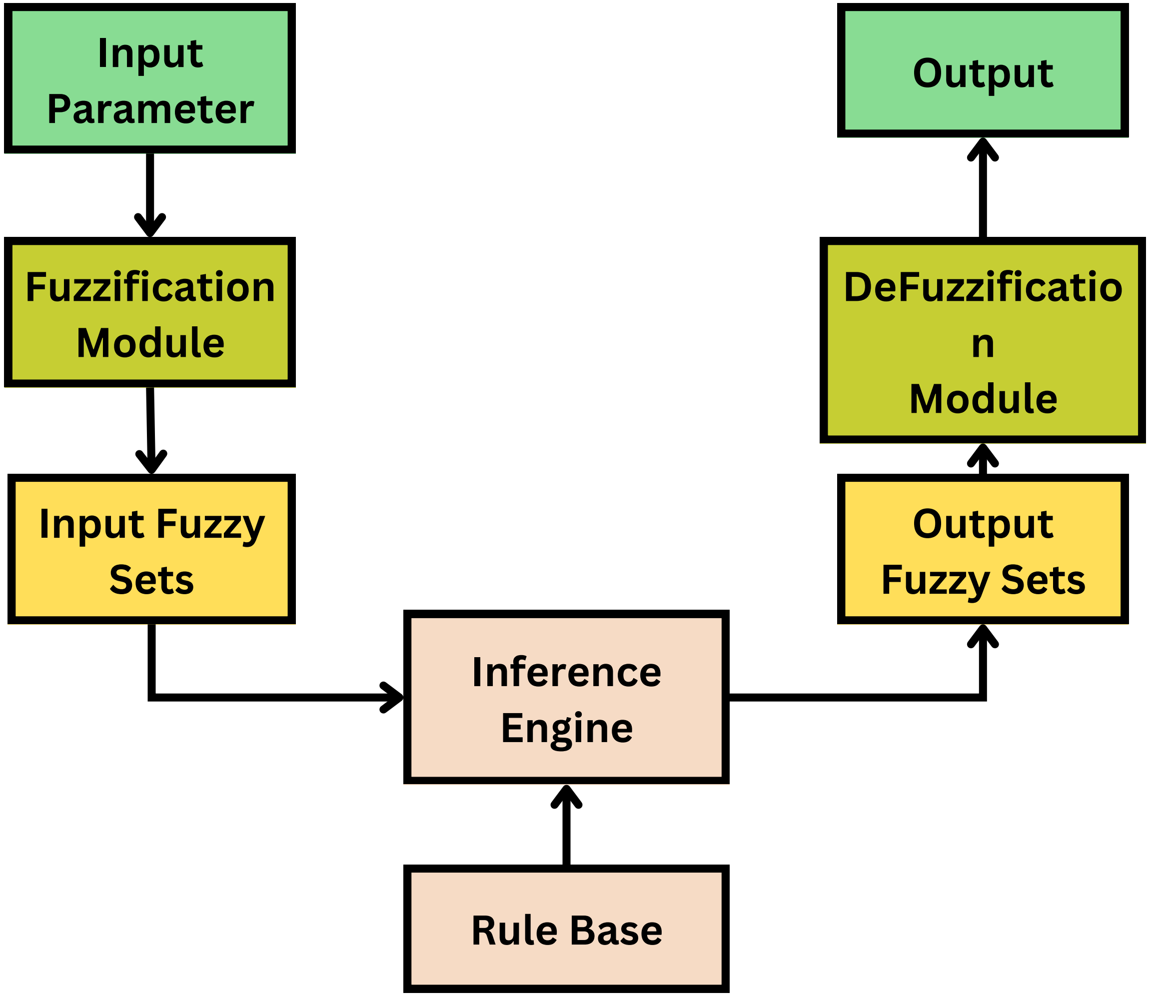

Sensor
Hop Path
Sink Node
Internet
Mobil
e
Deskto
p

Figure 5. Fuzzy system model.





Input Parameter
Fuzzification Module
Input Fuzzy Sets
Inference Engine
Rule Base
Output Fuzzy Sets
DeFuzzificatio
n
Module
Output

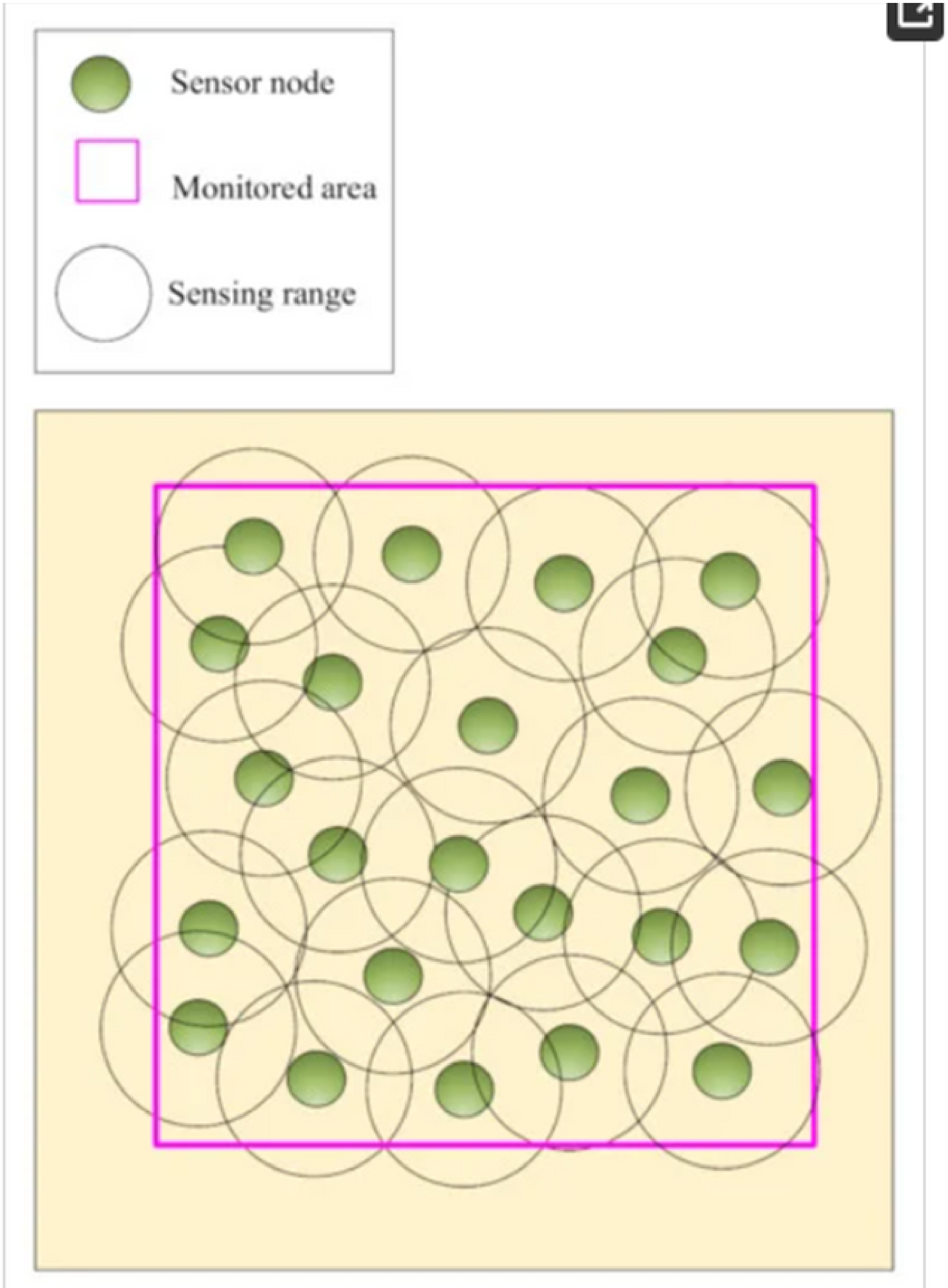
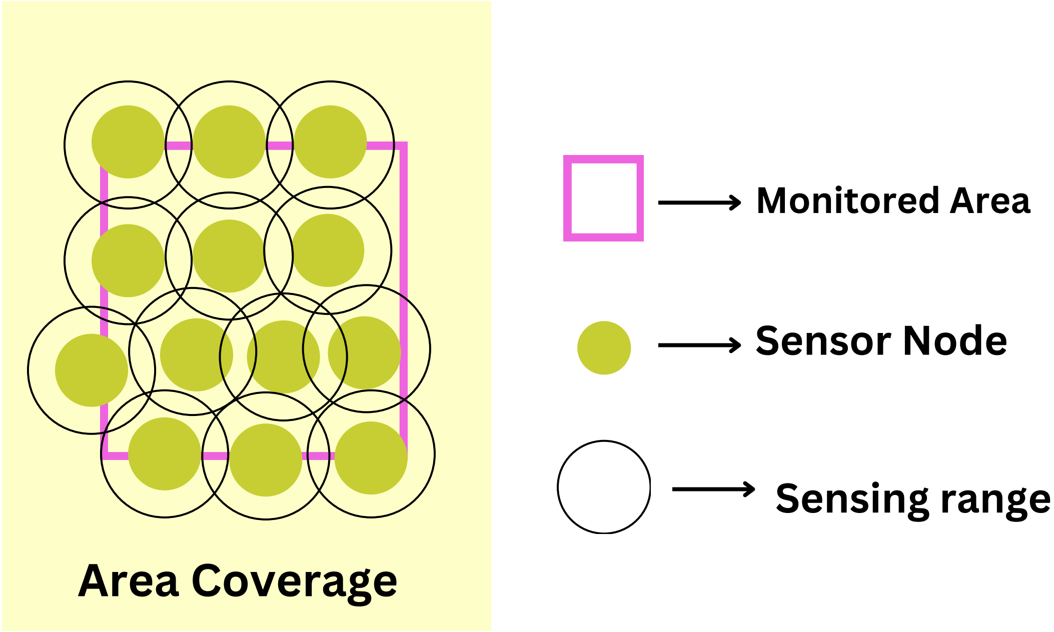


Figure 1. Area coverage.



Area Coverage
Monitored Area
Sensor Node
Sensing range

Feature	Description
Fuzzy Logic-Based On-Demand Charging Algorithm	A novel algorithm for on-demand charging in wireless rechargeable sensor networks (WRSNs) that utilizes fuzzy logic to determine the charging schedule and charging threshold for sensor nodes.
Multiple Chargers	The algorithm considers the use of multiple chargers to distribute the charging workload and improve overall charging efficiency.
Energy-Hungry Nodes	The algorithm prioritizes charging energy-hungry nodes to ensure that critical sensors remain operational.
Uneven Energy Consumption Rates	The algorithm adapts the charging threshold for nodes based on their energy consumption rates, ensuring that nodes are charged efficiently without wasting energy.
Improved Charging Performance	The algorithm demonstrates improved charging performance compared to state-of-the-art schemes in terms of various metrics, including charging success rate, energy utilization rate, and network lifetime.

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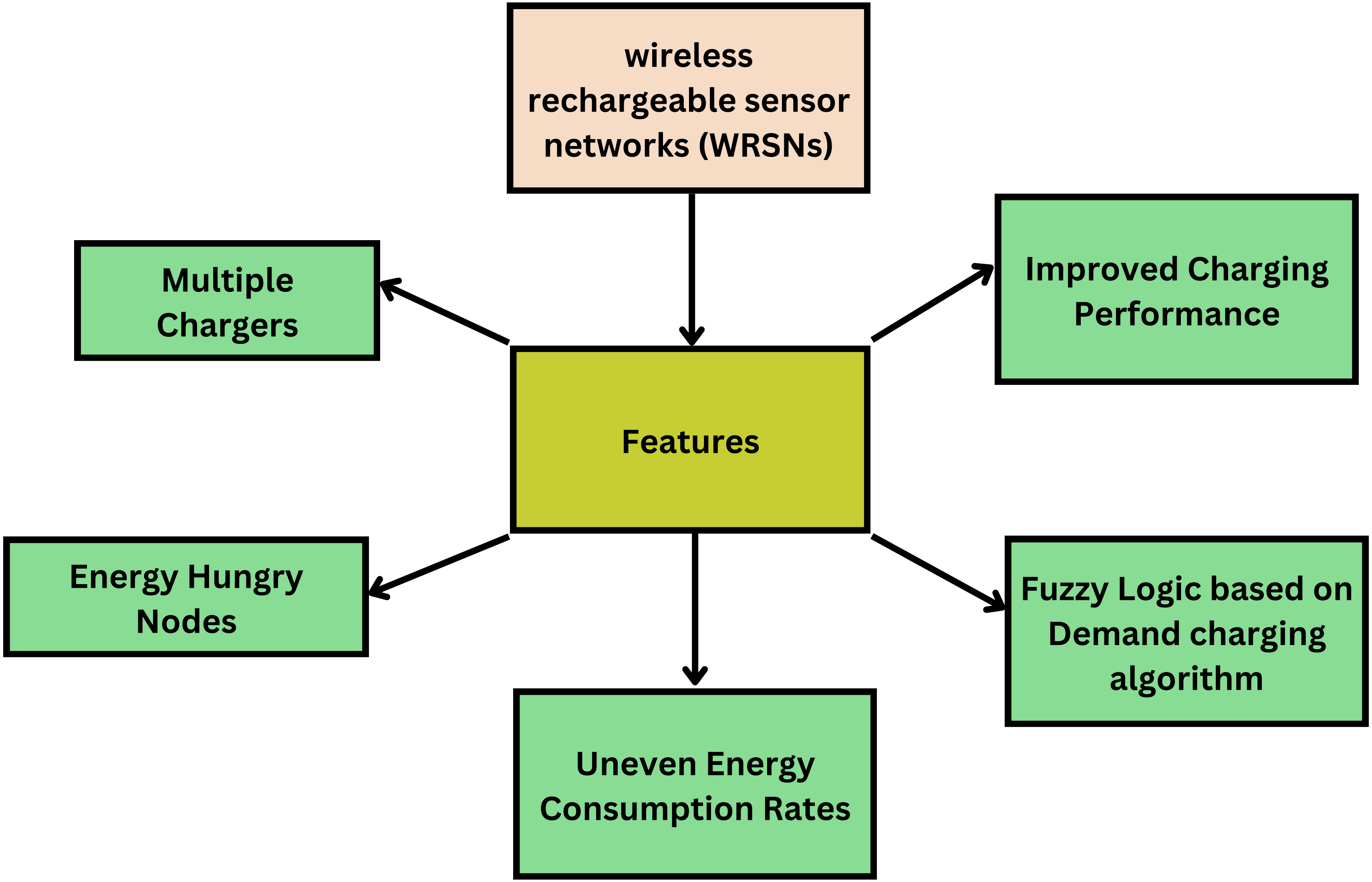
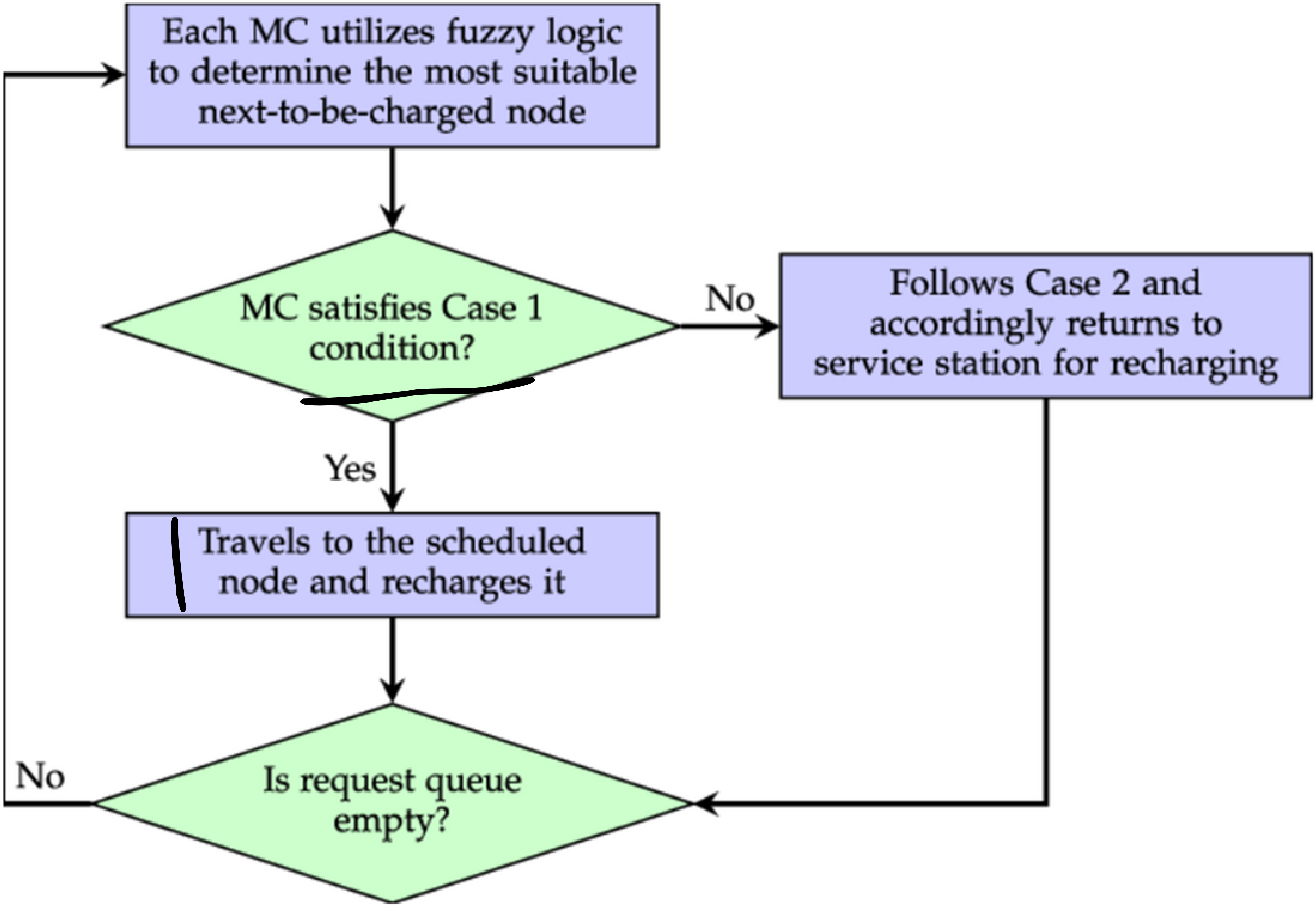
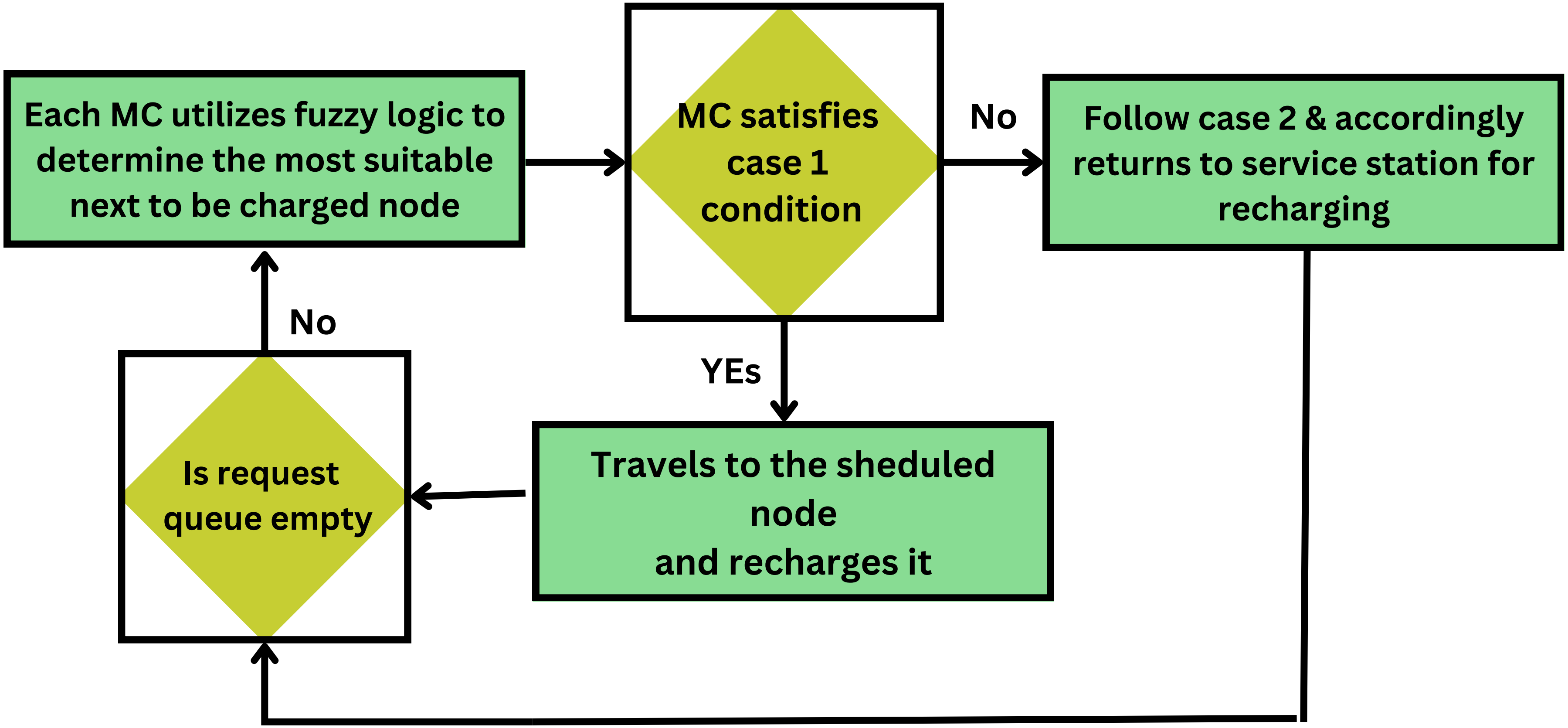
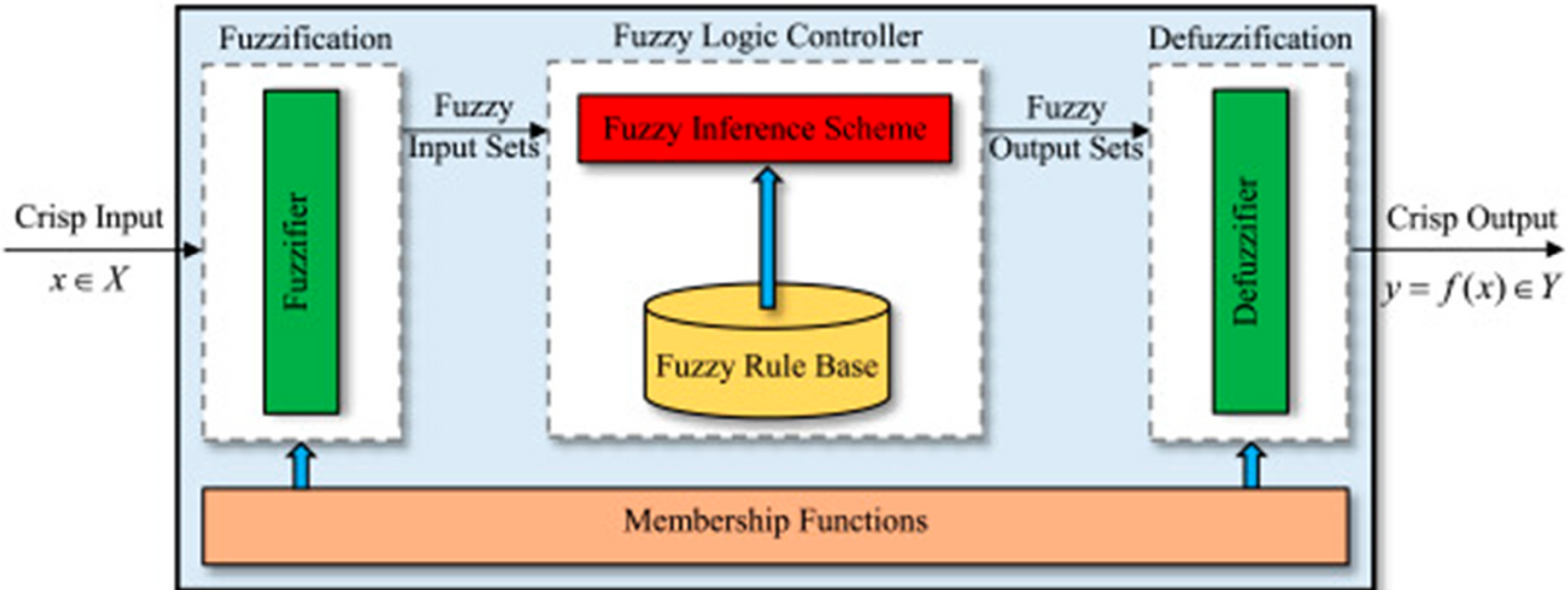

wireless rechargeable sensor networks (WRSNs)
Features
Multiple Chargers
Improved Charging Performance
Energy Hungry Nodes
Fuzzy Logic based on Demand charging algorithm
Uneven Energy Consumption Rates

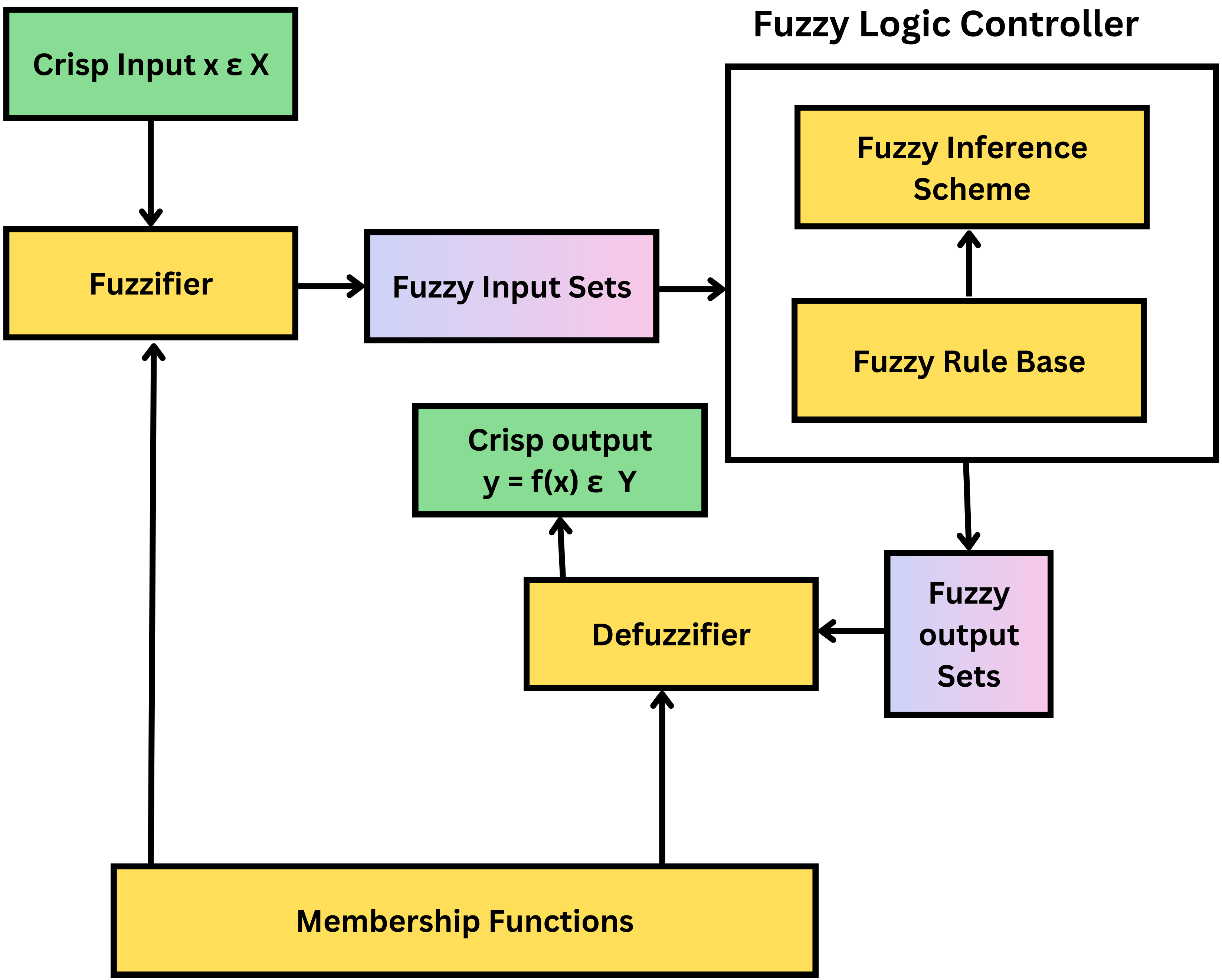


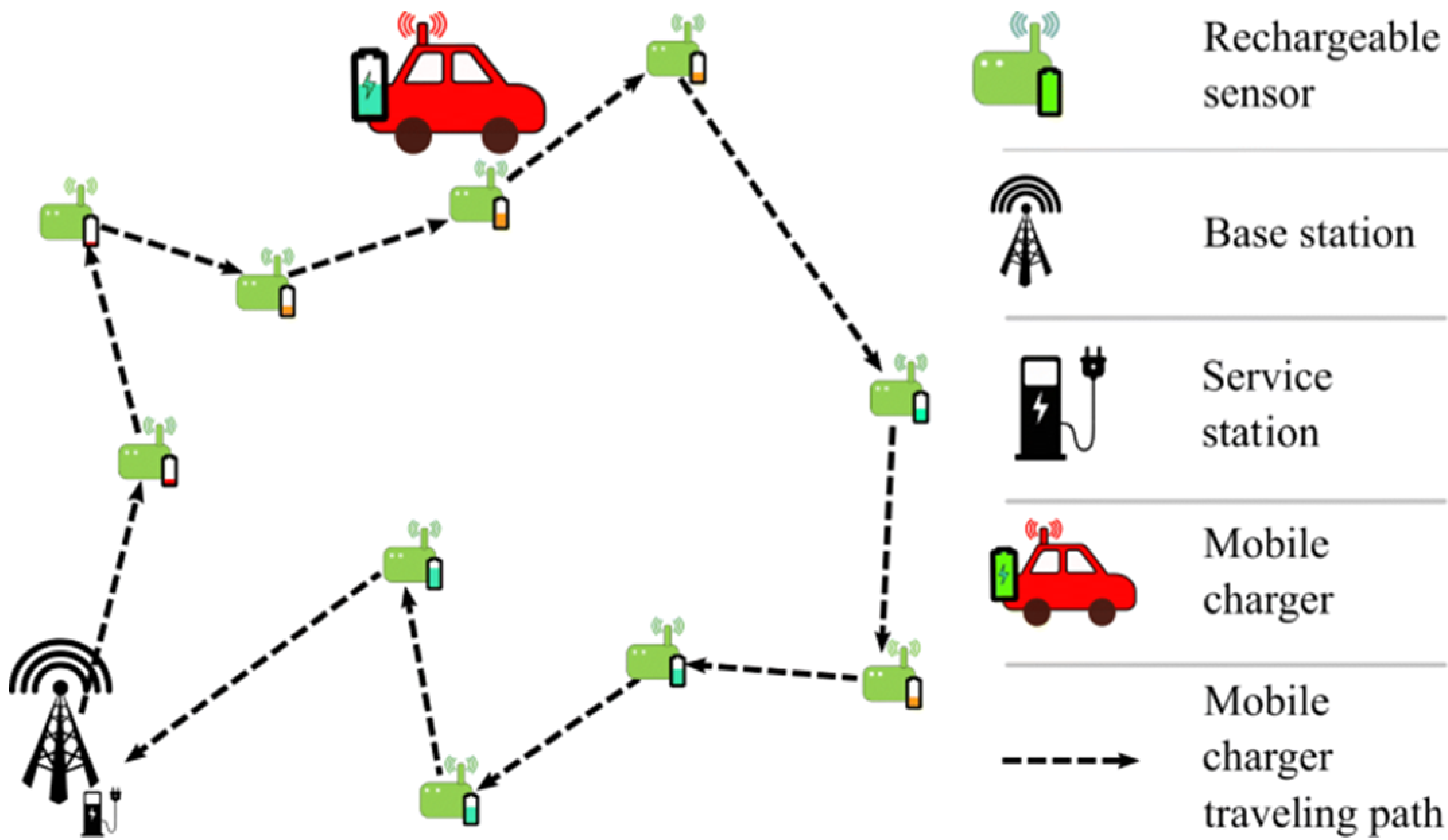
Flowchart of the FLCSD scheme.

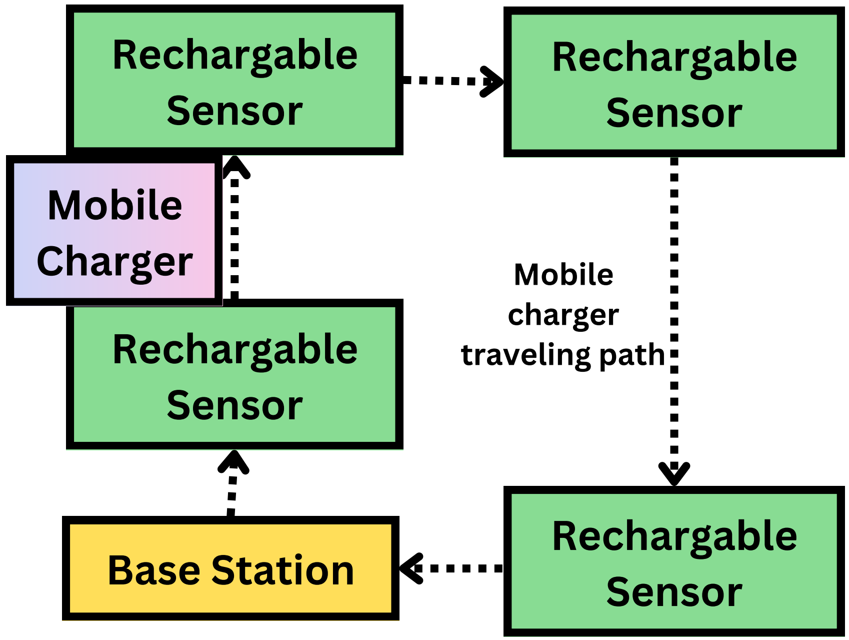


Each MC utilizes fuzzy logic to determine the most suitable next to be charged node
MC satisfies case 1 condition
No
Follow case 2 & accordingly returns to service station for recharging
No
YEs
Is request queue empty
Travels to the sheduled node
and recharges it

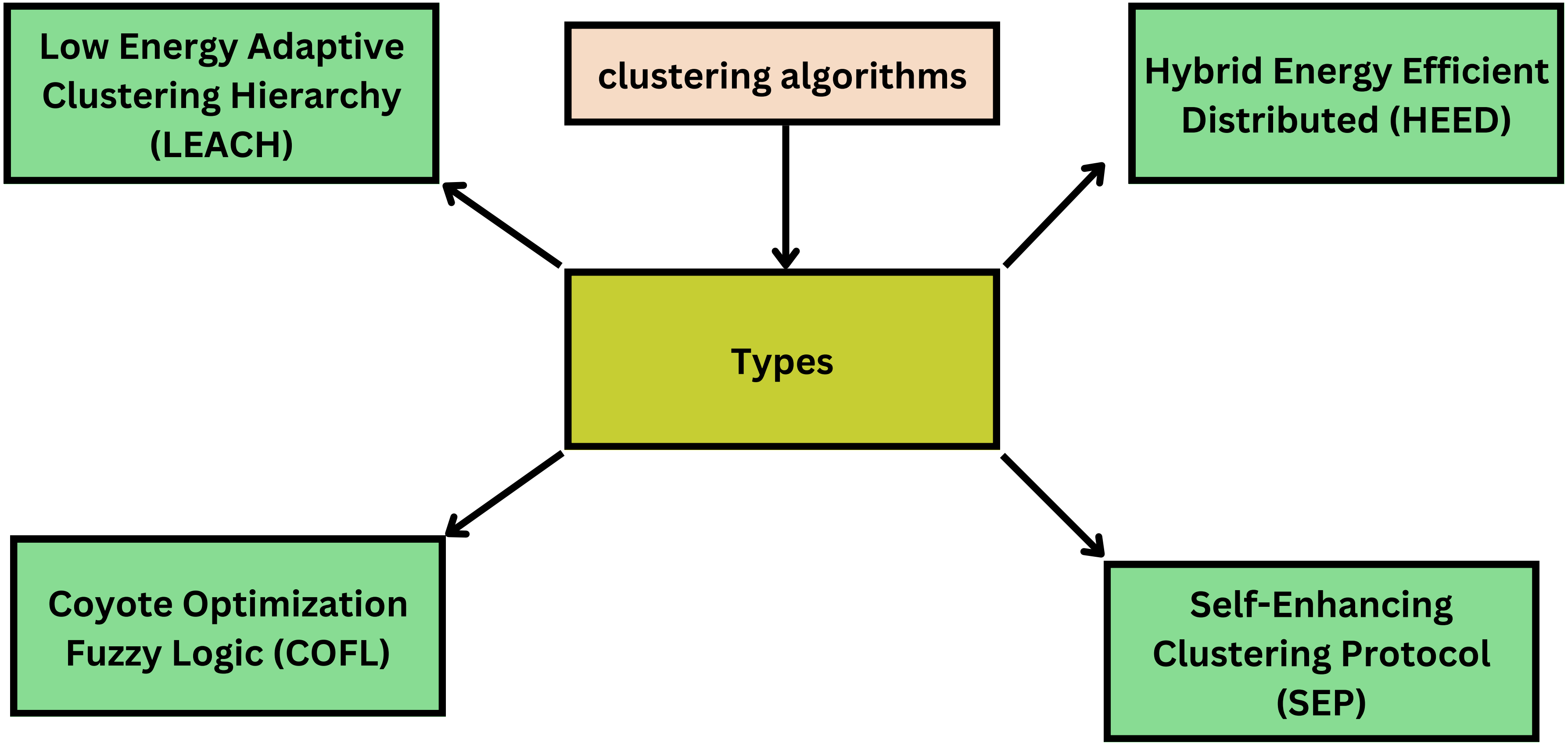

Fuzzification
Fuzzy Logic Controller
Defuzzification
Fuzzy
Input Sets
Fuzzy Inference Scheme
Fuzzy
Output Sets
Crisp Input
$x \in X$
Fuzzifier
Fuzzy Rule Base
Defuzzifier
Crisp Output
$y = f(x) \in Y$
Membership Functions


Fuzzy Logic Controller
Crisp Input x ε X
Fuzzifier
Fuzzy Input Sets
Fuzzy Inference Scheme
Fuzzy Rule Base
Crisp output y = f(x) ε Y
Defuzzifier
Fuzzy output Sets
Membership Functions


Rechargeable sensor
Base station
Service station
Mobile charger
Mobile charger traveling path


Rechargable Sensor
Rechargable Sensor
Mobile Charger
Rechargable Sensor
Mobile charger traveling path
Base Station
Rechargable Sensor

Feature	Description	Energy Consumption	Network Lifetime	Throughput	Scalability	Flexibility	Fault Tolerance
Coyote Optimization Based on a Fuzzy Logic Algorithm (COFL)	An energy-efficient clustering algorithm for Wireless Sensor Networks (WSNs) that leverages fuzzy logic to optimize cluster formation and reduce energy consumption.	Very Low	Very High	High	High	High	Medium
LEACH	A simple and efficient clustering algorithm that does not consider the energy levels of sensor nodes when selecting cluster heads.	High	Low	Moderate	Medium	Low	Low
SEP	An improvement over LEACH, as it considers the remaining energy of sensor nodes when selecting cluster heads.	Moderate	Moderate	Moderate	Medium	Medium	Medium
HEED	An energy-efficient clustering algorithm that considers both the energy levels and distances between sensor nodes.	Low	High	Low	Low	Medium	Medium


clustering algorithms
Types
Low Energy Adaptive Clustering Hierarchy (LEACH)
Hybrid Energy Efficient Distributed (HEED)
Coyote Optimization Fuzzy Logic (COFL)
Self-Enhancing Clustering Protocol (SEP)

Feature	Description
Coyote Optimization Based on a Fuzzy Logic Algorithm (COFL)	An energy-efficient clustering algorithm for Wireless Sensor Networks (WSNs) that leverages fuzzy logic to optimize cluster formation and reduce energy consumption.
Energy-Efficient Clustering	Intelligently selects cluster heads and optimizes data transmission routes to balance energy consumption across the network.
Fuzzy Logic Integration	Enhances adaptability and robustness to dynamic network conditions and varying energy levels of sensor nodes.
Coyote Optimization Algorithm	Utilizes a metaheuristic optimization technique inspired by the hunting behavior of coyotes to find optimal cluster configurations.
Improved Performance	Outperforms other clustering algorithms in terms of energy consumption, network lifetime, and throughput.
Scalability	Effectively handles large-scale WSNs with a large number of sensor nodes.
Flexibility	Adapts to different WSN scenarios and network topologies.
Fault Tolerance	Maintains network connectivity even in the presence of node failures.
Applications	Environmental monitoring, precision agriculture, healthcare monitoring.

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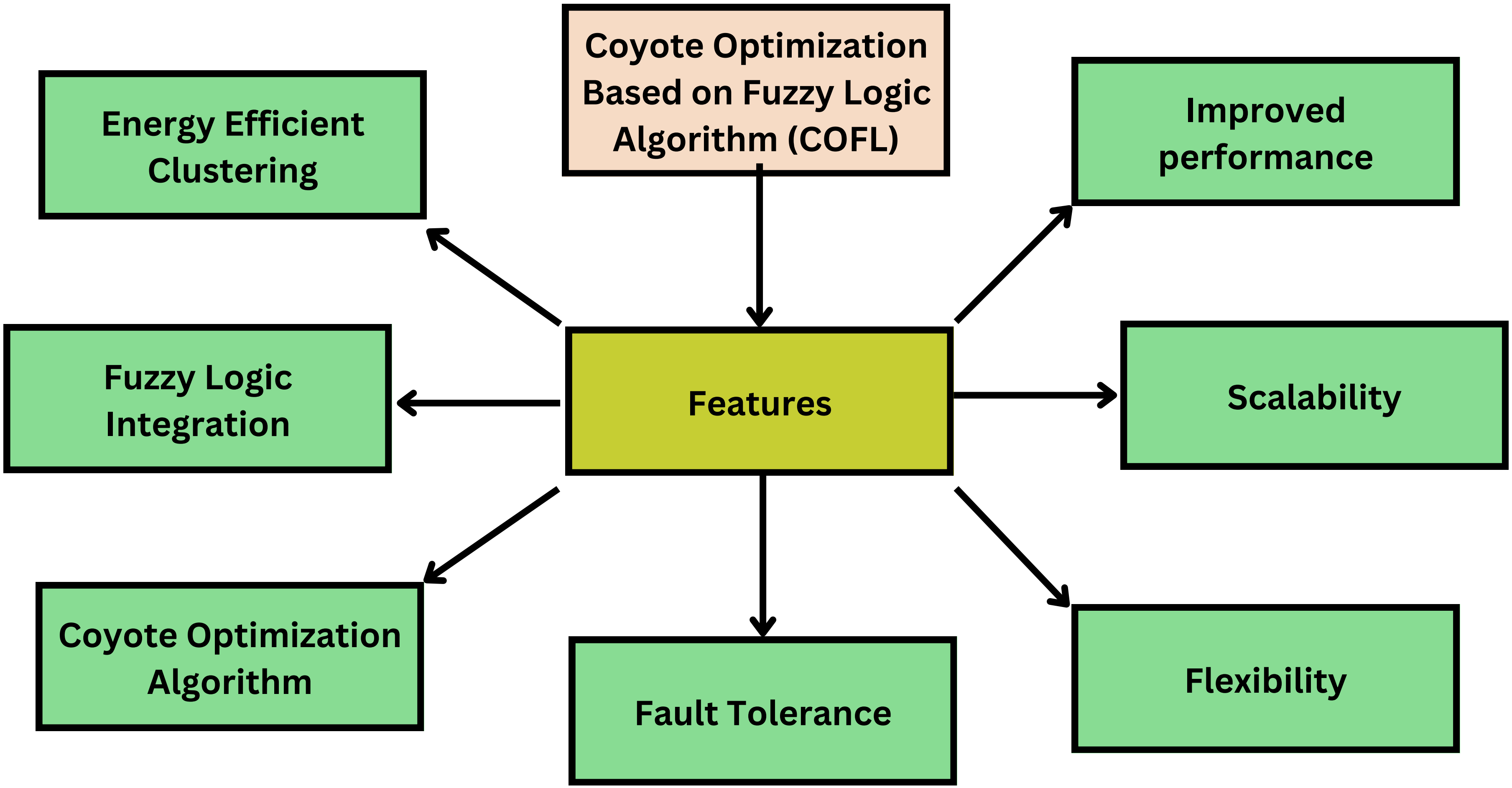
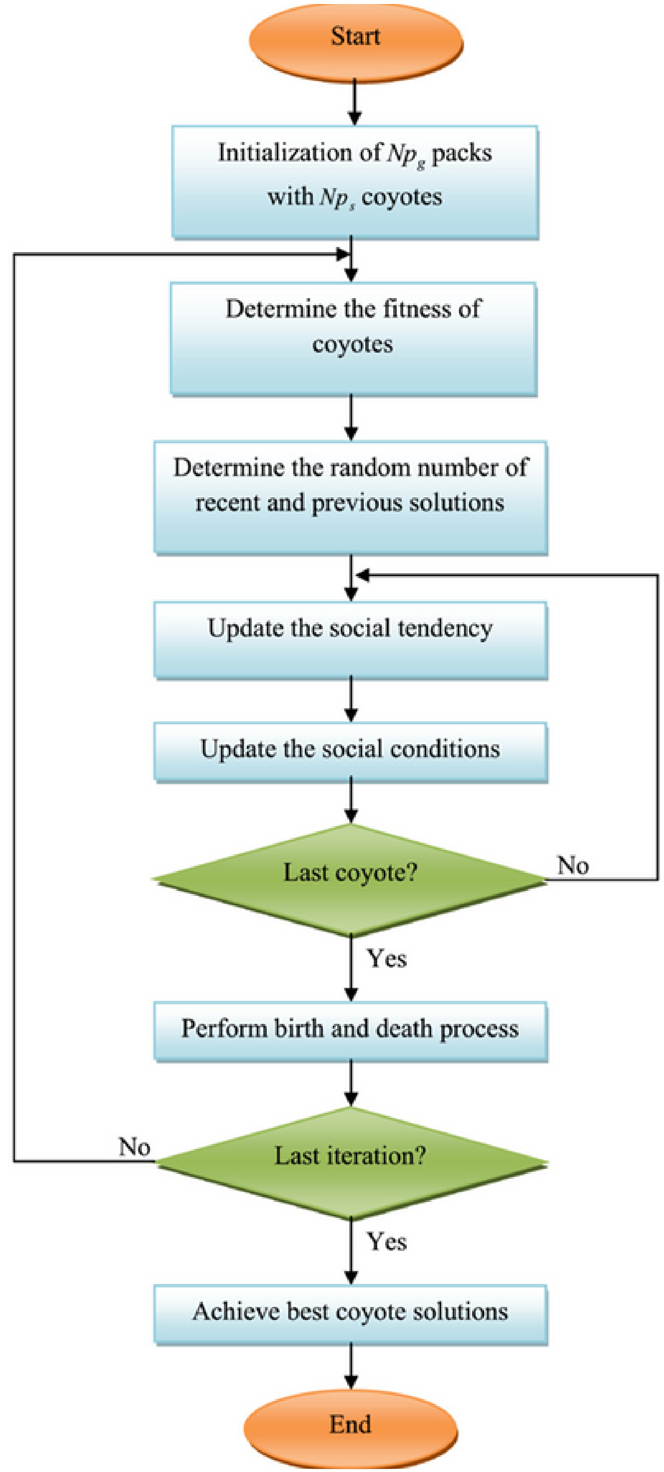
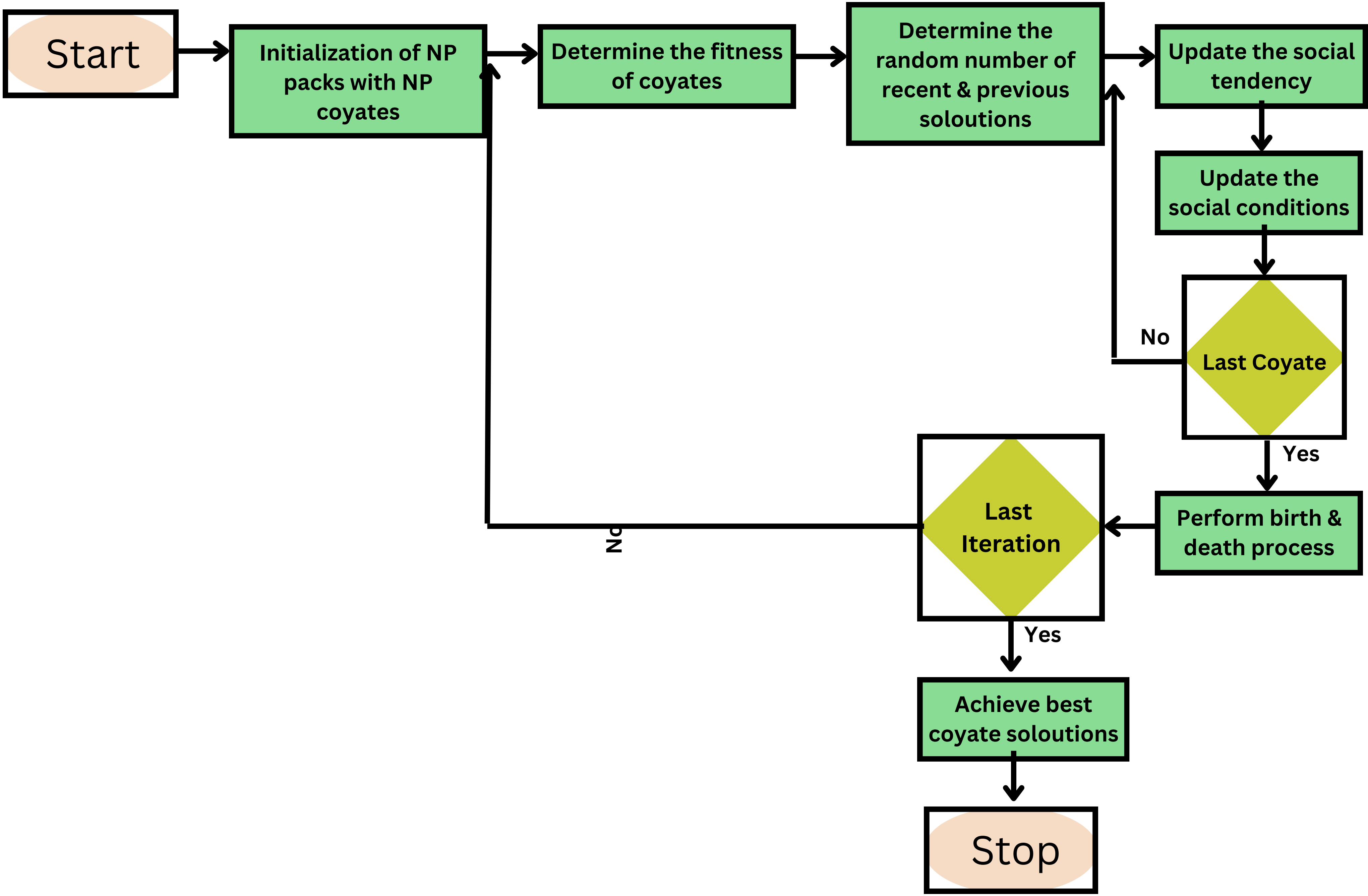

Coyote Optimization Based on Fuzzy Logic Algorithm (COFL)
Energy Efficient Clustering
Improved performance
Fuzzy Logic Integration
Features
Scalability
Coyote Optimization Algorithm
Fault Tolerance
Flexibility


Start
Initialization of Np_g packs with Np_s coyotes
Determine the fitness of coyotes
Determine the random number of recent and previous solutions
Update the social tendency
Update the social conditions
Last coyote?
No
Yes
Perform birth and death process
Last iteration?
No
Yes
Achieve best coyote solutions
End


Start
Initialization of NP packs with NP coyates
Determine the fitness of coyates
Determine the random number of recent & previous soloutions
Update the social tendency
Update the social conditions
Last Coyate
No
Yes
Perform birth & death process
Last Iteration
No
Yes
Achieve best coyate soloutions
Stop

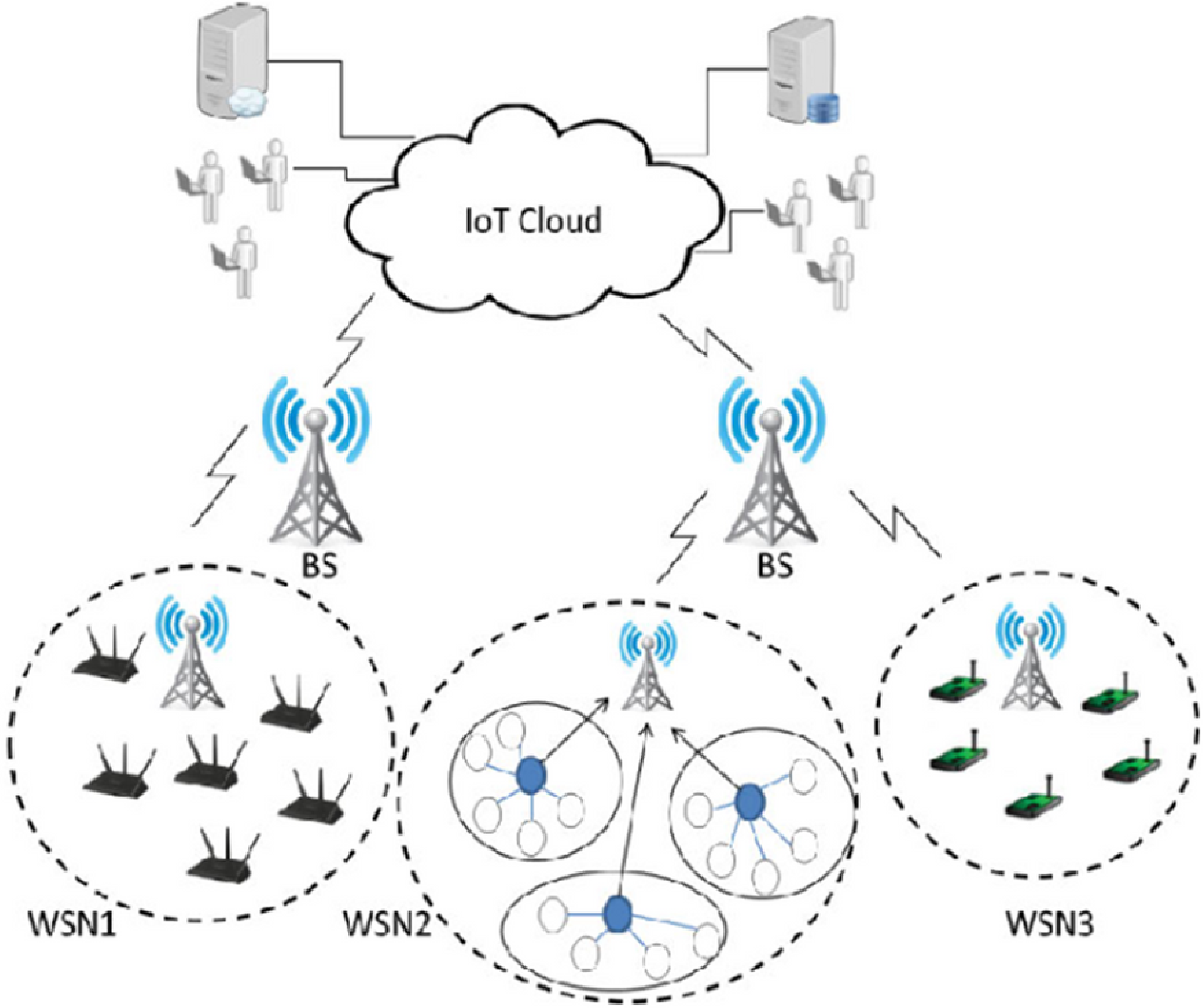
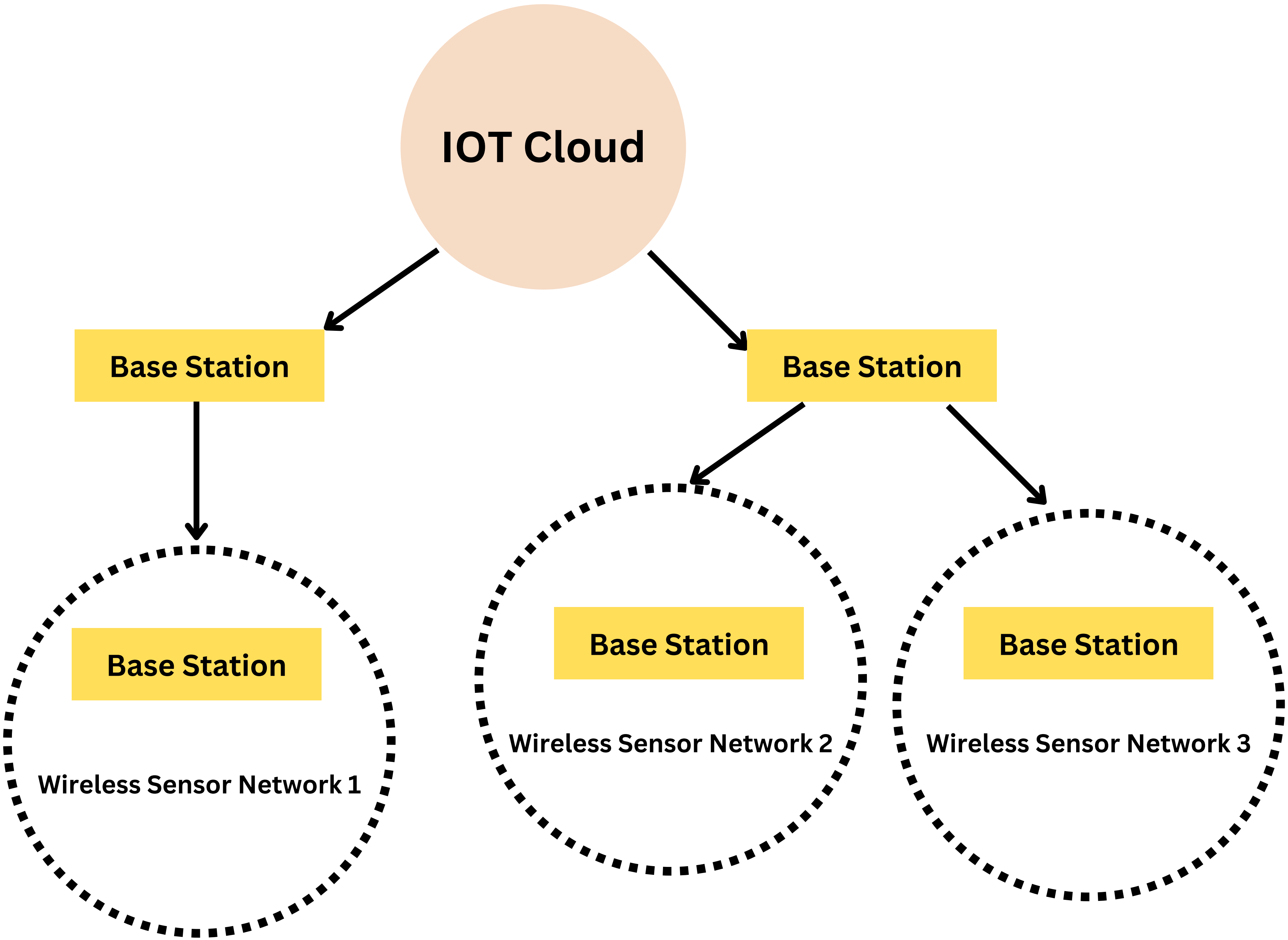


FIGURE 1. IoT Network architecture

FIGURE 1. IoT Network architecture.



IOT Network Architecture

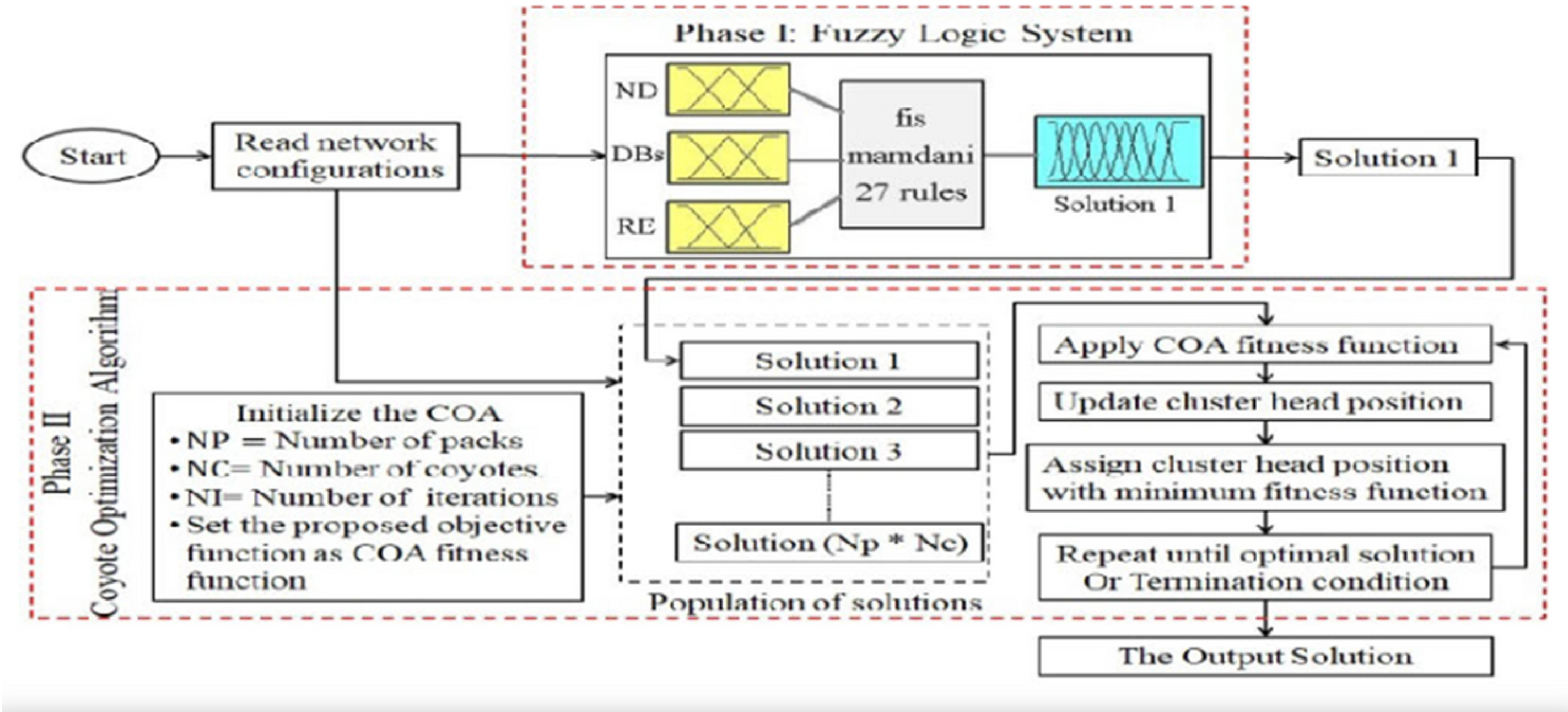
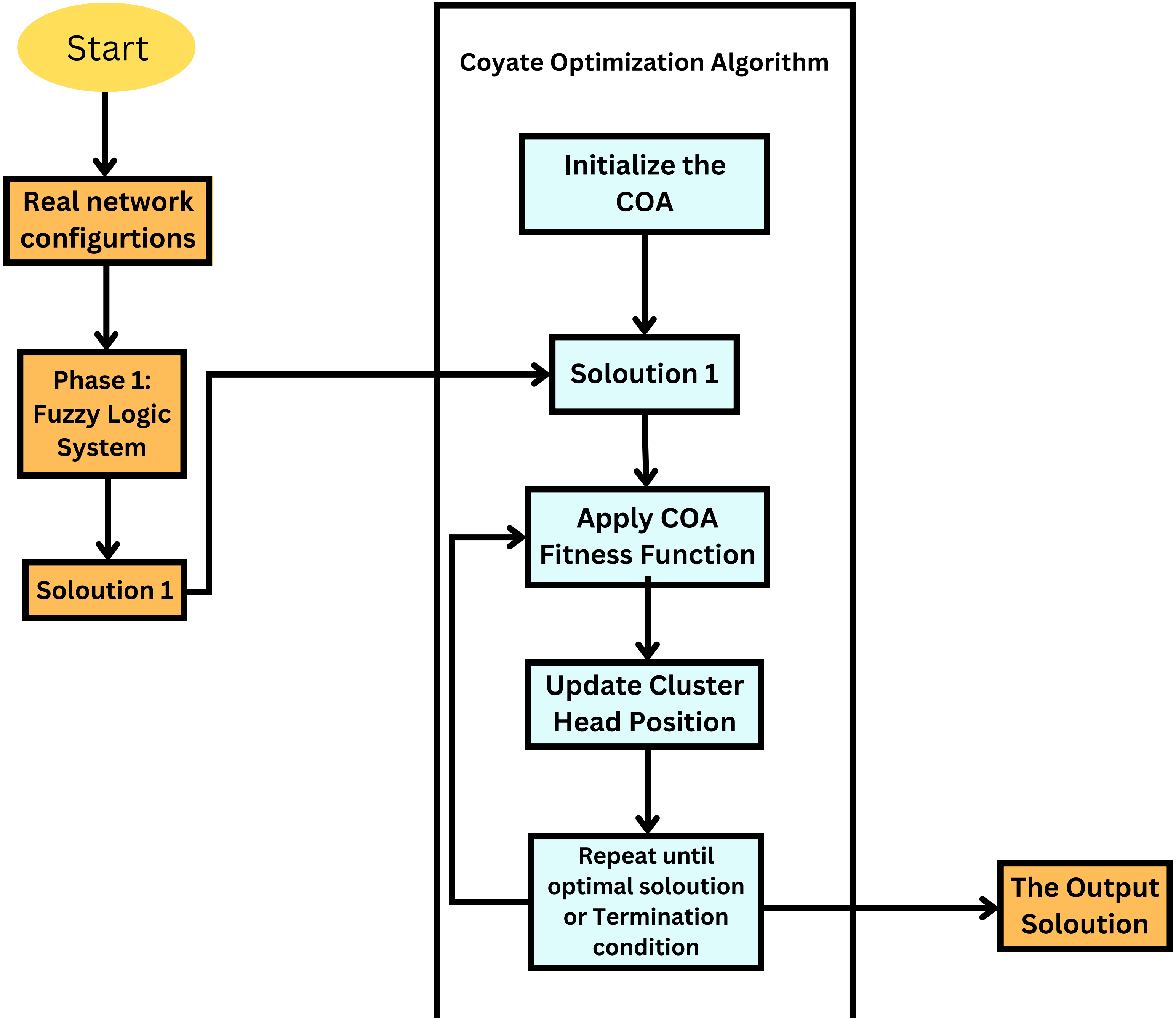


FIGURE 2. Flow structure of the COFL algorithm.


Start
Real network configurtions
Phase 1: Fuzzy Logic System
Soloution 1
Coyate Optimization Algorithm
Initialize the COA
Soloution 1
Apply COA Fitness Function
Update Cluster Head Position
Repeat until optimal soloution or Termination condition
The Output Soloution

Feature	Description
Smart Wireless Sensor Technology	Wireless sensor networks (WSNs) are increasingly being used in healthcare applications to monitor patients' vital signs, track their movements, and detect falls or other emergencies. These sensors can be worn on the body, embedded in clothing, or placed in the environment.
Cognitive Radio Networks	Cognitive radio (CR) is a technology that allows multiple users to share the same spectrum without interfering with each other. CR devices can sense the spectrum and identify unused channels, which they can then use to transmit data. This makes CR an ideal technology for use in healthcare applications, where it can be used to provide reliable and interference-free communication between sensors and medical devices.
Healthcare Monitoring Systems	Wireless sensor networks and cognitive radio networks can be used to create healthcare monitoring systems that are: - **Real-time:** The system can collect and transmit data in real time, allowing doctors and nurses to monitor patients' conditions remotely. - **Continuous:** The system can collect data 24/7, providing a complete picture of a patient's health. - **Mobile:** The system can be used to monitor patients at home, in the hospital, or in other settings. - **Cost-effective:** The system can be less expensive than traditional monitoring methods, such as wired sensors or wearable devices.
Benefits	Improved patient care, reduced healthcare costs, increased patient satisfaction
Applications	Remote patient monitoring, fall detection, vital sign monitoring, medication adherence, wound care

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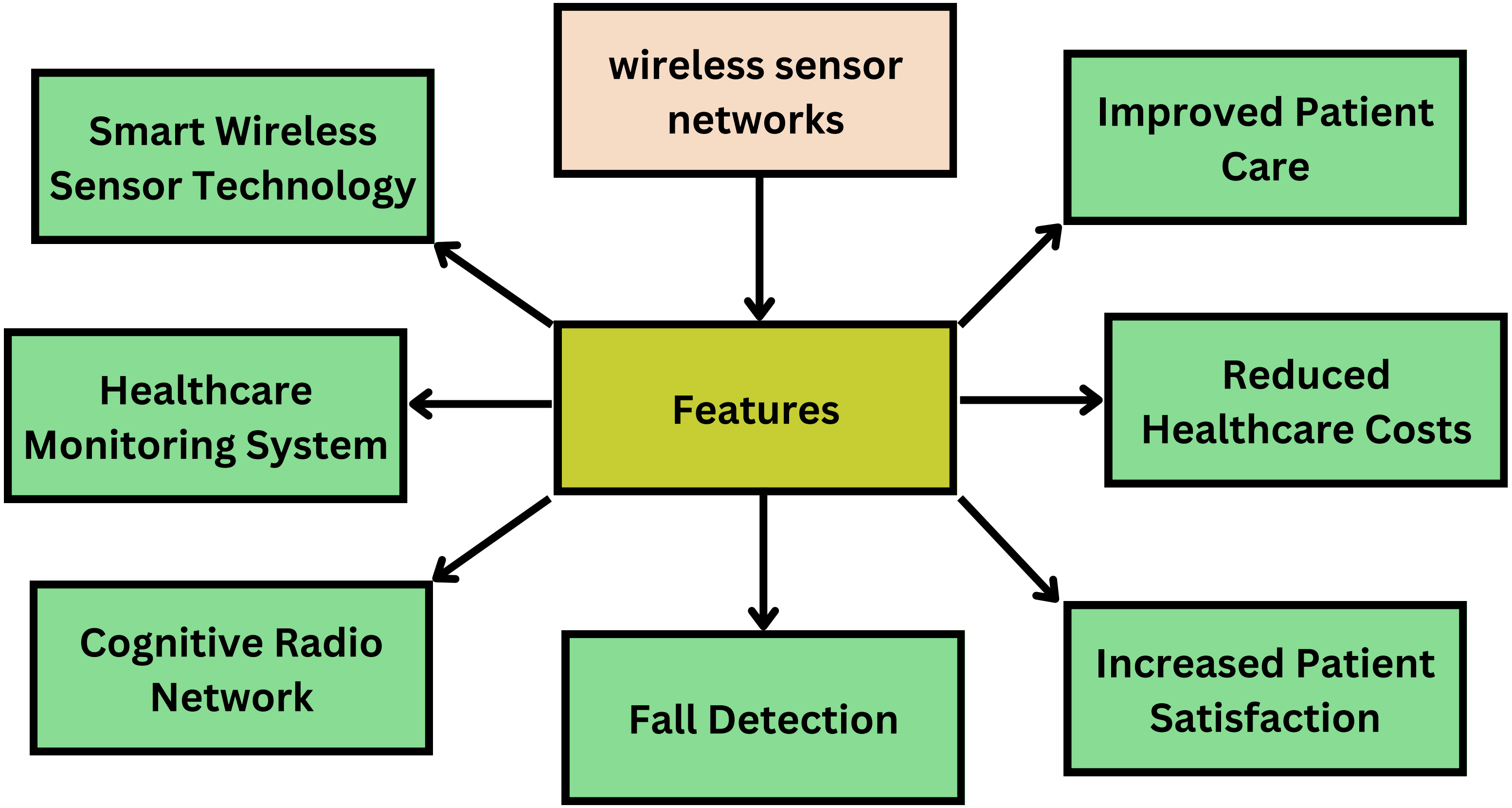
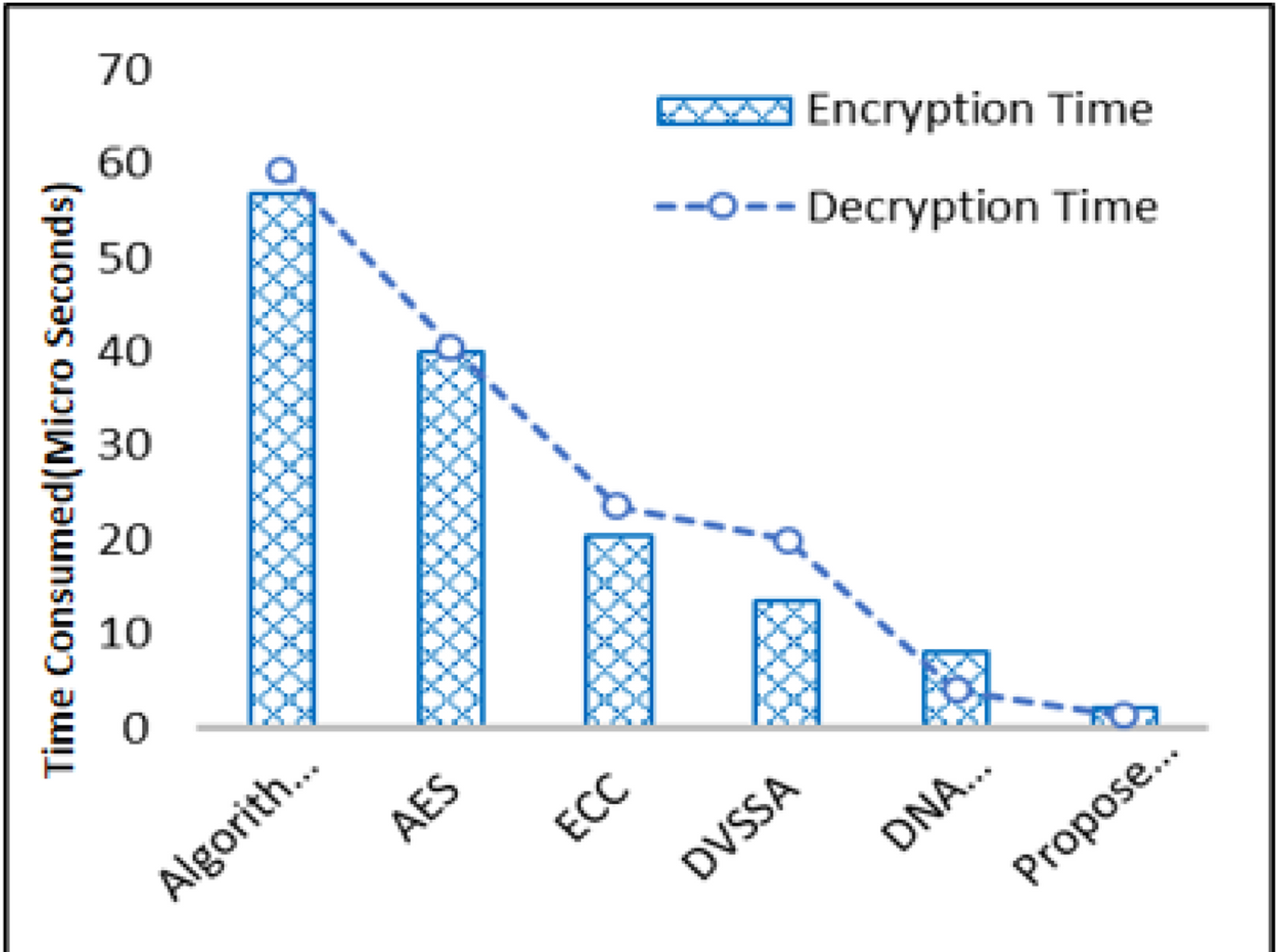

wireless sensor networks
Features
Smart Wireless Sensor Technology
Healthcare Monitoring System
Cognitive Radio Network
Fall Detection
Improved Patient Care
Reduced Healthcare Costs
Increased Patient Satisfaction



Encryption Time
Decryption Time
Time Consumed(Micro Seconds)
0
10
20
30
40
50
60
70
Algorith...
AES
ECC
DVSSA
DNA...
Propose...

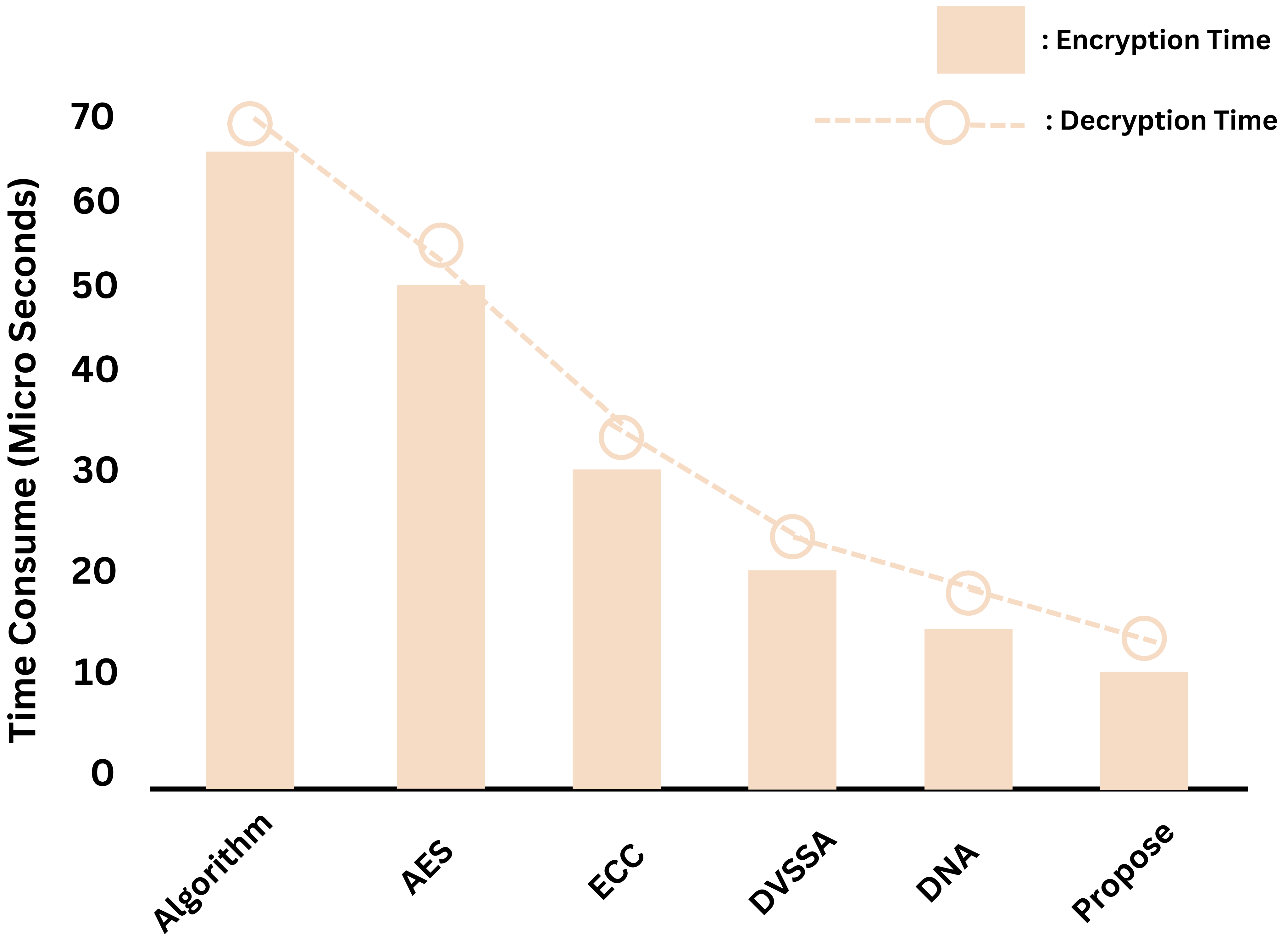
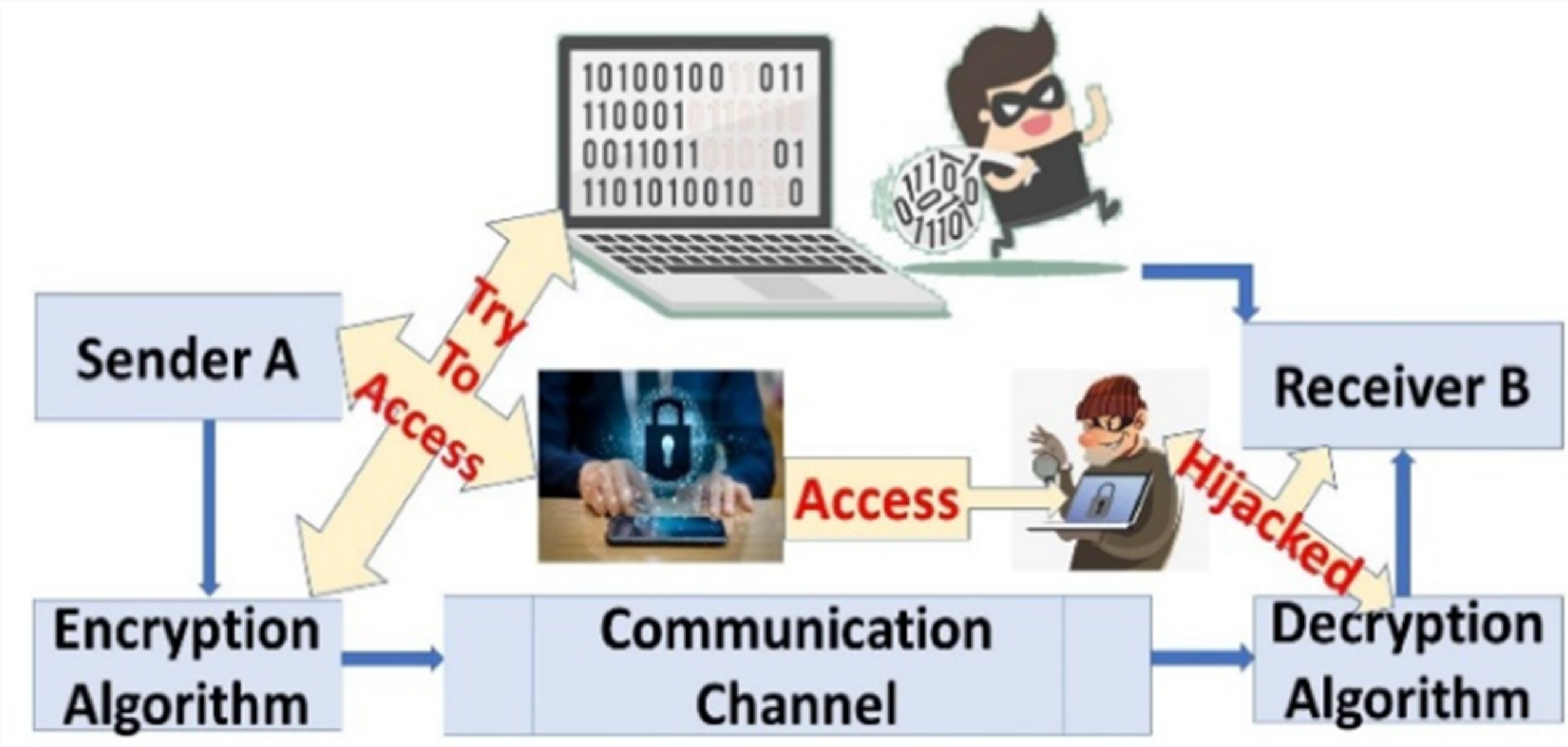

: Encryption Time
: Decryption Time
Time Consume (Micro Seconds)
70
60
50
40
30
20
10
0
Algorithm
AES
ECC
DVSSA
DNA
Propose

Figure 4. Plaintext Attack.



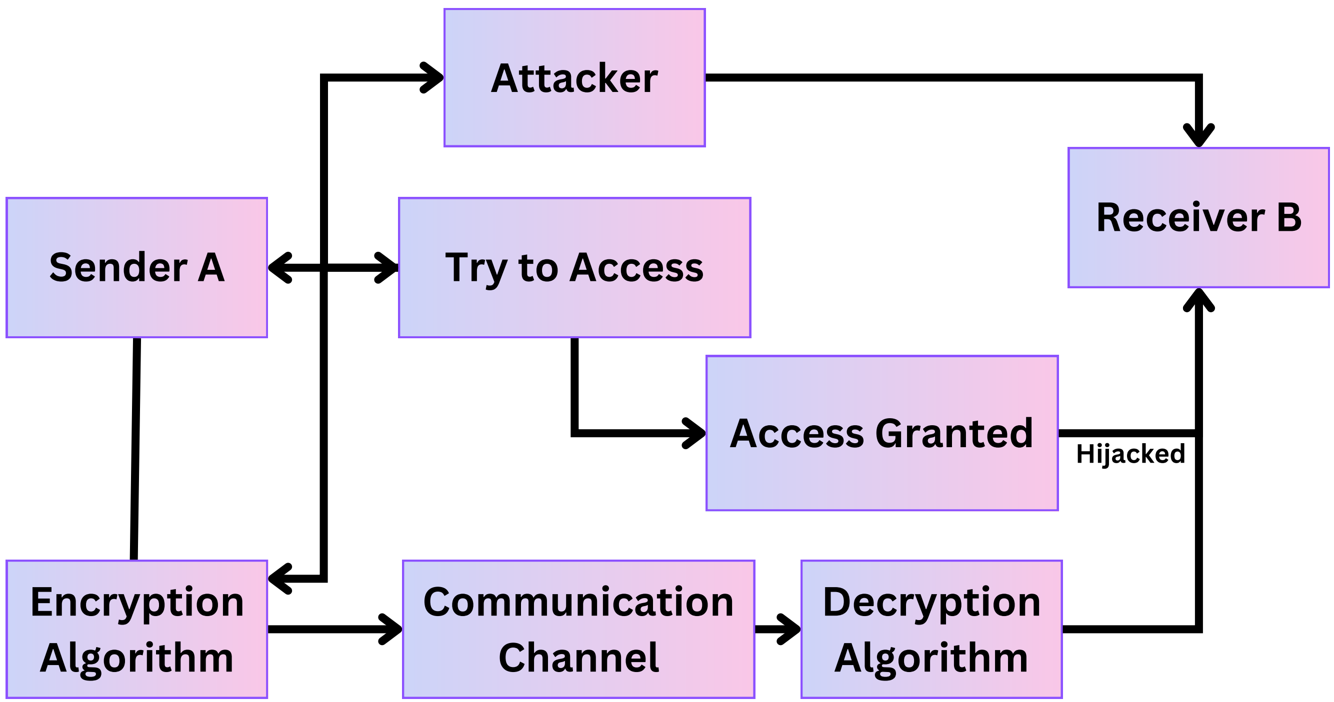
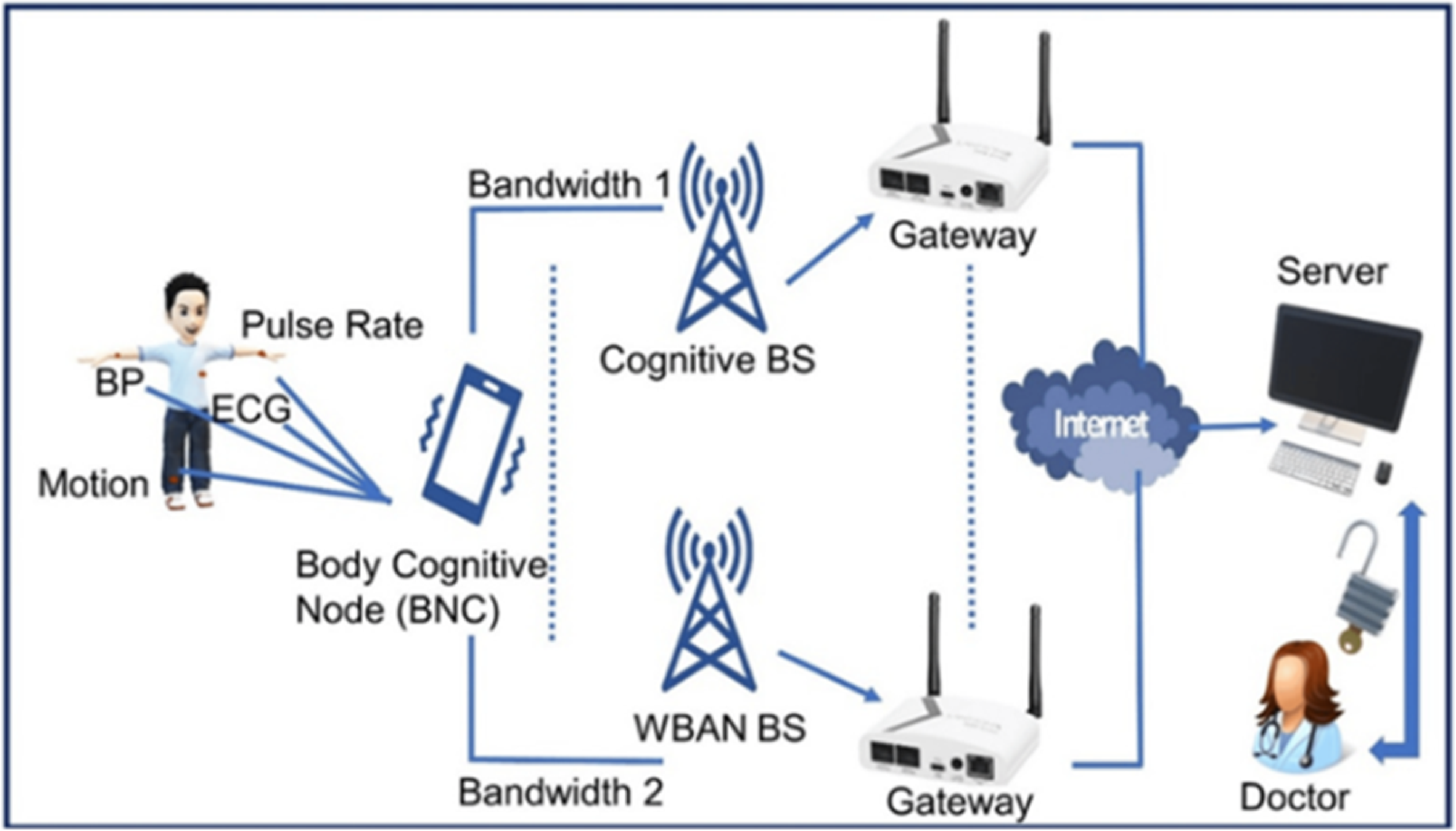

Attacker
Receiver B
Sender A
Try to Access
Access Granted
Hijacked
Encryption Algorithm
Communication Channel
Decryption Algorithm

Figure 1. The WBAN-CR Network Architecture.



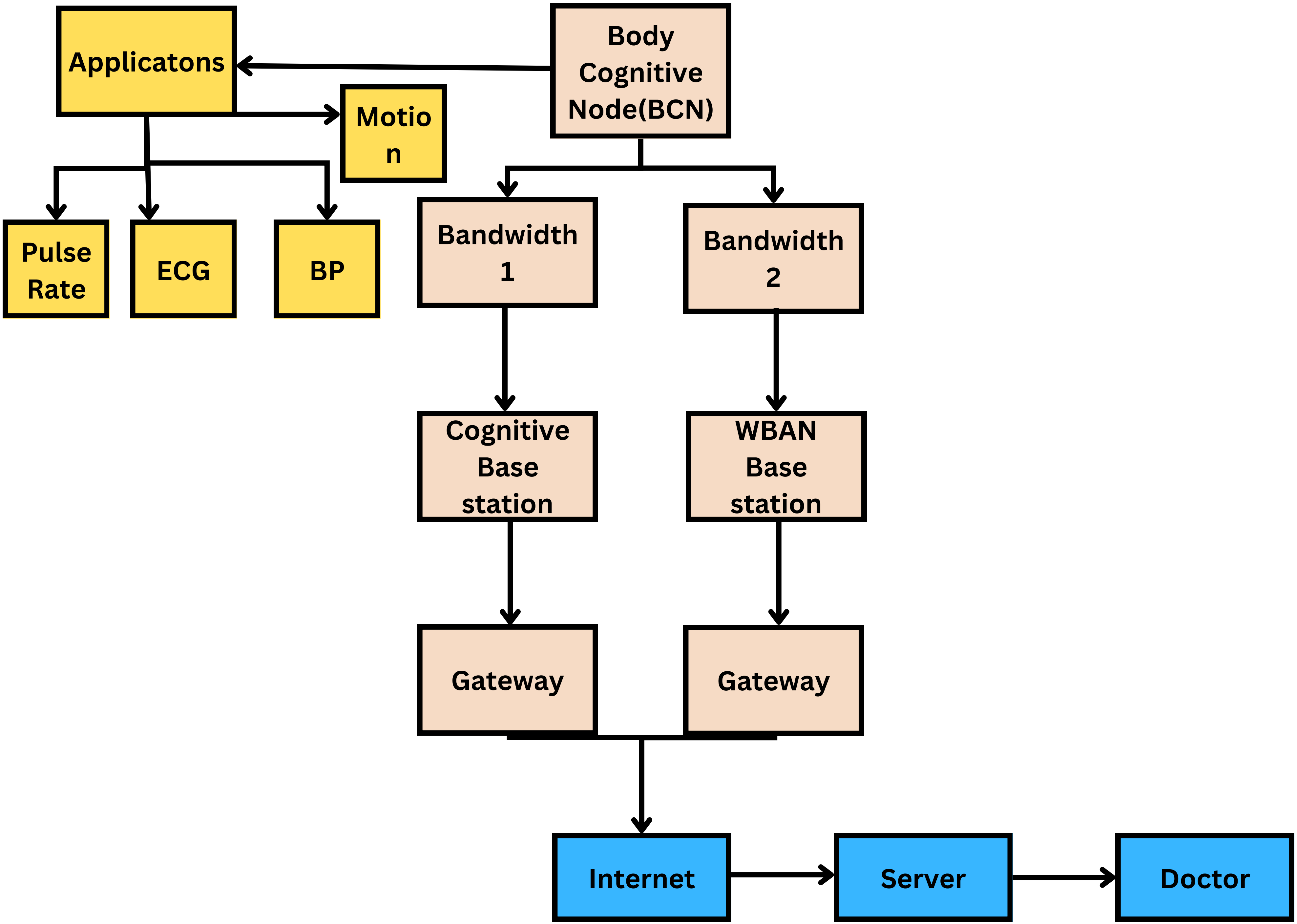
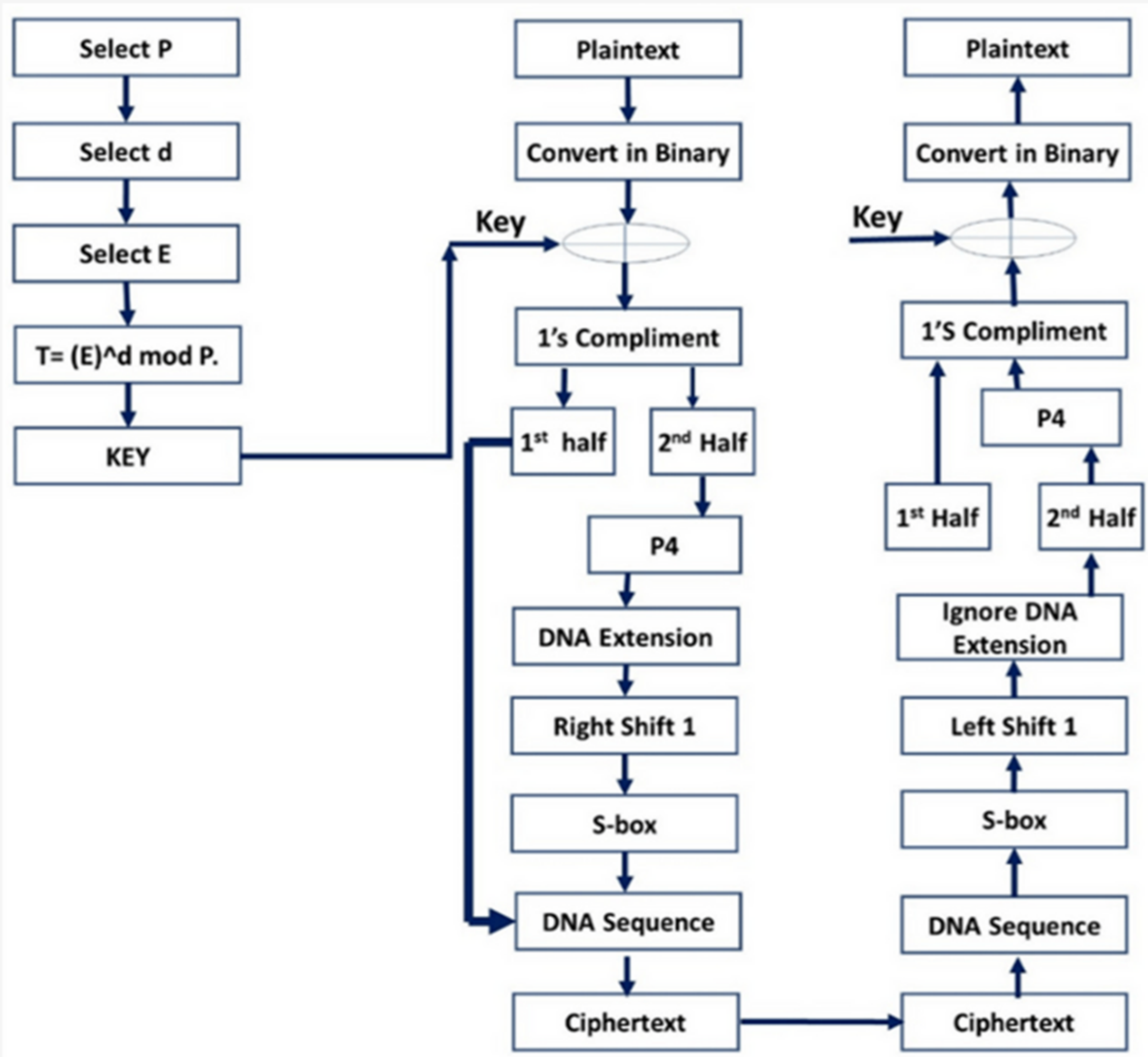
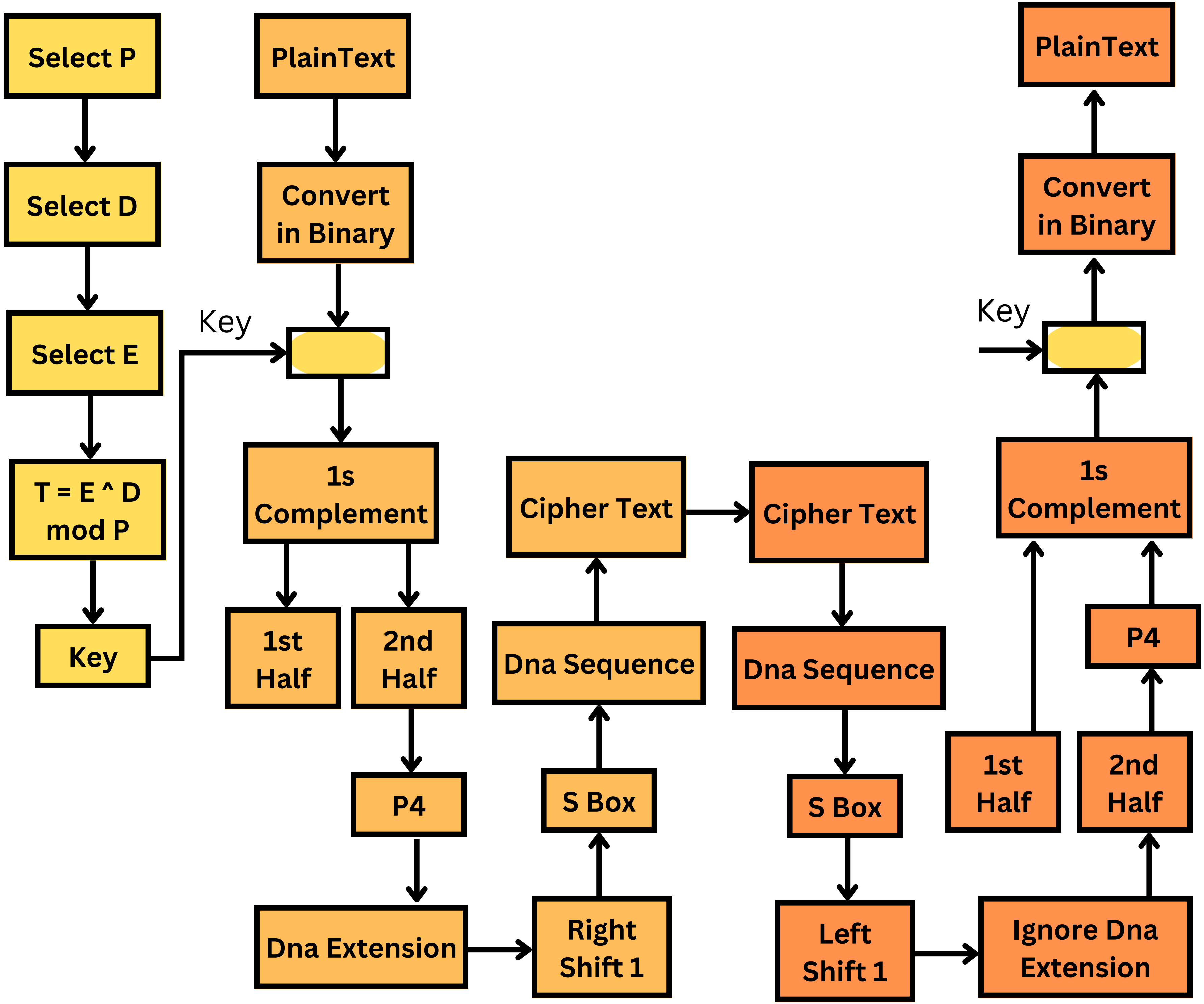

Applicatons
Body
Cognitive
Node(BCN)
Motio
n
Pulse
Rate
ECG
BP
Bandwidth
1
Bandwidth
2
Cognitive
Base
station
WBAN
Base
station
Gateway
Gateway
Internet
Server
Doctor

Figure 2. Encryption and Decryption Algorithm.




Select P
Select D
Select E
T = E ^ D mod P
Key
PlainText
Convert in Binary
Key
1s Complement
1st Half
2nd Half
P4
Dna Extension
Right Shift 1
S Box
Dna Sequence
Cipher Text
Cipher Text
Dna Sequence
S Box
Left Shift 1
Ignore Dna Extension
2nd Half
1st Half
P4
1s Complement
Key
Convert in Binary
PlainText

Feature	Description
Personalized Healthcare Monitoring System	A system that utilizes Bluetooth Low Energy (BLE)-based sensors and real-time data processing to monitor the health of diabetic patients.
BLE-based Sensors	Sensors that use BLE technology to collect data on various health parameters, such as blood glucose levels, blood pressure, heart rate, and weight.
Real-time Data Processing	A system that processes sensor data in real-time to provide healthcare providers with timely insights into a patient's condition and identify potential health risks.
Data Visualization and Analysis	A user-friendly interface that allows patients and healthcare providers to visualize and analyze sensor data to track trends, identify patterns, and make informed decisions about treatment and lifestyle changes.
Personalized Recommendations	A system that generates personalized recommendations for diet, physical activity, and medication adjustments based on a patient's individual health data and treatment goals.
Improved Patient Outcomes	The goal of the system is to improve patient outcomes by providing personalized care, facilitating timely interventions, and empowering patients to manage their condition effectively.

Export to Sheets

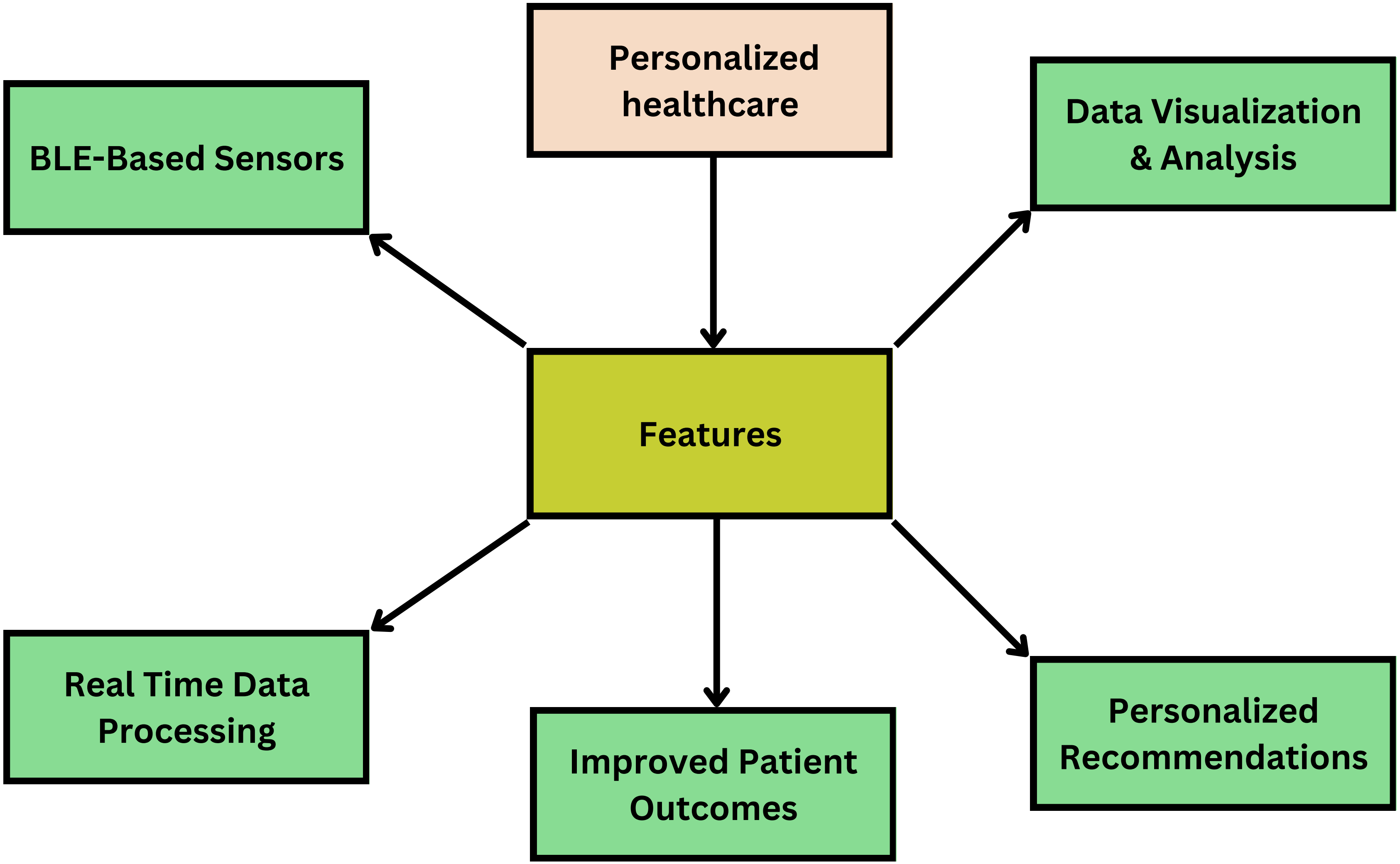
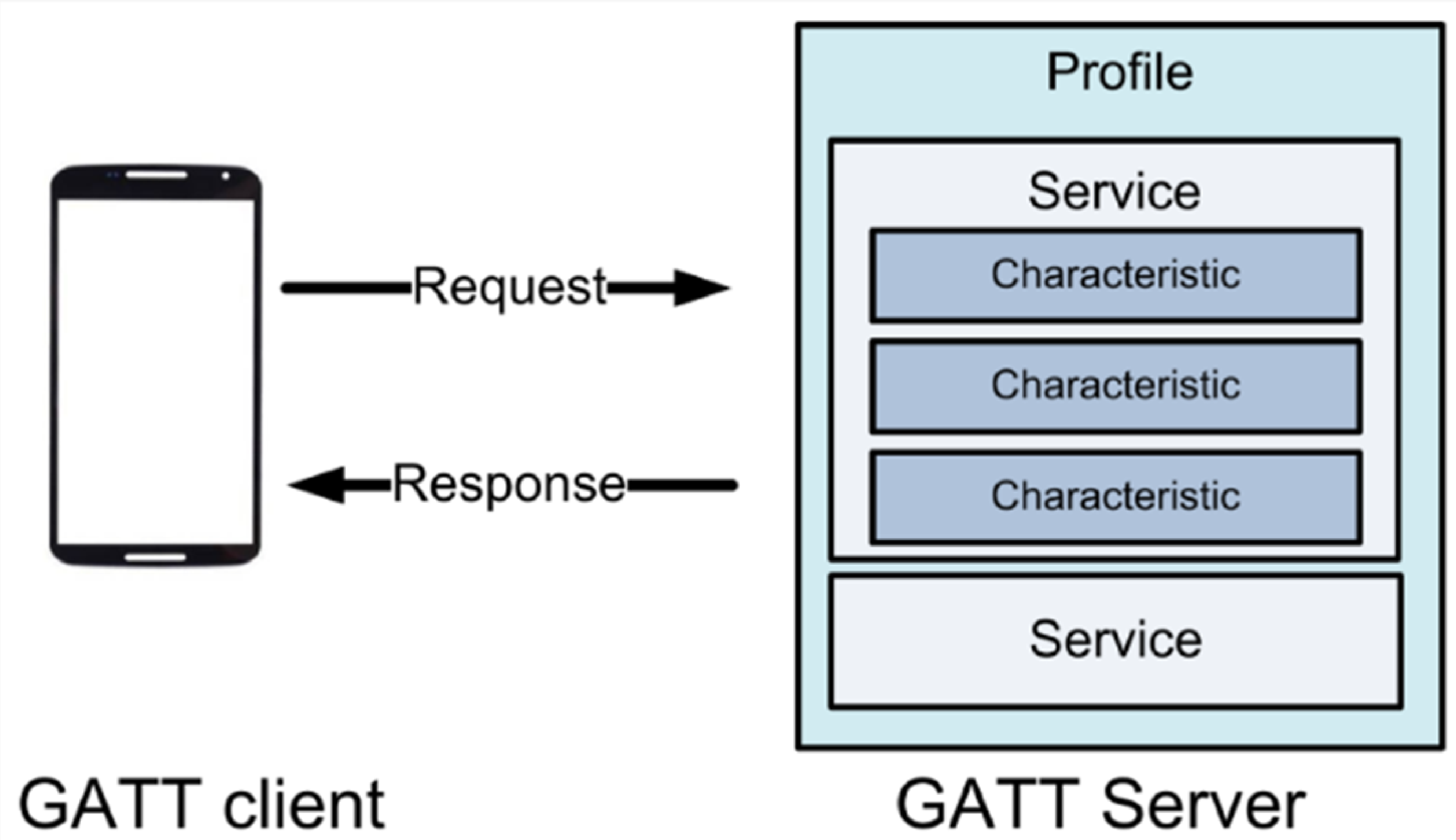

Personalized healthcare
BLE-Based Sensors
Data Visualization & Analysis
Features
Real Time Data Processing
Improved Patient Outcomes
Personalized Recommendations

Figure 4. A diagram of the Generic Attributes (GATT) server.



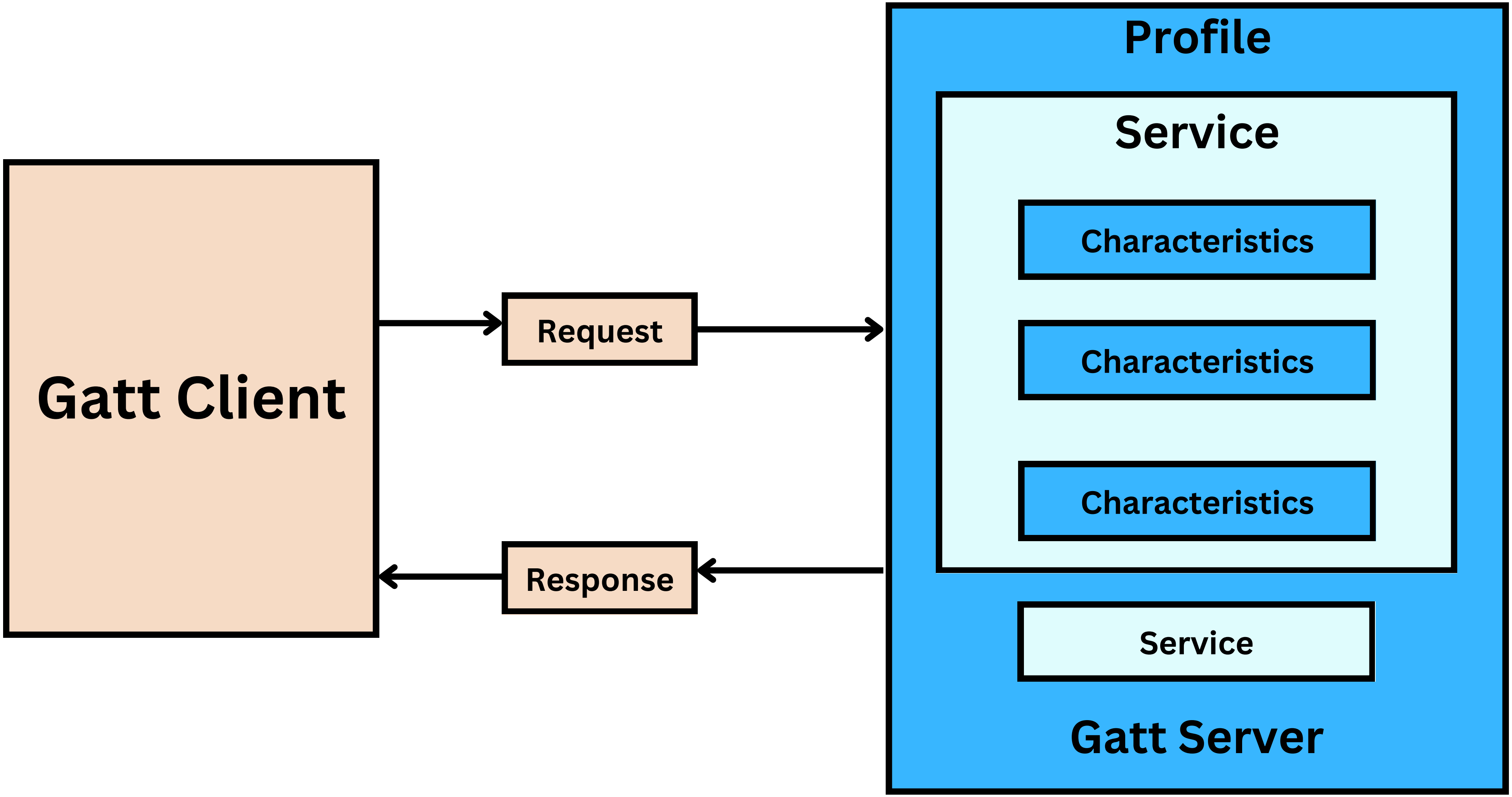
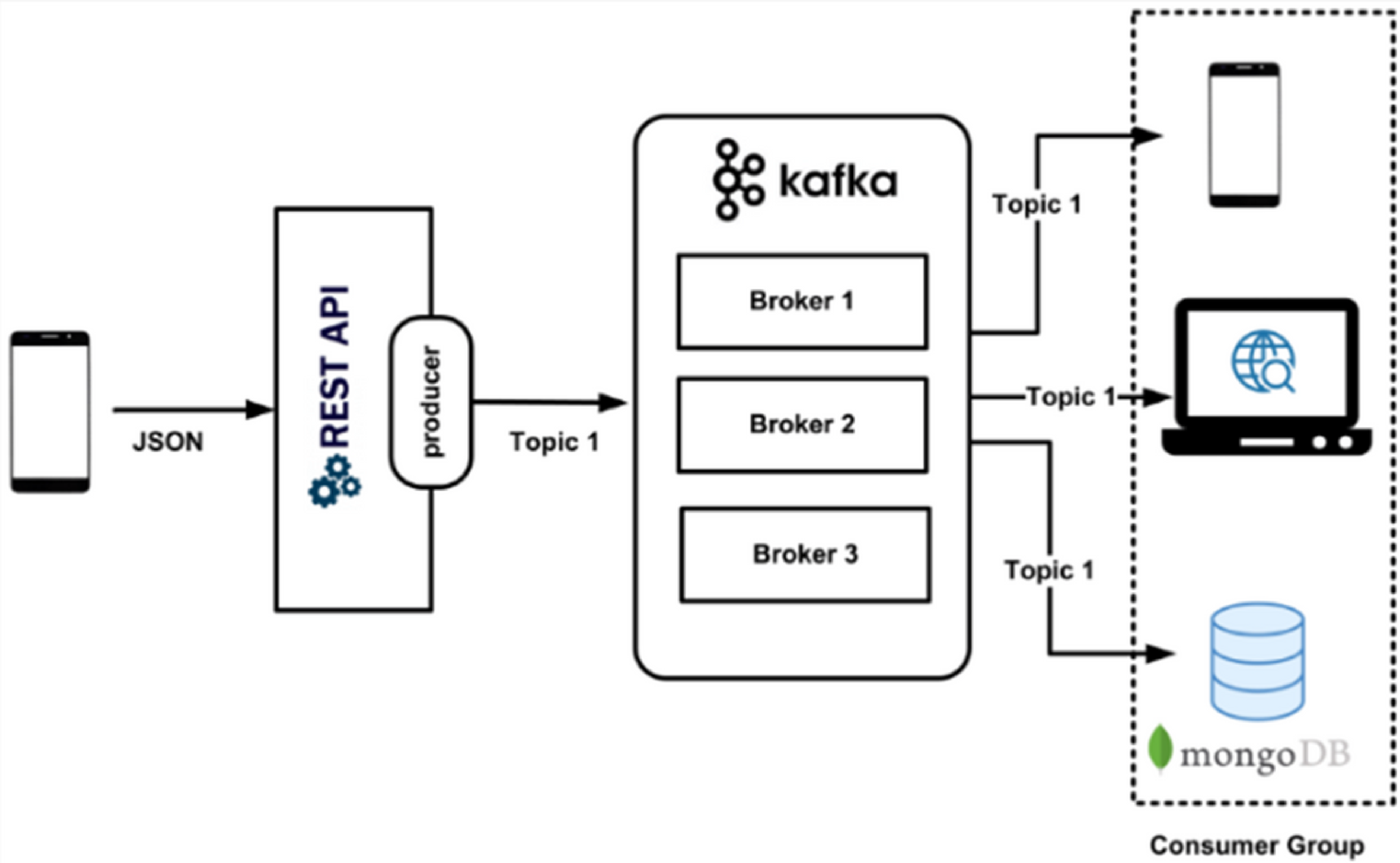
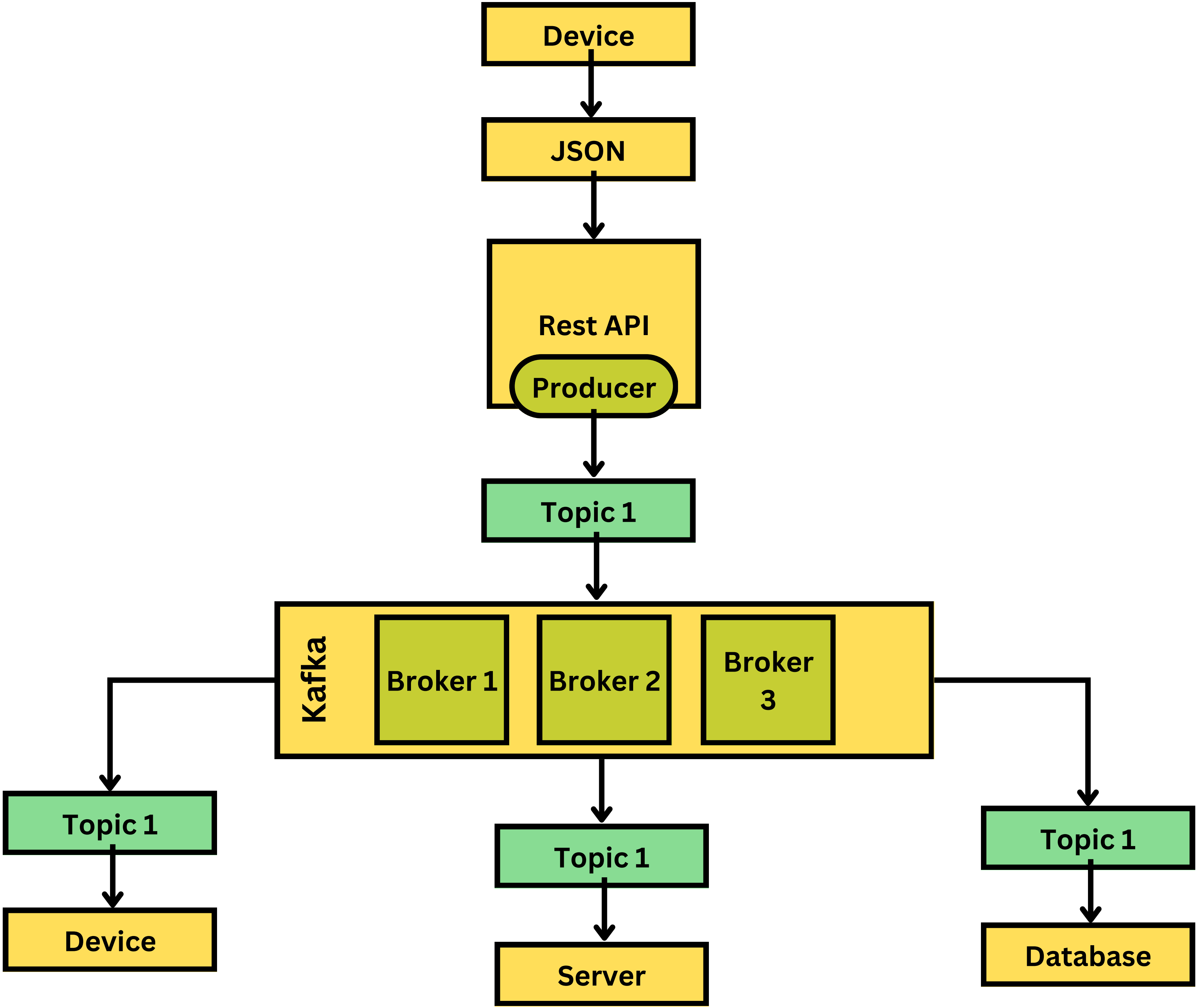


Diagram of the Generic Attributes GATT Server

Figure 2. System design of the real-time data processing.




Device
JSON
Rest API
Producer
Topic 1
Kafka
Broker 1
Broker 2
Broker 3
Topic 1
Device
Topic 1
Server
Topic 1
Database

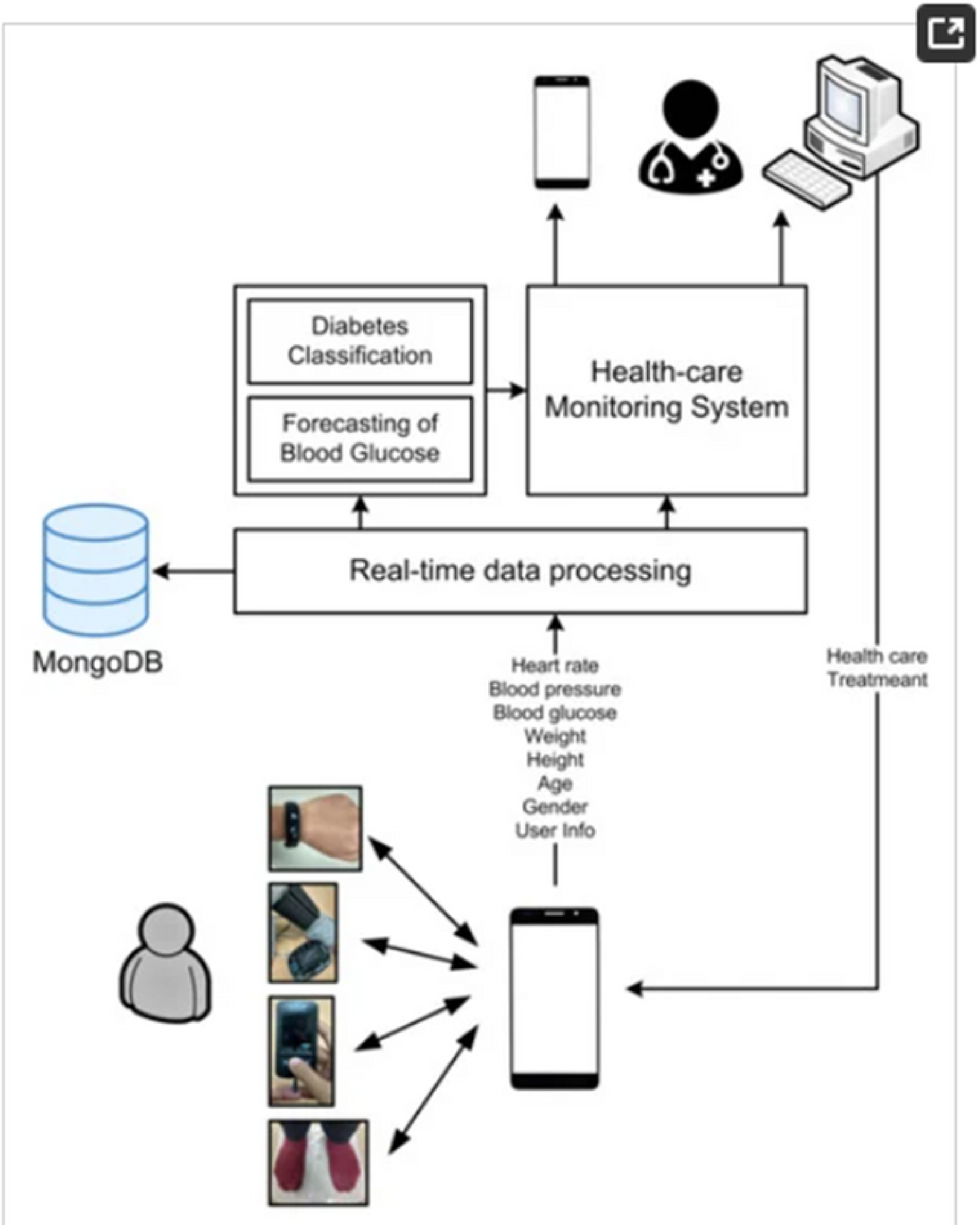
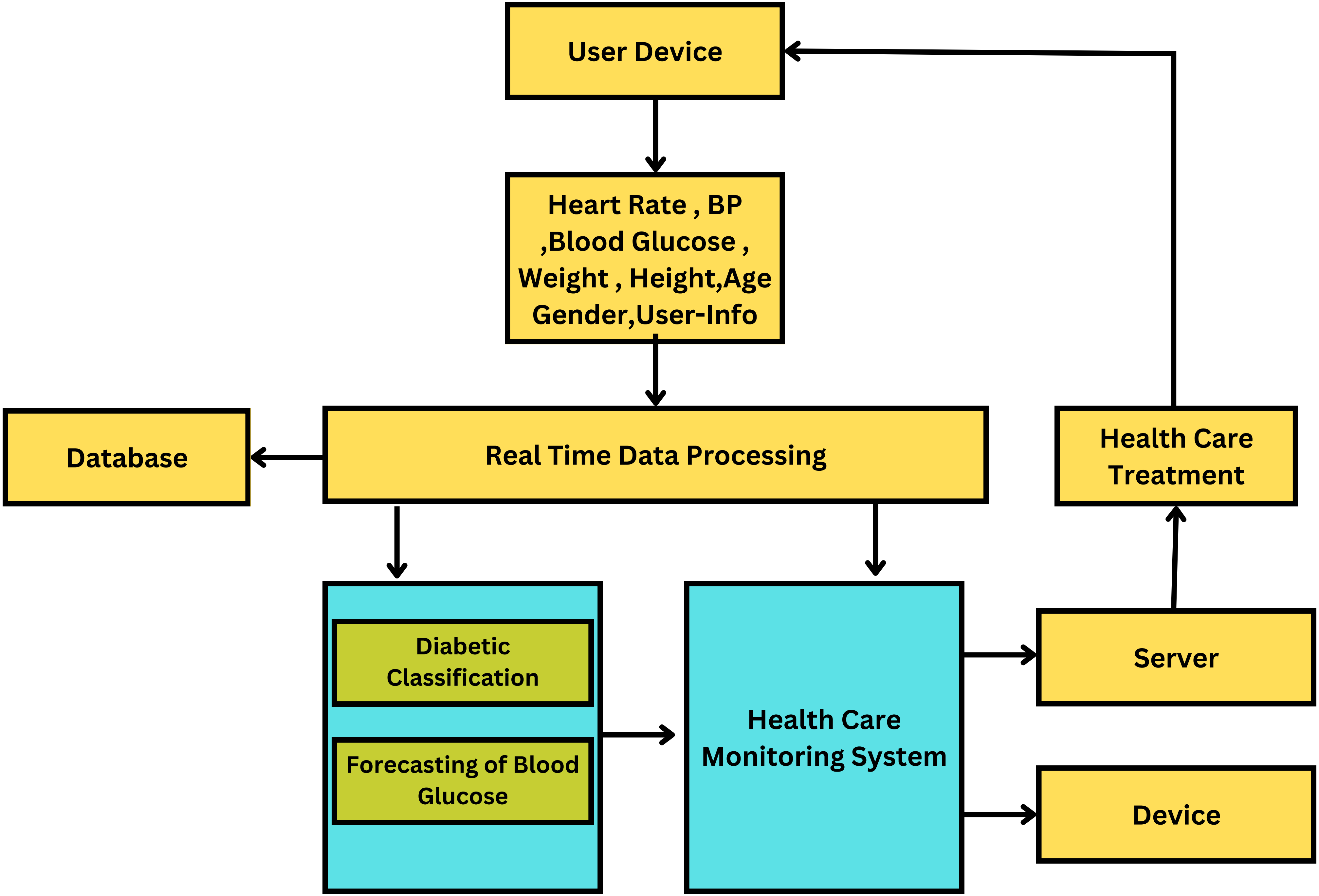
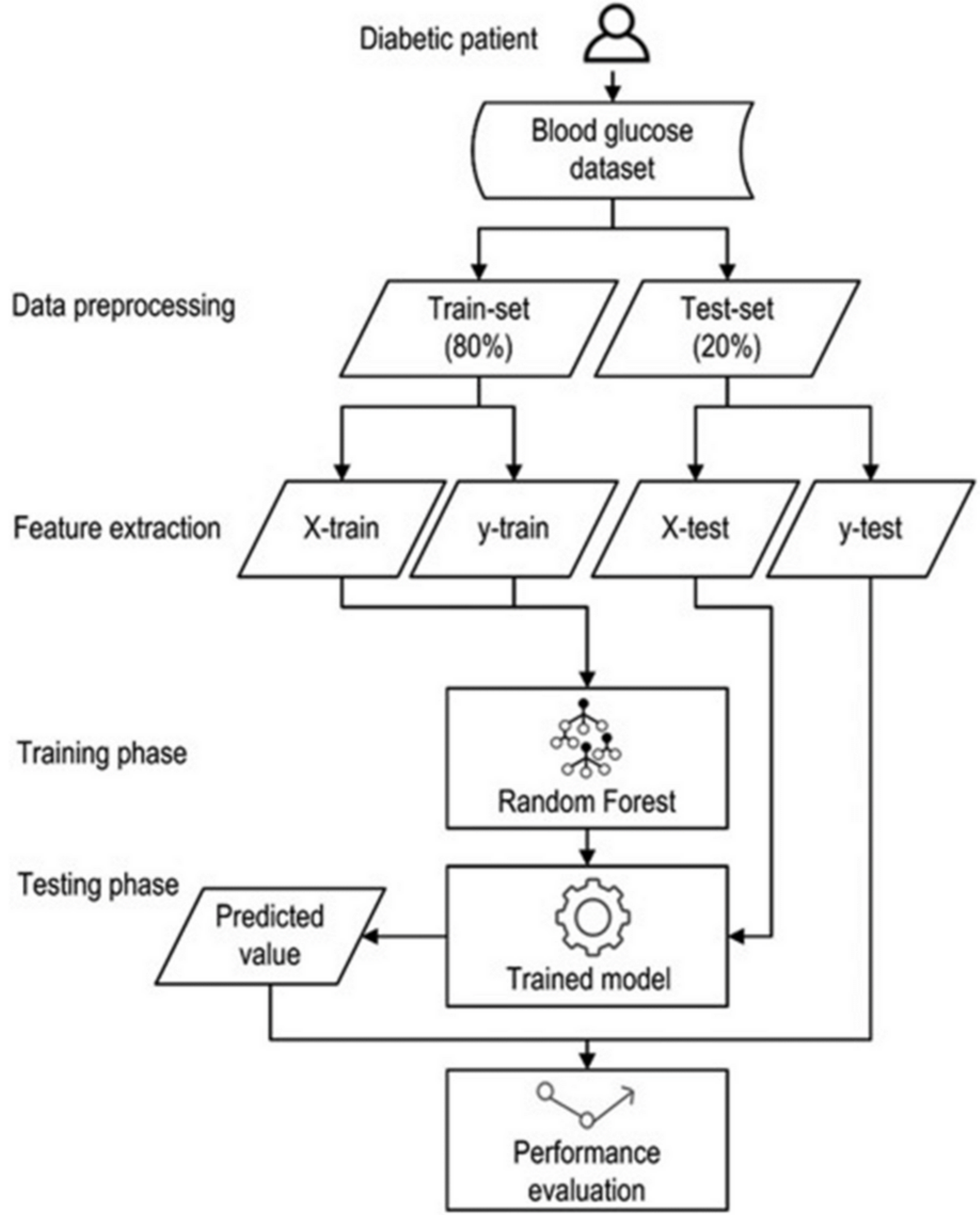


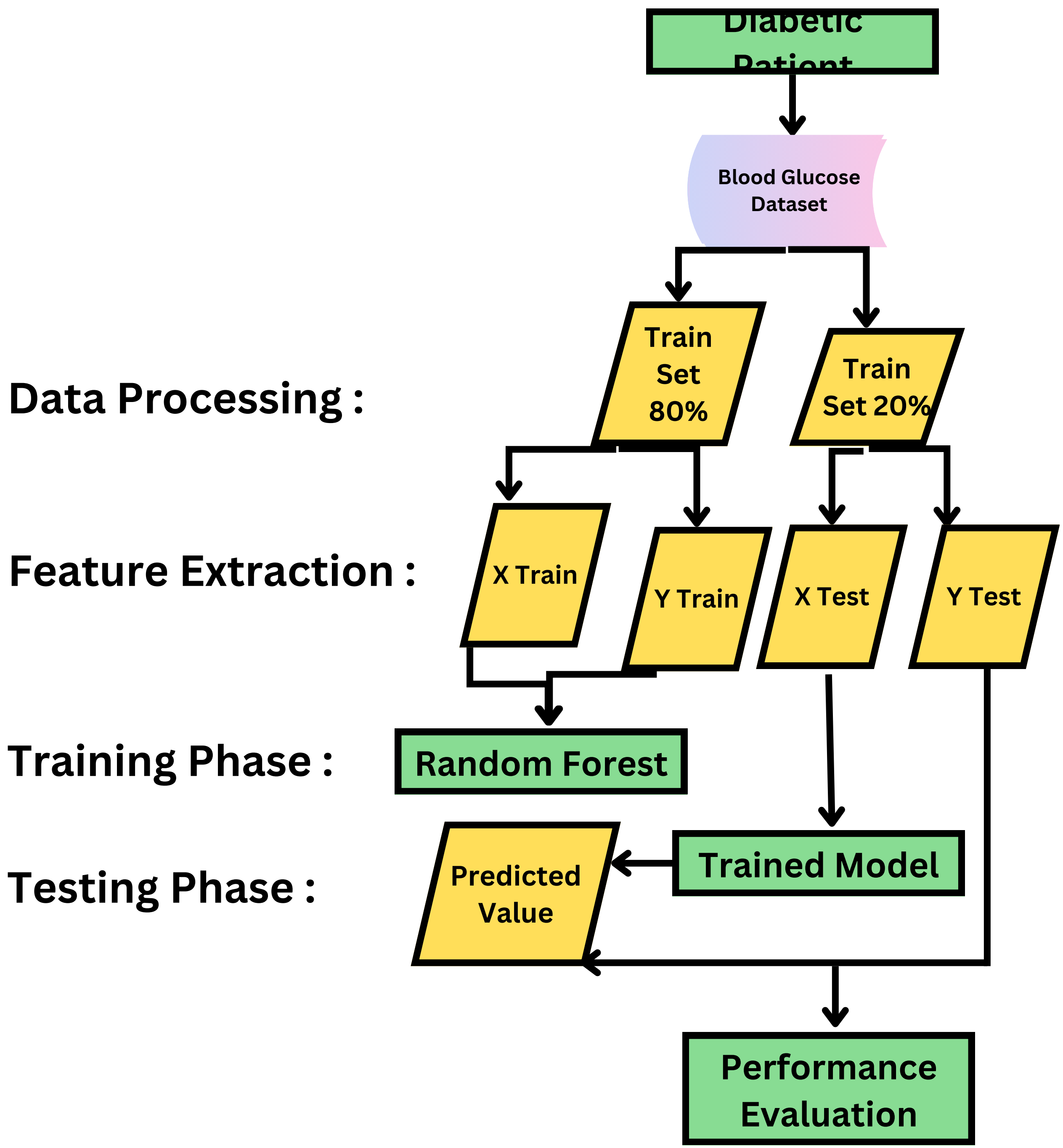
Figure 1. The architecture of the personalized healthcare monitoring system for diabetic patients.



The architecture of the personalized healthcare monitoring system for diabetic patients

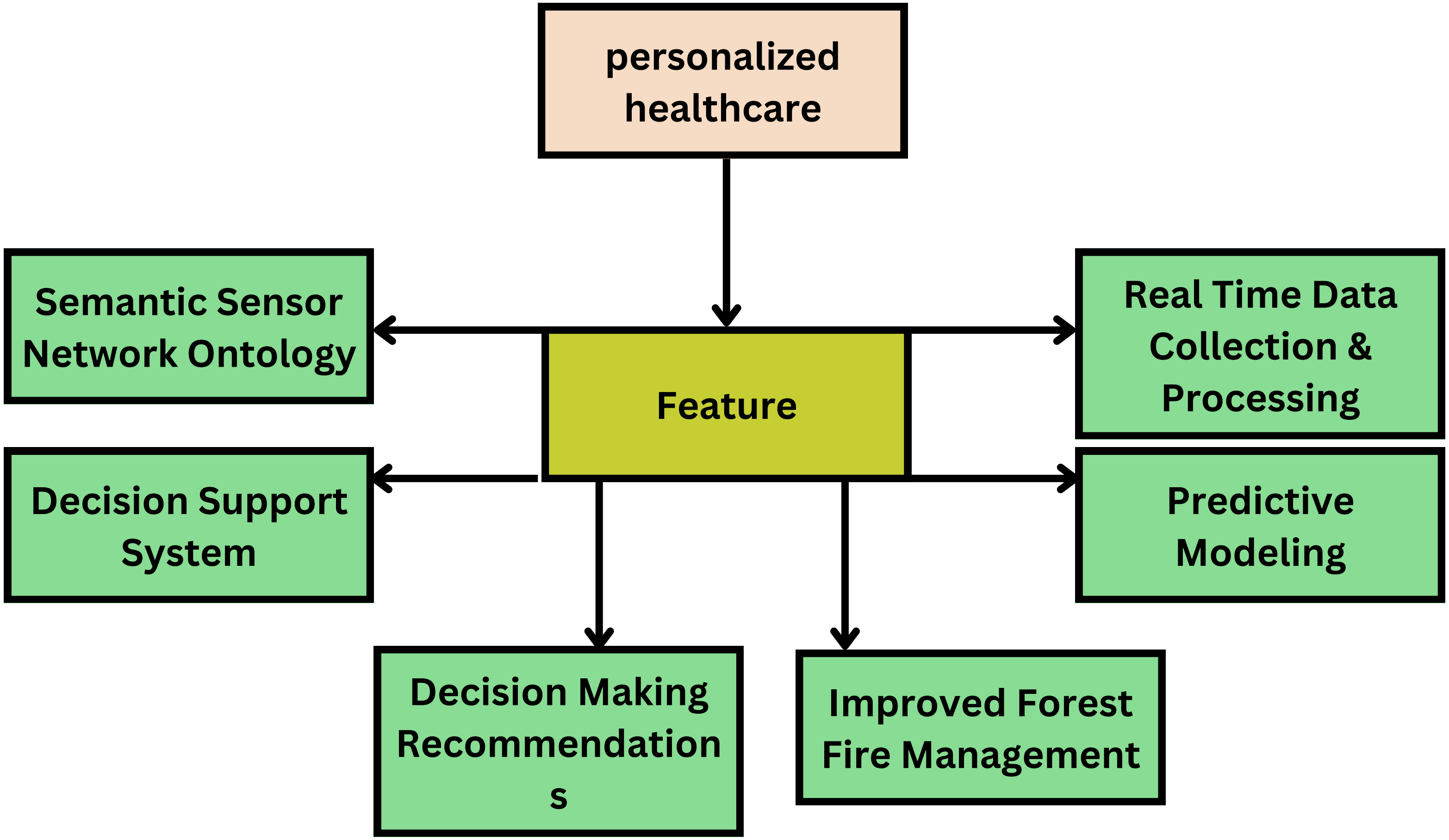


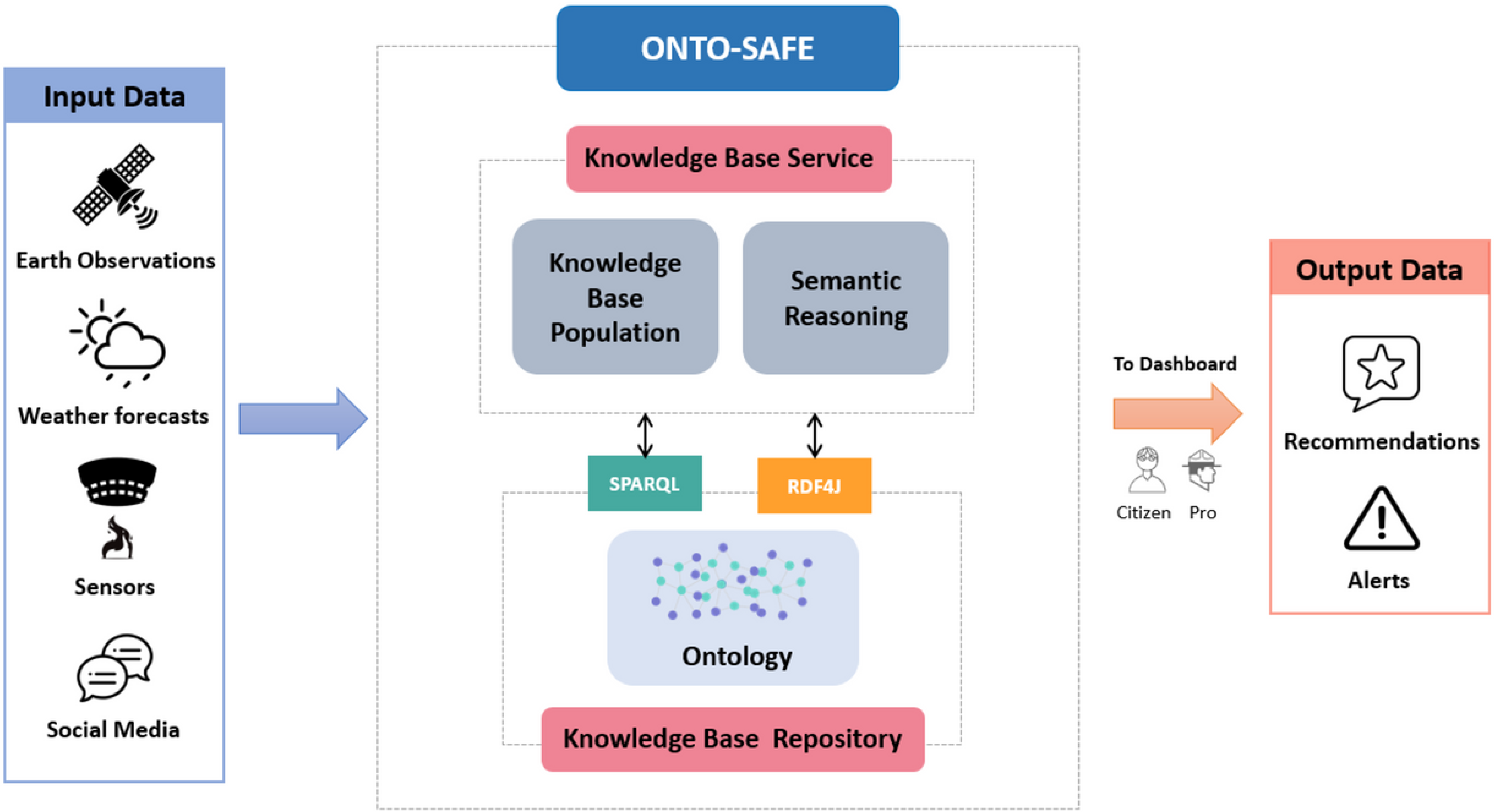
Diabetic patient
Blood glucose dataset
Data preprocessing
Train-set (80%)
Test-set (20%)
Feature extraction
X-train
y-train
X-test
y-test
Training phase
Random Forest
Testing phase
Predicted value
Trained model
Performance evaluation

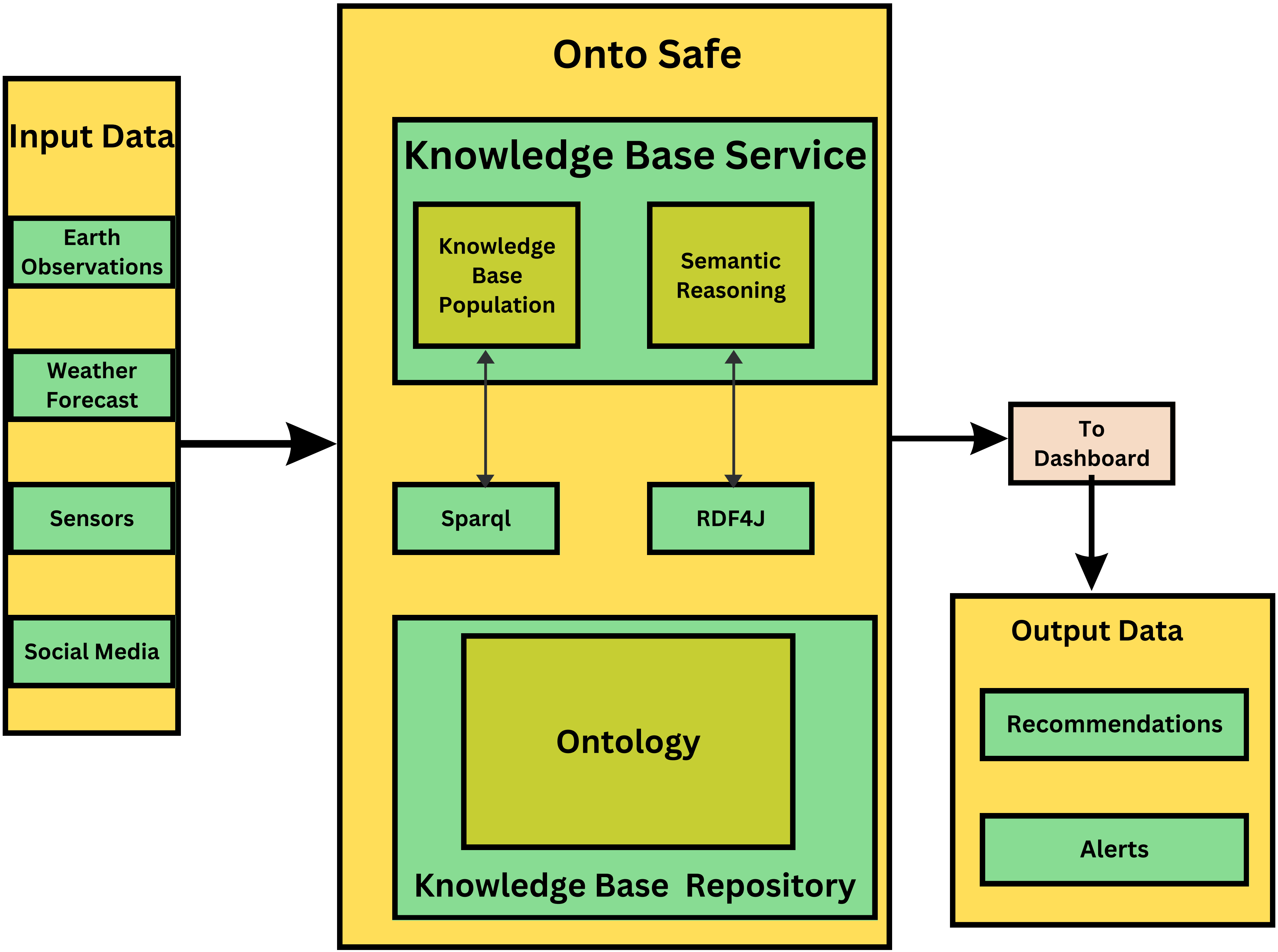

Diabetic Patient
Blood Glucose Dataset
Data Processing :
Train Set 80%
Train Set 20%
Feature Extraction :
X Train
Y Train
X Test
Y Test
Training Phase :
Random Forest
Testing Phase :
Predicted Value
Trained Model
Performance Evaluation

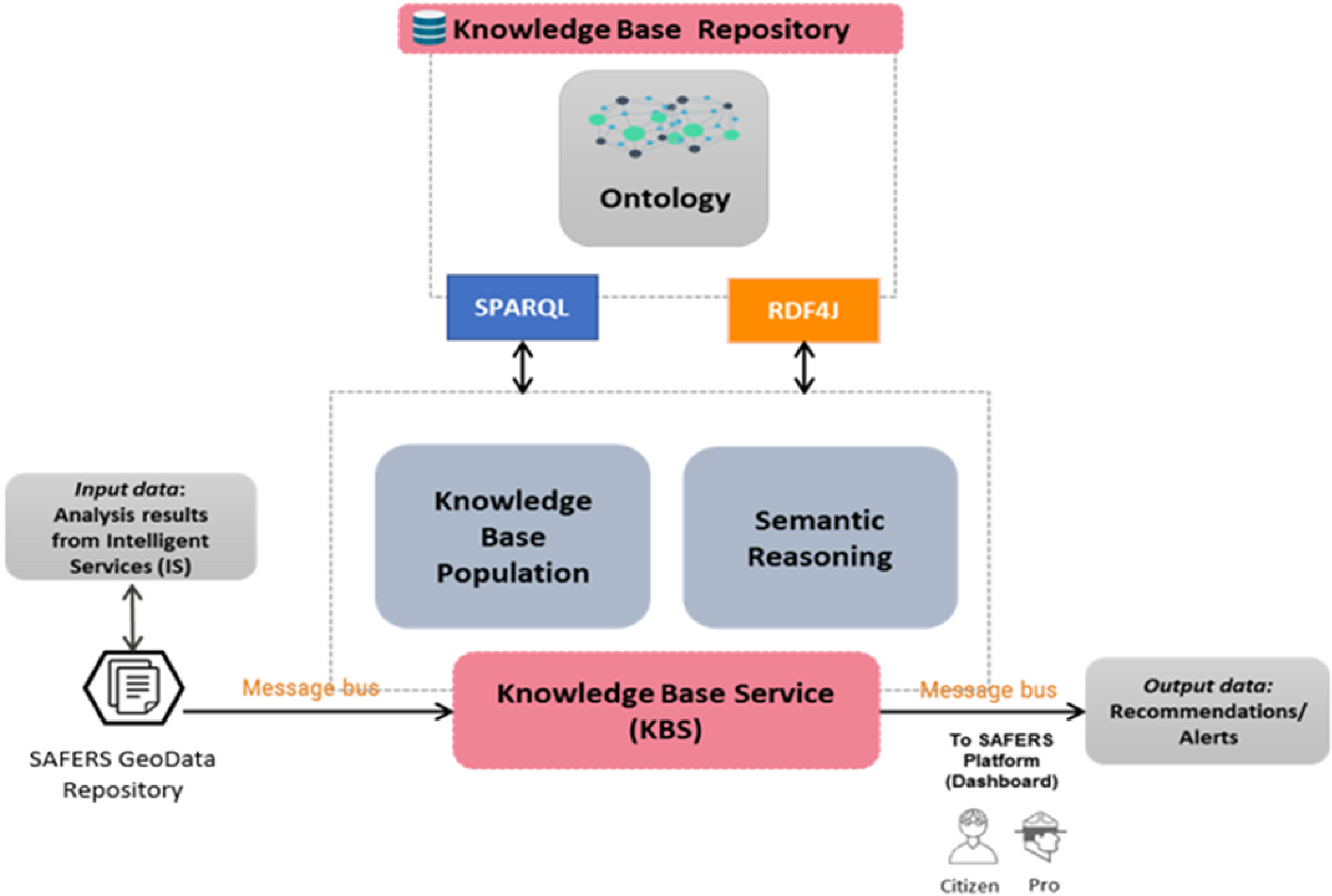
Feature	Description
Semantic Sensor Network (SSN) Ontology	A formal representation of the concepts and relationships related to forest fire management, including sensor data, weather conditions, and fire behavior.
Decision Support System (DSS)	A system that utilizes the SSN ontology to analyze sensor data, weather forecasts, and fire behavior models to provide recommendations for forest fire prevention, detection, and suppression.
Real-time Data Collection and Processing	The DSS collects data from various sources, including sensor networks, weather stations, and satellites, and processes it in real-time to provide up-to-date information on fire risk and fire behavior.
Predictive Modeling	The DSS utilizes predictive models to assess fire risk and forecast fire behavior based on historical data, current conditions, and weather forecasts.
Decision-making Recommendations	The DSS provides recommendations for forest fire prevention, detection, and suppression based on the analysis of sensor data, weather forecasts, and predictive models.
Improved Forest Fire Management	The DSS can help to improve forest fire management by providing timely and accurate information to decision-makers, enabling them to take effective measures to prevent, detect, and suppress forest fires.

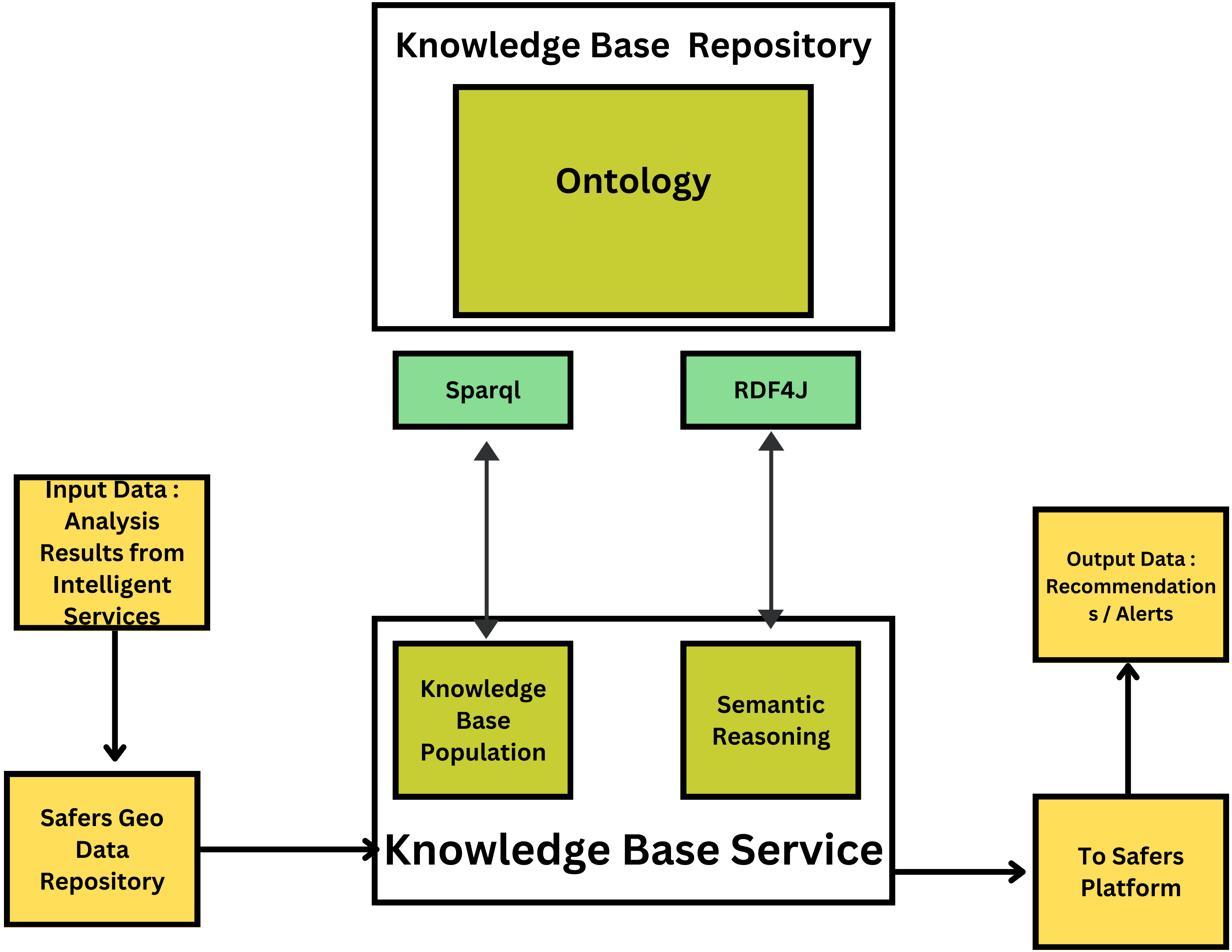
Export to Sheets

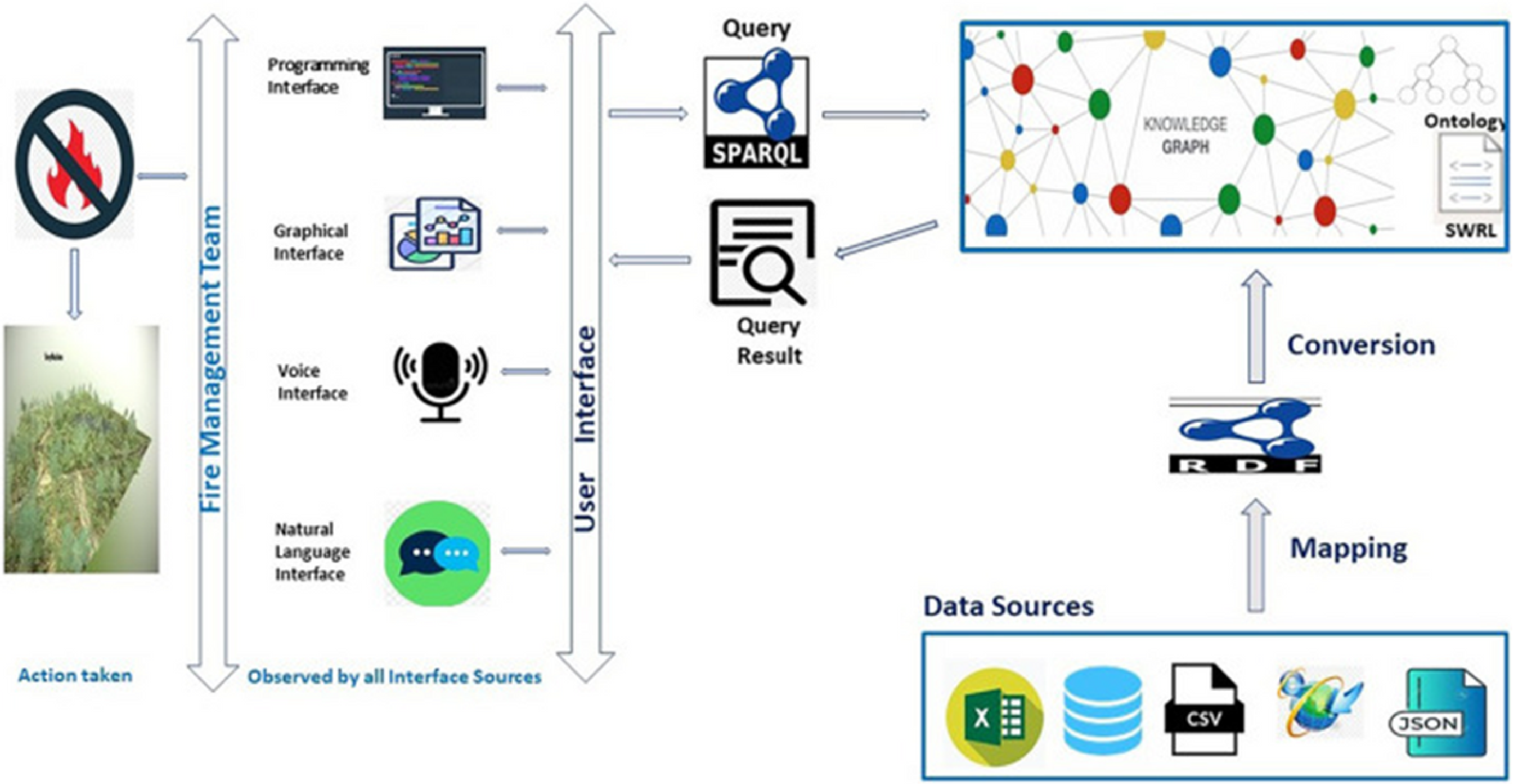

personalized healthcare
Feature
Semantic Sensor Network Ontology
Real Time Data Collection & Processing
Decision Support System
Predictive Modeling
Decision Making Recommendations
Improved Forest Fire Management


Input Data
Earth Observations
Weather forecasts
Sensors
Social Media
ONTO-SAFE
Knowledge Base Service
Knowledge Base Population
Semantic Reasoning
SPARQL
RDF4J
Ontology
Knowledge Base Repository
To Dashboard
Citizen
Pro
Output Data
Recommendations
Alerts

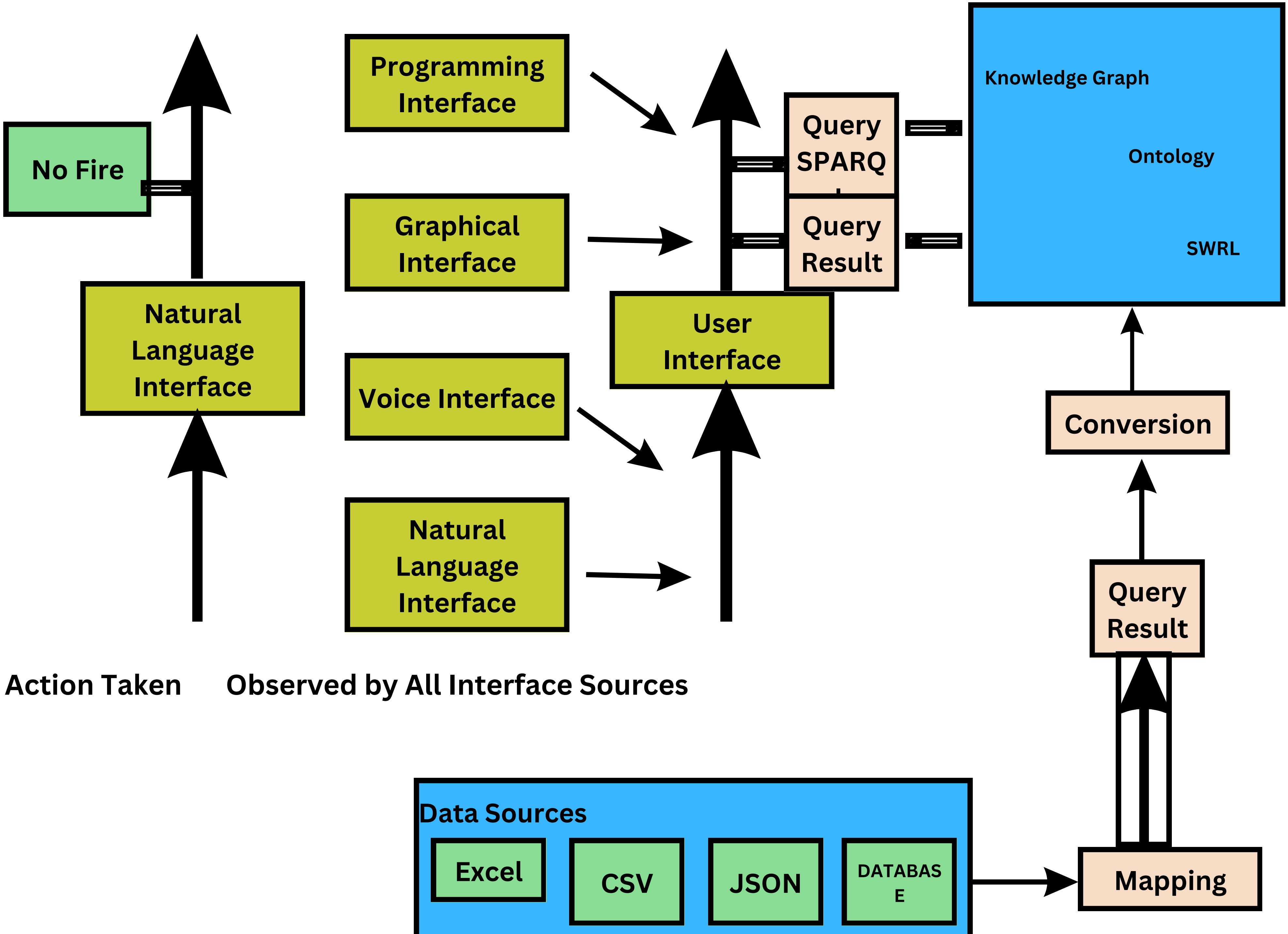

Input Data
Earth Observations
Weather Forecast
Sensors
Social Media
Onto Safe
Knowledge Base Service
Knowledge Base Population
Semantic Reasoning
Sparql
RDF4J
Ontology
Knowledge Base Repository
To Dashboard
Output Data
Recommendations
Alerts

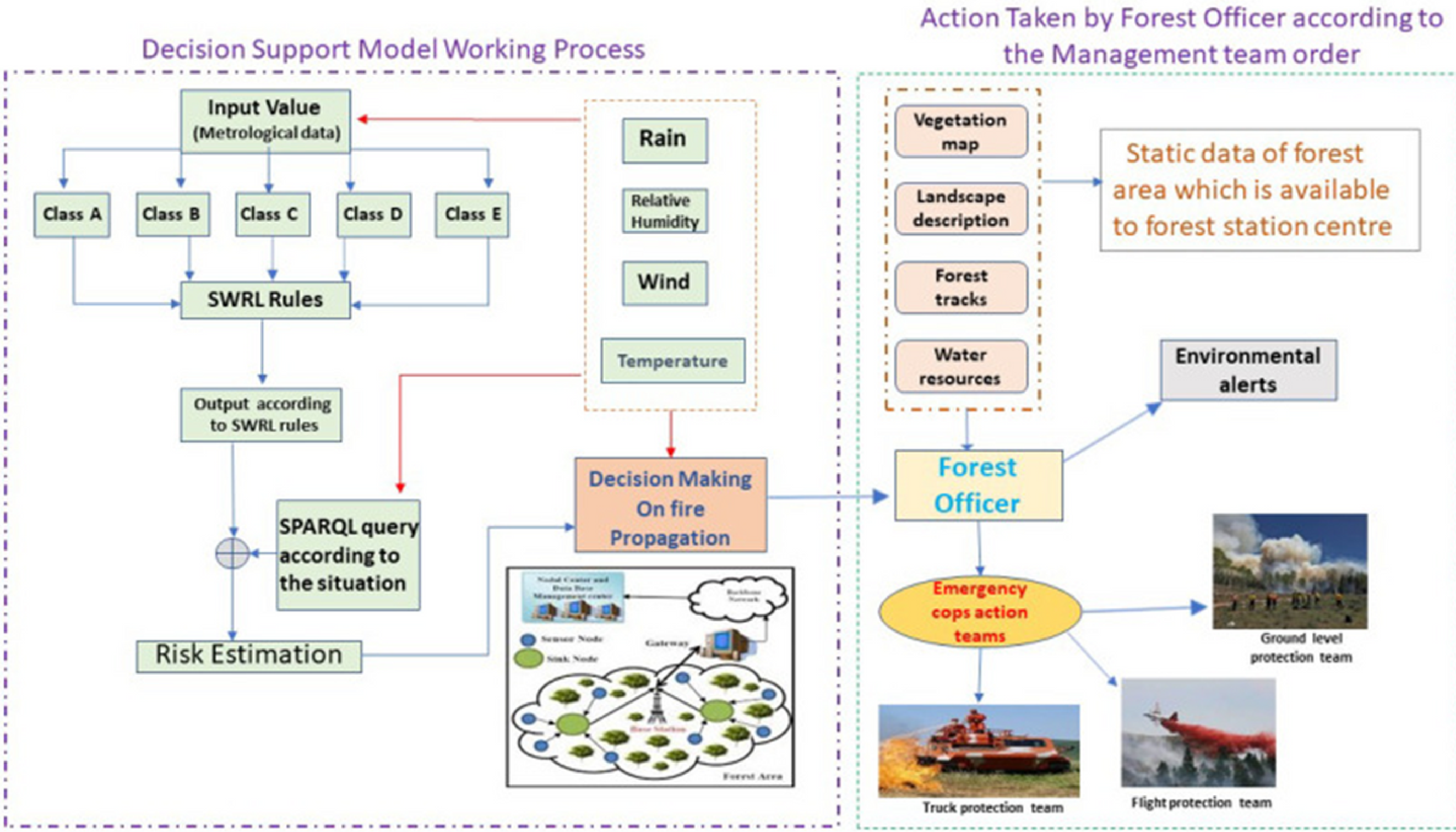

Knowledge Base Repository
Ontology
SPARQL
RDF4J
Knowledge Base Population
Semantic Reasoning
Input data: Analysis results from Intelligent Services (IS)
SAFERS GeoData Repository
Message bus
Knowledge Base Service (KBS)
Message bus
Output data: Recommendations/ Alerts
To SAFERS Platform (Dashboard)
Citizen
Pro


Knowledge Base Repository
Ontology
Sparql
RDF4J
Input Data : Analysis Results from Intelligent Services
Output Data : Recommendations / Alerts
Knowledge Base Population
Semantic Reasoning
Safers Geo Data Repository
Knowledge Base Service
To Safers Platform

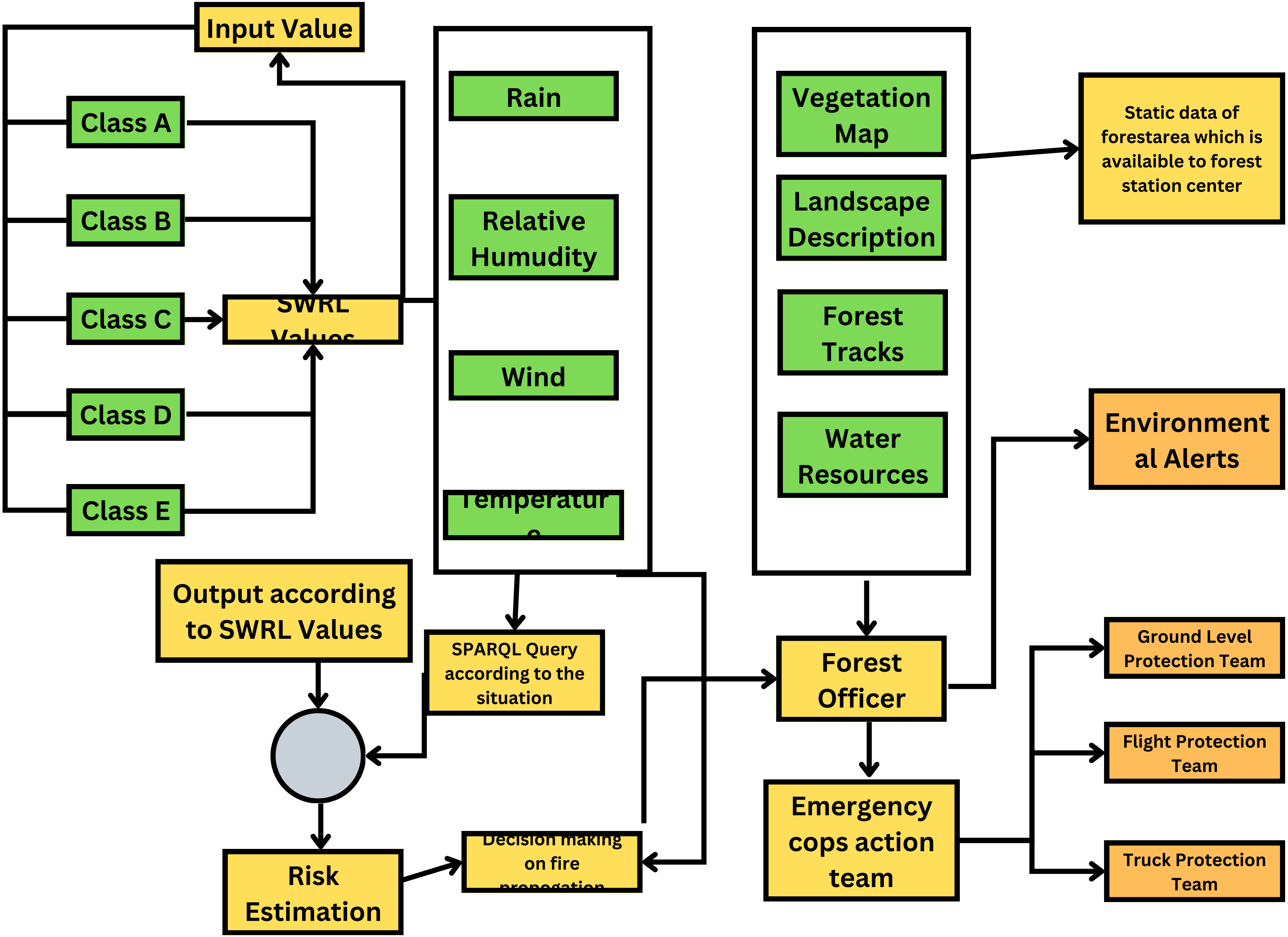


Fire Management Team
Action taken
Programming Interface
Graphical Interface
Voice Interface
Natural Language Interface
Observed by all Interface Sources
User Interface
Query
SPARQL
Query Result
KNOWLEDGE GRAPH
Ontology
SWRL
Conversion
RDF
Mapping
Data Sources
CSV
JSON


No Fire
Programming Interface
Graphical Interface
Natural Language Interface
Voice Interface
Natural Language Interface
User Interface
Query SPARQ
Query Result
Knowledge Graph
Ontology
SWRL
Conversion
Query Result
Data Sources
Excel
CSV
JSON
DATABAS E
Mapping
Action Taken
Observed by All Interface Sources



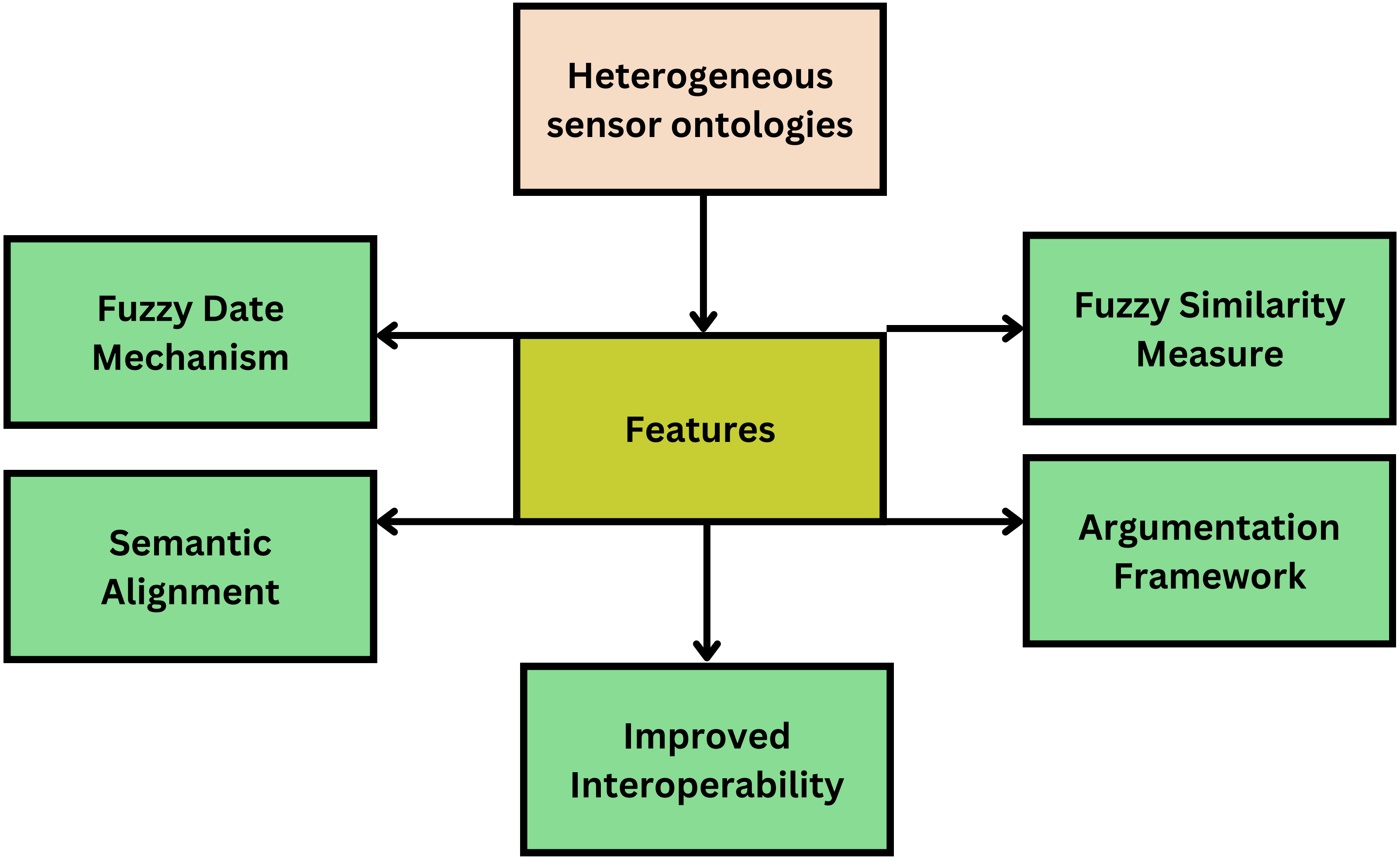
Decision Support Model Working Process
Action Taken by Forest Officer according to the Management team order
Input Value
(Metrological data)
Class A
Class B
Class C
Class D
Class E
SWRL Rules
Output according to SWRL rules
SPARQL query according to the situation
Risk Estimation
Rain
Relative Humidity
Wind
Temperature
Decision Making On fire Propagation
Vegetation map
Landscape description
Forest tracks
Water resources
Static data of forest area which is available to forest station centre
Environmental alerts
Forest Officer
Emergency cops action teams
Ground level protection team
Truck protection team
Flight protection team



Input Value
Class A
Class B
Class C
Class D
Class E
SWRL Values
Rain
Relative Humudity
Wind
Temperature
Vegetation Map
Landscape Description
Forest Tracks
Water Resources
Static data of forestarea which is availaible to forest station center
Environmental Alerts
Output according to SWRL Values
SPARQL Query according to the situation
Forest Officer
Ground Level Protection Team
Flight Protection Team
Emergency cops action team
Truck Protection Team
Risk Estimation
Decision making on fire propogation

Feature	Description
Heterogeneous Sensor Ontologies	Ontologies that represent the concepts and relationships related to different types of sensor data, such as temperature, humidity, and pressure.
Fuzzy Debate Mechanism (FDM)	A method for aggregating heterogeneous sensor ontologies by utilizing fuzzy logic to compare and merge concepts from different ontologies.
Semantic Alignment	A process of aligning heterogeneous sensor ontologies to ensure that concepts with similar meanings are represented in a consistent way.
Fuzzy Similarity Measure	A method for measuring the similarity between concepts in different ontologies, taking into account uncertainty and ambiguity in the data.
Argumentation Framework	A framework for negotiating and resolving differences between matching suggestions from different matchers.
Improved Interoperability	The FDM can help to improve interoperability between sensor networks and applications by providing a unified ontology that can be used to exchange and interpret sensor data.

Export to Sheets


Heterogeneous sensor ontologies
Fuzzy Date Mechanism
Features
Fuzzy Similarity Measure
Semantic Alignment
Argumentation Framework
Improved Interoperability

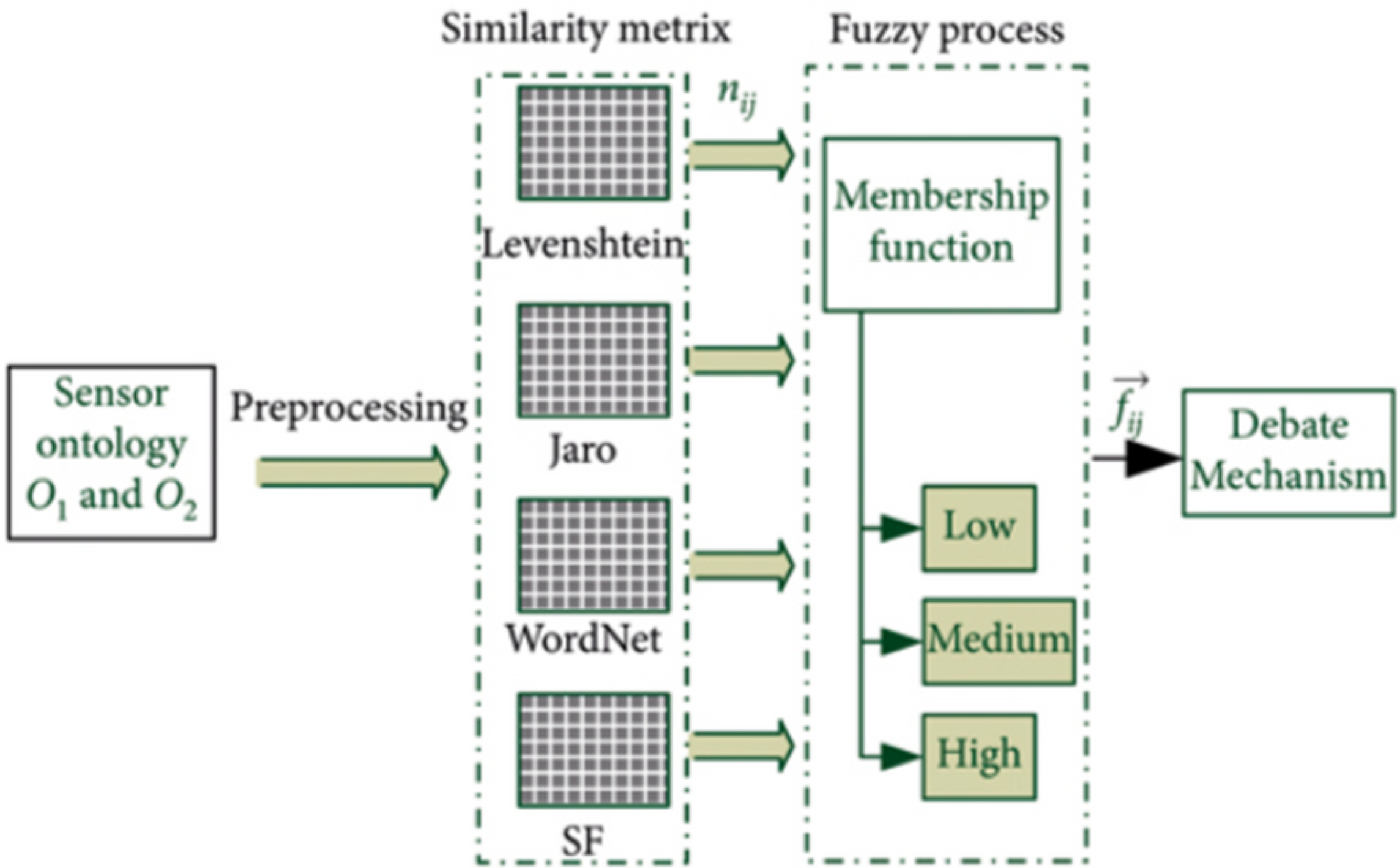
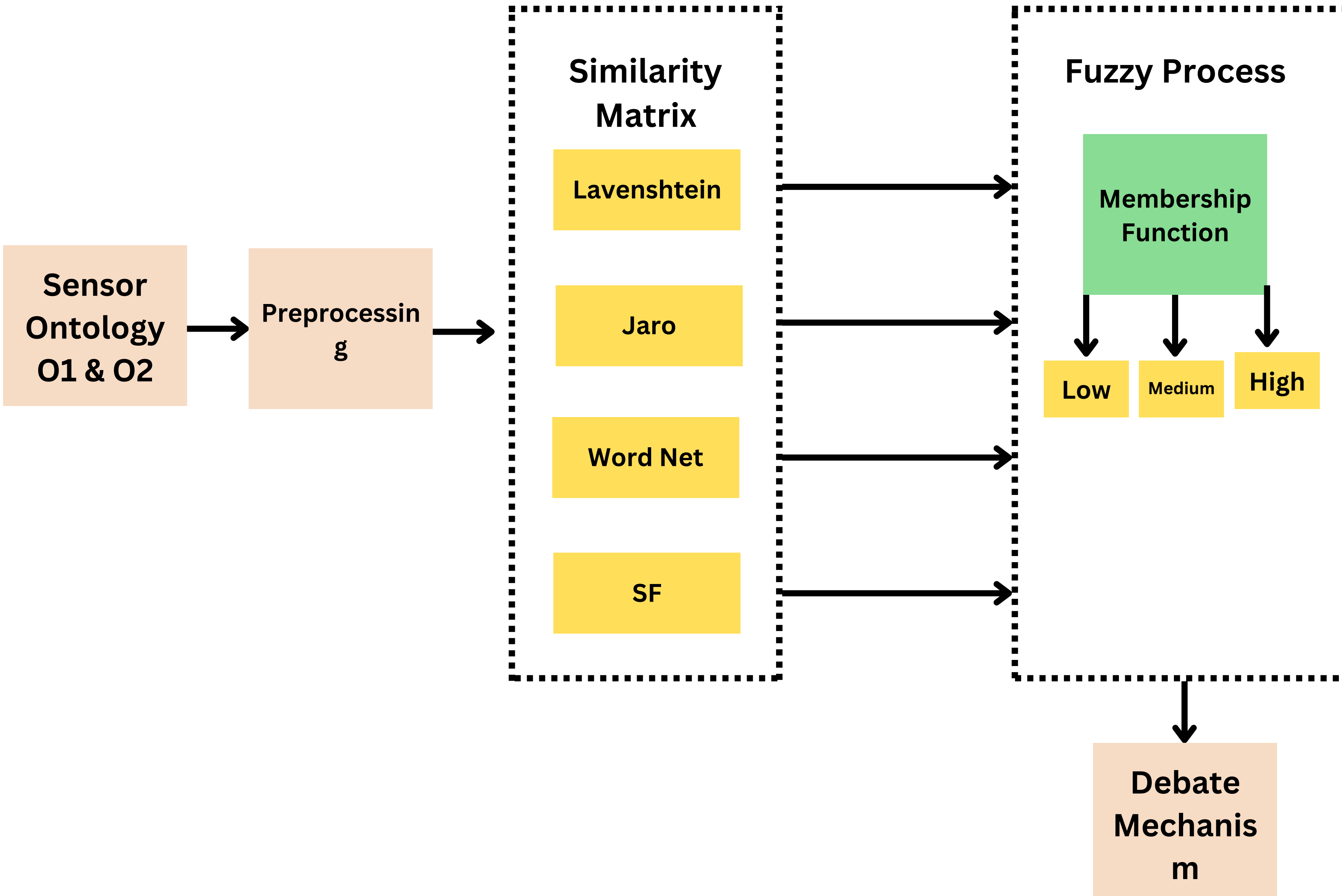
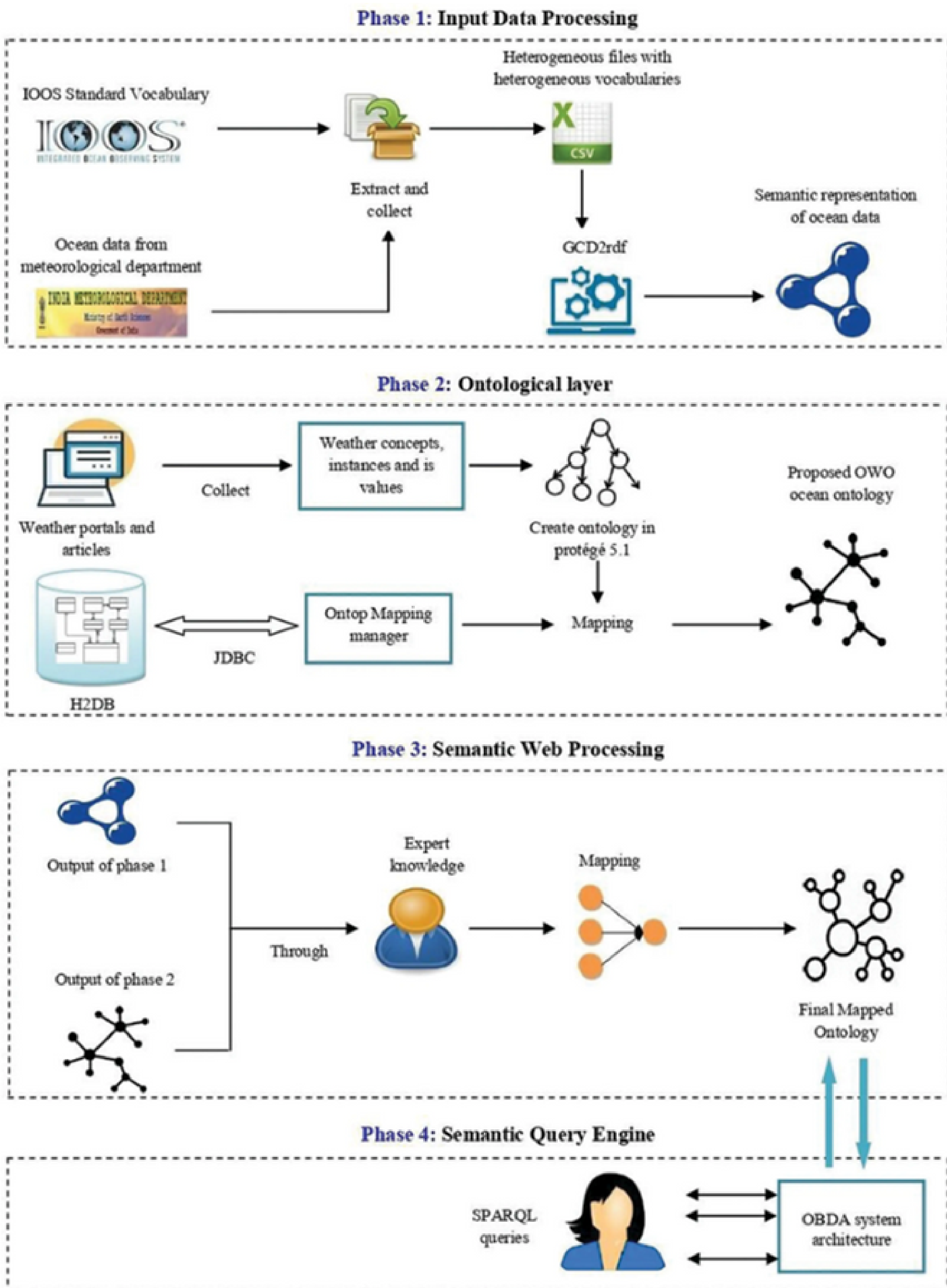


Figure 2

The flowchart of fuzzy similarity measure application process.



The Flowchart of fuzzy similarity measure application process


Phase 1: Input Data Processing
IOOS Standard Vocabulary
Heterogeneous files with heterogeneous vocabularies
Extract and collect
Ocean data from meteorological department
GCD2rdf
Semantic representation of ocean data
Phase 2: Ontological layer
Weather concepts, instances and is values
Collect
Weather portals and articles
Create ontology in protégé 5.1
Proposed OWO ocean ontology
Ontop Mapping manager
JDBC
Mapping
H2DB
Phase 3: Semantic Web Processing
Output of phase 1
Expert knowledge
Mapping
Through
Output of phase 2
Final Mapped Ontology
Phase 4: Semantic Query Engine
SPARQL queries
OBDA system architecture

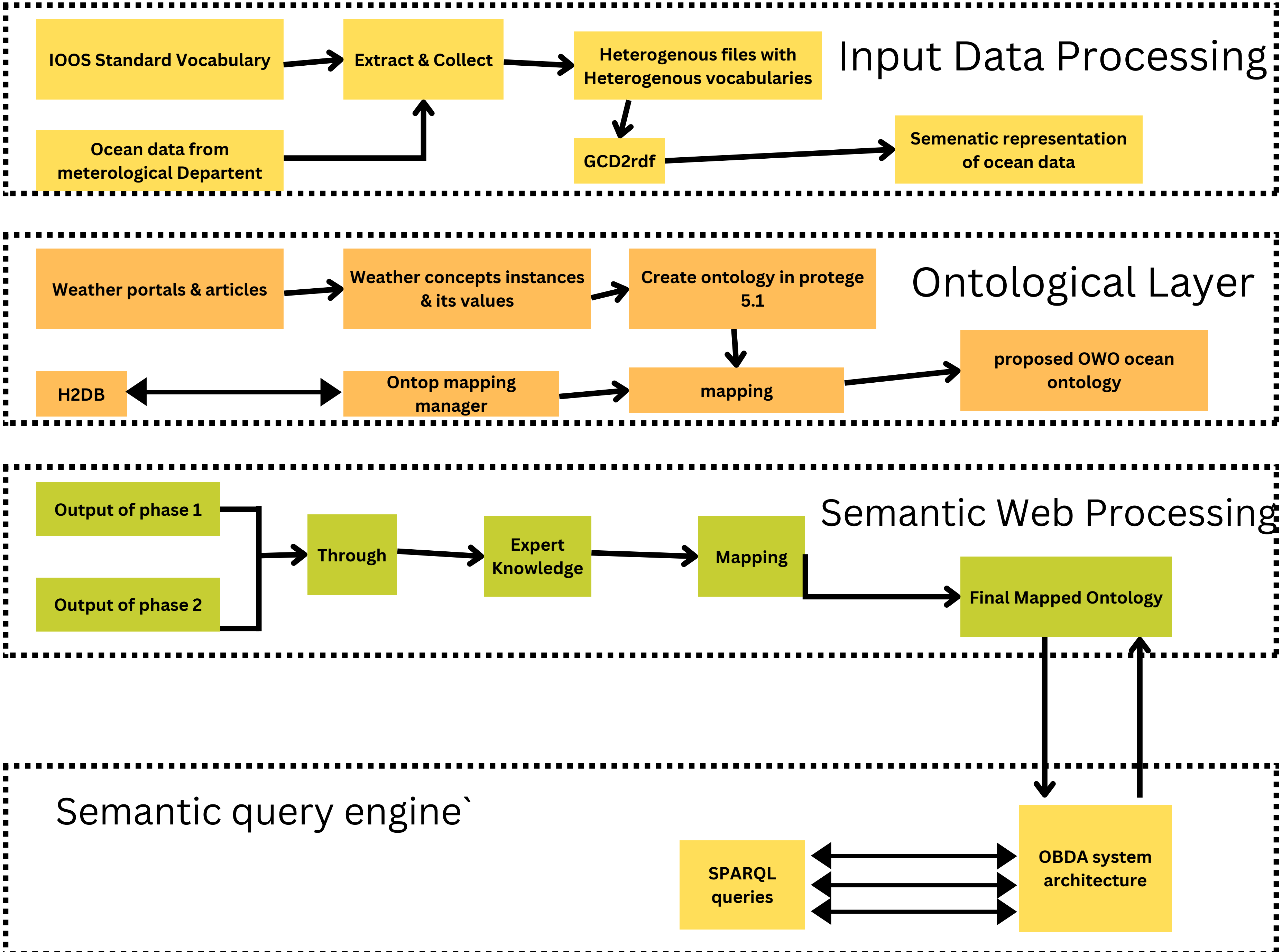
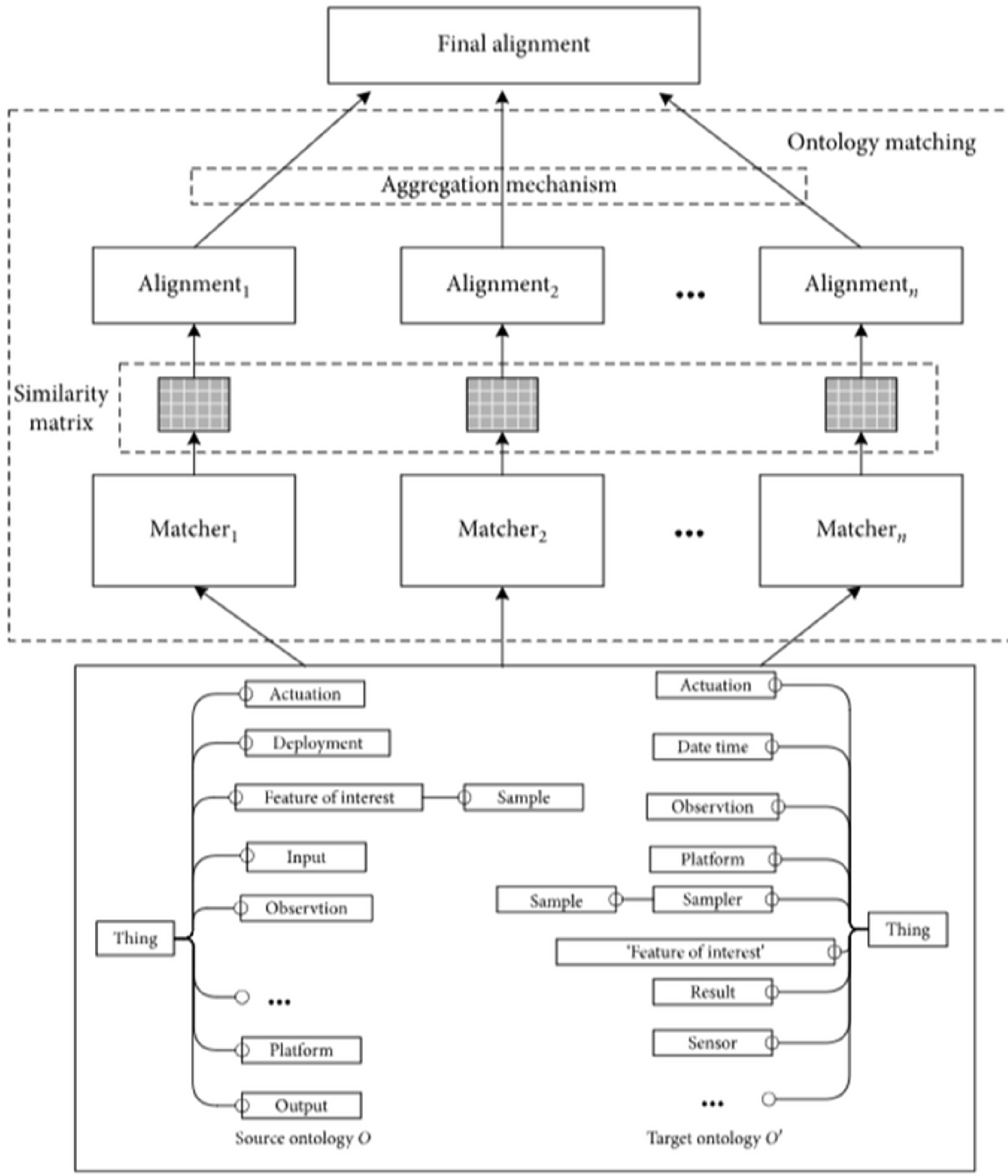

Input Data Processing
IOOS Standard Vocabulary
Extract & Collect
Heterogenous files with Heterogenous vocabularies
Ocean data from meterological Departent
GCD2rdf
Semenatic representation of ocean data
Ontological Layer
Weather portals & articles
Weather concepts instances & its values
Create ontology in protege 5.1
H2DB
Ontop mapping manager
mapping
proposed OWO ocean ontology
Semantic Web Processing
Output of phase 1
Output of phase 2
Through
Expert Knowledge
Mapping
Final Mapped Ontology
Semantic query engine`
SPARQL queries
OBDA system architecture

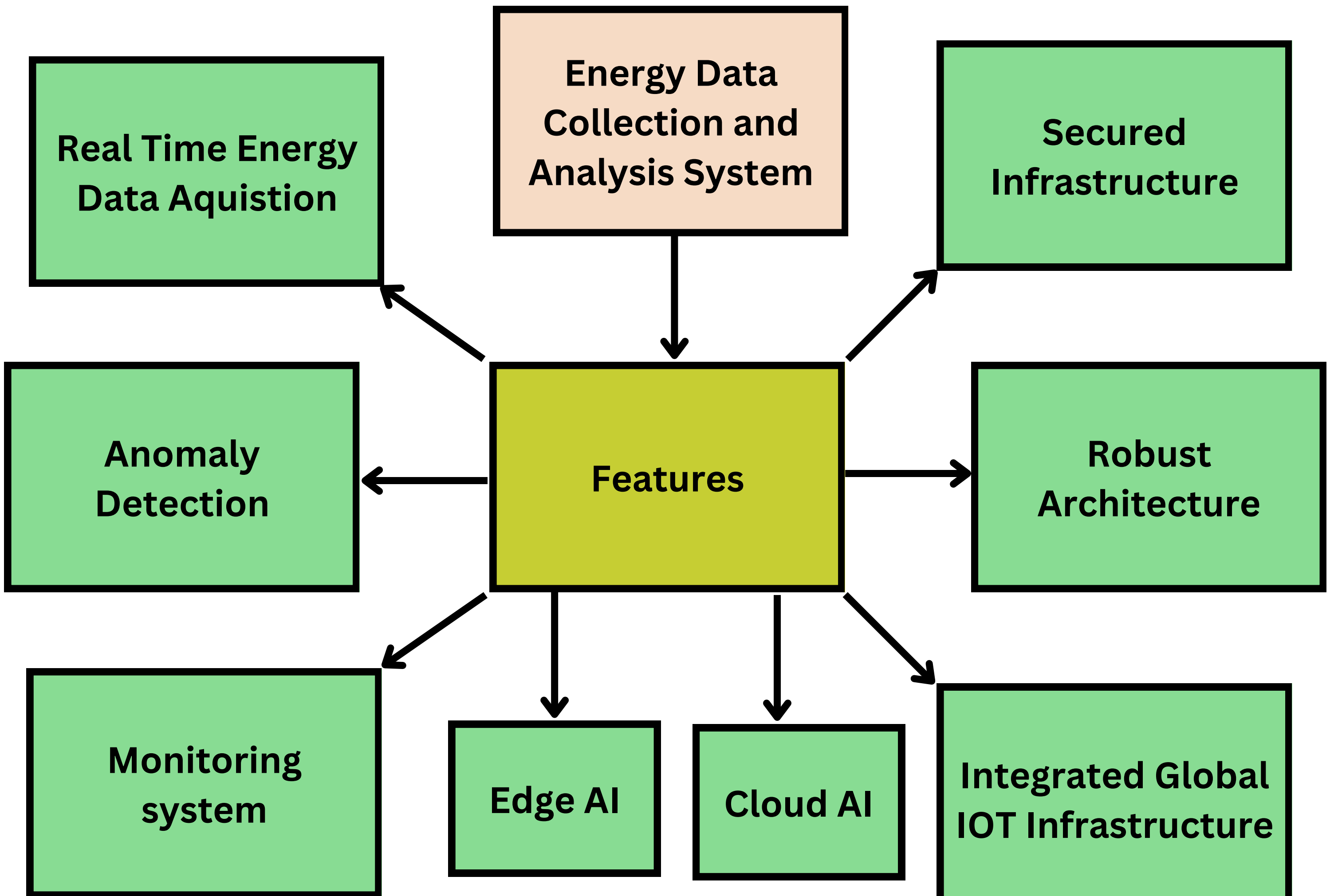
Figure 1

Framework of ontology alignment extraction.



Feature	Description
Real-time Energy Data Acquisition	The system continuously collects energy data from sensors deployed across various locations.
Anomaly Detection	The system utilizes advanced machine learning algorithms to identify anomalies in energy consumption patterns, indicating potential equipment malfunctions or security breaches.
Monitoring System	The system provides a comprehensive dashboard for visualizing energy consumption data, anomaly alerts, and system health metrics, enabling users to monitor the energy efficiency and security of their operations.
Secured Infrastructure	The system implements robust security measures to protect against cyberattacks and unauthorized access, safeguarding sensitive energy data and ensuring the integrity of the system.
Robust Architecture	The system is designed with redundancy and fault tolerance to ensure continuous operation even in the event of hardware or software failures.
Integrated Global IIoT Infrastructure	The system seamlessly integrates edge and cloud computing technologies to leverage the benefits of both distributed and centralized processing, enabling real-time data analysis and global reach.
Edge AI	Edge AI capabilities enable real-time anomaly detection and filtering of data at the edge, reducing network bandwidth requirements and improving response times.
Cloud AI	Cloud AI capabilities provide advanced analytics and machine learning capabilities for in-depth analysis of energy data and the identification of complex patterns and trends.

Export to Sheets


Energy Data Collection and Analysis System
Real Time Energy Data Aquistion
Secured Infrastructure
Anomaly Detection
Features
Robust Architecture
Monitoring system
Edge AI
Cloud AI
Integrated Global IOT Infrastructure

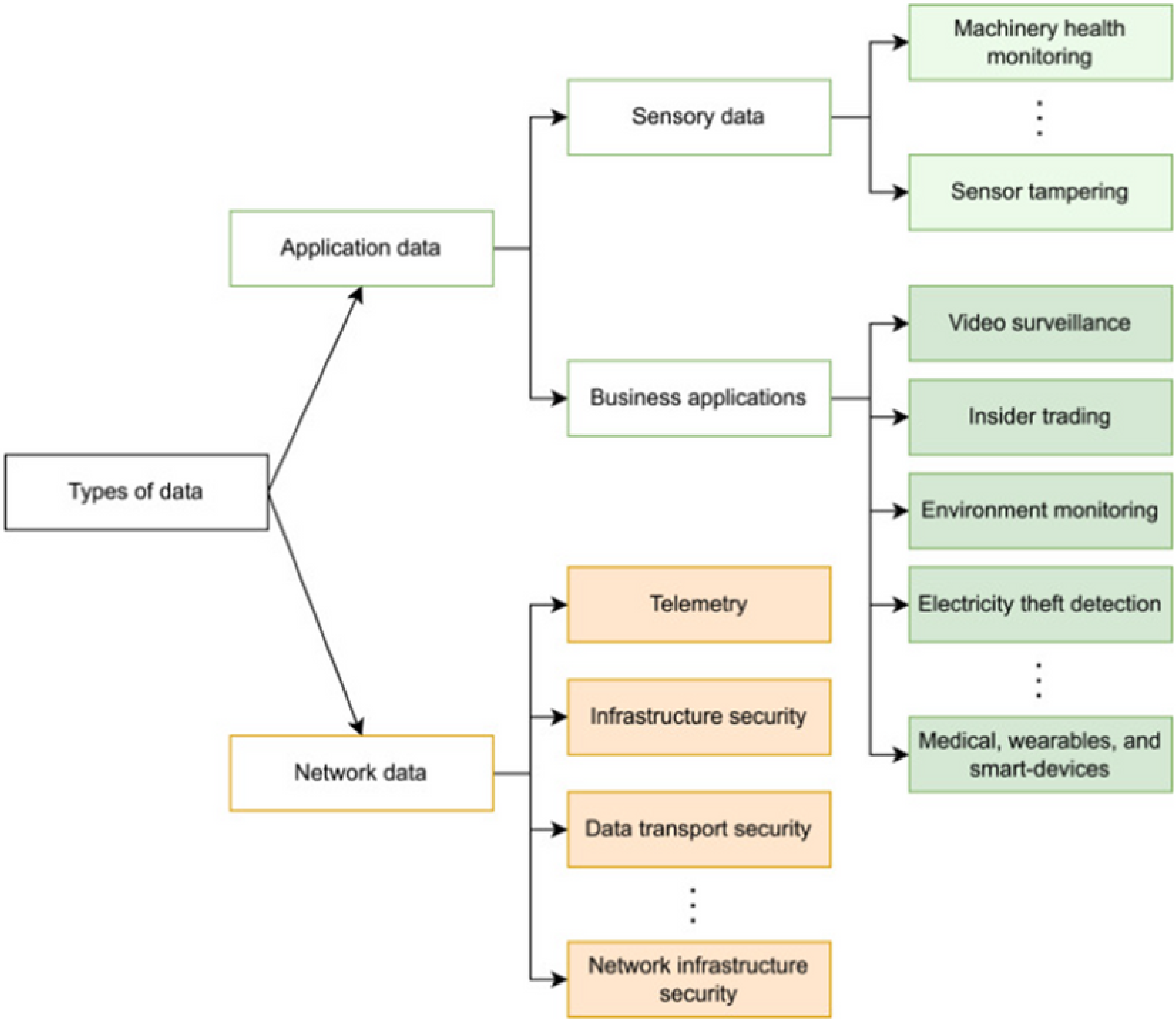
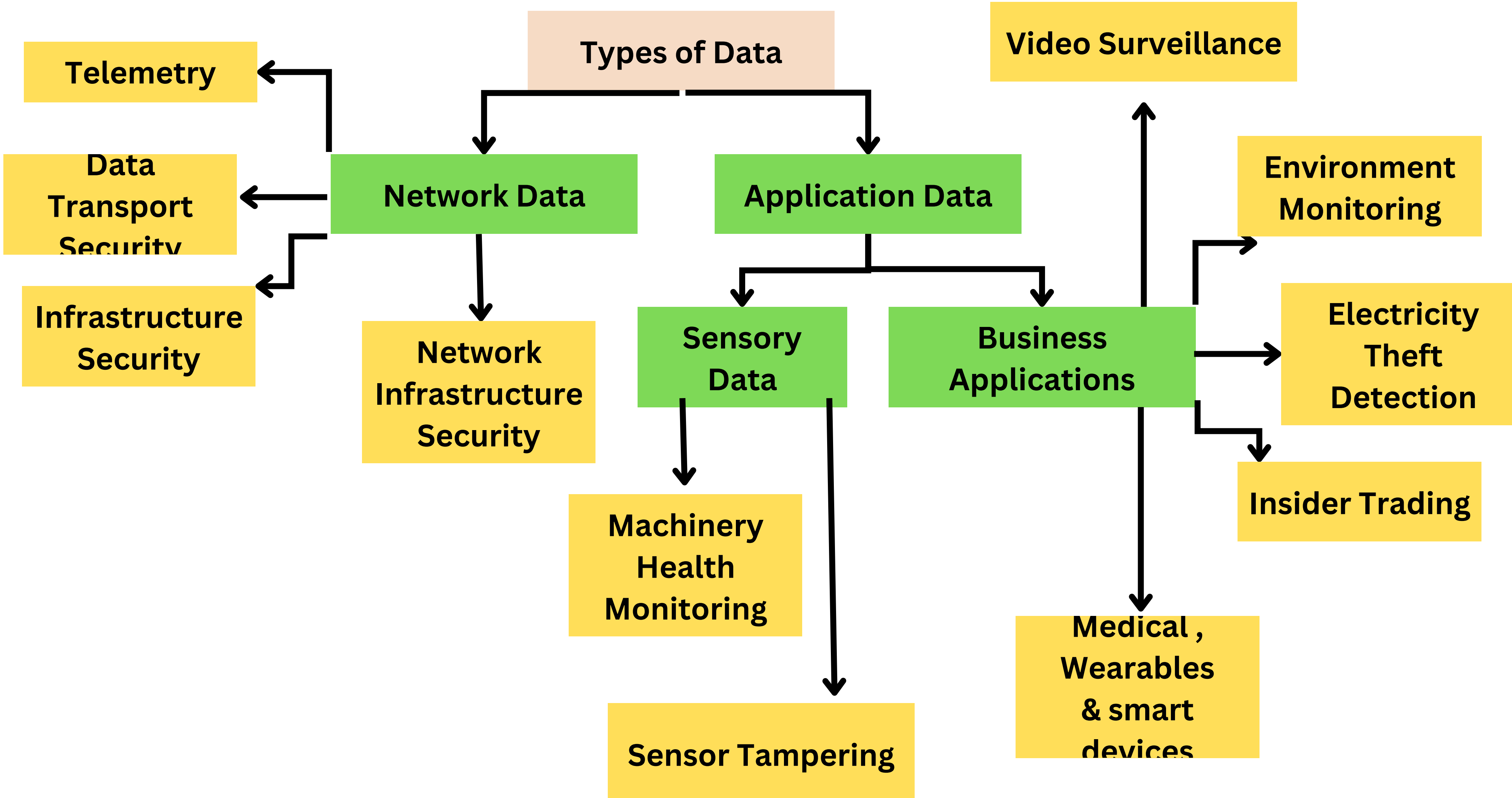
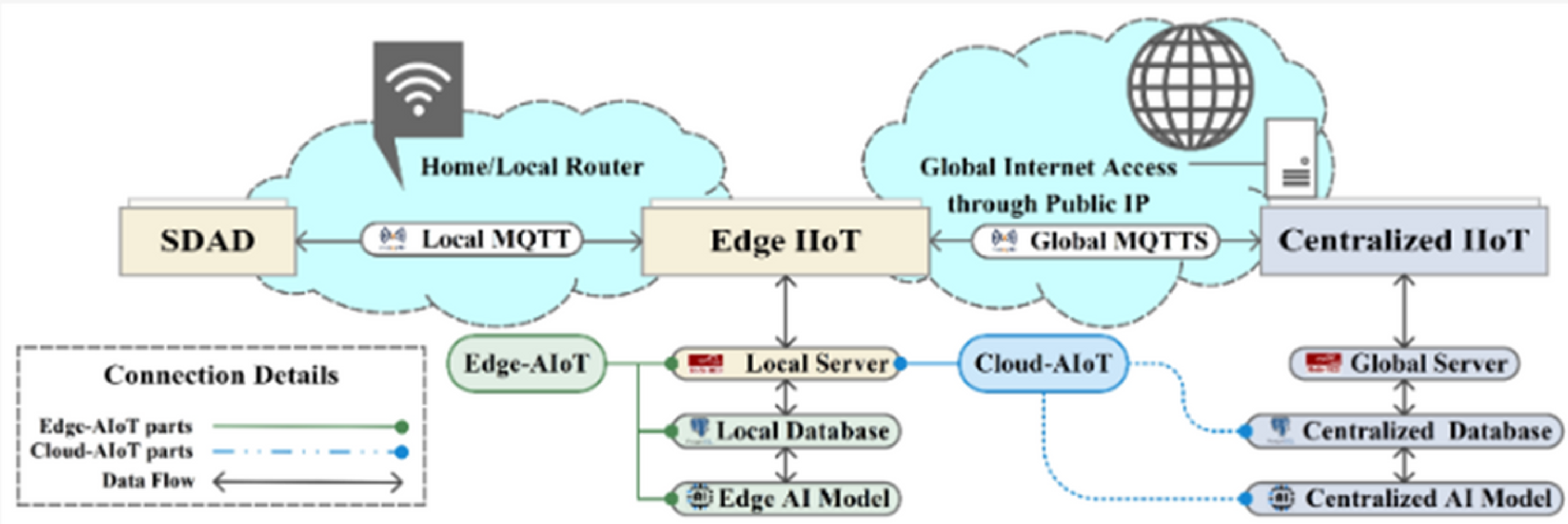


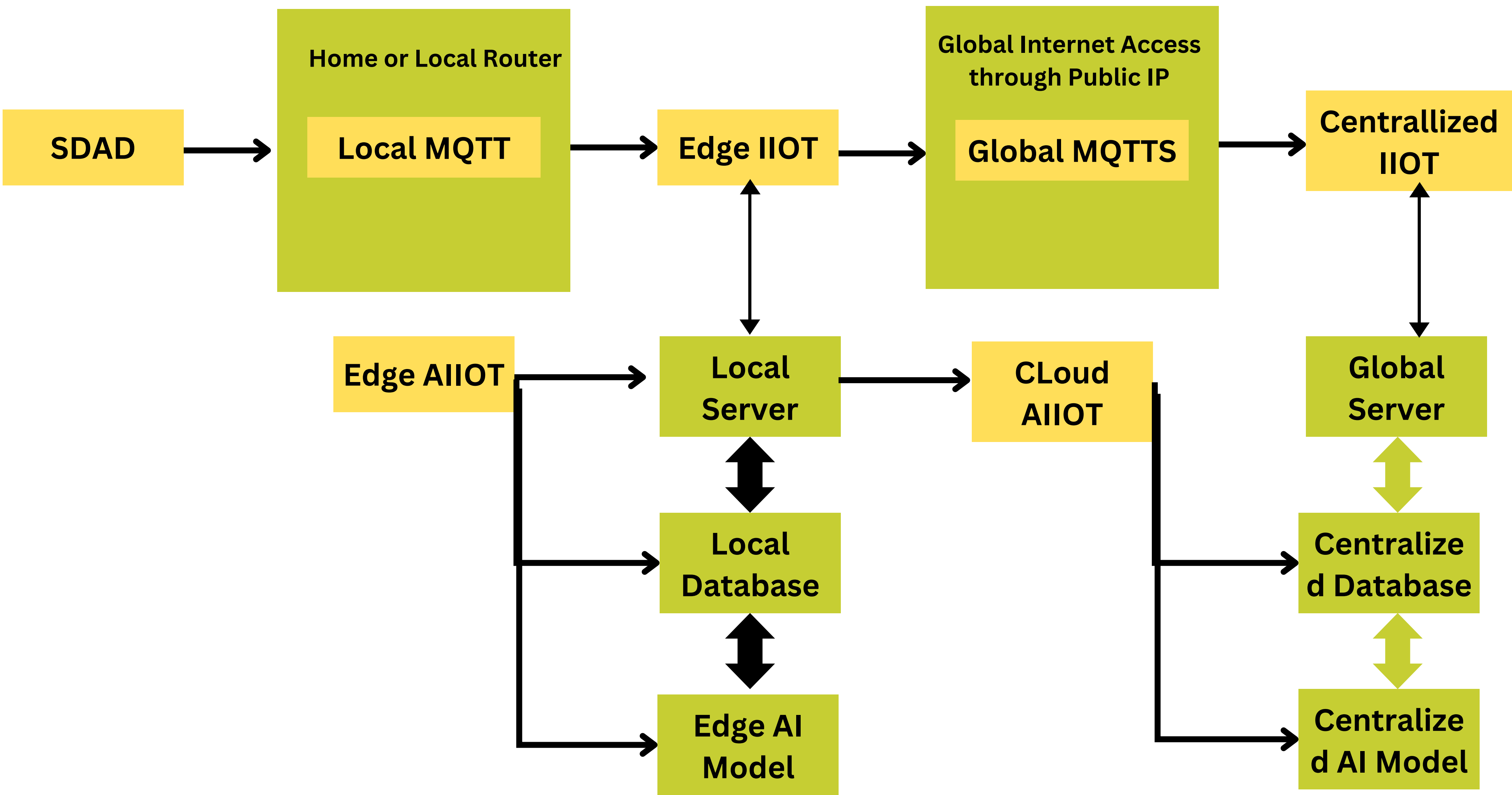
Fig. 5. The two types of data (network and application data) and their applications.



Types of Data
Network Data
Application Data
Telemetry
Data Transport Security
Infrastructure Security
Network Infrastructure Security
Sensory Data
Business Applications
Machinery Health Monitoring
Sensor Tampering
Video Surveillance
Environment Monitoring
Electricity Theft Detection
Insider Trading
Medical , Wearables & smart devices

Figure 2. Proposed IIoT infrastructure.




SDAD
Home or Local Router
Local MQTT
Edge IIOT
Global Internet Access
through Public IP
Global MQTTS
Centrallized
IIOT
Edge AIIOT
Local
Server
CLoud
AIIOT
Global
Server
Local
Database
Centralize
d Database
Edge AI
Model
Centralize
d AI Model

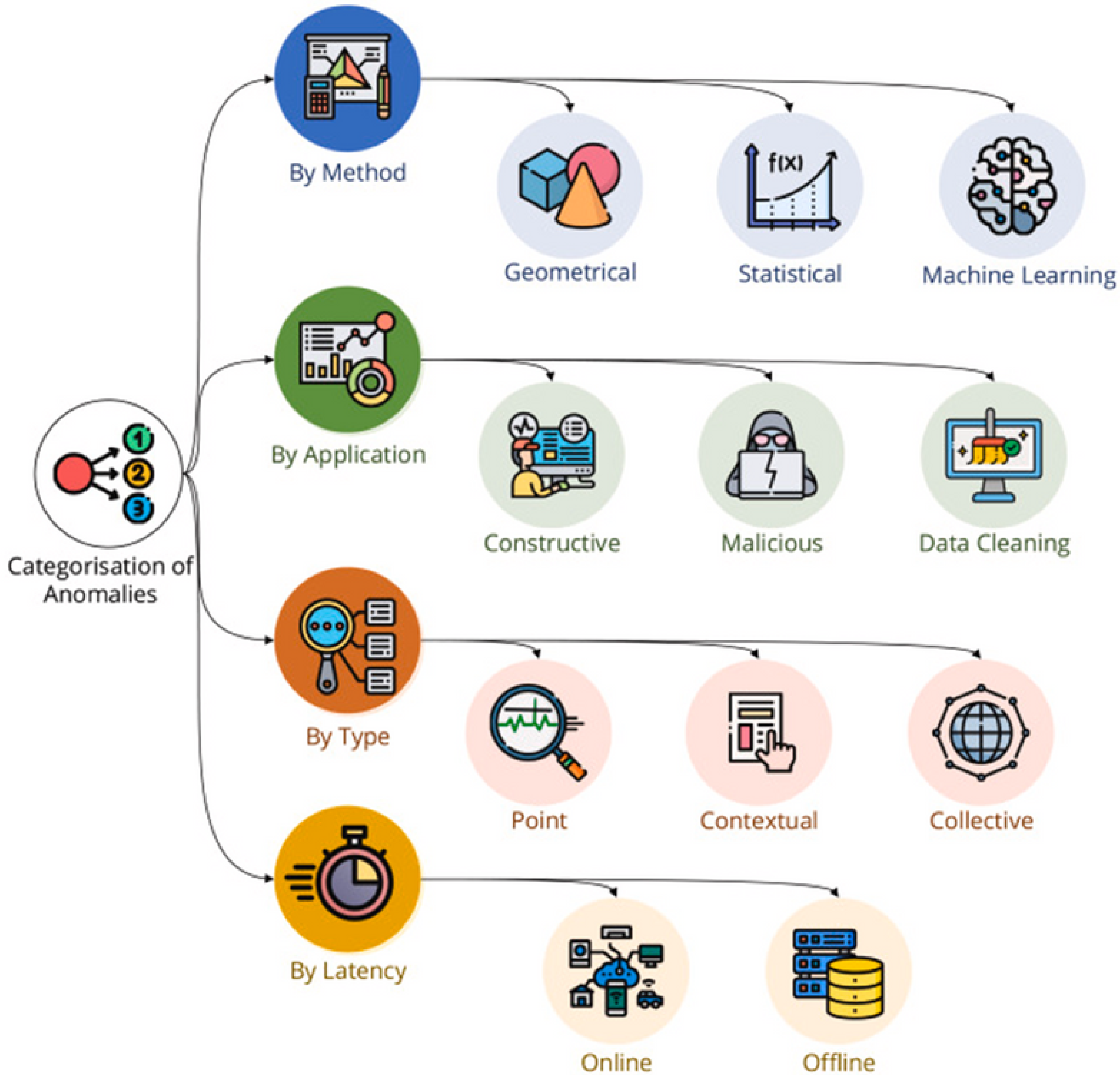
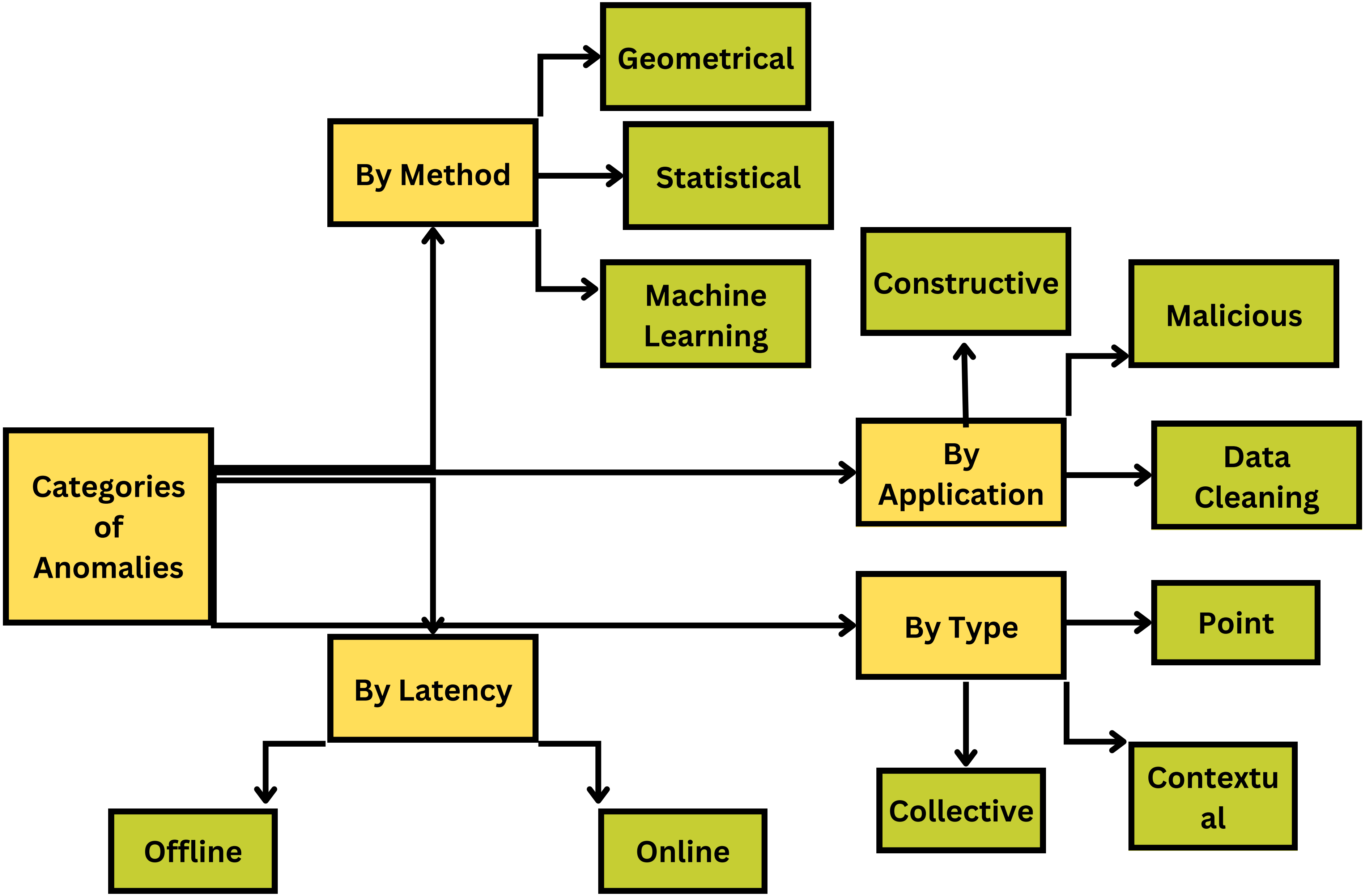
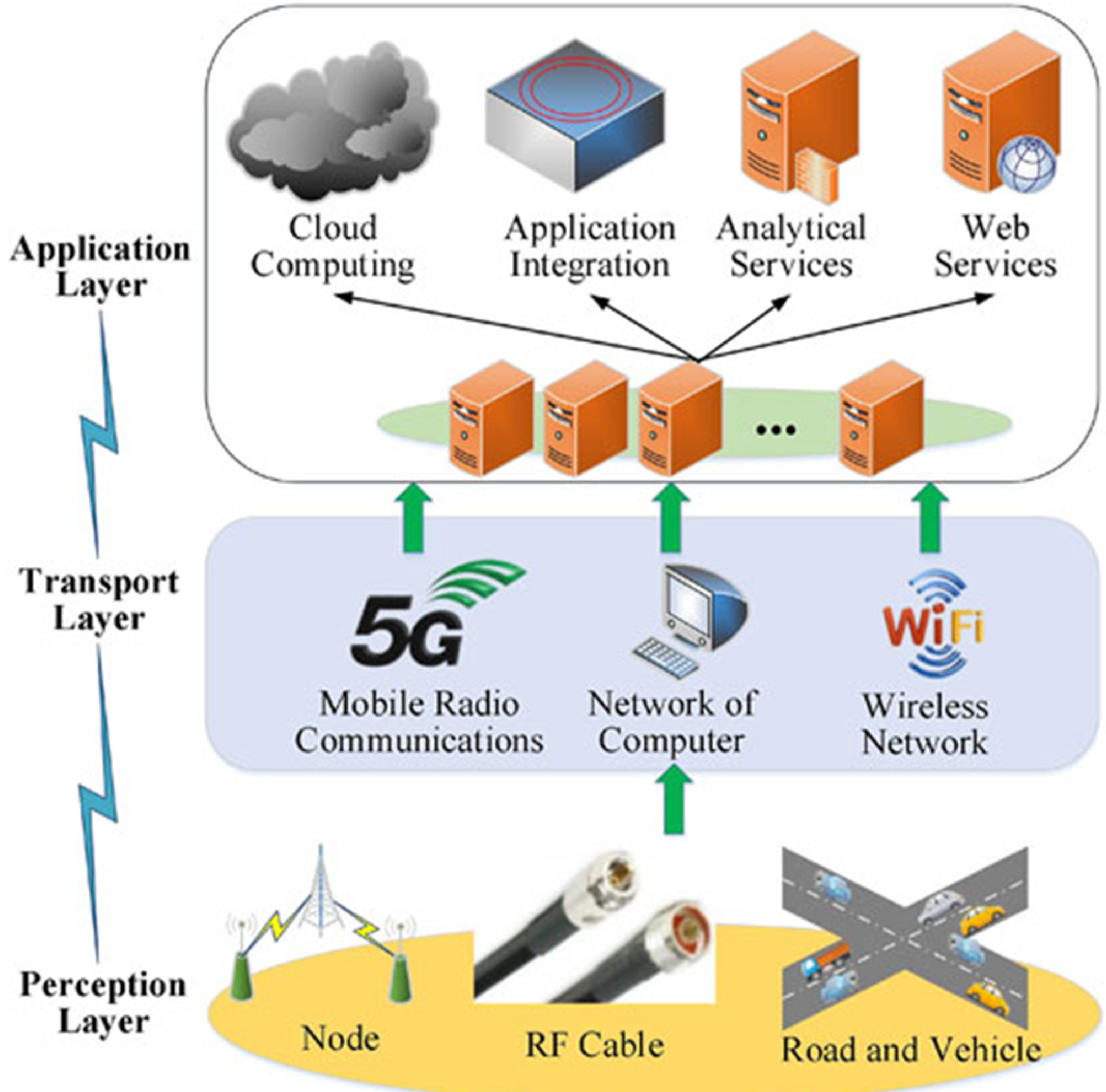
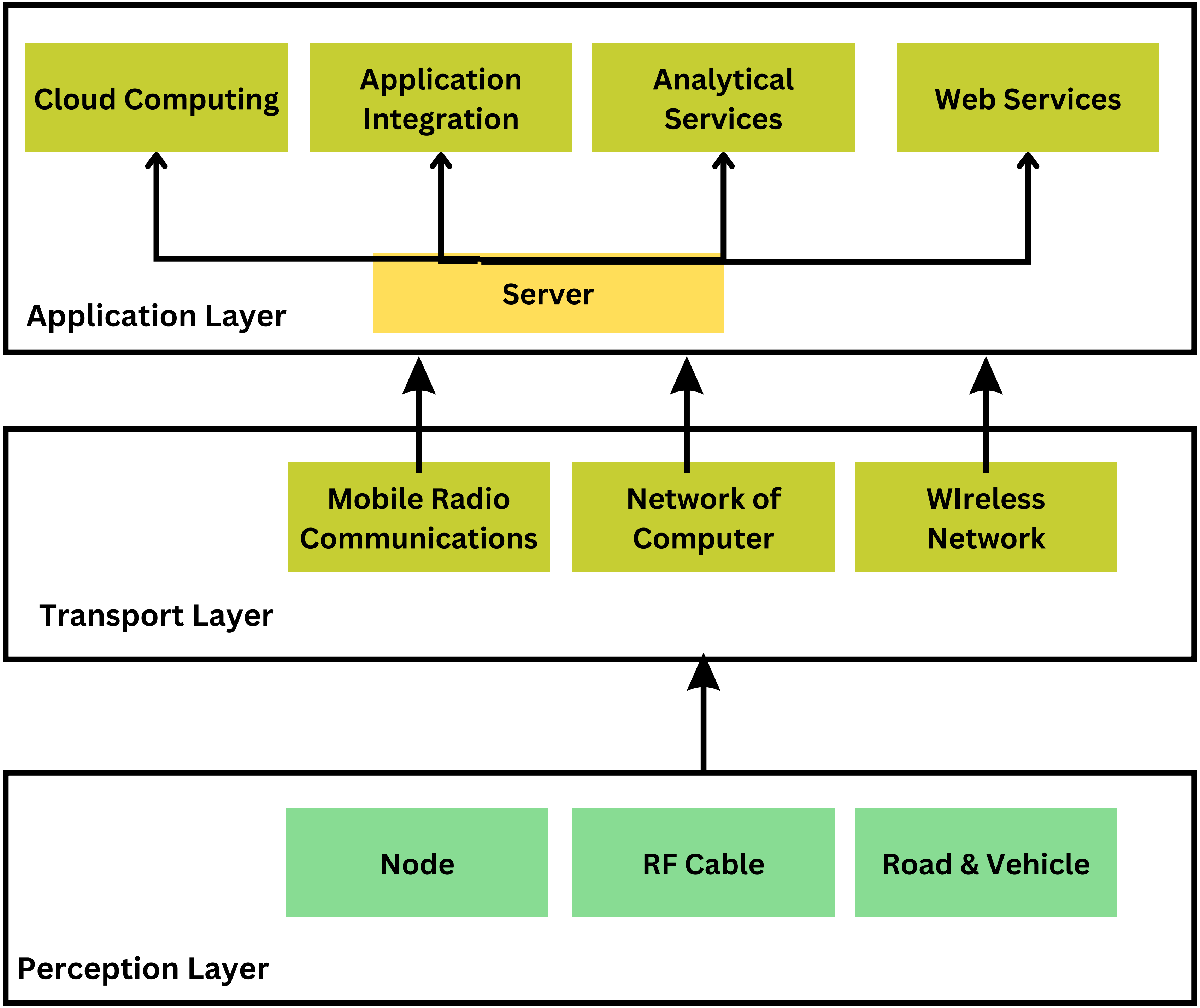


Fig. 2. An info-graphic overview of the categorization of anomalies.


Geometrical
By Method
Statistical
Machine Learning
Constructive
Malicious
Categories of Anomalies
By Application
Data Cleaning
By Type
Point
By Latency
Offline
Online
Collective
Contextu al


Application Layer
Cloud Computing
Application Integration
Analytical Services
Web Services
Transport Layer
5G
Mobile Radio Communications
Network of Computer
WiFi
Wireless Network
Perception Layer
Node
RF Cable
Road and Vehicle


Cloud Computing
Application Integration
Analytical Services
Web Services
Server
Application Layer
Mobile Radio Communications
Network of Computer
WIreless Network
Transport Layer
Node
RF Cable
Road & Vehicle
Perception Layer

Feature	Description	Latency Improvement	Energy Consumption	Scalability	Flexibility	Fault Tolerance
Multi-Layer Latency-Aware Workload Assignment	A novel strategy for assigning workload to cloudlets in mobile sensor cloudlet cloud networks that considers multiple sources of latency, including communication delay, round-trip delay, and migration delay.	Significant reduction in average response time	Moderate increase	High	High	Medium
Traditional Workload Assignment	Simpler strategies that do not consider multiple sources of latency or adapt to real-time network conditions.	Lower latency improvement	Lower energy consumption	Medium	Low	Low
No Workload Assignment	All workload is processed in a centralized cloud, resulting in high latency.	No latency improvement	Lowest energy consumption	Low	Low	Low

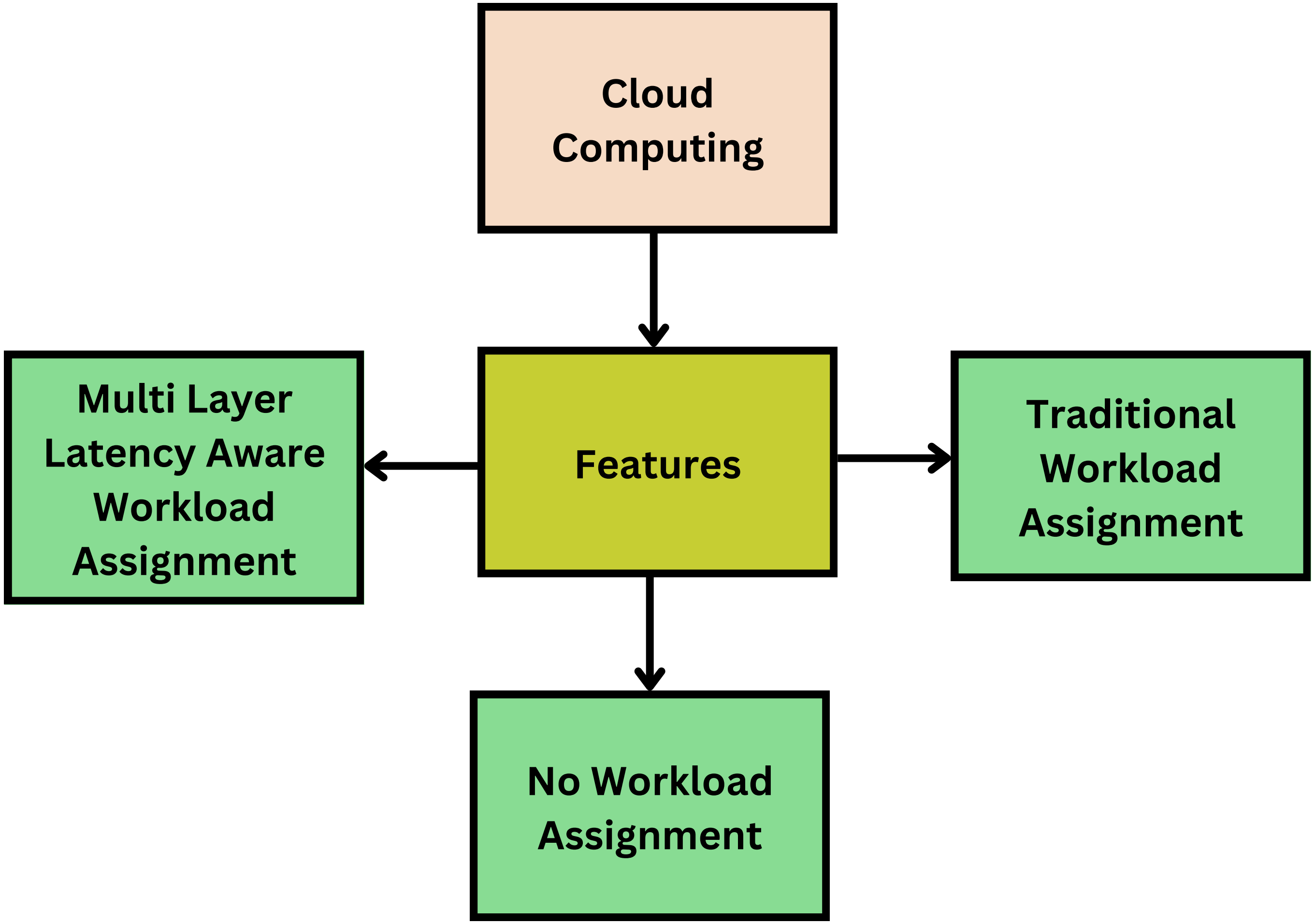
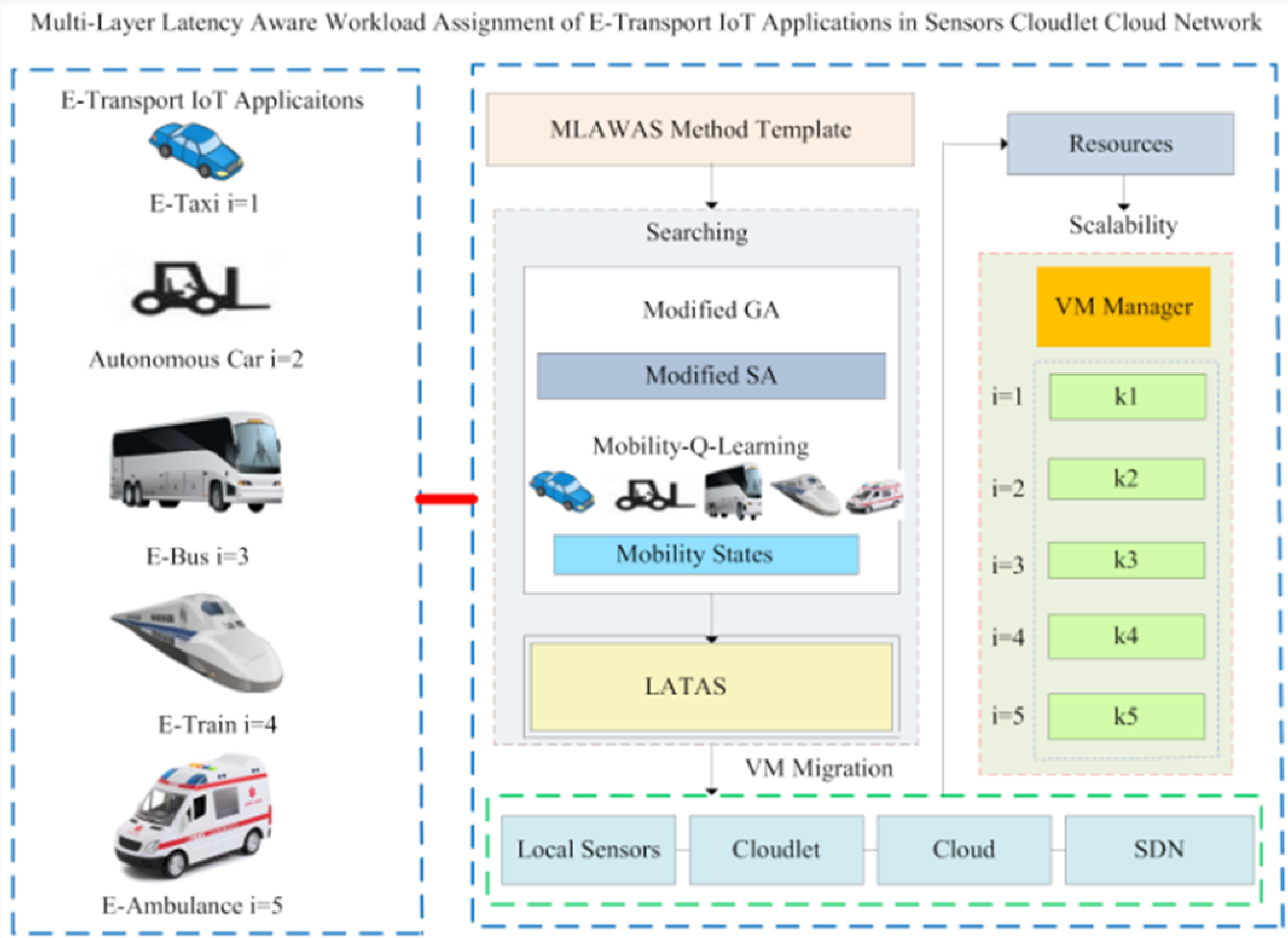
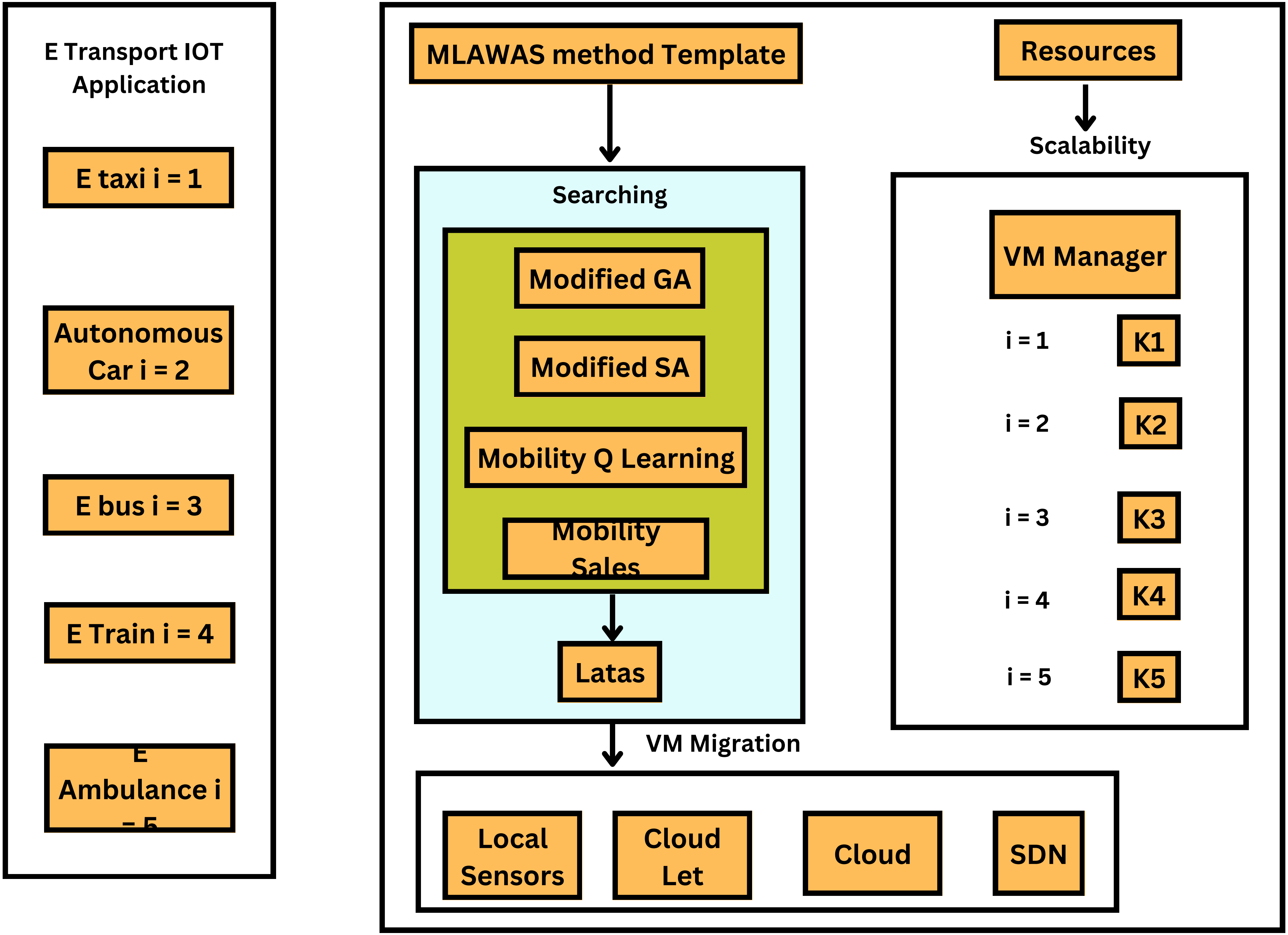
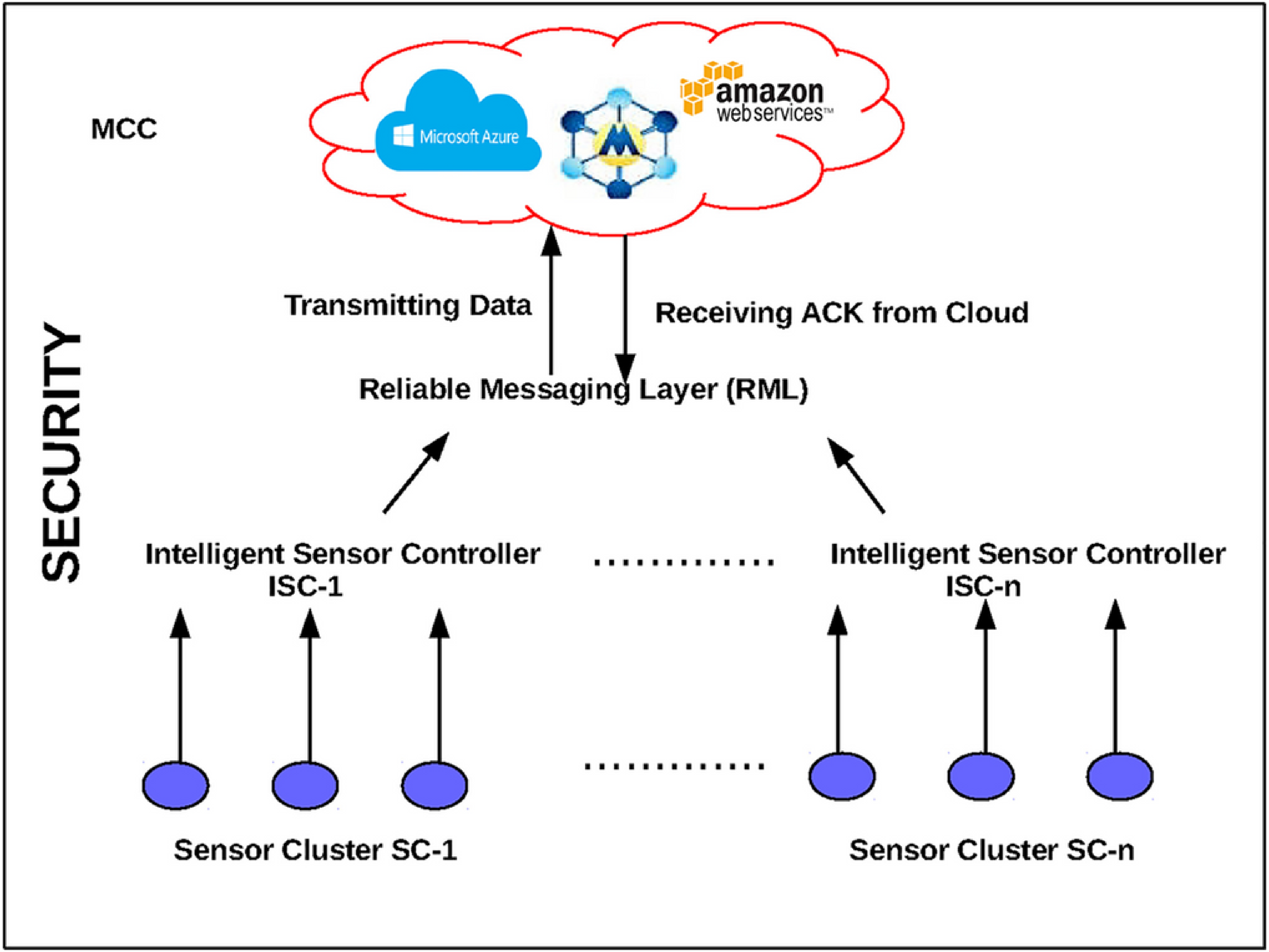

Cloud
Computing
Multi Layer
Latency Aware
Workload
Assignment
Features
Traditional
Workload
Assignment
No Workload
Assignment

Figure 1. IoT E-Transport System.




E Transport IOT Application
E taxi i = 1
Autonomous Car i = 2
E bus i = 3
E Train i = 4
E Ambulance i = 5
MLAWAS method Template
Searching
Modified GA
Modified SA
Mobility Q Learning
Mobility Sales
Latas
VM Migration
Local Sensors
Cloud Let
Cloud
SDN
Resources
Scalability
VM Manager
i = 1
K1
i = 2
K2
i = 3
K3
i = 4
K4
i = 5
K5


MCC
Microsoft Azure
amazon web services™
Transmitting Data
Receiving ACK from Cloud
Reliable Messaging Layer (RML)
SECURITY
Intelligent Sensor Controller ISC-1
Intelligent Sensor Controller ISC-n
Sensor Cluster SC-1
Sensor Cluster SC-n

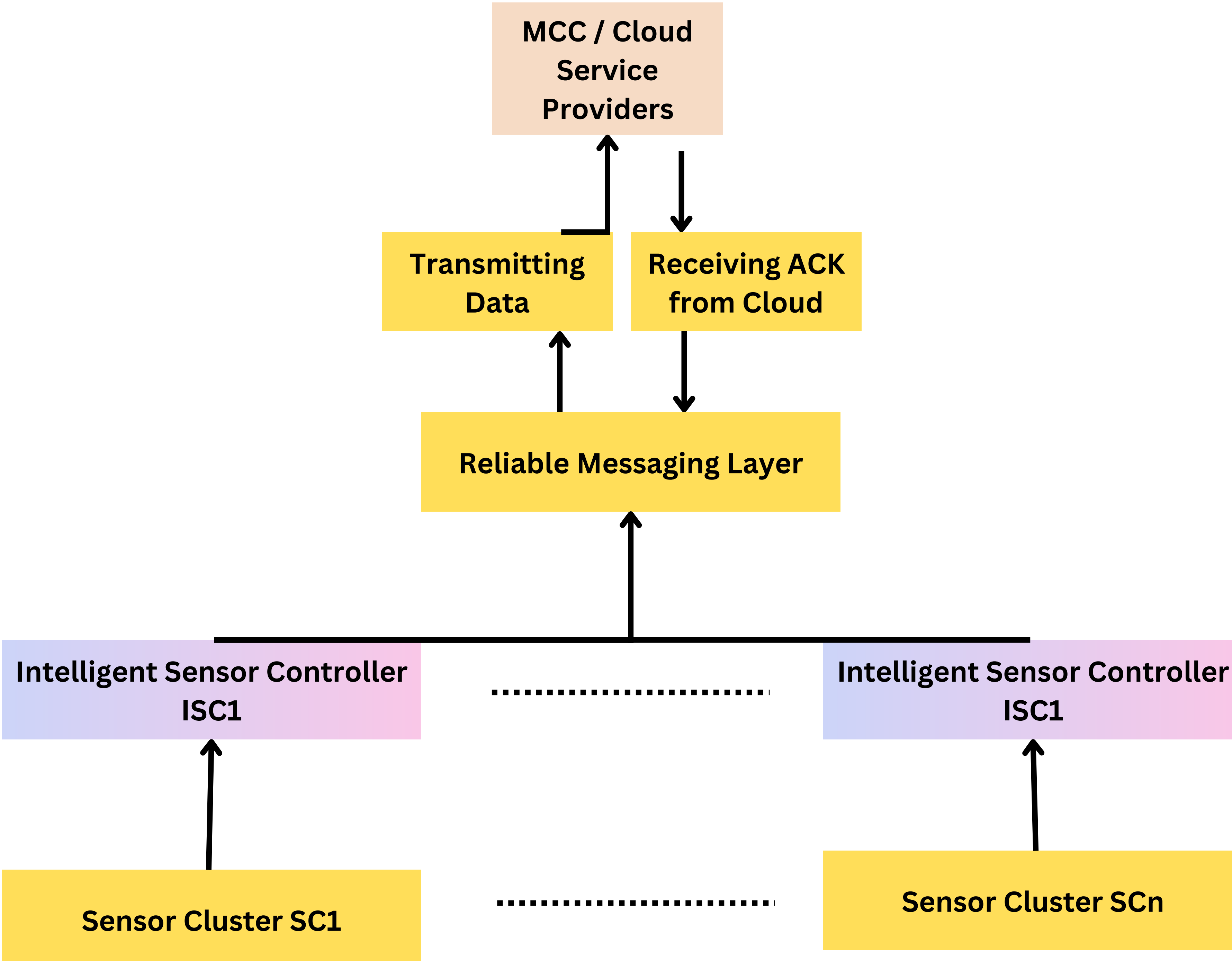
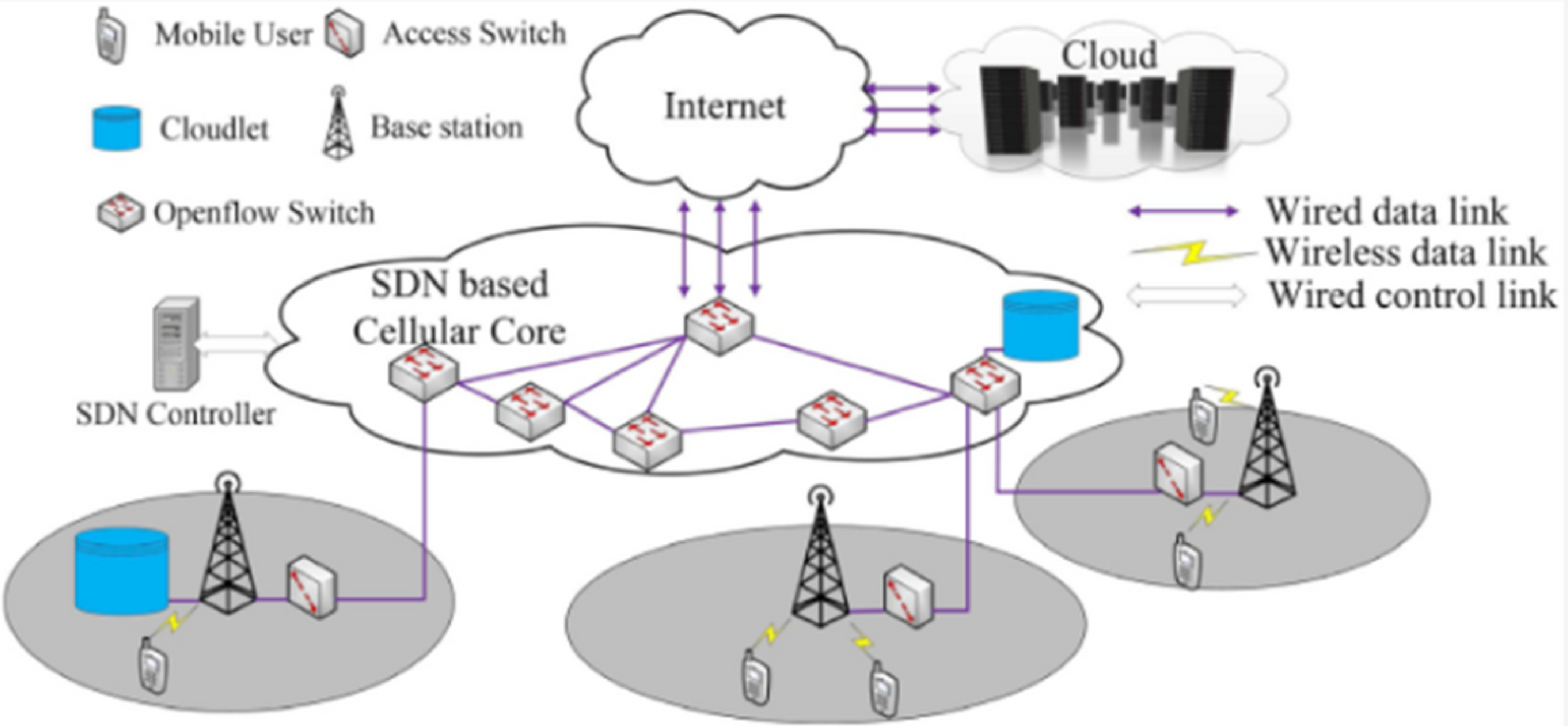

MCC / Cloud Service Providers
Transmitting Data
Receiving ACK from Cloud
Reliable Messaging Layer
Intelligent Sensor Controller ISC1
Intelligent Sensor Controller ISC1
Sensor Cluster SC1
Sensor Cluster SCn

Figure 3. SDN Based Mobile Sensors Cloudlet Cloud Network Scenario.



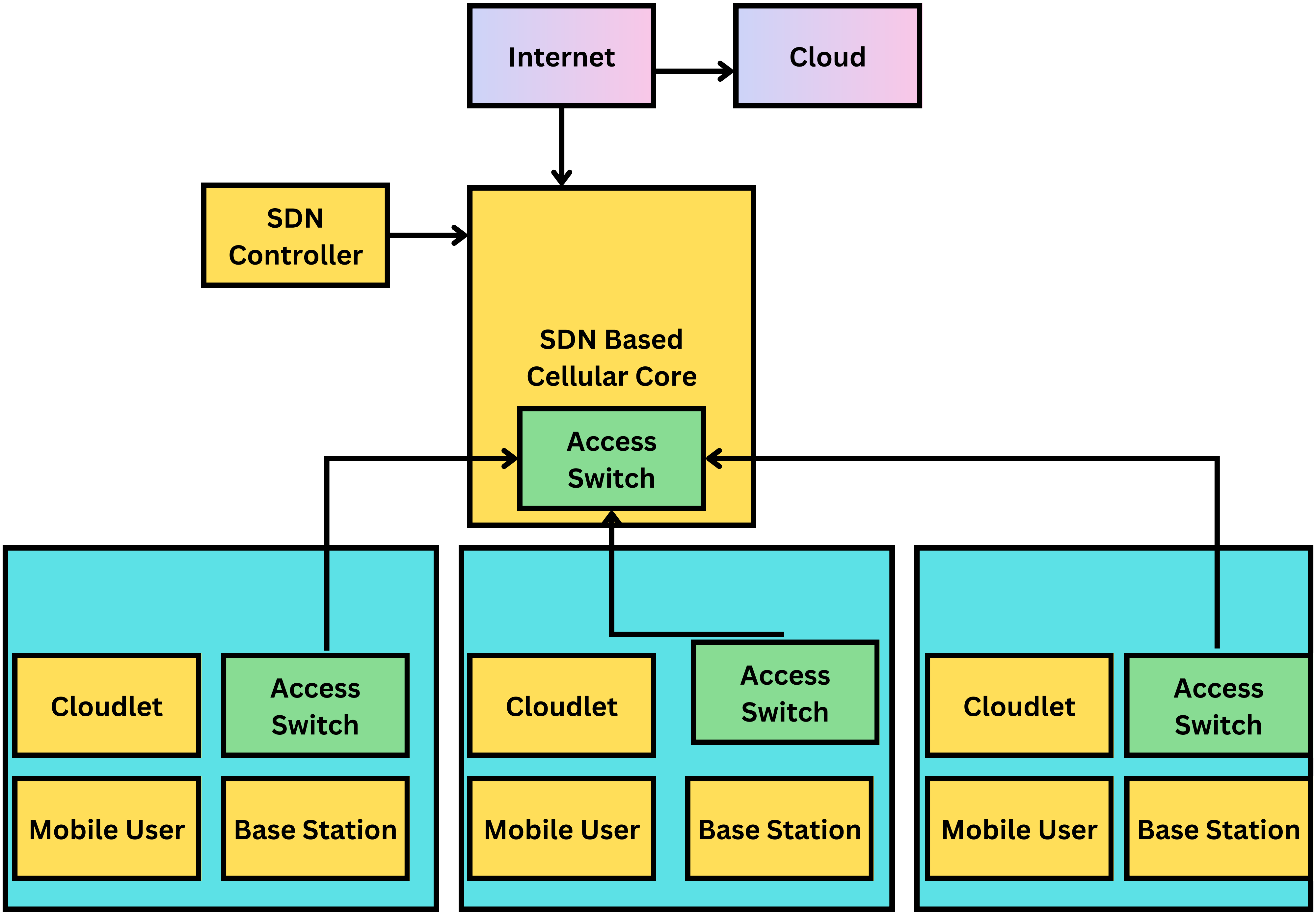

Internet
Cloud
SDN
Controller
SDN Based
Cellular Core
Access
Switch
Cloudlet
Access
Switch
Mobile User
Base Station
Cloudlet
Access
Switch
Mobile User
Base Station
Cloudlet
Access
Switch
Mobile User
Base Station

Figure 2. Proposed Multi-Latency Aware Offloading System Based on MLAWAS Framework.