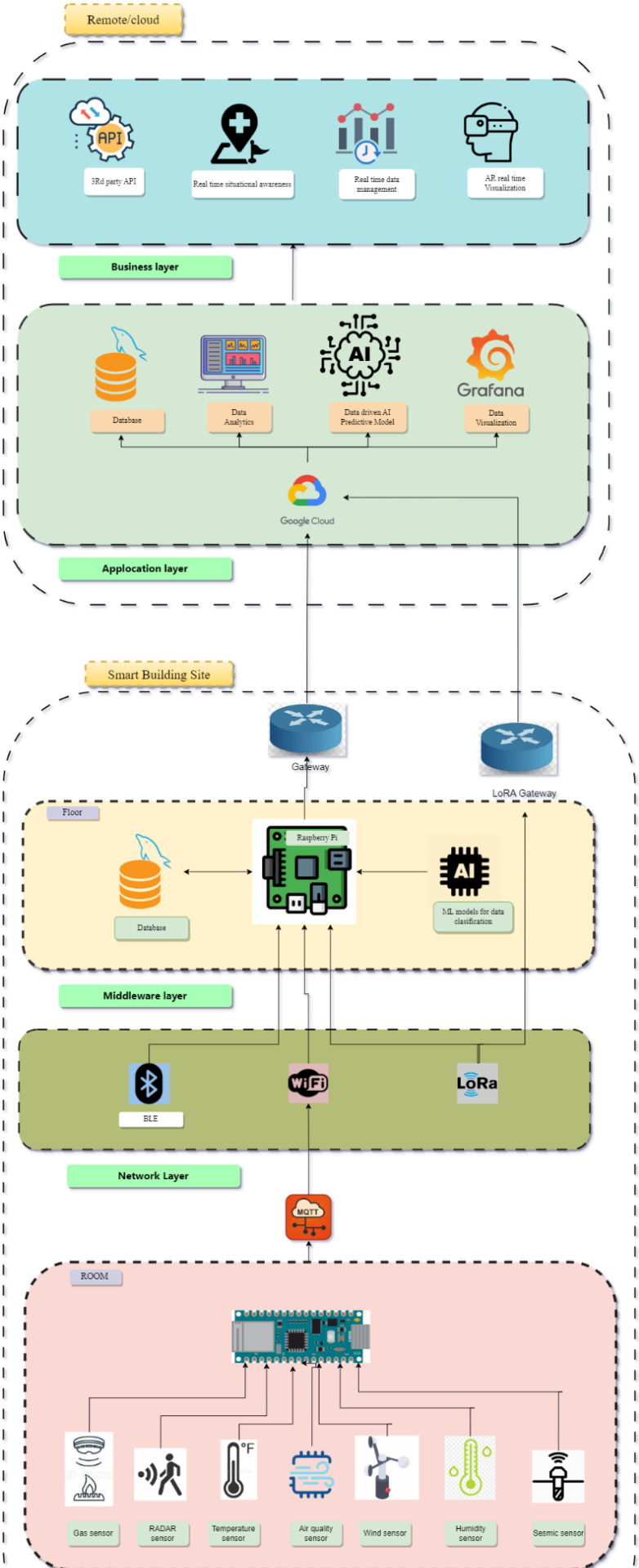
Five Layer Architecture

The overall system architecture consists of a 5-layer model. The perception layer incorporates various sensors such as flame, gas, humidity and temperature sensors, and an accelerometer and gyroscope for detecting seismic activities.

The network layer facilitates connectivity between the Arduino Nano 33 IoT and a Raspberry Pi. This connection is established over the same network using Wi-Fi and the MQTT protocol. Additionally, the Arduino utilizes Bluetooth Low Energy (BLE) and LoRa communication protocols to communicate with the Raspberry Pi. LoRa communication is specifically used during power shortages or when the Raspberry Pi is offline, allowing the Arduino to send data directly to a LoRa gateway. Data collected from the sensors is stored in a MySQL database. Machine learning models are employed for anomaly detection and classification of sensor data. Through queuing mechanisms, the data is further queried and sent to the Google Cloud Platform for additional analysis and visualization using Grafana.

The inferred data, obtained from the analysis and classification, is used for third-party APIs, and provides valuable information for augmented reality (AR) services during rescue operations in a disaster. This enables first responders to visualize hazard zones, locate individuals, and determine the shortest escape paths, aiding in efficient and effective rescue operations.


Remote/cloud
API
3Rd party API
Real time situational awareness
Real time data management
AR real time Visualization
Business layer
Database
Data Analytics
AI
Data driven AI Predictive Model
Grafana
Data Visualization
Google Cloud
Applocation layer
Smart Building Site
Gateway
LoRA Gateway
Floor
Raspberry Pi
Database
AI
ML models for data clasification
Middleware layer
BLE
WiFi
LoRa
Network Layer
MQTT
ROOM
Gas sensor
RADAR sensor
°F
Temperature sensor
Air quality sensor
Wind sensor
Humidity sensor
Sesmic sensor