UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Smart city: Smart Parking

Henrique Saccani
Matricola 130143

Inteligent internet of things
20/21

UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

IOT Smart Parking

- User Case Presentation
- Communication
- MQTT Design Overview
- Data Modelling
- Library Suport

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

User Case -Smart Parking

The user case of this application is to create a Smart parking with useful resources:

- Calculate the average parking time of a parking lot
- Share information about each parking spot and if they are occupied or free
- Control a led that change its colour depending if there is or not a car in the parking spot
- Control the availability of each parking spot

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

User Case -Smart Parking

Each parking is equipped with :

- presence sensor
  - In this project were emulated two presence Sensor producers, Philips and Bash, that send different types of messages, boolean and int(0-1)

- tri-colour led
  - red - occupied, green - free and yellow - unavailable

UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

User Case -Smart Parking

Each parking spot have:

- unique parking spot code inside a parking lot
- parking lot code shared by all the parking spots in the same lot
- Gps cordinates

Inside a parking lot there will be a Data Collector and Manager who will:

- receive all data generated from the parking slots
- Calculate the average parking time of a parking lot
- Share information about each parking spot and if they are occupied or free
- Control the availability of each parking spot

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Communication

The idealized communication technology to be used is the Lora/LoraWan technology:

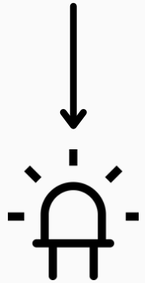
- low sensor energy utilization and wide coverage area
- Low bandwidth makes it ideal for practical IoT deployments with less data and with data transmissions which aren’t constant
- Fully bi-directional communication

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

MQTT Design Overview

Presence sensor

Smart Parking Object



Tri-state led

BASIC TOPIC + lot id+ PARKING TOPIC + parking id+ PRESENCE SENSOR TOPIC

BASIC TOPIC + lot id + PARKING TOPIC + parking id + LED_COLOR_TOPIC

BASIC TOPIC + lot id + PARKING TOPIC + parking id+ AVAILABILITY TOPIC

BASIC TOPIC + lot id + PARKING TOPIC + REGISTER_TOPIC

Mqtt Broker

BASIC TOPIC + lot id + #

BASIC TOPIC + lot id + PARKING TOPIC + parking id+ AVAILABILITY TOPIC

Data collector And Manager

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

MQTT Design Overview

Data collector And Manager

Persistence message

BASIC TOPIC + lot id + PARKING TOPIC + INFORMATION_TOPIC

BASIC TOPIC + lot id + PARKING TOPIC + CONTROL AVAILABILITY TOPIC

Mqtt Broker

GPS location of parking spots

Information about the state (free or occupied) of each parking spot

Parking spots ids

BASIC TOPIC + lot id +PARKING TOPIC + CONTROL AVAILABILITY TOPIC

External Server

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Data modelling resources

Generic Resource

field	type
type	String
id	String

Generic int Presence Sensor Resource

field	type
car presence	int

Generic boolean Presence Sensor Resource

field	type
car presence	boolean

Presence Sensor Resource Bash

field	type
car presence	int

Presence Sensor Resource Philips

field	type
car presence	boolean

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Data modelling: resources

Generic led

field	type
on	boolean
possibleColors	ArrayList <String>
actualColor	String

Parking Led

field	type
possibleColors	("red,green,yellow")

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Data modelling: descriptors

Availability Control Descriptor

field	type
unavailable	boolean
parking Id	String

Gps Descriptor

field	type
latitude	float
longitude	float
high	float

Parking Descriptor

field	type
lotId	String
Parking Id	String
gpsDescriptor	GpsDescriptor

Parking Lot Information Descriptor

field	type
averageParkingTimeInMilli	long
freeParkingSpots	ArrayList<String>
totalParkingSpots	HashMap<String, ParkingDescriptor>

Parking Time Descriptor

field	type
topic	String
timestamp	long
ledColor	String

UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Library Support

Mqtt Java:

- Paho

Json:

- Jackson