ISCTE IUL

Instituto Universitário de Lisboa

IoT Experiment

Plane detector using *The Things Network and LoRaWAN*

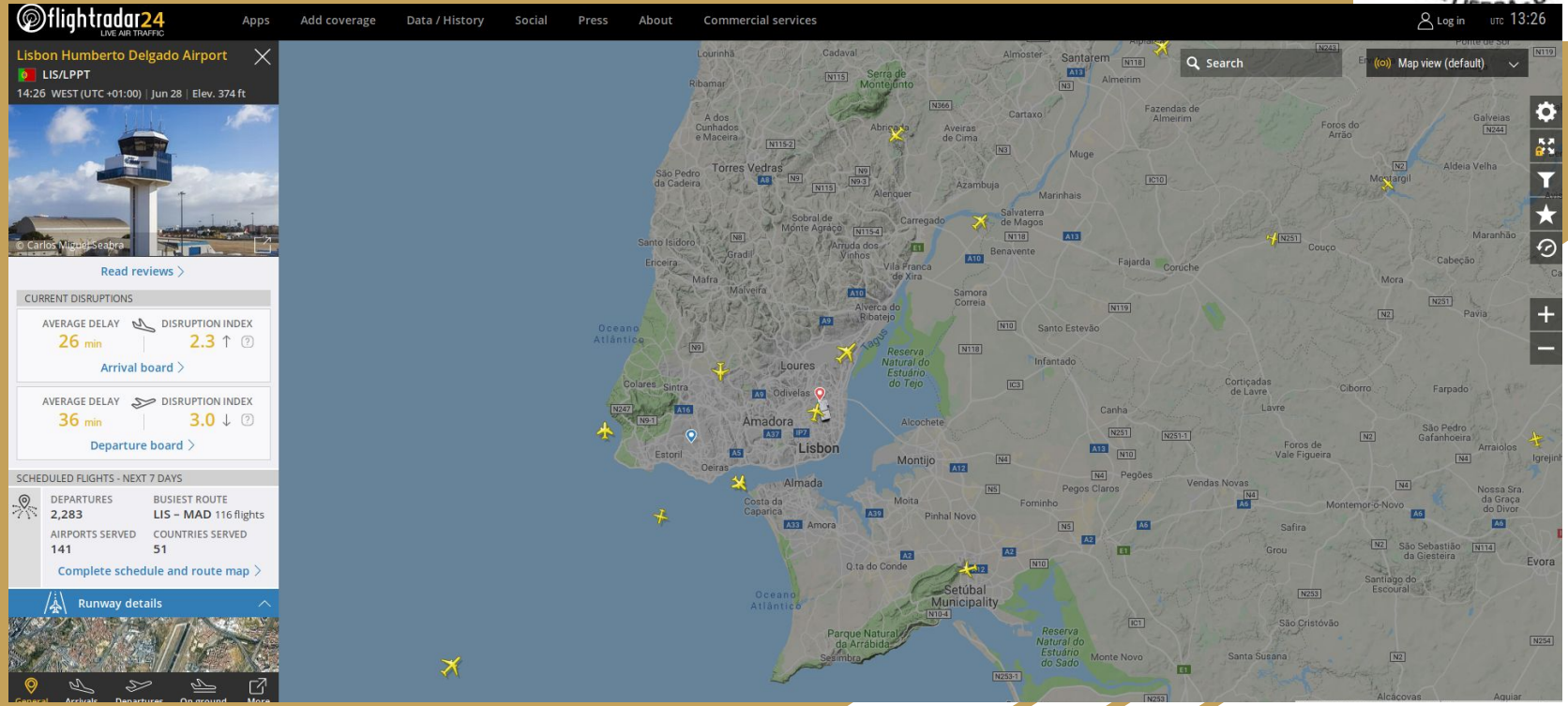
Plan:

- Goals of the experiment
- Description of the experiment
- Results
- Problems and critics

Goal

Detect planes to calculate the traffic over the university. ISCTE-IUL is located next to the Lisboa airport, so there is a huge amount of **noise pollution** caused by regular flights.

Goal


flightradar24
LIVE AIR TRAFFIC
Apps
Add coverage
Data / History
Social
Press
About
Commercial services
Log in
UTC 13:26
Lisbon Humberto Delgado Airport
LIS/LPPT
14:26 WEST (UTC +01:00) | Jun 28 | Elev. 374 ft
© Carlos Miguel Seabra
Read reviews
CURRENT DISRUPTIONS
AVERAGE DELAY
26 min
DISRUPTION INDEX
2.3
Arrival board
AVERAGE DELAY
36 min
DISRUPTION INDEX
3.0
Departure board
SCHEDULED FLIGHTS - NEXT 7 DAYS
DEPARTURES
2,283
BUSIEST ROUTE
LIS – MAD 116 flights
AIRPORTS SERVED
141
COUNTRIES SERVED
51
Complete schedule and route map
Runway details
General
Arrivals
Departures
On ground
More
Search
Map view (default)
Lisbon
Amadora
Loures
Almada
Setúbal Municipality
Montijo
Torres Vedras
Santarém
Évora

Brief Description

Acoustic Sensor to **detect sound disturbance**.

Calibration of the sensor to detect when a plane is over the university using a certain threshold value.

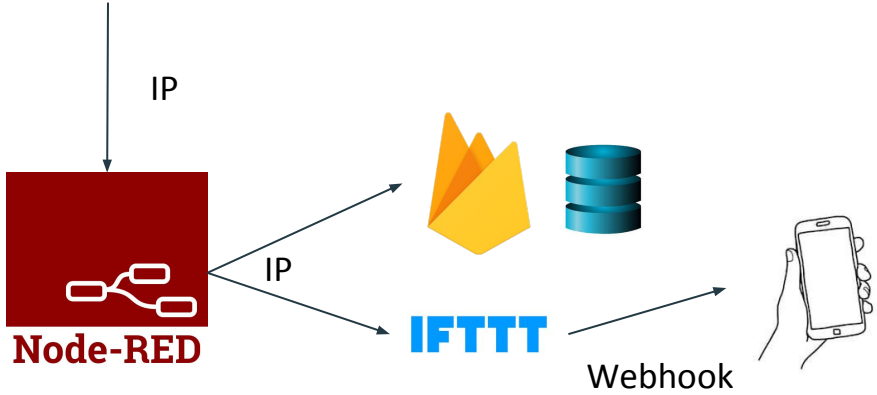
Edge computing to count the amount of planes.

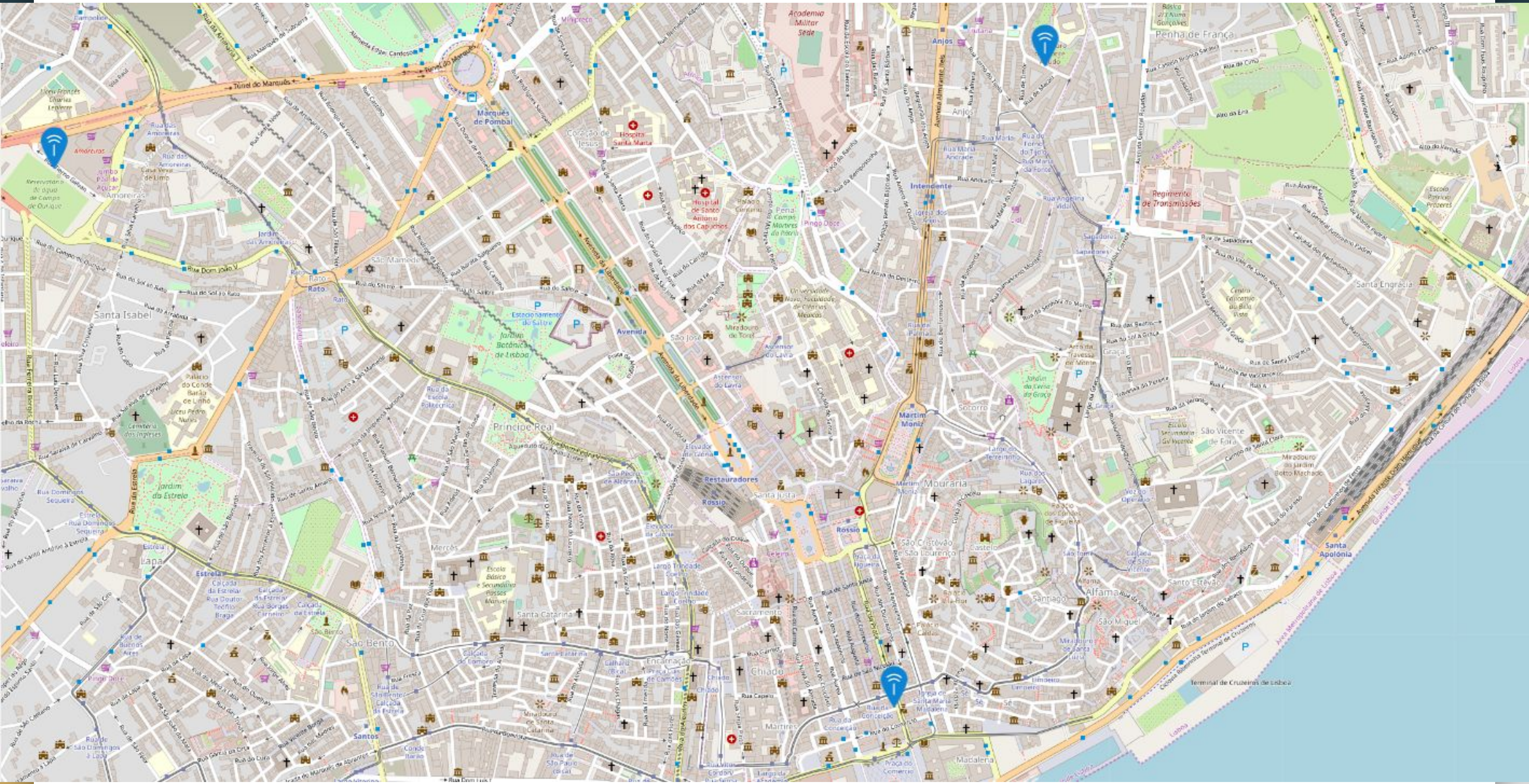
Sending the data via **TTN every 5 minutes** with the counter.

Node-RED server to data processing and connection to IFTTT and cloud database.

IFTTT applet configuration.

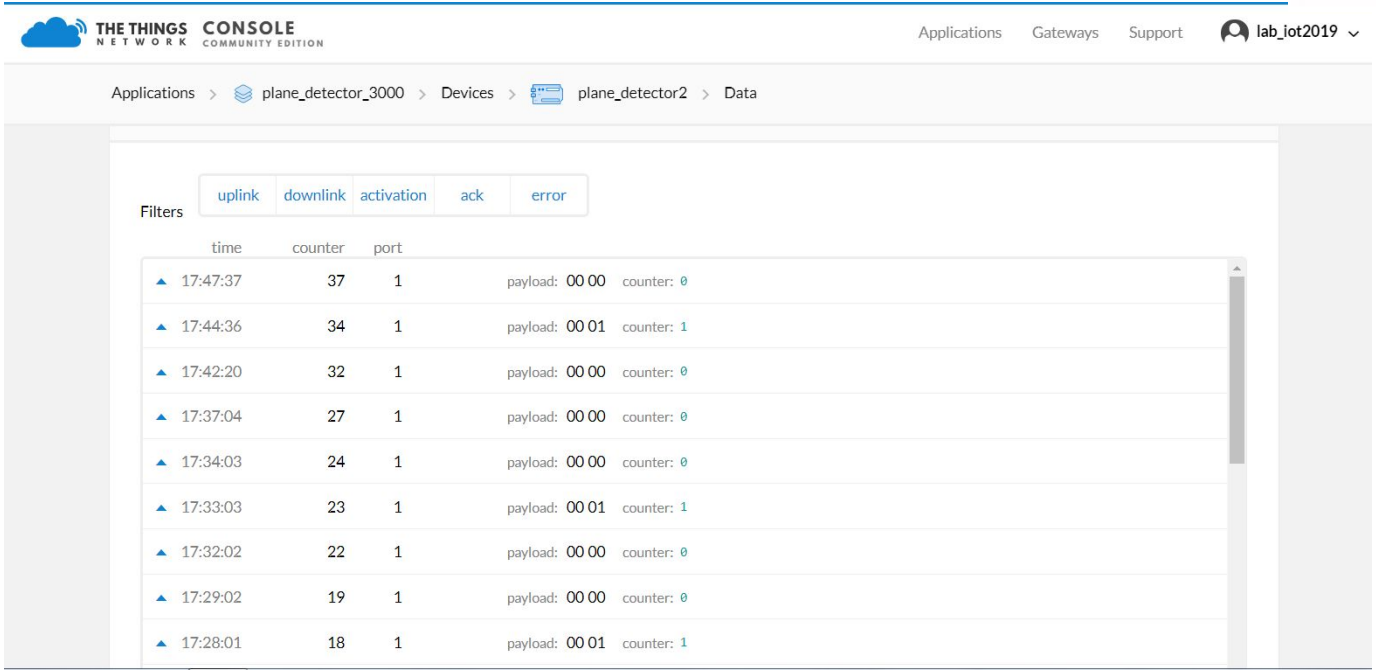
Architecture



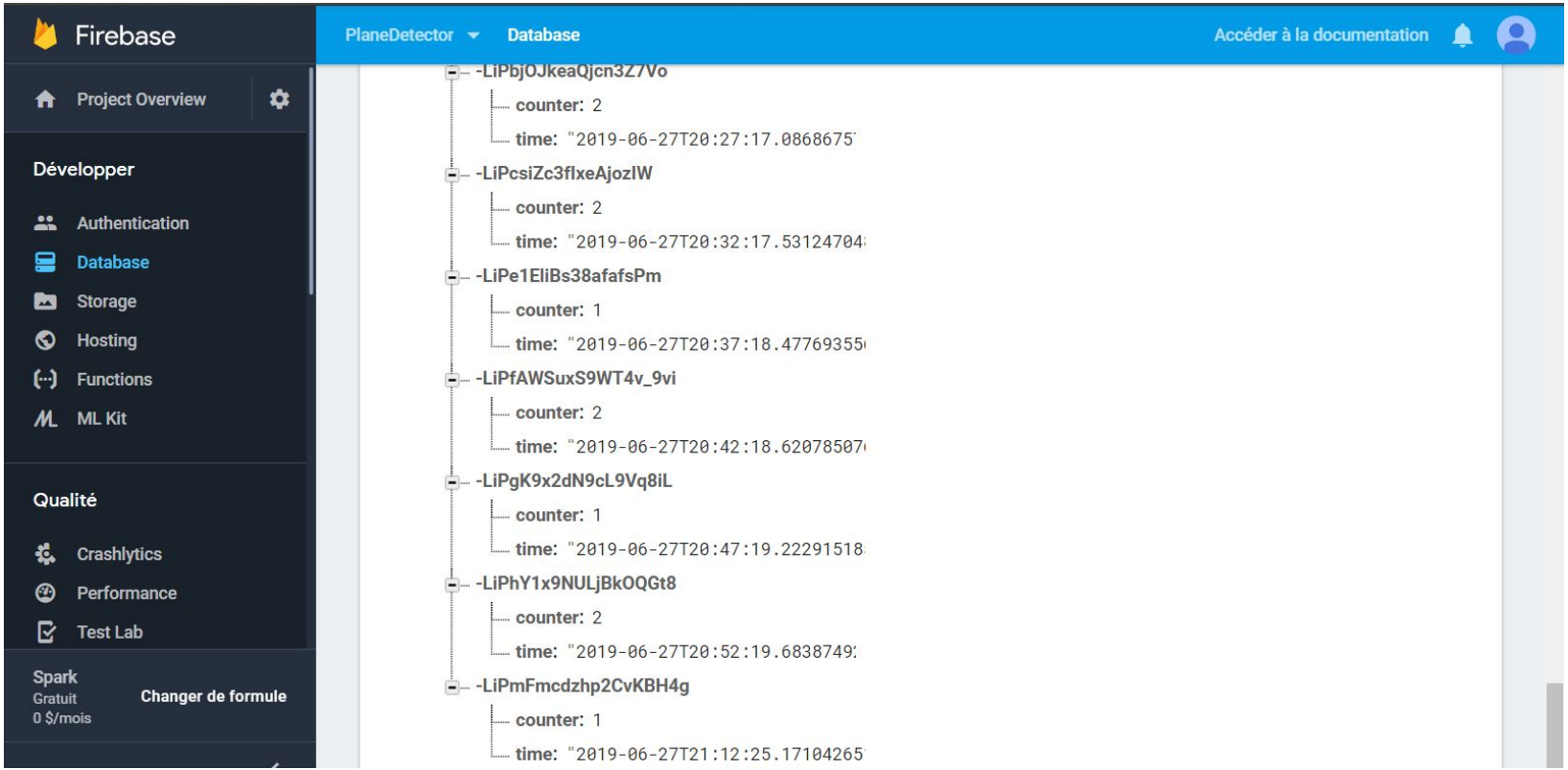


Túnel do Marquês
Marquês de Pombal
Academia Militar Sede
Penha de França
Anjos
Intendente
Hospital Santa Marta
Amoreiras
Regimento de Transmissões
Santa Isabel
Rato
Jardim Botânico de Lisboa
Avenida
Santa Engrácia
Príncipe Real
Martim Moniz
Mouraria
Restauradores
Rossio
São Vicente
Jardim da Estrela
Estrela
Lapa
Castelo
Alfama
Santa Catarina
São Bento
Chiado
Santa Apolónia
Santos
Madalena
Terminal de Cruzeiros de Lisboa

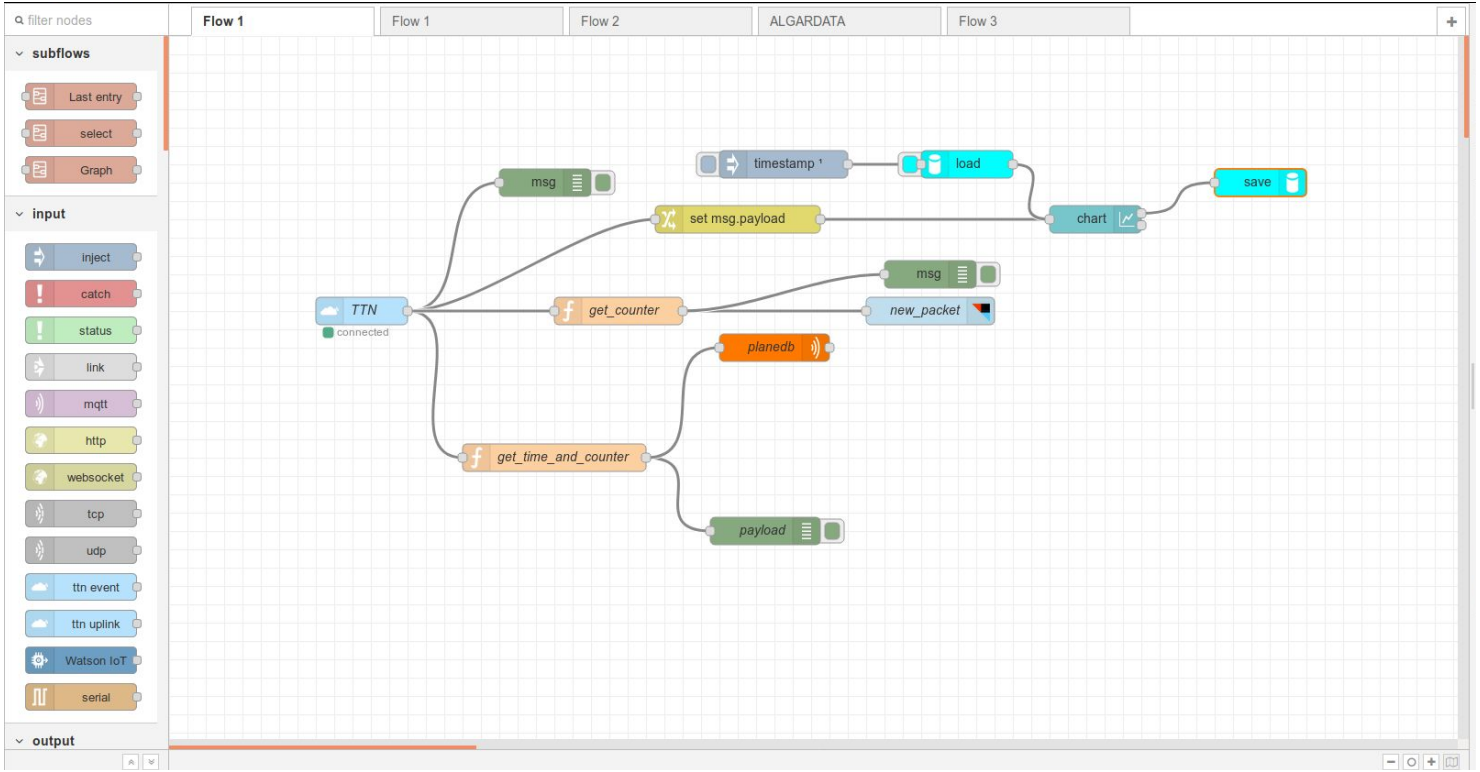
Receiving the data via the TTN



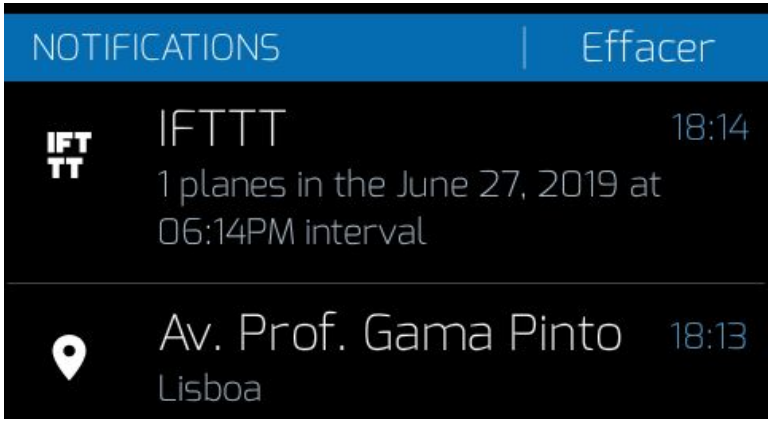
Data collection with Firebase



Node Red


filter nodes
Flow 1
Flow 1
Flow 2
ALGARDATA
Flow 3
subflows
Last entry
select
Graph
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
ttn event
ttn uplink
Watson IoT
serial
output
msg
timestamp
load
save
set msg.payload
chart
msg
TTN
connected
get_counter
new_packet
planedb
get_time_and_counter
payload

Push Notifications via IFTTT

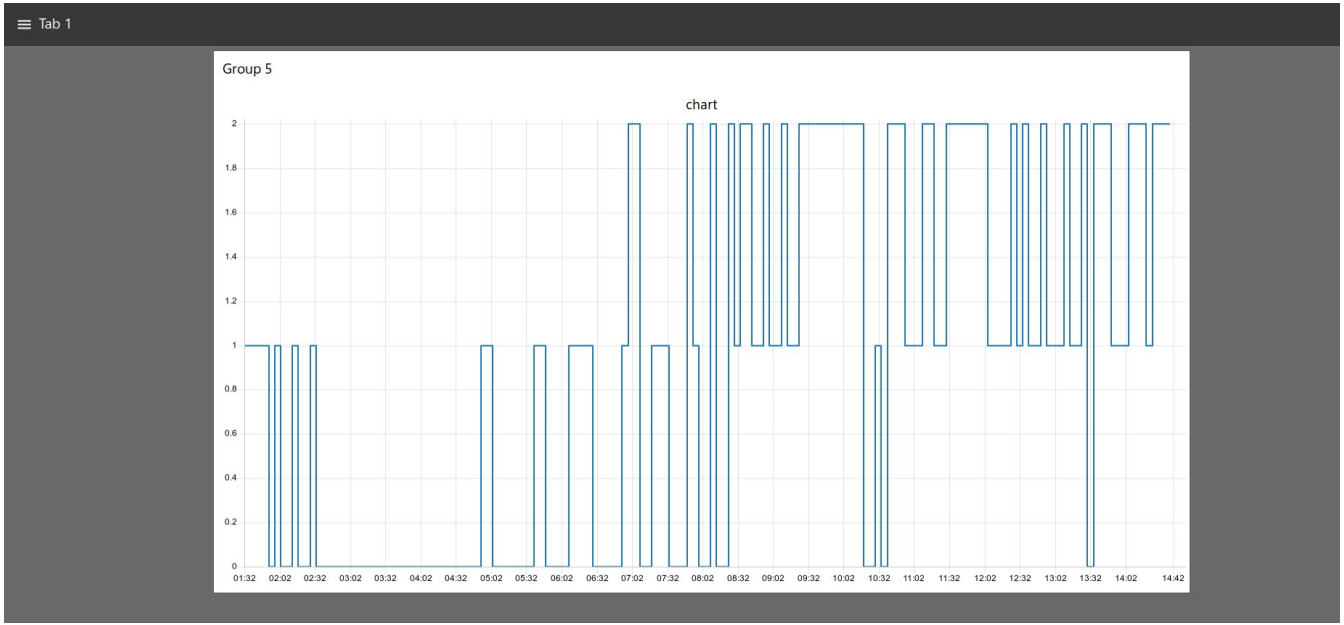


Notification every 5 minutes using Node-Red and IFTTT WebHook.

Node-RED

Webhooks

Data visualisation with Node-RED



11.58 planes every hour*

** Overnight data has also been taken into account. Less than 24 of data*

Results

- The system **worked correctly** although some packet losses.
- It is possible to **install several sensors** in different spots, modifying its code, to detect the **direction of the planes**.
- With a higher quality sensor and different edge-computing approach, it can be detected the **type of plane or noise disturbance**.
- With this data it can be analysed the **psychological impact** on students and staff, creating awareness of the potential problem of this pollution.

Problems and issues

- Antennas problem (TTN network)
- Battery life (Class C sensor) → now connected to a continuous power supply
- Difficulties to configure and calibrate the sensor (low-quality microphone sensor) → solved by looping and delaying measures in the Arduino code

Images Source :

https://commons.wikimedia.org/wiki/File:The_Things_Network_logo.svg

http://www.euram-online.org/images/euram/2019_Conference/logo_ISCTE-IUL.png

https://arduinodiy.files.wordpress.com/2018/01/webhookslogo.png

Obrigado e bom dia

Martiño Rivera Dourado
Sami Fakhry
Luis Elvas