

Serving Massive Metadata with NaviServer & OpenACS:

from Image recognition to cr_items and cr_revisions

Software Architecture Design

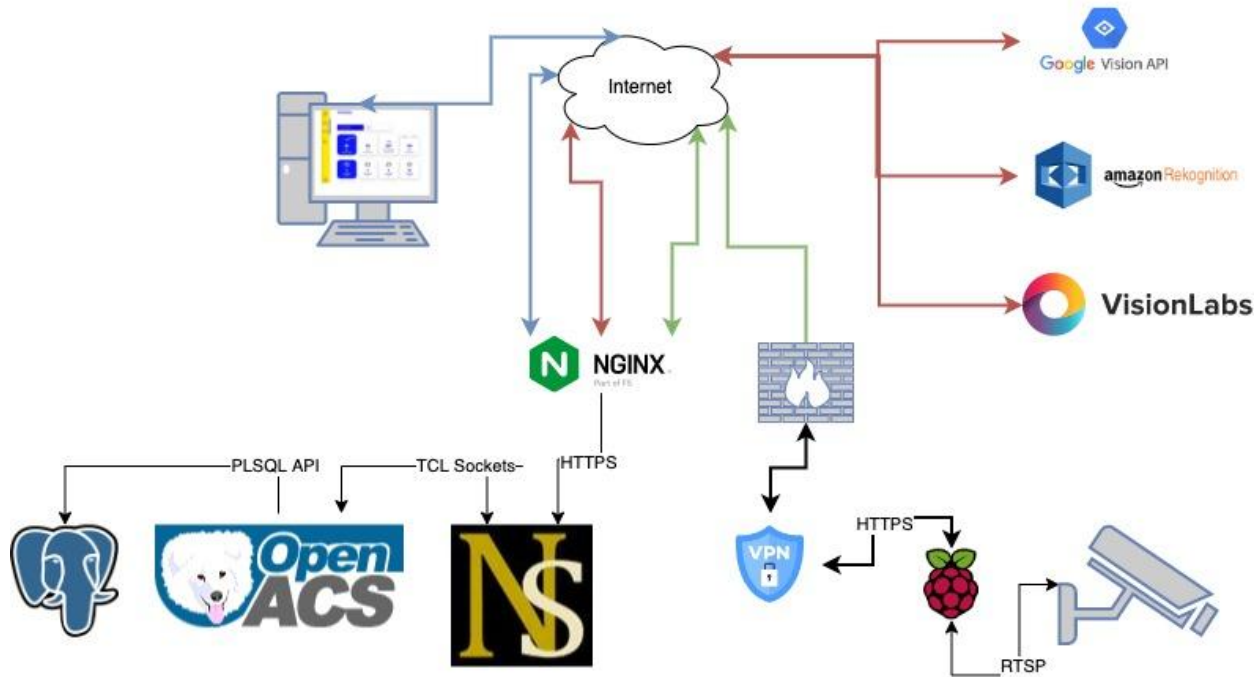


Figure 1. Architecture diagram. Source: created by the author

OACS Content Repository: Object Model

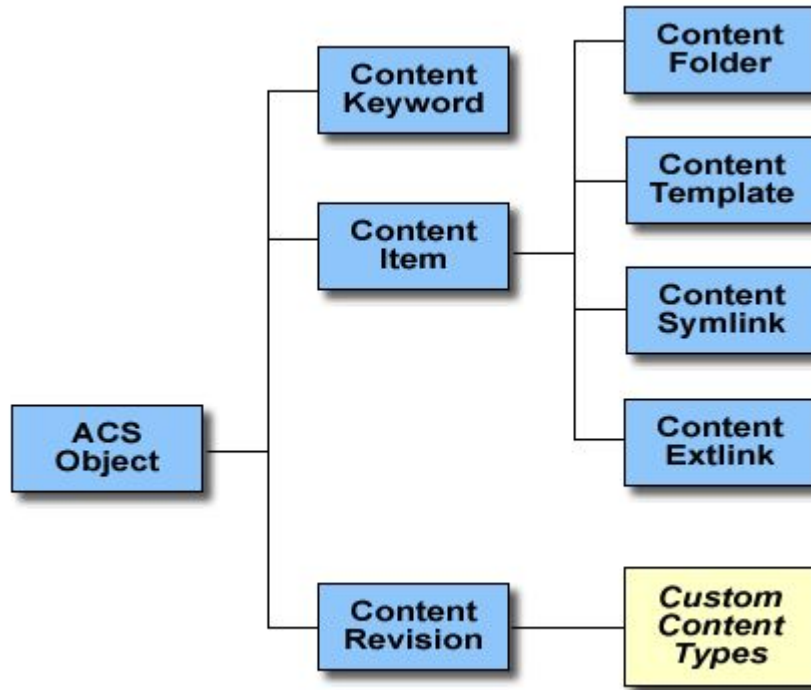


Figure 2. CR object model. Source: OpenACS Framework documentation.
Accessed in June 11th, 2022, <https://openacs.org/doc/acs-content-repository/object-model>

OACS Content Repository: API

```
--  
-- Vehicles  
--  
select content_type__create_type (  
    'qt_vehicle', -- content_type  
    'content_revision', -- supertype.  
    'Qonteo Vehicle', -- pretty_name  
    'Qonteo Vehicles', -- pretty_plural  
    NULL, -- table_name  
    NULL, -- id_column  
    'qt_vehicle__get_title' -- name_method  
);  
-- necessary to work around limitation of content repository:  
select  
content_folder__register_content_type(-100,'qt_vehicle','t');
```

- `acs_object_types` supports a null table name so we do that instead of passing a false value so we can actually use the content repository instead of duplicating all the code in `file-storage`
- `supertype`. We search revision content first, before item metadata
- `/api-doc/proc-search?query_string=content`

```
--  
-- Faces  
--  
select content_type__create_type (  
    'qt_face', -- content_type  
    'content_revision', -- supertype.  
    'Qonteo Face', -- pretty_name  
    'Qonteo Faces', -- pretty_plural  
    NULL, -- table_name  
    NULL, -- id_column  
    'qt_face__get_title' -- name_method  
);  
-- necessary to work around limitation of content repository:  
select  
content_folder__register_content_type(-100,'qt_face','t');
```

Vehicle's metadata: qt_vehicle_tx

object_id | item_id | revision_id | object_type | context_id | name | description

5882062 | 5882058 | 5882062 | qt_vehicle | 5882058 | mp354 | id 2
plate_number **_MP354** country_name **Colombia** country_symbol **CO** first_seen
{2020-07-11 12:45:51} last_seen {2020-07-11 12:45:51} probability 0.3
location_name {Gas station} camera_name LPR4 direction UNKNOWN class Car
plate_image http://178.62.211.78/plate_image_fa.php?id=2 car_image
http://178.62.211.78/car_image_fa.php?id=2

Face's metadata: qt_face_tx

```
object_id | item_id | revision_id | object_type | context_id | name
| description
-----670822
| 670820 | 670822 | qt_face | 670820 |
fc210f22-ddec-4d01-b9fa-9a2382779829 | face {{attributes {age 59 eyeglasses 0
gender 1 emotions {estimations {anger 0.333224237 disgust 0.001284677 fear
0.0394668095 happiness 0.008112357 neutral 0.3828634918 sadness
0.1980405301 surprise 0.0370079093} predominant_emotion Neutral}} id
fc210f22-ddec-4d01-b9fa-9a2382779829 score 54.32}} timestamp 1585077589
authorization {token_id df498422-6331-4580-ac63-aac5746eacab token_data
PRIMAX}
```

LGPD Compliant

- No personal data stored
- No face images stored
- No vehicles owner's data stored
- No vehicles critical data stored
- Unique hashes based on metadata

PGSQL's Performance Stats

Slow query execution:

```
-] Warning: db_exec: longdb 3996.90 ms nsdb0 select dbqd.qt-dashboard.tcl.qt-dashboard-procs.qt::dashboard::get_past_total  
-] Warning: db_exec: longdb 3141.52 ms nsdb0 select dbqd.qt-rest.www.get-vehicle-graphics.select_vehicles_grouped_hourly  
-] Warning: db_exec: longdb 9895.62 ms nsdb0 select dbqd.qt-dashboard.tcl.qt-dashboard-procs.qt::dashboard::get_types_tota  
-] Warning: db_exec: longdb 4472.81 ms nsdb0 select dbqd.qt-rest.www.get-vehicle-graphics.select_instant_data  
-] Warning: db_exec: longdb 5590.88 ms nsdb0 select dbqd.qt-rest.www.get-vehicle-types.select_avg_interval_per_type
```

Client 1: Vehicles around 50k+ requests daily, plus 8k faces

Client 2: Faces, traffic was around 18k requests per day

Client 3: Faces, traffic was around 5k per day

Client 4: just Facial login authentication, < 200

Total: 81k requests to insert data.

Approximately: 2k requests to present data.

PostgreSQL Statistics & KPI Metrics

Response Time

Query Performance

the average response time per query,

Database Events

Query Throughput

work done by your database server over a unit of time such as per second, or per hour

Open Connections

Buffer Pool Usage

Errors

PGSQL's Performance: Index Scan

```
qonteo=# select schemaname, relname, seq_scan, seq_tup_read, seq_tup_read / seq_scan as avg,  
idx_scan from pg_stat_user_tables where seq_scan > 0 order by seq_tup_read desc limit 25;
```

| schemaname | relname | seq_scan | seq_tup_read | avg | idx_scan |
|------------|----------------------|----------|--------------|---------|----------|
| public | qt_face_t | 77513 | 22639739524 | 292076 | 1383242 |
| public | cr_items | 2069 | 3956567736 | 1912309 | 6763139 |
| public | pa_albums | 329139 | 2272467935 | 6904 | 625029 |
| public | acs_objects | 54 | 337326513 | 6246787 | 54488513 |
| public | qt_face_range_totals | 356572 | 180477506 | 506 | 6935 |
| public | acs_sc_msg_types | 1186254 | 144722988 | 122 | 0 |
| public | user_ext_info | 11965 | 123071985 | 10285 | 6 |
| public | acs_object_types | 1651985 | 119478143 | 72 | 1176143 |
| public | site_nodes | 2367157 | 96692022 | 40 | 7298 |
| public | cr_revisions | 48 | 91248195 | 1901004 | 5858452 |
| public | apm_packages | 1181428 | 74386414 | 62 | 19024 |
| public | acs_sc_operations | 1177890 | 67139730 | 57 | 0 |
| public | qt_face_totals | 325519 | 52441248 | 161 | 321 |
| public | acs_sc_impls | 1266533 | 42167817 | 33 | 0 |
| public | apm_package_versions | 353681 | 39608458 | 111 | 1349644 |
| public | cr_child_rels | 23 | 36885230 | 1603705 | 5471990 |
| public | qt_vehicle_t | 39 | 33070563 | 847963 | 524825 |
| public | template_demo_notes | 1173585 | 23471700 | 20 | 0 |
| public | acs_sc_contracts | 1265613 | 20702223 | 16 | 0 |
| public | auth_authorities | 9389482 | 18778937 | 1 | 0 |
| public | txt | 23 | 17767135 | 772484 | 1176021 |
| public | acs_magic_objects | 2090149 | 14630791 | 6 | 0 |
| public | xowiki_page | 533959 | 12281057 | 23 | 349 |
| public | ec_products | 1174620 | 11745852 | 9 | 0 |
| public | qt_resources | 644144 | 11060913 | 17 | 0 |

(25 rows)

PGSQL's Performance: Heap Ratio

queries are served from cache

```
qonteo=# SELECT sum(heap_blks_read) as heap_read, sum(heap_blks_hit)
as heap_hit, sum(heap_blks_hit) / (sum(heap_blks_hit) + sum(heap_blks_
read)) as ratio FROM pg_statio_user_tables;
```

| heap_read | heap_hit | ratio |
|-----------|----------|-------|
|-----------|----------|-------|

| | | |
|----------|-----------|------------------------|
| 64882732 | 512492868 | 0.88762474202235078864 |
|----------|-----------|------------------------|

(1 row)

PGSQL's Performance Cache: [util_memoize]

```
ad_proc qt::dashboard::get_past_totals_per_hour {
  {-date_from ""}
  {-date_to ""}
} {
  It returns a list of lists within totals of vehicles per hour starting from yesterday's
  results untill the very beginning
} {
  ...
  set result [util_memoize \
              [list qt::dashboard::get_past_totals_per_hour_not_cached \
                  -date_from $date_from \
                  -date_to $date_to]]
  if {[length $result] eq 0} {
    util_memoize_flush \
      [list qt::dashboard::get_past_totals_per_hour_not_cached \
          -date_from $date_from \
          -date_to $date_to]
  }
  return $result
}
```

PostgreSQL Statistics & KPI Metrics

Database Monitoring Dashboard

Database Throughput (per Sec)

2,603

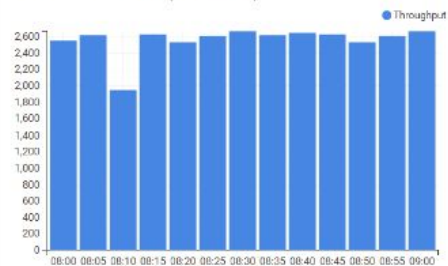
Average Database Response (msec)

5.7

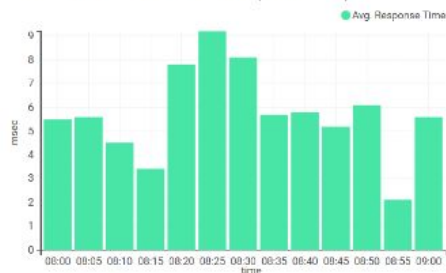
Live Database Connections

160

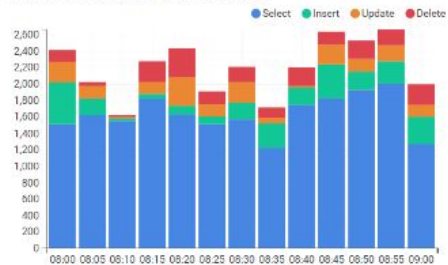
Database Throughput (Past 1 hour)



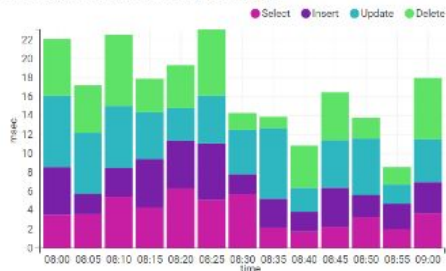
Average Database Response Time (Past 1 Hour)



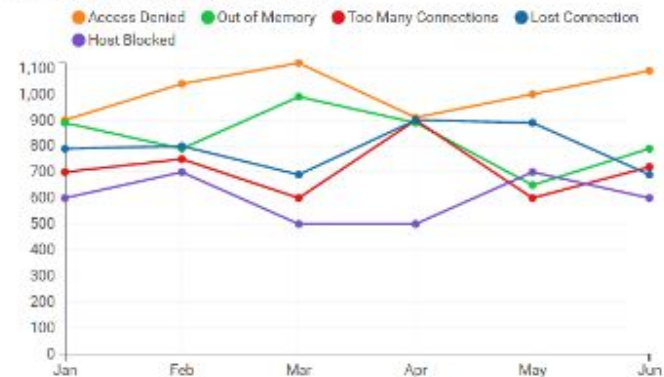
Database Throughput by Query Type



Average Response Time by Query Type



Number of Errors By Error Code



5 Most Frequency Queries

| Query | Frequency | Average Latency(ms) |
|----------------------------|-----------|---------------------|
| select * from products | 1,320 | 5.6 |
| insert into users | 720 | 3.2 |
| insert into shopping_cart | 630 | 5.1 |
| update product set item... | 510 | 2.7 |
| insert into product... | 430 | 1.9 |

Hardware Resources: AMD Ryzen 5, 6 core

```
root@gonteo1:~# lscpu
Architecture:          x86_64
CPU op-mode(s):      32-bit, 64-bit
Byte Order:          Little Endian
CPU(s):              12
On-line CPU(s) list:  4,6
Off-line CPU(s) list: 0-3,5,7-11
Thread(s) per core:  0
Core(s) per socket:  6
Socket(s):           1
NUMA node(s):        1
Vendor ID:            AuthenticAMD
CPU family:           23
Model:               113
Model name:           AMD Ryzen 5 3600 6-Core Processor
Stepping:             0
CPU MHz:              3265.980
CPU max MHz:          3600.0000
CPU min MHz:          2200.0000
BogoMIPS:             7199.95
Virtualization:       AMD-V
L1d cache:            32K
L1i cache:            32K
L2 cache:             512K
L3 cache:             16384K
NUMA node0 CPU(s):   0-11
```

VPS Resources: Proxmox 2Gib RAM, 2 cores, 30Gib HD...

PROXMOX Virtual Environment 6.4-13 Search

Server View

Container 779 (qonteo1) on node 'x2k-priv-30'

Summary Add Edit Remove Resize disk Move Volume Revert

| | |
|-----------|----------------------------------|
| Memory | 2.00 GiB |
| Swap | 2.00 GiB |
| Cores | 2 |
| Root Disk | nvme2:subvol-779-disk-0,size=90G |

Resources

Network

DNS

Datacenter

- x2k-priv-30
 - 778 (qonteo2)
 - 779 (qonteo1)
 - 909 (rite)
 - 902 (lunavm)

```
top - 17:10:00 up 25 days, 5:09, 1 user, load average: 2.20, 2.40, 2.51
Tasks: 44 total, 1 running, 42 sleeping, 1 stopped, 0 zombie
%Cpu(s): 0.2 us, 0.0 sy, 0.0 ni, 99.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 2097152 total, 1139252 free, 637472 used, 320428 buff/cache
KiB Swap: 4194304 total, 4099360 free, 94944 used. 1459680 avail Mem
```

Figure 13. VPS resources. Source: created by the author

Infra: Debian 9, Naviserver 4.99.19 & TCL 8.6, PGSQL 9.6

```
[root@qonteo1:~# lsb_release -a
```

```
No LSB modules are available.
```

```
Distributor ID: Debian
```

```
Description:    Debian GNU/Linux 9.13 (stretch)
```

```
Release:        9.13
```

```
Codename:       stretch
```

```
Notice: nsmain: NaviServer/4.99.19 (tar-4.99.19) starting
```

```
Notice: nsmain: security info: uid=1004, euid=1004, gid=1000, egid=1000
```

```
Notice: nsmain: Tcl version: 8.6.10
```

```
Notice: nsmain: max files: soft limit 524288, hard limit 524288
```

```
Warning: nsmain: rl_cur (524288) > FD_SETSIZE (1024), select() calls should not be used
```

```
onteo-] Notice: pool default: queueLength 90 low water 9 high water 90
```

```
onteo-] Notice: nsd/init.tcl[qonteo]: booting virtual server:  Tcl system encoding: "utf-8"
```

```
onteo-] Notice: modload: loading module nslog from file /usr/local/ns/bin/nslog.so
```

```
onteo-] Notice: nslog: opened '/var/www/qonteo/oacs/log//access.log'
```

```
onteo-] Notice: modload: loading module nsdb from file /usr/local/ns/bin/nsdb.so
```

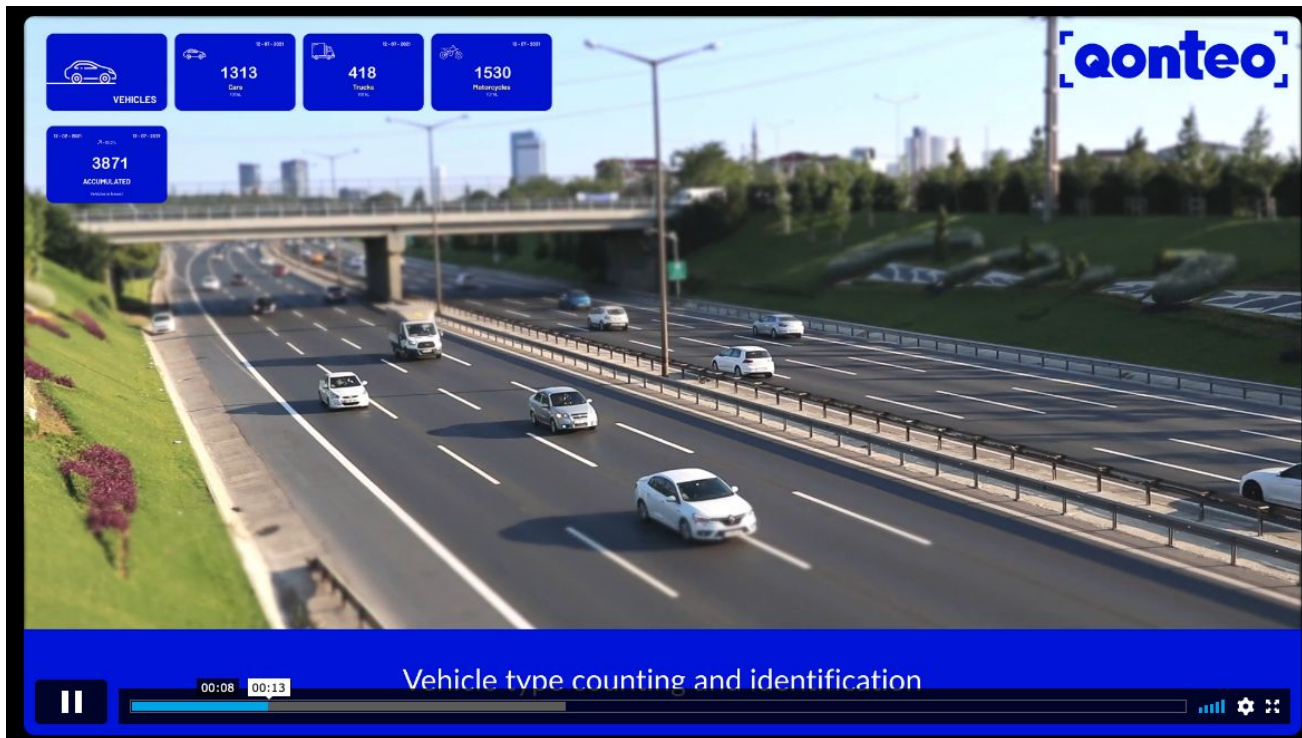
```
onteo-] Notice: modload: loading module ns/db/driver/postgres from file /usr/local/ns/bin/nsdbpg.so
```

```
onteo-] Notice: nsdbpg: version 2.4 loaded, based on PostgreSQL 9.6.20 and libbpg 90620
```

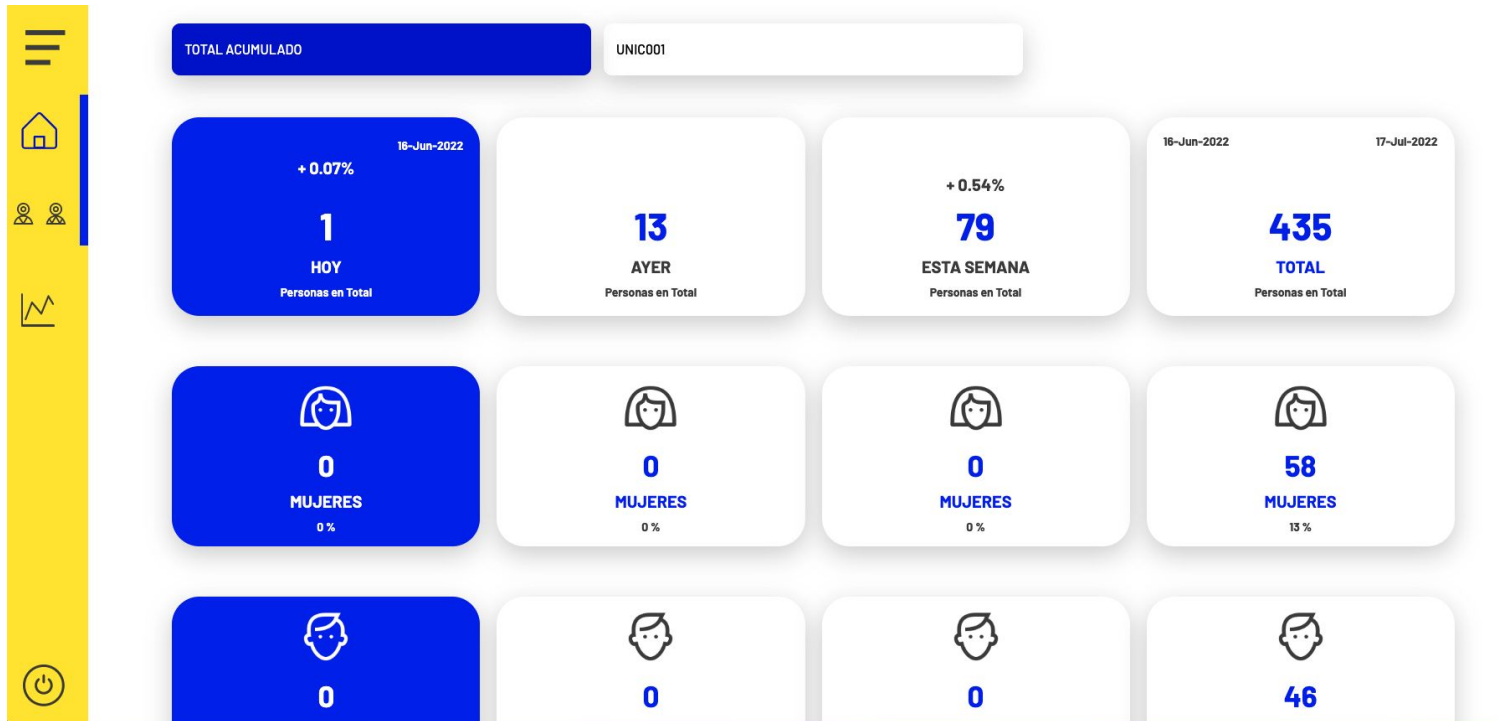

Future enhancements

- To explore PostgreSQL JSON support
- To explore PostgreSQL and OpenACS clustering
- To scale for industrial applications
- To enhance ML training algorithms
- To scale image recognition & processing solutions
- Package sources to contribute with OACS community
 - OACS - AWS Rekognition API
 - OACS - Gogole Vision API
 - OACS - Luna API
 - OACS - NodeJS API frontend dashboards *

Qonteo Demo Videos

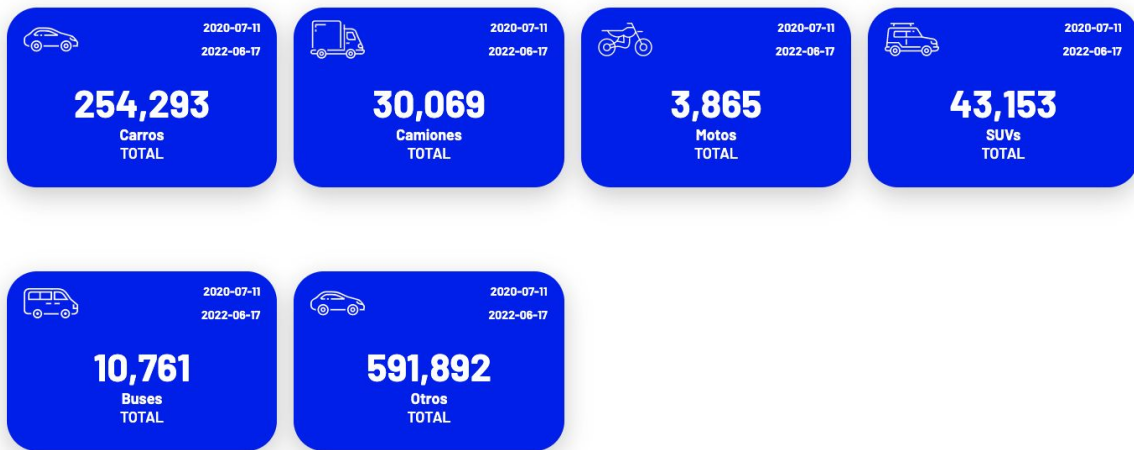


Qonteo Dashboards: Persons

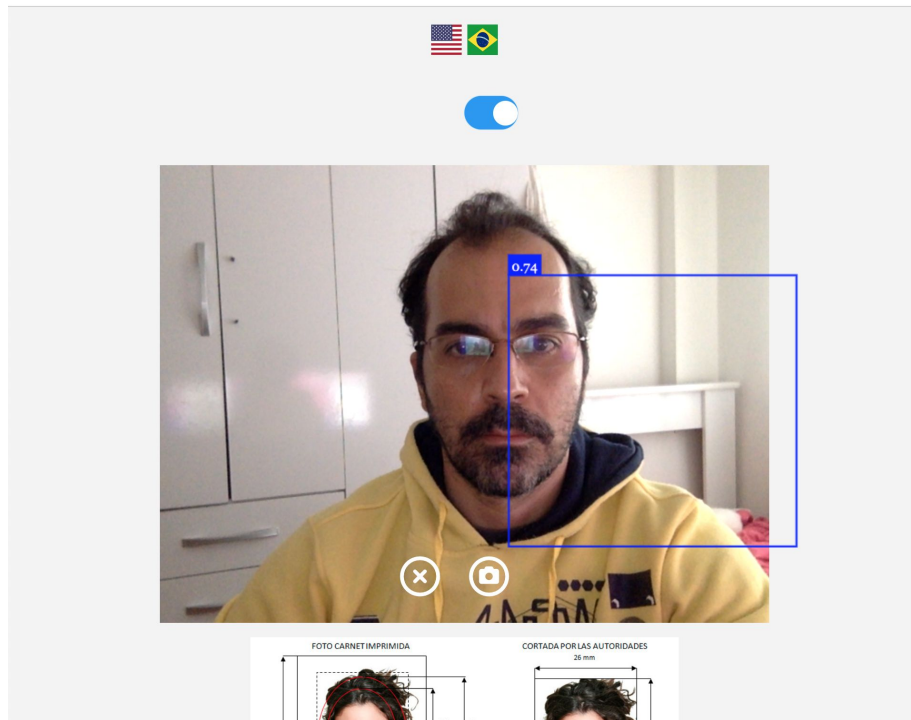


Qonteo Dashboards: Vehicles

Total vehículos por categoría



BiometricMax Authentication



References:

<https://www.postgresql.org/docs/8.0/performance-tips.html>

<https://www.cybertec-postgresql.com/en/3-ways-to-detect-slow-queries-in-postgresql/>

<https://severalnines.com/database-blog/how-identify-postgresql-performance-issues-slow-queries>

<https://kaleman.netlify.app/getting-query-performance-stats-with-pg>

https://gpdb.docs.pivotal.io/6-13/ref_guide/system_catalogs/pg_stat_tables.html

Greetings

QONTEO

OpenACS Framework & Community

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[qonteo]

