

# AFORO 1.0

## Real-time indoor occupancy monitoring and analysis using Computer Vision & Machine Learning

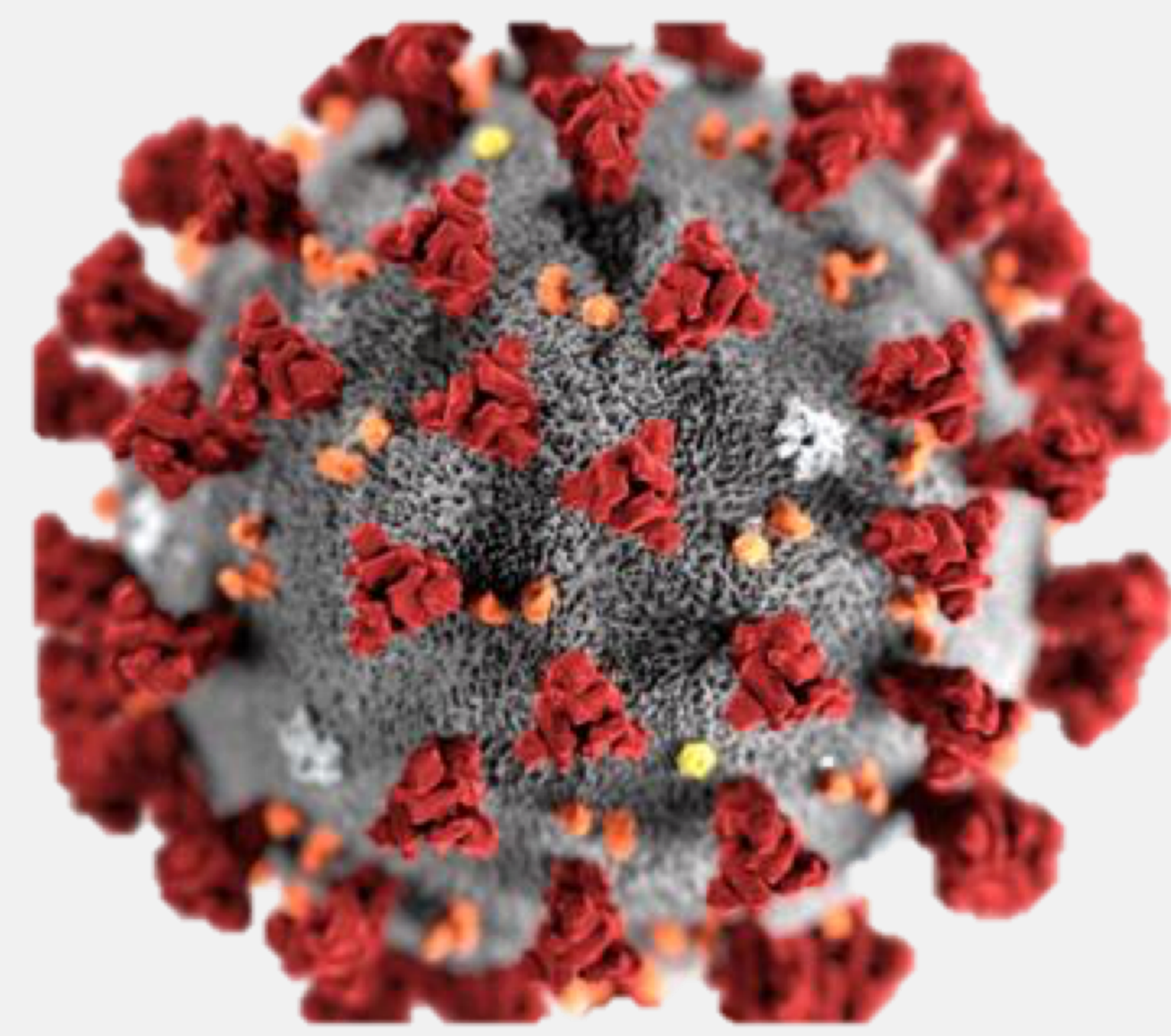


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### Highlights

- **High accuracy to identify people** in indoor places, helping to comply the regulations generated by COVID-19 pandemic.
- **Low cost** application to count people and measure occupancy.
- Generate valuable information in **real time** to **improve customers experience**.
- Technology that can be **used in different application** contexts.

### Problem



SARS-CoV-19 global pandemic has generated that companies that operates in indoor places, such Financiera Comultrasan, reduce the amount of people allowed in the service areas. To accomplish this, the measurements are taken manually and are susceptible to human error, implying a high risk that could lead to unnecessary and expensive biological outbreaks and fines.

### Business impact

An automated system for monitoring the user-access through the service areas, can allow for the company to:

- Accomplish the current regulations in relation to COVID-19 pandemic.
- Perform analysis on the quality of the service.
- Measure the average waiting time, and other KPIs that support decisions on the human resources and the office infrastructure.

### Solution

An integrated computer vision application to monitor the access through the service areas of close spaces, compound by the following modules:

- Computer Vision.
- Dashboard.
- Queue model, simulation & prediction.

Even though this idea was conceived in the context of safety & health policies for the Coronavirus crisis, AFORO 1.0 is meant to be used for improving customer service in general contexts.

### Computer vision



The Computer Vision module detects and tracks consistently the number of people entering to the service area where the camera system is installed. This module is in charge to:

- The count of people.
- Generation of alerts in case that the amount of people allowed in the service area either is or about to be exceeded.
- Determining the waiting time, and service time.

### Dashboard



This module presents charts of historical data about:

- Arrival time
- Queue time and
- Service time

The data can be grouped by:

- Year
- Month
- Day
- Day name

### Queue model, simulation & prediction

AFORO 1.0 can be used in different contexts to provide insights that improve the customers experience. To accomplish this, the last module of AFORO 1.0 is compound by:

1. A queue model based on historical data to generate indicators about system.
2. A simulation tool to calculate:

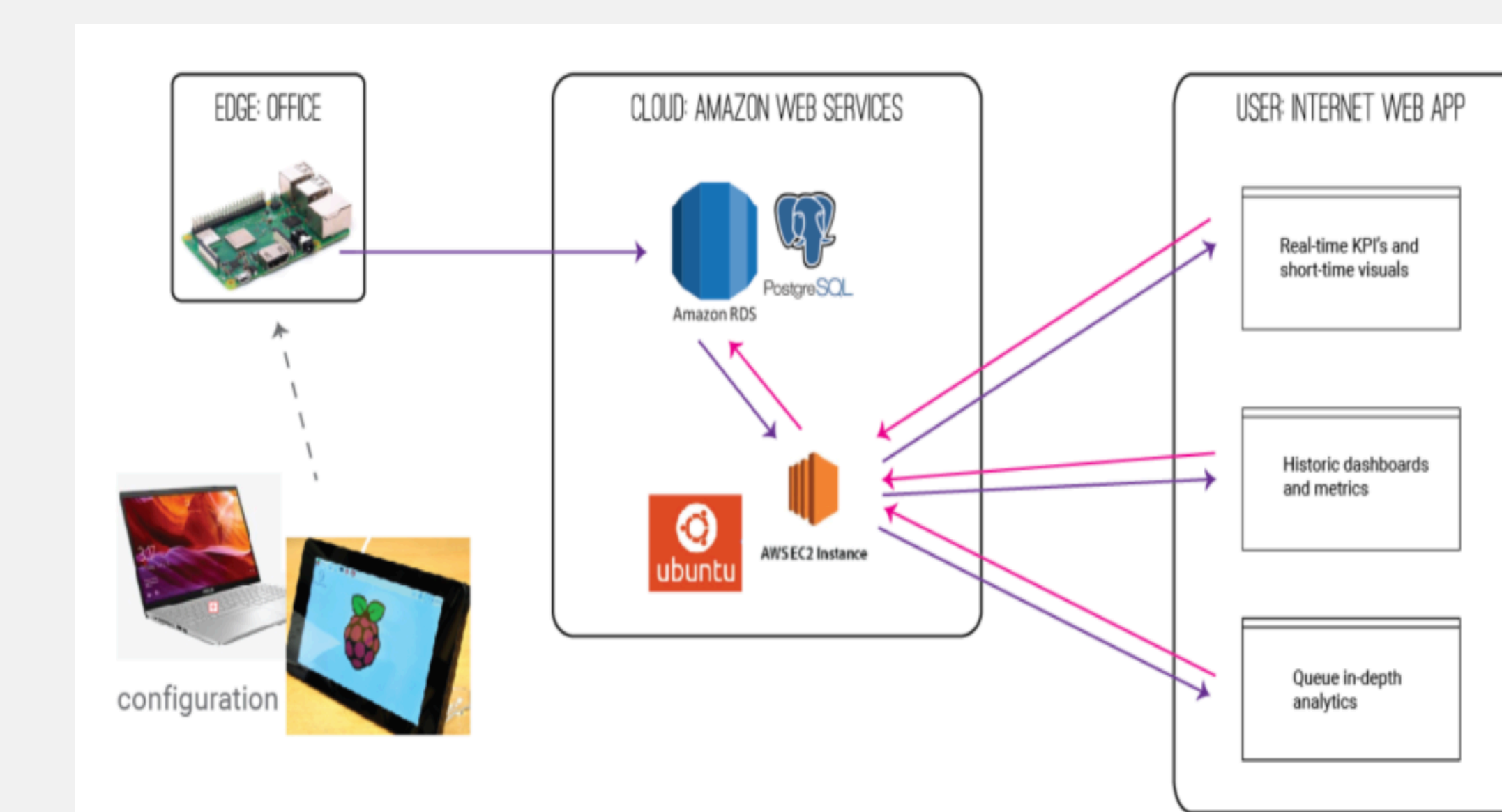
• Number of customers in the system.	• Number of customers in the queue
• Time a customer spend in the system.	• Utilization factor of the system
• Waiting time of customers in the queue	• Idle time of the system

3. A prediction model of people in the system using machine learning algorithms such as Linear Regression, Arima and Embedding Neural Networks. The main indicators we find in this module are:

Arrival rate	=60
Service rate	=10
Current number of servers	=13
<input type="button" value="Calculate"/>	
<b>Analysis Results</b>	
Queuing Intensity	= 6.000
Queuing Utilization	= 66.667%
Queue Length in Queue	= 0.392
Queue Length in System	= 6.392
Delay in Queue	= 0.007
Delay in System	= 0.107
Probability of idle server	= 0.235%

### Architecture

AFORO 1.0 is an application that integrates hardware and software to accurately identify people in an close space. AFORO 1.0 has a Raspberry Pi and an integrated camera that capture video and process it to obtain the data that enables the different modules to accomplish their tasks.



The data captured is inserted directly on the RDS database of the application, used later to calculate metrics, make predictions and simulations, and to create charts.