

Design and Implementation of an Environmental Monitoring System

Felipe A. Moreno

Advisor: Prof. Manuel Castillo



**UNIVERSIDAD
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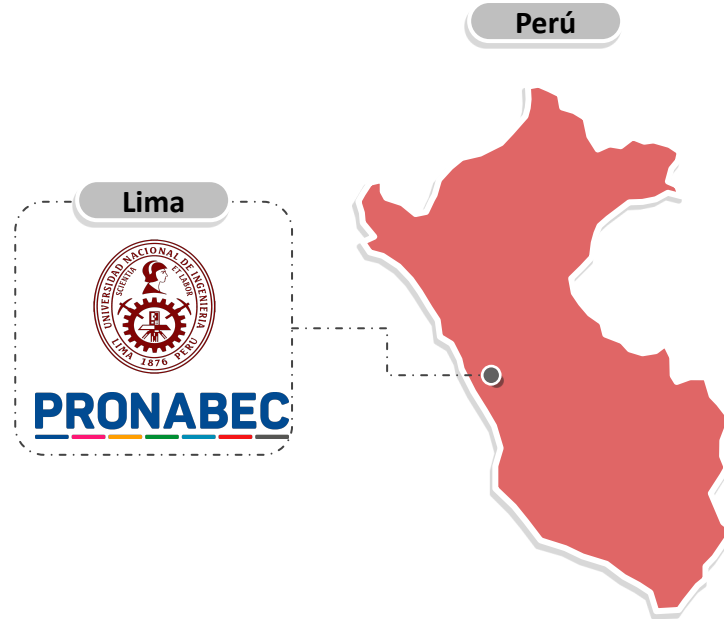
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About me



B.Sc. Felipe A. Moreno
www.fmorenovr.com



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Introduction

Motivation

The motivation for which this theme was decided is due to the huge amount of software, libraries and frameworks that carry out this work using other technologies to obtain and update in a certain time (it could be time real), in addition to the great need for software that provides information in a friendly and easy-to-use manner.

Context

We identify the necessity of implement a real-time system to collect and process data:

- Sensor information
- Real-time data
- Dashboard



Related Works

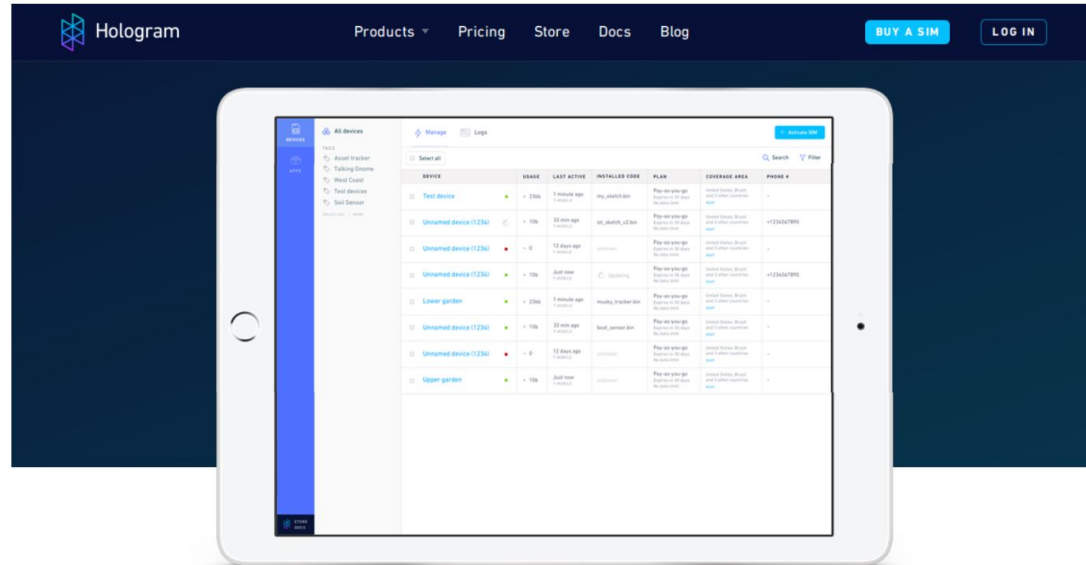
ClearBlade

The screenshot displays the ClearBlade IoT Security web platform. The interface includes a navigation bar with the ClearBlade logo and tabs for 'THE PLATFORM', 'PRODUCTS FOR DEVELOPERS', 'VIDEOS', 'PILOT PROGRAM', and 'ECOSYSTEM'. A map of the United States is visible in the background. Three callout boxes highlight specific features:

- Product List:** A table listing various hardware products, including 'Nvidia Jetson', 'ClearBlade S', 'BlackBerry', and 'Beats Solo3'.
- SmartFactory Dashboard:** A dashboard showing a table of project locations with columns for Name, Public Address, and Local Address. Projects listed include Philadelphia OneMain Project, Ohio Valley Project, Charleston Pier Phase 2, and Portsmouth Garage Project.
- Message History:** A log titled 'History for thunderboard1736261/environment' showing a series of MQTT messages with timestamps and payloads.

- It is a web platform software which provides services on IoT using the MQTT protocol and SDK of development, it will notify you about changes (on off, data, connectivity) in the associated devices, that is, ClearBlade works as a Socket MQTT web broker.

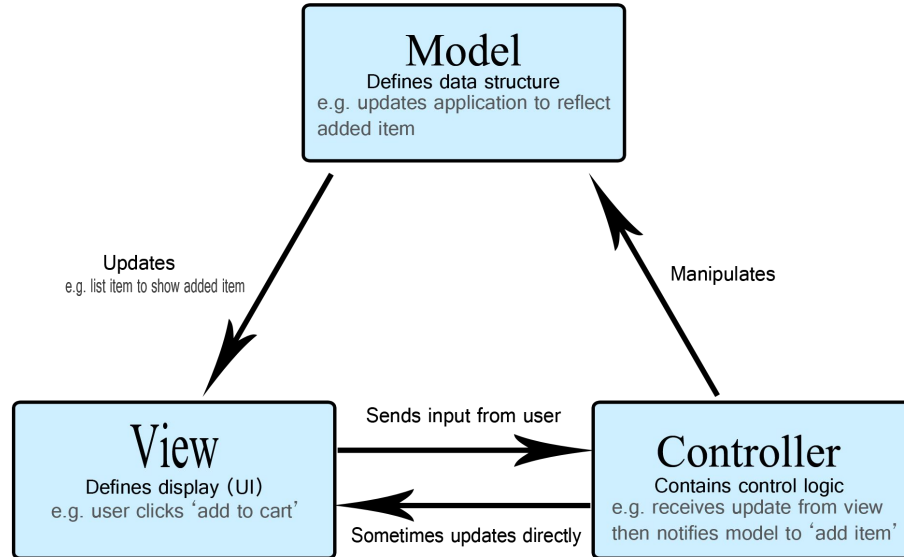
Hologram



- It is a web platform software which provides services storage and connectivity such as bluetooth, wifi, and GSM, which they send it to their web platform, storing it for subsequently display the information obtained in your dashboard.

Technologies

Model-View-Controller (MVC)



- The pattern of development on which the design of the implementation of the web platform is MVC (model-view-controller).

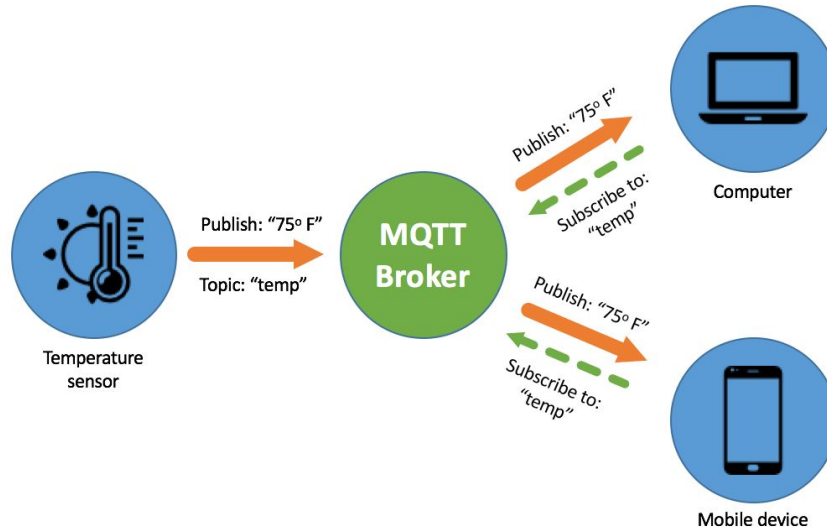
HTTP: Routing in MVC

Controller *Action method*
http://localhost:1234/home/index/100 ← *Id parameter value*

Controller *Action method*
http://localhost:1234/home/index

- For the development of a platform, a library, a package or a project in general, it is best to save the modifications or corrections of errors as they appear during the implementation stage.

MQTT: Message Passing



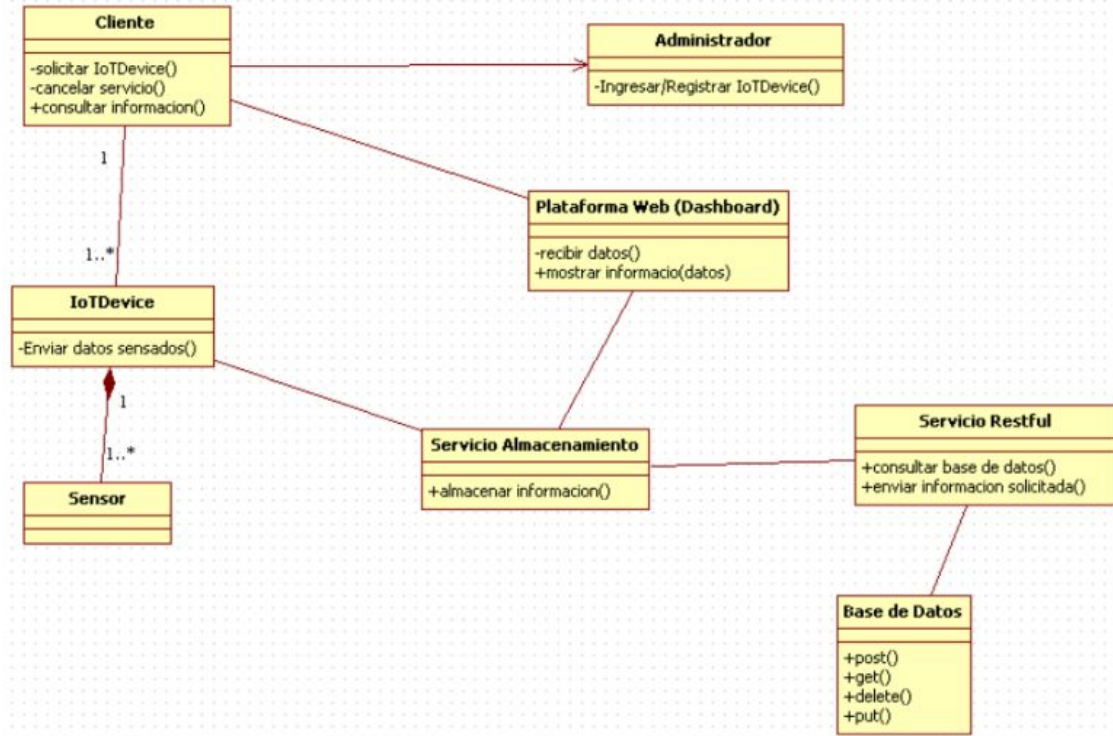
- It is an object-oriented design pattern, where objects to a class instead of the class itself instantiating the object, used for web application implementation making calls to various components necessary for the functioning.

System Analysis

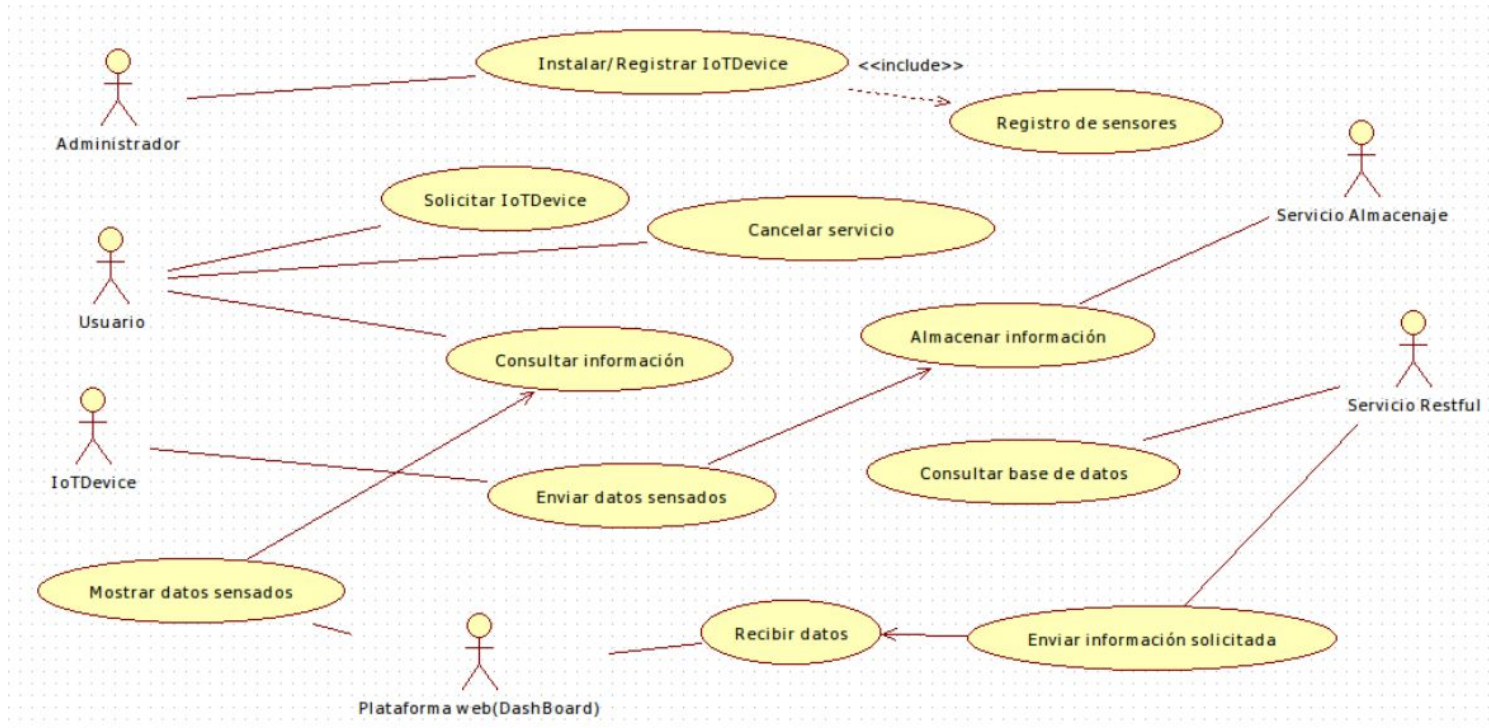
Definitions

- **Administrator** It is the actor in charge of the administration of the users. He is the only user who does not have IoT-Device registered.
- **User** It is the actor that has requested a service to the system, it is that is, it is aware of the sensed information displayed by the system depending on the devices that the same user have requested.
- **IoTDevice** It is the actor that sends the information that it captures from the sensors and sends them to the storage actor.
- **Dashboard** It is the actor in charge of displaying the information sensed and stored.
- **Restful** It is the actor that is in charge of performing and returning answers according to the requests of the actor dashboard, as well as also check the storage.
- **Storage** It is the actor in charge of storing the information

Classes Diagram

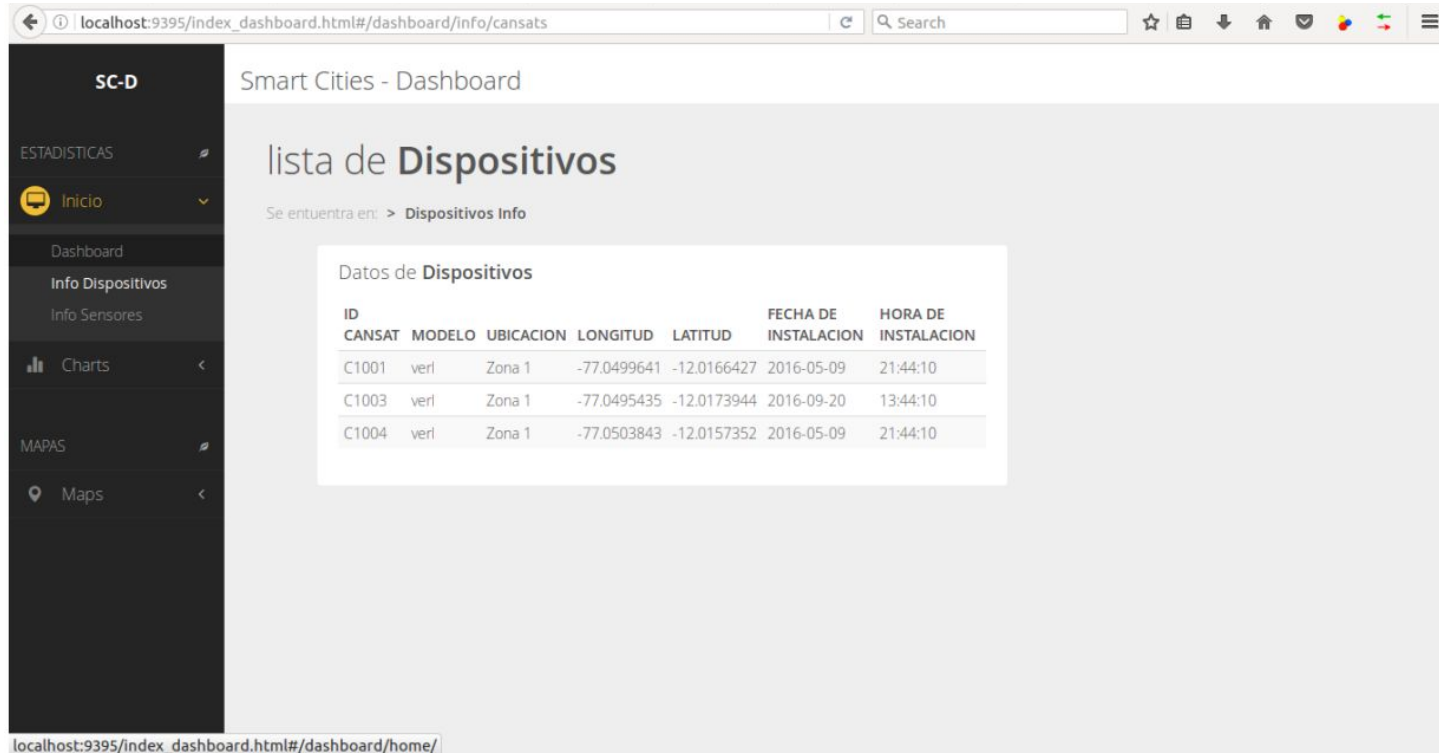


Case Study Diagram



Web Application

Device Information



The screenshot shows a web browser window displaying a dashboard for 'Smart Cities - Dashboard'. The page title is 'lista de Dispositivos'. Below the title, it indicates the current view is 'Dispositivos Info'. A table titled 'Datos de Dispositivos' contains the following data:

ID	CANSAT	MODELO	UBICACION	LONGITUD	LATITUD	FECHA DE INSTALACION	HORA DE INSTALACION
C1001	verl	Zona 1	-77.0499641	-12.0166427	2016-05-09	21:44:10	
C1003	verl	Zona 1	-77.0495435	-12.0173944	2016-09-20	13:44:10	
C1004	verl	Zona 1	-77.0503843	-12.0157352	2016-05-09	21:44:10	

The dashboard also features a sidebar with navigation options: ESTADISTICAS, Inicio, Dashboard, Info Dispositivos (selected), Info Sensores, Charts, MAPAS, and Maps. The browser address bar shows the URL: localhost:9395/index_dashboard.html#/dashboard/info/cansats.



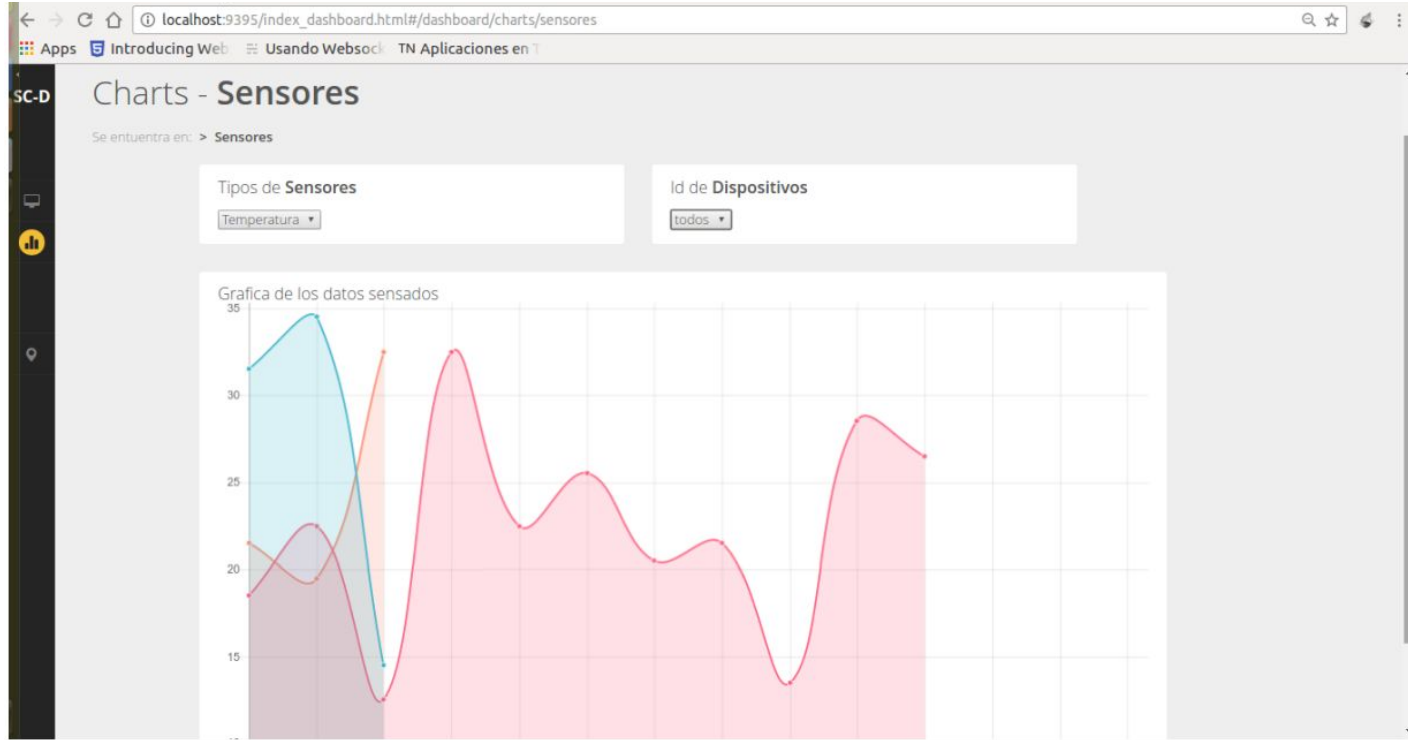
Device-Sensors Information

The screenshot shows a web browser window displaying a dashboard for 'Smart Cities - Dashboard'. The page title is 'lista de Sensores'. Below the title, there is a breadcrumb trail: 'Se encuentra en: > Sensores Info'. A table titled 'Datos de Sensores' contains the following data:

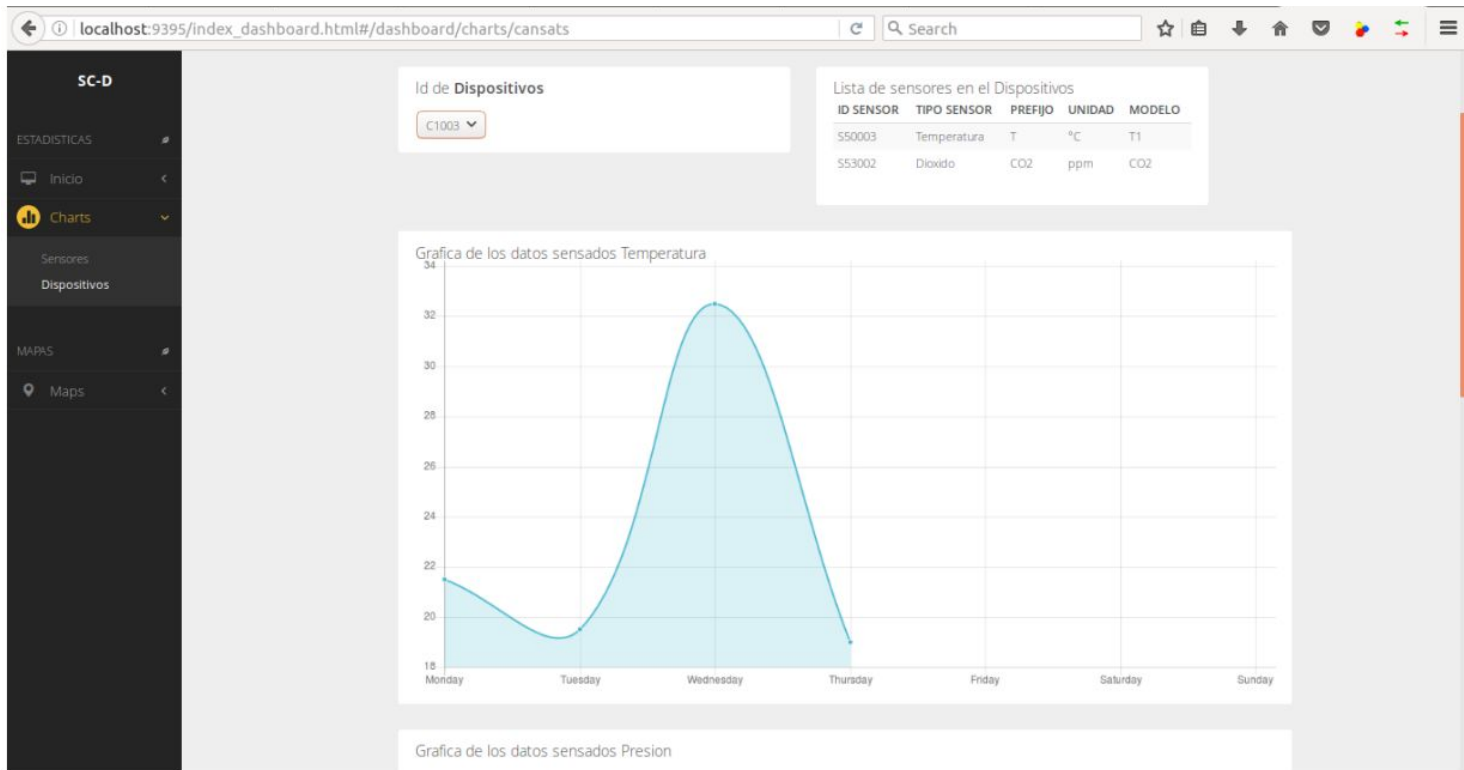
ID CANSAT	ID SENSOR	TIPO SENSOR	PREFIJO	UNIDAD	MODELO	FECHA DE INSTALACION	HORA DE INSTALACION
C1001	S50001	Temperatura T		°C	T1	2016-05-09	21:44:10
C1001	S51001	Presion P	Pa	Pa	PA1	2016-05-09	21:44:10
C1001	S52001	Monoxido CO	ppm	ppm	CO1	2016-05-09	21:44:10
C1003	S50003	Temperatura T		°C	T1	2016-05-09	21:44:10
C1003	S53002	Dioxido CO2	ppm	ppm	CO2	2016-05-09	21:44:10
C1004	S53003	Dioxido CO2	ppm	ppm	CO2	2016-05-09	21:44:10

The dashboard also features a sidebar with navigation options: 'SC-D', 'ESTADÍSTICAS', 'Inicio', 'Dashboard', 'Info Dispositivos', 'Info Sensores', 'Charts', 'MAPAS', and 'Maps'. The browser address bar shows 'localhost:9395/index_dashboard.html#/dashboard/info/sensores'.

Devices-Sensors Type Information



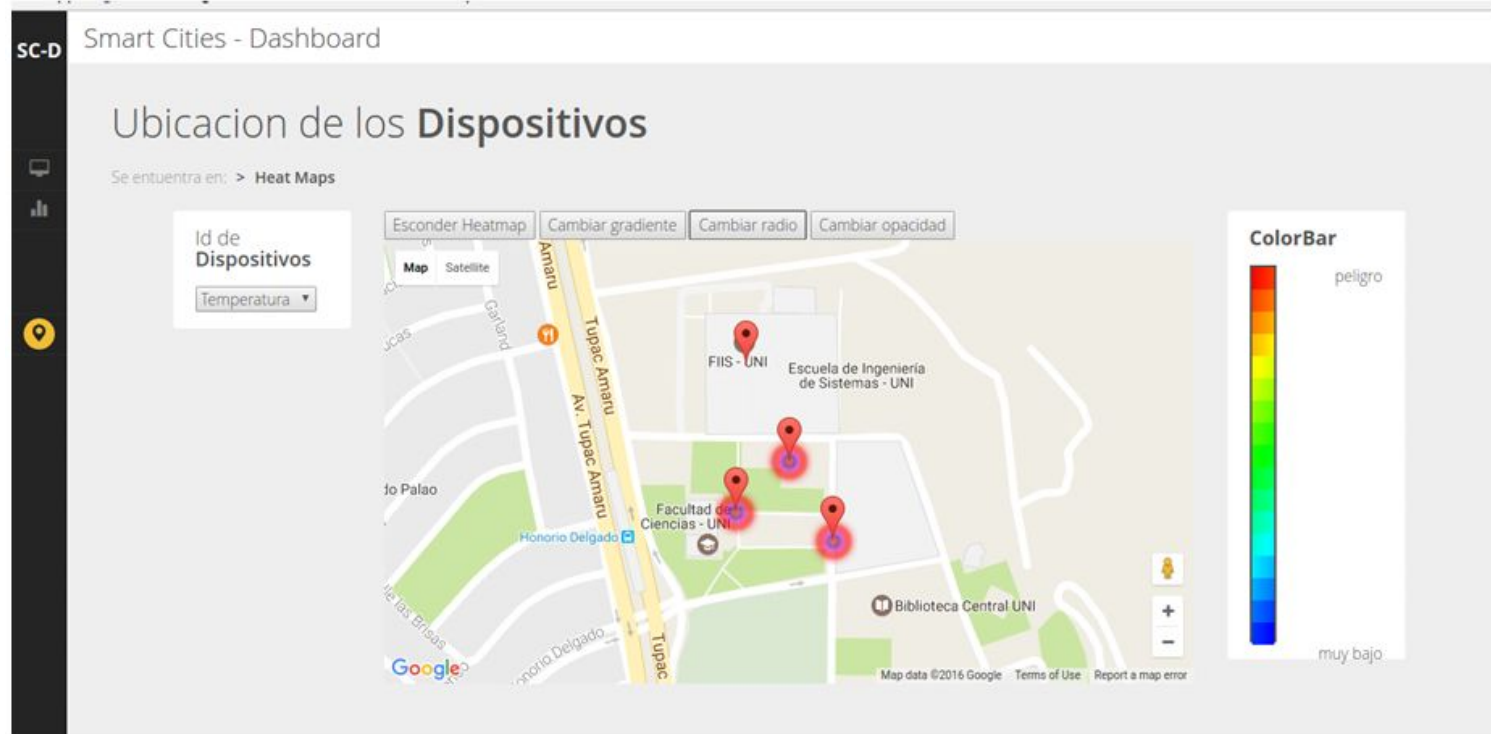
Sensor Data



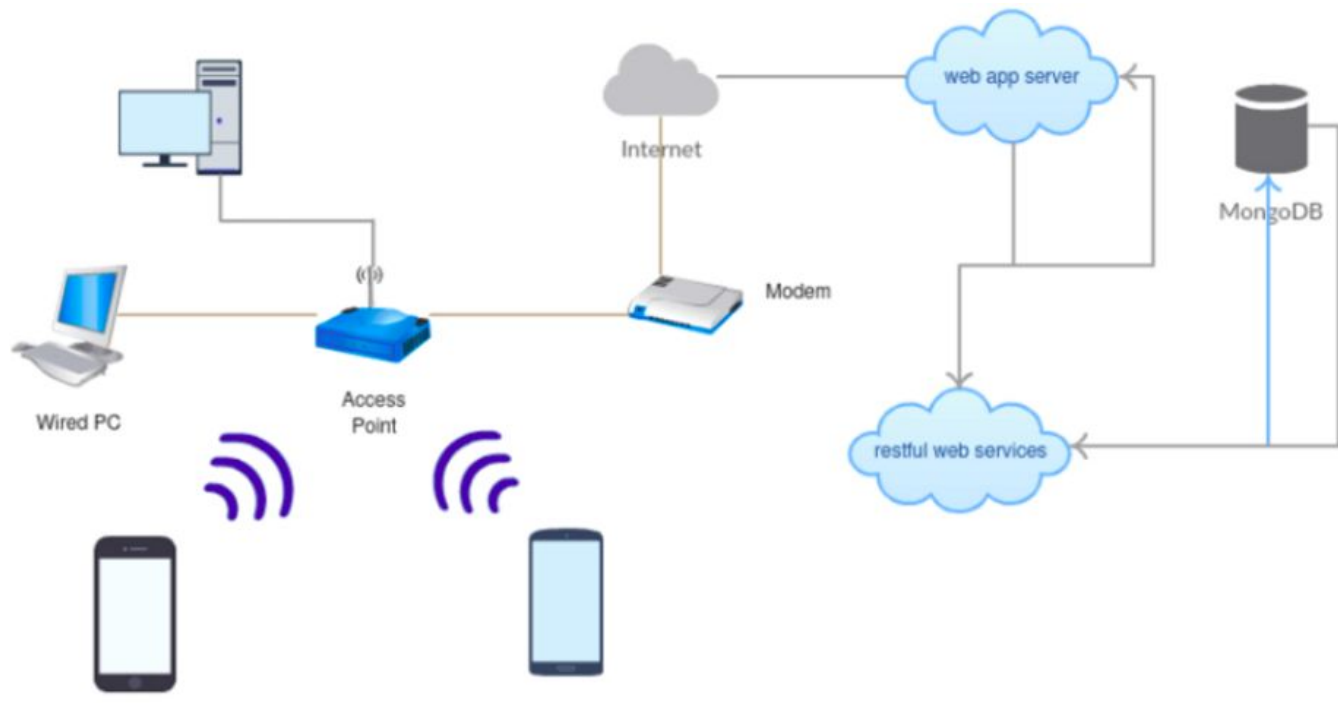
Sensor Locations

The screenshot displays a web browser window with the URL `localhost:9395/index_dashboard.html#/dashboard/maps/cansats`. The page title is "Smart Cities - Dashboard". The main heading is "Ubicación de los Dispositivos". Below the heading, it says "Se encuentra en: > Dispositivos Maps". The central part of the page is a Google Map showing the location of several devices, marked with red pins. The map includes labels for "FIIS - UNI", "Escuela de Ingeniería de Sistemas - UNI", "Facultad de Ciencias - UNI", and "Biblioteca Central UNI". The map also shows streets like "Av. Tupac Amaru" and "Calle Las Violetas". The left sidebar contains navigation options: "SC-D", "ESTADISTICAS", "Inicio", "Charts", "MAPAS", "Maps", "Dispositivos Maps", and "Heat Maps".

Sensor Heatmap



Rest API Architecture



Conclusions

Conclusions

- We propose a methodology to analyze income data from remote sensors.
- We implement a Fullstack application to process, clean, and show information sensed
- We develop a dashboard to show information in real-time.
- We build an Fog-based architecture to sensing, process, and track sensors data from different locations in real-time.



THANKS!

Any Questions?