

Revue - a distributed real-time system for video surveillance

Sistemi Distribuiti

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Introduction

Revue is a distributed real-time system for video surveillance. It allows the user to:

- ➊ Check an environment remotely through cameras
- ➋ Monitor an environment using sensors
- ➌ Add security rules based on his needs triggering alarms
 - ➊ Intrusions in case of broken safety rule by cameras
 - ➋ Outliers in case of broken safety rule by sensors

Due to his level of configurability Revue can be used in multiples scenarios.

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Architecture

Event-driven

An event-driven architecture was chosen for internal communications and core events management. Using a broker with *Publish-Subscribe* paradigm, *at least one* delivery is guaranteed.

REST API

To communicate with the system, a REST API layer is provided. This APIs allows to interact with the system using the classic paradigm *Request-Response*.

Microservices I

Revue is composed by multiple microservices, in particular:

- **Authentication Service**
- **Monitoring Service**
- **Recognition Service**
- **Alarm Service**
- **Notification Service**
- **Log Service**

Each one with his specific role. This type of architecture helped us to increase modularity, scalability, reliability and fault tolerance.

Microservices II

Each microservice consists of:

- 1 Web server exposing REST APIs
- 2 Database to store its data (except for the **Recognition Service**)

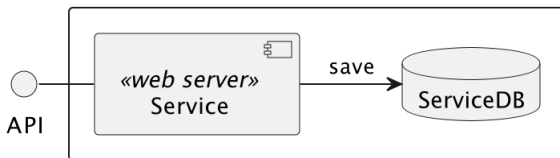


Figure: Microservice components

Other components

Other components are necessary to make the system work:

- **Media Server:** to increase compatibility with different protocols.
- **Broker:** to guarantee robust internal communications.

Whole architecture

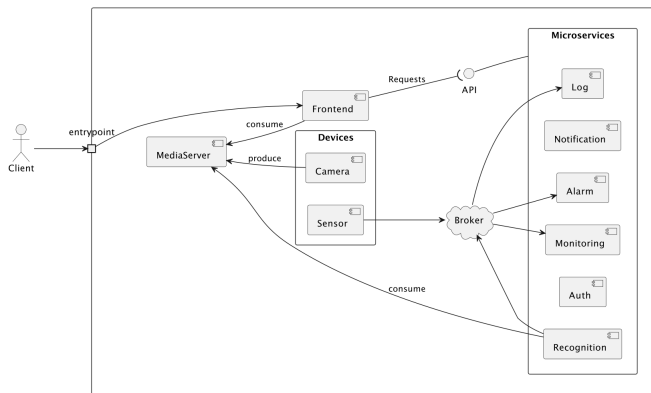


Figure: Revue Architecture

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Testing

Three main test suites have been carried out to guarantee the correctness of the system

- **Architectural testing:** to ensure respected layers dependencies;
- **API testing:** for integration purposes;
- **Fault tolerance tests:** to improve reliability under some fault condition;

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CAP Theorem

Due to the fact that Revue is a monitoring system, the best tradeoff we considered is:

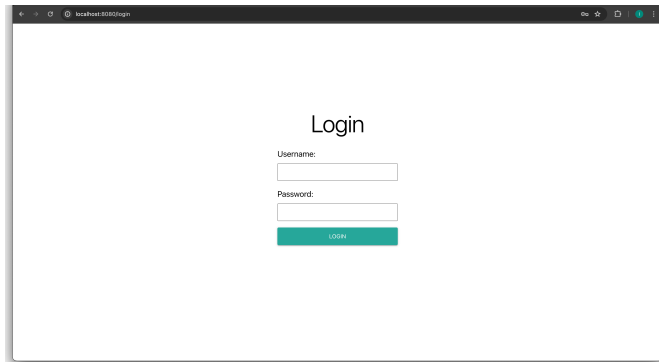
- ① **Consistency**
- ② **> Availability**
- ③ **> Partition tolerance**

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Usage Examples - Login

For every usage, the system requires a login for security reasons.



A screenshot of a web browser window displaying a login page. The browser's address bar shows 'localhost:8080/login'. The page content is centered and includes the title 'Login'. Below the title are two input fields: the first is labeled 'Username:' and the second is labeled 'Password:'. Both fields are empty. Below the password field is a green rectangular button with the text 'LOGIN' in white capital letters.

Figure: Login view

Usage Examples - Simplest Scenario I

In the simplest scenario, the user can see the section designated for sensor environment data or the camera video streams consultation.

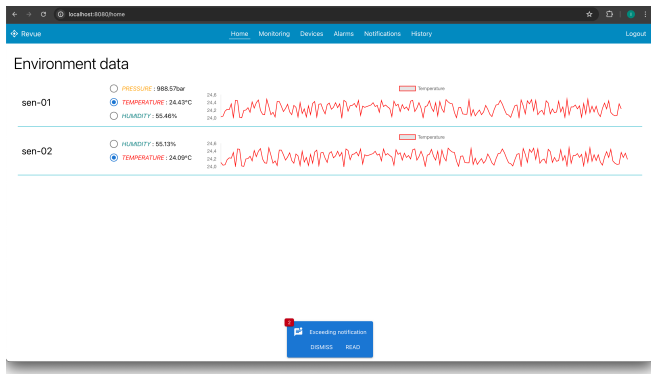


Figure: Home view

Usage Examples - Simplest Scenario II

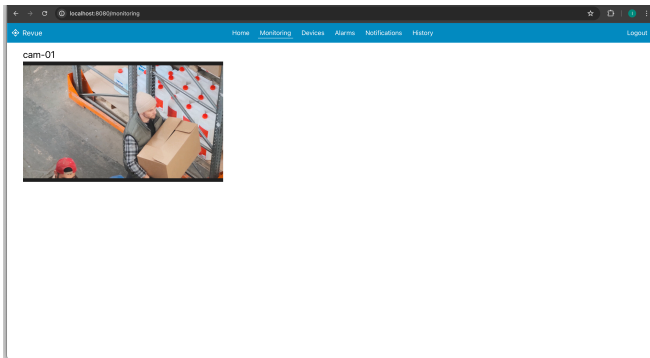
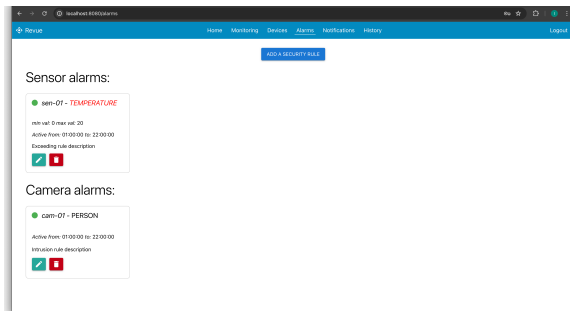


Figure: Monitoring view

Usage Examples - Complex Scenario I

Possibility to add security rules to detect exceeding values or unauthorized objects in the video streams.

- ➊ *Intrusion rule*: object class to detect, the camera and the time slot on which the rule will be active;
- ➋ *Exceeding rule*: range value (for a specific measure), the target sensor and the time slot validity;



Usage Examples - Configurations I

Both usages of the system consent to the user to add, delete or modify a device or a security rule configuration.

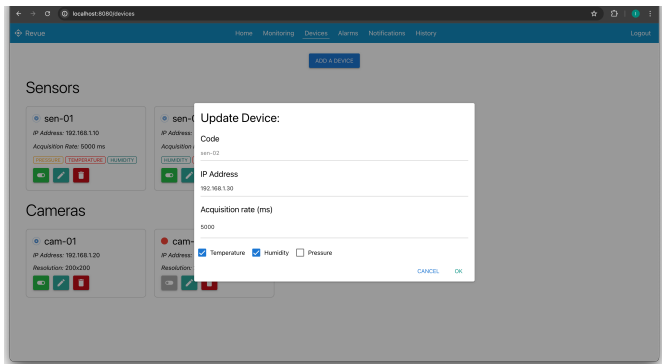


Figure: Updating a device

Usage Examples - Configurations II

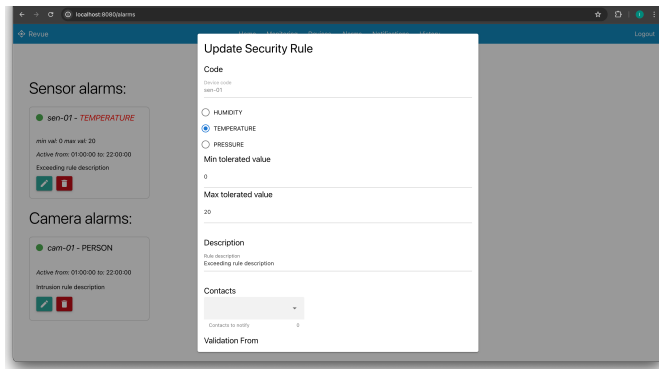
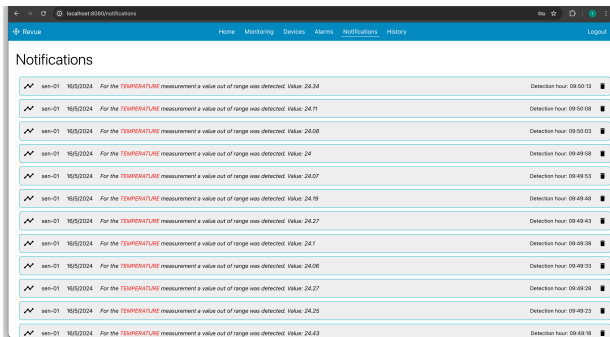


Figure: Updating a security rule

Usage Examples - History I

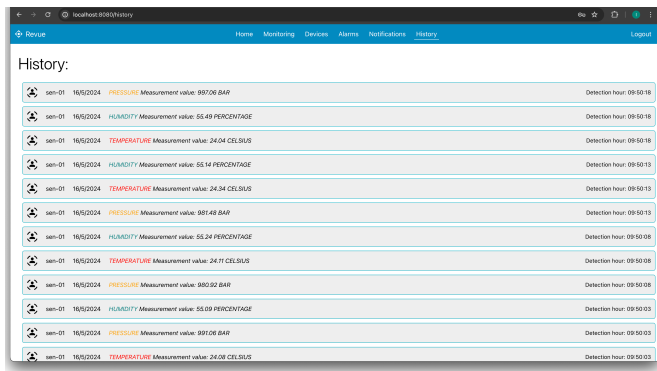
Moreover, the user can consult the history of produced data or all the notifications received by the system.



Notifications				
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 26.34	Detection hour: 09:50:13
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.11	Detection hour: 09:50:08
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 26.08	Detection hour: 09:50:03
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24	Detection hour: 09:49:58
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 26.07	Detection hour: 09:49:53
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.19	Detection hour: 09:49:48
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.27	Detection hour: 09:49:43
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.1	Detection hour: 09:49:38
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.06	Detection hour: 09:49:33
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.27	Detection hour: 09:49:28
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.25	Detection hour: 09:49:23
✓	sen-01	16/5/2024	For the TEMPERATURE measurement a value out of range was detected. Value: 24.43	Detection hour: 09:49:18

Figure: Notification view

Usage Examples - History II



History:

Sensor	Date	Measurement	Value	Detection hour
sen-01	16/5/2024	PRESSURE	Measurement value: 997.06 BAR	09:50:18
sen-01	16/5/2024	HUMIDITY	Measurement value: 55.49 PERCENTAGE	09:50:18
sen-01	16/5/2024	TEMPERATURE	Measurement value: 24.04 CELSIUS	09:50:18
sen-01	16/5/2024	HUMIDITY	Measurement value: 55.14 PERCENTAGE	09:50:15
sen-01	16/5/2024	TEMPERATURE	Measurement value: 24.34 CELSIUS	09:50:15
sen-01	16/5/2024	PRESSURE	Measurement value: 991.43 BAR	09:50:13
sen-01	16/5/2024	HUMIDITY	Measurement value: 55.24 PERCENTAGE	09:50:08
sen-01	16/5/2024	TEMPERATURE	Measurement value: 24.71 CELSIUS	09:50:08
sen-01	16/5/2024	PRESSURE	Measurement value: 980.92 BAR	09:50:08
sen-01	16/5/2024	HUMIDITY	Measurement value: 55.09 PERCENTAGE	09:50:03
sen-01	16/5/2024	PRESSURE	Measurement value: 991.06 BAR	09:50:03
sen-01	16/5/2024	TEMPERATURE	Measurement value: 24.08 CELSIUS	09:50:03

Figure: History view