RFID Access Management System: TagPass Project

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Abstract
The TagPass project implements an integrated access control solution based on RFID technology, connected to cloud services through Supabase and managed from a web interface developed with Flask. The system allows event logging, user management, and real-time card blocking, while ensuring data integrity through local synchronization on the Raspberry Pi.

Keywords: RFID, Access Control, Supabase, Flask, IoT

1. Introduction

The TagPass system emerges as a solution designed for secure access control using RFID cards. The project integrates a reader module based on the Raspberry Pi, a backend in Supabase, and a web interface developed with Flask. The architecture enables card management, access monitoring, and blocking control from a centralized platform accessible through a web browser.

2. System Architecture

The operational flow begins when the Raspberry Pi reads the UID using the MFRC522 RFID module through the SPI protocol. A Python service runs a continuous loop that validates the read UID by querying a local SQLite database. The Raspberry maintains a copy of permissions and logs to operate offline.

When connectivity is available, the Raspberry Pi synchronizes access logs with Supabase and updates local states. The system uses *Supabase Realtime* to receive changes in blocked or enabled cards, ensuring immediate response without manual data refresh.

3. Web Interface with Flask

The administrative panel was developed in Flask 3 using the official `supabase-py` SDK. Access credentials for the project are stored in a `.env` file, following security best practices.

The panel includes authentication via *email and password* using Supabase Auth. Once authenticated, the user can access modules to manage users, cards, buildings, rooms, and historical logs.

The main view allows filtering access logs by UID, owner name, institutional ID, building, room, and date-time ranges.

4. Log and Blocking Management

The interface allows blocking or unblocking cards, recording reasons and dates, and managing assignments. These changes are instantly reflected in Supabase and received by the Raspberry Pi through real-time events.

When the Raspberry Pi is offline, it continues operating autonomously by validating against its local database. Once the connection is restored, it synchronizes pending records and updates the permissions table according to the current state in Supabase.

5. Project Structure

The system repository includes:

- Web templates: `layout.html`, `login.html`, `dashboard.html`.
- Static files in `static/`, including CSS and scripts.
- Python service for the Raspberry Pi responsible for reading, validation, and synchronization.
- `.gitignore` file to avoid exposing secrets or virtual environments.

6. RFID Module Design

The MFRC522 RFID module connects to the Raspberry Pi via SPI. Figure 1 shows the physical assembly used in the prototype, including the Raspberry Pi, protoboard, and corresponding wiring.

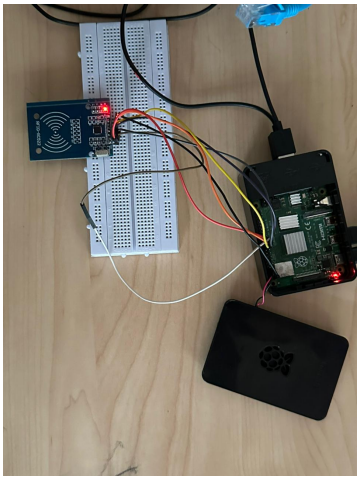


Figure 1: Physical assembly of the system: Raspberry Pi, MFRC522 module, and protoboard with wiring.

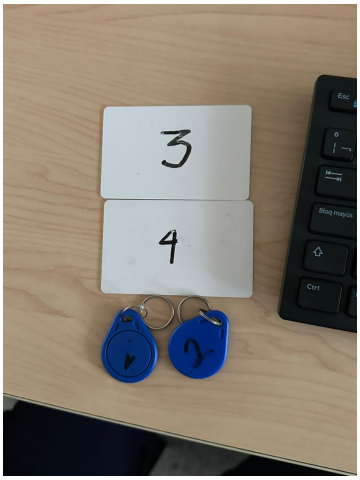


Figure 2: RFID identifiers used in the system: access card and keyfob.

6.1. RFID Identifiers Used

MIFARE Classic RFID cards were used in *card* and *keyfob* formats. Each identifier contains a unique UID used for authentication. Figure 2 shows the elements used in the tests.

7. Conclusions

TagPass presents a robust architecture based on hybrid synchronization (*online-offline*) using Supabase and Raspberry Pi. The integration between RFID hardware, local persistence, real-time events, and an administrative web interface enables efficient, scalable, and adaptable control for institutional environments.

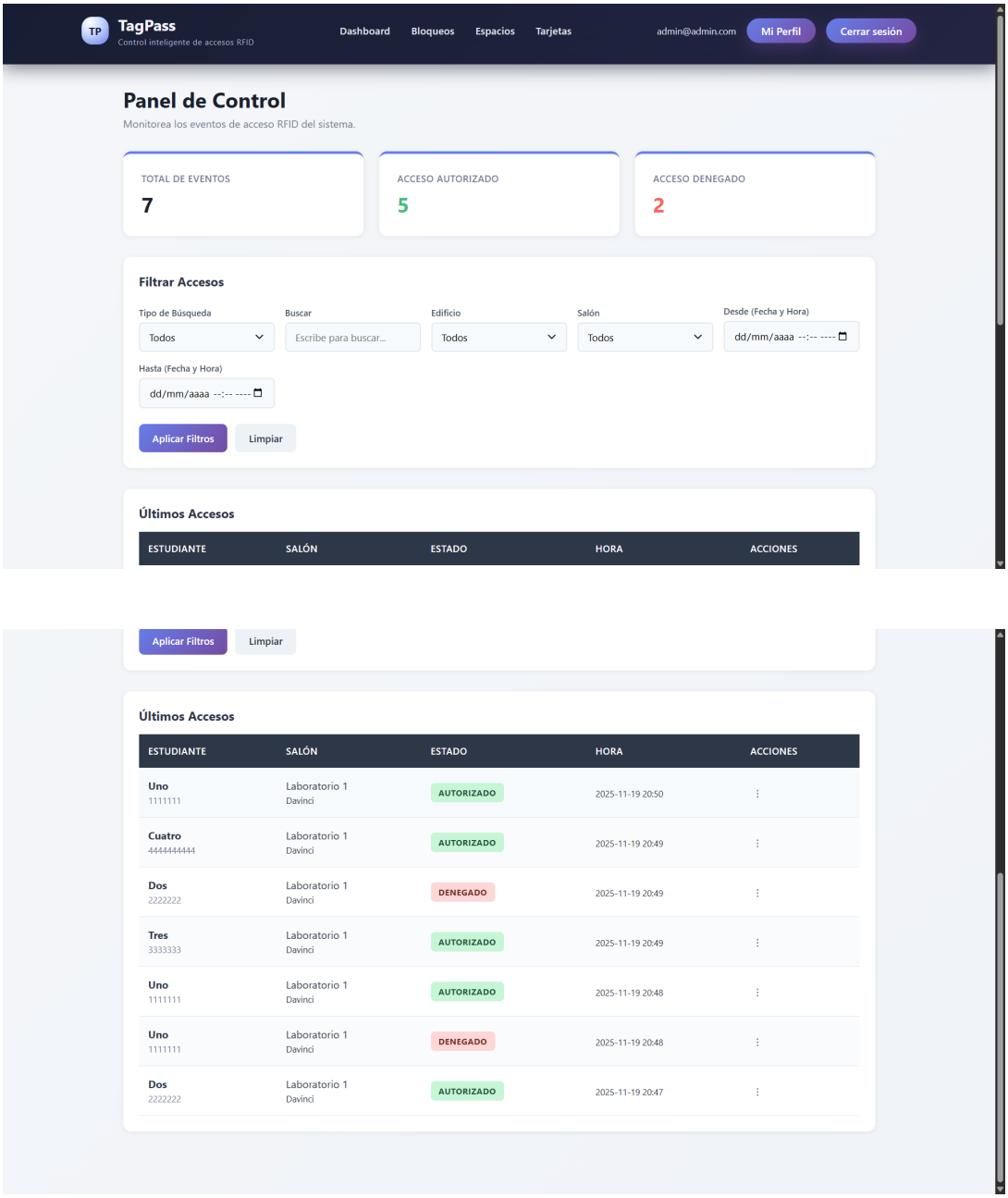
Project Repository

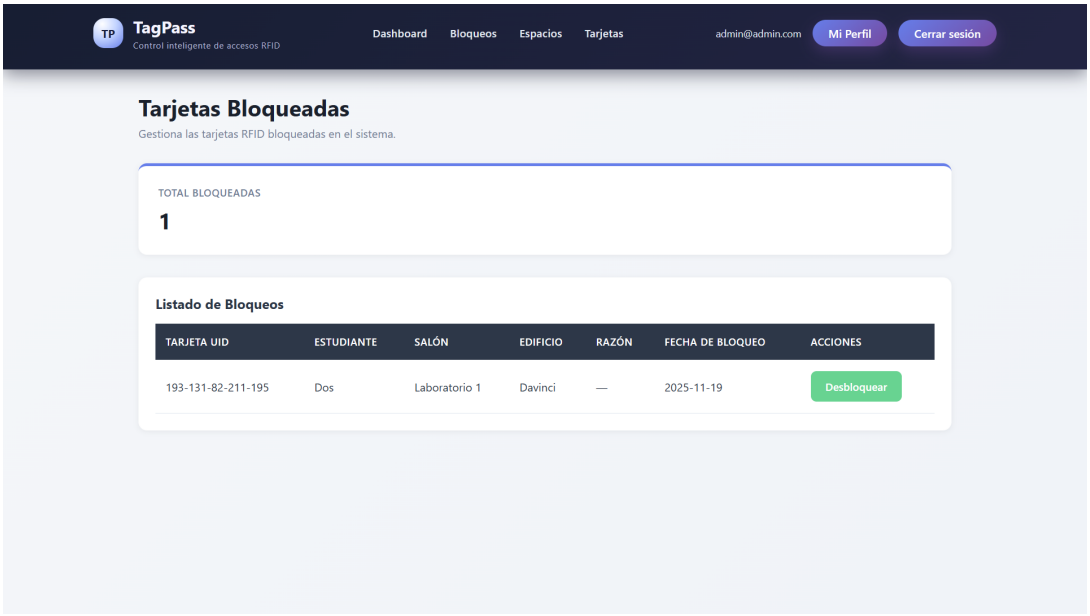
The source code of the TagPass system, including the synchronization logic, the service running on the Raspberry Pi, and the web interface developed in Flask, is available in the following public GitHub repository:

`https://github.com/Xan007/TagPass-RFID-Access-Management`

Appendix: System Interface Screenshots

Below are real screenshots of the TagPass administrative dashboard, showing user management, space management, card management, access logs, and blocking operations.

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TagPass
Control inteligente de accesos RFID
Dashboard
Bloqueos
Espacios
Tarjetas
admin@admin.com
Mi Perfil
Cerrar sesión
Tarjetas Bloqueadas
Gestiona las tarjetas RFID bloqueadas en el sistema.
TOTAL BLOQUEADAS
1
Listado de Bloqueos
TARJETA UID
ESTUDIANTE
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RAZÓN
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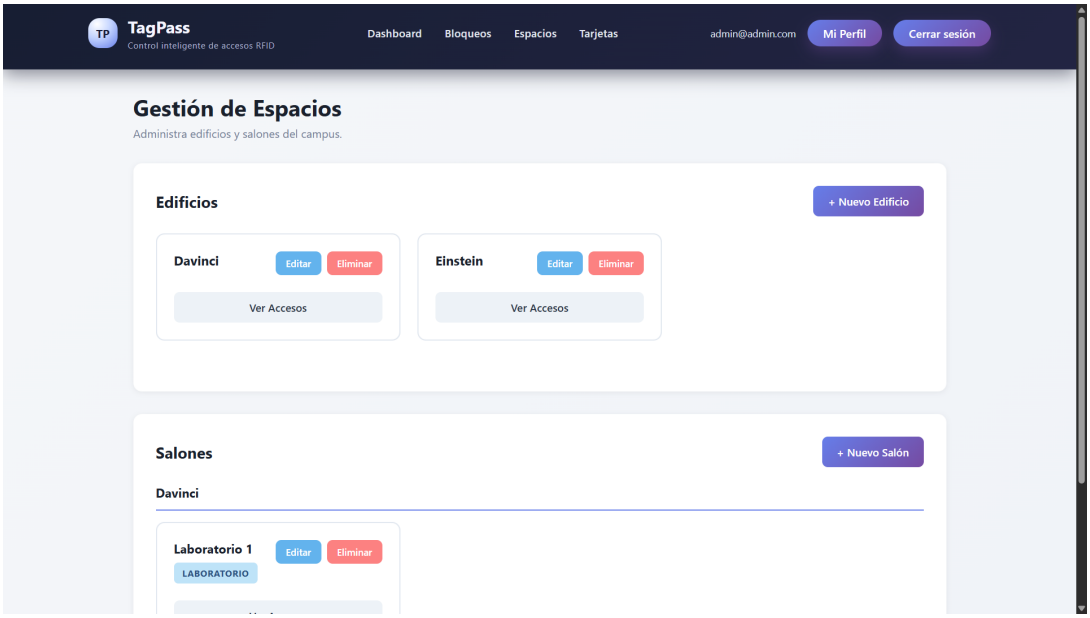
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Bloqueos
Espacios
Tarjetas
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Mi Perfil
Cerrar sesión
Gestión de Espacios
Administra edificios y salones del campus.
Edificios
+ Nuevo Edificio
Davinci
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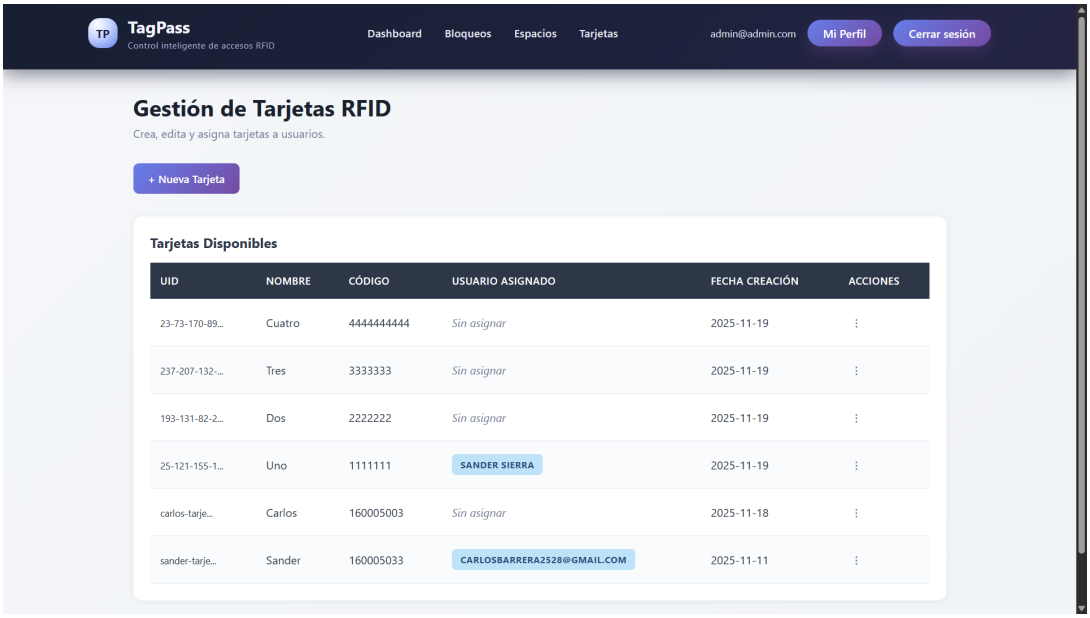
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Mi Perfil
Cerrar sesión
Gestión de Tarjetas RFID
Crea, edita y asigna tarjetas a usuarios.
+ Nueva Tarjeta
Tarjetas Disponibles
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