"POLITEHNICA" University - Timişoara

Department of ID/IFR and Digital Education (DeL)

Informatics

Syncretic Project

Intelligent Door Locking System

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Content

1. Project description

The project proposes the implementation of a smart door locking system, remotely controlled and integrated into an IoT architecture based on the MQTT protocol.

The system allows:

- Control of the closing and opening of an electric lock
- Local authentication via keyboard, RFID or PIN code
- Monitoring the door status (closed/open)
- Real-time notifications to the user and/or application
- Archiving events in a database.

This type of system is useful in residential buildings, offices, warehouses or industrial spaces where access needs to be controlled and monitored.

2. SWOT analysis

Strenghts

- Real-time remote control via MQTT
- Continuous access monitoring
- Low implementation cost (ESP32, servo/solenoid)
- High scalability - additional doors/sensors can be added

Weaknesses

- Requires stable WiFi connection
- Depends on MQTT implementation security
- Increased power consumption if using a continuous electromagnet

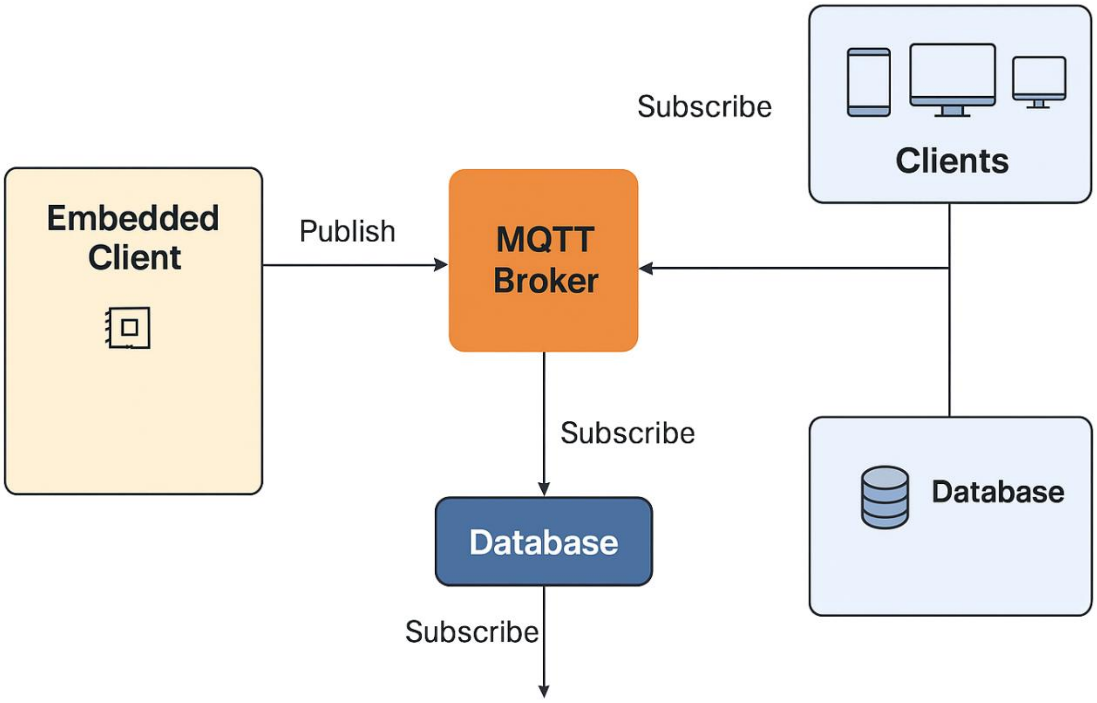
Opportunities

- Integration with mobile apps, alarm systems or video cameras
- Extension to complete smart home systems
- Implement multi-factor authentication

Threats

- Cyber attacks if MQTT is not secured (SSL/TLS)
- Hardware failures (servo, solenoid)
- Power supply problems

3. Architectural diagram/element description



◆ **Embedded MQTT Client**

Door-mounted IoT device:

- Microcontroller: ESP32 / ESP8266
- Sensors:
  - Door position sensor (reed switch)
  - RFID (optional)
  - Numeric keypad (optional)
- Actuator:
  - Servo motor/electromagnet (solenoid)

- Functions:
  - Send door status (door/status)
  - Receive commands from broker (door/command)
  - Publish access events (door/event)

◆ **MQTT Broker**

Examples:

- Mosquitto (local)
- HiveMQ Cloud

◆ **Receiving client(s)**

Can be:

- a mobile application
- a web dashboard
- a PC with an MQTT client (MQTT Explorer etc.)

Functions:

- Receive notifications
- Send lock/unlock commands
- View access history

◆ **Database**

Type: MySQL / SQLite / Firebase

Recommended tables:

1. users – authorized users
2. events – access log
3. door_status – real-time door status

4. Description of major functions

Embedded client (ESP32)

- Reads the door position sensor
- Initiates WiFi + MQTT connection
- Receives commands to operate the lock
- Periodically sends status (online/offline, open/closed)
- Sends events: access approved, access denied, actuator error.

MQTT broker

- Routes messages between the embedded client and the receiving clients
- Manages the topics created according to the hierarchical structure
- Provides QoS (Quality of Service) for secure message delivery.

Receiving client

- Sends the "lock/unlock" command
- Displays the door status
- Stores data in the DB
- Generates alerts/messages to the user.

5. Database diagram + description

Recommended tables

1. **users** - Keeps track of the users authorized to open the door.

id	**name**	**rfid_code**	**pin**	**role**
1	Alexandru	23C21G	7468	admin

2. **events** - Access events, lock/unlock, failed attempts.

id	**user_id**	**event_type**	**timestamp**
31	1	unlocked	2025-12-10 17:03

3. **door_status** - Maintains the last state of the door.

id	**status**	**updated_at**
1	closed	2025-12-10 18:30

6. Conclusions

The smart door lock system offers a modern, secure and scalable solution for access control using IoT technologies.

The use of MQTT ensures a fast response time, and integration with a database allows for monitoring accesses. The system can be easily expanded with additional functions such as: video cameras, geofencing, biometric authentication or dedicated mobile applications.

7. Bibliography

- MQTT Topics, Wildcards, & Best Practices
- Wokwi for VS Code
- Building a Smart Door Lock System with ESP32
- RFID Security Door Lock Using ESP32

8. Source code (github)

SmartDoorLock