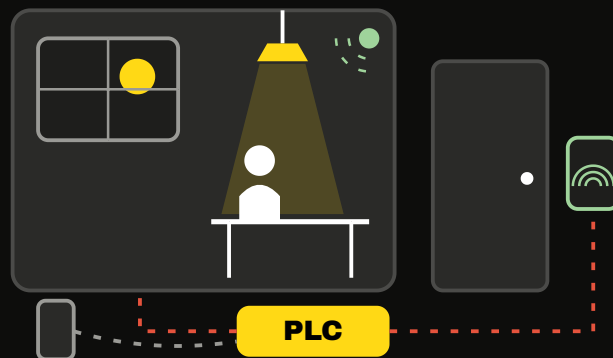


## SMART OFFICE · RASPBERRY PLC

# Who gets in, how bright, how warm. Raspberry PLCs run the office.

Biometric access, automatic lights and the climate on your phone.

[Read the interactive case study online ›](#)



access, light, climate and alarm  
Schematic illustration

**2**

biometric methods at the door: fingerprint and face

**3**

sensor types in the office: light, temperature and motion

**1**

mobile app for the light and temperature of each employee

**4**

project steps: risks, design, install and test, maintain

## THE CHALLENGE

# Security and comfort in the same office.

A smart office automates daily tasks and processes. In this case the company wanted two things at once: control who enters the building and its sensitive areas, and give each employee more control over the light and the temperature at work, with less energy wasted.

01

### Who gets in

Access to the building and to the sensitive areas must be controlled. The company chose biometric technology: fingerprint and facial recognition.

02

### Light where people are

The lights must turn on and off by themselves with presence sensors in the rooms, and adapt to the light outside and to the preferences of the employees.

03

### Each person sets the comfort

Employees set their own light and temperature preferences from a mobile app. The system takes the occupancy and the weather into account.

04

### Intruders

Motion sensors must detect any unauthorised movement in the office. When there is an intrusion, the alarm starts.



### Start with the risks

The first step of the project was to identify the potential risks to mitigate. The automated safety system was designed after that, and then installed, wired, programmed and tested.

## HOW IT WORKS

### Three jobs: light the rooms, keep each person comfortable, guard the door.

#### Job 1 · Light the rooms

#### Lights by presence and by daylight.

Presence sensors in each room tell the PLC when someone is there. A light sensor tells it how much daylight comes in. The PLC switches the lights and dims them so the desk gets enough light, not more. Change the sky and walk in or out.

- On and off with presence sensors in the rooms
- Dimmed by the light from outside
- Off by itself when the room is empty

#### Job 2 · Keep each person comfortable

#### The temperature you set on your phone.

Employees choose their temperature from a mobile app. Temperature sensors give the PLC the real value of the room, and the PLC asks the heating or the cooling for more. When the office is empty, it can fall back to an energy saving setpoint. Change the weather and use the app.

- Temperature preference from a mobile app
- Temperature sensors close the loop
- Occupancy and weather change the setpoint

#### Job 3 · Guard the door

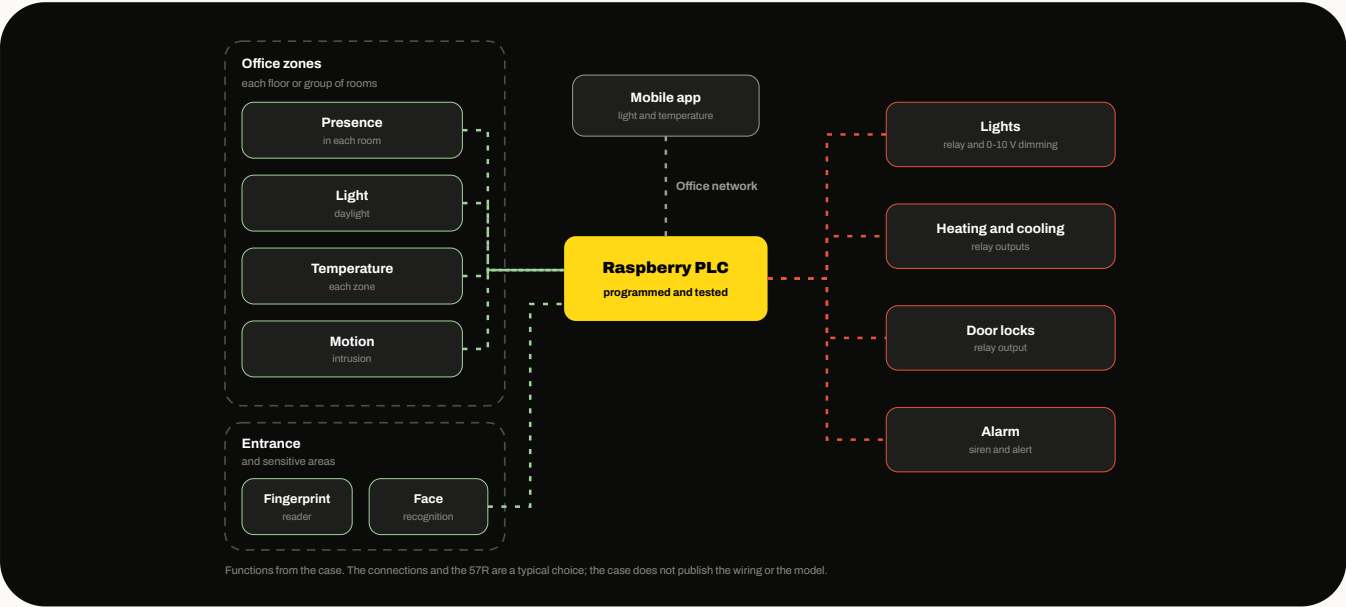
#### Biometric access by day, an alarm at night.

Fingerprint and face readers control the access to the building and to the sensitive areas. Motion sensors watch the office, and the PLC starts the alarm when there is an intrusion. Close the office and try to get in.

- Fingerprint and facial recognition
- The alarm starts when motion sensors detect an intruder
- A valid access stops the alarm

# How do you connect access, lights, climate and alarm to one PLC system?

In each zone, presence, light, temperature and motion sensors send their information to the Raspberry PLCs. At the entrance and the sensitive areas, fingerprint and face readers decide who gets in. The PLCs drive the actuators: lights, heating and cooling, door locks and the alarm. A mobile app on the office network lets each employee send light and temperature preferences. The case uses PLCs, in plural; a typical split is one PLC per floor or per group of rooms.



- Sensors in the office
- Raspberry PLC
- Office network and app
- Actuators: lights, climate, doors, alarm

## Signals and data (types are a typical choice; the case does not publish them)

| Signal              | Between                            | Type                             | Purpose                                            |
|---------------------|------------------------------------|----------------------------------|----------------------------------------------------|
| Presence            | Presence sensor in each room → PLC | Digital input                    | Lights on and off with people in the room          |
| Daylight            | Light sensor → PLC                 | Analog input, 0-10 V             | The lighting adapts to the light from outside      |
| Room temperature    | Temperature sensor → PLC           | Analog input, 0-10 V             | The real value against the setpoint of the app     |
| Movement            | Motion sensors → PLC               | Digital input                    | Detect unauthorised movement and start the alarm   |
| Access              | Fingerprint or face reader → PLC   | Contact, RS-485 or Ethernet      | Who gets into the building and the sensitive areas |
| Lights              | PLC → lighting circuits            | Relay output and 0-10 V output   | Switch and dim the lights                          |
| Heating and cooling | PLC → HVAC units                   | Relay outputs                    | Ask for heat or cold to meet the setpoint          |
| Door locks          | PLC → electric locks               | Relay output                     | Open the door after a valid access                 |
| Alarm               | PLC → siren and alert              | Relay output and network message | Stop or start the emergency alarm                  |
| Preferences         | Mobile app ↔ PLC                   | Office network                   | Light and temperature chosen by each employee      |

# A Raspberry PLC with relays for a building.



## CURRENT FIT

## RASPBERRY PLC 57R FLEX

A Raspberry Pi based PLC with 24 relays and 12 analog inputs. It runs Linux, so the same controller can host the logic and the service for the mobile app.

|                     |                                                                                                     |
|---------------------|-----------------------------------------------------------------------------------------------------|
| Role in this design | Reads the sensors of a floor or zone, drives lights, climate, locks and alarm, and talks to the app |
| Computer            | Raspberry Pi 4, quad core 64-bit, 1.8 GHz, 2, 4 or 8 GB RAM                                         |
| Software            | Debian 64-bit: Python, Node-RED, C/C++                                                              |
| Inputs              | 18: 12 analog/digital (0-10 V, 12-bit) and 6 digital optoisolated, 5 to 24 Vdc                      |
| Outputs             | 33: 24 relays (230 Vac 4 A / 24 Vdc 2 A, resistive) and 9 analog/digital/PWM (0-10 V)               |
| Communication       | Gigabit and 10/100 Ethernet, 2 x RS-485, Wi-Fi, Bluetooth LE                                        |

The case says Raspberry PLC and does not publish the model. We show the 57R because it has relays for every load of a zone and analog inputs for light and temperature.

[See the Raspberry PLC 57R ›](#)

### Risks first

The project started with the risks to mitigate, and only then designed the automated safety system. The sensors and the alarm answer those risks.

### Tested before use

Once the devices are installed and wired, the PLCs are programmed and the whole system is tested to make sure it works properly.

### Maintained, not forgotten

Regular maintenance and monitoring of the PLC system find potential problems before they become critical failures.

#### PLANNING A SMART OFFICE?

**Tell us about your building. An engineer will answer.**

Tell us the zones, the doors, the sensors you already have and what people must control from their phone. We will propose the PLCs, the wiring and the software.

#### READ IT ONLINE

[industrialshields.com/case-study-smart-office-raspberry-plc](https://industrialshields.com/case-study-smart-office-raspberry-plc)

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