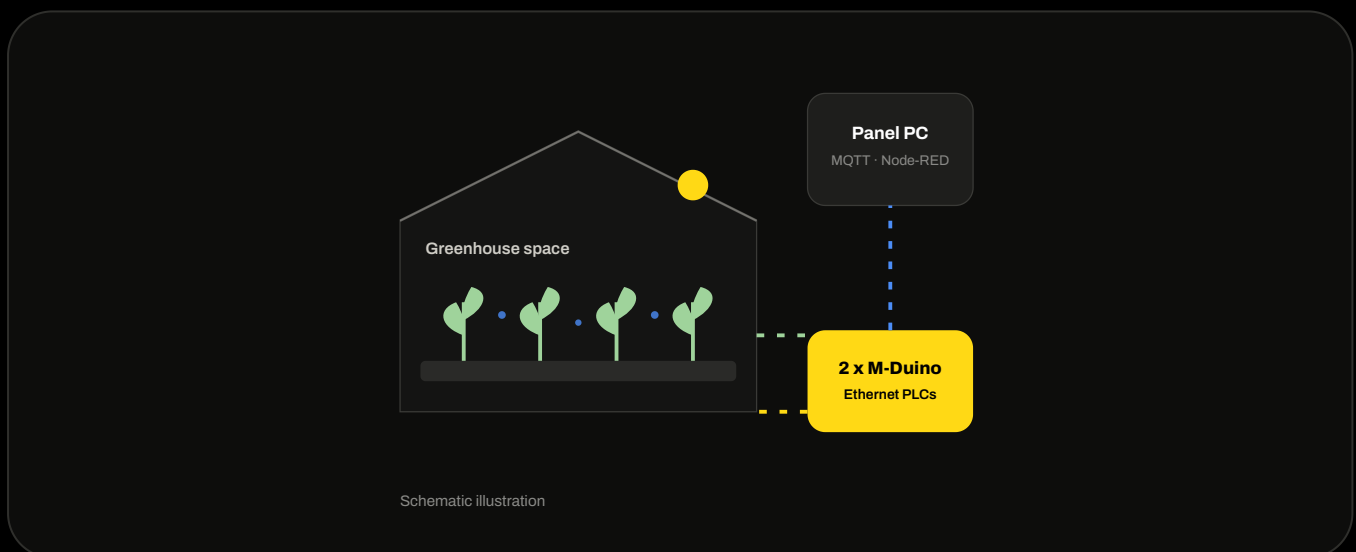


GREENHOUSE AUTOMATION · ARDUINO PLC + RASPBERRY PI

Humidity, CO2, temperature and light. **Two Arduino PLCs** run the greenhouse.

How a greenhouse manager built an open control system with Industrial Shields equipment: two Ethernet PLCs read the sensors and drive the actuators, and a Raspberry Pi Panel PC with MQTT and Node-RED gives remote control and alerts.

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

4

variables controlled:
humidity, CO2,
temperature, light

2 PLCs

Arduino based Ethernet
PLCs read sensors and
drive actuators

I2C

bus with multiplexers for
the climate sensors

MQTT

broker and Node-RED
dashboard on a Raspberry
Pi Panel PC

THE CHALLENGE

Control every space of the greenhouse remotely, and know when something goes out of range.

The greenhouse is made of several spaces. Each one needed remote control of humidity, CO2, temperature and lighting, plus a system to alert the customer when any variable is out of range.

01

Humidity

Relative humidity is measured at the climate station inside the greenhouse and acts on the fog or cooling systems.

02

Ventilation

Without proper ventilation, some areas would have different temperature and humidity, and the harvest would decrease.

03

CO2 level

CO2 application systems are controlled from the measurements of the CO2 content inside the greenhouse.

04

Light

Lights follow a time schedule and can also be set manually. Controlling the lighting avoids burns on plant leaves.



A base project to scale up

The customer started the project as a test, with the aim of defining the hardware and software that would later be scaled up to other installations he owns.

HOW IT WORKS

Automatic climate, scheduled light, one screen.

Loop 1 · Humidity and temperature

Fog, cooling and ventilation

The PLC reads humidity and temperature from the climate sensors and decides on the fog or cooling systems and on the ventilation, so all the areas of a space stay at the same conditions.

- Inputs: humidity and temperature sensors on the I2C bus
- Logic: ranges in the Arduino IDE sketch
- Outputs: pumps, valves and ventilation

Loop 2 · CO2

CO2 application from measurement

The CO2 content inside the greenhouse is measured and the PLC controls the CO2 application systems from that measurement.

- Input: CO2 level
- Logic: range in the PLC
- Output: CO2 application system

Loop 3 · Light

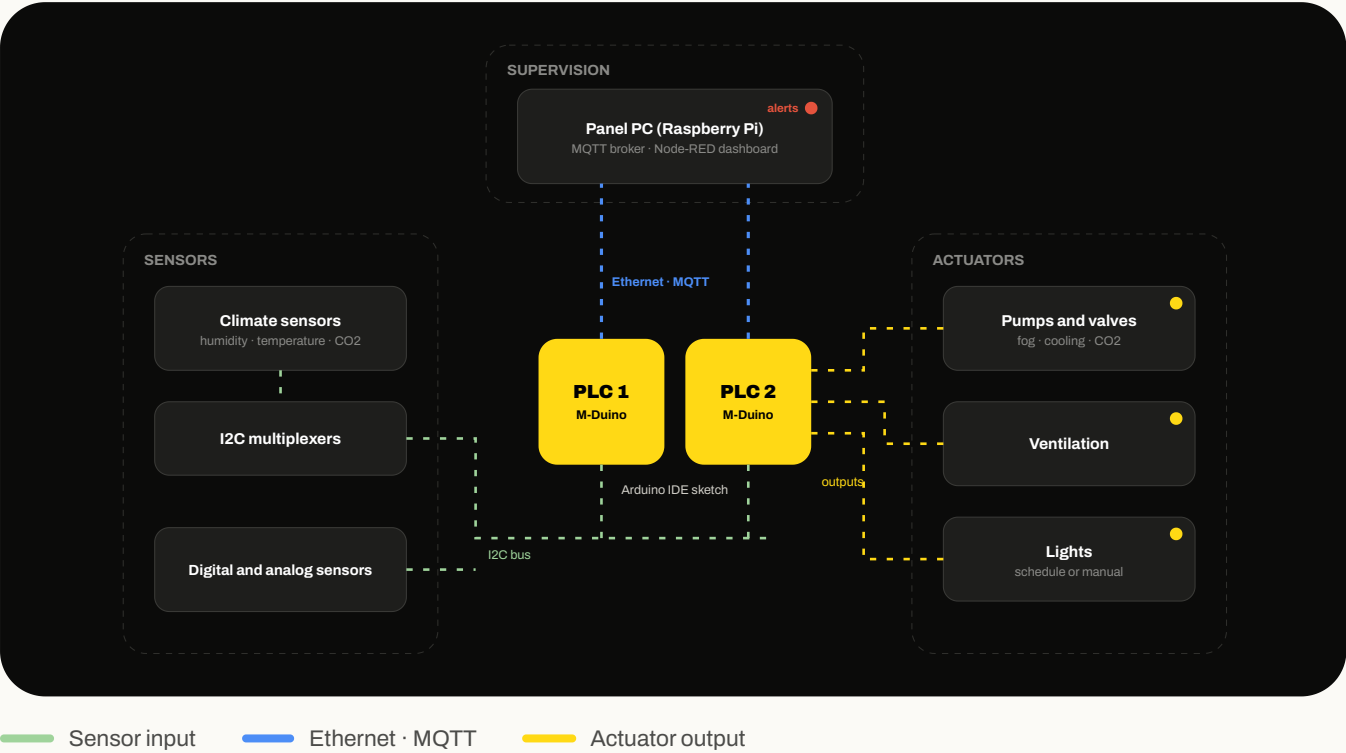
Lights by schedule, with manual override

While humidity, CO2 and air are controlled automatically, the lights follow the time of day. They can also be set manually from the Panel PC.

- Input: time schedule
- Override: manual command from the dashboard
- Output: greenhouse lights

From the sensor bus to the dashboard.

The architecture of the installation, redrawn from the project description. Sensors on the left, the two PLCs in the middle, actuators on the right and the Panel PC on top.



Signal list

Signal	Direction	Type	Purpose
Climate sensors	Sensor → PLC	I2C bus with multiplexers	Humidity, temperature and CO2 of each space
Other sensors	Sensor → PLC	Digital and analog	Complete the measurement of the installation
Pumps and valves	PLC → actuator	PLC output	Fog, cooling and CO2 application
Ventilation	PLC → actuator	PLC output	Keeps temperature and humidity even
Lights	PLC → actuator	PLC output	Lighting by schedule or manual command
Process data	PLC → Panel PC	Ethernet · MQTT	Values of the two PLCs sent to the broker
Dashboard and alerts	Panel PC → user	Node-RED	Remote control and out of range alerts

HARDWARE USED

Two PLCs on the DIN rail, one Panel PC on the wall.



M-Duino Ethernet PLCs

Two Arduino based Ethernet PLCs of the M-Duino family read the sensors and run the control sketch of each phase.

Role	Sensor reading and actuator control
Sensors	I2C bus, digital and analog
Programming	Arduino IDE
Link	Ethernet to the Panel PC

The case does not publish the exact M-Duino model. The image shows the M-Duino Ethernet 21.

[See the Arduino PLCs >](#)



Panel PC with Raspberry Pi

An Industrial Shields Panel PC with a built-in Raspberry Pi hosts the MQTT broker and the Node-RED dashboard.

Role	Supervision and remote control
Software	MQTT broker, Node-RED
Link	Ethernet to both PLCs

[See the TouchBerry Pi 10.1" >](#)

No turnkey limits

An open source solution let the customer implement all the specifications he wanted, with unlimited options.

Easy to wire

Screwless connectors make the wiring of sensors and actuators faster.

Your choice of tools

The PLCs are programmed with the Arduino IDE and the dashboard with Node-RED, both free tools.

SIMILAR PROJECT?

Tell us your crop and your variables. An engineer will answer.

Greenhouses, vertical farms or climate rooms: describe what you need to measure, control and supervise, and we will tell you which controllers fit.

FULL CASE STUDY ONLINE

industrialshields.com/case-study-greenhouse-automation-arduino-plc-raspberry-pi

EMAIL

info@industrialshields.com

PHONE

[\(+34\) 938 760 191](tel:+34938760191)