GREEN HOUSE
smart culture

Measurement of microclimatic conditions and automated actions in the greenhouse and in other controlled environments.

white paper 2014

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The needs of a greenhouse

The farming in greenhouse requires high management costs and investments.

Alleviate the pressure is possible thanks to GREEN HOUSE, the technology signed by Auroras..

GREEN HOUSE allows to:
- maximize the product yeld and quality in order to produce fruits as the market demands **(fresh, fleshy, juicy)**;
- automate several processes for **energy and worked hours saving**;
- provide scientific data for a **sustainable use of plant protection products**.

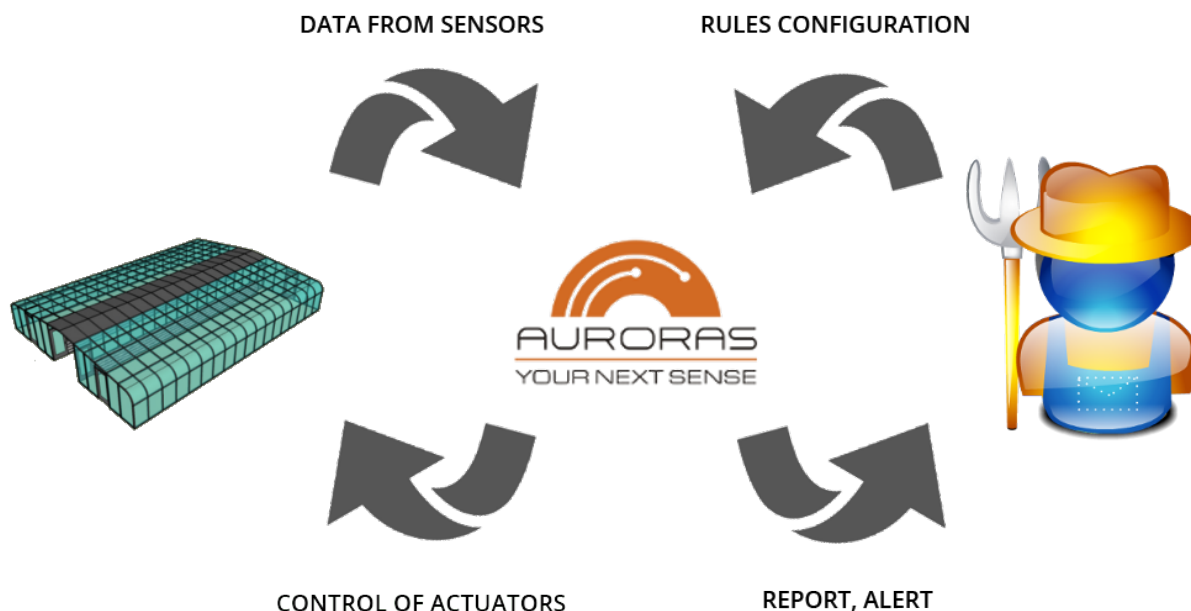GREEN HOUSE is the solution for an efficient greenhouse.

What GREEN HOUSE is

GREEN HOUSE is an advanced control and monitoring system of the microclimatic conditions in the greenhouse.

GREEN HOUSE is suited for those who design greenhouse from the ground or for those who want automate and rationalise an existing greenhouse.

GREEN HOUSE maximizes return of the greenhouse cultivations by reducing the costs of energy needs.

How it works

The GREEN HOUSE architecture is flexible and modular. It includes 3 areas:

1. WSN (wireless sensor nodes): they send micro-climatic parameters to the gateway;

2. WAN (wireless actuators nodes): they execute commands of the gateway;

3. COORDINATOR: it takes the decisions concerning automation processes and connects all of the nodes.

The initiation rules and the ignition parameters of automation are totally configurable also at a later date. So GREEN HOUSE is able to meet and adapt to the greenhouse growers' requirements over time.

DATA FROM SENSORS

RULES CONFIGURATION

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CONTROL OF ACTUATORS

REPORT, ALERT

Practical applications

The purpose of the GREEN HOUSE is to preserve the balance of the micro-climate in the greenhouse, the most congenial one for different growth stages of flowers, plants, fruit and vegetables.

| AUTOMATISM	FUNCTION	PARAMETER
Aeration doors	To adjust the air temperature and humidity.	Internal/external temperature Internal/external humidity Wind, speed and direction (external) Rain, presence, absence (external)
Ventilation fans	To adjust the air temperature and humidity.	Internal temperature Internal humidity Wind, speed and direction Rain, presence, absence (external)
Heating	To control the heating	Ambient temperature
Shading net	To reduce the luminous intensity	Luminosity
Lamps	To increase the luminous intensity	Luminosity
Vaporizers	To adjust the air humidity	Internal humidity
Fertilisation	Balance of the fertilising elements and distribution of the nutritional solution	EC Electrical conductivity pH
Irrigation	To adjust the soil moisture	Soil moisture

Example: aeration doors

Objective: **to regulate air temperature and humidity.**

The interventions carry out at the most appropriate moment, as soon as needs emerge.

The system is automatized: interventions are planned in advance according to contingent requirements.

Rapidity and accuracy in order to guarantee high-performance productions.
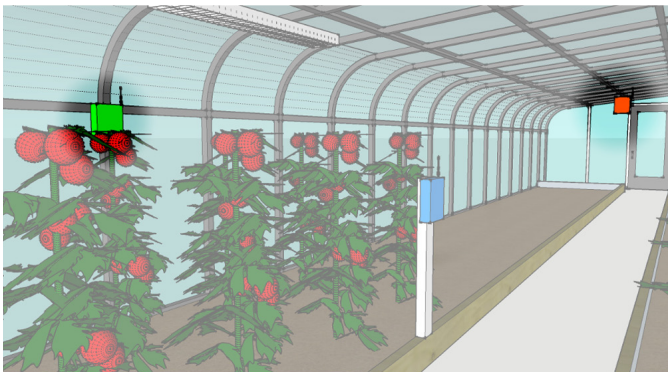
The operations are reconfigurable.
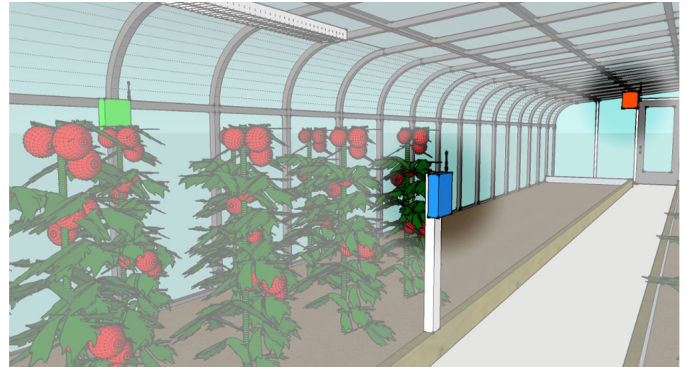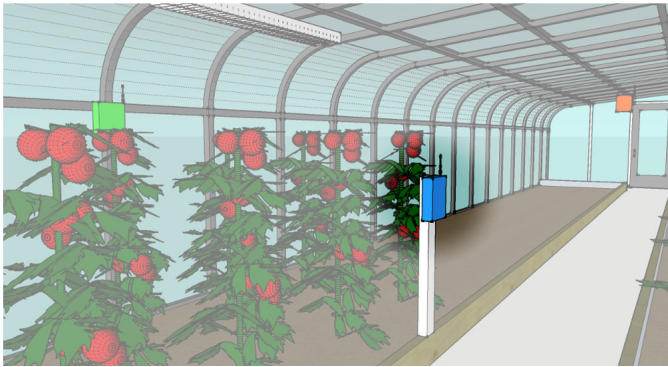
Objective: to regulate air temperature and humidity.
WSN (wireless sensor nodes) reveal the thermohygrometric data in real time.

The data are sent to the **COORDINATOR** which forwards them to Auroras Service Centre, where they are processed.

The COORDINATOR communicates to **WAN (wireless actuator nodes)** the interventions to carry out.

The WAN runs the command, opening (in this example) the aeration doors.

Applications

- **In drying greenhouses** for the drying process of agricultural products and forestry such as grain, figs, tomatoes, corn, hay, tobacco, mushrooms etc.. and for drying process of biomass such as cut wood, wood chips or faggots. The drying greenhouses are used for sludges drying.

- **In propagation or multiplication greenhouses** for the rooting of flowering trees and fruit plants.

- **In forcing or growing greenhouses** for the growing of flowering trees and fruit plants.

- **In ordinary crops greenhouses** for the growing of vegetable trees.

- **In hydroponic greenhouses**.
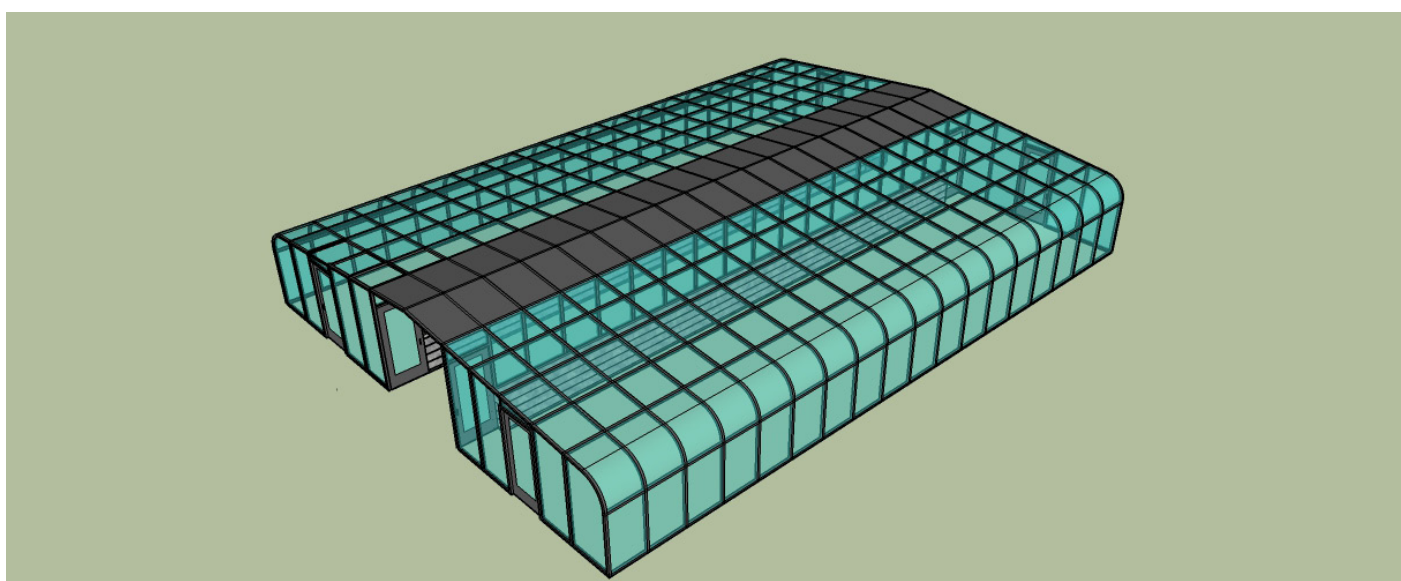
Scalability

- **single-span or isolated greenhouses**. Unique span.

- **double o twinned greenhouse**. Double span with or without partition.

- **multi-span greenhouses**.

The management GREEN HOUSE system software can automate Alert sending via sms or email upon the occurrence of preset events.

GREEN HOUSE allows the greenhouse growers to monitor and adopt measures in real time.
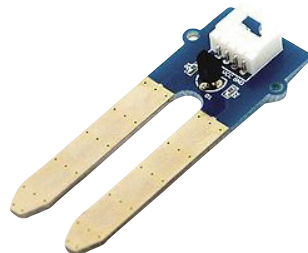
Sensors

Air temperature sensor (indoor/outdoor): it's useful for optimizing the aeration doors opening and closure and the fan turning on and off.

Air humidity sensor (indoor/outdoor): it's useful for optimizing the aeration doors opening and closure and the fan turning on and off.

EC electrical conductivity: it measures the soil conductivity which is useful for optimizing the fertirrigation.

Soil moisture sensor: it's useful for optimizing the irrigation.

PH sensor: it's useful for optimizing the fertirrigation.

Brightness sensor: it's useful for optimizing the use of shading net.

Anemometer: it's useful in order to control the wind speed during the aeration doors opening.

Rainfall: it's useful in order to control the rain presence or absence during the aeration doors opening.

Camera module: remote surveillance.

Actuators

Wireless relays module: it's suitable for on/off lighting, irrigation pumps.

Mosfet/PWM Module: it's suitable for variable intensity heating, fans and lighting.

The GREEN HOUSE modular architecture allows the system to integrate with electric motors, pumps and lighting which are already present on site and have not yet been automated.

GREEN HOUSE technology connects motors, pumps and electrical loads, generally, up to 220v 16 A

Installation

INSTALLATION

The installation is preceded by a **survey in order to find the ideal place** for sensors on the basis of specific features of soil and cultivations.

ASSISTANCE

Auroras Services Centre controls constantly the system efficiency in order **to prevent malfunctions** and undertake the tasks of the reactivation.

Auroras provides assistance and maintenance. Timescale for actions and maintenance frequency vary depending on the commercial offer purchased.

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smart culture

- **it takes a picture of the greenhouse in real time**
- **it reveals microclimatic data**
- **it processes predictive models**
- **it operates automatically**
- **it warns of the specific events**

- **it's modular**
- **web data transmission**
- **easy to use**
- **malfunctions self-diagnosis**

- **energy saving**
- **saved working hours**
- **safety**
- **high accuracy**

Modular proactive system

GREEN HOUSE **supports the decision-making**, thanks to the effective analysis of the data.

It's a modular monitoring system which guarantees flexible implementation. GREEN HOUSE is perfectly **customizable**, according to specific needs. .

On the basis of sensors and actuators chosen, GREEN HOUSE provides different services for the control and management of the microclimate.

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technology for control
and automation of greenhouses

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