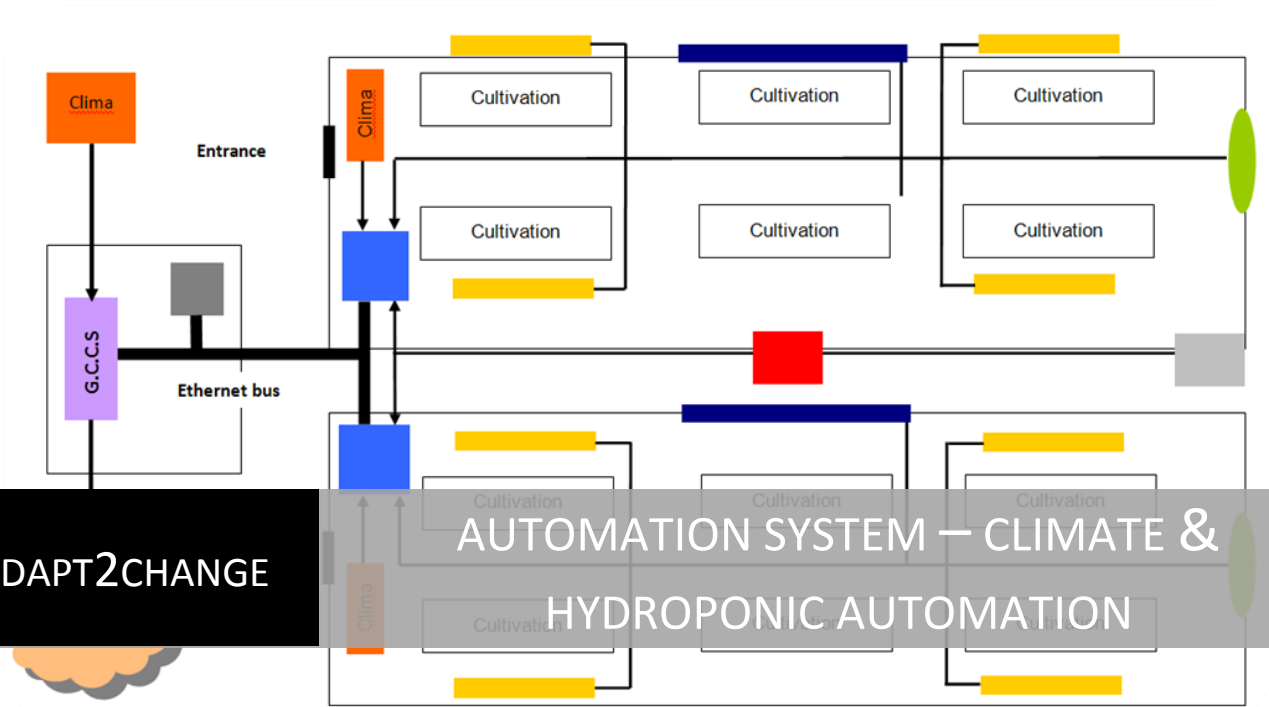




December 2012



ADAPT2CHANGE

AUTOMATION SYSTEM – CLIMATE &  
HYDROPONIC AUTOMATION

Project Partnership

Project Brief Description



TEI of Larisa  
Lead Partner



Agricultural  
Research  
Institute



TEI of Piraeus



Europiroforisi S.A.

- Cofounded by EC – LIFE+ (50%)
- Project budget: €2.576.548
- Project duration: 1/09/2010-31/08/2014

Adapt2change – Adapt Agricultural Production to climate change and limited water supplies



**Contents**

1. Summary.....3

2. Characteristics of the Greenhouse Central Control System.....4

    2.1 G.C.C.S Hardware: .....4

    2.2 Monitoring and linkage material of the Greenhouse Central Control System  
        5

    2.3 Greenhouse Central Control System Software: .....5

3. Installation plan .....7

**List of Tables**

Table 3.1 – Installation subsystems page. 5

**List of Schemes**

Scheme (rough drawing) 3.1 – Installation top view page. 6

**Abbreviations**

- G.C.C.S - Greenhouse Central Control System
- A.S. - Automation Subsystem
- P.L.C – Programmable Logic Controller



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## 1. Summary

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In the frame of implementation of the European Project “Adapt2Change”, four plastic greenhouses have been designed and constructed in Cyprus and Larissa (two greenhouses at each area) in order to provide adequate testing towards the collection and preservation of water, but also to minimize the energy required for the overall operation of the greenhouses. Considering the equipment that will be established, the researchers have designed the prototype units with the following dimensions: Unit A and B: – 12 m x 18 m and Unit C: - 8.5 m x 10 m.

The automatic central control system of each installation consists of the Greenhouse Central Control System (G.C.C.S) and the Automation Subsystem (A.S.), which is a programmable logic controller (PLC).

The Greenhouse Central Control System communicates with the Automation Subsystem for the recording and processing of all measured quantities of the greenhouse facility.



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## **2. Characteristics of the Greenhouse Central Control System**

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The Greenhouse Central Control System consists of an industrial PC, suitable for operation in greenhouse conditions (high temperature and humidity). The G.C.C.S can:

- Be flexible towards user manual reprogramming
- Create cultivation scenarios for each greenhouse
- Check all the subsystems that are installed and operate in both greenhouses
- Collect information: a) from sensors and b) greenhouse control panel sensors via the Automation Subsystem
- Communicate with the Automation Subsystem through standard communication protocols ETHERNET MODBUS
- be capable of remote communication (telemetry, tele-maintenance).

### **2.1 G.C.C.S Hardware:**

The central control unit consists of a desktop computer, which has the following specifications:

- Industrial type unit that will operate as SCADA Server
- Ability to mount rack 19"
- Locking lid system for protection
- Visual and audible indication of system failure or network
- Watchdog Timer
- Motherboard with a Processor CPU Intel Core i5-660 3,33 GHz
- Dynamic memory 4 GB RAM DDR3 1333 MHz
- Two hard disks type SATA II, 1TB capacity with Raid Connection
- VGA and DVI Outputs monitors
- A display monitor with corresponding characteristics in terms of protection from moisture with dimensions of at least 19", high brightness and contrast and wide viewing angle.
- Optical Drive DVD  $\pm$  R / RW
- Audio Drive
- Two GB network doors



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- Peripheral units: 10xUSB, 3xRS-232, 1xRS-232/422/485, 2xPS2
- 1 Parallel door
- Motherboard receptor: 4xPCI, 1x PCIe, 1x PCIe4, 1xPCIe16
- Keyboard and Mouse
- Power 500 W

## **2.2 Monitoring and linkage material of the Greenhouse Central Control System**

The industrial computer of the Greenhouse Central Control System must be equipped with peripheral support cards of the automation subsystems, which should provide at least:

- Fourteen (14) digital inputs (DI) at 24V DC
- Ten (10) digital outputs (DO) at 24V DC
- Two (2) analog inputs (AI) with input signal 0-1V
- Twelve (12) analog inputs with input range: + / - 10V, + / - 5V, + / - 2.5V, 0-20 mA (12 bits Resolution Conversion).

The Greenhouse Central Control System can connect to the internet through the device modem / router, which can incorporate serial and Ethernet inputs (LAN Hub).

## **2.3 Greenhouse Central Control System Software:**

- The operating system that comes with the central unit is MS WINDOWS 7 PRO ENG.
- SCADA Software with graphic illustration of the subsystems, the functions and the measured quantities is also provided. On the home screen there will be shown the greenhouses and the following subsystems: Natural ventilation roof windows, Dehumidification system / water/air recycle system, cooling system (evaporative cooling pads), dynamic ventilation fans, heat pumps.
- The display screen can display the measured data, such as: Indoor greenhouse temperature, Indoor greenhouse humidity, Outdoor temperature, Outdoor humidity, Outdoor wind speed, Rain, Total solar radiation ( $W/m^2$ ).

Scenarios for crops with a parallel configuration of all functions, signaling events (alarms), collection and storage of data for processing can be executed.



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The measured data can be extracted to EXCEL log files giving the capacity for further evaluation.

- Support for online communication for programming, visualization and maintenance from distance is possible.



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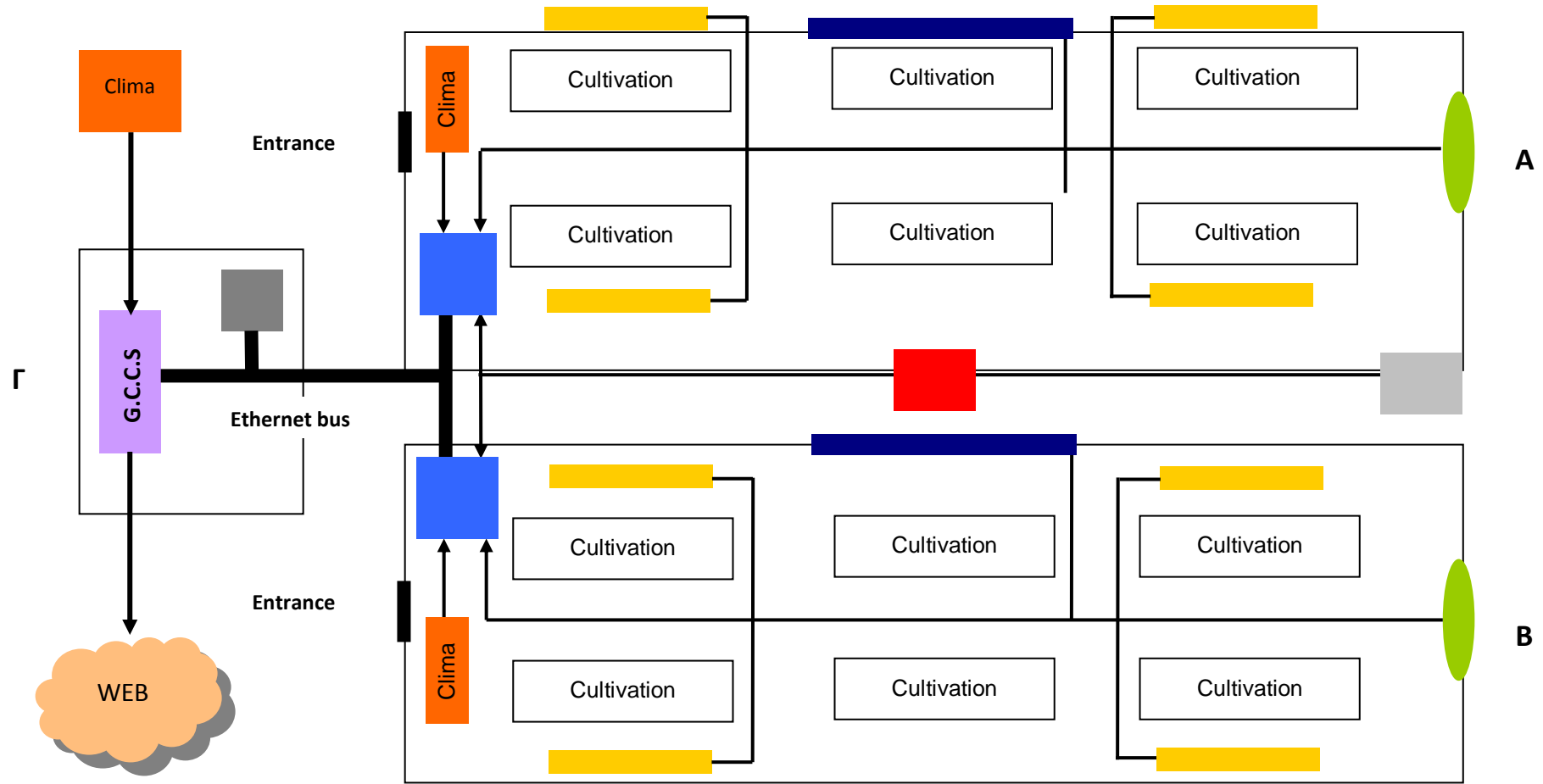
### 3. Installation plan

Rough Drawing 3.1 shows the setup with the Greenhouse Units A & B and Unit C that houses the mechanical equipment. The subsystems are presented in Table 3.1.

**Table 3.1 Installed subsystems**

Color	Subsystem description
Yellow	Ventilation windows
Green	Ventilation blinds
Dark Blue	Evaporative cooling pad
Grey	Hydroponic System
Light Grey	Air/water recycling system
Red	Heat Pump
Orange	Climate measurement sensors
Blue	Subsystem Panel

- At each subsystem’s panel there is a PLC which controls the individual systems and is linked with the Greenhouse Central Control System via Ethernet Bus.
- The Greenhouse Central Control System is connected to the outdoor climate detection unit, it is also connected via Ethernet to the two control panels of the Units and it is a server network (Web Server) for the interconnection with the Internet and the implementation of monitoring and control activities from distance.
- The Greenhouse Central Control System is connected to the hydroponics system via Ethernet. The hydroponics system is controlled through an individually controlled PLC.



Rough Drawing 3.1 Greenhouse top view



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