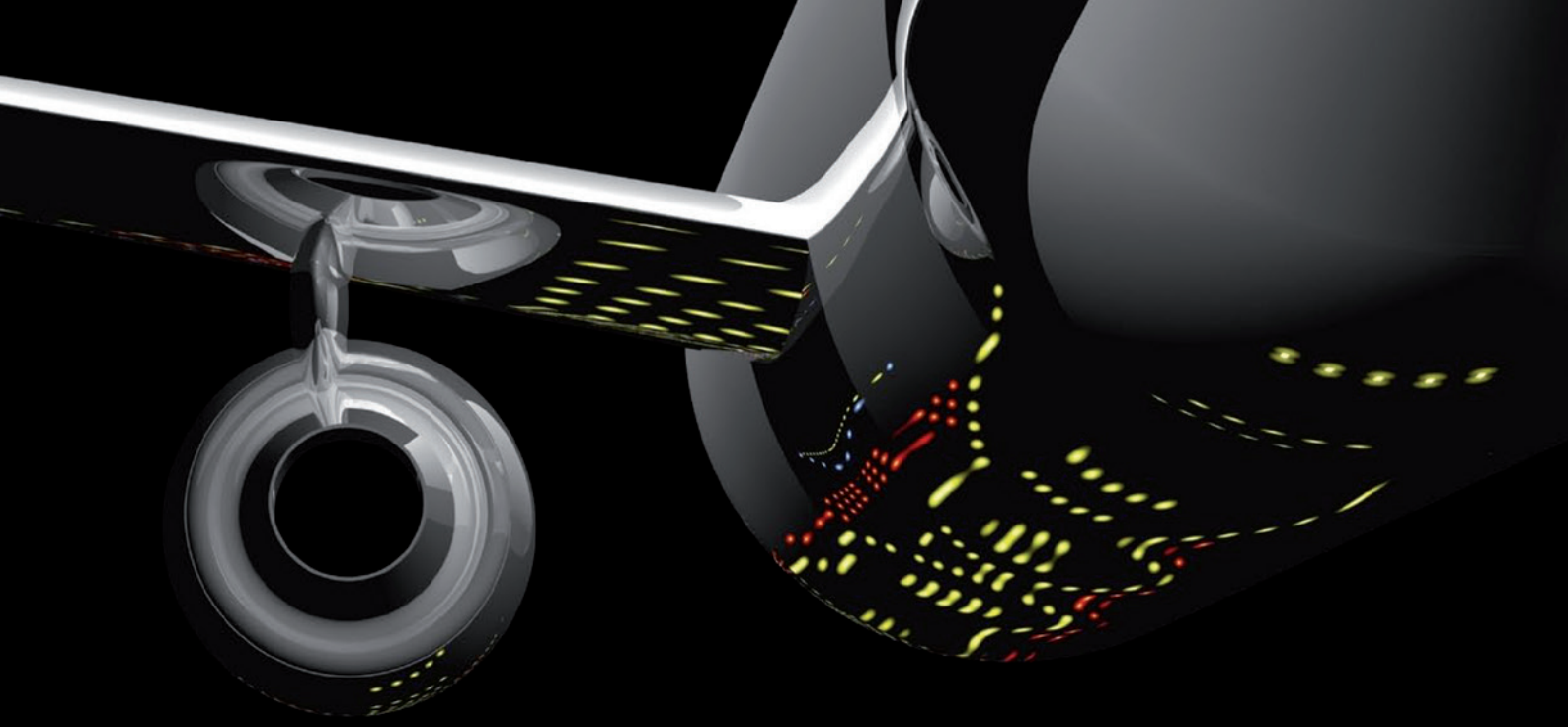
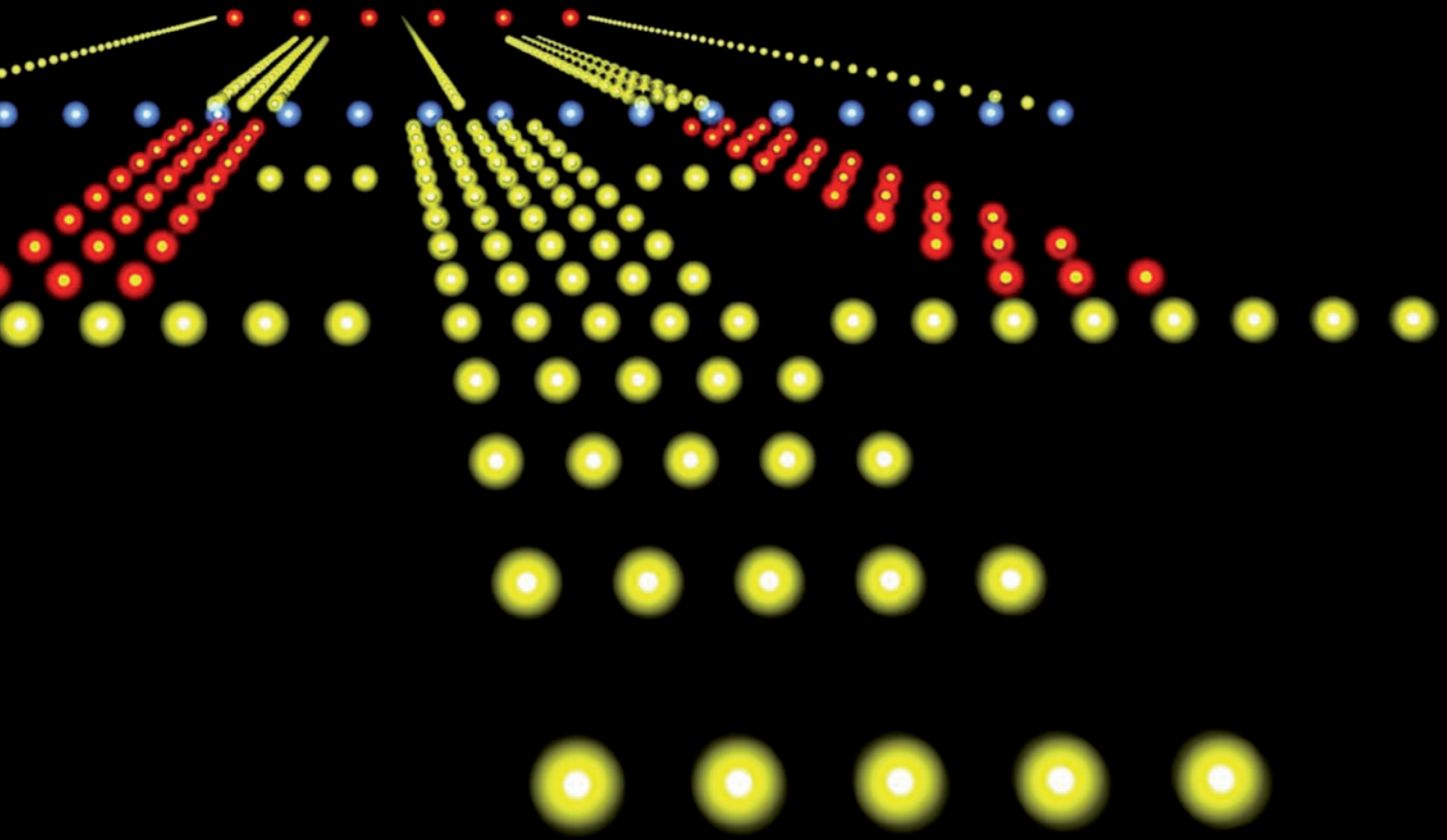


MIA SYSTEM

Modular Intelligence Airport



MC® SOLUTIONS

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USA 11.459.119 B2

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MIA SYSTEM
Modular Intelligence Airport

MIA System is an innovative product, based on a technology that takes advantage on our 10-year experienced team on project and installation, as well as on maintenance coordination of AVL (Lighting Visual Aids) remote control, remote management and monitoring in several main national airports.

MIA System *(Modular Intelligence Airport System)* is an infrastructure composed of application software and hardware components. As described through the following diagram *(diagram 1)* this new infrastructure boasts a variety of virtual and physical instruments, equipped with an efficient and intuitive software in order to manage in every moment the different situations that may occur in the AVL systems operation.

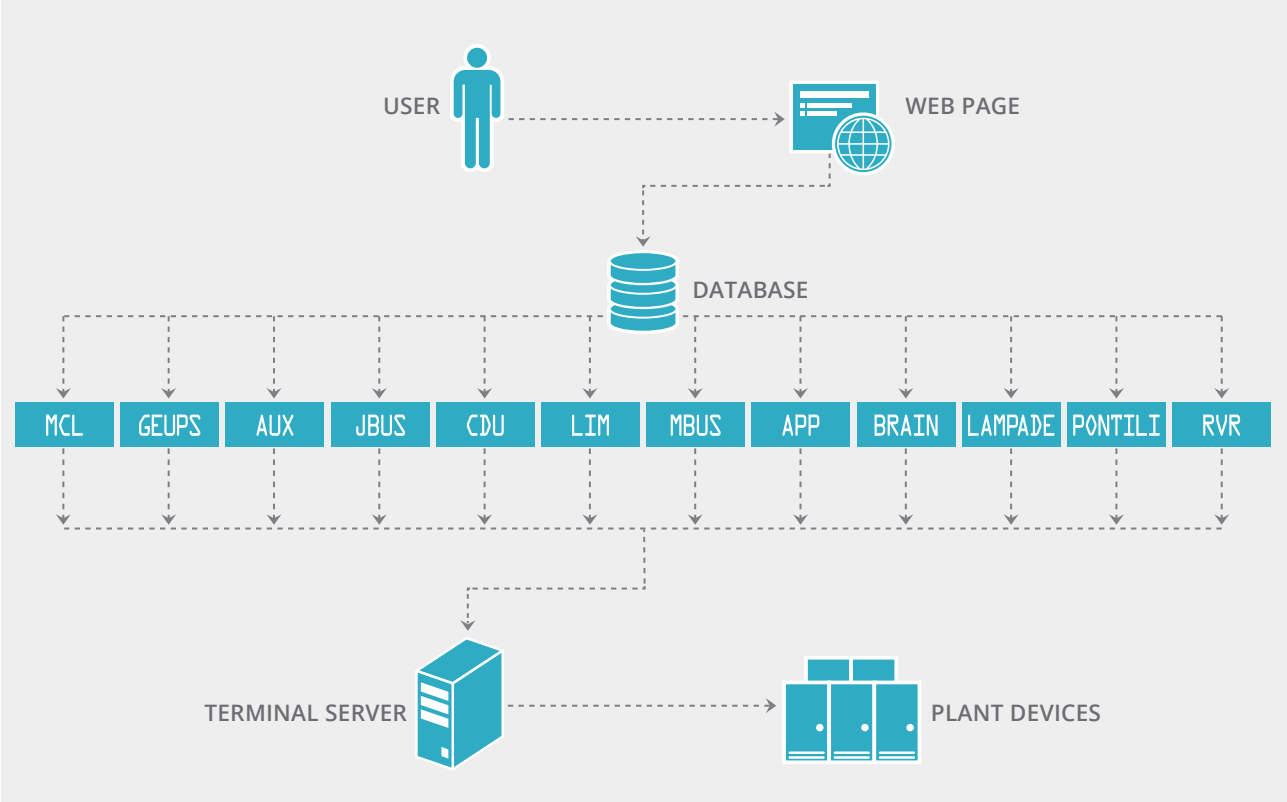


diagram 1

MIA System can interface devices and systems already installed by other manufacturers, integrating and/or expanding the plants, making them **more responding to actual rules** in force and to new technologies available on the market.

The **modularity** of MIA System is another important characteristic that makes it recommended both for small and international airports; in fact, each device can manage plants and functionalities with several performances that can be implemented time to time following the improvement of airport services.

Remote control – Remote monitoring software has been developed and designed to manage AVL (Lighting Visual Aids) services for airports, mainly based on a **optical fiber communication system** with a **fault tolerance** logic among the various active operators, covering all the airport functions (Control Tower, Maintenance, Electrical Vault, Direction Center etc…).

The system includes 2 Servers in Back Up for the applications management, data storage and system LOG, **granting always and in anyway the correct** data transmission, even after a malfunctioning of one of the two servers, saving all the phases of the occurred event.

By means of a **continuous real-time update**, in case of malfunctioning, the servers take over automatically the control of the plant with no disruptions. This important innovation allows the visualization of the services state from the different posts and not just from the electrical vault, because the situation will be visible as a **WEB page** on any personal computer connected to the same remote control and monitoring network, with the required access credentials.

The *diagram 2* shows the diverse infrastructure levels and the information access method; the user in fact, through the web page, can enter the database, containing the information, that are coming from the field, passing previously through the Terminal server and then transferred to the application software.

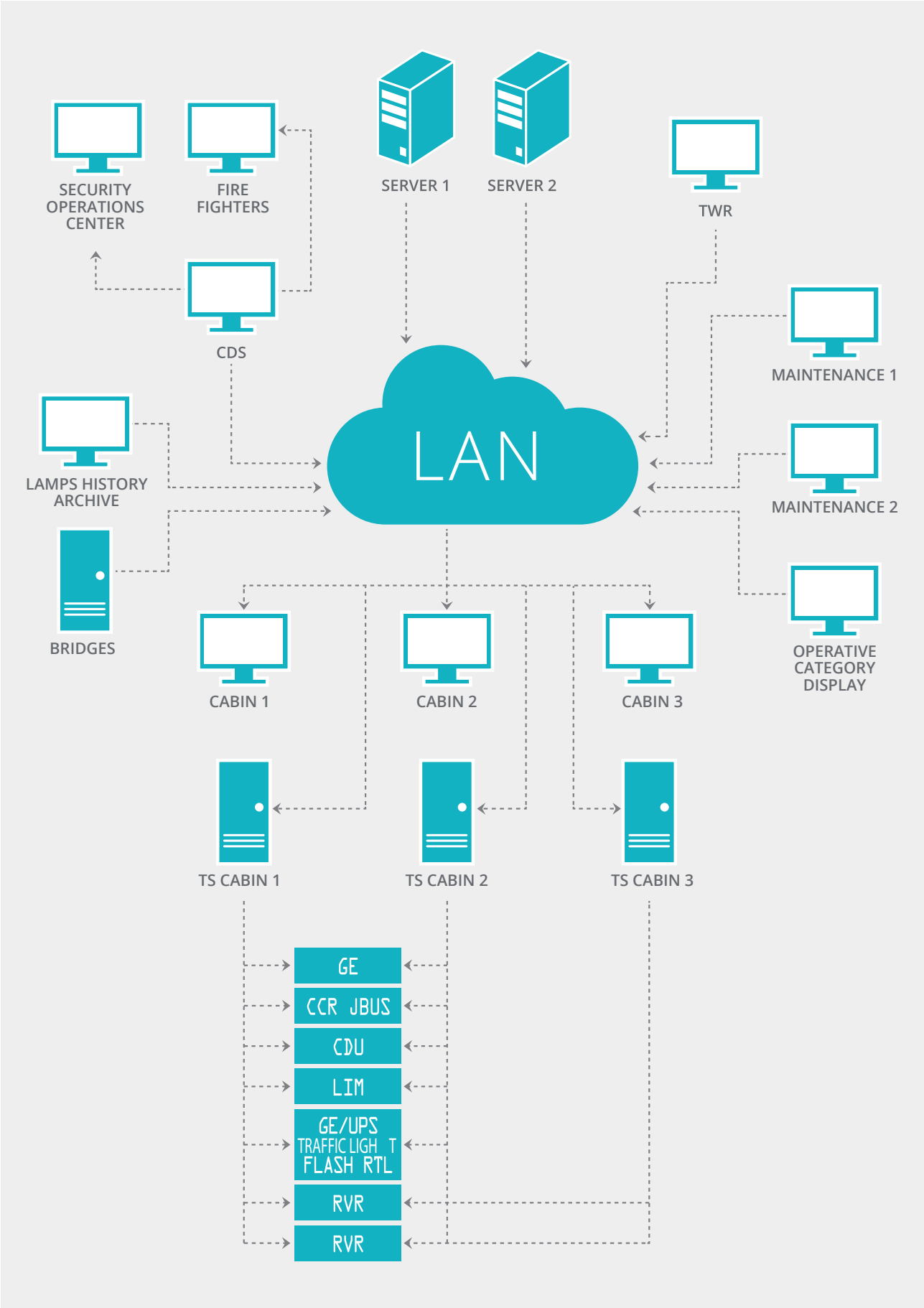

SECURITY OPERATIONS CENTER
FIRE FIGHTERS
SERVER 1
SERVER 2
TWR
CDS
MAINTENANCE 1
LAN
LAMPS HISTORY ARCHIVE
MAINTENANCE 2
BRIDGES
OPERATIVE CATEGORY DISPLAY
CABIN 1
CABIN 2
CABIN 3
TS CABIN 1
TS CABIN 2
TS CABIN 3
GE
CCR JBUS
CDU
LIM
GE/UPS
TRAFFIC LIGH T
FLASH RTL
RVR
RVR

diagram 2

General Characteristics

MIA System is a modular system designed to manage the AVL airport services and to manage the aircrafts surface guidance according to the SMGCS standards *(Surface Movement Guidance Control System)* and to ICAO, ENAC and EASA regulations.

It is mainly made of devices installed on the field and of a tailored software that is capable to interconnect and manage these devices including:

- Automatic and manual Airport category CAT III management
- Runway Incursion management
- Lamps data archive
- Airport apron and bridge lighting management
- Runway light management
- Electrical vault services management (URCC/UPS/GE etc.)
- Airport obstacle lights management
- RVR interconnection signals

Since the System is a modular one, it is managed by a customized software composed of diverse positions according to the airport dimension and structure:

- Multiple control tower posts
- Airport coordination posts
- Multiple maintenance posts
- Data lamp history archive
- Multiple electrical vault posts
- Authority posts (Security and Firefighter)

Each post is personalized and structured exclusively for the end user, each one has been improved up to obtain a user-friendly product that is extremely intuitive.
Security is a topic to which has been deserved particular attention, implementing always more accurate instruments to trace and record (LOG) each action or command executed within the system.
The access to the software is provided by means of apposite credentials and, thanks to the punctual LOG structure files, it is possible to check and verify each event occurred in the system.
All the data that provide the functionality of the system are transmitted in a numerical format in digital mode. For each piece of information that is transmitted, the system has been designed systems to guarantee data integrity, such as parity bit and checksum.

The MIA System here described can be installed partially, according to the services required. At a later time, it is possible to extend the services up to reach the complete control as foreseen for the whole structure.
The control system is then, both from a software and from a hardware point of view, designed on a modular basis.
The MIA system is based on a loop local network realized on Gigabit optical fiber.

Applications definition

MIA System is composed of the following applications:

- **Control Tower App**
- **Maintenance App**
- **Prevention Maintenance / Historic data lamp archive App**
- **Cabin App**

Each Application is server located and it has precise functions that are described here below.

Tower control app

The control tower post is made of an industrial Computer integrated with a touch screen monitor 21" Full HD installed in the operator post (flight controller), with an option to turn on a 50" Full HD monitor the display of the synoptic and of the plants state.

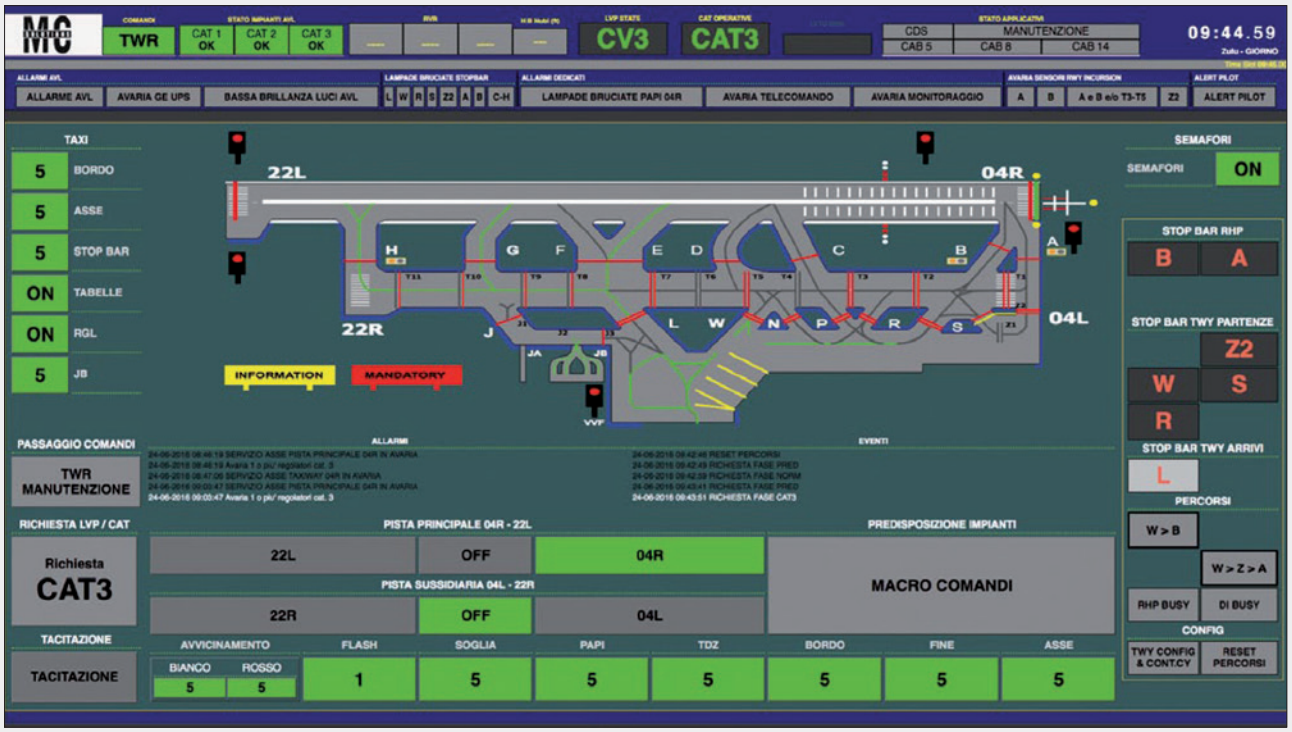
Here the operated tasks:

1. Turning-on of each circuit (taxyway, center line etc.) independently, with confirmation of the selected brillance level.
2. Turning-on of pre-determined circuits with a pre-determined brilliance level.
3. Automatic setting of the various brilliance levels according to the data transmitted by the RVR system, with the possibility for the controller to set a higher or lower level on each circuit.
4. Automatic setting of the AVL sub-systems required, depending on the airport operation category (i.e. CAT I at that moment).
5. Automatic control of each circuit, both as for its functionality and its performed brilliance level in regard to the desired one.
6. Automatic turning-off of single stop-bar installed to protect the holding-point of runway.
7. Turning-on of the taxi-route prepared for both arriving aircrafts and leaving ones even with optional keyboard 7" touch screen.
8. All database and application programs are installed in the servers and the user can connect to them through a broadband connection, from a remote post to execute auto-analysis and automatic updating, always under apposite security log-in and permissions.
9. The system provides a different colouring to highlight active and functioning systems and lighting and/or different colouring to display circuits failure. The video display masks can be anyway personalized according to customers' needs.

Moreover, Control Tower App enable the following functions:

- allows the operator to be promptly and completely informed about the functioning state of the plant;
- guides the operator on the plant interventions;
- shows the airport area synoptic, displaying the lighting state and aircrafts position.

The hardware used for Tower Control post complies to industrial standards, in particular regarding the use of fan less computer operating 24/7.



MIA System Tower Control

Maintenance app

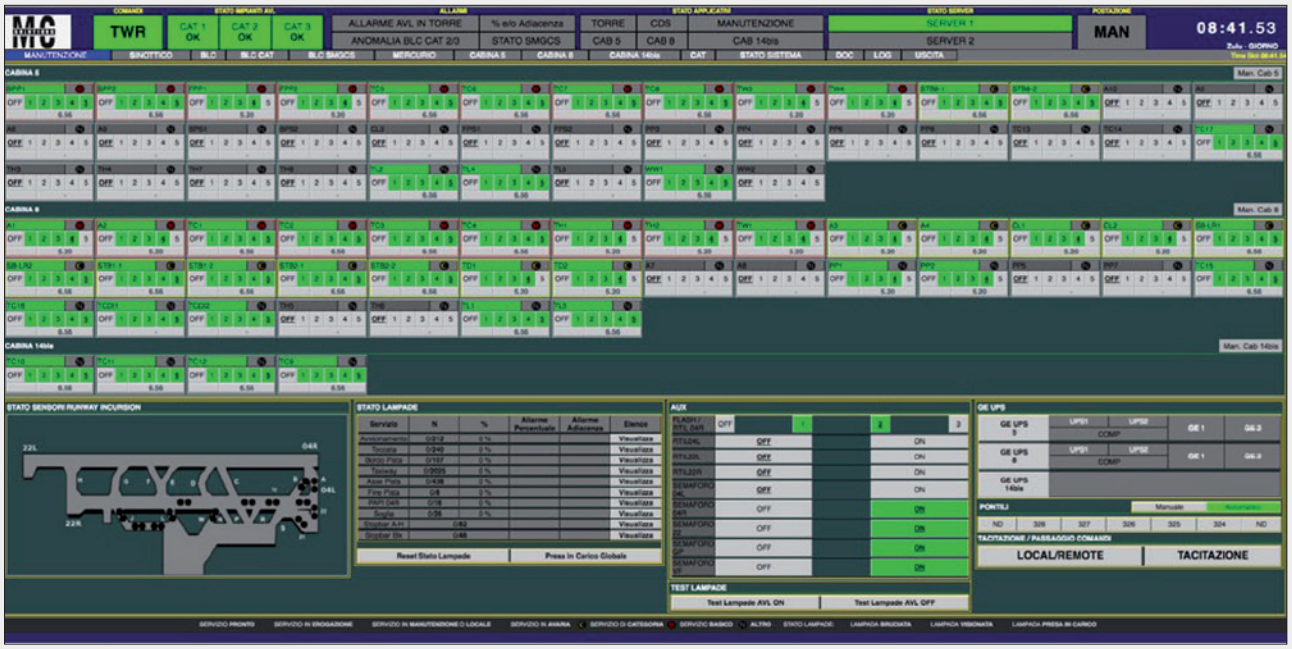
Maintenance post is made of a computer that is installed in the Maintenance Office that displays the application software. As previously described, all the system data are located in the server and not by the operator post.
This subsystem graphically represents, with a simple and immediate understanding, all the devices that have been foreseen by the control system and the user can control and make a device query, by means of a mouse.
The system provides a specific coloring to indicate that the lighting systems are active and functioning, and in alternative a flashing or different color to draw the attention on circuit failure.

Working in effect as Tower post, the maintenance computer, upon Control Tower approval, can control each AVL plant function as well as auxiliary services. The Maintenance post collects and records the information sent by Constant Current Regulators (CCR).

In details the managed, saved and/or checked data are the followings:

- detection of eventual overcurrent of the CCRs and subsequent command to put them out of order;
- detection and management of each kind of warning received from the CCRs;
- check of the coherence between the brilliance level required by the Control Tower and the one activated by each single CCR;
- communication network condition;
- CCR control board status;
- AVL plants status;
- auxiliary services status.

The server 2, that is placed in maintenance office, is the system back-up and it is updated by server 1 and vice-versa, moreover they can replace one-another in case of failure. All database and application software are located in the servers and through a broad band connection they can be reached from remote to operate queries or automatic updates, always prior to reserved log-in with password.



MIA System Maintenance

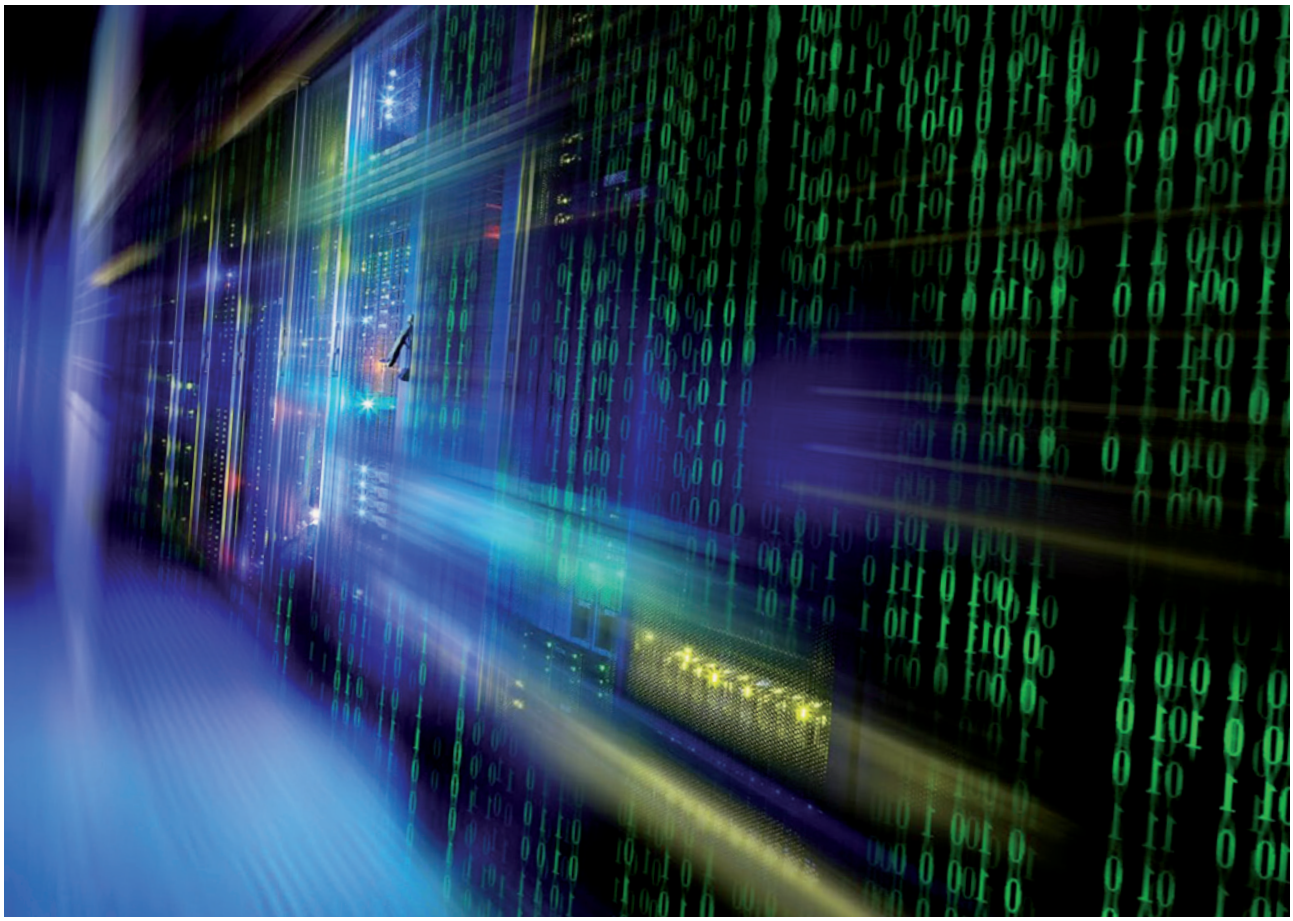
The software is tailored to the specific requirements of the managing Airport Authority.
The hardware used for the maintenance post complies to industrial standards and especially it is supplied with fanless 24/7 operating computers.

Preventive maintenance app

The Preventive Maintenance post is made of a computer that is installed in the Maintenance Office displaying the application software and, as previously described, all the data are saved in the Server and not by the operator post.
The preventive Maintenance App manages an appositely structured database, in order to guide the operations of periodic preventive maintenance.
This sub-system graphically represents, with a simple and immediate interpretations, the time of use and the brilliance of each single lamp so that it is possible to relate this data to the expected life-time of the lamp. This information is available to Maintenance personnel.

In detail the recorded and/or checked data are the followings:

- number of turning on/off for each lamp
- turning-on time at the various brilliance levels;
- type of installed lamps database and life time expected related to the diverse brilliance levels
- lamp warehouse management.



MIA System Lamps History Archive

The computer is supplied with a specific managing software through guiding windows to display, with a self-explicative graphic, the information required by the personnel in charge of Maintenance.
The software is tailored according to the specific managing Airport Authority requirements.
The preventive maintenance post is in compliance with the industrial standards and takes advantage of fan less computer with 24/7 operativity.

Cabin app

The Cabin post is made of the following devices:

- The cabin computer has the purpose to display and control the sub-systems connected to the terminal server;
- The Terminal server that connects the following sub-systems:
  - CDU (Crossing Detection Unit): localization sensors to pinpoint the aircraft on runway by means of optical fiber backbone;
  - remote modules to control the runway lights and the other lighting signals in the newst version MCLO1 and MCLO2... MCLO5 (Monitor Control Lamp) with optical fiber backbone; or MCL1 and MCL2... MCL5 with copper technology;
  - CCR management;
  - GPI (General Purpose Interface) IN/OUT interface to manage the input/output digital signals and analogue input inter-connected on bus RS485;
  - LIM (Current Limiter) device dedicated to the protection of the power supply lines of the above listed devices: GPI, CDU, MCLx with the possibility to remote turn on/off. The communication with the devices installed on field is obtained through a conversion copper/fiber to guarantee the Galvanic Isolation among Electric Vault and the field with a performance increase.

MIA System Maintenance

The cabin post is in compliance with the industrial standards and takes advantage of fan less computer with 24/7 operativity.

The computer is not essential to the system functioning, since it is used just to control or display the services connected to the Terminal Server and, in case of need, it can replace the TWR computer.

The software installed on the Cabin computer is designed to automatic restart, in case of malfunctioning or replacement.

The connections to the peripheral devices in cabin are on LAN 10/100 Mbit network.

Technical characteristics of cabin sub-systems

The field sub-system is composed of all the devices that are installed along the runways, the apron and the aircraft parking area.

These devices are:

MONITORING

MCLO1... MCLO5 or MCL1... MCL5: modules to control the lamps.
These modules allow the punctual control of all the lamps connected to a transformer: this last can supply from one up to five lamps.

CDU (Crossing Detection Unit)

Aircraft detection sensors. These sensors allow to detect the position, the direction and the speed of an aircraft or of a car that is passing through the taxiways, the junction ways and stop bar. The amount and the positioning of these detection devices is established by the Managing Airport Authority.

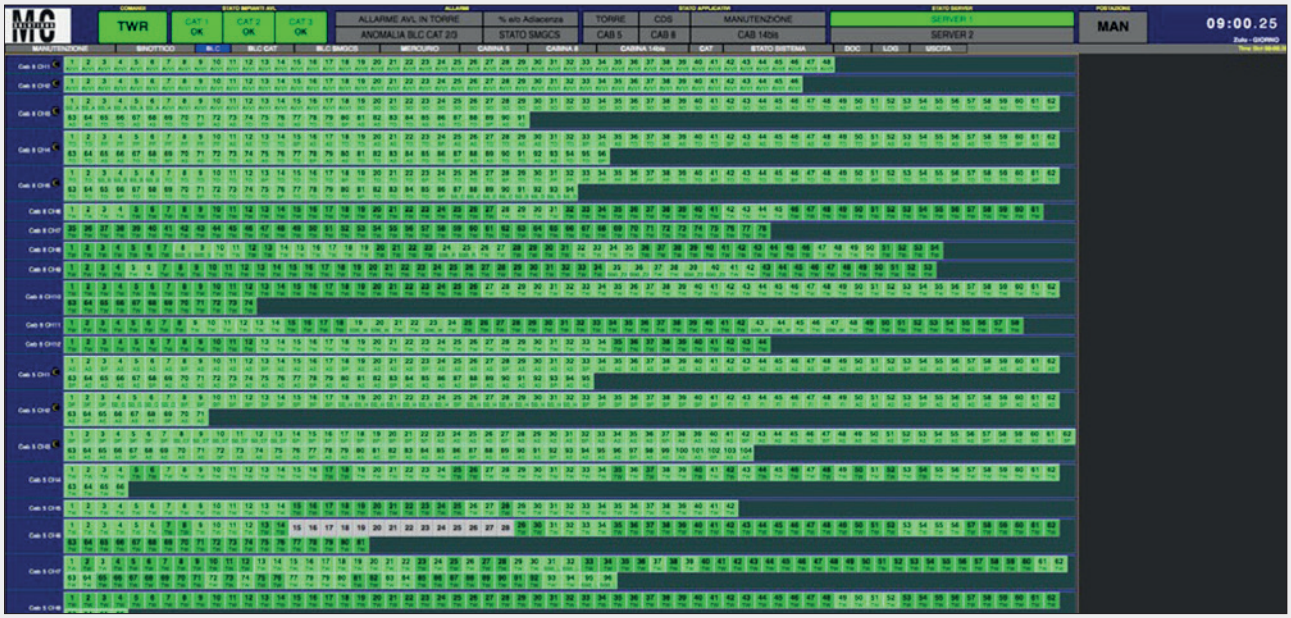
The sensors dedicated to the aircraft detection have the following characteristics:

- box with joint at break, in compliance with FAA regulations;
- operating temperature from -34°C to +74° C;
- humidity lower than 95%;
- wide range power supply: from 25Vdc to 60Vdc;
- Optical fiber connections with installation of maximum 4 units per single fiber optical backbone segment.

Cabin monitoring

The modules dedicated to lamps control (MCLO1...MCLO5 and MCL... MCL5) allow:

- the turning on/off controlling each single lamp through the models type MCLO1... MCLO5 and MCL... MCL5;
- the short circuit of the lamp, when it is burnt;
- the signalling of the lamp status (functioning or burnt) to the cabin sub-system;
- **the malfunctioning transformer diagnostic;**
- **the electric current value of RMS for each single lamp;**
- the monitoring of each module temperature to display the voltage of each monitoring module;
- to display the packages for each monitoring module in order to activate in advance the proper maintenance operations;
- **to display the monitoring status of plant functioning, even with CCR turned-off power.**



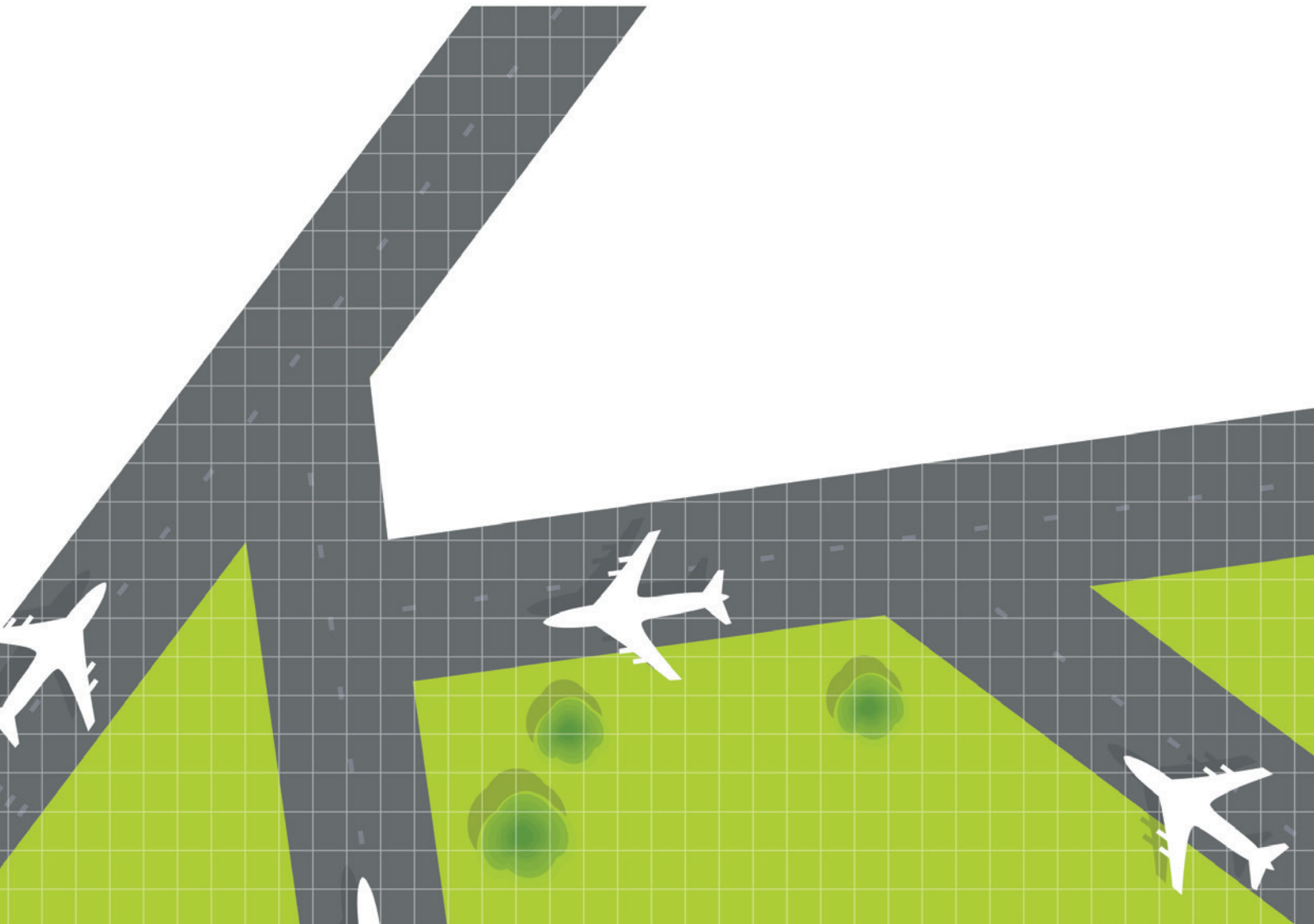
This subsystem manages each kind of runway signal and it is extended to more circuits in series.
The subsystem is a modular one, both for its hardware and software components, that allows in future to implement a global system such as A-SMGCS (Advanced Surface Movement Guidance and Control System), starting from the basic functions: regulators management or detection of single burnt lamp.

Connection to cabin sub-systems

The communication network among the Terminal server installed in electrical vault and the remote modules placed on field to control the runway lights. Is based on:

- A MTC-A cable that delivers the power supply and an **optical fiber cable** that delivers data from the electrical vault **to the first monitoring module**.
- A backbone cable (MTC01) that delivers the power supply to the electronic in the module devices on field. The other task is then to transmit the data of the first monitoring module to the following ones.

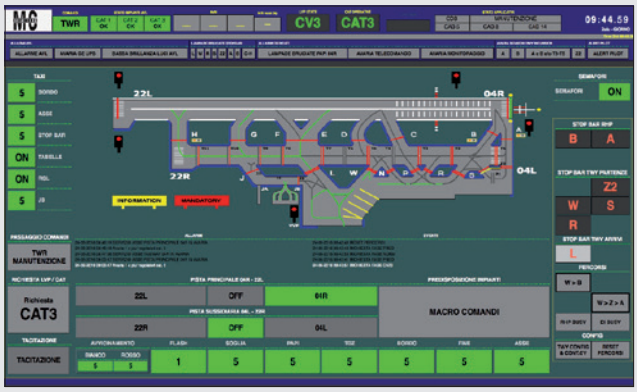
The MTC-A power supply cable, to control runway lights modules, starts from Cabin. In this post the system foresees power supply protection circuit (LIM).
On the backbone MTC01 are installed derivation boxes “DC” that allow through connectors to link to the remote modules, in order to control the runway lights and other lighting signals.



MIA SYSTEM
Simulator

The simulator offered by **MC SOLUTIONS** allows to simulate the control center that manages the AVL (Lighting Visual Aids), setting up all the devices exactly as they are installed in airports.

The simulation project takes shape from the need to realize and test the Software that checks the correct functioning of all the field devices. (the term “filed” refers to runways and nearby airport areas).
It would be otherwise not realistic to cause the diverse and possible anomalies stressing directly the devices already installed on field with just the aim of testing the custom-made Software. Currently the personalized Software is installed and tested at MC Solutions laboratories and then supplied to the customer in order to preserve the routine airport management activities.



Here it is briefly described the MIA System *(Modular Intelligent Airport System)*, for which it has been appositely created the simulation project.
MIA System is a modular hardware and software system that is completely automatic and studied for the management of the whole *(Lighting Visual Aids, now on called AVL)* plants management in airport environment.
The project takes advantage of the ten-year team’s experience that has already projected and installed remote control, remote check and monitoring of AVL plants in important national airports.
The goal of MC Solutions is to develop MIA System making it at the leading edge of technology, to be reckoned with the peculiar requirements of the sensitive installation area. For the above reason MC Solutions has implemented, at its offices, a simulator of the entire plant designed for the airport with the aim to test and manage safely eventual system anomalies. Then the engineers can find solutions and offer improvements, significantly increasing the performance of the already installed plants.
The technical team of many years’ experience in this specific sector has enabled MC Solutions

to understand the need to develop and design all kind of systems with the aim of improving the offered service and most of all to speed up and optimize the response time to manage eventual anomalies.
Upon these ambitious presumptions emerged the simulator project providing positive effects on the entire airport system, in accordance with ICAO, ENAC rules and the latest EASA regulations.
The project includes as well the developing phase to design the A-SMGCS simulator (aircraft movement control on connection runways and parking areas); in this way the traffic flow can be optimized. Assuming the aircraft distribution, so that the last one in stand-by wouldn't be penalized, the system can reduce the waiting time, granting a higher safety level and a lower environmental pollution, besides the efficiency of all ground operations.
In order to test the A-SMGCS here too is confirmed the key role of the simulator, that becomes a continuously expanding plant, with several and enormous potentialities: from a control software to a simulation structure for training courses dedicated to the personnel that will be in charge of the plant management.

The simulator is made of six workstations that represent the whole AVL monitoring plant, but can be implemented with additional booths and different systems:

1. **TWR**: pc simulating the Control Tower
2. **Maintenance:** pc simulating maintenance post
3. **Cabin:** pc simulating the electrical vault post
4. **Server:** pc managing the connection among all the posts
5. **Touch Screen:** a keyboard to control the plants
6. **Field simulator:** pc that recreates all field devices that are installed and connected to runway lights.

The above described units, properly interconnected, can represent an entire airport in a limited space and they allow to simulate eventual anomalies that could occur while managing an AVL plant (Stop Bar, regulators, auxiliary services and monitoring).
The project allows to activate training courses with practical experience for the personnel in charge of the system management, directly on the simulator or from remote posts, granting a better knowledge of the basic concepts for the correct AVL plant monitoring.
It is very interesting to consider the additional improvements in the simulator use, in fact there are several scenarios to be replicated and studied to analyze systematically and singularly the aircraft movements (SMGCS). The benefit will be the optimization of the airport operation in compliance to the regulations in force.
At present in airport sector of activity it does not exist a plant capable to simulate the whole AVL monitoring system, as close as it is in every detail.
The asset of this project is the effective training course that, even from a remote workstation, can increase the staff skills, as well as strengthen and promote the attention towards safety aspects in sensitive areas, such as the airport ones.

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