

## Energy saving for historical heritage: the domotised lighting system of the Cathedral of Nardò (Lecce-Italy)

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### 1. Energy saving for historical heritage

#### 1.1. Introduction

Our goal was to use domotics to transform the Cathedral of Nardò into a “smart building”, a first step towards the creation of a “smart city”. In brief, a domotic system is a system for the control and management of electrical or electrifiable apparels and devices, allowing, among other things, to optimise consumptions.

##### 1.1.1 .History

The original system of the Cathedral of Maria SS.ma Assunta of Nardò probably dates back to the VII-XI centuries. The first significant restoration intervention was carried out by the Benedictine monks after the 1245 earthquake. The oak crucifix dates back to more or less the same period: among the oldest wooden crucifixes in Southern Italy, it is commonly referred to as the “Black Christ”. Further restoration was carried out after the 1350 and 1456 earthquakes, followed by other interventions completed at the hands of various bishops, such as the Neapolitan bishop Antonio Sanfelice (1708-1736), supported by his brother Ferdinando, a famous architect. In 1892, bishop Giu-



Central Nave (ph Studio Aerrekappa S.R.L.)

sepe Riccardi decided to start to demolish the Cathedral, but as soon as the first wall surfaces came down, the original medieval structure was unveiled: the baroque stuccos which had been disguising the ancient cathedral to follow the trends of the past were therefore removed and bishop Riccardi appointed the famous painter Cesare Maccari from Siena to fresco the chancel, the apse and the ogival vault in the presbytery.

### 1.2. The design of the new lighting system of the Cathedral

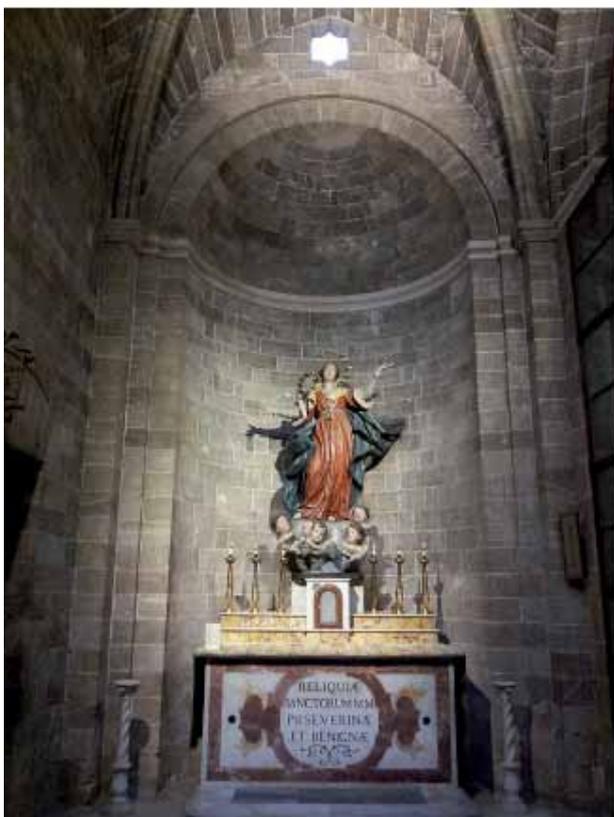
The design of the new lighting system of the Cathedral mainly focuses on energy saving systems and the compliance of the chosen illuminating devices with the real needs of the building, through a careful selection of the best solutions, in terms of luminous efficacy, Colour Rendering Index, life, luminous flux and colour temperature, to be positioned and angled according to the specific needs of each single room for the best luminous effect. The chosen illuminating devices are characterised by extreme flexibility, allowing to modify the luminous fluxes through a continuous regulation of the load; moreover, using both halogen and LED lamps (Light Emitting Diode) with dual KNX and DALI control systems (Digital Addressable Lighting Interface), the best illuminating effect is guaranteed, even for any future requirement. Particularly, all illuminating devices are custom and ad-hoc devices specifically conceived for the Cathedral and equipped, following our indications, with specific DALI feeders and therefore all adjustable and adaptable to each “functional scenario”. Having chosen the BUS system allows to save material, optimise the path of the conduit pipes and carry out quick and simple modifications at any time, simply



Central Nave (ph Studio Aerrekappa S.R.L.)

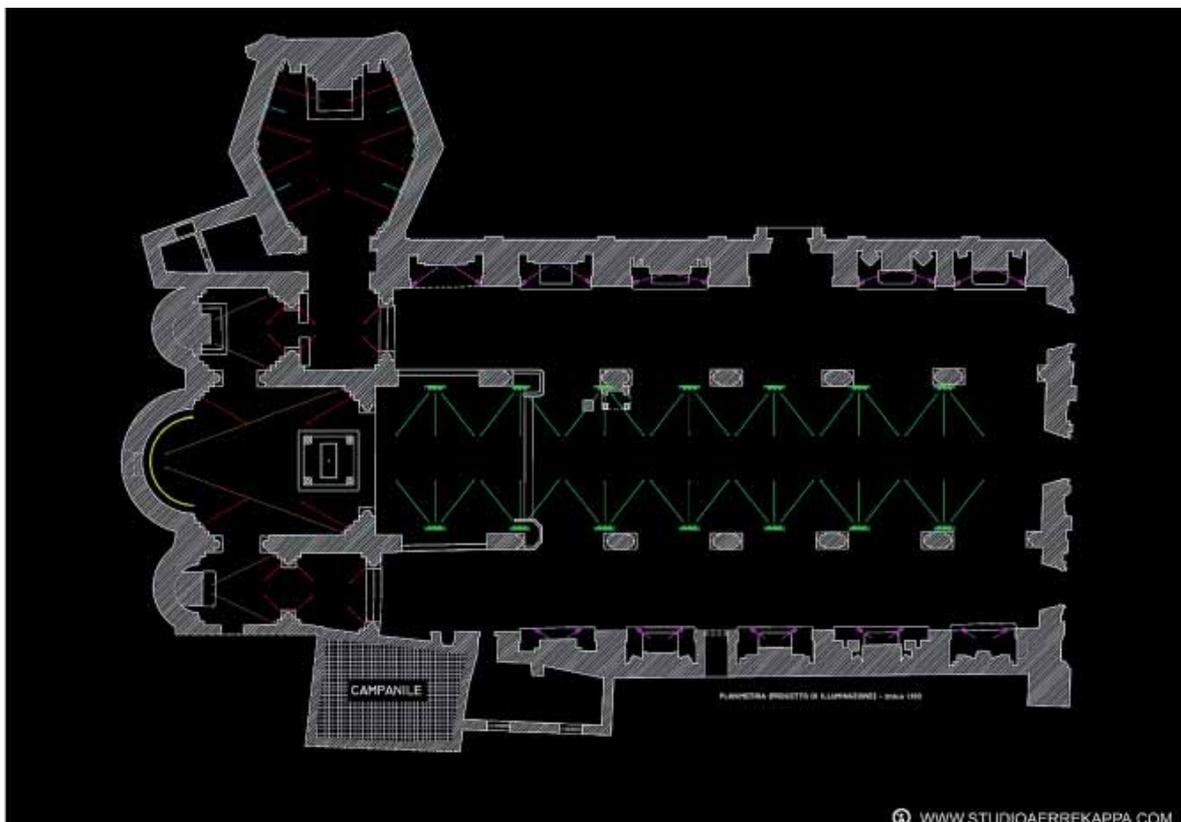


Side-chapels (ph Studio Aerrekappa S.R.L.)



Mary Immaculate chapel (ph Studio Aerrekappa S.R.L.); Holy Mary of Graces chapel (ph Marco De Luca)

excluding or adding illuminating sources in a “scenario” or creating brand new “scenarios” by means of elementary programming operations from the console, without needing a technician, exclusively required if the control unit is to be managed or if an update of the configuration is asked by the Customer. With specific reference to the Cathedral of Nardò, the (still on-going) qualification process is based on the analysis of a system aimed at providing the building with a new, modern lighting system as well as at optimising consumptions for a remarkable energy saving. For such reasons a domotic system was chosen, already experimented in 1998 in the Sanctuary of San Giuseppe da Copertino, one of the first protected sacred historical buildings in Italy to use domotics. By means of an integrated combination of sensors and digital actuators, the systems can be controlled (even remote) through a software, according to given data transmission protocols. Lighting, heating, watering systems, as well as blinds and electrified windows or alarm systems: everything can be controlled through domotics, also referred to as a “smart” system in that, once programmed, it is able to automatically respond to an event or to a different status of the operated device. With specific reference to the Cathedral of Nardò, the project provides for an electronic system of interconnection and management. In other words, a system of serial communication on conductors with adequate section and isolation so to allow their installation in the same conduit pipes of the power system, with a DALI (open) protocol to manage the illumination of the Cathedral and an electronic system of management and interconnection (on UTP - Unshielded Twisted Pair), adequately isolated so to allow its installation in the same conduit pipes of the power system, with a KNX (open) protocol to supervise and light the accessory areas and the ma-



Design of the lighting system: plan (drawing by Studio Aerekappa S.R.L.)



Design of the lighting system: longitudinal section; cross section; cross section (drawing by Studio Aerekappa S.R.L.)

naging of over 50% of all the sockets present in both the sacred and auxiliary rooms, controlled and regulated for an optimised energy consumption. The two domotic systems are connected by means of specific KNX/DALI gateways and can be programmed by PC (connected through dedicated KNX/USB interfaces), so to guarantee the necessary save of the configuration for an easy reproducibility of the conceived “scenarios” in case of failure. Moreover, further dedicated interfaces (KNX/Internet Gateway and KNX/GSM) allow the systems to be switched on, switched off or controlled (even remote). The “functional scenarios” designed according to the needs of the Cathedral (liturgic or not), each of them operated by means of one single control, will be carried out through lighting devices controlled by a program control unit, which will attribute a specific configuration to each single “scenario”, though always modifiable, with no changes in the system infrastructure. All the systems can be controlled via software and be eliminated at any time from one “scenario” and added to another one, or can belong to two or more “scenarios” at the same time with different illumination levels: with Domotics this is possible. Hence, in the future, should the needs of the Cathedral change, it will be sufficient to update the “scenarios” accordingly and re-programme the system, avoiding masonry works or interventions on the systems, therefore minimising costs and inconveniences.

#### References

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