# SMART BUIDLING SKIN AND ITS EFFECT ON BUILDING SYSTEM
(Analytical study for smart skin types and evaluation)


By

Marina Maged Malak


A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Architectural Engineering


FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Under the Supervision of


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**Title of Thesis:**

Smart building skin and its effect on building systems
(Analytical study for smart skin types and evaluation)

**Key Words:**
Smart Building Skin; Smart Material; Building Skin Classification; Sustainability; Evaluating Building Skin

**Summary:**

Smart building skin is considered the first defense line for the building, main element affecting the building energy consumption rates, main connection between the external environment and the internal environment of the building and it presents a big percentage of the construction cost of the building. By understanding the smart building skin concepts, types and technical aspects we will be able to make a classification for the building skin types to assist us in studying the effect of the building skin on energy consumption and generating design guidelines for smart building skin, evaluation form to evaluate existing building skin, and a study the availability of applying the different types of smart building skins in Egypt with considering the technical and economic issues that will face the designer when applying the smart technologies in the buildings.

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# Abstract

In the beginning of the 20th century, the side effects of the increasing rates of building constructions has appeared clearly causing environmental problems as greenhouse effect. It became a necessity to use smart building technologies to solve these problems as smart buildings are the buildings that have integration between smart technology, the means of communication and controlling systems to respond to the user’s demands and to achieve users comfort zone.

The main goal is to decrease the energy consumed by the building through its skin to decrease the environmental problems, this will be reaching through three scales: large scale which is the macro urban scale where its concerned by planning of the city, then the medium scale which is concerned by the building as a whole unit and its form, then the small scale which is concerned by the building skin.

In this thesis it will be concerned with studying the smart building skin, as the building skin is considered as the first defense line for the building, main element affecting the building energy consumption rates, main connection between the external environment and the internal environment of the building and it presents a big percentage of the construction cost of the building.

By understanding the smart building skin concepts, types and technical aspects we will be able to make a classification for the building skin types to assist us in studying the effect of the building skin on energy consumption through artificial lighting systems, HVAC systems and the ability to connect the smart building skin with responsive smart building systems to enhance the air quality of the inner environment and improve the users comfort.

After making a classification for the smart building skin types according to their composition, function, advantages and disadvantages, we will be able to choose the needed type for every type of climate in Egypt to study the availability to be applied either on existing building or to be considered from the early stages of design.

To analyze the building skin there are some aspects to be evaluated as: the location of the building, climate type, the effect of the building skin on the indoor air quality and lighting levels, integration between the building skin and the building management systems, the ability to generate renewable energy through building skin, energy consumption through occupation of the building, and the maintenance and technical aspects of the building skin should also be considered.

The expected outcome of the thesis will be design guidelines for smart building skin, evaluation form to evaluate existing building skin, and a study the availability of applying the different types of smart building skins in Egypt with considering the technical and economic issues that will face the designer when applying the smart technologies in the buildings.