POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Sustainable Architecture
Honors theses

Integrated wall system for passive cooling of building: state of art, functional analysis and standards of technology planning

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In this work we have analyzed the technologies for passive cooling of buildings.

Considering the history of these applications, it appear a stoppage in the development of technologies in the contemporary era.

Theoretically, the potential application of these technologies is demonstrated by the results of recent research projects as well, as papers published in international scientific literature. In practical application, they are not actually available on the market engineered systems to a level comparable to that of mechanical air-conditioning systems.

Ventisol and PRIME3 research projects, within which the work of this thesis has been developed, aiming to contribute to the technological development of cooling techniques theoretically available and, numerically, demonstrated.

The results of the thesis represents a positive contribution to the diffusion of the systems and show that it is necessary to devote an effort to integrate the spatial requirements / functional system, instances of architectural design and industrial technologies currently available.

In order to obtain the desired results described above, it was necessary to perform a careful study of the system under study in more large views. Matrices and tables were useful to obtain information about the operation of the system, its modularity, its efficiency and its producibility.

It was concluded , therefore, a series of data and standars desing for this system wall , through which it is possible to exploit with maximum performances. (Fig. 1)

The system will then be composed of a dehumidifier, an evaporative cooling tower, a low pressure heat exchanger, a solar chimney, and a solar collector. The position of these elements has been studied in such a way as to ensure the natural ventilation of the air flows, exploiting the natural motions upward and descent. (Fig. 2)

These elements will be enclosed within a shell of aluminum sheet, supported by uprights and crosspieces in aluminum as well.

Then, everything need to be isolated. Therefore, we have designed a coat, the thickness is around 8 cm, and a second shell to close whole system-wall.

Hybrid-natural air conditioning system is conceived as a structure can be extended to most of existing buildings. In fact, it doesn't replace or affect the existing wall, but it is just hooks to the wall, being a self supporting structure, making it to be a sort of building's appendix.

Two necessary holes will be created in the existing wall at the outlet ducts, recovery and rigeneration circuit.

The system is enclosed in a "box" of 185 x 60 centimeters, measures significantly contained. Its height is at least 3 meters, to allow natural air flow movimentation; this height could be adapted in relation to the building under object. (Fig. 3)

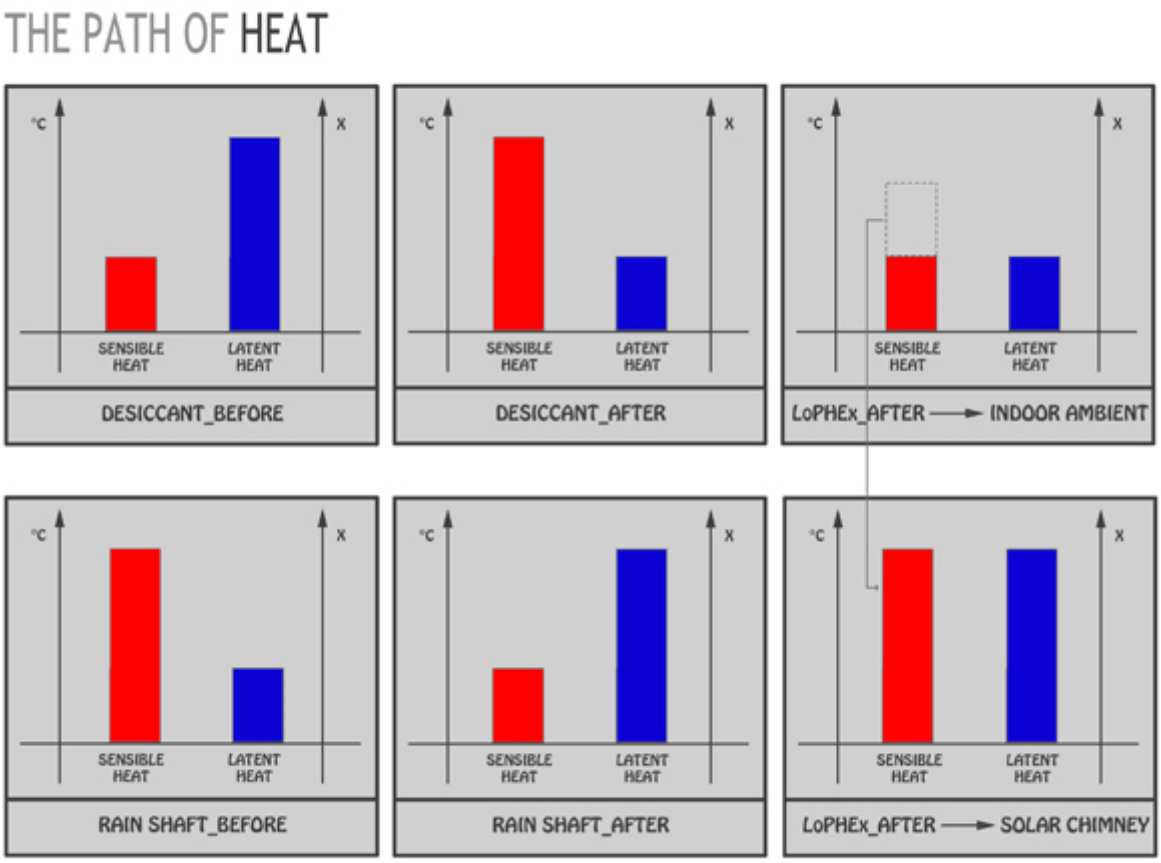

Fig. 1

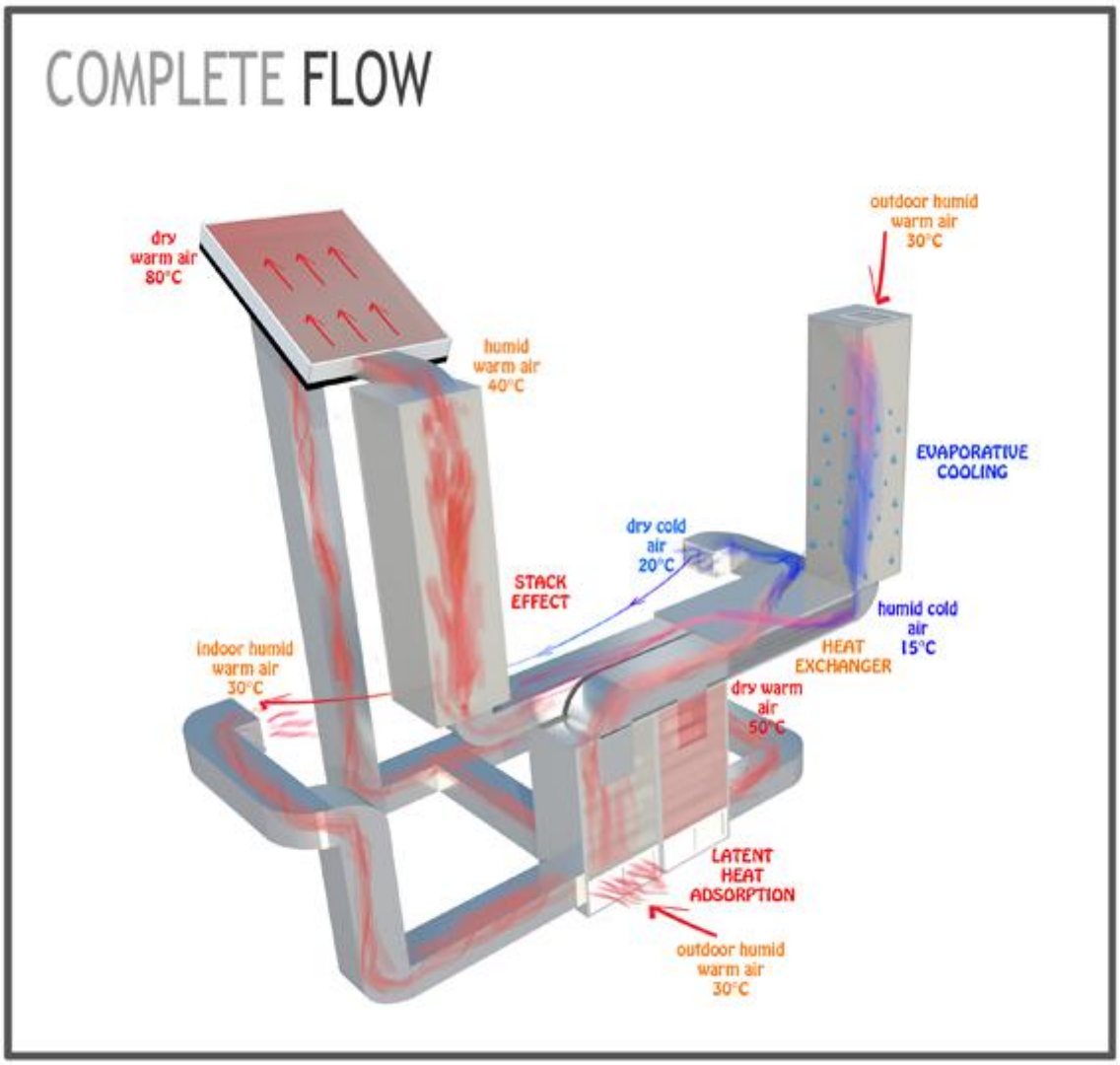
COMPLETE FLOW
dry
warm air
80°C
humid
warm air
40°C
outdoor humid
warm air
30°C
EVAPORATIVE
COOLING
dry cold
air
20°C
STACK
EFFECT
humid cold
air
15°C
HEAT
EXCHANGER
indoor humid
warm air
30°C
dry warm
air
50°C
LATENT
HEAT
ADSORPTION
outdoor humid
warm air
30°C

Fig. 2

Fig. 3

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