

Design of Active and Passive Solar Elements for Sustainable Contemporary Architecture

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Within this paper we describe the design and development of technological innovative modules to be applied in architecture cladding. They combine passive solar features like solar protection, solar thermal energy storage, ventilated and Trombe wall effects with active solar thermal collectors and photovoltaic systems. The proposed solar protection features can also include a biological element, proving support for vertical gardens and shelter for small birds. This novel modular system comprises several multifunctional technical parts. A prototype of the thermodynamic module was constructed with selected cork, ceramic, glass and copper materials.

Keywords: Active and Passive Solar Elements; Sustainable Architecture; Design

Introduction

Sustainable architecture is a concept that has been gaining momentum in recent years. It refers to the design and construction of buildings that are environmentally friendly, energy efficient, and socially responsible. One of the key aspects of sustainable architecture is the use of passive solar elements, which can help to reduce the energy consumption of a building and improve its overall performance. Passive solar elements are designed to take advantage of the sun's energy and store it for use during the winter months. This can be achieved through a variety of techniques, including the use of solar collectors, thermal mass, and Trombe walls. The design of passive solar elements is a complex task that requires a deep understanding of the building's orientation, climate, and energy needs. In this paper, we describe the design and development of a novel modular system for passive solar elements. This system is designed to be multifunctional, providing solar protection, solar thermal energy storage, and ventilation. It also includes a biological element, which can support vertical gardens and provide shelter for small birds. The system is made up of several technical parts, each of which is designed to perform a specific function. A prototype of the system was constructed using cork, ceramic, glass, and copper materials.

Active solar elements, on the other hand, use mechanical or electrical systems to collect and store solar energy. This can be done through a variety of methods, including the use of solar collectors, heat exchangers, and storage tanks. Active solar systems are typically more expensive than passive solar systems, but they can provide a more consistent and reliable source of energy. In this paper, we describe the design and development of a novel modular system for active solar elements. This system is designed to be multifunctional, providing solar protection, solar thermal energy storage, and ventilation. It also includes a biological element, which can support vertical gardens and provide shelter for small birds. The system is made up of several technical parts, each of which is designed to perform a specific function. A prototype of the system was constructed using cork, ceramic, glass, and copper materials.

Natural ventilation is another important aspect of sustainable architecture. It refers to the use of natural forces, such as wind and buoyancy, to move air through a building. This can help to reduce the need for mechanical ventilation and improve the indoor air quality. In this paper, we describe the design and development of a novel modular system for natural ventilation. This system is designed to be multifunctional, providing solar protection, solar thermal energy storage, and ventilation. It also includes a biological element, which can support vertical gardens and provide shelter for small birds. The system is made up of several technical parts, each of which is designed to perform a specific function. A prototype of the system was constructed using cork, ceramic, glass, and copper materials.

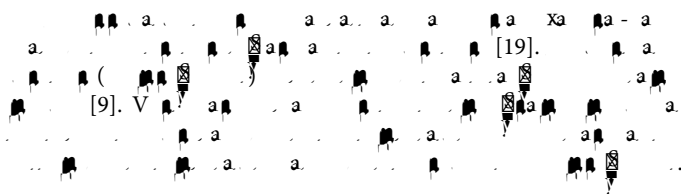
In addition, the system is designed to be easy to install and maintain. It is made up of several modular components that can be assembled in a variety of ways to suit different building types and climates. The system is also designed to be aesthetically pleasing, so that it can be used in a wide range of architectural contexts. In conclusion, the design and development of a novel modular system for passive and active solar elements is a complex task that requires a deep understanding of the building's energy needs and the local climate. This system is designed to be multifunctional, providing solar protection, solar thermal energy storage, and ventilation. It also includes a biological element, which can support vertical gardens and provide shelter for small birds. The system is made up of several technical parts, each of which is designed to perform a specific function. A prototype of the system was constructed using cork, ceramic, glass, and copper materials.

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- identidade cultural como referente para uma actividade projectual sustentada, Phd Thesis, Faculty of Engineering of the University of Porto, Porto.
20. Said I (2010) Carving motifs in timber houses of Kelantan and Terengganu: sustaining Malay architecture identity. In: Conference on Technology and Sustainability in the Built Environment, King Saud University, Saudi Arabia.
 21. El-Said I, Parman E (1976) *Geometric Concepts in Islamic Art*, London.
 22. Gan G, Riffat RB (1998) A numerical study of solar chimney for natural ventilation of buildings with heat recovery. *Applied Thermal Engineering*, 18: 1171-1187.
 23. Chan HY, Riffat SB, Zhu J (2010) Review of passive solar heating and cooling technologies. *Renewable and Sustainable Energy Reviews* 14: 781-789.
 24. Liu YW, Feng W (2012) Integrating passive cooling and solar techniques into the existing building in South China. *Advanced Materials Research*, 368-373.
 25. Asnaghi A, Ladjevardi SM (2012) Solar chimney power plant performance in Iran. *Renewable and Sustainable Energy Reviews* 16: 3383-3390.
 26. Fiaschi D, Bertolli A (2012) Design and energy analysis of solar roofs: a viable solution with esthetic appeal to collect solar heat. *Renewable Energy* 46: 56-61.
 27. Koyunbaba BK, Yilmaz Z (2012) The comparison of Trombe wall systems with single glass, double glass and PV panels. *Renewable Energy* 45: 111-118.
 28. Quesada G, Rouse D, Dutil Y, Badache M, Halle S (2012) A comprehensive review of solar facades. Opaque solar facades. *Renewable and Sustainable Energy Reviews* 16: 2820-2832.
 29. Albanese MV, Robinson BS, Brehob EG, Sharp MK (2012) Simulated and experimental performance of a heat pipe assisted solar wall. *Solar Energy* 86: 1552-1562.
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