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PRINCIPLES OF GREEN ARCHITECTURE AND ITS ROLE IN SUSTAINABLE DEVELOPMENT

(The Case of Uzbekistan)

Abstract: This article is devoted to the analysis of the theoretical foundations of the concept of green architecture, the factors influencing its formation and its significance in ensuring sustainable development within modern urban planning systems. The study considers green architecture as a comprehensive approach based on the rational use of energy and natural resources. In addition, issues related to ensuring environmental safety, improving energy efficiency and creating a healthy and comfortable living environment during the design and operation of buildings are discussed. Taking into account the climatic and territorial characteristics of Uzbekistan, the application of green architecture principles is analyzed through real architectural practices in the cities of Tashkent, Samarkand and Bukhara.

Annotatsiya: Mazkur maqola yashil arxitektura tushunchasining nazariy asoslarini, uning shakllanishiga ta'sir etuvchi omillarni hamda zamonaviy shaharsozlik tizimida barqaror rivojlanishni ta'minlashdagi ahamiyatini tahlil qilishga bag'ishlangan. Tadqiqotda yashil arxitektura energiya va tabiiy resurslardan oqilona foydalanishga asoslangan kompleks yondashuv sifatida qaraladi. Shuningdek, binolarni loyihalash va ekspluatatsiya qilish jarayonida ekologik xavfsizlikni ta'minlash, energiya samaradorligini oshirish hamda inson salomatligi uchun qulay muhit yaratish masalalari yoritib beriladi. Maqolada O'zbekistonning iqlimiy va hududiy xususiyatlari inobatga olingan holda Toshkent, Samarqand va Buxoro shaharlaridagi real arxitektura amaliyotlari misolida yashil arxitektura tamoyillarining qo'llanilishi tahlil qilinadi.

Аннотация: Данная статья посвящена анализу теоретических основ концепции зелёной архитектуры, факторов, влияющих на её формирование, а также её роли в обеспечении устойчивого развития в системе современного градостроительства. В исследовании зелёная архитектура рассматривается как комплексный подход, основанный на рациональном использовании энергии и природных ресурсов. Кроме того, освещаются вопросы обеспечения экологической безопасности в процессе проектирования и эксплуатации зданий, повышения энергоэффективности и создания благоприятной среды для здоровья человека. В статье анализируется применение принципов зелёной архитектуры на примере реальных архитектурных практик в городах Ташкент, Самарканд и Бухара с учётом климатических и территориальных особенностей Узбекистана.

KeyWords: Green architecture, sustainable development, energy efficiency, ecological design, renewable energy sources, urban environment.

Introduction

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In recent years, the rapid pace of urbanization worldwide has had a significant impact on the ecological condition of urban environments. Population growth, increased construction activity and the expansion of infrastructure require intensive use of natural resources. As a result, issues such as increased energy consumption, air pollution and the disruption of natural balance have emerged. This situation has intensified the need to seek environmentally sustainable and long-term solutions in the fields of architecture and urban planning.

Green architecture is a modern concept that has emerged in response to these challenges, aiming to harmonize buildings and urban environments with nature. Within this approach, architecture is developed not only based on aesthetic and functional criteria but also through a comprehensive consideration of ecological, social and economic factors.

Main Part

Essence and Fundamental Principles of Green Architecture

The concept of green architecture is based on the idea of minimizing the negative impact of buildings on the environment throughout their entire life cycle. This process includes the stages of design, construction, operation and reconstruction. The main objective is to ensure environmental sustainability through the efficient use of energy and resources.

One of the key principles of this concept is improving energy efficiency. This is achieved through optimal building orientation, extensive use of natural lighting and ventilation and the application of modern thermal insulation materials. In particular, the use of renewable energy sources is considered an integral component of green architecture.

Passive Energy Solutions in the Climatic Conditions of Uzbekistan

Uzbekistan is characterized by a sharply continental climate, with high temperatures in summer and cold weather in winter. Under these conditions, the application of passive energy methods in building design is of particular importance. Orienting buildings along the east–west axis, using deep loggias and verandas and incorporating sun-shading elements can significantly reduce summer heat loads.

Solar protection structures applied on the façades of modern public buildings in Tashkent serve as a clear example of this approach. These solutions not only increase energy efficiency but also enrich the architectural expression of buildings.

Energy-Efficient Technologies and Solar Energy

Uzbekistan is one of the regions with high solar radiation potential. Therefore, the integration of solar panels in modern residential and public buildings is considered one of the most promising directions for improving energy efficiency. In newly constructed residential complexes in Tashkent and Samarkand, rooftop solar panels help reduce electricity consumption while contributing to environmental sustainability.

Use of Local Construction Materials

The use of local construction materials in green architecture is of great ecological and economic importance. Traditional materials widely used in Uzbekistan, such as fired brick, adobe and natural stone, possess high thermal mass, allowing for the stabilization of indoor microclimates. Combining these materials with modern technologies yields effective results in the construction of energy-efficient housing.

Water Resource Conservation and Green Infrastructure

The limited availability of water resources in Uzbekistan makes the implementation of rainwater harvesting and reuse systems a pressing issue. In addition, green roofs and vertical green walls improve the urban microclimate and reduce the urban heat island effect. Such solutions play an important role in maintaining ecological balance in densely built urban areas.

Building section with applied green roof technology:



Experience in Tashkent and in Historic Cities: Samarkand and Bukhara

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In the cities of Samarkand and Bukhara, the principles of green architecture are historically reflected in traditional architectural solutions. Inner courtyards, thick walls, verandas and natural ventilation systems have long ensured energy efficiency in these regions. Today integrating this experience with modern technologies is considered one of the most promising directions of green architecture.

In Tashkent, the development of green architecture is mainly associated with contemporary urban projects, where energy-efficient materials, modern engineering systems, landscaped public spaces and climate-responsive design solutions are increasingly applied in new residential and public buildings.

Green Architecture on the Case of Tashkent

Tashkent is one of the largest megacities in Uzbekistan and has significant potential for the implementation of green architecture principles. In recent years, the “Tashkent City” complex has been constructed, incorporating modern energy-efficient technologies. The buildings feature double-glazed windows, sun-shading façade elements and efficient engineering systems.

In addition, the “National Library” building in Tashkent has improved the ecological environment by expanding green areas and making use of natural lighting and ventilation opportunities.

Green Architecture in the Case of Samarkand

Samarkand is a city where historical heritage and modern architecture coexist harmoniously. The “Silk Road Samarkand” tourist complex was designed based on green architecture principles, incorporating solar panels, artificial water bodies to moderate the microclimate and extensive green spaces.

Green areas and water elements in the "Silk Road Samarkand" complex, Samarkand:



This complex plays an important role in creating a naturally cooled and comfortable recreational environment under Samarkand's hot climatic conditions.

Green Architecture in the Case of Bukhara

In Bukhara green architecture is primarily expressed through traditional architectural solutions. Thick walls, inner courtyards, verandas and natural ventilation systems have historically ensured energy efficiency in ancient buildings. Modern eco-hotels preserve these traditions while integrating solar energy systems and water-saving technologies.

Conclusion

In conclusion, green architecture is a crucial tool for ensuring sustainable development in modern urban planning and construction. This approach promotes the rational use of energy and natural resources, reduces negative environmental impacts, creates a healthy and comfortable living environment for people. In the context of Uzbekistan the widespread implementation of green architecture principles not only helps address environmental challenges but also lays the foundation for the sustainable development of cities.

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