Final Year Design Project Showcase
Batch-2021
Year 2026

Department: Architecture and Planning Programme: Architecture and Planning	
1	**Project Title** **From Nature to Algorithm:** A Biomorphic Parametric Approach to Climate-Adaptive Architecture
2	**Project Idea** With the emergence of computational design tools, parametric design tools are being widely used globally to create complex and climate-responsive designs. However, their application remains limited in Pakistan's context. The idea was to understand how parametric design tools can be used with Biomorphic principles to create spaces that have better environmental performance and yet are contemporary.
3	**Process** The process begins by establishing the research problem of how biomorphic principles can be translated through parametric design tools to create climate-responsive architecture suited to Karachi's context. A comprehensive review of literature then explores the evolution of biomorphism, nature-inspired design strategies, computational and parametric design, environmental simulation tools, and traditional climate-responsive architectural elements, while identifying the gap between advanced digital technologies and contemporary architectural practice in Pakistan. An evaluative qualitative research methodology is employed, combining focus group interviews with architects and professionals alongside the analysis of local and international precedents to gather theoretical and practical insights. The research findings reveal the need for a context-sensitive approach that integrates computational design with regional architectural identity, highlighting the potential of Digital Regionalism. Based on these findings, a suitable site is selected and analyzed at the macro, meso, and micro scales, followed by the development of a design brief and program. To conclude, research outcomes are translated into a tangible modular form that is digitally modelled using software like Rhino and Grasshopper while environment simulations were carried out using Grasshopper plugins like Ladybug and Honeybee.
4	**Outcome** Located in Korangi Industrial Estate, Innovation Hub provides a collaborative space between students, researchers and industrialists.The building comprises a series of modular forms, each designed to accommodate a specific function. Shared facilities, including the multipurpose hall, café, and research library, are accessible to all users. Dedicated co-working spaces and laboratories are primarily for students and researchers. . A Biomorphic Parametric approach takes inspiration from a natural specie to determine its form and patterns while using environmental simulation softwares to create optimised form and facade of the building.

5	**Evidence** **Theoretical Evidence** The literature review establishes the theoretical foundation for understanding the relationship between biomorphism, computational design, and climate-responsive architecture. It traces the evolution of biomorphism from organic architecture to contemporary digital biomorphism, highlighting how nature-inspired forms, patterns, and processes can enhance both the aesthetic and functional performance of buildings. The review examines natural geometries and further explores the role of tools such as Rhino, Grasshopper, Ladybug, and Honeybee in form generation and environmental optimization. **Methodological Evidence** The research methodology adopts an evaluative qualitative approach to examine the potential of integrating biomorphic principles with parametric design for climate-responsive architecture in Karachi. The study utilizes both primary and secondary sources of data to establish a comprehensive research framework. Primary data consists of focus group interviews conducted with architects and architectural professionals, providing expert perspectives on the current state of architecture in Pakistan. A structured questionnaire was developed to guide the focus group discussions, addressing themes related to contemporary architectural identity, environmental performance, biomorphism, and the role of parametric design Secondary data is collected through an extensive review of international and local architectural precedents. The selected case studies demonstrate the application of biomorphic principles, computational design techniques, and climate-responsive strategies across different contexts. The research findings emphasized the importance of **Digital Regionalism**, an approach that combines advanced computational technologies with locally responsive architectural principles. Rather than replicating international parametric forms, the research supports reinterpreting passive design strategies like courtyards, jalis, shading systems, and climatic orientation.
6	**Competitive Advantage or Unique Selling Proposition**
a	**Attainment of any SDG** The project directly contributes to several United Nations Sustainable Development Goals: ● **SDG 4:** Quality Education Innovation Hub provides areas like co working spaces along with prototyping labs and exhibition areas that will help in developing technical and vocational skills. Continuous collaboration between students, researchers and industrialists will promote lifelong learning while also encouraging creativity and problem solving through project based learning. ● **SDG 9:** Industry, Innovation and Infrastructure The main goal of the building type is to connect universities, industry partners, and researchers to accelerate technology transfer and innovation.

	A parametric biomorphic approach represents an innovative direction in contemporary architecture in Karachi, introducing computationally driven, nature-inspired design methodologies that are still emerging within the local context. The project promotes research infrastructure by allowing collaborative spaces for multiple universities and specialised laboratories to encourage practical learning. • **SDG 13:** Climate Action Intersection of Biomorphic architecture with Parametric Design enables data driven solutions to enhance environmental performance of the building. Form optimization based on cardinal directions provides comfortable and shaded outdoor spaces while exposing surfaces of the building to the right amount of natural light. Moreover, facade Optimization via sun radiation analysis and Sun hour study lowers the need of artificial lightning. Proposing the idea of Space truss as a structural system rather than using the conventional concrete load system, allows sustainable construction practices and reduces greenhouse gas emissions.
b	**Any Environmental Aspect** Carbon footprint reduction Green Roofing and Vegetation Integration Greywater Recycling Use of Passive energy strategies Use of Solar Energy
f	**Capture New Market** Pre Engineered Building, a steel building construction method in which structural components are designed, manufactured, and fabricated in a factory according to project requirements, then transported and assembled at the site. The project proposes the idea of using Space truss as a structural load system that is not widely explored in Public architecture of Karachi. However, its use remains common in construction of warehouses and factories. The project aims to touch the niche market of steel construction that can replace the excessive use of concrete in the near future.
7	**Target Market** Academic Institutions Researchers Industrialists Entrepreneurs
8	**Team Members** (Names along with email address)	Maria Aquil mariaaquil053@gmail.com
10	**Supervisor Name** (along with email address)	Ar Fariha Tahseen (fariha tahseen@yahoo.com) Dr Masooma Shakir (masoomashakir@gmail.com) Dr. Tania Ali Soomro (architect.tania@gmail.com)
11	**Video (If any)**	NA

PAK REFINARY RD 30.0°
INNOVATION HUB

SIDE ELEVATION
(SCALE: 1'=3/32")