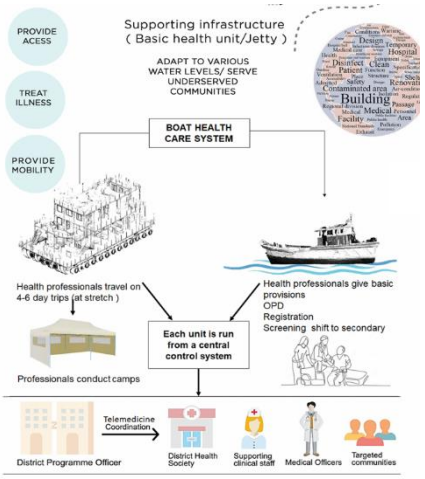
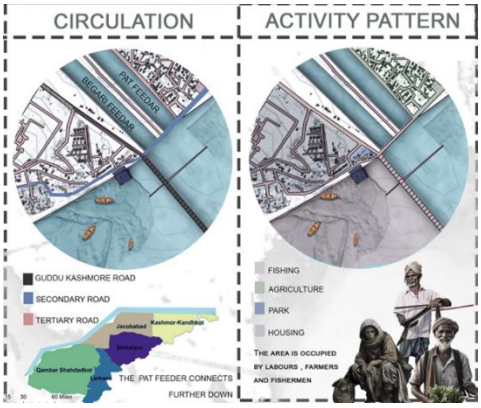
Final Year Project Showcase Batch 2019
Year 2024

Department: Architecture and Planning
Programme : Architecture

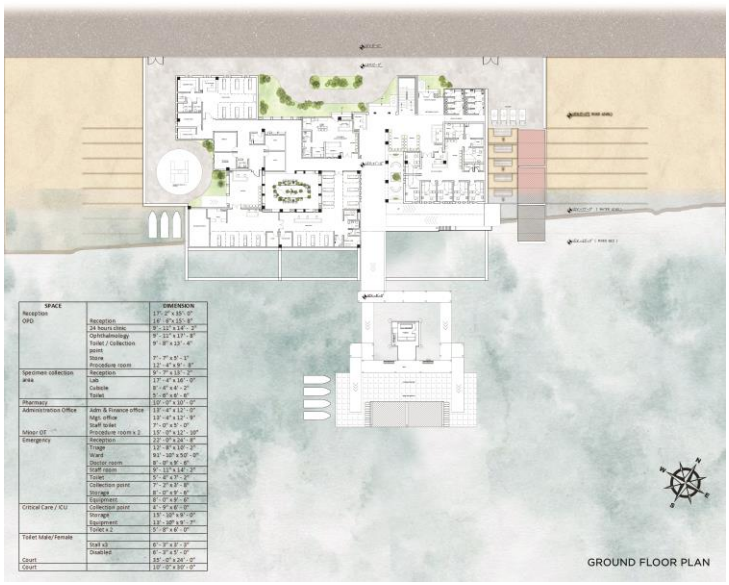
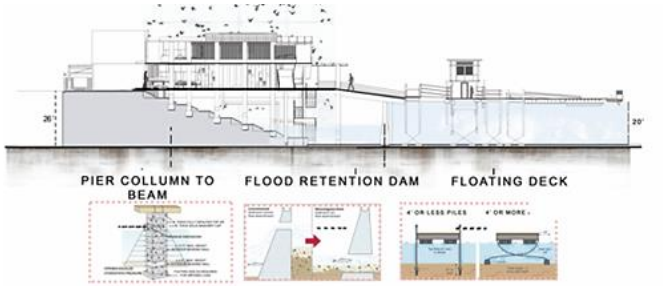
1	**Project Idea** "Innovating Healthcare Delivery: From Brick-and-Mortar to Mobility" aims to transform healthcare accessibility in flood-prone regions by developing mobile healthcare units and supporting dock structures. This approach focuses on overcoming the challenges posed by static facilities in providing medical care during floods. This model leverages rafts and boats as mobile healthcare units to provide access, treat illnesses, and ensure mobility in Sindh's flood-affected regions along the Indus River. This approach is designed to enhance accessibility, improve health outcomes, and strengthen community resilience.
2	**Process** The project unfolded through distinct phases, addressing healthcare challenges along the Indus River from Guddu Barrage to Manchar Lake in Sindh. **Initial Exploration**: The research began with a comprehensive literature review focused on healthcare delivery in flood-prone areas of Sindh. This review highlighted the limitations of traditional healthcare infrastructure during floods and identified mobile healthcare units as a flexible solution. I explored how architecture could enhance healthcare delivery in these challenging conditions. **Validation Through Case Studies**: To validate this approach, I examined global case studies from Bangladesh and India, where mobile healthcare systems have been successfully implemented in similar flood-prone regions. These cases underscored the importance of community involvement, sustainable design, and telemedicine. The positive outcomes confirmed that architectural design could improve healthcare access in the flood-affected areas between Guddu and Manchar. **Design Development**: The design phase involved creating conceptual models for mobile healthcare units, including floating healthcare hubs and amphibious structures. These designs incorporated sustainable materials and technologies to ensure resilience against floods. A key consideration was integrating local water mobility practices to adapt to the region's varying water levels and environmental conditions. The project identified several viable solutions: • ***Floating Healthcare Units****: Designed to remain operational during high water levels, ensuring healthcare access during severe floods.* • ***Amphibious Structures****: Capable of transitioning between land and water, offering flexibility in response to changing conditions.* • ***Flexible Dock Structures****: Functioning as primary care units, these docks adapt to fluctuating water levels, providing a stable base for mobile units during both floods and dry spells.* This approach blends modern technology with traditional practices, offering a practical and sustainable model for healthcare delivery in the flood-prone Sindh region. It ensures that essential medical services remain accessible year-round, addressing the challenges posed by variable water levels. These solutions utilize water-based transportation systems to

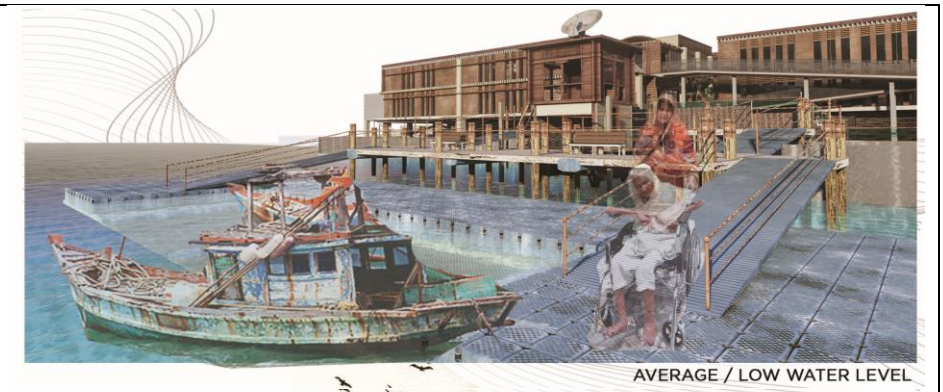
	maintain healthcare access .
3	**Outcome** The project is divided into three key components designed to provide comprehensive healthcare in flood-prone areas of Sindh, specifically from Guddu Barrage to Manchar Lake along the Indus River. 1. **Basic Unit with Jetty**: • **Location**: Strategically placed at Guddu, Sukkur, and Aral Bridge—each approximately 50 km apart—these basic units serve as fixed healthcare hubs. • **Spaces**: Includes essential facilities such as reception areas, outpatient departments (OPD), 24-hour clinics, ophthalmology rooms, and pharmacies. These units are equipped to handle general healthcare needs and are supported by flexible jetty structures that adapt to fluctuating water levels. This unit is designed as a healthcare hub capable of transitioning between land and water. They include facilities for primary care, emergency treatment, and specialized services like maternal care 2. **Raft with OPD and Pharmacy**: • **Function**: Operated by boats, these rafts provide essential services including immunization, basic medical care, and pharmacy services. The mobile units navigate through canals and along the Indus River, extending healthcare access to remote areas. • **Operation**: Rafts and boats are coordinated to cover upper Sindh, ensuring that healthcare services reach communities isolated by floods or lacking infrastructure The floating units are integrated into the broader system , ensuring continuous healthcare delivery and support in response to seasonal and environmental changes. This comprehensive approach blends fixed and mobile healthcare solutions, ensuring that essential medical services remain accessible throughout the year despite the challenges posed by variable water levels and flooding. 
4	**Evidence (Theoretical Basis)** The 2022 floods in Pakistan, which severely affected Sindh, Punjab, and KPK, highlighted significant barriers to healthcare access, primarily due to the destruction of infrastructure. A UNOCHA assessment revealed that up to one-third of the population in these areas could not access health services due to the inoperability of facilities, staff shortages, and depletion of medicines. Satellite imagery showed the Indus River overflowing and merging with Hamal Lake, creating vast floodwaters that obstructed access to healthcare. Extensive

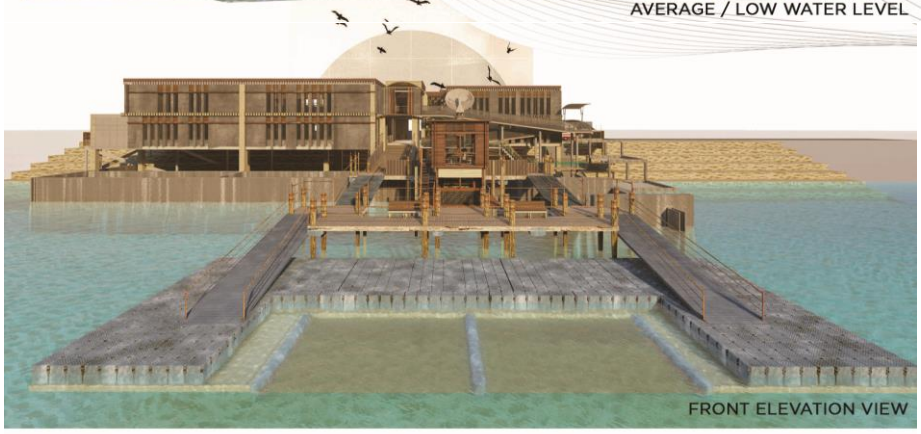
	damage to roads and bridges compounded the problem, making transportation to healthcare facilities extremely challenging. The floods displaced over 33 million people, many of whom were relocated to relief camps, disrupting traditional healthcare systems. Over 1,000 health facilities in Sindh alone were damaged, resulting in an estimated financial loss of PKR 26.2 billion. The destruction of infrastructure, including roads and healthcare facilities, severely hampered the delivery of medical services. Before the floods, Pakistan's rural healthcare system, consisting of primary, secondary, and tertiary care levels, faced challenges such as weak infrastructure, regional disparities, limited access to specialists, and a growing burden of non-communicable diseases. The floods exacerbated these issues, leading to severe disruptions in healthcare delivery. Post-flood, the healthcare system experienced several critical challenges: the destruction of health facilities led to significant loss of access to care; shortages of medical staff and medicines occurred due to disrupted transportation and supply chains; and a surge in diseases such as diarrheal diseases, malaria, respiratory infections, and vaccine-preventable diseases emerged, exacerbated by unsanitary conditions and population displacement. Pregnant women were particularly vulnerable due to interruptions in antenatal services, and the financial losses inflicted on the healthcare sector further complicated recovery and response efforts. The situation underscores the need for innovative healthcare solutions. Global disaster management strategies, especially those highlighted during the COVID-19 pandemic, emphasize the importance of flexible and resilient healthcare systems. Innovations such as mobile clinics and pop-up testing centres have proven effective in providing care in disaster scenarios. These approaches, which offer adaptability and resilience, are crucial for addressing the challenges posed by floods. Integrating these innovations with traditional systems could help create a more resilient healthcare infrastructure capable of maintaining continuity of care in extreme conditions. This integration is vital for ensuring that vulnerable populations continue to have access to essential medical services, even in the face of natural disasters.
5	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"**  This project aligns with SDG-11, "Sustainable Cities and Communities," by offering a sustainable healthcare delivery model tailored for flood-prone regions. The initiative employs boat-based healthcare units, inspired by local crafts and supported by floating bases made from recycled plastic, to provide adaptable and mobile services. This minimizes the environmental footprint by reducing the need for permanent healthcare facilities and extensive infrastructure. Leveraging Pakistan's extensive canal network, particularly around the Guddu Barrage, the project integrates water-based healthcare delivery with the local context. The area presents a stark contrast in land use: clusters of farming villages and fishermen relying on nearby water bodies on one side and a self-contained colony on the other, reflecting diverse community needs. The primary cause of flooding here is the presence of numerous unreinforced embankments, which heightens vulnerability. By utilizing inland waterways and addressing these weak points, the project ensures resilient, accessible healthcare for both rural and urban communities, enhancing overall

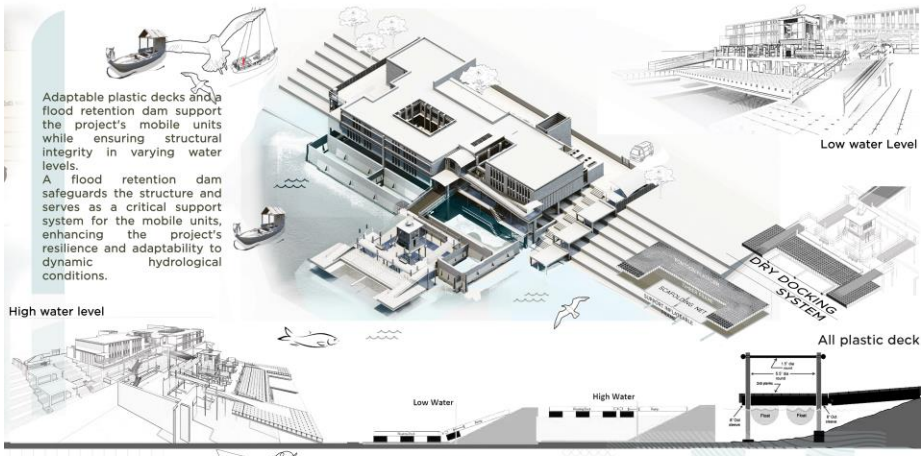
	sustainability and resilience to environmental challenges.
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal) This system presents a unique, flexible, and cost-effective approach to healthcare delivery, specifically tailored for remote and underserved communities. Unlike fixed structures that require extensive repairs and reconstruction after flood damage, this model distinct advantage lies in its adaptability to use existing waterways, like those around the Guddu Barrage, to ensure continuous healthcare access where traditional facilities are often inaccessible. The model's cost efficiency is further enhanced by integrating telemedicine, enabling real-time consultations with specialists and reducing the need for extensive physical infrastructure. Floating healthcare units, crafted with local design elements and floating bases made from recycled plastic, promote sustainability and cultural relevance. By bringing healthcare services directly to communities, this innovative approach fosters trust and encourages greater healthcare utilization. It alleviates the strain on urban healthcare systems, improves health outcomes, and reinforces resilience against environmental challenges, ultimately providing a sustainable solution in line with SDG-11 for "Sustainable Cities and Communities.
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) The "Boat Healthcare System" addresses multiple Sustainable Development Goals (SDGs) critical for the region: • **SDG 3 (Good Health and Well-being):** By ensuring access to quality healthcare services in remote and flood-prone areas, this project improves overall health outcomes. The boat-based healthcare model effectively reaches underserved communities, delivering essential medical services, and bridging gaps in healthcare access caused by geographical barriers and disasters. • **SDG 11 (Sustainable Cities and Communities):** The adaptable healthcare solutions provided by this system enhance community resilience, particularly in disaster-prone regions. The mobile healthcare units can operate effectively during natural disasters like floods, providing continued access to healthcare and reducing dependency on fixed, vulnerable infrastructure. • **SDG 13 (Climate Action):** This initiative supports climate adaptation by delivering healthcare services designed to withstand environmental disruptions. Utilizing local waterway networks and integrating sustainable materials, such as recycled plastic, the project aligns with climate resilience strategies, ensuring healthcare delivery is sustained in the face of climate-related challenges.
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) The use of mobile healthcare units and dock structures minimizes the environmental footprint compared to traditional healthcare facilities. Unlike fixed structures that require extensive repairs and reconstruction after flood damage, this model reduces damage and ensures sustainability by leveraging existing river networks. By utilizing boats and floating platforms, it avoids the carbon emissions associated with road-based transport. This approach not only ensures continuous healthcare accessibility despite environmental changes but also promotes a more resilient and eco-friendly solution for flood-prone regions, aligning with sustainable development goals.

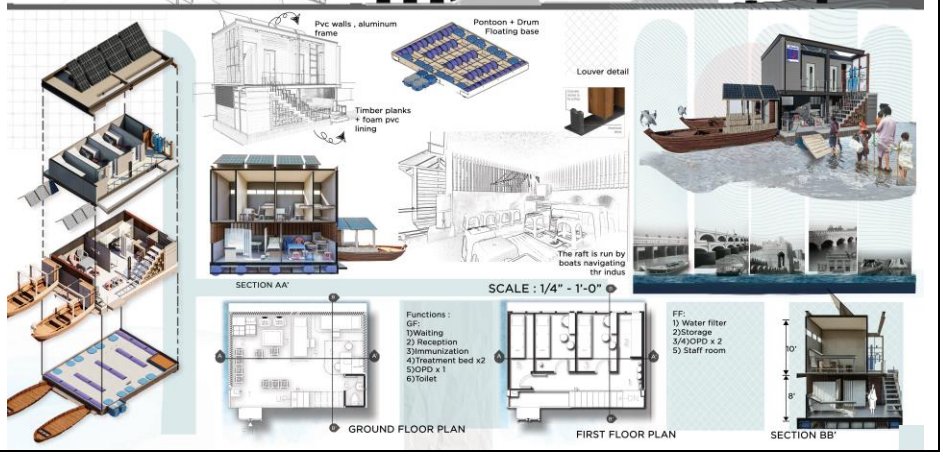
c	**Cost Reduction of Existing Product** This project primarily focuses on enhancing healthcare access and long-term resilience rather than directly reducing costs. However, by using mobile healthcare units and dock structures, the model reduces the need for extensive repair and reconstruction associated with traditional fixed healthcare facilities damaged by floods as mentioned around PKR 26.2 billion loss in the health sector in 2022 .This reduction in infrastructure damage and repair contributes to overall cost savings by minimizing the need for rebuilding and reducing operational disruptions. Furthermore, utilizing existing waterways for healthcare delivery lowers transportation.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggest) Currently, traditional healthcare infrastructure is vulnerable to flood damage, leading to significant repair and operational costs. The proposed mobile healthcare units and dock structures address this issue by offering a flexible and resilient solution. These units can be deployed quickly and are less susceptible to environmental disruptions, reducing the need for costly repairs. The integration of telemedicine further enhances the efficiency of the process by allowing real-time consultations, improving care quality, and reducing the reliance on physical infrastructure. This approach not only increases the efficiency of healthcare delivery but also ensures continuous access to medical services in flood-prone regions.
e	**Expanding of Market share** (e.g. how it expands and what is the problem with the current market The current healthcare system in flood-prone regions relies heavily on static facilities, which are often rendered ineffective during disasters. The introduction of mobile healthcare units and floating clinics expands the market share by providing healthcare services where traditional facilities are impractical. This model enhances accessibility to healthcare for underserved and remote communities, particularly during and after floods, and reduces the reliance on costly, fixed infrastructure. By extending the reach of healthcare services to areas previously underserved, this approach increases the overall market for healthcare services and improves community health outcomes.
f	**Capture New Market** (e.g. Niche market or unaddressed segment) The concept of mobile and floating healthcare units is relatively new and presents an opportunity to capture a niche market within disaster response and healthcare delivery. This innovative approach is particularly relevant in regions with frequent flooding or geographical challenges. By pioneering this model, the project addresses a previously unaddressed segment of the healthcare market, focusing on adaptability and resilience in healthcare delivery.
g	**Any Other Aspect** (Please tag it like above options) **Sustainability and Environmental Impact**: The mobile healthcare units and floating docks are designed to minimize environmental impact. By reducing the need for permanent infrastructure and utilizing existing waterways, the project lowers carbon emissions associated with road transport and construction. The use of recycled plastic for floating bases further supports sustainability efforts and aligns

	with environmental goals.	
7	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service **Industries, Groups, Individuals**: The target market for this project includes disaster response organizations, healthcare providers, and local communities in flood-prone regions. Key stakeholders include government agencies involved in disaster management, non-governmental organizations focusing on healthcare access, and local health authorities. The end-users of this project are the residents of flood-affected areas who will benefit from improved access to healthcare services. Additionally, healthcare professionals and volunteers involved in operating and maintaining these units form a critical part of the target market.	
8	**Team Members** (Names along with email address	Meh-e-kamil meh.e.kamil.a@gmail.com
9	**Supervisor Name** (along with email address)	Ar.Fariha Tehseen fariha_tahseen@yahoo.com
10	**Pictures (If any)**	 


AVERAGE / LOW WATER LEVEL


FRONT ELEVATION VIEW


Adaptable plastic decks and a flood retention dam support the project's mobile units while ensuring structural integrity in varying water levels.
A flood retention dam safeguards the structure and serves as a critical support system for the mobile units, enhancing the project's resilience and adaptability to dynamic hydrological conditions.
Low water Level
DRY DOCKING SYSTEM
High water level
All plastic deck
Low Water
High Water


Pvc walls , aluminum frame
Pontoon + Drum Floating base
Louver detail
Timber planks + foam pvc lining
The raft is run by boats navigating thr indus
SECTION AA'
SCALE : 1/4" - 1'-0"
Functions :
GF:
1)Waiting
2) Reception
3)Immunization
4)Treatment bed x2
5)OPD x 1
6)Toilet
FF:
1) Water filter
2)Storage
3/4)OPD x 2
5) Staff room
GROUND FLOOR PLAN
FIRST FLOOR PLAN
SECTION BB'

		  FIRST FLOOR WARD RECEPTION GROUND FLOOR CORRIDOR
11	**Video (If any)**	Thesis walk-through video is available at this link: https://drive.google.com/file/d/1WB9M4BoAALI4sLClFPPykicImnMkeYJn/view?usp=sharing