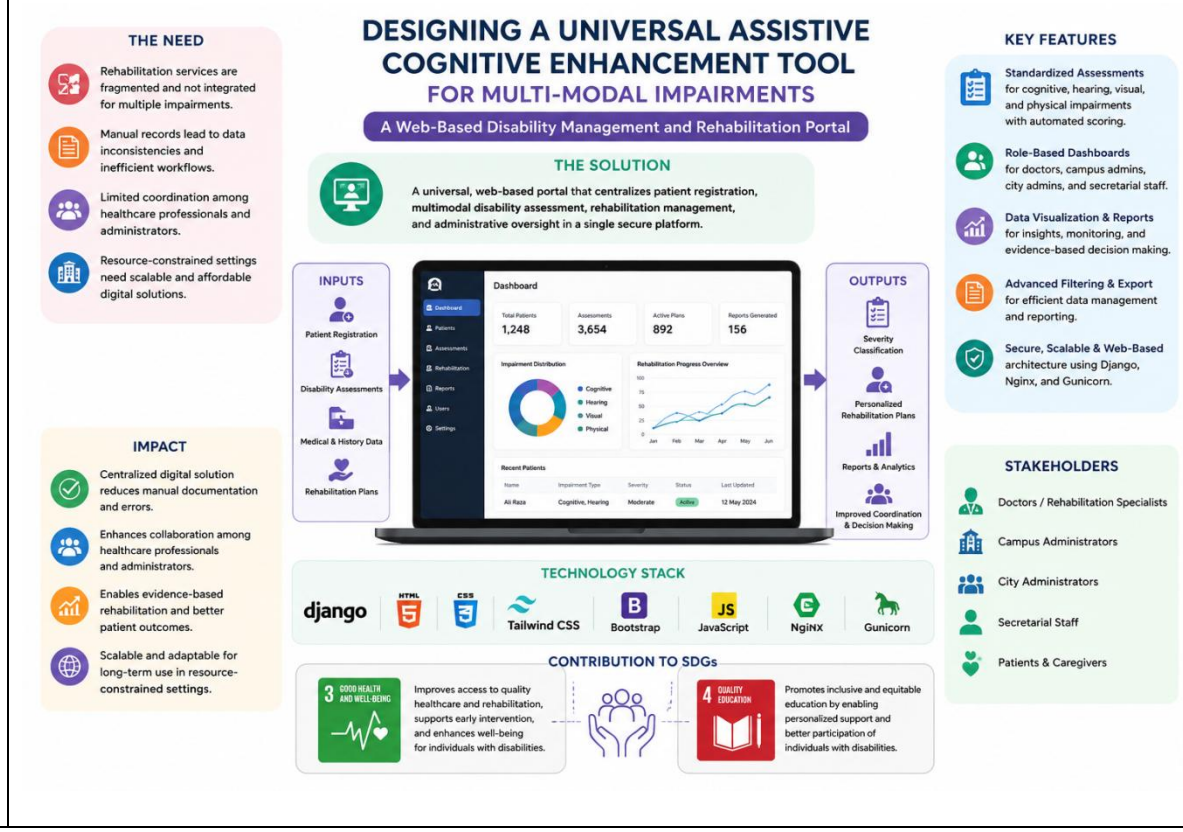
Masters Thesis Information Showcase
Spring Semester-2026
Year 2026

Department: Biomedical Engineering
Programme: Evening
Specialization: M.Engg. Biomedical Engineering

1	**Title of the Thesis** Designing a Universal Assistive Cognitive Enhancement Tool for Multi-Modal Impairments
2	**Abstract** (min 300 to 500 words) Individuals with multimodal impairments, including physical, cognitive, visual, and hearing disabilities, often require coordinated rehabilitation services that involve multiple healthcare professionals and administrative stakeholders. However, existing digital health solutions are predominantly designed to address single disability categories, resulting in fragmented patient records, inefficient workflows, and limited interdisciplinary collaboration. These challenges are particularly significant in low- and middle-income countries such as Pakistan, where rehabilitation services are frequently constrained by inadequate technological infrastructure and reliance on manual documentation. This study addresses these limitations by designing and developing a universal web-based assistive cognitive enhancement and disability management portal that integrates assessment, patient management, and administrative functions within a centralized platform. The system was developed following a comprehensive requirement-gathering process involving healthcare professionals, rehabilitation specialists, and administrative personnel to identify functional and operational needs. The portal was implemented using the Django framework with HTML5, CSS3, Tailwind CSS, Bootstrap, and JavaScript for frontend and backend development, while Nginx and Gunicorn were employed to ensure secure and scalable deployment. The platform incorporates standardized assessment questionnaires for cognitive, visual, hearing, and physical impairments, supported by automated scoring algorithms that classify disability severity and facilitate evidence-based rehabilitation planning. Furthermore, role-based dashboards were designed for doctors, campus administrators, city administrators, and secretarial staff to enable efficient patient registration, record management, data visualization, report generation, and organizational decision-making. The developed system successfully demonstrates the feasibility of a unified digital platform for managing individuals with multiple impairments. By centralizing patient information and integrating multimodal assessment tools, the portal reduces dependence on paper-based documentation, enhances data consistency, improves communication among stakeholders, and supports personalized rehabilitation planning. The modular architecture also provides scalability for incorporating additional assessment modules and rehabilitation services in future developments. This research contributes to the fields of biomedical engineering, assistive technology, and digital health by presenting a practical and scalable framework for multimodal disability

	management. The proposed platform offers an effective solution for improving organizational efficiency, supporting evidence-based clinical decision-making, and promoting accessible, integrated rehabilitation services, particularly in resource-constrained healthcare environments.
3	**Impact on SDG#__"** (min 500 words) (Please mention the impact of the relevant attained SDG) **<u>Impact on SDG #3 – Good Health and Well-being</u>** The proposed universal web-based assistive cognitive enhancement and disability management portal contributes to SDG 3: Good Health and Well-being by improving the quality and accessibility of rehabilitation services for individuals with multimodal impairments. The platform integrates patient management, standardized disability assessments, and automated severity classification into a centralized system, enabling healthcare professionals to provide timely, coordinated, and evidence-based care. By replacing paper-based records with digital documentation, it enhances data accuracy, improves collaboration among healthcare providers, and supports better rehabilitation outcomes. **<u>Impact on SDG #4 – Quality Education</u>** The developed system also supports SDG 4: Quality Education by promoting inclusive education for individuals with disabilities. Through comprehensive assessments of cognitive, visual, hearing, and physical impairments, the platform helps professionals identify individual needs and develop personalized rehabilitation and learning plans. Additionally, it improves institutional efficiency through secure record management, progress monitoring, and report generation, enabling educational and rehabilitation organizations to provide better support and make informed decisions for inclusive learning environments.
4	**Scholar Name** (along with contact details) **Scholar name:** Muhammad Ebaad Khan **Email:** mebaad22@gmail.com
5	**Supervisor & Co-supervisor Name** (along with contact details) **Supervisor name:** Prof. Dr. Muhammad Abul Hasan **Email:** abulhasan@cloud.neduet.edu.pk **Co-supervisor name:** Prof. Dr. Muhammad Saad Qazi **Email:** saadqazi@neduet.edu.pk
6	**Graphical Abstract**


DESIGNING A UNIVERSAL ASSISTIVE COGNITIVE ENHANCEMENT TOOL
FOR MULTI-MODAL IMPAIRMENTS
A Web-Based Disability Management and Rehabilitation Portal
THE NEED
Rehabilitation services are fragmented and not integrated for multiple impairments.
Manual records lead to data inconsistencies and inefficient workflows.
Limited coordination among healthcare professionals and administrators.
Resource-constrained settings need scalable and affordable digital solutions.
THE SOLUTION
A universal, web-based portal that centralizes patient registration, multimodal disability assessment, rehabilitation management, and administrative oversight in a single secure platform.
KEY FEATURES
Standardized Assessments for cognitive, hearing, visual, and physical impairments with automated scoring.
Role-Based Dashboards for doctors, campus admins, city admins, and secretarial staff.
Data Visualization & Reports for insights, monitoring, and evidence-based decision making.
Advanced Filtering & Export for efficient data management and reporting.
Secure, Scalable & Web-Based architecture using Django, Nginx, and Gunicorn.
INPUTS
Patient Registration
Disability Assessments
Medical & History Data
Rehabilitation Plans
Dashboard
Total Patients 1,248
Assessments 3,654
Active Plans 892
Reports Generated 156
Impairment Distribution
Cognitive
Hearing
Visual
Physical
Rehabilitation Progress Overview
Recent Patients
OUTPUTS
Severity Classification
Personalized Rehabilitation Plans
Reports & Analytics
Improved Coordination & Decision Making
IMPACT
Centralized digital solution reduces manual documentation and errors.
Enhances collaboration among healthcare professionals and administrators.
Enables evidence-based rehabilitation and better patient outcomes.
Scalable and adaptable for long-term use in resource-constrained settings.
STAKEHOLDERS
Doctors / Rehabilitation Specialists
Campus Administrators
City Administrators
Secretarial Staff
Patients & Caregivers
TECHNOLOGY STACK
django
HTML
CSS
Tailwind CSS
Bootstrap
JavaScript
NgiNX
Gunicorn
CONTRIBUTION TO SDGs
3 GOOD HEALTH AND WELL-BEING
Improves access to quality healthcare and rehabilitation, supports early intervention, and enhances well-being for individuals with disabilities.
4 QUALITY EDUCATION
Promotes inclusive and equitable education by enabling personalized support and better participation of individuals with disabilities.