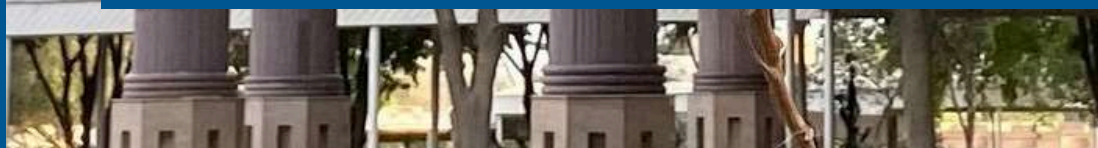
SEECS
SCHOOL OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE, NUST

ABSTRACT BOOKLET

CLASS OF
2026

SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

BESE & BSCS - BACHELOR OF SOFTWARE ENGINEERING & COMPUTER SCIENCE



INTRODUCTION TO SEECS

NUST-SEECS stands as a center of excellence, dedicated to advancing research and innovation in the fields of computing and electrical engineering. Our institution fosters a dynamic learning environment where students are encouraged to bridge the gap between academic theory and practical industry application. We take immense pride in our faculty and students, whose unwavering commitment ensures a spirit of distinction in every project and endeavor. By integrating professional ethics with technical mastery, we prepare our graduates to lead with integrity in the global technological landscape.

SEECS programs are globally recognized in the QS World University Rankings by Subject - **Computer Science ranks 114th globally, making it the #1 Computer Science program in Pakistan**, while **Electrical Engineering ranks 131st** and **Software Engineering ranks 132nd worldwide. Computer Science** also holds the distinction of being the **top merit program across all NUST programs,** reflecting the exceptional caliber of students it attracts.

The school remains at the forefront of national progress, cultivating the next generation of strategic thinkers and visionary engineers. Our graduates are equipped with a unique blend of technical expertise and leadership skills, making them highly sought after in the professional sector. By fostering a culture of continuous improvement and self-empowerment, SEECS continues to define the standard for engineering education in the region.

Greeting & Message from

Principal NUST-SEECS
Dr. Muhammad Ajmal Khan, SI(M)

PhD (Michigan State University, USA)

It is a pleasure to introduce to you the graduating classes of 2026 in the disciplines of Electrical Engineering, Software Engineering, and Computer Science. NUST-School of Electrical Engineering and Computer Science (SEECS) is committed to providing first-rate higher education in Pakistan. We emphasize making SEECS a center of excellence for imparting high-quality education in the areas of Electrical Engineering and Computer Science that would lead to the promotion of research and scholarly achievements at National & International levels. We foster a passion for creativity and productivity in our students through an enabling environment of state-of-the-art labs, arranging industry visits, seminars, and international conferences, etc. Besides imparting thorough professional knowledge, we also believe in instilling sound entrepreneurial, social and humanitarian values. The programs offered at SEECS include Electronics, Digital Systems, RF and Microwave, Telecommunication and Networks, Artificial Intelligence, Machine Learning, Big Data, Cyber Security, and Cloud Computing. Hands-on training in these domains augments the basic knowledge of our students, giving insights into its practical application, an essential prerequisite for potential technical leaders of the 21st century. The projects showcased in the Open House demonstrate the skill set of our graduating students, and the highly interactive sessions with the industrial professionals provide them a platform for networking. Another aim of holding this event is to address the dire need for industry-academia partnerships in Pakistan. Through Open House, the industry can witness the outstanding research of various disciplines that are being offered at NUST-SEECS. At the same time, the industry feedback helps us update our curriculum according to the contemporary market trends. Henceforth, I take immense delight in presenting the batch of 2026 as the proud product of SEECS and wish them success as they go forward in their respective fields, with all the best for their journey ahead.

OVERVIEW OF

OPEN HOUSE

NUST SEECS organizes its annual open house to showcase the skills of its graduating students. The idea is to provide a platform where our students and industry representatives can mingle and have informal or formal discussions. The students showcase their final year projects which represent their skill set and enable potential employers to identify any matching requirements. The projects are presented by students from:

Department of Electrical and Computer Engineering (ECE)

The Department of Electrical and Computer Engineering has divided its projects into five knowledge areas: Power Electronics and Control, Digital Systems and Signal Processing, Integrated Circuits and Systems, RF & Microwave, and Smart Telecommunications and Systems. There are a total of 70 projects presented by 168 students, divided into the above mentioned knowledge groups. Most of the projects are aimed at providing technology-based solutions for social problems.

At NUST SEECS, we take pride in molding our bright entrants into well trained and appropriately groomed professionals in Computer Science, Software Engineering & Electrical Engineering. Our graduates are actively sought by the industry and our Alumni are occupying promising positions in some of the most prestigious industrial and business houses, both in public and private sectors. We hope you enjoy the hard work of our students and find the right candidate or the next big idea for your company.

Contents

01 Knowledge Group
Algorithms and Complexity

Persona Driven Inclusive AI Game to Cultivate Children's Awareness of their ‘Personal Boundaries’

Group Members: Marya Humayun | Muhammad Noshair Ghani

Advisor: Sidra Sultana Co-Advisor: Nazia Perwaiz

This project develops an AI-driven inclusive educational game designed to cultivate environmental and social awareness among children through persona-driven interactive narratives. Persona modeling adapts game scenarios, dialogue, and difficulty to align with individual children's backgrounds, learning styles, and emotional responses. Deep learning models analyze player behavior to dynamically adjust content, ensuring sustained engagement and effective learning outcomes. The game integrates curriculum-aligned awareness topics, making learning both entertaining and educationally substantive. The project contributes a scalable, inclusive digital tool that supports equity in early childhood education through personalized, AI-enhanced gameplay.

ExportEdge: AI-Powered Fruit Screening for Global Markets

Group Members: Hannan Yousaf Butt | Muhammad Ammar Bin Akram | Muhammad Moosa

Advisor: Muhammad Shahzad Younis Co-Advisor: Momina Moetesum

ExportEdge is an AI-powered fruit quality screening system designed to help Pakistani exporters meet international market standards through automated defect detection and grading. Computer vision models analyze fruit surface imagery to classify specimens by quality grade, identifying defects, discolorations, and size non-conformances against export specifications. The system processes fruit samples at production line speeds, replacing slow and inconsistent manual inspection with objective, standardized grading. Integration with export documentation systems automates quality certification workflows, reducing processing time and compliance costs. ExportEdge targets improved export competitiveness for Pakistani fruit producers by ensuring consistent quality standards and reducing rejection rates in international markets.

02 Knowledge Group
Computational Science

GENCell: Generative Models for Microscopic Cell Instance Segmentation

Group Members: Haseeb Muhammad

Advisor: Junaid Younas Co-Advisor: Muhammad Imran Malik

GENCell applies generative deep learning models to the task of microscopic cell instance segmentation, addressing the challenge of limited annotated training data in biomedical imaging. Generative adversarial networks and diffusion models are used to synthesize realistic, diverse cell microscopy images augmenting scarce real training datasets. Instance segmentation models trained on combined real and synthetic data achieve improved accuracy in delineating individual cell boundaries under varying staining conditions and cell morphologies. The system supports downstream biomedical analysis including cell counting, morphological profiling, and disease classification from microscopic images. GENCell demonstrates the value of generative augmentation in improving deep learning performance for data-limited biomedical image analysis tasks.

Disease Detection from Microscopic Cell Images

Group Members: Kaif Ul Imaan | Muhammad Ali Irfan

Advisor: Junaid Younas Co-Advisor: Muhammad Naseer Bajwa

This project develops a deep learning pipeline for automated disease detection from microscopic cell images, targeting conditions diagnosable through cellular morphology analysis. Convolutional neural network models are trained on annotated microscopic datasets to classify normal and pathological cell populations with clinical-grade accuracy. Image preprocessing and augmentation techniques improve model robustness across varying microscope configurations, staining protocols, and image quality levels. The system provides cell-level detection outputs with visual saliency maps indicating diagnostic evidence regions to support pathologist interpretation. The platform contributes an accessible, scalable digital pathology tool for disease screening in resource-limited laboratory environments.

Finasaan

Group Members: Muhammad Hadi Khan | Muhammad Muzamil Kaleem | Syed Aman Hussain

Advisor: Farzana Jabeen Co-Advisor: Huzaifa Sarfraz

Finasaan is a financial literacy application helping Pakistani users understand and manage personal finances across five key domains: stock market, mutual funds, insurance, taxation, and budgeting. The app collects real-time financial data from public sources and uses AI to extract, summarize, and explain information in plain language tailored to each user's experience level. A conversational AI assistant answers finance-related questions and provides personalized insights based on the user's financial profile and stated goals. Educational content is structured progressively, guiding users from foundational concepts to actionable investment and saving strategies. Finasaan aims to democratize financial literacy in Pakistan by making complex financial knowledge accessible to all.

To Build Comprehensive Automated Machine Learning Engineering Pipeline

Group Members: Aqeedat Fatima | Zunair Saleem

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project builds a comprehensive Automated Machine Learning Engineering (AutoMLE) pipeline that automates the full ML model development lifecycle from data ingestion through model deployment. Automated components cover data cleaning, feature engineering, algorithm selection, hyperparameter optimization, and model evaluation, reducing the expertise required for end-to-end ML project execution. Meta-learning techniques guide the pipeline to prioritize promising algorithm-configuration combinations for each new dataset, accelerating optimization convergence. The pipeline produces deployment-ready model artifacts

alongside automatically generated documentation of the development process and achieved performance metrics. The system democratizes high-quality ML model development for domain experts without deep machine learning engineering backgrounds.

03 Knowledge Group
Human-Computer Interaction

Adab Dost : an AI-driven Urdu Literature Library and Learning Platform

Group Members: Fatima Nisar | Sadia Masood

Advisor: Farzana Jabeen Co-Advisor: Bilal Ali

Adab Dost is an AI-driven Urdu literature library and learning platform designed to preserve and promote Pakistan's literary heritage through intelligent digital engagement. The platform provides a curated digital repository of Urdu prose, poetry, and classical texts alongside AI-powered search, annotation, and contextual explanation features. NLP models trained on Urdu literary corpora enable semantic search, thematic discovery, and personalized content recommendations tailored to each user's literary interests. Interactive learning modules support language learners in developing Urdu reading comprehension and literary appreciation skills. Adab Dost bridges the gap between classical Urdu literature and contemporary digital audiences through culturally grounded AI.

Memora: A Voice-Driven Productivity Assistant for Individuals with ADHD

Group Members: Aamna Khan | Ali Abbas

Advisor: Farzana Jabeen Co-Advisor: Tahira Anwar Lashari

Memora is a voice-driven productivity assistant designed to support individuals with cognitive and motor disabilities in managing daily tasks, schedules, and information retrieval. Natural language understanding models process spoken commands to create reminders, capture notes, and retrieve previously stored information without requiring fine motor interaction with a device. The system maintains a personalized memory layer that retains user context across sessions, enabling proactive reminders and contextually relevant information surfacing. Accessibility-first design principles ensure compatibility with assistive technologies and diverse speech patterns. Memora targets improved independence and quality of life for users with memory impairments, ADHD, or physical disabilities affecting device interaction.

USTAAD: AI powered Path to Freelance

Group Members: Muhammad Talha | Raahima Aamir

Advisor: Farzana Jabeen Co-Advisor: Sadiq Amin

USTAAD is an AI-powered platform designed to guide aspiring freelancers from initial skill assessment through to securing their first paid client engagement. The system evaluates users' existing skills and market demand signals to recommend the most viable freelancing specializations for their profile. Personalized, step-by-step action plans are generated covering portfolio development, platform selection, proposal writing, and client communication strategies. AI mentoring sessions provide real-time feedback on deliverables and pitch materials to accelerate professional readiness. USTAAD addresses the lack of structured pathways for new freelancers by combining career intelligence with practical, actionable onboarding guidance.

EchoLoop: A Proactive Voice AI Solution for Customer Churn Analysis and Retention

Group Members: Ibrahim Iqbal Khuram

Advisor: Muhammad Imran Malik Co-Advisor: Maajid Maqbool

EchoLoop is a proactive voice AI solution that monitors customer interactions to detect early signals of customer churn and trigger targeted retention interventions. Conversational AI agents conduct proactive outreach calls to at-risk customers, delivering personalized retention offers and resolving service issues identified through sentiment and behavioral analysis. NLP models analyze call transcripts, support ticket history, and usage patterns to build dynamic customer health scores that predict churn likelihood with high

accuracy. Automated escalation workflows route high-risk customers to human agents when complex retention conversations are required. EchoLoop reduces customer acquisition costs by improving retention rates through timely, data-driven proactive engagement.

CogniLink

Group Members: Hassan Mansoor | Muhammad Mashhood

Advisor: Momina Moetesum Co-Advisor: Faisal Shafait

CogniLink is an AI-powered cognitive assistance platform designed to support individuals with cognitive impairments in managing daily activities and social interactions. Multimodal AI models process voice, text, and contextual sensor data to provide real-time guidance, reminders, and simplified task breakdowns tailored to each user's cognitive profile. Adaptive interfaces adjust complexity and interaction style based on the user's current cognitive state, reducing cognitive load during demanding tasks. Caregiver dashboards provide oversight of user activity patterns, flagging concerning behavioral changes for professional follow-up. CogniLink aims to enhance autonomy, safety, and quality of life for individuals living with cognitive disabilities through intelligent, continuous assistive support.

04 Knowledge Group
Information Assurance and Security

Web Application Firewall: A Hybrid Approach Using Signatures and Machine Learning

Group Members: Ali Abdullah | Rehan Haider | Syed Fahad Shah

Advisor: Mehdi Hussain Co-Advisor: Sana Qadir

This project develops a hybrid Web Application Firewall (WAF) combining signature-based detection with machine learning models to provide robust protection against modern web threats. Signature rules identify known attack patterns such as SQL injection and cross-site scripting, while the ML layer detects novel, zero-day threats through behavioral anomaly analysis. The dual-layer architecture enables high detection accuracy across both known and previously unseen attack vectors with reduced false positive rates. The system is designed for deployment as a lightweight, configurable security layer compatible with existing web infrastructure. The project contributes a scalable, adaptive WAF solution addressing the limitations of purely rule-based cybersecurity approaches.

AI Based Anti Virus and Malware Detection and Prevention System

Group Members: Haider Musavi | Rashid Yaseen

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project develops an AI-based antivirus and malware detection system that identifies malicious software through behavioral analysis and static code feature extraction. Machine learning classifiers are trained on large datasets of benign and malicious software samples to distinguish known and novel malware variants with high accuracy. Behavioral monitoring during runtime detects suspicious process activities including unauthorized file modifications, network communications, and privilege escalations indicative of malware execution. The system provides real-time alerts and automated quarantine responses upon threat detection, minimizing damage from successful infections. The solution addresses the limitations of signature-only antivirus approaches against rapidly evolving, polymorphic malware threats.

Private Blockchain System for Multiple Domains

Group Members: Ibn E Abbas | Muhammad Saad Ibrahim | Shaheer Kashif

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project designs a private blockchain system supporting secure, trust-minimized data sharing and transaction management across multiple independent organizational domains. Smart contracts automate cross-domain business processes while enforcing domain-specific access control and privacy policies without requiring centralized coordination. Consensus mechanisms are selected and configured to balance security, throughput, and finality requirements across participating domains with heterogeneous trust levels. The system provides immutable audit logs and tamper-evident records for all cross-domain interactions, supporting regulatory compliance and accountability. Applications include supply chain management, inter-institutional academic records, and multi-party healthcare data exchange.

Design of Artificial Intelligence Based Web Application Firewall

Group Members: Mirza Muhammad Abdul Ahad | Muhammad Muzammil

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project designs an AI-based Web Application Firewall that uses machine learning to detect and block malicious HTTP traffic targeting web applications. The system analyzes incoming request patterns, headers, payloads, and session behavior to distinguish legitimate from malicious traffic with high precision. Models are trained on diverse attack datasets including OWASP Top 10 vulnerability classes to provide comprehensive

threat coverage across common web attack vectors. Adaptive retraining mechanisms allow the firewall to update its detection models in response to emerging attack patterns without manual rule updates. The result is a proactive, self-updating security layer that reduces exposure to web-based attacks for organizations of all sizes.

Development of a DDoS Network Traffic Dataset for Deep Learning-Based Prediction and Prevention of Attacks

Group Members: Bissal Javaid | Hammad Ali

Advisor: Hasan Tahir Co-Advisor: Muhammad Zeeshan

This project develops a comprehensive, labeled DDoS network traffic dataset designed specifically for training and benchmarking deep learning-based intrusion detection systems. Traffic capture methodologies generate diverse DDoS attack scenarios including volumetric, protocol, and application-layer attacks at realistic network scales. Data preprocessing pipelines extract statistical, temporal, and packet-level features from raw network captures to produce structured, ML-ready datasets. Baseline deep learning detection models are trained and evaluated on the dataset to validate its utility for DDoS detection research. The public release of the dataset addresses the scarcity of high-quality, up-to-date DDoS traffic data available to the security research community.

AI-powered Hybrid Intrusion Detection and Prevention System (IDPS)

Group Members: Khawaja Hamza Siddiqui

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project develops an AI-powered hybrid Intrusion Detection and Prevention System (IDPS) combining signature-based rules with machine learning anomaly detection for comprehensive network security. The signature layer identifies known attack patterns with high precision, while the ML component detects novel, previously unseen threats through statistical behavioral profiling of network traffic. Automated prevention responses including traffic blocking, rate limiting, and alert escalation are triggered upon confirmed threat detection. The system is designed for real-time deployment in enterprise network environments, processing high-throughput traffic with minimal latency impact on legitimate communications. The hybrid architecture achieves higher overall detection coverage than either approach individually.

05 Knowledge Group
Information Management

AI-Based Resume Screening System for Job Portals

Group Members: Muhammad Bashar Siddiqui

Advisor: Shah Khalid Co-Advisor: Bilal Ali

This project develops an AI-powered resume screening system that automates the matching of candidate CVs to job descriptions for deployment on job portals. Natural language processing and machine learning models parse, analyze, and rank resumes based on relevance to specified role requirements. The system reduces manual recruiter effort and improves the consistency and speed of candidate shortlisting at scale. A web-based interface provides recruiters with ranked candidate lists alongside AI-generated match scores and justifications. The platform aims to enhance hiring efficiency and reduce unconscious bias in the initial screening stage of recruitment.

Parhlai

Group Members: Asghar Ali | Zalaid Saleem

Advisor: Maajid Maqbool Co-Advisor: Mehwish Kiran

Parhlai is an AI-driven entry test preparation platform democratizing access to quality education for students across Pakistan through adaptive, personalized learning. A modular multi-agent deep learning pipeline automatically generates unlimited, syllabus-aligned MCQs with personalized explanations calibrated to each student's learning level using advanced OCR and LLMs. Adaptive learning paths and dynamic difficulty adjustment enable students to improve systematically, while intelligent feedback identifies and targets specific knowledge gaps. The platform addresses affordability barriers by delivering high-quality test preparation at a fraction of the cost of traditional coaching centers. Parhlai makes equitable, effective test preparation accessible to students regardless of geographic location or economic background.

ElevateAI

Group Members: Abdul Moiz | Faakhir Ul Hassan Zahid | Syed Muhammad Abbas Askari

Advisor: Maajid Maqbool Co-Advisor: Hirra Anwar

ElevateAI is an AI-powered platform helping businesses identify, score, and convert high-potential users into paying customers through intelligent lead analysis. Vector search and retrieval-augmented generation (RAG) analyze product information and website data to surface the most relevant leads from large user bases sourced primarily from platforms such as LinkedIn. Automated cold outreach tools, product-user fit scoring, vertical discovery, and competitor analysis features collectively optimize the customer acquisition pipeline. Lead scoring models rank prospects by conversion likelihood, enabling sales teams to prioritize high-value opportunities and reduce wasted outreach effort. ElevateAI provides a comprehensive, data-driven solution for scaling B2B and B2C customer acquisition strategies.

06 Knowledge Group
Intelligent Systems

Modeling Glacier Retreat and Water Security in Pakistan Through Remote Sensing Technologies

Group Members: Abubakar Imran | Ali Haider | Muhammad Sarmad Saleem

Advisor: Zuhair Zafar Co-Advisor: Muhammad Moazam Fraz

Pakistan hosts over 7,000 glaciers — the highest concentration outside polar regions — which are retreating at an accelerating rate due to rising temperatures and shifting precipitation patterns. This project applies remote sensing technologies combined with glacier-related variables such as temperature trends, snow cover, and ice mass balance to monitor and model this retreat. Satellite imagery is analyzed alongside historical climate data to develop predictive models simulating future glacier behavior under varying climate scenarios. The models target key threats including glacial lake outburst floods, seasonal water shortages, and disruptions to agriculture and hydroelectric power generation. The outcome is a data-driven forecasting tool to support Pakistan's water security planning and disaster risk management.

XMedFusion: Agentic and Expert-Driven AI for Cross-Modal Medical Report Generation

Group Members: Arham Haroon | Hamza Riaz | Maha Baig

Advisor: Muhammad Moazam Fraz Co-Advisor: Muhammad Naseer Bajwa

XMedFusion proposes an AI-driven framework for automated medical report generation that integrates multimodal imaging data from chest X-rays, brain MRIs, and CT scans using a Mixture of Experts (MoE) architecture. Specialized expert models process each imaging modality, coordinated by a dynamic gating mechanism to ensure contextually accurate and clinically relevant diagnostic outputs. Explainable AI techniques provide transparent justifications for all diagnostic decisions, enhancing trust and clinical utility. An Agentic AI framework enables proactive collaboration with medical professionals through human-in-the-loop feedback for continuous system improvement. Federated learning is implemented to allow decentralized training on sensitive patient data without compromising privacy.

Analysing UAV-Based Multispectral Data for Genotypic-Aware Crop Performance Assessment

Group Members: Abdullah Imran | Muhammad Hissan Umar | Muhammad Tayyab Iftikhar

Advisor: Zuhair Zafar Co-Advisor: Muhammad Moazam Fraz

This project analyzes UAV-captured multispectral imagery to enable genotypic-aware crop phenotyping, supporting precision agricultural decision-making. Machine learning models process vegetation indices derived from multispectral bands to extract quantitative crop traits including canopy cover, biomass, and stress indicators. The system correlates aerial phenotypic measurements with genotypic data to assist breeders in selecting high-performing and climate-resilient crop varieties. Automated trait extraction pipelines replace labor-intensive manual field measurement methods, enabling large-scale deployment across diverse crop environments. The outcome is an intelligent, scalable phenotyping platform that accelerates modern crop breeding and field management.

AI-Based Automatic Frequency Offset Selection for bSSFP CINE MRI at 3.0 Tesla

Group Members: Abdul Rehman | Abdul Rehman | Muhammad Moiz

Advisor: Momina Moetesum Co-Advisor: Faisal Shafait

Balanced Steady-State Free Precession (bSSFP) CINE MRI is highly sensitive to off-resonance effects that cause banding artifacts, degrading image quality for cardiac diagnostics. This project develops an AI model

that automatically selects the optimal frequency offset for bSSFP acquisitions, replacing the current manual and time-consuming tuning process. Deep learning techniques analyze MRI scan characteristics to predict the frequency offset that minimizes banding artifacts for each individual patient. Automated selection reduces scan time, operator dependency, and variability in image quality across different scanning environments. The system aims to improve the clinical reliability and reproducibility of cardiac MRI diagnostics.

HireMind: AI Interview Simulator and Evaluator

Group Members: Abdul Rehman Memon | Avinash Kumar | Syed Abdullah Kashif Mashhadi

Advisor: Seemab Latif Co-Advisor: Maajid Maqbool

HireMind is an AI-powered interview simulation and evaluation platform designed to help job candidates prepare for technical and behavioral interviews. The system generates role-specific interview questions and conducts interactive mock interview sessions through a conversational AI interface. Candidate responses are evaluated in real time using NLP-based scoring models that assess content quality, communication clarity, and relevance. Personalized feedback and improvement recommendations are provided after each session to guide targeted preparation. The platform democratizes access to high-quality interview coaching, reducing reliance on expensive human coaching services.

Deep Learning-Based User Interface Adaptation via Cognitive and Contextual Sensing

Group Members: Eashah Emaan | Shanza Ali | Taha Ahmed Rasheed

Advisor: Hashir Moheed Kiani Co-Advisor: Muhammad Imran Malik

This project develops a deep learning system that dynamically adapts user interfaces based on real-time analysis of users' cognitive load and contextual behavioral signals. Sensor and interaction data streams are processed by neural network models to infer user cognitive states including attention, fatigue, and task difficulty. The UI adaptation engine responds by adjusting layout complexity, information density, and interaction modalities to optimize usability under detected cognitive conditions. The system targets accessibility improvements for users with varying cognitive abilities and dynamic use contexts. The outcome is an adaptive interface framework demonstrating measurable improvements in user performance and satisfaction.

Multilingual Personalized Vocational Training Using Recommendation Intelligence for Youth Empowerment

Group Members: Isra Mansoor | Muhammad Abdullah

Advisor: Junaid Younas Co-Advisor: Muhammad Moazam Fraz

This project builds a multilingual personalized vocational training platform using recommendation system techniques to deliver contextually relevant educational content. The system supports Urdu and other regional languages, using NLP models trained on low-resource language datasets to provide accessible training for underserved learners. Personalization algorithms adapt content difficulty, pacing, and topic sequencing based on each learner's progress and knowledge profile. German vocational training content is translated and integrated into the corpus to enrich the platform's domain coverage. The platform aims to bridge skills gaps in Pakistan's workforce through scalable, AI-enhanced, multilingual vocational education delivery.

Text-to-Document: A Generative Framework for Privacy-Preserving Document Image Synthesis

Group Members: Ahmad Sarmad Ali | Malik Muhammad Aman | Muhammad Ahad Hassan Khan

Advisor: Momina Moetesum Co-Advisor: Faisal Shafait

This project develops a generative AI framework that produces realistic synthetic documents from natural language text descriptions while preserving privacy of sensitive source data. Large language models are fine-tuned to generate structured documents such as medical reports, legal forms, and financial statements with authentic formatting and content. Privacy-preserving techniques ensure that generated documents do not leak or reconstruct personally identifiable information from training data. The synthetic documents support downstream AI model training and testing in data-scarce domains where real data is restricted by privacy

regulations. The framework provides a scalable solution for generating high-quality labeled training data for document understanding systems.

Agentic AI for Dynamic Public Space Threat Prediction

Group Members: Muhammad Ismaeel Zeb | Muhammad Wahaj Masroor Khan | Syed Muhammad Abbas

Advisor: Ayesha Kanwal Co-Advisor: Farzana Jabeen

This project develops an agentic AI system for dynamic threat prediction and proactive security monitoring in public spaces. Multiple AI agents collaborate to ingest and correlate data streams from surveillance feeds, social media, and environmental sensors to assess evolving threat levels in real time. Predictive models anticipate potential security incidents before they materialize, enabling preemptive resource deployment and alert generation. The system's agentic architecture allows autonomous decision-making and task delegation across specialized monitoring agents without constant human oversight. The platform targets smart city security applications requiring continuous, adaptive, and scalable threat assessment.

MedLingo – Medical LLM with Mixture of Experts

Group Members: Ahmad Jan | Muhammad Samiullah | Sarmad Sultan

Advisor: Muhammad Moazam Fraz Co-Advisor: Muhammad Naseer Bajwa

MedLingo is a specialized medical large language model built using a Mixture of Experts (MoE) architecture to deliver accurate, domain-specific clinical responses across diverse medical specialties. Each expert module is trained on specialty-specific medical literature and patient case data, with intelligent routing directing queries to the most relevant expert for each clinical question. The system integrates retrieval-augmented generation to ground responses in current, authoritative medical knowledge sources including clinical guidelines and published research. Explainability mechanisms provide transparent reasoning pathways alongside clinical recommendations, supporting physician trust and responsible AI-assisted decision-making. MedLingo targets deployment as a clinical decision support tool in resource-limited healthcare settings.

Inverse EEG-Based 3D Brain Mapping for Early Neurological Disease Detection

Group Members: Hira Sardar | Muhammad Zikrullah Rehman | Shahliza Ahmed

Advisor: Faisal Shafait Co-Advisor: Junaid Younas,Adnan Ul-Hasan

This project develops a deep learning pipeline for inverse EEG source localization, enabling 3D brain activity mapping for early detection of neurological disorders such as epilepsy and Alzheimer's disease. Neural network models solve the ill-posed inverse problem of mapping scalp electrode signals back to underlying brain source distributions with high spatial accuracy. The system processes multi-channel EEG recordings to generate real-time 3D brain activation maps without requiring expensive MRI infrastructure. Interpretability tools allow clinicians to visualize and interact with the reconstructed brain activity for diagnostic assessment. The platform offers an affordable, portable neurological diagnostic aid for clinical and research applications.

LiteDoc: Distilling Large Document Models into Efficient Task-Specific Encoders

Group Members: Hamza Mahmood | Syed Muhammad Taha Imam | Tayyab Raza

Advisor: Momina Moetesum Co-Advisor: Faisal Shafait

LiteDoc applies knowledge distillation techniques to compress large, general-purpose document understanding models into compact, task-specific models suitable for resource-constrained deployment. The distillation framework transfers structured knowledge from a high-capacity teacher model to a lightweight student model while preserving task performance on targeted document analysis tasks. Inference speed, memory footprint, and computational cost are substantially reduced, enabling practical deployment on edge devices and low-resource servers. The system is validated on document tasks including information extraction, classification, and question answering across multiple document types. LiteDoc bridges the gap between state-of-the-art large model performance and the practical constraints of real-world deployment environments.

Self Evolving Multi Agent Society

Group Members: Maheen Ahmed | Syed Muhammad Taha | Zain Ali

Advisor: Muhammad Moazam Fraz Co-Advisor: Faisal Shafait

This project develops a self-evolving multi-agent AI society in which autonomous agents interact, collaborate, and adapt their behaviors over time through emergent social learning. Agents are equipped with independent goal structures, communication protocols, and memory systems enabling dynamic role formation and cooperative task execution. Reinforcement learning and evolutionary algorithms drive agent adaptation, allowing the society to develop increasingly sophisticated collective problem-solving strategies without explicit programming. The system models complex social phenomena such as specialization, knowledge sharing, and norm emergence in artificial agent populations. Applications include automated research assistance, collaborative simulation, and the study of emergent intelligence in complex multi-agent environments.

EduAgent: A Self-Optimizing Reward System for Student Engagement using LLMs

Group Members: Abdul Moiz | Laiqa Ali | Syeda Ayesha Wajahat

Advisor: Nazia Perwaiz Co-Advisor: Ayesha Kanwal,Sidra Sultana

EduAgent is a self-optimizing AI platform that personalizes student engagement and learning outcomes through an adaptive reward and feedback system. Reinforcement learning agents continuously monitor student interaction patterns, performance metrics, and engagement signals to dynamically adjust content delivery and incentive structures. The system models each student's motivational profile and learning preferences to recommend the most effective engagement strategies in real time. Automated analytics provide educators with actionable insights into class-level and individual student engagement trends. EduAgent targets improved learning retention and student motivation by making the educational experience responsive to each learner's evolving needs.

Transforming Clinical Decision-Making: Predicting Antimicrobial Resistance from MALDI-TOF Data

Group Members: Afra | Hasaan Hamid | Suman Kumari

Advisor: Muhammad Moazam Fraz Co-Advisor: Muhammad Naseer Bajwa

Antimicrobial resistance (AMR) poses a critical global health threat, making accurate prediction of resistance patterns essential for effective clinical treatment decisions. This project develops a machine learning system that predicts antimicrobial resistance profiles from patient and pathogen data to support evidence-based prescribing. Genomic, clinical, and epidemiological features are integrated into predictive models that identify resistance likelihood across multiple drug-pathogen combinations. The system provides actionable treatment recommendations ranked by predicted efficacy, reducing reliance on broad-spectrum antibiotics and improving patient outcomes. The platform supports real-time clinical decision-making while contributing to antimicrobial stewardship and resistance surveillance efforts.

PANDA – Pain Assessment in Neonates using Deep learning and Analytics

Group Members: Hira Sajid | Muhammad Umer Ali

Advisor: Muhammad Imran Malik Co-Advisor: Maajid Maqbool,Muhammad Khuram Shahzad

PANDA is a deep learning system for automated, objective assessment of pain in neonates using facial action unit analysis and behavioral signal processing. Neonates cannot self-report pain, making reliable automated detection from non-verbal cues critical for safe clinical care in neonatal intensive care units. Computer vision models analyze video streams of neonatal facial expressions, extracting pain-relevant action units to produce continuous pain intensity scores. The system reduces dependence on subjective, inconsistent manual pain assessments by nursing staff under high-workload conditions. PANDA aims to improve pain management accuracy and timeliness for vulnerable neonatal patients through clinically validated AI-assisted monitoring.

AIcruit : Smart Interview Automation System

Group Members: Ahmad Tariq | Mansoor Abid | Sarmad Majeed Abbasi

Advisor: Ayesha Kanwal Co-Advisor: Iram Tariq Bhatti

AIcruit is a smart interview automation system that uses AI to streamline end-to-end recruitment workflows from job posting through candidate evaluation. Automated resume screening shortlists candidates based on

role-specific criteria using NLP and semantic matching models. AI-driven interview sessions are conducted through a conversational interface, with responses evaluated for technical competency, communication quality, and cultural fit using multi-dimensional scoring rubrics. Hiring managers receive structured evaluation reports with ranked candidate comparisons, accelerating informed selection decisions. AIcruit reduces recruiter workload, minimizes hiring cycle time, and improves consistency across large-volume candidate evaluation processes.

Federated Learning-Based AI Mental Health Chatbot

Group Members: Qurrat Ul Ain Zafar | Rabbiya Riaz

Advisor: Hirra Anwar Co-Advisor: Ayesha Kanwal

This project develops a federated learning-based AI mental health chatbot that delivers personalized conversational support while preserving user privacy through decentralized model training. Local models are trained on individual user devices using their interaction data, with only encrypted model updates aggregated on a central server — raw personal data never leaves the device. NLP models provide empathetic, context-aware responses tailored to the user's expressed mental health needs and conversational history. The chatbot integrates clinical guidelines for anxiety, depression, and stress management to ensure response quality and safety. The federated architecture makes AI-powered mental health support scalable and privacy-preserving across diverse user populations.

Fortis Aegis: An Intelligent, Autonomous AI Platform for Multi-Asset Wealth Management

Group Members: Abdul Moeez Asad | Muhammad Waleed Tariq Awan | Wadood Ur Rehman Ranjha

Advisor: Hashir Moheed Kiani Co-Advisor: Muhammad Daud Abdullah Asif

Fortis Aegis is an intelligent, autonomous AI platform for multi-asset portfolio management, risk monitoring, and automated trading strategy execution. Reinforcement learning agents optimize asset allocation decisions across equities, bonds, and alternative assets based on real-time market signals, macroeconomic indicators, and risk tolerance parameters. Predictive models assess portfolio risk exposure, detect regime changes, and trigger automated rebalancing to protect against downside scenarios. A natural language interface allows non-technical users to interact with the system, set investment objectives, and review AI-generated portfolio performance reports. Fortis Aegis targets wealth management applications requiring continuous, intelligent market monitoring without constant human intervention.

Signify: An intelligent interface for real-time Sign Language recognition

Group Members: Ashbal Atif | Hussein Ahmad

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Shah Khalid

Signify is an intelligent real-time sign language recognition interface enabling seamless communication between sign language users and those unfamiliar with sign languages. Computer vision models process live video input to recognize hand gestures and body language, translating them into text and synthesized speech in real time. The system supports recognition of both individual signs and continuous sign language sequences to enable fluid conversation translation. A responsive interface provides immediate feedback to signers, confirming accurate recognition and flagging ambiguous gestures for clarification. Signify targets accessibility improvements in education, public services, and professional environments where sign language users face communication barriers.

FreeMind: A Web-Based Art Tool for Accessible Creative Expression

Group Members: Muzaynah Farrukh

Advisor: Bilal Ali Co-Advisor: Shah Khalid,Syed Imran Ali

FreeMind is a web-based digital art tool designed to provide accessible creative expression for users with physical and cognitive disabilities. Adaptive input methods including eye tracking, voice commands, and simplified gesture recognition allow users with limited motor control to create digital artwork intuitively. AI assistance features offer creative suggestions, automated color harmonization, and style transfer to support users with limited artistic background in producing meaningful creative outputs. The interface is optimized for

accessibility compliance, supporting screen readers and customizable UI scaling for users with visual impairments. FreeMind democratizes digital artistic expression by removing physical and technical barriers to creative participation.

AceVision - Sports Analysis Tool (II)

Group Members: Ahmed Mohiuddin Shah | Aqsa Batool | Muhammad Hamza

Advisor: Jaudat Mamoon Co-Advisor: Muhammad Moazam Fraz

AceVision is an AI-powered sports performance analysis tool that processes video footage to extract tactical and biomechanical insights for coaches and athletes. Computer vision models detect and track players, equipment, and game events across multi-camera or single-camera match recordings with frame-level precision. Automated performance metrics including movement patterns, positioning heatmaps, and event statistics are generated and presented through an interactive analysis dashboard. Deep learning models trained on sport-specific datasets provide specialized insights such as shot analysis, formation detection, and physical load estimation. AceVision enables data-driven coaching decisions and personalized athlete development planning without requiring expensive proprietary sports analytics infrastructure.

07 Knowledge Group
Parallel and Distributed Computing

Presence+ – An Enhanced Bluetooth-Based Attendance System with Odoo Integration

Group Members: Muhammad Fahad | Muhammad Mahad

Advisor: Muhammad Khuram Shahzad Co-Advisor: Bilal Ali,Sana Qadir,Syed Imran Ali

Presence+ is an enhanced Bluetooth-based attendance system that incorporates odometry and multi-signal fusion to overcome proximity spoofing vulnerabilities in conventional Bluetooth attendance solutions. The system uses device motion sensors alongside Bluetooth signal strength to verify that a user is physically present and moving naturally within the designated space. An anomaly detection layer identifies and flags suspicious attendance patterns consistent with proxy attendance or device sharing. The backend provides real-time attendance records with visualizations for administrators and instructors. The system delivers a more reliable, tamper-resistant automated attendance solution for academic and corporate environments.

08 Knowledge Group

Platform-based Development

FitSmart: Personalized Fitness & Diet Planner

Group Members: Ahsan Mohsin | Muhammad Salman | Syed Sarib Sultan

Advisor: Ayesha Kanwal Co-Advisor: Naema Asif

FitSmart is a cross-platform mobile application that enables users to log fitness activities, track dietary intake, and receive AI-generated personalized fitness and diet plans. Machine learning models analyze user profiles, behavioral patterns, and historical activity data to deliver recommendations tailored to individual goals and lifestyle. The system identifies similarities between users to suggest routines and dietary plans that have proven effective for comparable profiles. Goal-setting features and progress tracking dashboards motivate sustained engagement and adherence to personalized health plans. FitSmart aims to make evidence-based fitness guidance accessible and personalized for a broad range of users.

09 Knowledge Group
Software Engineering

Penny – Keeps Every Cent Accounted (Finance)

Group Members: Abdullah Asim | Hakim Mahfooz | Haziq Ali Naqvi

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Shah Khalid

Penny is a personal finance management application designed to help users track income, expenses, and savings goals with minimal manual effort. Automated transaction categorization using machine learning simplifies expense tracking by classifying financial activity from linked accounts. AI-driven insights and spending pattern analysis provide users with actionable recommendations for improving their financial health and reaching savings targets. Budgeting tools allow users to set spending limits per category, with real-time alerts when thresholds are approached or exceeded. The application makes disciplined personal financial management accessible and engaging for everyday users.

A Super App Connecting Homeowners with Trusted Service Providers

Group Members: Husnain Asim | Muhammad Ali | Saim Mahmood

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Maajid Maqbool

This project develops a super app platform connecting homeowners with verified, trusted service providers for home maintenance, repair, and improvement tasks. An AI-powered matching engine recommends the most suitable service providers based on job requirements, provider ratings, availability, and location. Integrated scheduling, real-time communication, and secure payment processing provide a seamless end-to-end experience for both homeowners and service professionals. Automated review aggregation and trust-scoring mechanisms help users make informed provider selection decisions. The platform addresses the fragmented and informal home services market by centralizing and digitizing the service discovery and booking process.

Sehatyab – Location-Based Medical Assistance App

Group Members: Abdullah Naeem | Sarmad Shabir | Syed Muhammad Afaq

Advisor: Sadiq Amin Co-Advisor: Abdullah Mughees,Mohsin Kamal

Sehatyab is a location-based mobile medical assistance application connecting patients with nearby healthcare facilities, specialist doctors, and emergency services in real time. AI-driven triage guidance helps users assess their symptoms and identify the most appropriate level of care required before visiting a facility. The platform integrates live availability data for clinics and hospitals, enabling users to find and book appointments based on proximity and waiting time estimates. A multilingual interface ensures accessibility for users across Pakistan's diverse linguistic regions. Sehatyab aims to reduce delays in accessing appropriate healthcare by bridging the information gap between patients and available medical resources.

Shah Alami market digital platform

Group Members: Aadel Asad | Moeed Furqan

Advisor: Maajid Maqbool Co-Advisor: Hirra Anwar

This project develops a comprehensive digital platform for the Shah Alami traditional market, digitizing vendor discovery, product browsing, and order management for Pakistan's historic textile and goods market. An AI-powered search and recommendation engine helps customers navigate the extensive vendor network based on product type, price range, and location within the market complex. Vendor management tools enable sellers to list inventory, manage orders, and track sales performance through a simple mobile interface. Integrated logistics coordination and payment processing support end-to-end digital transactions between vendors and remote buyers. The platform bridges traditional commerce with digital market access, expanding vendor reach beyond physical foot traffic.

10 Knowledge Group
Algorithms and Complexity

InnBotics

Group Members: Asna Maqsood | Idrees Khan Dawar | Muhammad Owais Khan

Advisor: Sadiq Amin Co-Advisor: Muhammad Saqib Iqbal

InnBotics is an AI-driven accommodation management platform that automates hotel and hospitality operations while personalizing guest experiences through intelligent service recommendations. Automated operations modules handle booking management, housekeeping scheduling, inventory tracking, and staff task allocation, reducing manual administrative workload across property management functions. Guest preference learning models analyze behavioral data from previous stays to deliver proactive, personalized service recommendations and room configuration adjustments throughout each visit. Real-time operational dashboards provide managers with live occupancy, revenue, and service quality metrics to support dynamic pricing and resource allocation decisions. InnBotics targets improved operational efficiency and guest satisfaction for hospitality businesses through seamless AI-powered property management.

AI-Tutor for University Entry Test Preparation

Group Members: Abdullah Usama | Hafiz Muhammad Anas | Muhammad Musfir Baig

Advisor: Sohail Iqbal Co-Advisor: Muhammad Moazam Fraz

This AI-Tutor platform provides personalized, adaptive preparation for university entry tests through an intelligent tutoring system that identifies and targets each student's specific knowledge gaps. Diagnostic assessments map student competency profiles across all tested subject domains, generating individualized study plans prioritizing high-impact improvement areas. An AI tutor delivers targeted practice questions, detailed explanations, and conceptual clarifications adapted to the student's demonstrated understanding level in real time. Progress tracking and predictive performance modeling inform students and tutors of expected test readiness and recommended focus areas as the exam date approaches. The platform makes high-quality, personalized university entry test preparation accessible to students regardless of their access to traditional tutoring resources.

11 Knowledge Group
Computational Science

Federated Data Lakes and Intelligent Healthcare Management for Pakistan

Group Members: Ahmed Bilal | Muhammad Zaid | Muhammad Zohaib

Advisor: Junaid Younas Co-Advisor: Bilal Ali

This project develops a federated data lake architecture for intelligent healthcare management that enables privacy-preserving data integration and analytics across distributed hospital systems. Federated learning protocols allow AI models to be trained on patient data distributed across multiple healthcare facilities without centralizing sensitive records, preserving patient privacy and regulatory compliance. Unified data schemas and interoperability standards enable seamless cross-institutional analytics for population health monitoring, disease surveillance, and treatment outcome research. The system incorporates role-based access control and audit logging to ensure data governance integrity across all participating institutions. The platform provides healthcare networks with actionable intelligence from their collective data while maintaining strict privacy and security boundaries.

12 Knowledge Group
Graphics and Visualization

A Hybrid AI Framework for Dynamic Behavioral Adaptation

Group Members: Abdullah Hussain | Effan Shakeel | Muniba Noor

Advisor: Momina Moetesum Co-Advisor: Shahzad Rasool

This project develops a hybrid AI framework combining rule-based reasoning with deep learning for dynamic behavioral adaptation of intelligent agents in complex, evolving environments. Symbolic rule systems handle structured, well-defined decision scenarios while neural network components manage ambiguous, high-dimensional perceptual inputs requiring flexible pattern recognition. A meta-learning layer continuously updates behavioral policies based on environmental feedback, enabling agents to adapt to distribution shifts and novel situations without full retraining. The hybrid architecture balances the interpretability of rule-based systems with the adaptability of neural approaches, addressing the limitations of either method applied alone. Applications include adaptive game AI, autonomous robotics, and intelligent tutoring systems requiring context-sensitive behavioral flexibility.

13 Knowledge Group
Information Assurance and Security

CyberShield: Cybersecurity Awareness & Incident Reporting Portal

Group Members: Aimen Munawar | Hadia Ali | Maheen Akhtar Khan

Advisor: Ayesha Kanwal Co-Advisor: Sana Qadir

CyberShield is a cybersecurity awareness and incident reporting portal designed to strengthen organizational and public cyber resilience through education and streamlined threat reporting. Interactive awareness modules deliver role-tailored cybersecurity training covering phishing, social engineering, password hygiene, and safe digital practices. An integrated incident reporting workflow enables users to submit and track cybersecurity incidents through a structured, guided interface that captures essential forensic details for rapid response. AI-assisted triage categorizes incoming incident reports by severity and type, prioritizing response actions for security operations teams. CyberShield builds a culture of proactive cyber awareness while providing organizations with a practical tool for coordinated incident management.

EmergeOS: Autonomy-as-a-Service

Group Members: Azan Hyder | Muhammad Farzan Saqib | Muhammad Sulleman

Advisor: Syed Taha Ali Co-Advisor: Wajahat Hussain

EmergeOS is an Autonomy-as-a-Service platform that provides organizations with on-demand access to autonomous AI agent capabilities for complex, multi-step operational tasks. The platform abstracts AI agent orchestration infrastructure, enabling businesses to deploy task-specific autonomous workflows without requiring in-house AI engineering expertise. Modular agent components are dynamically composed and deployed to address diverse enterprise automation requirements spanning data processing, decision support, and external system integration. A robust security framework governs agent permissions, audit logging, and compliance controls to ensure safe and accountable autonomous operation. EmergeOS democratizes access to advanced AI autonomy capabilities for organizations across all sizes and technical maturity levels.

Artificial Intelligence based End Point Detection and Response system

Group Members: Abdul Rehman Shahid | Ahmed Umar

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project develops an AI-based Endpoint Detection and Response (EDR) system that monitors, detects, and responds to security threats across organizational endpoints in real time. Machine learning models analyze process behavior, file system activity, network connections, and registry changes to identify indicators of compromise across diverse endpoint environments. Automated response actions including process termination, network isolation, and forensic artifact collection are triggered upon confirmed threat detection to minimize dwell time and damage. Threat intelligence integration enriches detection context, enabling correlation of endpoint events with known attack campaigns and threat actor tactics. The system provides organizations with comprehensive endpoint visibility and rapid automated response to advanced persistent threats.

AI Based Security Orchestration, Automation, and Response System

Group Members: Muhammad Taha Salaar | Muhammad Zain | Sameed Ilyas

Advisor: Muhammad Ashraf Co-Advisor: Tauseef ur Rehman

This project develops an AI-based Security Orchestration, Automation, and Response (SOAR) system that enhances security operations center efficiency through intelligent threat triage and automated incident response. Machine learning models correlate security alerts from diverse sources, reducing alert noise and accurately prioritizing genuine threats for analyst attention. Automated response playbooks execute remediation actions for common threat scenarios, dramatically reducing mean time to response for high-

frequency security incidents. NLP-driven case management tools assist analysts in documenting investigation findings and generating structured incident reports from unstructured investigation notes. The system scales SOC capabilities by automating repetitive response workflows, freeing analysts to focus on complex, high-priority security investigations.

14 Knowledge Group
Information Management

Design and Development of a Decentralized B2B2C Platform for Skilled Labor Connectivity

Group Members: Ali Haris Chishti | Muhammad Umar Khan

Advisor: Bilal Ali Co-Advisor: Shah Khalid,Syed Imran Ali

This project designs and develops a decentralized B2B2C platform connecting skilled professionals with businesses and end consumers through a blockchain-backed credential and service marketplace. Decentralized identity and skill verification using blockchain smart contracts ensures tamper-proof professional credential records that parties can trust without intermediary verification services. AI-powered matching algorithms connect clients with the most suitable professionals based on skill requirements, availability, and verified track records. Transparent smart contract-based payment escrows protect both service providers and clients throughout transaction lifecycles. The platform addresses fragmentation and trust deficits in the informal skills marketplace by combining decentralized trust with intelligent matching.

AI-Powered Profitability Estimation for Short-Term Rental Properties

Group Members: Abdul Munim Adil | Muhammad Ammar Shahzad

Advisor: Bilal Ali Co-Advisor: Shah Khalid,Syed Imran Ali

This project develops an AI-powered profitability estimation platform for short-term rental properties, providing hosts and investors with data-driven revenue forecasting and pricing optimization. Machine learning models trained on historical booking data, seasonal demand patterns, and competitive market listings predict occupancy rates and optimal nightly pricing for target properties across platforms like Airbnb. Location intelligence, amenity scoring, and market saturation analysis are integrated to assess property-level profitability potential for investment decision support. Automated monitoring tracks market condition changes and triggers pricing adjustment recommendations to maintain competitive positioning. The platform empowers short-term rental operators and prospective investors with actionable intelligence for maximizing rental property returns.

15 Knowledge Group
Intelligent Systems

TaxSimplify: Automated Budgeting & Tax Return Filing System

Group Members: Muhammad Junaid Akram

Advisor: Ayesha Kanwal Co-Advisor: Farzana Jabeen

TaxSimplify is a web-based financial management solution comprising two integrated modules: a Smart Budgeting Module and a Tax Return Assistance Module tailored for Pakistani users. The budgeting module enables users to track income and expenses, categorize transactions, and generate personalized budget plans based on their financial behavior. The tax module simplifies IRIS tax return filing by organizing financial data and guiding users through the preparation process with minimal manual effort. Together, the modules provide a comprehensive end-to-end financial management platform addressing both day-to-day budgeting and annual tax compliance needs. TaxSimplify aims to reduce the complexity and effort associated with personal financial management and tax filing in Pakistan.

HunarmandAI: Culturally-Aware Intelligent Tutoring for Low-Literacy Urdu Speakers

Group Members: Abu Bakar Khan | Muhammad Nabeel

Advisor: Junaid Younas Co-Advisor: Muhammad Moazam Fraz

HunarmandAI presents an Intelligent Tutoring System (ITS) delivering advanced Urdu-language reasoning and dialogue-based education specifically designed for low-literacy learners in Pakistan. The system supports real-time, interactive learning through multimodal communication combining Urdu text and speech for an accessible, inclusive educational experience. Low-resource Urdu datasets are curated covering vocational and academic domains, supplemented by translated German vocational training materials to enrich the learning content corpus. Specialized language models fine-tuned for Urdu fluency, comprehension, and cultural alignment power the personalized, adaptive tutoring interactions. Evaluation frameworks measuring response accuracy, fluency, and user experience ensure pedagogical effectiveness and sustained learning outcomes.

LiDAR-Based Plant Phenotyping for Precision Agriculture

Group Members: Abdul Wahab | Faareh Ahmed | Malik Shahzaib Khan

Advisor: Zuhair Zafar Co-Advisor: Muhammad Moazam Fraz

This project develops a LiDAR-based plant phenotyping system that captures high-resolution 3D structural data from crops at various growth stages to accelerate precision agricultural research. LiDAR point cloud data is processed using 3D deep learning models to automatically extract quantitative plant traits including height, volume, canopy architecture, and leaf area index. The non-destructive sensing approach eliminates the labor-intensive and error-prone manual measurements that characterize traditional phenotyping workflows. Trait extraction pipelines are validated against ground-truth measurements to ensure accuracy suitable for plant breeding and agronomic decision-making. The system enables scalable, high-throughput phenotyping for large field deployments supporting climate-resilient crop variety development.

Smart AgriAssist: AI-Powered Crop Disease Detection and Market Advisory System for Small Farmers in Pakistan

Group Members: Imama | Tehreem Ahmad

Advisor: Shah Khalid Co-Advisor: Muhammad Daud Abdullah Asif

Smart AgriAssist is an AI-powered mobile and web platform supporting small-scale Pakistani farmers with crop disease detection, market intelligence, and agronomic advisory services. Computer vision models analyze crop images captured via smartphone cameras to diagnose plant diseases and recommend targeted treatment and fertilizer interventions. Real-time market price data for regional crops is aggregated and displayed to help

farmers make informed selling and harvesting decisions. Weather integration provides irrigation planning guidance and crop protection alerts based on upcoming meteorological conditions. The platform empowers smallholder farmers with data-driven tools previously accessible only to large commercial agricultural operations.

Adaptive Web Interaction: Leveraging Reinforcement Learning for Comprehensive Action Support

Group Members: Awais Nazir | Muhammad Saad Ashraf | Muhammad Salman Siddiq

Advisor: Faisal Shafait Co-Advisor: Adnan Ul-Hasan

This project develops a reinforcement learning-based web interaction system that autonomously adapts website behavior and content presentation to comprehensively support diverse user actions and needs. RL agents learn optimal interface adaptation policies by observing user interaction patterns, session objectives, and engagement signals across browsing sessions. The system dynamically adjusts navigation structures, content recommendations, and UI complexity to align with each user's inferred goals and preferences in real time. Continuous policy improvement through interaction feedback enables the system to progressively enhance its adaptation accuracy without manual reconfiguration. The project demonstrates how RL-driven web personalization can significantly improve user task completion rates and satisfaction.

AI-Driven UAV System for Disaster Response and Real-Time Rescue Operations

Group Members: Haroon Tahir | Muhammad Bilal Khan

Advisor: Rizwan Ahmad Co-Advisor: Muhammad Daud Abdullah Asif

This project develops an AI-driven UAV system for autonomous disaster response, enabling real-time aerial surveillance, victim detection, and rescue operation coordination in emergency scenarios. Computer vision and thermal imaging models identify survivors, map hazard zones, and assess structural damage from aerial footage across disaster-affected areas. Autonomous navigation using SLAM and path planning algorithms enables safe UAV deployment in GPS-degraded and obstacle-rich post-disaster environments. An operations dashboard aggregates live aerial intelligence and generates prioritized rescue recommendations for on-ground response teams. The system aims to dramatically reduce the time between disaster occurrence and the initiation of targeted rescue interventions.

Callisto AI: Conversational Intelligent CI/CD Automation tool

Group Members: Ali Amar | Ibrahim Qaiser

Advisor: Ayesha Kanwal Co-Advisor: Bilal Ali

Callisto AI is a conversational intelligent CI/CD automation tool that enables software development teams to manage build, test, and deployment pipelines through natural language interactions. NLP models interpret developer commands and queries, translating them into pipeline configuration updates, trigger executions, and status reporting without requiring manual YAML or configuration file editing. AI-driven anomaly detection monitors pipeline health metrics, proactively identifying build failures, performance regressions, and deployment risks before they impact production systems. Integration with popular DevOps platforms enables broad compatibility across existing CI/CD infrastructure. Callisto reduces the operational complexity of pipeline management, making DevOps automation accessible to developers without deep infrastructure expertise.

Explainable AI for EEG Signal Classification (NeuroXplain)

Group Members: Abdul Moiz | Muhammad Asim | Muhammad Faiq Qazi

Advisor: Faisal Shafait Co-Advisor: Muhammad Naseer Bajwa

NeuroXplain develops an explainable AI framework for EEG signal classification that provides transparent, clinically interpretable justifications alongside diagnostic predictions. Deep learning models classify EEG recordings to identify neurological conditions including epilepsy, sleep disorders, and cognitive impairments with high diagnostic accuracy. Explainability techniques including saliency maps and attention visualization highlight the specific EEG signal features driving each classification decision, supporting neurologist review and clinical trust. The framework is validated on publicly available clinical EEG datasets, demonstrating competitive accuracy while maintaining interpretability throughout the diagnostic pipeline. NeuroXplain bridges

the gap between high-performance AI diagnostics and the clinical requirement for explainable, auditable medical AI systems.

AI-Assisted Forensic Analysis System for Decision Support

Group Members: Saif Muhammad Sheikh | Zainab Athar

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Shah Khalid

This project develops an AI-assisted forensic analysis system that provides decision support for digital and physical forensic investigations. Machine learning models automate evidence pattern recognition across forensic data types including digital artifacts, document analysis, and biometric evidence to accelerate case analysis workflows. The system integrates a structured decision support interface guiding forensic analysts through evidence evaluation, hypothesis testing, and case linkage analysis. Explainable AI outputs provide transparent reasoning chains that meet evidentiary standards for use in legal proceedings. The platform aims to improve forensic investigation throughput, consistency, and analytical rigor, particularly in resource-constrained law enforcement environments.

EEGWriter: Multimodal Deep Learning Framework for Automated EEG Diagnostic Report Generation

Group Members: Abdullah Waqas | Muhammad Arsalan Khan | Muhammad Athar

Advisor: Faisal Shafait Co-Advisor: Adnan Ul-Hasan,Muhammad Naseer Bajwa

EEGWriter develops a multimodal deep learning framework for automated EEG signal documentation, translating raw EEG recordings into structured clinical reports. Temporal and spectral features are extracted from multi-channel EEG data using specialized neural architectures combining convolutional and recurrent components for robust signal representation. Natural language generation models synthesize clinical-quality documentation from extracted EEG features, covering signal quality assessment, identified abnormalities, and diagnostic impressions. The framework reduces the time burden on neurologists in producing EEG documentation while maintaining clinical accuracy and terminology compliance. EEGWriter supports scalable neurological diagnostics in settings where specialist availability is limited.

An Expert-Guided Multimodal AI Ecosystem for Diagnostic Intelligence

Group Members: Ahmed Sultan | Farhan Kashif

Advisor: Muhammad Moazam Fraz Co-Advisor: Muhammad Naseer Bajwa

This project develops an expert-guided multimodal AI ecosystem that integrates medical imaging, clinical text, and patient history data for comprehensive diagnostic intelligence. Specialist AI models for imaging, pathology, and clinical text are coordinated by an expert routing layer that assigns cases to the most appropriate diagnostic model based on input type and clinical context. Human expert feedback loops enable continuous model refinement, ensuring diagnostic accuracy improves with real-world clinical use over time. Explainable outputs provide clinicians with evidence-backed diagnostic justifications that support informed, transparent medical decision-making. The ecosystem targets deployment as an integrated clinical decision support platform across multi-specialty hospital environments.

Gaze-Guided Explainable AI for EEG-Based Brain Disorder Classification

Group Members: Amna Ahmed | Ayesha Siddiqa | Navaal Iqbal

Advisor: Faisal Shafait Co-Advisor: Muhammad Naseer Bajwa

This project develops a gaze-guided explainable AI system for EEG-based brain disorder classification that incorporates neurologist eye-tracking data to improve model interpretability and clinical alignment. Gaze fixation patterns recorded during expert EEG review sessions are used to train attention mechanisms that focus classification models on diagnostically relevant signal regions. Explainability outputs are guided by expert gaze distributions, producing saliency maps that align with established clinical EEG interpretation practices rather than purely data-driven features. The system provides neurologists with transparent, expert-aligned explanations that increase trust and facilitate adoption of AI-assisted EEG diagnostics in clinical workflows. The approach bridges the gap between AI model attention and human clinical expertise in neurological signal interpretation.

FleaderAI: An AI-Driven End-to-End Lead Relationship Automation via Memory-Centric Conversational Agents

Group Members: Ch Muhammad Umair Gosal | Haris Rehman | Waqas Ali Qureshi

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Shah Khalid

FleaderAI is an AI-driven end-to-end lead relationship automation platform that manages the complete customer acquisition lifecycle from initial lead identification through conversion and retention. AI agents autonomously execute outreach sequences, personalize communication based on lead behavior signals, and adapt engagement strategies in response to prospect responses and interest signals. CRM integration ensures all lead interactions are tracked, scored, and synchronized, providing sales teams with a unified view of pipeline health and individual prospect journeys. Predictive conversion models identify the optimal timing and channel for each touchpoint to maximize engagement and conversion rates. FleaderAI reduces manual sales development effort while improving pipeline velocity and lead-to-customer conversion outcomes.

HRXpert: Automating Talent Acquisition with Artificial Intelligence

Group Members: Jaweria Manahil | Sara Adnan Ghori | Umar Farooq

Advisor: Seemab Latif Co-Advisor: Mehwish Fatima

HRXpert is an AI-driven recruitment and HR automation platform that streamlines talent acquisition processes, reduces operational costs, and improves candidate-job matching accuracy. Automated resume screening, AI-generated assessment tests, and structured interview analysis replace time-consuming manual evaluation steps across the full recruitment pipeline. Advanced AI models evaluate candidates consistently against role-specific competency frameworks, delivering objective scoring that reduces assessment variability and unconscious bias. The platform enables organizations to scale hiring operations efficiently during peak recruitment periods without proportional increases in HR team size. HRXpert accelerates time-to-hire, improves quality-of-hire metrics, and delivers measurable ROI on recruitment investment.

From Drones to Decisions: LLM-Based Crop Health Insights from RGB and Multispectral Data

Group Members: Munazza Raees Butt | Saleha Zainab Fatima

Advisor: Zuhair Zafar Co-Advisor: Muhammad Moazam Fraz

This project develops an LLM-based crop health intelligence system that processes RGB and multispectral drone imagery to generate natural language agronomic insights and actionable recommendations. Computer vision models analyze aerial imagery to detect crop stress, disease outbreaks, and nutrient deficiencies at field scale, producing structured diagnostic outputs. A large language model synthesizes visual analysis results with agronomic knowledge bases to generate human-readable field reports and context-specific treatment recommendations. The natural language interface enables farmers and agronomists without deep data science expertise to query and interact with drone-derived crop intelligence directly. The system bridges the gap between drone remote sensing capabilities and practical, accessible agricultural decision support.

Emotion Detection from Micro-Expressions

Group Members: Ahmad Shahroz Qadri | Ahsan Taimoor Ghazi | Hasnain Ali

Advisor: Bilal Ali Co-Advisor: Muhammad Daud Abdullah Asif,Shah Khalid

This project develops a deep learning system for detecting and classifying human emotions from micro-expressions, which are brief, involuntary facial movements lasting as little as 40 milliseconds. High-frame-rate video capture combined with facial action unit detection models extracts subtle expression dynamics invisible to the naked eye or standard video analysis. Multi-class emotion classifiers trained on micro-expression datasets identify emotional states including concealed feelings that subjects attempt to suppress during interaction. Temporal modeling architectures capture the rapid dynamics of micro-expressions, distinguishing them from voluntary macro-expressions in real-world video streams. Applications include security screening, clinical mental health assessment, and human-computer interaction systems requiring nuanced emotional awareness.

SmartSketch: AI-Powered Facial Image Generator from Natural Language Descriptions

Group Members: Eman Chaudhary | Muqadas Zahra | Muqaddas Anees

Advisor: Hashir Moheed Kiani Co-Advisor: Maajid Maqbool

SmartSketch is an AI-powered facial image generation system that creates realistic portrait sketches from natural language descriptions provided by users. A generative AI pipeline translates textual descriptions of facial features, expressions, age, and physical characteristics into high-fidelity facial images through transformer-based image synthesis models. Iterative refinement through user feedback allows progressive adjustment of generated outputs to converge toward the intended facial likeness. Applications include forensic composite sketch generation, character design for creative industries, and avatar creation for digital platforms. SmartSketch demonstrates the practical utility of text-to-image generation for identity visualization tasks requiring precise, description-guided facial synthesis.

Disrupting Deepfake Generation Through Adversarial Attacks

Group Members: Mati Ur Rehman | Muhammad Saad Umer | Sharjeel Sajid

Advisor: Faisal Shafait Co-Advisor: Momina Moetesum

This project develops adversarial attack techniques that disrupt the generation process of deepfake models, proactively protecting individuals' digital likenesses from unauthorized synthetic media creation. Adversarial perturbations are crafted and embedded into source facial images, causing deepfake generation models to produce visibly degraded or incoherent outputs when attempting to synthesize fake content from protected images. The protection approach operates without requiring access to or modification of the deepfake generation model itself, enabling practical deployment as a preprocessing step before image sharing. The system is evaluated against state-of-the-art deepfake architectures to verify robust protection across diverse generation techniques. The project contributes a proactive, source-side defense strategy against the growing threat of non-consensual synthetic media.

16 Knowledge Group
Networking and Communications

Cloud Optimization: Cost and Security for Enterprise Success

Group Members: Muhammad Ahsan Gill | Muhammad Muaz

Advisor: Mohsin Kamal Co-Advisor: Muhammad Moazzam Ali

This project develops a framework for optimizing enterprise cloud infrastructure across the dual objectives of cost efficiency and security posture. AI-driven cost analysis models identify resource waste, rightsizing opportunities, and underutilized services across cloud deployments, generating automated optimization recommendations. Security assessment modules continuously monitor cloud configurations against compliance benchmarks, flagging misconfigurations and vulnerabilities that increase attack exposure. Unified dashboards present integrated cost and security metrics, enabling organizations to make holistic infrastructure decisions balancing financial and risk management objectives. The framework supports cloud-native enterprises in achieving sustainable, secure, and cost-effective cloud operations at scale.

17 Knowledge Group
Software Engineering

Non Technical Cofounder Super Agent (Ecommerce)

Group Members: Muhammad Abdul Sami | Muhammad Affan Amir | Muhammad Ahsan

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Maajid Maqbool

The Non-Technical Cofounder Agent (NCA) is an intelligent super-agent that autonomously manages and automates essential eCommerce business operations without requiring a dedicated technical team. Multiple specialized sub-agents orchestrated by the NCA handle marketing, customer support, advertisement management, social media, SEO, store configuration, and analytics using no-code and low-code automation platforms. Complete business context is maintained across all sub-agents to ensure coordinated, coherent decision-making across interconnected business functions. SOC 2 Type 2 and GDPR compliance is ensured through encryption and role-based access controls, safeguarding operational data throughout all automated workflows. NCA enables non-technical eCommerce founders to scale operations efficiently without proportional increases in team size.

Troubleshooting Copilot

Group Members: Ahmar Kamran | Hafiz Muhammad Ammar | Muhammad Tauha Kashif

Advisor: Muhammad Daud Abdullah Asif Co-Advisor: Maajid Maqbool

Troubleshooting Copilot is an AI-powered technical support assistant that guides users through complex software and hardware troubleshooting processes through conversational, step-by-step problem resolution. NLP models diagnose reported issues by mapping symptom descriptions to known problem-solution knowledge bases enriched with historical support case data. The system generates context-aware, personalized troubleshooting workflows that adapt based on user responses and intermediate diagnostic outcomes. Escalation pathways route unresolved issues to human support agents with a complete diagnostic history, reducing resolution time and agent onboarding effort. Troubleshooting Copilot reduces support ticket volume, improves first-contact resolution rates, and enhances user self-service capability.

OBE Assess: AI-Powered Outcome Based Education Assessment System

Group Members: Aima Sibtain | Asma Saeed | Eman Muhammad

Advisor: Madiha Khalid Co-Advisor: Sana Qadir

OBE Assess is an AI-powered academic assessment system that modernizes evaluation practices through automated, rubric-based grading aligned with Outcome-Based Education (OBE) frameworks. The system supports mapping of assessments to Course Learning Outcomes (CLOs), Program Learning Outcomes (PLOs), and Bloom's Taxonomy levels, ensuring pedagogical alignment across all evaluated work. AI grading models evaluate student submissions against structured rubrics, delivering consistent, bias-free feedback at scale across large class sizes. Analytical dashboards provide educators with actionable insights into student performance trends, CLO attainment rates, and areas requiring instructional improvement. OBE Assess reduces faculty administrative workload while enhancing the quality and consistency of outcome-aligned academic assessment.

Sedata.AI

Group Members: Ahmed Faizan | Rao Muhammad Rayan Sikandar

Advisor: Madiha Khalid Co-Advisor: Maajid Maqbool

Sedata.AI is a comprehensive platform for building, deploying, and managing Model Context Protocol (MCP)-based agentic AI applications through a unified, developer-friendly toolbox. MCP provides a standardized interface abstracting the complexities of individual tool integrations, simplifying the development and management of AI agents that interact with diverse external applications and data sources. The platform

consolidates agent building, testing, deployment, and monitoring workflows into a single integrated environment, reducing the technical overhead of multi-agent application development. Pre-built MCP connectors for popular business applications accelerate agent deployment across common enterprise use cases. Sedata.AI empowers developers to fully leverage MCP's standardization benefits for scalable, maintainable agentic AI development.

Smart Parental Control & Monitoring System for Child Devices

Group Members: Ahmad Shajee

Advisor: Mehvish Rashid Co-Advisor: Bilal Ali,Farzana Jabeen

This project develops a smart parental control and monitoring system that provides parents with comprehensive visibility and control over children's digital device usage across multiple platforms. AI-powered content filtering dynamically blocks age-inappropriate content across web, application, and social media channels while adapting to evolving content patterns and new platforms. Screen time management tools enforce usage schedules and application access restrictions, with behavioral analytics detecting signs of excessive usage or potentially harmful digital interactions. Remote monitoring dashboards provide parents with real-time and historical reports on children's online activity patterns without requiring physical access to monitored devices. The system balances effective child protection with appropriate privacy considerations as children develop digital literacy and independence.

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