MINDS

MOBILE SYSTEMS, INTERACTIONS, NETWORKS, DISTRIBUTED SYSTEMS

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Bahria University's MINDS research group brings together researchers from the domain of Mobile Intelligent Systems, Interactions (involving post-desktop and post-mobile interactions between humans and smart devices), and Smart environments (smart grids, smart farms, smart transportation and smart factory or industry 4.0).

Mobile Intelligent Systems: Within the Mobile Intelligent Systems research domain, our priority focus is mobile systems, autonomous systems, and robotics.

Interactions: Within the Interactions research domain, our primary focus is on designing novel interaction techniques to enable people to interact with computing devices. One of the major thrust in this domain is eye-based human computer interactions, whereby our researchers are designing novel techniques and methods to enable people to interact with computing devices using eye gaze, eye blink or a hybrid of these approaches. Another major thrust within this research area is learnability and accessibility. Our researchers are working on creating techniques and methods to assist special people to interact with computing devices and the world in general and also to enable these individuals to learn irrespective of their physical and mental shortcomings.

Networks: Within the Networks research domain, our priority focus is SDNs, Network Security and Network Simulations.

Distributed Smart Systems: Within the Distributed Smart Systems research domain, traceability and integrity and security are major requirements. The traceability requirements are typically solved by applying blockchain based solutions. The group has already designed and developed blockchain-based solutions to track counterfeit drugs in the pharma industry, and money tracking within charitable organizations such as WFP and BISP to name a few. Whereas the security requirements are addressed by designing and developing complex and custom-built security infrastructures and architectures for these smart environments. In addition to this, the group works on designing, developing and researching on different aspects of Smart Factory, Smart Transport Networks, Smart Farms, and Smart Grids.

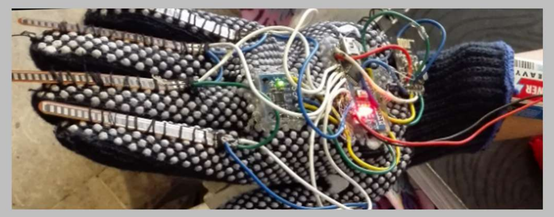
CONSULTING SERVICES

- Interactions: We can advise, review or develop your post-pc or post-mobile interaction designs or products.
- Learnability and Accessibility: MINDS can consult or develop novel learning and accessibility solutions for the education and healthcare sector. The solutions that we can create could be used to enable special children (Autistic, ADHD and so on) and people with permanent disabilities to learn and acquire new skills and interact with their environments.
- Smart Environments: MINDS can assist its clients in designing and developing smart environments such as smart urban farms, smart factories (which are now known by the term industry 4.0), smart grids, and smart transportation networks. The group has extensive and real world experiences of designing smart factory and smart grid environments in Europe and the MENA region.
- Blockchain and Traceability: MINDS can assist its clients in designing and developing traceability and real-time tracking solutions that may use blockchains. The research group has already designed and developed blockchain-based solutions that are being used commercially.
- Security: MINDS can assist its clients in assessing their cyber security needs and vulnerabilities and developing security frameworks and architectures to safeguard their critical digital infrastructures.

RESEARCH & SERVICES PORTFOLIO

Mobile Augmented Reality Plant Inquiry Learning System

Augmented Reality technology has become widespread for conducting learning activities using mobile devices. In this research, a mobile system MAPILS was designed to conduct plant IBL activities using AR technology. The system consists of three main modules; learning, training and testing. The learning module presents information regarding four different plants including Lotus, Pine tree, Palm tree and Mushroom. Students have to use their mobile devices to target a particular marker and learn about a specific plant. The information will be displayed on their mobile devices once the student selects any part of a given plant by scaling up or down. After selecting a specific part of a plant then the information will appear about that part in the form of text. Also audio will be played if students require. Students enjoyed the use of such system that facilitates and motivates towards science learning.



Smart Gloves: Arduino Based Gloves for Sign Language Urdu Interpretation

Arduino-based wearable device called Smart Gloves were developed. Using these gloves, special people can communicate in Urdu with their fellow beings. These gloves have speaker module that can translate sign language into Urdu. For the evaluation purposes, this glove was tested with special school students for shopping mall environment. The results showed that special school students were communicated well via Smart Gloves.

Ontology-Driven Context Aware Game Based Inquiry For Museum Environment

In this study, an ontology-driven context-aware game-based inquiry learning application 'MUSEON' was developed in order to generate adaptive learning content for museum exhibits. The application consists of three components; mobile inquiry, web server and ontology. Visitors have to learn about the exhibits in Maritime museum. When visitors are close to any designated exhibit then the application will give inquiry tasks in the form of questions through Bluetooth low energy beacons. The questions are generated using ontology-based approach. The results of this study indicate that museum visitors enjoyed this ontology-driven context-aware game-based inquiry learning application for learning about museum exhibits.

Ontological Approach For Emotion Analysis

This research project presents an ontological approach to emotion analysis, for software development teams, especially for open-source projects which are usually geographically dispersed. Emotional state of team members affects the performance and outcomes of the team processes. Therefore, emotion analysis becomes an important area for investigation. In this study an analyzer was developed using emotion ontology, which performed analysis on emails taken from mailing lists of Apache Software Foundation projects. The results indicate that software developers do express emotions in their discussions. Thus, the emotion analysis can be used to study the emotional state of teams, and hence, can act as an aid in team facilitation.

Reducing Road Accidents using Alert Messages

Multi-hop message dissemination is expected to be the primary mode of communication among vehicles for many applications. This research investigated the performance aspects of message dissemination in vehicular networks, with a particular focus on improving message reachability over high node density networks. The first part of this research proposes a new message dissemination scheme for multi-hop communication over a platoon of vehicles, referred to as Link Quality-Based Message Dissemination. A plausible spectrum of applications that can be benefited from our proposed LQMD scheme over VANETs include pre-emptive measures for enhancing road safety and traffic flow efficiency alongside with the provision of a variety of infotainment services. The second part evaluated performance of single-hop periodic broadcast communication, in terms of packet delivery ratio and message delivery delay through experimental field tests.

Cyber Security for Power Grid Systems

Power grid systems have witnessed different kind of non-physical attacks being initiated from both internal and external sources that have resulted into physical damages and economical losses. The integration of computation and communication components within the power grid systems has resulted in enhancing the capability and improving performance efficiency of these systems. However, the incorporation of computation and communication modules open the doors for vulnerabilities that can lead towards cyber-attacks. The employment of effective cyber-security measures, playing the role of defense mechanisms in modern power grid systems, are of primary importance for both academia and industry led by governments initiatives. The development of cyber-security solutions for power grid systems requires profound knowledge of the physical components within the power system. This work proposed the design and development of a prototype for cyber physical energy systems that can be utilized as an experimental test bed suitable for executing a range of experiments concerning the performance impact of cyber-attacks on power grid systems and the effectiveness of countermeasure.

EM Radiation Levels Emitting from Cellular Base Stations

This project presents quantitative analyses of human exposure to electromagnetic radiations emitted from NAWRAS Telecom mobile phone base stations present at Sultan Qaboos University Campus. Analyses are based on field measurements taken along different locations within the campus. Measurements were performed for three different mobile communication technologies covered by Nawras, which includes Global System for Mobile Communications, Universal Mobile Telecommunication System and Wireless Interoperability Mobile Access System.

KEY RESEARCHERS

Dr. Sohaib Ahmed

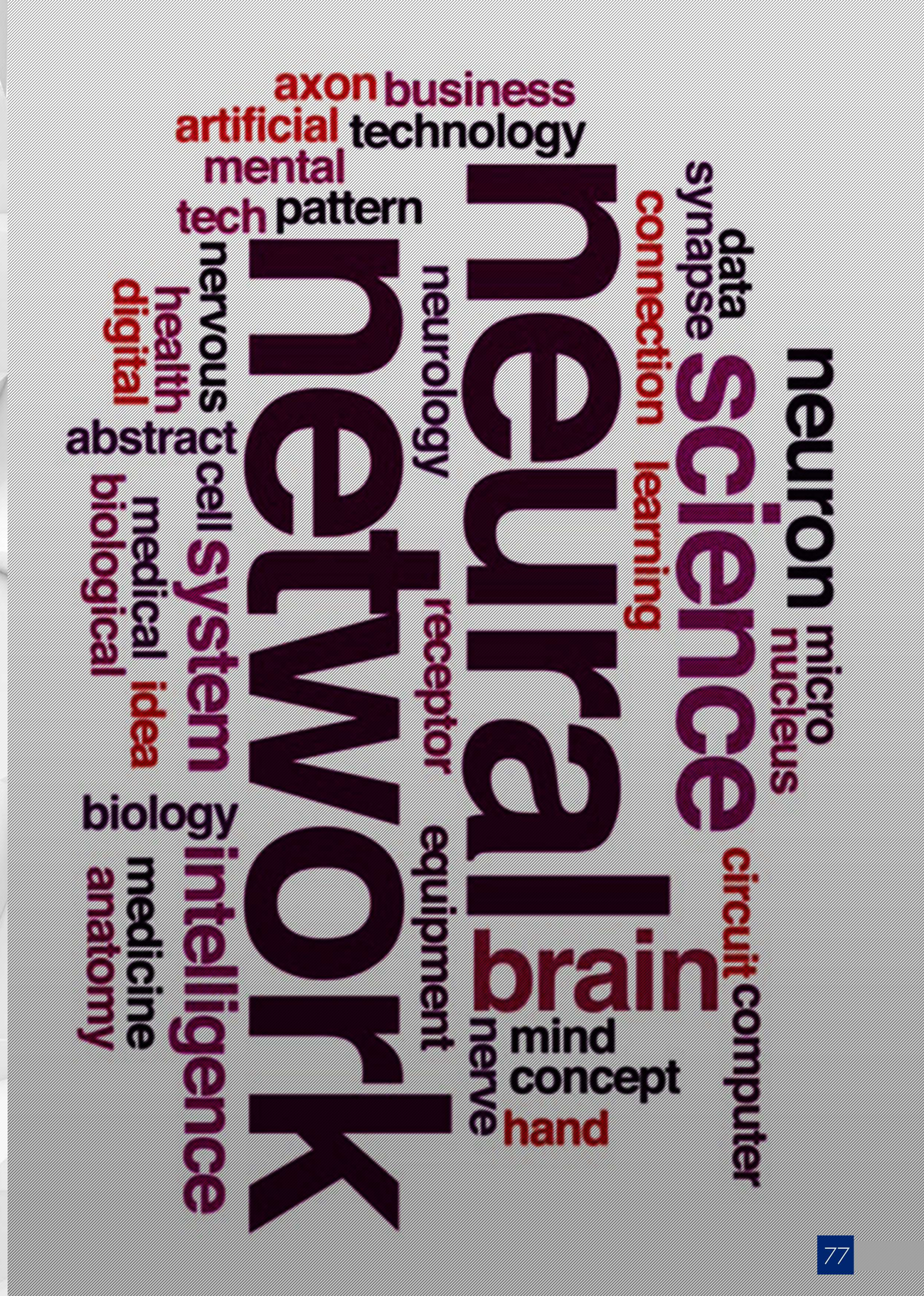
Dr. Sohaib Ahmed is currently working as Head of the Department, Software Engineering and Associate Professor at Bahria University, Karachi Campus. Dr. Ahmed received his doctorate from Massey University, New Zealand in 2013 on HEC MS leading to PhD scholarship. His thesis was declared as one of the top three for the annual information systems doctoral thesis award competing against all the Universities in New Zealand. He also received best paper award in the International conference on Mobile and Contextual Learning (MLearn) held at Helsinki, Finland in October, 2012. His research interests include semantic web, ontology engineering, technology enhanced learning, mobile and ubiquitous learning, inquiry based learning, user modelling and personalization, natural language processing, augmented reality, artificial intelligence and sentiment analysis. Dr Ahmed is serving as reviewer in international reputed journals and conferences such as Computers & Education, Journal of Computer-Assisted Learning , Australasian Conference of Information Systems and IEEE Global Engineering Education Conference.

Dr. Osama Rehman

Dr. Osama Rehman is a Senior Assistant Professor at the Department of Software Engineering, Bahria University Karachi Campus, Pakistan. Prior to that, he has worked as a Post-Doctoral Research Fellow at Sultan Qaboos Univeristy (SQU) - Oman. In addition, he was a Research Assistant at the Communication and Information Research Center (SQU) – Oman, and a faculty member at IQRA University - Pakistan. He has received his PhD in Electrical and Computer Engineering from Sultan Qaboos University (SQU), Oman. He received his BS in Computer Engineering and MS in Network Engineering, both from Sir Syed University of Engineering and Technology, Pakistan. He has served as a reviewer for several conferences and well-reputed journals. He has worked in research areas related to vehicular ad hoc networks, internet of things, Cyber Security for Cyber Physical Systems and Intelligent Security Solutions. His other research interests include open source software and Software Defined Networks.

Dr. Bilal Hameed

Dr Bilal Hameed is currently a Senior Assistant Professor at the Department of Computer Science, Bahria University Karachi Campus. At Bahria University. His research interests are in the domain of Cloud Computing, Smart Environments (Smart Homes, Smart Factories etc.) IOT, and Blockchains. Prior to joining Bahria University, Karachi, Dr Hameed was working as a scientific researcher at the Computer Science Department of the University of Stuttgart. Dr Hameed's research work targeted the development of concepts and framework to monitor the production and processes in a factory and produce stochastic and probabilistic guarantees for error detections. The direction of the research and its results received extremely favorable reviews by the scientific community of Internet of Things

Mr. Azmat Khan

Mr. Khan is currently a Research Faculty at Bahria University, Karachi Campus. He is currently working on on computer vision problems and solutions for different types of Information and Communication paradigms. In particular his research deals with all aspects of applied computer vision, with an emphasis on machine learning and deep learning algorithms for eye tracking and gaze control and blinking. In the past 8 years Mr. Azmat has supervised 15 FYPs.