AMITY UNIVERSITY
RAJASTHAN

Kant Kalwar, NH-11C,
Jaipur (Rajasthan) 303002
Tel. : 01426-405678
Fax : 01426-405679

Establishment of Centre of Excellence
Amity Cognitive Computing and Brain Informatics Centre (ACCBI)

1. Introduction

Amity Cognitive Computing and Brain Informatics Centre (ACCBI) is proposed to be established to emphasise the promotion of humanitarian science & technology through innovation and multidisciplinary research.

2. Vision

To be a premier global centre of excellence in cognitive engineering, humanitarian science, and technology. We aspire to bridge computational biology, artificial intelligence, and advanced electronics to drive life-changing innovations in healthcare, neurodevelopment, and biomedical science through deep international and multidisciplinary collaboration.

3. Objectives:

The primary objective of ACCBI is to establish a premier, comprehensive research and innovation ecosystem dedicated to advancing humanitarian science and technology through cognitive computing and brain informatics.

The Centre shall be committed to exploring the experimental, theoretical, and applied frontiers of computational engineering to develop innovative, rapid, and reliable technological solutions for healthcare, electronics, and biomedical science.

Specific Objectives of the Centre:

- **To Advance Cognitive and Computational Engineering:** Conduct cutting-edge research into mathematical and computer-based approaches to deeply investigate neurodevelopmental, behavioral, and biological disorders.
- **To Innovate Healthcare Informatics Platforms:** Design, develop, and validate computational techniques, advanced electronics, and internet-of-things (IoT) frameworks to improve clinical outcomes, data analytics, and high-power computing (HPC) deployment in health domains.
- **To Drive Diagnostics and Brain Health Breakthroughs:** Pioneer early detection, diagnostic, and management tools – particularly explainable AI-powered tools and neurofeedback/neuroplasticity therapies – to address complex brain and cognitive conditions such as dementia.
- **To Bridge Interdisciplinary Physics and Engineering:** Leverage specialized domains including antenna theory, soft computing, network security, and

interdisciplinary physics to build robust, secure biomedical and healthcare technologies.

- **To Foster High-Impact Global Collaborations:** Cultivate and expand strategic international research partnerships, joint workshops, and academic networks with global institutions (such as Nottingham Trent University, University of Montreal, and others) to exchange cross-border innovations and publish high-quality research.
- **To Bridge Academia, Industry, and Society:** Bring together global researchers, dedicated educators, PhD scholars, and business experts across allied R&D disciplines to turn theoretical computational models into translational, real-world humanitarian solutions.

4. **Sustainable Development Goals (SDGs) Linked with ACCBI Activities**

The Amity Cognitive Computing and Brain Informatics Centre (ACCBI) shall align its cutting-edge research, technological innovations, and institutional practices with several United Nations Sustainable Development Goals (SDGs). By bridging computer science, advanced engineering, and health informatics, the Centre will contribute directly to global advancements in health, industry, and international knowledge-sharing.

Key SDG Alignments

- **SDG 3: Good Health and Well-Being** ACCBI will directly drive advancements in global health by developing explainable AI-powered tools for the early detection and management of dementia. Its dedicated research into neurofeedback, neuroplasticity, and computational engineering will provide non-invasive, innovative technological solutions to treat complex neurodevelopmental, behavioral, and biological disorders.
- **SDG 4: Quality Education** By integrating global educators, researchers, PhD scholars, and students into advanced cross-disciplinary projects, ACCBI will act as a vibrant hub for high-level technical education. The Centre will organize high-impact international conferences, neural health workshops, and seminars that foster continuous learning and academic excellence.
- **SDG 9: Industry, Innovation, and Infrastructure** The Centre will serve as a modern innovation ecosystem, pioneering applied research in advanced electronics, IoT frameworks, high-power computing (HPC), and antenna theory customized for healthcare delivery. By publishing top-tier research in indexed series like Springer LNNS, ACCBI shall strengthen international scientific infrastructure.
- **SDG 17: Partnerships for the Goals** Strategic collaboration is at the very heart of ACCBI's architecture. Through formal Memorandums of Understanding (MoUs) and joint projects, the Centre shall maintain active research networks spanning the UK, Canada, Japan, Saudi Arabia, Malaysia, Uzbekistan, Thailand, and Bangladesh, embodying the true spirit of global cooperation for sustainable development.

5. **Functions of ACCBI**

The Centre shall perform cutting-edge multidisciplinary functions encompassing theoretical research, experimental system design, professional training, and global academic outreach. The major functions include:

5.1. Research and Development

- **Computational Health Innovations:** Conducting advanced research into experimental, theoretical, and applied computational and cognitive engineering to design diagnostic and management solutions for healthcare and biomedical sciences.
- **Algorithmic & Hardware Design:** Developing, optimizing, and validating soft computing models, explainable artificial intelligence (XAI) frameworks, and advanced electronic systems optimized for high-power computing (HPC) deployment.
- **Interdisciplinary Physical Systems:** Investigating complex biological, neurodevelopmental, and behavioral disorders using advanced mathematics, computer-based modeling, and network security infrastructures.
- **Advanced Biomedical Engineering:** Exploring specialized applications in antenna theory, IoT frameworks, and electromagnetic techniques customized for next-generation healthcare delivery.

5.2. Diagnostic Analytics and Informatics Services

- **Neuro-Informatics & Brain Signal Processing:** Utilizing data analytics, machine learning, and cognitive computing models to process complex neurological datasets for cognitive health tracking.
- **Cognitive Pattern Analysis:** Profiling and analyzing behavioral, neuroplastic, and cognitive data trends to assist clinical research in identifying early-stage neurodegenerative conditions such as dementia.

5.3. Surveillance, Modeling, and Public Health Frameworks

- **Epidemiological & Behavioral Monitoring:** Tracking and forecasting structural patterns in behavioral and biological disorders via computational biology models.
- **Dementia & Cognitive Disease Modeling:** Utilizing explainable AI tools to provide predictive analytics on data patterns related to neurodevelopmental regression and long-term brain health.
- **Humanitarian Science Data Security:** Collecting and managing encrypted healthcare informatics data across high-performance networks while maintaining strict data integrity and network security protocols.

5.4. Capacity Building and Training

- **Advanced Skill Development:** Organizing high-impact international conferences (such as TCCE), international research seminars, and specialized technical workshops.
- **Hands-on Technical Training:** Providing dedicated, practical training modules in emerging clinical-technical fields like neurofeedback and neuroplasticity therapies.

- **Academic Research Mentorship:** Supporting and supervising advanced research projects, dissertations, and technical investigations for PhD scholars, research fellows, and post-graduate students.

5.5. Collaborative and Translational Activities

- **Global Institutional Networks:** Cultivating formal research partnerships, joint global workshops, and academic MoUs with premier international bodies like Nottingham Trent University, University of Montreal, and other global stakeholders.
- **Translational Innovation & Publishing:** Facilitating the commercialization, real-world deployment, and global dissemination of cognitive technologies, including technical indexing through established channels like the Springer LNNS Scopus series.
- **Cross-Border Grants & Projects:** Securing and executing multi-institutional, interdisciplinary research grants supported by global funding networks and national bodies like DST PURSE.

6. Operational Framework of the Centre

The Amity Cognitive Computing and Brain Informatics Centre (ACCBI) shall function through an integrated and collaborative operational framework involving faculty members, research scholars, technical staff, and external collaborators. The Centre shall operate through thematic research groups aligned with its core domains: Healthcare Informatics and Interdisciplinary Physics, Cognitive Science and Computational Biology, Artificial Intelligence and Soft Computing, IoT and Data Analytics with High-Performance Computing (HPC), Antenna Theory and Techniques for Healthcare, and Network and Security.

The Centre Director/Coordinator will be responsible for the strategic planning, research activities, collaborations, and administrative functioning of ACCBI. All research activities shall be conducted in accordance with institutional ethical principles and relevant regulatory guidelines.

ACCBI will encourage strong interdisciplinary interaction and foster collaborative projects with academic institutions, research organizations, hospitals, industries, and government agencies. Regular meetings, research seminars, workshops, and progress review sessions are held to track ongoing projects, promote scientific exchange, and strengthen communication among researchers, students, and stakeholders.

This framework will support ACCBI's vision of advancing humanitarian science and technology through innovation in computational and cognitive engineering, in close partnership with the Cognitive Computing and Brain Informatics (CCBI) research group at Nottingham Trent University (UK) and other international collaborators.

7. Outreach and Academic Dissemination Activities

ACCBI will be actively involved in global outreach, academic extension, and public awareness initiatives designed to promote humanitarian science and enhance understanding of advanced cognitive technological frameworks. The Centre's outreach initiatives encompass:

7.1. Academic and Technical Dissemination

- **Emerging Technologies Seminars:** Organizing specialized guest lectures and international technical seminars covering computational engineering, explainable artificial intelligence (XAI), and cognitive computing.
- **High-Impact Professional Conferences:** Hosting and coordinating landmark international assemblies, such as the *International Conference on Trends in Computational and Cognitive Engineering (TCCE)* and the *International Conference on Trends in Electronics and Health Informatics (TEHI)*, to bring global experts together.
- **Global Research Knowledge Sharing:** Broadly sharing scientific breakthroughs, peer-reviewed models, and collaborative data through high-quality indexed publications, including established channels like the *Springer LNNS Scopus series*.

7.2. Skill Development and Professional Training

- **Advanced Neural Health Workshops:** Conducting dedicated technical training sessions and workshops focused on cutting-edge clinical technology, such as neurofeedback and neuroplasticity therapies, for students, researchers, and healthcare professionals.
- **Multidisciplinary Training Frameworks:** Providing practical, hands-on training to PhD scholars and research fellows in computational biology, internet-of-things (IoT) applications, and advanced healthcare informatics.

7.3. Community Outreach and Institutional Cooperation

- **Cognitive Health and Brain Awareness:** Promoting public and academic awareness regarding early detection methodologies and engineering-driven management tools for complex neurodegenerative conditions like dementia.
- **Cross-Border Interdisciplinary Synergy:** Cultivating deep, active cooperation with international universities, local educational institutions, and public health stakeholders to build cross-disciplinary research networks.
- **Global Humanitarian Initiatives:** Contributing directly to international and national public sector initiatives (such as those supported by DST PURSE) to deploy secure, advanced electronic systems and high-power computing infrastructure for the betterment of human health and society.

8. The centre will work closely with various Institutes abroad and the required labs would be established in collaboration with them (mentioned as collaborators) in due course:

Global Collaborative Ecosystem

ACCBI will establish strong global linkages with leading minds and institutions to drive multi-centered research projects, exchange programs, and infrastructure sharing:

Key International Collaborators

Collaborator	Affiliation / Institution	Primary Research Synergy
Dr. Mufti Mahmud	Nottingham Trent University, UK / KFUPM, Saudi Arabia	Brain Informatics & Neuro-AI Frameworks

Dr. J.E. Lugo	University of Montreal, Canada	Cognitive Neuroscience & Psychophysiology
Prof. Jocelyn Faubert	University of Montreal, Canada	Visual Perception, Attention & Human Performance
Dr. Anirban Bandopadhyay	National Institute for Materials Science (NIMS), Japan	Brain-Inspired Systems & Advanced Materials
Prof. Shamim Kaiser	Jahangirnagar University, Bangladesh	Neuroinformatics Data Standardization
Prof. Sazzad Hossain	Samarkand State University, Uzbekistan	Computational Modeling & Complex Systems

9. Outcomes and Expected Impact

The establishment of ACCBI is strategically designed to drive substantial breakthroughs in scientific research, advanced technology infrastructure, and humanitarian healthcare innovations. The anticipated outcomes and impacts of the Centre include:

9.1. **Advanced Diagnostic Frameworks:** Development of explainable artificial intelligence (XAI)-powered systems, advanced computational tools, and electronics engineered for the early detection and long-term management of complex neurodegenerative conditions like dementia.

9.2. **Deepened Neurodevelopmental Insight:** Enhanced mathematical and computer-based understanding of behavioral, biological, and complex neurodevelopmental disorders through structured cognitive and computational engineering models.

9.3. **Next-Generation Health Technology:** Creation and validation of innovative, secure diagnostic platforms utilizing interdisciplinary physics, antenna theory, and Internet of Things (IoT) architectures adapted for modern healthcare systems.

- **High-Impact Scientific Literature:** Generation of high-quality, peer-reviewed research publications, patents, and funded projects indexed in elite global networks, including formal publication arrangements with the *Springer LNNS Scopus series*.
- **Global Academic and Industrial Network:** Growth of a vibrant ecosystem that successfully brings together global researchers, dedicated educators, PhD scholars, and business leaders across allied R&D fields to drive translational innovation.
- **Advanced Capacity Building:** Training a new generation of skilled researchers, students, and clinical-technical specialists through international conferences (e.g., TCCE, TEHI) and practical workshops in cutting-edge domains like neurofeedback and neuroplasticity.

The Centre shall aspire to grow as an internationally recognized hub of excellence for cognitive computing, advanced health informatics, and collaborative engineering frameworks that provide real-world, compassionate solutions for global human health.

Short term goals of the ACCBI (1-2 years)

- To establish a research ambience looking into the premier institutes of India and abroad keeping in mind Amity's motto "Research and innovation driven University".
- To recruit personnel dedicated to ACCBI. We also aim to recruit high caliber postdoctoral research fellows and research assistants (JRF/SRF) once extramural grants are obtained.
- To obtain preliminary data for our potential grant applications. To recruit high caliber students to our centre. We will attempt to train undergraduate and graduate students. (B.E, M.Tech. and Ph.D.) of Amity University Rajasthan in research in diverse areas withing the scope of the centre. This will strengthen our academic program and it will build our reputation among the student community within and outside Amity.
- To organize an annual national/international workshop/conference focused on the themes of the CCBI from first year itself.
- To submit manuscripts (at least 2 per year per faculty of ACCBI) to high impact journals second year onwards.
- To submit joint grant applications for both national and international funding.
- In addition, we have plans to expand and diversify our research capabilities in the future. In view of this, we have set up a few long-term objectives as well.

Long Term objectives (>5 years)

- To establish long term extramural funds to Amity University Rajasthan for carrying out cutting edge research in ACCBI and to strengthen our academic program.
- To develop additional research areas within the scope of ACCBI, for high-end research activities.
- Diversify and expand the ACCBI into other related areas of research in coming years.
- To provide a platform for training our graduate (M.Tech and Ph.D.) and undergraduate (B.Tech) students in innovation research at International level under the umbrella of ACCBI.
- The ACCBI will be jointly guiding international Ph.D. students with the support of our global partners.

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Submitted by	Recommended by	Approved by
Kanad Ray		
Prof. Kanad Ray **Director-ACCBI** **&** **Professor - ASAS**	**Dr. Nitin Bhardwaj** **Registrar**	**Prof. Amit Jain** **President**