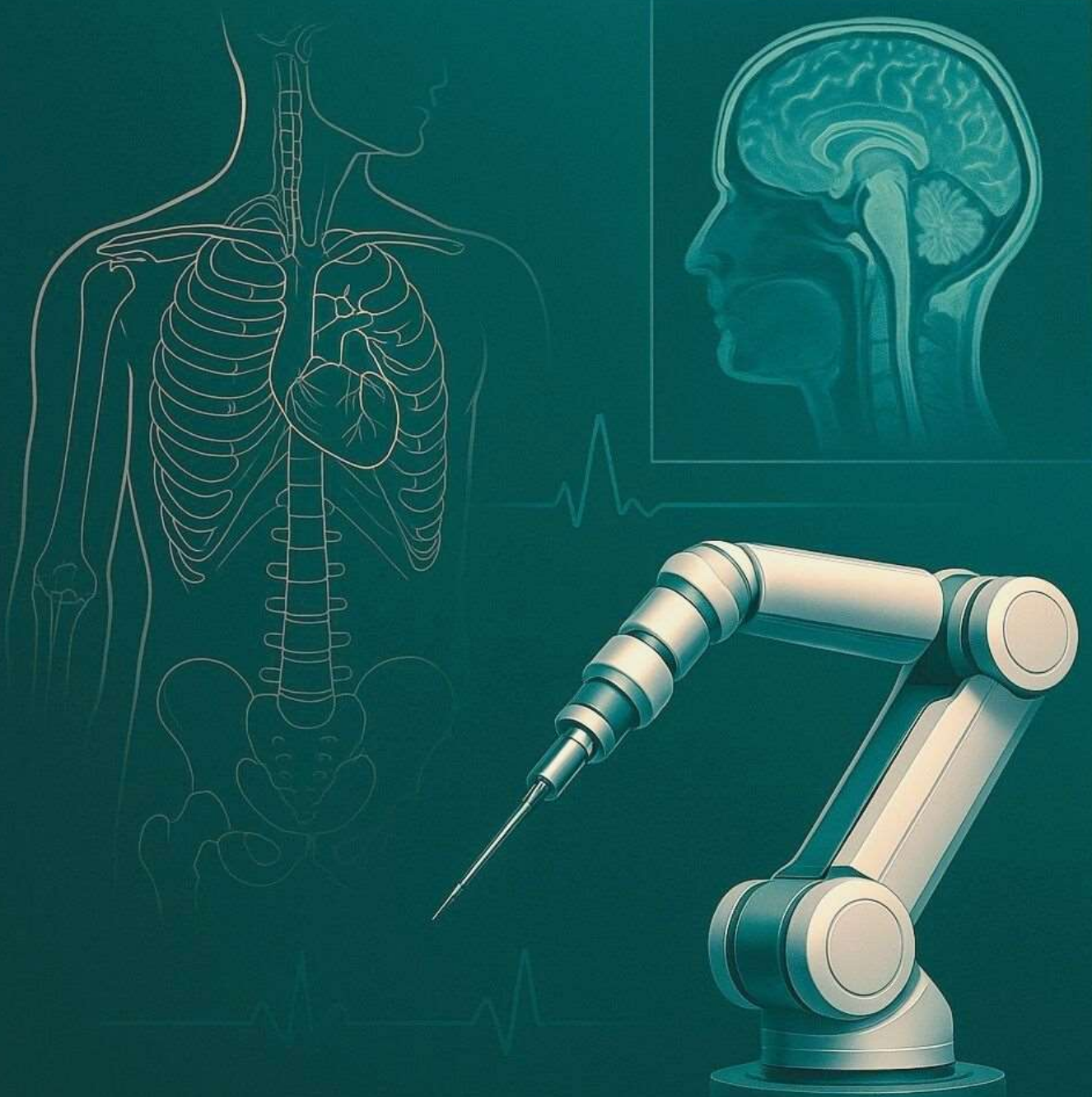




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R&D Institute of Science and Technology
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BIOVERSE

INNOVATING THE FUTURE OF LIFE AND MEDICINE



JAN 2023
VOLUME IV

SCHOOL OF ELECTRICAL AND COMMUNICATION
DEPARTMENT OF BIOMEDICAL ENGINEERING

Institute Vision

To create, translate and disseminate frontiers of knowledge embedded with creativity and innovation for a positive transformation of emerging society.

Institute Mission

- M1:** To nurture excellence in teaching, learning, creativity and research; translate knowledge into practice
- M2:** To foster multidisciplinary research across science, medicine, engineering, technology and humanities
- M3:** To incubate entrepreneurship; instill integrity and honour
- M4:** To inculcate scholarly leadership towards global competence and growth beyond self in a serene, inclusive and free academic environment

Department Vision

To be recognized as an excellent centre in Biomedical Engineering for imparting quality technical education that leads to transformative advancements in healthcare industries

Department Mission

- M1:** To infuse critical thinking skills by providing a strong foundation that enables the students for continuing education
- M2:** To create an ambience of academic excellence with state-of-the-art laboratories to compete globally
- M3:** To establish a dynamic research environment that integrates advanced healthcare technologies for innovation and progress

Program Education Objectives

- PEO1:** Exhibit proficiency in designing and analyzing healthcare solutions to cater to the needs of the medical industry and societal needs
- PEO2:** Demonstrate professional networking in a diverse team setting and collaborate among peers with ethical practices in the workplace, ensuring integrity
- PEO3:** Reinforce lifelong learning practices for professional advancement not limited to higher studies and research.

Program Special Outcomes

- PSO1:** Apply critical reasoning to analyse, identify and solve solutions for problems related to Brain-Computer Interface (BCI)
- PSO2:** Design an effective interface between biological and electronic systems.
- PSO3:** Apply the knowledge of Artificial intelligence in healthcare engineering to solve real-time problems

Magazine Credits

From the Magazine Team

“As the new year unfolds, we are thrilled to present **Volume 4** of our Biomedical Engineering departmental magazine. This edition is more than just a collection of articles—it is a celebration of curiosity, innovation, and the relentless spirit of discovery that defines our department. This volume also marks a milestone in our magazine’s journey—four editions of capturing creativity, learning, and collaboration. It is a testament to the vibrant energy of our students, the guidance of our faculty, and the support of our staff. Each article, illustration, and insight has been carefully curated to spark curiosity, ignite conversation, and celebrate the interdisciplinary spirit that makes biomedical engineering so unique. As you turn the pages, we hope you feel the enthusiasm, dedication, and imagination that went into this edition .

HAPPY READING!”

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DEAN'S Desk



Time gives perspective. With each passing academic cycle, a department does more than progress—it refines its identity. As I turn the pages of the fourth volume of the Biomedical Engineering departmental magazine, I see not just records of activity, but a narrative of thoughtful growth and quiet determination.

Biomedical Engineering needs us to balance precision with purpose. Over time, this department has demonstrated that balance through consistent academic effort, meaningful engagement, and a commitment to learning that goes beyond outcomes. The strength of the department lies in its ability to evolve while remaining grounded in strong educational values—an achievement that reflects the collective resolve of its students and faculty.

This volume stands as a reflection of that journey. It captures moments of learning, collaboration, and reflection that define the department's culture. More importantly, it represents a space where ideas are nurtured patiently and progress is viewed as a shared responsibility rather than an isolated accomplishment.

I would like to acknowledge the editorial team for curating this volume with care and intent. Their effort is evident not only in the presentation, but in the coherence of thought that runs through these pages. By documenting the department's journey, they have created a record of learning and growth.

As we begin another year, I hope this magazine inspires readers to pause, reflect, and appreciate the process of growth—both individual and collective. May the Department of Biomedical Engineering continue to move forward with clarity, curiosity, and confidence, shaping not only capable professionals but thoughtful contributors to society.

Prof. Dr. R S Valarmathi

Dean- School of Electrical & Communication

HoD's Reflection



A department is often measured by its results, but its true strength lies in its rhythm — the way ideas are questioned, efforts are sustained, and learning quietly takes shape over time. As I reflect on the journey of the Department of Biomedical Engineering, what stands out most is not a single milestone, but the steady progression that has defined our collective growth.

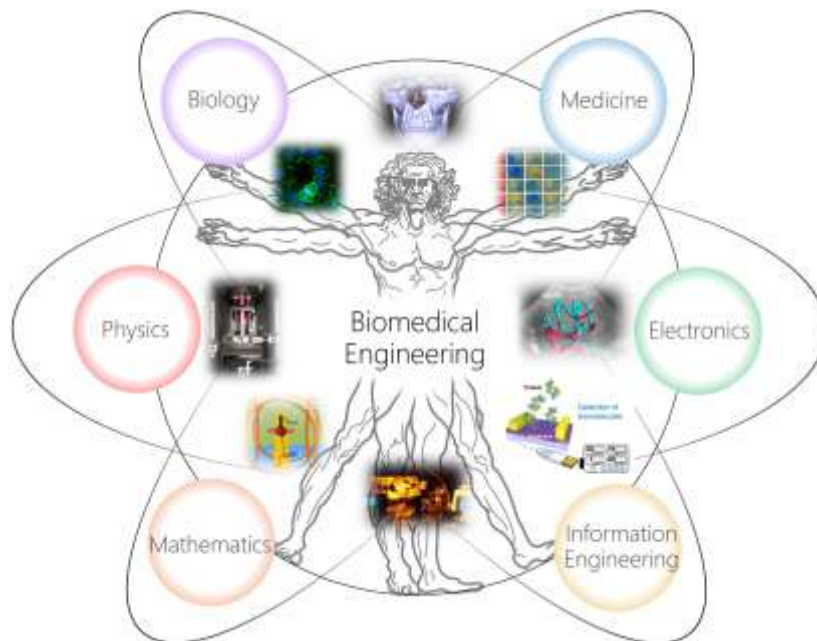
Over the years, our department has evolved into a space where learning extends beyond syllabus and classrooms. Students are learning to observe closely, think independently, and approach problems with patience and responsibility. Faculty continue to shape this environment by encouraging reflection, discipline, and thoughtful inquiry. These everyday academic moments, though often unnoticed, form the foundation of meaningful education.

This fourth volume of the departmental magazine captures that essence. It does not merely document activities or achievements; it reflects the mindset of a department that values consistency, collaboration, and purpose. Each page mirrors the curiosity, effort, and learning culture that we strive to nurture.

As we move forward, my hope is that our department continues to grow with clarity and confidence — embracing change while staying rooted in strong academic values. May this volume serve as a quiet reminder that progress is built through commitment, reflection, and the shared pursuit of knowledge.

Dr. Masoodhu Banu

About the Department



The Department of Biomedical Engineering was established in the year 2017 with the objective of bridging engineering principles with medical and biological sciences to address challenges in healthcare. The department offers B.Tech. and Ph.D. programs, aimed at developing skilled professionals and researchers capable of contributing to healthcare technology, medical device development, and biomedical research. Emphasis is placed on outcome-based education, hands-on learning, and research-oriented training. With a focus on emerging areas such as medical imaging, biomechanics, biomedical signal processing, and artificial intelligence in healthcare, the department strives to produce graduates who are industry-ready, research-driven, and socially responsible.

Python coding contest

The **Department of Biomedical Engineering** organized a **Python Coding Competition** on **5th September 2022** with the aim of improving students' programming knowledge and encouraging them to explore coding skills relevant to biomedical applications. Python is one of the most widely used programming languages in the field of biomedical engineering, especially for data analysis, signal processing, machine learning, and medical image analysis. Therefore, this competition was conducted to help students understand the importance of programming in modern healthcare technology and research.

The event was organized by the department faculty members with the support of student coordinators. The competition witnessed enthusiastic participation from many students of the department who were eager to test their coding abilities and logical thinking skills. Before the competition began, the organizers explained the rules and structure of the event. Participants were provided with a set of programming problems that required them to write Python code to solve them within a limited time.

The problems included questions related to **basic Python programming concepts** such as loops, conditional statements, functions, arrays, and simple algorithm development. Some questions were also designed to test the participants' problem-solving ability and logical thinking. Students worked individually to develop correct and efficient code solutions. The competition created a healthy and competitive environment where students were motivated to think critically and apply their knowledge practically.

Faculty members monitored the event and evaluated the participants based on several criteria such as **accuracy of the program, efficiency of the code, logical approach, and time taken to complete the tasks**. At the end of the competition, the best-performing students were recognized and appreciated for their efforts. The winners were awarded certificates and appreciation by the department.

Python coding contest



News in Trend – Reshaping the future of Biomedicine

In recent years, **Artificial Intelligence (AI)** has evolved from a futuristic concept into a powerful force shaping the world around us. From smartphones to autonomous vehicles, AI has begun to influence almost every aspect of modern life. But perhaps its most transformative impact is being felt in the **biomedical industry**, where intelligent technologies are redefining how we diagnose diseases, develop treatments, and deliver healthcare.

What is Artificial Intelligence?

Artificial Intelligence refers to the ability of machines or computer systems to mimic human intelligence processes. These include learning from experience (called **machine learning**), understanding language (**natural language processing**), recognizing images and patterns (**computer vision**), and making decisions or predictions. AI systems are designed to process and analyze vast amounts of data, often much faster and more accurately than humans can.

At a high level, AI is categorized into three types:

- **Narrow AI (Weak AI):** These systems are designed to perform a specific task, such as voice recognition or image analysis. Most current applications—including those in biomedicine—fall into this category.
- **General AI (Strong AI):** This type of AI would be capable of performing any intellectual task a human can do, with the ability to understand, reason, and learn across a wide range of domains. It remains largely theoretical at this point.
- **Superintelligent AI:** A hypothetical level of intelligence that surpasses human capabilities in every field. While it's the subject of much debate and speculation, it's not currently a focus in biomedical applications.

News in Trend

At the core of modern AI is **machine learning (ML)**—an approach where computers are trained using large datasets to “learn” patterns and make predictions. A more advanced subset of ML, called **deep learning**, uses artificial neural networks inspired by the human brain to perform complex tasks such as interpreting medical images or analyzing genetic data.

Thanks to advances in computing power, big data availability, and algorithm design, AI has become increasingly reliable, fast, and accessible. These capabilities make it a natural fit for industries like healthcare and biomedicine, which generate massive amounts of complex, high-stakes data that require precision, speed, and continuous improvement.

AI Meets Biomedicine: A Perfect Match

In the **biomedical industry**, AI is no longer just a tool—it’s becoming a trusted partner. One of the most impactful areas is **medical imaging and diagnostics**, where AI algorithms assist in analyzing X-rays, CT scans, MRIs, and even pathology slides. These systems can detect early signs of diseases such as cancer, heart conditions, and neurological disorders with remarkable precision, often flagging issues that might escape the human eye.

Another major frontier is **drug discovery and development**. Traditionally a slow and costly process, drug development has been transformed by AI models that predict how new compounds will interact with the human body. This allows scientists to identify promising drug candidates, assess side effects, and simulate clinical trials—cutting years off development timelines and saving billions in costs.

In the realm of **genomics and personalized medicine**, AI helps decode massive amounts of genetic data to pinpoint mutations, biomarkers, and treatment responses. This enables highly targeted therapies, especially in areas like cancer care, where personalized approaches can drastically improve survival rates.

News in Trend

Smarter Surgeries and Predictive Care

AI's influence also extends to the operating room. **AI-assisted robotic surgery** is enhancing precision and reducing human error in complex procedures. These systems help surgeons plan operations, navigate with millimeter accuracy, and even perform minimally invasive techniques that shorten recovery times.

Beyond the clinical side, AI is optimizing healthcare management through **predictive analytics**. By analyzing electronic health records (EHRs), AI can identify high-risk patients, predict hospital readmissions, and suggest preventive interventions. It's also streamlining administrative tasks—like billing, appointment scheduling, and documentation—freeing up time for healthcare providers to focus on patient care.

Virtual Health and Pandemic Response

The rise of **virtual assistants and AI chatbots** has further revolutionized patient interaction. These tools provide 24/7 support, guide users through symptoms, and answer basic health questions—all while reducing the burden on healthcare professionals.

During the COVID-19 pandemic, AI proved its worth in real time. From tracking the virus's spread to supporting vaccine development and resource allocation, AI was crucial in enabling faster, data-driven decisions during a global crisis.



News in Trend

Challenges on the Horizon

Despite the excitement, integrating AI into biomedicine is not without its challenges. **Data privacy** is a top concern, especially when dealing with sensitive patient information. There are also issues of **bias and fairness**—AI systems are only as good as the data they are trained on, and poor data quality can lead to inaccurate or even harmful outcomes.

Regulation is another key factor. As AI systems begin to influence life-or-death decisions, robust ethical and legal frameworks are essential to ensure safety, transparency, and accountability. And, crucially, AI tools must be designed to **fit into clinical workflows**, rather than disrupt them.

The Road Ahead

The integration of AI into the biomedical industry is still in its early stages, but the trajectory is clear: smarter, faster, more personalized healthcare is on the horizon. As research continues and ethical frameworks evolve, the synergy between artificial intelligence and biomedicine promises to usher in a new era of innovation.

Whether it's detecting disease before symptoms appear, tailoring treatments to a person's unique genetic makeup, or assisting surgeons with robotic precision—AI is not just supporting medicine, it's reshaping it.

Wandahunshisha P Marak(VTU16364)

Best Project

AI POWERED SPASTICITY DETECTION

The project titled “**AI Powered Spasticity Detection**” focuses on developing an intelligent and automated system for the early identification and assessment of spasticity in patients with neurological disorders. Spasticity, a condition characterized by abnormal muscle stiffness and involuntary contractions, commonly occurs in individuals affected by stroke, cerebral palsy, spinal cord injuries, and multiple sclerosis. Traditional assessment methods rely heavily on clinical observation and manual scales such as the Modified Ashworth Scale, which can be subjective and vary between examiners. This project aims to overcome these limitations by introducing an AI-driven, objective, and data-based evaluation system.

The proposed system integrates wearable sensors such as surface electromyography (sEMG) sensors and motion sensors (accelerometers or gyroscopes) to capture muscle activity and limb movement patterns. These sensors collect real-time physiological and biomechanical signals during controlled movements. The acquired data is then processed and analyzed using machine learning algorithms to identify abnormal muscle activation patterns associated with spasticity.

Artificial Intelligence models, including supervised learning techniques, are trained using labeled datasets to classify the severity of spasticity accurately. Signal preprocessing methods such as filtering and feature extraction are applied to remove noise and extract meaningful parameters like muscle activation intensity, frequency components, and movement velocity. The trained model predicts the spasticity level and provides quantitative results, reducing human bias and improving diagnostic consistency.

Best Project

To enhance safety, the system incorporates an intelligent alert mechanism. If the heart rate falls below 60 BPM (bradycardia) or exceeds 100 BPM (tachycardia), automatic notifications are sent through mobile alerts, SMS, or email, ensuring timely medical intervention. Experimental results demonstrated high accuracy with minimal deviation compared to standard pulse oximeters, along with low latency suitable for real-time applications. The device is also energy-efficient, making it ideal for wearable and portable use.

Overall, this project exemplifies how IoT can revolutionize healthcare by creating a connected, patient-centered monitoring system. By integrating wearable sensors, embedded processing, wireless communication, and cloud computing, the system enhances accessibility to cardiac care, reduces hospital dependency, and supports preventive healthcare—marking a significant step forward in modern telemedicine.

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***
[✓] Using Fixed Sampling Rate: 200 Hz
Total Windows for New Patient: 4823
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you train or evaluate the model.
Loaded selector from selector.pkl and scaler from scaler.pkl
151/151 ██████████ 0s 2ms/step

--- FINAL PREDICTION ---
Scale Reading: **1**
Spasticity Level: **Mild Spasticity (MAS 1)**
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Aravind M S (VTU16502)

Alumni Spotlight

As I step into a new phase of my journey, I often find myself reflecting on how my time in the Department of Biomedical Engineering quietly shaped the person I am today. What began as a structured academic path gradually became a space for exploration, self-discovery, and growth. The lessons I carry forward are not limited to textbooks or laboratories, but are deeply rooted in learning how to think critically, adapt to change, and remain curious even in moments of uncertainty.

During my student years, there were moments of uncertainty and self-doubt, especially when certain concepts felt overwhelming or when outcomes did not meet my expectations. Yet, those moments turned out to be the most valuable learning experiences. They taught me resilience, the importance of consistency, and the confidence to keep moving forward despite setbacks. The encouragement and guidance from our faculty, along with the shared journey with my peers, created a supportive environment where learning and growth became possible even during challenging times.

Beyond academics, the department helped me develop essential life skills such as effective communication, teamwork, and the ability to approach problems with a structured and analytical mindset. These skills have continued to guide me in my professional journey, helping me adapt, learn, and grow in dynamic and ever-changing environments. What I carry with me today is not just academic knowledge, but a mindset shaped by curiosity, responsibility, and a continuous desire to learn.

Looking back, progress was not always immediate, but every challenge—whether academic or personal—contributed to building confidence and clarity over time.

The foundation you build during these years will support you long after you leave the campus. Trust the process, stay committed, and allow your experiences to shape you into the professional and individual you aspire to become.

- Vidhyadarshini

Gallery

