



AAVARTAN'23-24



VIGYAAN

**DEPARTMENT OF BIOMEDICAL ENGINEERING
PROBLEM STATEMENTS**

BME01. Developing an Affordable and Robust Digital Blood Pressure Monitoring Solution for Accurate and Accessible Healthcare.

There is a growing need for a low-cost, reliable, and durable digital blood pressure (BP) monitoring device that can accurately measure and track blood pressure readings for individuals in various healthcare settings. Existing digital BP machines often suffer from issues of inaccuracy, fragility, and high cost, limiting their accessibility and effectiveness in providing accurate blood pressure monitoring for both medical professionals and individuals monitoring their own health at home. Addressing these challenges and developing a low-cost, sturdy digital BP machine with precise measurements and robust construction will greatly improve the quality of blood pressure monitoring, enhance patient care, and promote overall health management.

BME02. Addressing the Accessibility and Affordability Gap in Accurate Blood Glucose Monitoring for Diabetes Management.

The affordability and accessibility of accurate blood glucose monitoring remain significant challenges for individuals with diabetes, healthcare facilities, and resource-constrained regions. Current glucometers on the market often come with high costs, making consistent blood sugar monitoring difficult for economically disadvantaged populations and limiting the ability of healthcare providers to deliver comprehensive diabetes management. The need for a low-cost glucometer solution that maintains high accuracy, reliability, and usability is crucial to empower individuals with diabetes to effectively monitor their blood glucose levels, improve their health outcomes, and reduce the burden on healthcare systems by preventing diabetes-related complications.

BME03. Enabling Reliable Insulin Storage in Power-Scarce Rural Areas through Affordable and Adaptive Refrigeration Solutions."

Rural households in areas with frequent power cuts face a critical challenge in storing insulin safely and effectively due to the lack of affordable and reliable refrigeration options. Current insulin fridges available in the market are often expensive, power-intensive, and not tailored to the specific needs of these communities. As a result, individuals with diabetes who rely on insulin therapy encounter difficulties in maintaining the required temperature for insulin storage, leading to compromised medication efficacy and potentially life-threatening health consequences. Developing a low-cost insulin fridge solution that operates efficiently even during power outages, ensuring consistent and appropriate storage conditions for insulin, is essential to address the healthcare disparities faced by rural populations and improve diabetes management outcomes in resource-constrained environments.

BME04. Elevating Type 1 Diabetes Management: Innovating Accessible and Personalized Insulin Pump Solutions for Enhanced Glucose Control and Quality of Life

Type 1 diabetes patients often encounter challenges in achieving optimal blood glucose control and maintaining their quality of life due to the limitations and barriers associated with traditional insulin administration methods. Conventional insulin injection regimens can

lead to inconsistent blood sugar levels, frequent hypoglycemia or hyperglycemia episodes, and the need for strict adherence to complex dosing schedules. Additionally, the burden of frequent injections can have a negative impact on the emotional well-being of individuals with type 1 diabetes. There is a pressing need to develop advanced and accessible insulin pump solutions that provide precise and personalized insulin delivery, minimize glycemic fluctuations, and improve overall diabetes management while addressing concerns related to affordability, usability, and integration into daily life for individuals living with type 1 diabetes.

BME05. Breaking Barriers to Affordable Arterial Blood Gas Analysis: Developing Accessible and Cost-Effective Solutions for Healthcare Settings.

The current landscape of arterial blood gas (ABG) analysis is hindered by the high cost of specialized reagents and consumables required for accurate measurements. This financial barrier restricts the accessibility of ABG testing for healthcare facilities, particularly in resource-limited settings where cost-effective medical solutions are crucial. The reliance on proprietary chemicals and components further exacerbates the affordability issue, impeding the widespread adoption of ABG machines. To address this challenge, there is a critical need to develop low-cost ABG machines that utilize generic chemicals and easily accessible consumables, without compromising the accuracy and reliability of the test results. By creating an affordable and sustainable ABG analysis solution, healthcare providers can enhance patient care and diagnosis while ensuring equitable access to vital medical testing in diverse healthcare settings.

BME06. Enhancing Surgical Capabilities: Creating Affordable and Reliable Operating Theater Equipment for Improved Healthcare Access

The availability of cost-effective operating theater (OT) equipment, including surgical lights and equipment for surgical suction (quattri), remains a substantial concern in healthcare facilities, particularly in regions with limited resources. Existing OT equipment options often come with exorbitant price tags, restricting the ability of healthcare providers to adequately equip and maintain operating rooms. The lack of affordable surgical lights and reliable suction devices hampers surgical procedures, jeopardizes patient safety, and hinders the overall quality of surgical interventions. To address this challenge, there is an urgent need to develop and implement innovative, cost-effective solutions for OT equipment, such as surgical lights and quattri devices, that meet essential performance standards while remaining accessible to a wide range of healthcare settings. By doing so,

healthcare facilities can enhance surgical outcomes, reduce healthcare costs, and ensure safer and more effective surgical procedures for patients.

BME07. Empowering Rural Health Literacy: Developing an Inclusive Digital Platform for Accessible and Understandable Health Information.

Rural populations often face significant barriers in accessing timely and relevant health information due to limited digital infrastructure, low literacy rates, and inadequate resources for understanding complex medical concepts. Existing digital platforms for accessing health information predominantly rely on text-based content, which can be inaccessible and challenging to comprehend for individuals with varying levels of literacy and digital literacy skills. This lack of accessible health information hinders health awareness, preventive measures, and timely decision-making among rural communities, ultimately contributing to suboptimal health outcomes. To bridge this gap, there is a critical need to design and implement a user-friendly digital platform that offers health information in audio and visual formats, incorporating pictures and intuitive navigation. By creating an easily accessible and comprehensible digital resource, rural individuals will be empowered to proactively manage their health, make informed decisions, and enhance their overall well-being, thereby reducing health disparities between urban and rural populations.

BME08. Empowering Low Birth Weight Infants in Electricity-Scarce Regions: Creating Sustainable Solutions for Optimal Care and Survival.

In rural areas lacking access to electricity, the care and survival of low birth weight (LBW) babies pose a significant challenge. These infants are at heightened risk of health complications and require specialized care, often involving incubators, temperature regulation, and medical monitoring. The absence of reliable electricity sources hampers the provision of necessary medical interventions and technologies, leading to increased infant morbidity and mortality rates. Developing an effective and sustainable solution to maintain optimal conditions for LBW babies without electricity is essential to ensure their survival and well-being in resource-constrained rural settings. This problem requires innovative approaches that can provide consistent temperature control, nutritional support, and medical supervision, even in off-grid environments, to safeguard the health and future prospects of these vulnerable newborns.

