THE TECHNOCRACY
STUDENTS' TECHNICAL COMMITTEE, NIT RAIPUR

AAVARTAN'22-23

VIGYAAN
DEPARTMENT OF BIOMEDICAL ENGINEERING

PROBLEM STATEMENTS

BME01. <u>Wireless Telemetry for SpO2 measurement</u>

Wireless medical telemetry is generally used to monitor patient physiological parameters (e.g., cardiac signals) over a distance via radio-frequency (RF) communications between a transmitter worn by the patient and a central monitoring station.Develop Wireless Telemetry for Oxygen Saturation (SpO2) Measurements.

BME02. <u>Stress monitoring using an intelligent system</u>

The selection process of military members undergoing intense training can make use of a personal health monitor to keep an eye on the stress levels of the individual as a part of psychophysiological evaluation in the military. Develop a device for monitoring stress levels using an intelligent system.

BME03. <u>Device to detect air quality inside the cabin and improve it</u>

Typically truck drivers operate for long hours and at times in highly polluted environments like mines. Driver health and alertness while driving is key to avoiding accidents at work sites. Sometimes air quality deteriorates inside the cabin, and this could lead to driver fatigue.Develop a device that can detect the air quality level inside the cabin and improve it, and at the same time alerting the driver as well as fleet management about the vital health characteristics of the driver

like heart rate, oxygen level etc.

BME04. Device for mobile monitoring with wearable photo plethysmographic biosensors

Photoplethysmography (PPG) is a simple and low-cost optical technique that can be used to detect blood volume changes in the microvascular bed of tissue. It is often used non-invasively to make measurements at the skin surface. Develop a device for mobile monitoring with wearable photo plethysmographic biosensors.

BME05. Digitized Microscope

Artificial Intelligence based Deep Learning (DL) is opening new skylines in biomedical examination and vows to alter the microscopy field.Develop a model based on deep learning to push the limits of microscopy, enhancing resolution, signal and information content.(1000x Zoom, f/1.3 (focal length)).

BME06. Light Tissue Interaction

The effects of light tissue interaction determines how far light can penetrate into a specific tissue. Develop a model for light tissue interaction using suitable software.

BME07. Breast Cancer Classification

Develop a Breast cancer classification model using Machine Learning with the help of clinical data and gene expression profiles of the patients.

BME08. Device to detect Microsleep

Microsleep refers to periods of sleep that last from a few to several seconds.It can occur anywhere,such as at work even while driving which makes it a dangerous condition. Develop a system to detect microsleep with the help of biosignals.

BME09. Brain tumor detection

Brain tumors are detected traditionally with the help of MRI.But, with the application of machine learning in healthcare better diagnostic tools are being developed to analyze medical images. Develop a model using ML to detect brain tumors.

BME10. Microfluidic chip for oxygen diffusion from liquid and gases

The oxygen tension, also known as oxygen partial pressure, in the microenvironment has an impact on cellular behaviour and function. The degree of oxygenation is significant because maintaining normoxia requires a balance between the supply and use of oxygen. Develop a microfluidic chip for oxygen diffusion from liquid and gases.

BME11. Defibrillator

Defibrillators available in the market have the user guide in English or Chinese. Construct a defibrillator with a user interface in Indian languages.

BME12. Noise reduction in ultrasound images

Speckle noise is an inherent property of medical ultrasound imaging, and it generally tends to reduce the image resolution and contrast, thereby reducing the diagnostic value of this imaging modality. As a result, speckle noise reduction is an important prerequisite, whenever ultrasound imaging is used for tissue characterization. Develop a method to reduce noise in ultrasound so that images with high contrast and resolution can be produced.

BME13. Glucometer

Diabetes patients must regularly check their blood sugar levels and administer insulin as necessary. The glucometers are currently uncomfortable and invasive. We've seen tools like pulse oximeters, which are easy to use and provide precise measurements for blood oxygen levels (SPO2). Similar to pulse-oximeters, a non-invasive,portable,battery operated and accurate glucometer is highly desirable and has a sizable market.
Develop a glucometer that works on the principle of
(1) Photometry or electrochemical technology to determine the glucose level in the blood
(2) Resistance Calculation

BME14. Next Generation Ventilator

The ventilators available now require a person to monitor the amount of oxygen given to the patient continuously and switch between the percentage of oxygen. Develop a NEXT GENERATION VENTILATOR that automatically switches between 100% oxygen to 80% oxygen to normal air, as per the requirement of the patient and has a user interface in Indian languages.

BME15. Seizure alert system

Create a portable, battery-operated generalized tonic-clonic seizure alert system that may alert carers or family members who are nearby when a seizure occurs via alarms, phone calls, or text

messages, depending on the device.

BME16. <u>Mechanical system to support knee joint</u>

In the majority of older patients, knee replacement is not advised, and pain management is required for life. In order to reduce knee pain caused by stress from body weight, it is preferred that a mechanical system be created to support knee movement and transmit body weight to the shoe. The knee joint's range of motion shouldn't be restricted.

BME17.

Signal processing from sound signal to image formation can be commonly seen in the medical field. Stethoscope is a commonly used medical device that helps doctors to hear lungs and diagnose the patient. Develop a device to convert the sound signal to an image and then process the image.

BME18.

The COVID-19 and it’s potential for harm increased the amount of face masks and medical waste in the environment, making the pandemic urgently preventable and manageable. As adequate medical waste disposal efficiently reduces infection sources, standardization, protocols, guidelines, and strict implementation of medical waste management connected to COVID-19, community habitats, and public spaces should be carefully studied to reduce pandemic risks in hospitals. Develop a device that can convert this medical waste into an environment friendly substance.