Electronics Communication and Instrumentation Engineering

PG-Research & Education Centre Research Laboratory	Room No. B-I-217/A

About the DREC:	The **Department Research and Education Centre (DREC)** Research Laboratory supports advanced research, innovation, and practical learning in various engineering and scientific fields. It provides students, researchers, and faculty members with state-of-the-art laboratory equipment and software to facilitate hands-on experimentation, circuit design, and real-time data analysis. The center fosters a collaborative environment where theoretical knowledge is reinforced through practical applications, making it a vital part of academic and industrial research.

Primary functions of the DREC:	1. **Hands-on Learning & Experimentation** – Provides students with practical experience in electronics, instrumentation, and control systems using tools like NI ELVIS II and LabVIEW. 2. **Research & Development** – Supports faculty and student-led research projects in areas such as embedded systems, signal processing, and automation. 3. **Instrumentation & Testing** – Enables testing, analysis, and validation of electronic circuits and systems using Digital Storage Oscilloscopes and other diagnostic tools. 4. **Software Simulation & Data Acquisition** – Utilizes LabVIEW for graphical programming, real-time data acquisition, and automation in experimental setups. 5. **Skill Development & Training** – Offers workshops and training programs to enhance technical skills in circuit design, signal analysis, and system prototyping. 6. **Collaboration & Innovation** – Encourages interdisciplinary research and partnerships with industries to develop cutting-edge solutions in engineering and technology.

Major equipment available in DREC:

Sl. No.	Name of the Major Equipment	Description of equipment	Cost
1.	NI ELVIS –II Kit with Lab VIEW 8.1 software	8differntial or 16 single ended Sample rate 1.25MS/s single channel, 1.00MS/s multi channel – USB based	1,80,574.00
2.	25 MHZ Digital Storage Oscilloscope	Dual Channel; Bandwidth:25MHz; Sampling Rate:250MSPS; Display Memory Depth:25 kpts; Calculated Rise Time:14ns; Scope Display Type: WQVGA LCD Colour	35,900.00

3.	30 MHZ Dual Channel 4 -Trace CRO	1mV/div Sensitivity on Both Channels CH1 & CH2 Independent Channels.CH1 Signal Output Algebraic Addition and Subtraction, X-Y Operation 20ns/div to 0.2s/div Time Base ALT MAG. Trace - Max. 4 Traces, Scale Illumination Z Modulation 8 x 10 cm Display Internal Graticule Auto Focus TV Triggering Frame (V) & Line (H) Line Trigger ALT Triggering C.T. Facility	86,000.00
4.	Universal µC Programmer	40 pin DIP programmer for EEPROM, FLASH , Microcontroller flash memory burner	72,038.00
5.	ECG monitor(model_ scientific ST2351)	12 lead ECG with 3digits compatible with pc interfacing	10,500.00
6.	Respiration monitor(model_ scientific ST2353)	Separate Test-Points to observe waveforms after each block. User Selectable Tachypne a limit adjuster. On board visual and audible Tachypnea and Apnea indicator. User selectable Apnea period control. On board Respiration event indicator.16x2 LCD display for Respiration-rate. On board threshold control. On board Reset for display and One minute timer reset.User selectable buzzer for abnormality indication.	9,375.00
7.	Heart/Pulse rate monitor (BIOPAC/System) Mp150)	Data acquisition unit: MP150A-CE Universal interface module: UIM100C Ethernet Switch (for user-supplied Ethernet card or adapter): ETHSW1 Transformer: AC150A Cables: CBLETH1 (2) ®Acq Knowledge software CD	12,375.00
8.	3 MHZ Function Generator	Wide Frequency Range Sine, Triangle, Square, Ramp, Pulse, TTL (Sync) & DC Outputs Low Distortion High Resolution on Low Frequency Output Attenuation up to 80Db Variable DC Offset Control Four Digit digital Display with Frequency Indication in Hz, KHz, MHz / Amplitude display	52,500.00
9.	DSP prototyping Board	High performance floating –point digital signal processor (DSP) 150million floating –point operations (MFLOPS) 75 million instructions per second (MIPS) 34k*32 (1.1 M bits)on chip words of dual access static bit integer and 32/40bit floating point operations 32 bit instruction word,24 –bit addresses	89,424.00
10.	FPGA prototyping Board	Xilinx xc 3S500E-4FTG256C,500K system gates 10,476 logic cells, logic family. CMOS Platform flash configuration prom 4M -bit	26,860.00
11.	Embedded module for ARM microcontroller	When referring to an "embedded module for ARM microcontroller," it typically means a compact, integrated module that incorporates an ARM microcontroller along with other essential components. These modules are designed to simplify the integration of ARM-based processing capabilities into various electronic devices and applications.	28,154.00
12.	Desktop Systems	AcerPentium(R)Dual-CoreE6600 @3.06GHz500GB Hard Disk, 2GB RAM	79,500.00

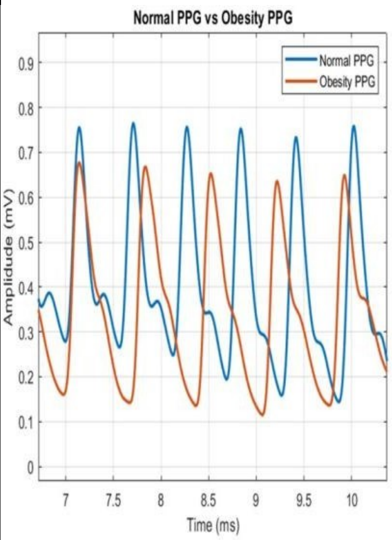
Software available in DREC:

Sl. No.	Name of the Software	Purpose of Software	Cost (in Rs.)
1.	BIOPAC system software	Used To Identify &Record Signals	10,17,035.00

Sl. No.	Name of the Project / Research carried out in the DREC	Outcome of Project / Research carried out
1.	Cardiovascular Disease detection using PPG and ML	Article communicated and Under Review
2.	Prediction of health disordered associated with obesity using PPG SIGNAL	In progress
3.	Extraction of Respiratory rate from PPG signal using ML algortihm	Article communicated and Under Review

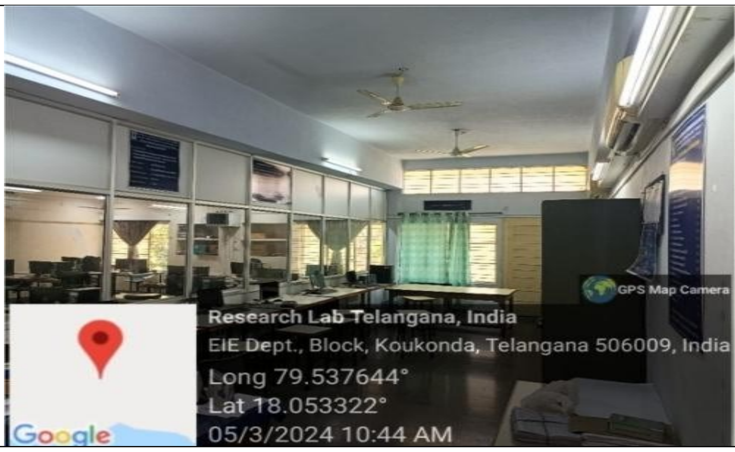
Photographs of working models / application software developed with description:

S. No.	Name of the Working model developed in the DREC	Details of working model developed
		Detecting Cardiovascular Disease (CVD) using Photoplethysmography (PPG) signals and Machine Learning (ML) techniques is an emerging field that shows promise for non-invasive and early detection. PPG is a simple and cost-effective optical technique that measures blood volume changes in the microvascular bed of tissue. ML algorithms can be trained on PPG data to identify patterns and anomalies associated with cardiovascular conditions. Here's a general overview of the process: Steps in Cardiovascular Disease Detection using PPG and ML: Data Collection: Gather PPG data: Use wearable devices, such as smart watches or fitness trackers, equipped with PPG sensors to collect continuous and real-time PPG signals. Include relevant demographic and health information in the dataset, such as age, gender, medical history, and lifestyle factors. Preprocessing: Clean the PPG data: Remove noise, artifacts, or motion-related interference from the raw PPG signals. Segment the data into relevant time intervals for analysis. Feature Extraction: Extract meaningful features from the PPG signals, such as pulse rate, heart rate variability, and characteristics of the PPG waveform. Time-domain and frequency-domain features can be used to capture different aspects of the signal.



Labeling: Annotate the dataset with labels indicating the presence or absence of cardiovascular disease. This can be done based on medical records, diagnostic tests, or other relevant information.
Data Splitting: Divide the dataset into training, validation, and test sets to train and evaluate the ML model.
Model Selection:
Choose an appropriate ML algorithm. Common choices include: Support Vector Machines (SVM)Random Forest Neural Networks Gradient Boosting algorithms Training:
Train the ML model using the labeled training dataset.
The model should learn to distinguish between PPG patterns associated with healthy and diseased individuals.
Validation: Evaluate the model on the validation set to fine-tune hyper parameters and ensure it generalizes well to new data.
Testing: Assess the model's performance on the test set, providing an unbiased estimate of its effectiveness.
Interpretation and Visualization:
Understand which features contribute most to the model's predictions. Visualization techniques can help interpret the model's decision-making process.
Deployment: Integrate the trained model into a user-friendly application or healthcare system for real-time CVD risk assessment.
Monitoring and Updating:
Continuously monitor the model's performance and update it as needed to adapt to changes in the population or technology.
It's crucial to collaborate with healthcare professionals, validate the model on diverse populations, and adhere to ethical and privacy considerations when developing and deploying such systems. Additionally, obtaining regulatory approvals and ensuring the security of health data are important steps in bringing these technologies into clinical practice.

Picture of DREC



Details of Faculty incharge for Research and Education Centre: (Photo, Contact details)

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