



BM 2243 Engineering Project Design

**Design of an Integrated Early Warning System
for Sepsis Detection Using Earlobe-Based
Monitoring**

A.D.U. DEWMINI – D/ENG/23/0160/BM

Bachelor of Science in Engineering Honors

Department of Electrical Electronic and Telecommunication Engineering

Faculty of Engineering

General Sir John Kotelawala Defense University

Sri Lanka

July 2024

Research Proposal Topic

Development of an Integrated Earlobe Device for Early Detection of Sepsis Using Pulse Oximetry and Temperature Sensing

Introduction

The challenge of sepsis in healthcare is a critical issue due to its rapid progression and severe outcomes when not promptly diagnosed and treated. Early detection is crucial for improving patient outcomes, highlighting the importance of innovative medical devices for effective vital sign monitoring. Early detection of physiological changes such as oxygen saturation levels, pulse rate, and body temperature are crucial in initiating timely medical interventions for sepsis, often triggered by infections. Current monitoring methods are cumbersome and lack real-time responsiveness, highlighting the need for a more integrated and user-friendly solution. This project aims to address this need by developing a medical device for early sepsis detection.

This project aims to merge a pulse oximeter and temperature sensor into a wearable device that conveniently clips onto the earlobe. The earlobe's proximity to arterial blood flow ensures precise readings of SpO₂ and pulse rate, while also providing accurate temperature measurements close to core body temperature. This design enables continuous, non-invasive monitoring, playing a pivotal role in early sepsis detection within clinical settings. This device's key features include an ergonomic design and wireless functionality. It incorporates sensors directly into a clip-on earlobe device, prioritizing comfort and ease of use for patients and healthcare providers. Additionally, the separate placement of the alarm system and color-coded display on a nearby table ensures instant alerts for abnormal readings without compromising patient comfort.

Objectives

- 1) Develop a reliable pulse oximeter and temperature sensor integrated into a compact earlobe clip-on device.
- 2) Ensure continuous and non-invasive monitoring of SpO₂, pulse rate, and body temperature.
- 3) Design an alarm system and color-coded display to alert users to abnormal conditions.
- 4) Ensure the system is user-friendly and provides accurate, real-time data.

Methodology

- 1) Integrate a compact, clip-on device for the earlobe combining a pulse oximeter and temperature sensor, prioritizing comfort and accuracy.
- 2) Develop algorithms for real-time data acquisition and processing from sensors, focusing on SpO₂, pulse rate, and body temperature.
- 3) Implement wireless connectivity between the earlobe device and the alarm system and color-coded display, improving user mobility and convenience.
- 4) Design an alarm system with audible alerts and a color-coded display to promptly notify users of abnormal readings, enabling early intervention.
- 5) Conduct testing to validate sensor accuracy and system reliability, ensuring clinical standards for early sepsis detection are met.

Resource Requirements and Availability

Resource requirements	Availability
Hardware -Maxim MAX30102, MLX90614, ESP32	Available
Software tools – Arduino IDE, ESP32 libraries	Available

