**OBJECTIVE 3:** To validate system performance and reliability by conducting thorough testing across various operational scenarios, including real-time updates, alert notifications, and scheduling accuracy, to ensure high functionality and responsiveness.

The objective of this testing is to validate the system's performance and reliability by conducting thorough testing across various operational scenarios that is

Real-time updates; Verify that the system updates the SpO2 value in real-time.

Alert notifications; Test the buzzer and LED indicators to ensure they function correctly during alerts Scheduling accuracy; Verify that the system's scheduling feature functions correctly.

**Components and their purposes**

Arduino board Used to process sensor data and control the system.

MAX30105 particle sensor: Used to measure SpO2 levels.

Liquid crystal display (LCD): Used to display the SpO2 value.

Buzzer: Used to indicate alerts.

LEDs: Used to indicate machine status.

Serial monitor: Used to debug and verify system functionality.

Jumper wires: used for connecting components to the bread board.

System overview

The system is designed to measure oxygen saturation levels (SpO2) using a MAX30105 particle sensor. The sensor is connected to an Arduino board, which processes the data and displays the SpO2 value on a liquid crystal display (LCD). The system also includes a buzzer and LEDs to indicate machine status.

**Procedures**

The tests covered various operational scenarios, starting with "System Initialization" to ensure all components (Arduino, MAX30105 sensor, LCD, buzzer, and LEDs) are correctly connected and the system boots up as expected, verifying the initial states of the display and indicators.

Subsequent tests focus on sensor functionality and accuracy. "Sensor Calibration" verified the sensor's ability to detect a finger, initiate SpO2 measurement, and trigger a calibration alert, confirmed by the LCD message, buzzer, and LED. "SpO2 Measurement" checked the accuracy of SpO2 level readings displayed on the LCD and confirms that the green LED illuminates to indicate a valid measurement.

Finally, the system's alert and real-time capabilities are tested. "Alert Notifications" validates the system's response to a "STOP" command, ensuring the buzzer and blue LED activate, and SpO2 measurement halts. "Real-Time Updates" confirms that the SpO2 value on the LCD is updated dynamically as measurements are taken and that the green LED remains on while a finger is present on the sensor.

Setup and initialization, Initialize the system, ensuring all components are properly connected and configured.

Sensor calibration, verify that the sensor is calibrated correctly and that the system detects calibration due dates.

SpO2 measurement, place a finger on the sensor and verify that the system displays the correct SpO2 value on the LCD.

Alert notifications, Test the buzzer and LED indicators by triggering alerts .

Real-time updates, verify that the system updates the SpO2 value in real-time.

Scheduling accuracy, Verify that the system's scheduling feature (if applicable) functions correctly.

Testing schedule

Testing has been conducted over a period of one month, with regular intervals to ensure thorough testing of all operational scenarios as stated above.