Non-invasive Diabetes Detection System

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Year of Project: 2022 **Budget : 14,000**

Problem Statement

To overcome the discomfort and infection risks of traditional finger-prick glucose monitoring, a non-invasive system is proposed that accurately classifies blood glucose levels without skin penetration, enhancing patient comfort

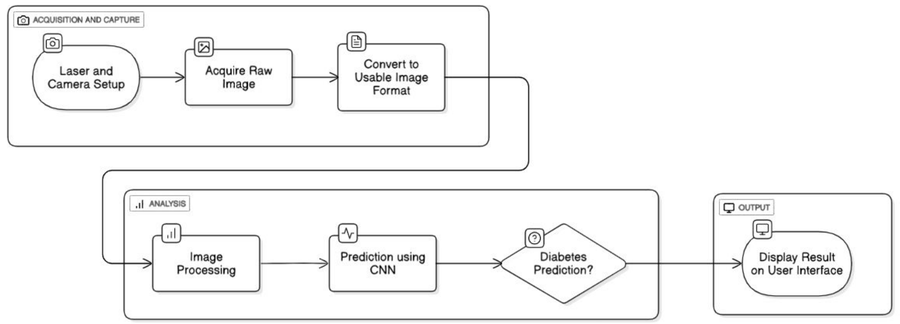
Objective

- To develop a non-invasive diabetes monitoring system that utilizes advanced image processing of laser-illuminated fingertip images and artificial neural networks (Convolutional Neural Networks) to accurately measure blood glucose levels.
- This system aims to provide a reliable alternative for both mass screening of diabetic patients and regular home glucose monitoring, thereby improving the convenience and effectiveness of diabetes management

Drawbacks of Existing System

- **Invasiveness and Pain** - Frequent finger pricks causing discomfort and bruising
- **High Cost and Maintenance** - Expensive test strips, lancets, and ongoing sensor expenses
- **Cross-Contamination Risk** - Potential infection from improper equipment handling
- **Time-Consuming Process** - Multiple steps required for each measurement with waiting periods

Hardware Connection Diagram / Architecture



Implementation / Modules / Results

- **Image Capturing Module**: Raspberry Pi Camera captures high-resolution images of laser-illuminated (675 nm) skin tissue to analyze light absorption patterns related to glucose concentration.
- **Feature Extraction Module**: Raspberry Pi Zero processes captured images using algorithms to extract key features like light intensity variations and absorption patterns for glucose assessment.
- **Prediction Module**: Trained CNN model estimates blood glucose concentration from extracted features, providing diabetes predictions based on real-time image analysis.

Novelty

- **Integration of Low-cost Hardware with Deep Learning**: Combines affordable Raspberry Pi technology with CNN algorithms for accessible non-invasive glucose monitoring.
- **Laser-illuminated Approach**: Utilizes 675 nm laser wavelength with image analysis to detect glucose absorption patterns through skin tissue.

Prototype (image)

Features / Deliverables

- **Portable Non-invasive Device**: Complete hardware system with Raspberry Pi, camera module, and 675 nm laser for painless glucose monitoring without finger pricks.
- **Real-time Glucose Classification**: CNN-based software that processes fingertip images and provides instant glucose level predictions with user-friendly interface.

Outcome (published paper / product / patent / Impact on Society and Industry)

• **Improved Healthcare Accessibility**: Makes glucose monitoring affordable and accessible to low-income diabetic populations by eliminating recurring test strip costs.

• **Enhanced Patient Compliance**: Painless monitoring