

AI-INTEGRATED SMART HEALTHCARE KIOSK FOR VITAL MONITORING AND DIABETIC RISK DETECTION

Problem Statement: Product Category Creation for Healthcare Kiosks in India
(Intel Unnati Submission – July 2025)

Name of the Students: RAHUL BHATT (220051601094), SAKTHI SWETHAA A (220051601099)
MUHAMMAD NAINA AASIF (220051601080)

Name of the Mentor: Dr. S. KALAIVANI, AP (Sel. Gr)/ECE

Institution: BSA Crescent Institute of Science and Technology

Contact: skalaivani@crescent.education; 9600099904

rahulb9340@gmail.com; 8762912191

PROJECT OVERVIEW & VISION

1. Problem Statement

Access to basic healthcare diagnostics remains a challenge for rural and semi-urban areas in India. There is a dire need for affordable, self-service, and AI-enabled solutions that ensure early detection and monitoring of health conditions, reducing the burden on tertiary hospitals and enabling timely interventions.

2. Proposed Solution

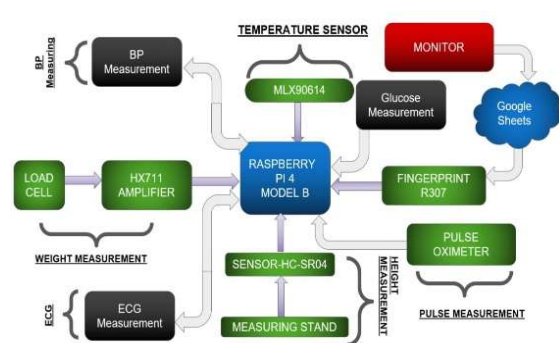
We propose a **smart healthcare kiosk**—a product category that bridges primary health screening and early disease detection at the point of care. *The work has been carried out in two phases*

Phase 1: Development of kiosk

Phase 2: AI based diabetic foot ulcer detection

Our kiosk:

- Collects personal info via **Fingerprint sensor**.
- Acquires **vital signs**: Body temperature, blood pressure, heart rate, SpO₂, (height and weight) BMI, ECG, height, and weight.
- Uses **cloud-based storage** with timestamped, patient-specific data.
- Generates an auto-formatted **health report** accessible via a **mobile app**.



Block Diagram of Proposed Healthcare Kiosk



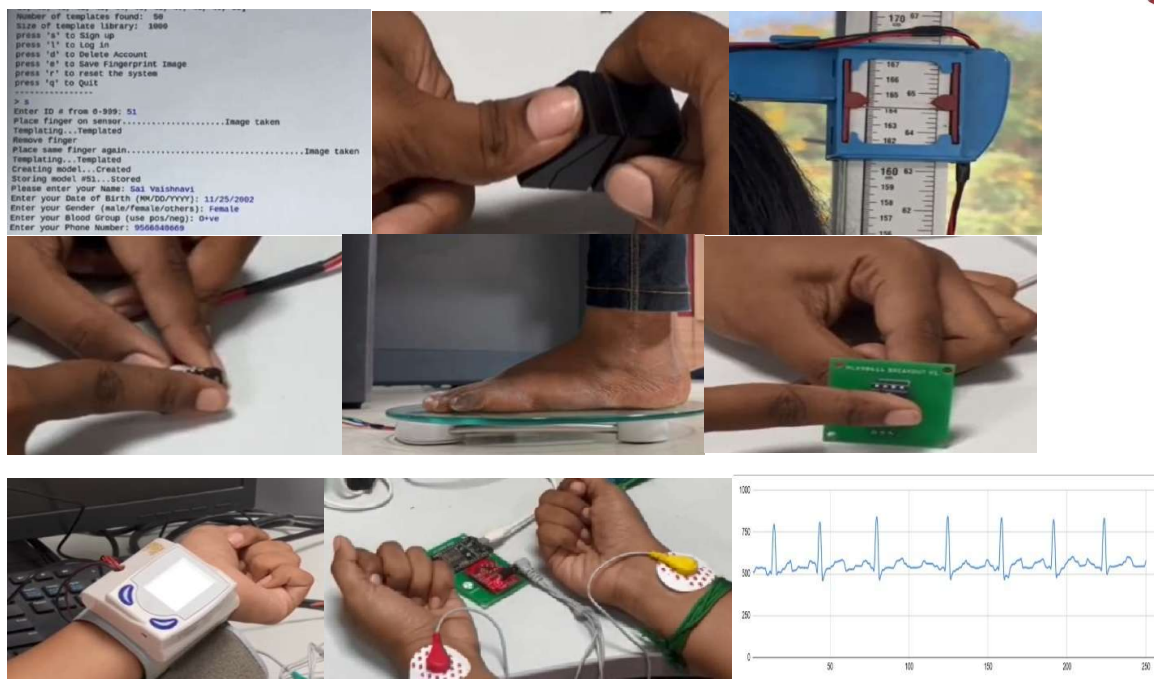
Implementation of Healthcare Kiosk

ANALYSIS REPORT			
Date	7/19/24	TIME	13:56:57
ID	58	GENDER	Female
NAME	Sai Vashnavi S	BLOOD GROUP	O+
DOB	11/25/2002	PHONE NUMBER	9500010009
AGE	21		
DETAILED ANALYSIS			
PARAMETER	NORMAL RANGE	DIAGNOSED DATA	RESULT
TEMPERATURE			
Room Temperature	20-25 Celsius	26.05	-
Body Temperature	98-99 Fahrenheit	98.45	NORMAL
BODY MEASUREMENTS			
Height	-	164.6	-
Weight	-	58.79	-
BMI			
Min value of BMI	18.5	21.0001414	NORMAL
Max value of BMI	25		
PULSE OXIMETRY			
Pulse (BPM)	60-100	99.75	NORMAL
Blood oxygen level (SpO2)	>95	98.17	NORMAL
BLOOD PRESSURE			
Systolic	95-140	112	NORMAL
Diastolic	65-100	86	NORMAL

Analysis Report generated



Mobile App



Personal Data and Vital Parameter acquisition

3. Innovation Extension (Phase 2): AI-Based Diabetes Detection

To enhance diagnostic capabilities, we have integrated a **deep learning model to detect diabetes via thermal foot imaging**, targeting **diabetic foot ulcer** identification—an early sign of neuropathy.

Dataset preprocessing using thermal images taken from the following database.

- <https://www.kaggle.com/datasets/vuppalaadithyasairam/thermography-images-of-diabetic-foot/data> For Validation and Testing
- <https://share.google/kXPUz7BqKpNU2QoRh> For Testing

Total Dataset Breakdown:

- i. Training Set - Control Group: 720 images, DM Group: 724 images, Total (Train): 1,444 images
 - ii. Validation Set- Control Group: 170 images, DM Group: 172 images
 - iii. Test: Control Group: 90 images, DM Group: 93 images
- <https://share.google/RfyWizHMTk3MHfKmd> For Testing with another dataset

Models compared: **MobileNetV2, EfficientNetB0, ResNet50V2.**

TECHNICAL IMPLEMENTATION

1. Hardware Components

Components	Function
Raspberry Pi 4	Central controller & computation
Fingerprint Sensor (Adafruit R307)	Patient authentication and login.
Infrared Temperature Sensor (MLX90614 with ESP8266)	Body and ambient temperature measurement.
Load Cell + HX711	Weight measurement
Ultrasonic Sensor	Height detection
PTI120-9Hz (Thermal Camera)	Diabetic foot imaging
Pulse Oximeter (MAX30102)	Heart rate (BPM) and SpO2
Blood Pressure Module (Serial BP Monitor)	Systolic and diastolic pressure readings.
ECG Module(AD8232)	Serially connected, retrieves and uploads ECG wave data.

2. Software Stack

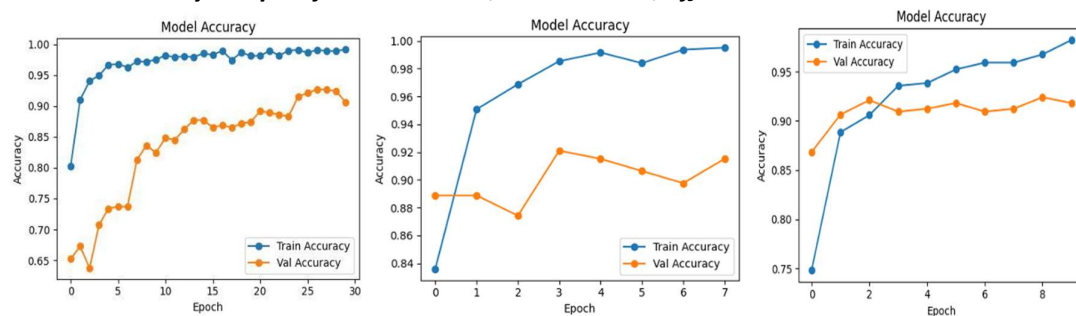
- **Languages:** Python (sensors + AI)
- **ML/AI Tools:** TensorFlow, NumPy, Scikit-learn, Matplotlib, Seaborn, OpenCV
- **Cloud:** Google Sheets API using Google Apps Script for storing patient records automatically.
- **App Stack:** PyCharm

3. AI Model for Diabetes Risk Detection

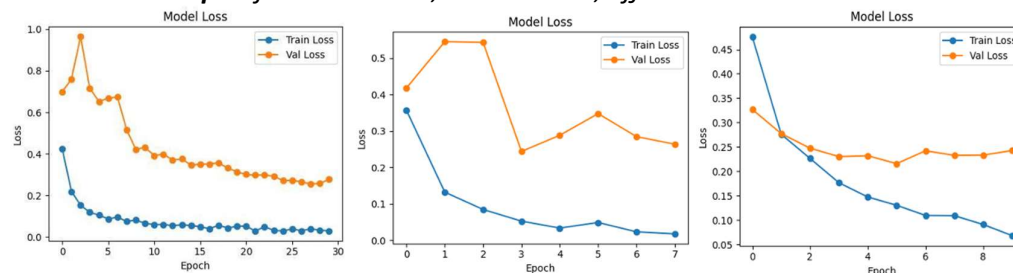
- **Input:** Thermal foot images (infrared format)
- **Goal:** Detect early-stage diabetic foot complications
- **Models Evaluated:** ResNet50V2, EfficientNetB0, MobileNetV2 (*Selected based on accuracy and performance*)

Accuracy Achieved (MobileNetV2): ~95%

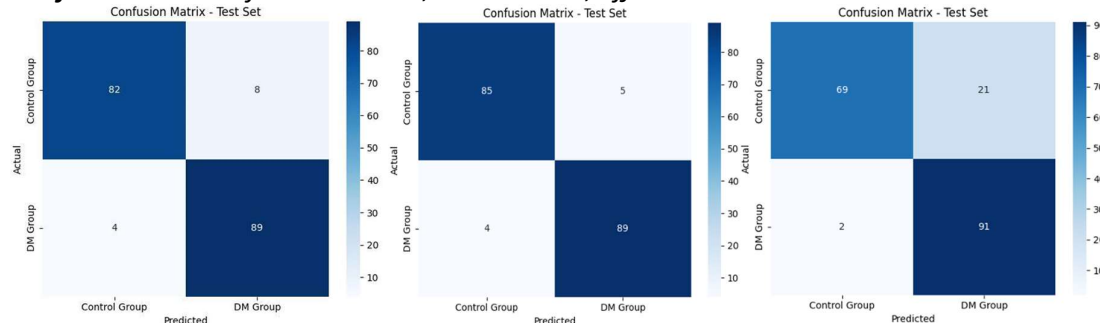
Model Accuracy Graph of MobileNetV2, ResNet50V2, EfficientNetB0:



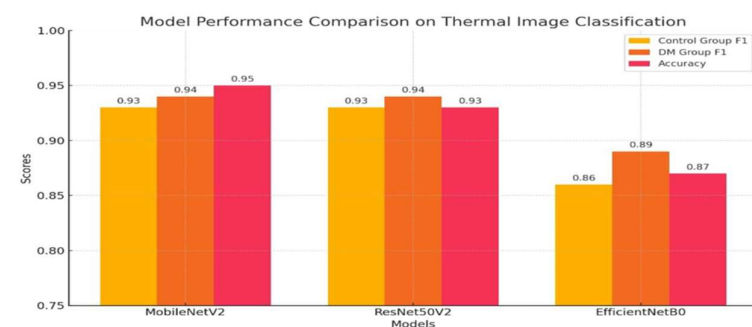
Model Loss Graph of MobileNetV2, ResNet50V2, EfficientNetB0:



Confusion Matrix of MobileNetV2, ResNet50V2, EfficientNetB0:

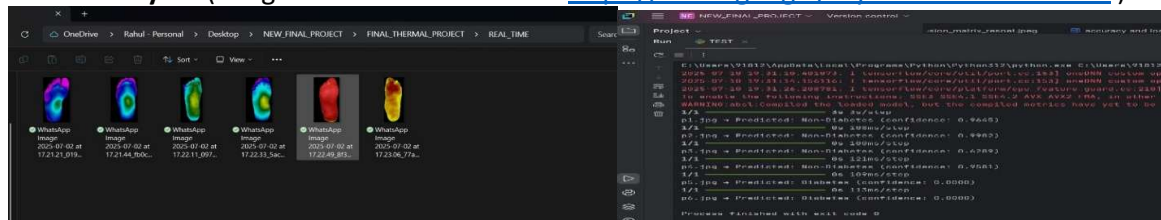


Model Comparison Chart:



- **MobileNetV2 is better than other models with accuracy of 95%**

Result analysis: (images taken from data link: <https://share.google/RfyWizHMTk3MHfKmd>)



SIMULATION RESULT SHOWING DIABETIC AND NON-DIABETIC IMAGES

Real time implementation using thermal camera (AD8232):



SIMULATION RESULT SHOWING DIABETIC AND NON-DIABETIC IMAGES



Result discussion with Dr. Thayalan Kuppusamy, Consultant Medical Physicist Dr. Kamakshi Memorial hospital, Chennai & Former Professor, Madras Medical College

IMPACT, SCALABILITY & ROADMAP

1. Societal Impact

- **Rural Health Empowerment:** No need for specialist presence.
- **Accessible:** Suitable for semi-urban PHCs, community health centers, and camps.
- **Affordable Health Screening:** Costs less for screening.
- **Data-Driven Public Health:** Real-time cloud analytics.

2. Alignment with National Missions

- **Viksit Bharat 2047:** Technology-led governance for wellness.
- **SDG 3 – Good Health and Well-Being:** Focused on universal health coverage.
- **Digital Health Mission:** Aadhaar-linked patient data history & interoperability.

3. Future Roadmap

Timeline	Milestone
July - Sep 2025	Real-time integration of thermal camera with MobileNetV2
Oct - Dec 2025	Edge AI deployment with optimized quantized models
Jan - April 2026	App full release and Pilot deployment in 5 PHCs
May - July 2026	Integration with Ayushman Bharat Digital Mission (ABDM)

CONCLUSION AND FUTURE SCOPE

1. Key features of proposed system

- **Multi-sensor kiosk platform:** Not limited to a single screening function.
- **AI-enhanced diagnosis:** Moves beyond vitals to risk prediction.
- **Offline-Ready:** Data sync when connectivity is restored.
- **Mobile App Support:** For post-screening follow-up and continuity.

2. Future Work

- **Real-time thermal classification on-device** with model quantization.
- **Clinical validation** of foot ulcer detection via AI inference.
- **Expansion to include:** Non-invasive blood glucose estimation and AI analysis for ECG signal patterns.