

REMOTE MONITORING DEVICE FOR DIABETIC FOOT ULCER WOUND HEALING

Group: RM-2

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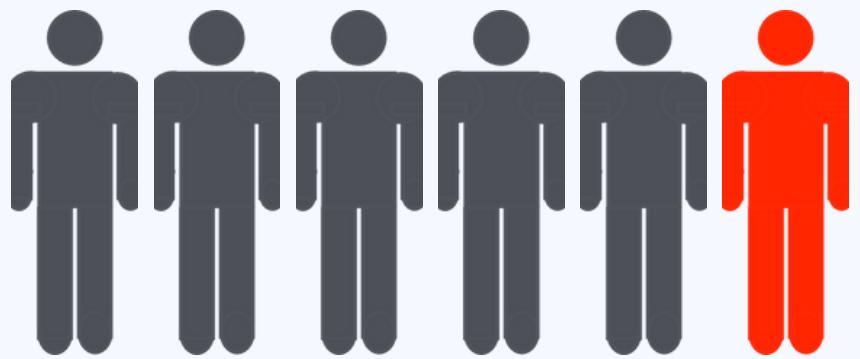
MUSAFA MAMUR AKON

NUR ZULAYFA IDRINA BINTI ZAKIMAN

SALAHUDDIN FATHULLAH BIN SHAHARUM



PROBLEM STATEMENT

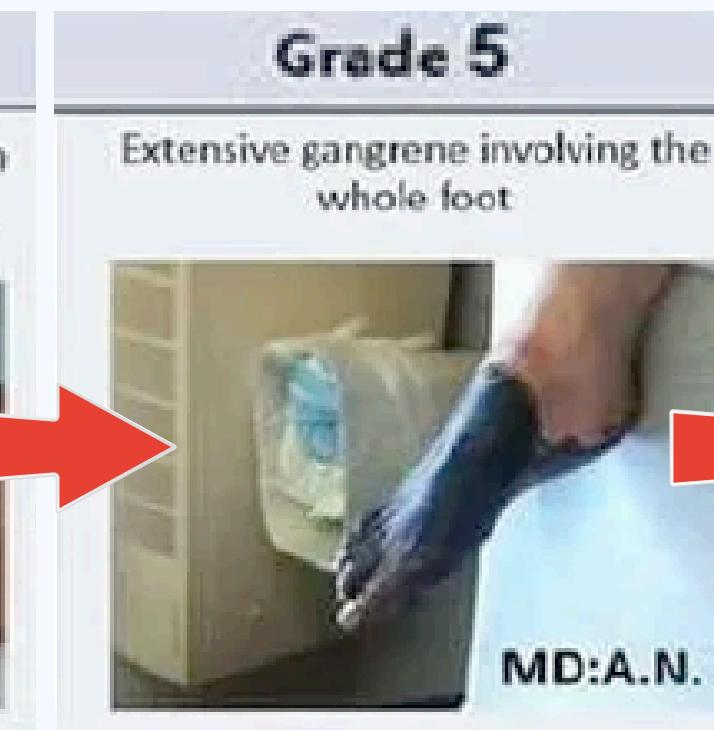
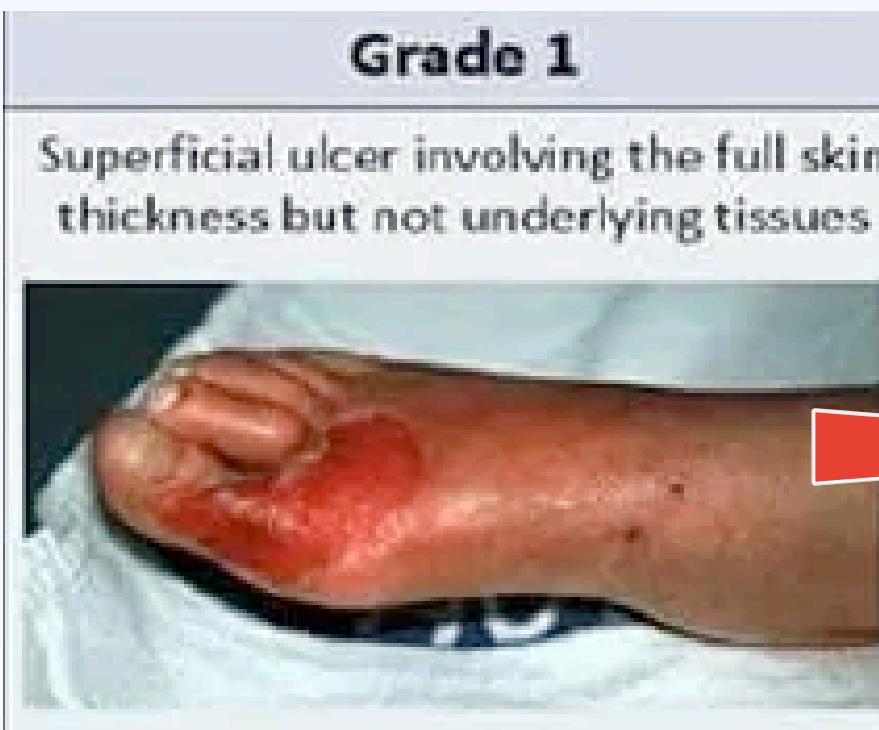


“1 out of 6
Malaysians
are diabetic.”
– NHMS, 2023

“1 out every 10 Malaysian develops
DIABETIC FOOT ULCERS (DFU).”

– 2022 study in International Journal of
Environmental Research and Public Health

This is especially a problem in rural areas...



57% MAJOR LLA
46% MINOR LLA
MORTALITY AFTER 5 YEARS

TARGET USERS/ENVIRONMENT

END PRODUCT AND ECOSYSTEM

- Low-cost device.
- Portable kit.
- Simple to use.
- Supports basic medical process.

SPECIFIC PLACE/APPLICATION

- Rural areas in Sabah and Sarawak.
- For use at home.
- Ulcer condition can be monitored by patients themselves.
- Helps lessen time from clinical visits.

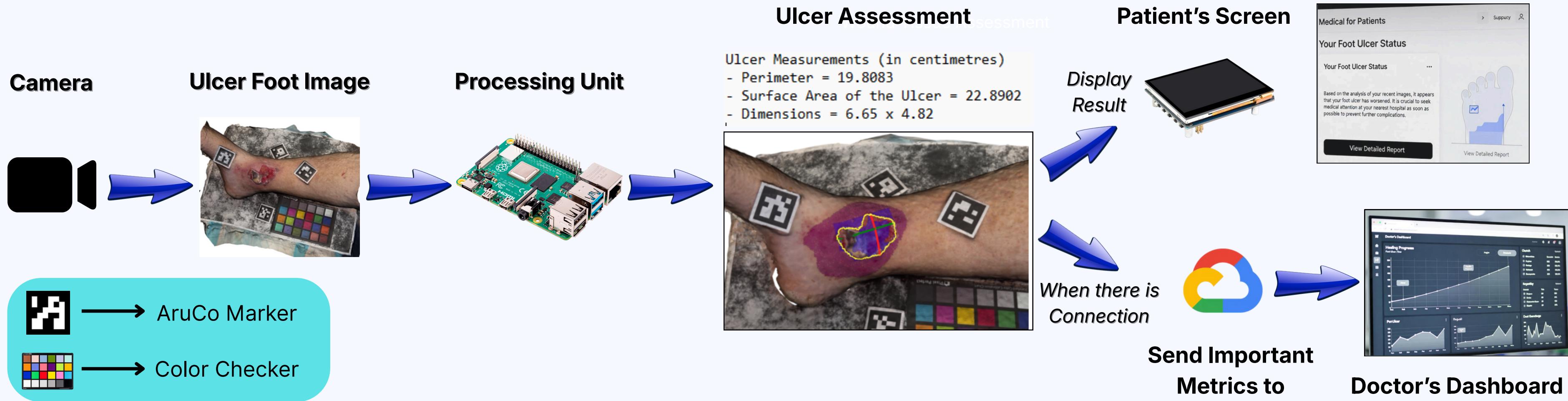
SIZE AND CONDITION OF THE AREA

- Area with unstable internet connection.
- Area with inconsistent electricity supply.
- Areas with enough signal strength to sync intermittently.

TARGET USERS

- Elderly or limited mobility patients with Diabetic Foot Ulcer (DFU).
- Patients with limited access to the clinic.
- Caregivers.
- Clinics and hospitals.

DESIGN CONCEPT: INNOVATION



Why is our solution better?

Problem with Current Solutions

Taking Picture Everyday

Manually sending pictures creates workload for doctors and patients.

Manual photos have no standardisation.

Manual photos depend on internet.

How Our Device Solves The Problems

→ Automatic processing, the doctor only receive useful metrics.

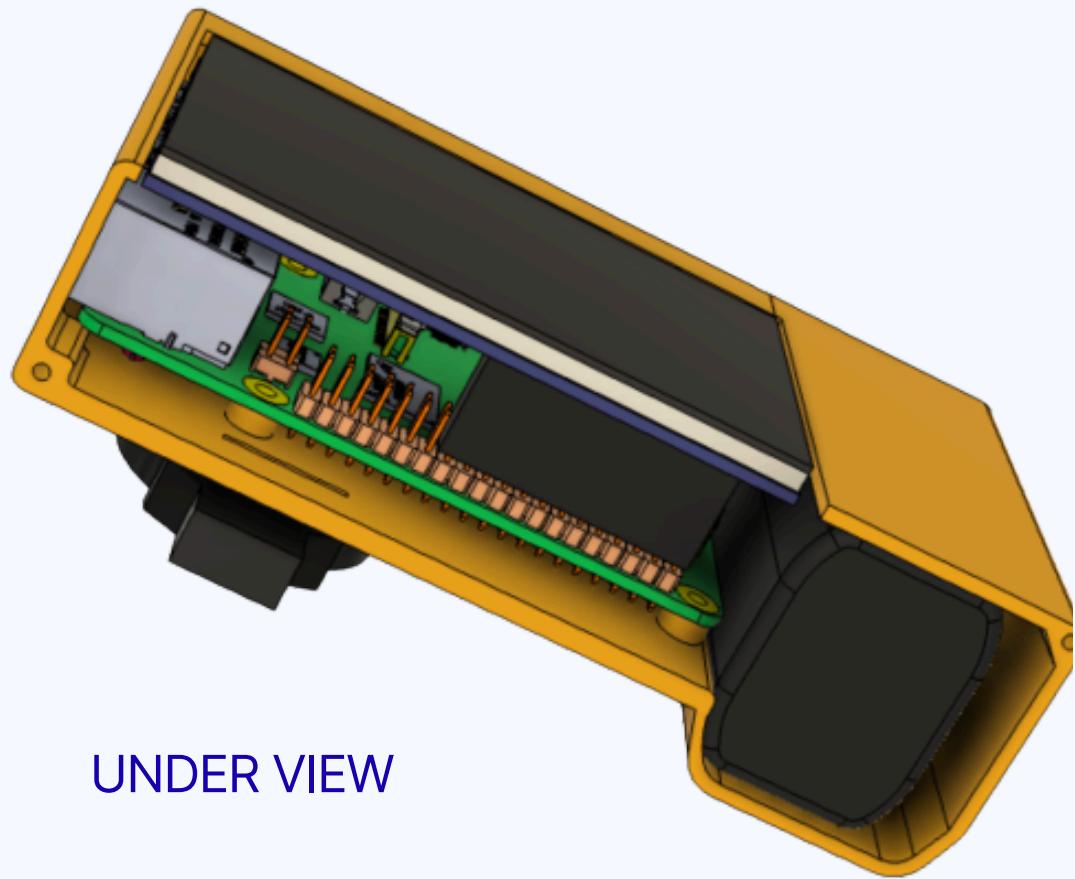
→ Camera distance is guided and lighting is consistent.

→ Device still works even during offline periods.

ELEGANCE OF THE DESIGN



FRONT VIEW



UNDER VIEW

01 USABILITY

Simple Wound Screening Flow

- One button capture
- On-screen instructions and results
- Auto detections of wound region
- No complicated calibration steps

02 DESIGN SIMPLICITY

Compact Hardware

- Lightweight
- Portable

Integrated lighting

- Built-in Ring Light LED
- Ensures consistent image lighting

03 ROBUSTNESS

Works with Poor Connections

- Offline processing first
- Auto-sync when connection comes back

Stable Image Quality

- Auto color correction using Color Board

Consistent Measurements

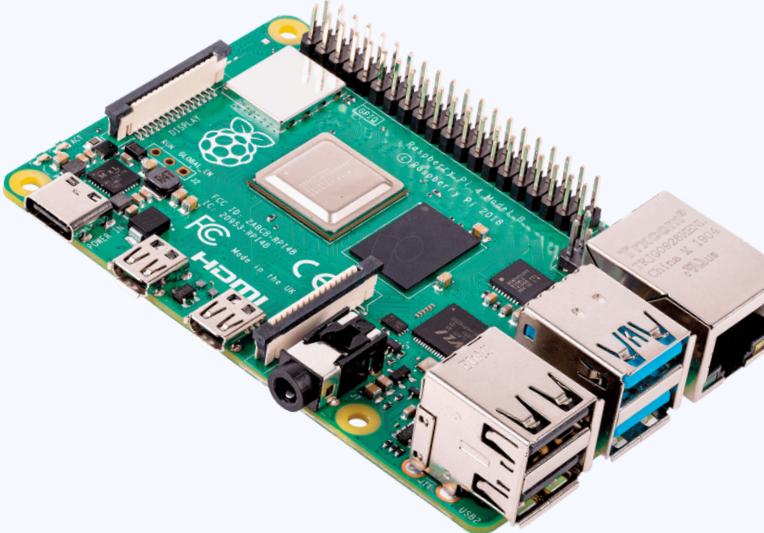
- ArUco marker as reference measurement to measure distance and ulcer area

IMPLEMENTATION STRATEGIES

HARDWARE

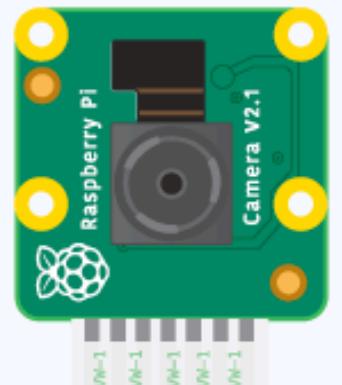
Raspberry Pi as Processing Unit

- Broad hardware availability.
- Strong ecosystem support.
- Native camera interface capability.



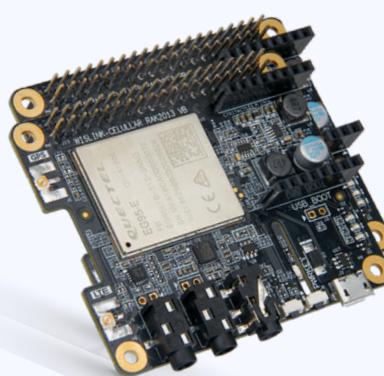
Cellular IoT as Networking Mode

- Operates with poor signal strength.
- Compatible with rural infrastructure.
- Can 'trickle' image data.



Custom Chassis via 3D CAD

- Saves on manufacturing cost.
- Good understanding of dimensions.



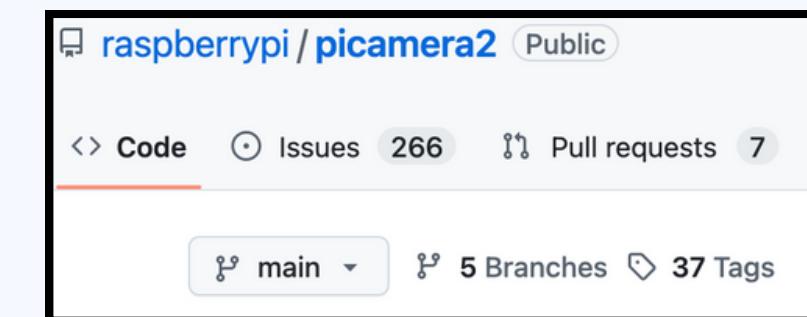
SOFTWARE

Unified Software Stack: Raspberry Pi OS

- Simplifies software development.
- Shared libraries and toolchains.
- Integrated debugging and testing.

Open Source Development

- Free.
- Community support.



Public Training Datasets

- Can be found online.
- Community effort ensures reliability.



Cross-Platform Development

- Windows & Mac support.
- Saves development time.

CHALLENGES

CONSISTENCY ACROSS USERS

- Variability in Wound Appearance

EXTERNAL AND ENVIRONMENTAL INTERFERENCE

- Thermal Management Under Continuous Load
- Camera Calibration & Consistent Imaging
- Reliability in Low-Connectivity Environments

INDUSTRY, MEDICAL, AND ETHICAL STANDARDS

- Cleaning, Sterilisation & IP Ratings
- Integration With Clinical Record Systems
- Need for Clinical Acceptance & Trust

MARKETIBILITY



IMPACT ON INDUSTRY NEEDS

- Improve workflow efficiency
- Expansion of telehealth service
- Meeting unmet market demand
- Align with United Nation Sustainability Development Goal 3

IMPACT ON COMMUNITY NEEDS

- Increase the access to care the patient
- Prevention of severe complication
- Simplified for the caregiver

GLOBAL PRODUCT MARKETIBILITY

- High potential for developing and middle-income countries
- Driving down total cost of care
- Help focus on health equity

PRODUCT MARKETIBILITY IN MALAYSIA

- High diabetes prevalence
- Government led healthcare
- Rural healthcare challenge

ESTIMATED COST PER DEVICE

RASPBERRY
PI 4

RM 250

BATTERY
RM 20

OTHERS
RM 80

CAMERA
MODULE
RM 100

EXTERNAL
SENSOR
RM 50

TOTAL

RM500

PRICING MODEL SUBSCRIPTION

DEPOSIT:
RM 50

MONTHLY FEE:
RM 10

MSRP
RM550

10% PROFIT
MARGIN