Enhancing Healthcare Access: Overcoming South Africa's health limitations

SCHOOL OF MECHANICAL, INDUSTRIAL & AERONAUTICAL ENGINEERING

BACKGROUND

Rural Eastern Cape faces critical healthcare access challenges due to limited facilities and long travel distances. Vulnerable groups, including the elderly, new mothers, and those with chronic conditions, experience delayed treatment, worsening health outcomes, and higher mortality rates. Existing initiatives like mobile clinics have limited impact due to sustainability and coordination issues.

DESIGN REQUIREMENTS

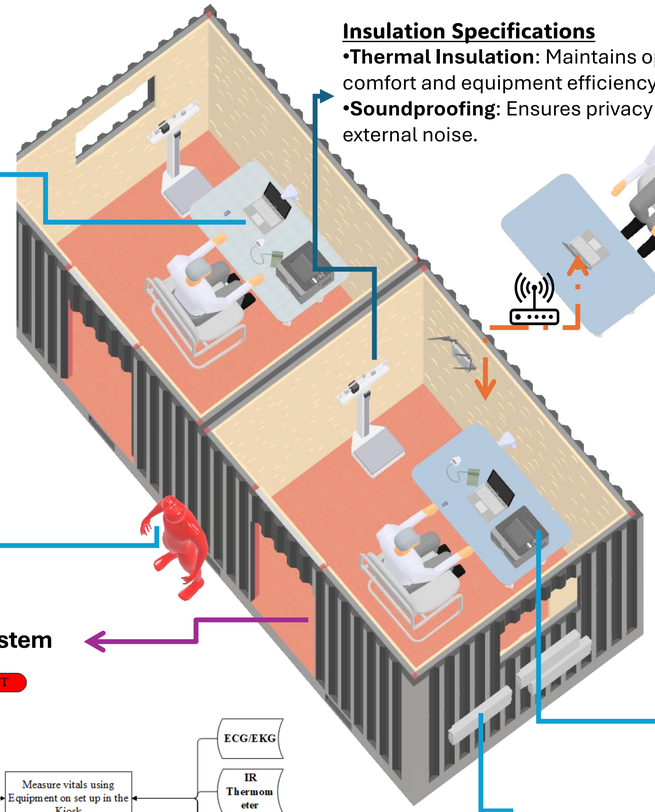
- ❑ **User-Friendly Access:** Simple platform for remote consultations, health monitoring, and digital prescriptions, tailored for rural communities, including elderly users.
- ❑ **Data Security & Integration:** Secure data management with seamless integration into existing healthcare systems and continuity of care through community health workers (CHWs).
- ❑ **Scalability & Connectivity**: Scalable design to accommodate growth, with functionality in low-bandwidth areas and offline capabilities
- ❑ **Cost effective:** the solution should be affordable to implement and use in low-income areas
- ❑ **Compliance**: The system must comply with HPCSA guidelines

SOLUTION

The solution is a modular telehealth kiosk made from repurposed shipping containers, designed to improve healthcare access in rural Eastern Cape communities. It features two consultation rooms with essential medical screening devices (e.g., blood pressure monitors, pulse oximeters, and weight scales) and facilitates remote consultations via a user-friendly interface. Powered by a hybrid solar system, the kiosk is built with durable Corten steel and insulated for climate resilience. Community Health Workers assist patients, and the system operates efficiently in low-bandwidth areas. Costing R61,110 per unit, it offers a scalable, cost-effective alternative to traditional healthcare facilities

Kiosk Equipment:

- Blood Pressure Monitor: BM 27 upper arm BP monitor
- Pulse Oximeter: Beurer Pulse Oximeter PO 30
- Weight Scale: BW-1110H
- Infrared Thermometer: Wall-Mounted Infrared Forehead Thermometer
- Computer: Lenovo V15 G2 ITL
- Laptop Security: Kinston laptop lock K60600WW
- Receipt Printer: EPSON TM-T20II
- Low-bandwidth WIFI operation capability
- 4G LTE with satellite backup
- Secure end-to-end encryption

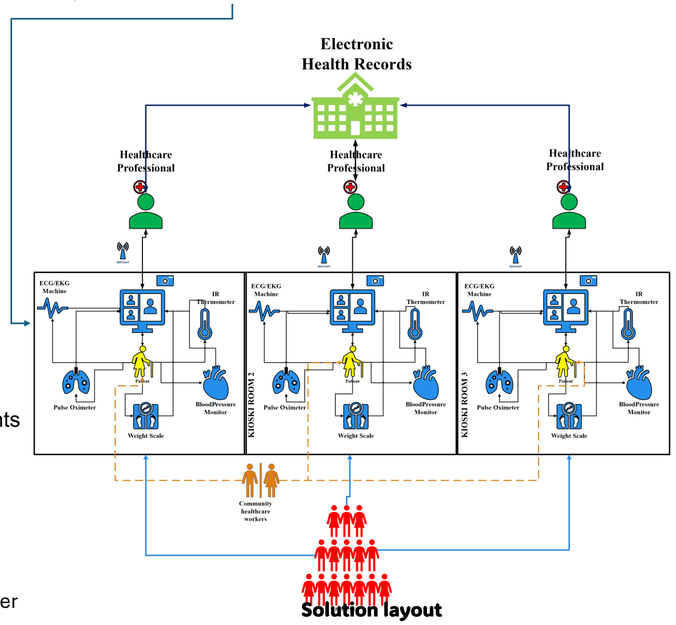


Insulation Specifications

•**Thermal Insulation**: Maintains optimal indoor temperature for patient comfort and equipment efficiency.
•**Soundproofing**: Ensures privacy during consultations by minimizing external noise.

Remote healthcare specialist

- Registered healthcare professional
- Provide virtual consultations
- Prescribe medicine and diagnose patients
- Update patient EHR



Solution layout

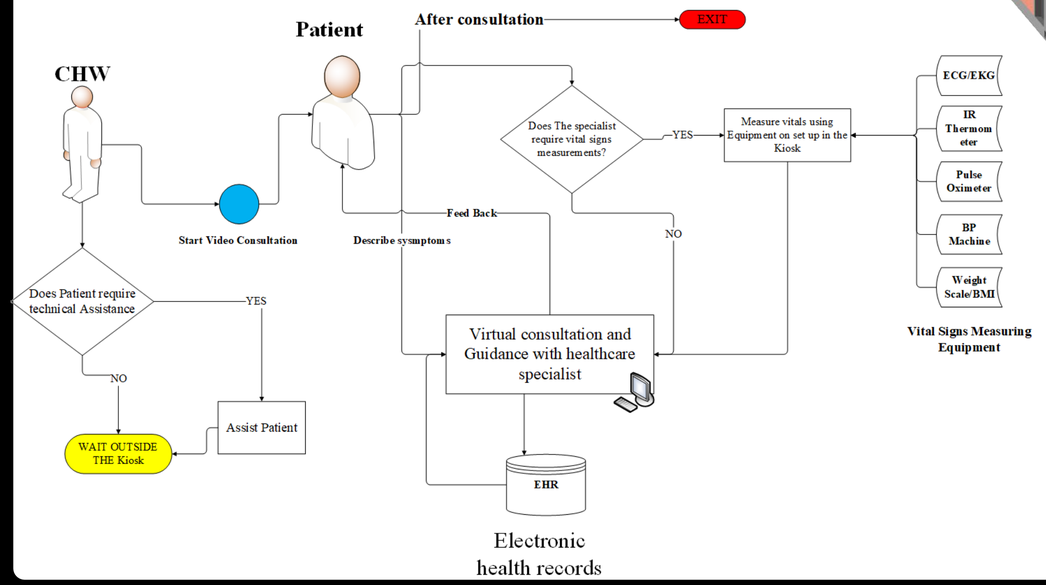
Community healthcare worker

- Assist patient with technical issues
- stand outside for privacy

Structural Specifications:

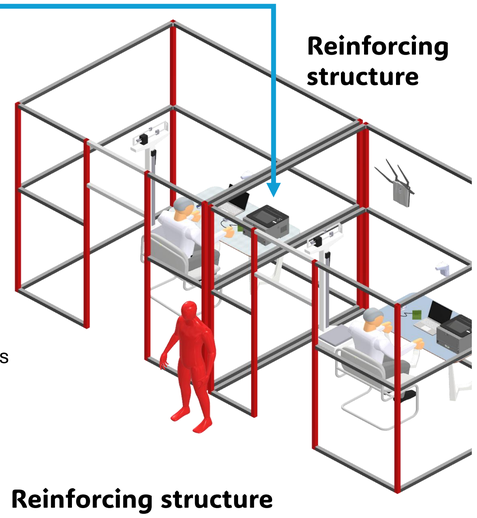
- Container size: 6m x 2.2m
- Consultation room size: 3m x 3m (2 rooms per container)
- Main Material: Corten steel with polyurethane foam insulation
- Galvanised Steel Square: 50 pieces (for reinforcement)
- Features: Aluminium door (2.2m x 0.910m), aluminium window (910mm x 910mm)

User interaction process with proposed system



Power Specifications:

- **Backup Solar Batteries:** Ensure continuous operation during power outages.
- **Dual Power Supply**: Operates on both solar and grid electricity for reliability and flexibility



Reinforcing structure

Design conclusion

The telehealth kiosk successfully fulfils its primary function of increasing healthcare accessibility in rural Eastern Cape through remote consultations and vital sign monitoring. The design effectively integrates off-the-shelf equipment for easy maintenance, industrial-grade Wi-Fi for stable connectivity in low bandwidth areas, and secure systems for valid prescription distribution. While the system demonstrates strong functionality in remote healthcare delivery, some limitations exist, such as the manual blood pressure measurement process and medication collection requirements. Despite these constraints, the kiosk functions as a cost-effective, scalable alternative to traditional healthcare facilities, successfully balancing essential medical services with practical implementation considerations.

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