NEST360

Innovation Technology Landscape

1st Edition, December 2022

Technologies from African Universities
Designed to Solve Local and Global Challenges

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NEST360 is made possible by made possible by generous commitments from the John D. & Catherine T. MacArthur Foundation, the Bill & Melinda Gates Foundation, the Children's Investment Fund Foundation, The ELMA Philanthropies, The Lemelson Foundation, the Sall Family Foundation, the Ting Tsung and Wei Fong Chao Foundation, and individual donors to NEST360.

This report was prepared by Rebecca Kirby from Northwestern University in collaboration with the NEST360 invention education teams at Addis Ababa University, the Dar es Salaam Institute of Technology, the Malawi University of Business and Applied Sciences, the Malawi University of Science and Technology, the University of Ibadan, and the University of Lagos. Padraic Casserly, Esalee Andrade-Guerrero, Ashley Taylor, and Jennifer Werdenberg from Rice University also contributed to this report. This report was inspired by the Newborn Technology Landscape Report developed by Rebecca Kirby and Kara Palamountain from Northwestern University and through discussions with Rebecca Kirby, Kara Palamountain, and Ashley Taylor. All reasonable precautions have been taken by the author to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the authors be liable for damages arising from its use.

If you would like to reference this document, please use the following citation:
Kirby, R., Taylor, A., and Casserly, P. (2022). *Innovation Technology Landscape: Technologies from African Universities Designed to Solve Local and Global Challenges: 1st Edition Technical Report*. NEST360: Retrieved from www.nest360.org/resources.

Executive Summary

In partnership with African universities, NEST360 is building an ecosystem of innovators to create the next generation of technologies to support newborn care and other global health needs.

NEST360's Invention Education program enables students and faculty to improve healthcare by developing and delivering inventions that solve local and global challenges through international collaboration among universities, industries, hospitals, and non-profit organizations.

The Innovation Landscape serves as a resource to feature the impressive work of innovators working to design solutions to address real-world challenges. The ideas featured are designed for resource-limited settings by innovators who are on the ground and working in these settings.

Invention education challenges inventors at partnering universities to collaboratively develop innovative solutions to pressing global health challenges, ultimately improving health equity around the world. These solutions address real-world problems within the inventors' communities. Each university shares knowledge and best practices around invention education curriculum, infrastructure, stakeholders, and tools to rapidly prototype solutions.

The invention education model consists of four key elements, all underpinned by a supportive network of collaborators:

1. Design studios (maker spaces), where innovators have access to hands-on prototyping tools and training.
2. Curricular reform led by faculty champions to incorporate active learning and design education in university courses.
3. Endorsement and support from university administrators.
4. A connected local innovation ecosystem, where innovation challenges are sourced from local community partners, such as hospitals, industries, and non-profits.

Pictured above: 'Supportive Africa Invention Education Network' model

Introduction to Invention Education

Invention education (IvE) provides a powerful transdisciplinary approach to inspire and empower innovators of the future.

Invention Education improves lives through invention by establishing an ecosystem that fosters technical innovation, improves health, and reduces poverty. Together, the Malawi University of Business and Applied Science (MUBAS, formerly the University of Malawi, the Polytechnic), the Malawi University of Science and Technology (MUST), the Dar es Salaam Institute of Technology (DIT), Rice University (Rice), and most recently, the University of Ibadan (UI), the University of Lagos (UNILAG), and Addis Ababa University (AAU) have collaborated to develop a scalable model and network of collaborators for invention education that empowers innovators to address pressing local and global challenges.

Key elements of the invention education model are design studios, curricular reform, administrative buy-in, a supportive local innovation ecosystem, and a supportive Africa IvE Network:

Design Studios

In the invention education model, design studios engage student teams in project-based learning focused on solving real-world problems identified by clinical and industry collaborators. Across universities in the Africa IvE Network, design studios are integrated with curriculum (e.g., course projects) and co-curricular activities (e.g., design competitions).

Curricular Reform Led By Faculty Champions

Faculty champions drive curricular change in the invention education model. Faculty leverage active learning approaches and incorporate the design studios into their curriculum. Therefore, an important element of the invention education model is faculty support- resources, trainings, and institutionalized incentives for faculty to lead curricular reform through pedagogical training and faculty development initiatives.

Administrator Endorsement

In order to build and sustain a supportive environment for invention education, garnering support from university administration is critical. Identifying and cultivating alignment of goals for invention education from institutional decision-makers is necessary to institutionalize invention education.

Supportive Local Innovation Ecosystem

Connecting invention education initiatives to a supportive network of local innovation ecosystem partners is vital for scaling and sustaining the invention education model. Local innovation ecosystem partners support invention education by contributing project ideas and bridging connections between faculty and students and the broader ecosystem through engagement in curricular and co-curricular activities. Additionally, increasing connectedness between universities and the innovation ecosystem provides opportunities for faculty to pursue technology commercialization. Ultimately, by connecting university invention education programs with the local innovation ecosystem, the invention education model leads to expanded employment opportunities for graduating students, along with expanded opportunities for technology design, transfer, and commercialization support to both students and faculty.

Supportive Africa IvE Network

The multi-institutional network of invention education champions serves as the connecting element and driving force of the IvE model. Through the network, faculty and representatives from the innovation sector collaborate to share knowledge and experiences through faculty exchanges, student internship exchanges, international design competitions, and most recently, the development of the Invention Education (IvE) Toolkit, an active platform for sharing knowledge and experiences to support implementation of invention education in sub-Saharan Africa. The network is united in a vision to leverage invention education to transform engineering education and to position students and faculty to solve local and global challenges.

Methodology

The Innovation Technology Landscape was gathered by NEST360. The material in the landscape report was gathered from innovators from the NEST360 Africa Invention Education Partners:

1. AAiT Design Studio (Addis Ababa, Ethiopia)
2. MUST Design Studio (Limbe, Malawi)
3. MUBAS Design Studio (Blantyre, Malawi)
4. UI Design Studio (Ibadan, Nigeria)
5. UNILAG Design Studio (Lagos, Nigeria)
6. DIT Design Studio (Dar es Salaam, Tanzania)

All information included in the report is self-disclosed and directly provided by the innovators or their institutions.

This document provides visibility to the innovations featured and connects innovators with potential funders, partners, and collaborators.

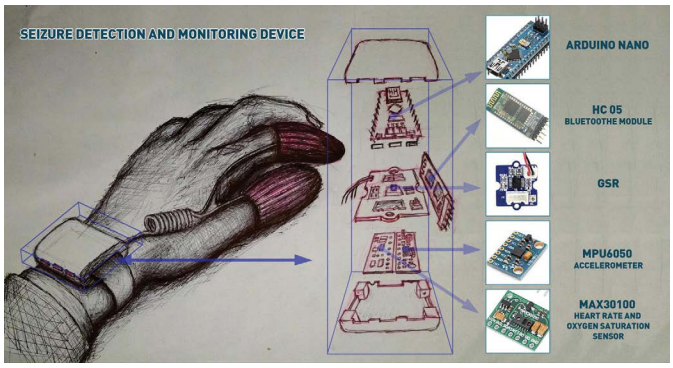
Innovations from Ethiopia

1. AAiT DESIGN STUDIO

Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

Seizure detection and monitoring device

Biomedical Students Union – AAiT



Health Issue Addressed:

Epilepsy is characterized as a chronic neurological disorder leading to recurrent seizures, manifesting as events involving convulsions of a part (partial) or complete body (generalized). The gold standard method for detection of epileptic seizures is video-electroencephalography monitoring. However, these approaches are limited mainly to the hospital setting and require video/EEG analysis by experts, which is resource- and labor-intensive. Alternatively, we aim to develop a wrist-worn epilepsy monitoring system that detects seizures wirelessly. The ability to alert caretakers of seizures would reduce the anxiety that persons with epilepsy can experience due to the helplessness that seizures can lead to. Also, it could potentially reduce the risk of sudden unexpected death in epilepsy patients.

Innovation Overview:

The Seizure detection device uses physiological signals that are expressed by epileptic patients during the prodromal phase of a seizure attack. Based on skin conductance, heart rate, oxygen saturation, and sense movement, this paper proposes a prototype for real-time epilepsy seizures detection.

Through Bluetooth, the prototype is connected to the mobile application and can be worn like watches by epilepsy patients. Our algorithm detects simple and complex partial seizures as well as generalized tonic-clonic seizures. Algorithms are developed by a combination of sensors. The algorithm will be manually tested using an epilepsy simulation model. Using sliders on the app, we can manually adjust all the required parameters. The algorithm then receives the set value. The algorithm then processes these values to detect epilepsy. Epilepsy patients will benefit from this proposed work by receiving immediate help from those around them when seizures occur.

Seizure detection and monitoring device

Team member(s)	**Mary Seifu** **Ferdows Kemal** **Helina Fekadesilassie**
Advisor(s)	**Robele Gemechu** **Surafel Tehulu** **Belayneh Mamush**
Organization	**Biomedical Students Union**
Academic affiliate	**AAiT Design Studio** **Addis Ababa, Ethiopia**
Technology name	**Seizure detection and monitoring device**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Epilepsy**
Level of the healthcare system innovation is inteded for	**Secondary**

Contact Information:

AAiT Design Studio

Mary Seifu

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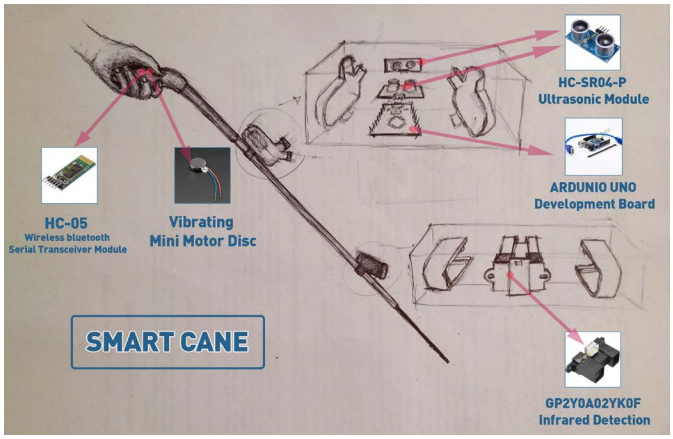
Smart Cane

Biomedical Students Union – AAiT



Health Issue Addressed:

Visual impairment affects the day to day life of individuals to a great extent. In addition to walking, which presents a number of different obstacles, they have to handle daily routine tasks with precision. In general, persons with blindness use white canes as support tools, enabling them to avoid obstacles. In order for white canes to function effectively, however, objects must be touched physically and approaching objects cannot be recognized. In addition, in most cases existing white canes require assistance from another person. The challenge is to design white canes that are both supportive and smart in nature to offer more accurate and timelier predictions to avoid obstacles above the waist and on the ground.

Innovation Overview:

For the prototype smart cane, a simple design leveraging ultrasonic and IR sensors was utilized to enable obstacles detection along with vibrotactile and audio feedback. A pair of ultrasonic sensors are placed so the range of sensors covers the left and right fronts of the user and ground-level up to head level. Meanwhile the IR sensor detects uneven surfaces, such as holes and stairs. By combining ultrasonic and infrared technology, we are able to take advantage of the best properties of both kinds of sensors. In contrast to the infrared sensor, which cannot intercept glass or mirror, the ultrasonic sensor can intercept any surface.

On the contrary the infrared sensor has the ability to detect smaller spots compared to the ultrasonic sensor. That gives the possibility to intercept better the position of an obstacle. Through Bluetooth, the prototype is connected to the mobile application which integrates a voice recognition system to the design. It allows the user to speak commands to the cane or be notified when an object is detected. Combining all these features in our proposed smart cane makes the daily life of the visually impaired much easier.

Smart Cane

Team member(s)	**Ramlla Akmel** **Saron Fasil**
Advisor(s)	**Robele Gemechu** **Surafel Tehulu** **Belayneh Mamush**
Organization	**Biomedical Students Union**
Academic affiliate	**AAiT Design Studio** **Addis Ababa, Ethiopia**
Technology name	**Smart Cane**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Walking assistance for the visually impaired**
Level of the healthcare system innovation is inteded for	**Secondary**

Contact Information:

AAiT Design Studio

Ramlla Akmel

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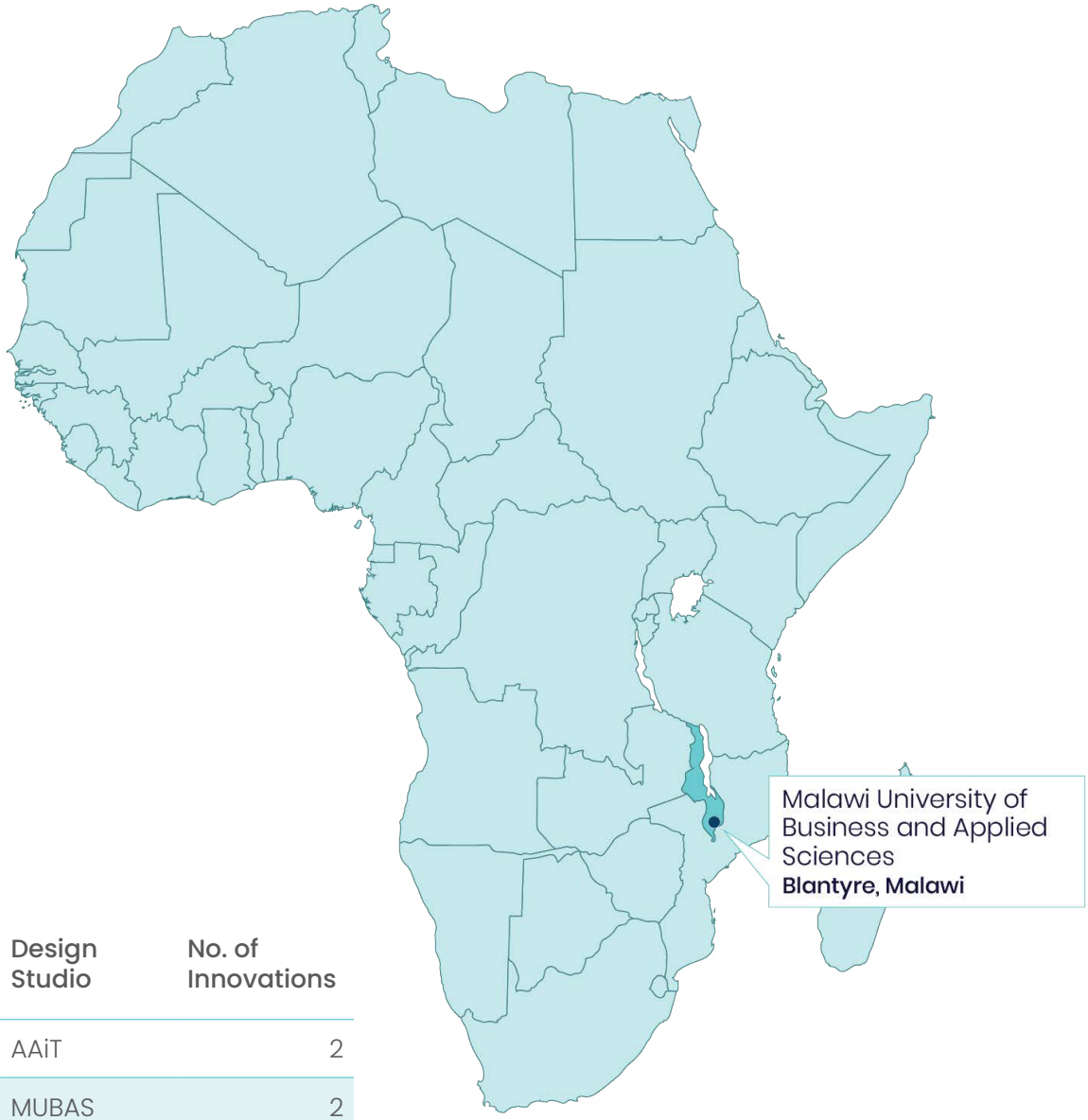
Innovations from Malawi

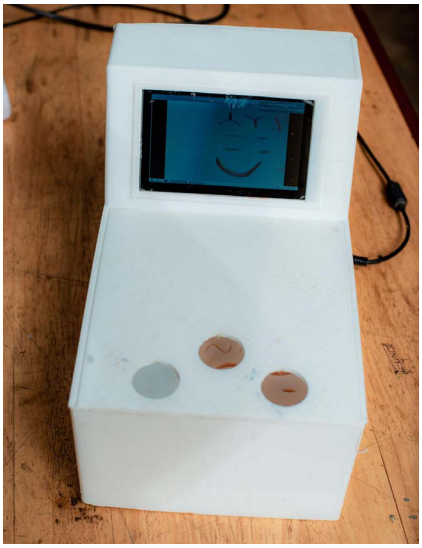
2. MUBAS DESIGN STUDIO



Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

Training Kit for Laparoscopic Surgery

MUBAS Design Studio



Health Issue Addressed:

High cost and limited accessibility of laparoscopic training kits pose a major barrier for medical students and professionals in low resource settings to learn basic laparoscopic skills that are a vital component of surgical education. This innovation aims to address that challenge.

Innovation Overview:

This innovation is a low-cost novel training kit for laparoscopic surgery. The solution is comprised of a benchtop box and graspers kit, which leverages machine learning and artificial intelligence to collect and analyze user performance data in order to support autonomous assessment of training outcomes.

The device provides trainees with a two-dimensional spatial learning platform where important laparoscopic skills such as dissection, cutting, suturing and knot-tying can be practised.

Training Kit for Laparoscopic Surgery

Organization	**Malawi University of Business and Applied Sciences**
Academic affiliate	**MUBAS Design Studio Blantyre, Malawi**
Technology name	**Training Kit for Laparoscopic Surgery**
Development status	**Alpha prototype**
Health care issue innovation addresses	**High cost and limited accessibility of laparoscopic training kits**
Level of the healthcare system innovation is inteded for	**Primary**

Contact Information:

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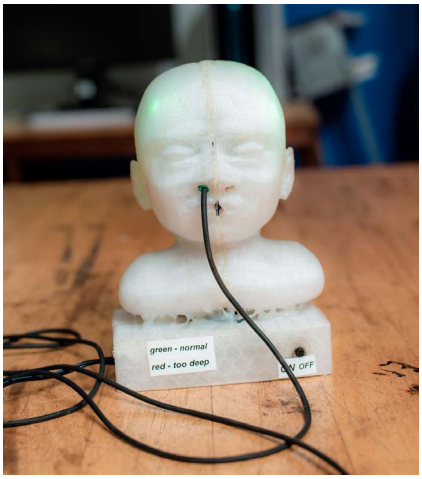
Training Kit for Nasopharyngeal and Oropharyngeal Suctioning in Newborns



MUBAS Design Studio

Health Issue Addressed:

This innovation is addressing the problem of high cost and limited accessibility of commercial airway suction training kits in low-resource settings to allow medical students and paramedics to easily practice oral and nasal intubation, as well as various suction techniques.

Innovation Overview:

This innovation is a low-cost training kit for demonstration of suctioning procedure via the oral and nasal routes in newborns in order to remove secretions in the airway.

The training kit is a human head model with realistic anatomic structure in both size and detail powered by electronics to provide trainees with step-by-step guidelines and real-time alerts.

Training Kit for Nasopharyngeal and Oropharyngeal Suctioning in Newborns

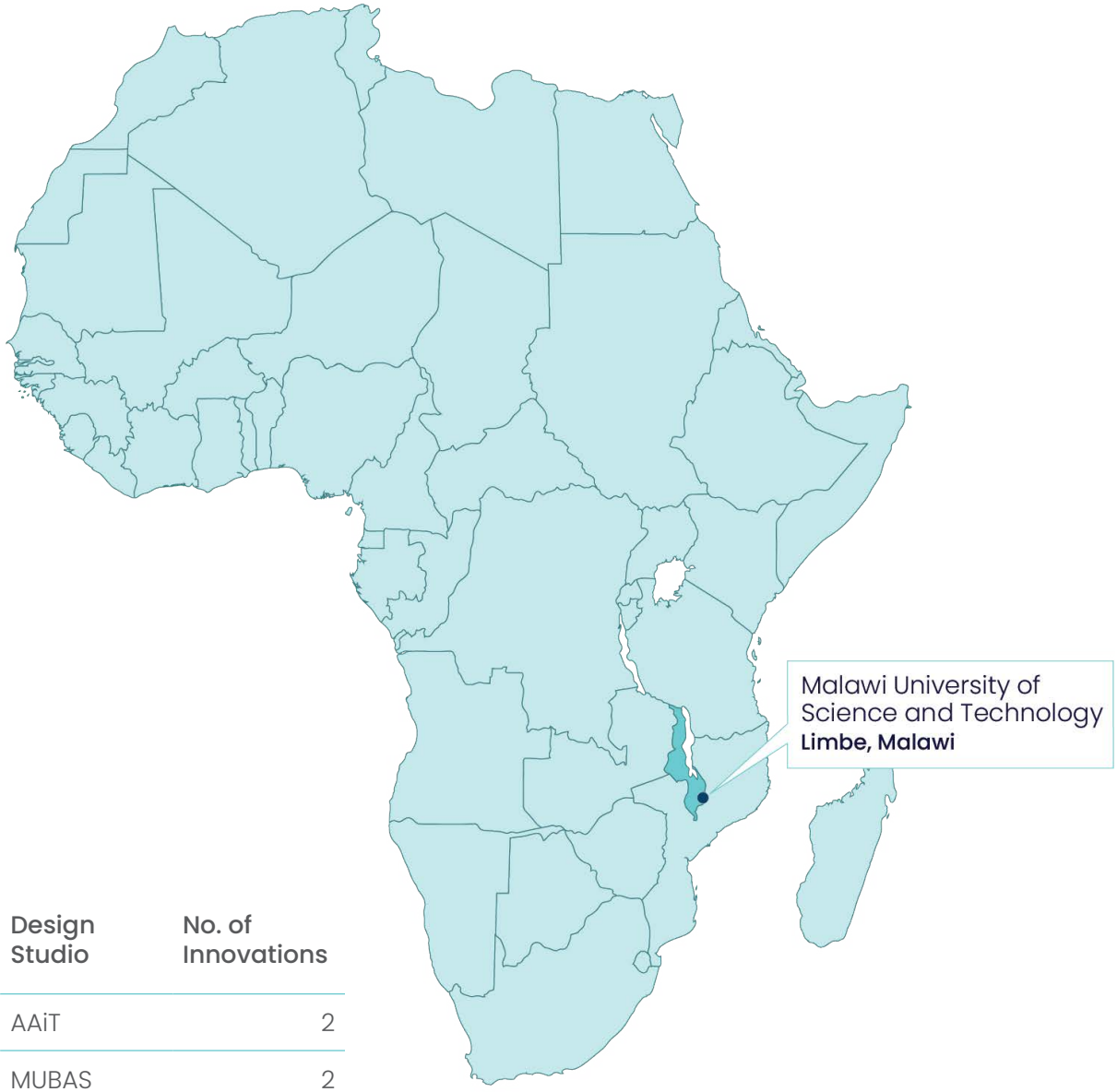
Organization	**Malawi University of Business and Applied Sciences**
Academic affiliate	**MUBAS Design Studio Blantyre, Malawi**
Technology name	**Training Kit for Nasopharyngeal and Oropharyngeal Suctioning in Newborns**
Development status	**Alpha prototype**
Health care issue innovation addresses	**High cost and limited accessibility of commercial airway suction training kits**
Level of the healthcare system innovation is inteded for	**Primary**

Contact Information:

Hillary Lodzanyama

hlodzanyama@mubas.ac.mw

3. MUST DESIGN STUDIO



Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

IoT Based Infant Monitoring System

MUST Design Studio

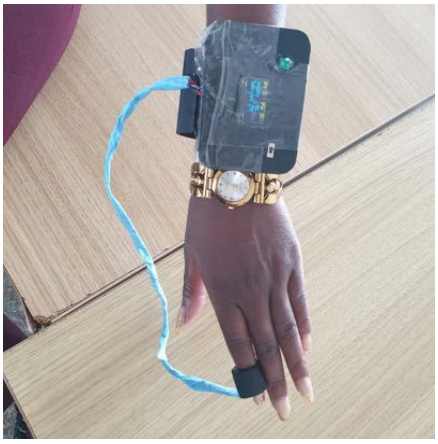
Health Issue Addressed:

The project seeks to address challenges of overcrowding in the under-five clinical facilities in Malawi. Infants with non-critical clinical conditions can be treated as outpatients and thereafter monitored remotely by the medical staff using the app. This will allow doctors to communicate with the parents at any time.

In addition, the project also seeks to improve a family's ability to monitor the child more closely at home. Family members can be in reach of infants that are being monitored more freely as compared to if they had been admitted. It will also allow parents and guardians to be productive in their daily activities yet still be aware of the infant's real time status.

Innovation Overview:

This innovation is an Internet of Things (IoT) Based Infant Monitoring System designed to monitor infant vitals, including temperature, heart rate, and oxygen saturation. The wearable device is meant to monitor the named parameters of a newborn and provide real-time data to the parents and/or guardians through a mobile application. The recorded data is uploaded from the device to a cloud storage which is linked to the application.



IoT Based Infant Monitoring System

Team member(s)	**Nelson Mwenifumbo** **Ethel Phiri** **Chucks Mlowa**
Advisor(s)	**Richard Chilipa**
Academic affiliate	**Malawi University of Science and Technology**
Technology name	**IoT Based Infant Monitoring System**
University / design lab	**MUST Design Studio** **Limbe, Malawi**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Challenges of overcrowding in the under-five clinical facilities in Malawi**
Healthcare system level	**Primary**

Contact Information:

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Low-Cost Ultra-Violet Disinfection System for N95 Masks

MUST Design Studio

Health Issue Addressed:

With increased global attention to appropriate infection prevention control spurred by COVID-19, addressing global demands for PPE in innovative ways is critical. This innovation seeks to reduce the burden on the demand and supply by disinfecting the N95 masks so that they can be reused.

Innovation Overview:

The low-cost UV disinfection system for sterilizing N95 masks utilizes UV rays with 254nm wavelength to carry out the disinfection. It is able to sterilize up to eight masks in a cycle with at least 95% efficiency at 180s exposure time. The system has autonomous mechanisms in place that ensure safe operation due to the dangerous nature of UV Rays.

Low-Cost Ultra-Violet Disinfection System for N95 Masks in Low-Resource Settings

Team member(s)	**Hannah Chirambo** **Rhonnex Msomali** **Effa Solomon** **Madalo Lapken**
Advisor(s)	**Dumisani Namakhwa** **Mayamiko Msonkho**
Academic affiliate	**Malawi University of Science and Technology**
Technology name	**Low-Cost Ultra-Violet Disinfection System for N95 Masks in Low-Resource Settings**
University / design lab	**MUST Design Studio** **Limbe, Malawi**
Development status	**Beta prototype**
Health care issue innovation addresses	**Reduce the burden on the demand and supply of N95 masks via disinfection**
Healthcare system level	**Primary**

Contact Information:

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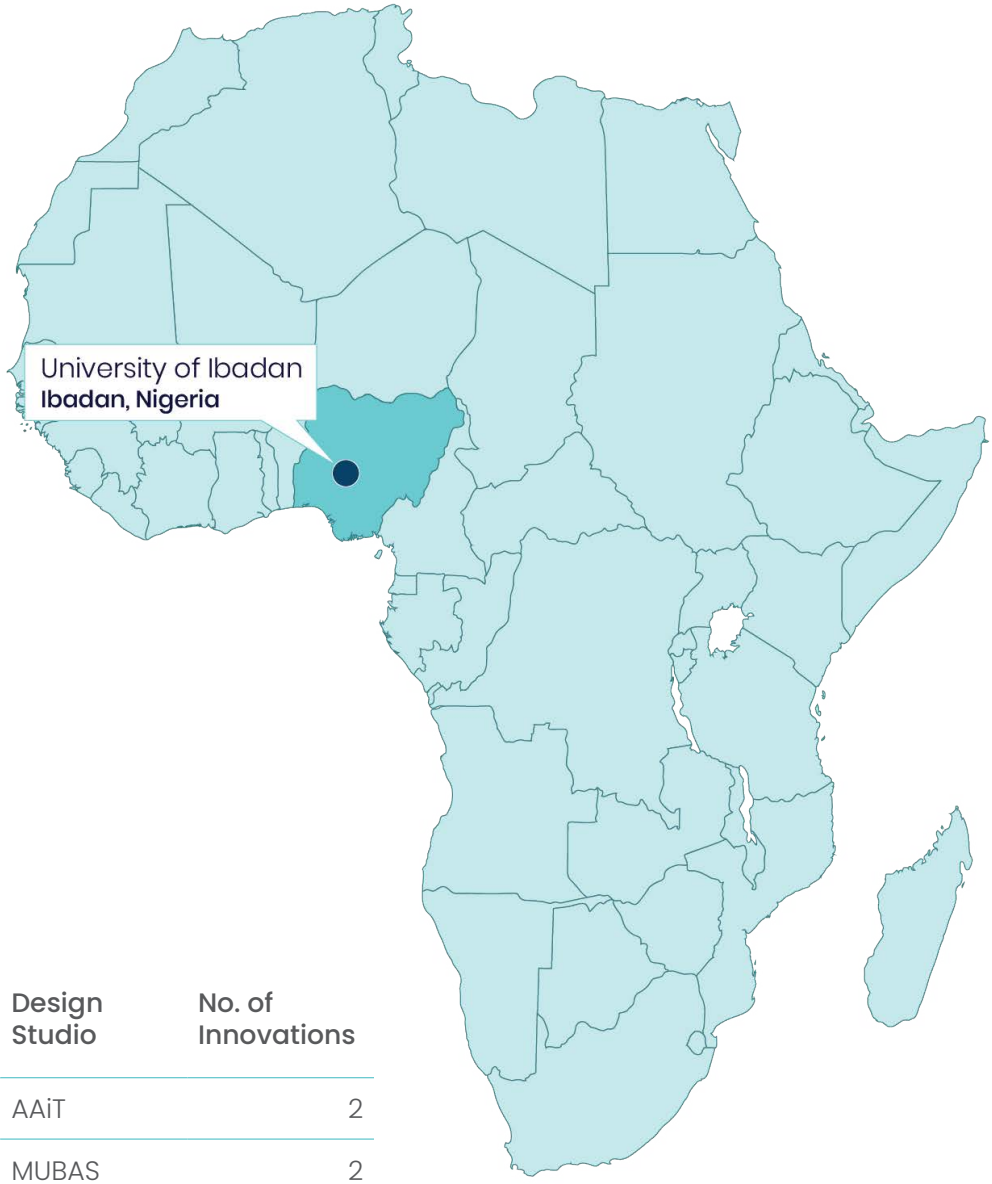
Innovations from Nigeria

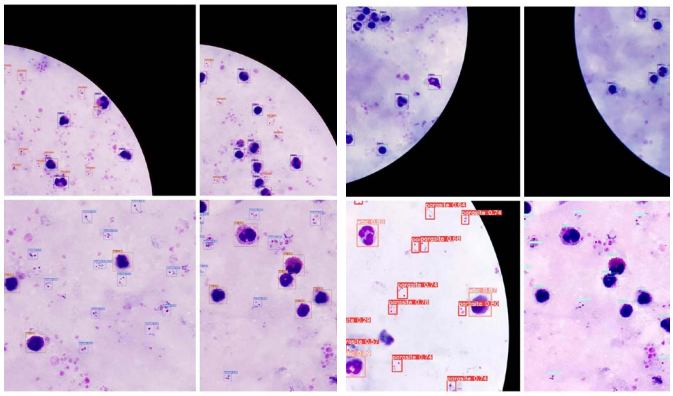
4. UI DESIGN STUDIO



Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

Artificial Intelligence for Malaria Diagnosis

UI Design Studio



Health Issue Addressed:

1. Inadequacy of current malaria diagnostic methods and tools at the primary healthcare level.
2. Limited availability of portable, cost-effective and highly reliable tools and equipment at all levels of healthcare.
3. Limitations of current malaria diagnostic methods, such as microscopy, in maximizing human efficiency.
4. The prevalence of human errors in diagnosis of malaria due to fatigue, limited training and experience.
5. The lack of an affordable, accessible, easy-to-use and automated intelligent malaria diagnostic tool at all levels of healthcare in Nigeria.

Innovation Overview:

Our innovation is an artificial intelligence (AI) based mobile/web software designed to aid the diagnosis of malaria. The aim of our innovation is to create a faster, more accessible, and more reliable method of malaria diagnosis using computer vision. It uses a convolutional neural network architecture (YOLO V5) which identifies and estimates malaria parasitemia and white blood cells that exist in images of thick blood films. We are working on training and testing learning models based on the YOLO V5 architecture that can accurately predict the presence or absence of malaria parasites while also estimating the density of malaria parasitemia where present.

Artificial Intelligence for Malaria Diagnosis

Team member(s)	**Emmanuel Bukoye** **Pamela Whiley**
Engineering advisor(s)	**Dr. Nosa Idusuyi**
Clinical mentor(s)	**Dr. Michael Obaro**
Technology name	**Artificial Intelligence for Malaria Diagnosis**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Diagnosis of Malaria**
Healthcare system level	**Primary** **Secondary** **Tertiary**

Contact Information:

UI Design Studio

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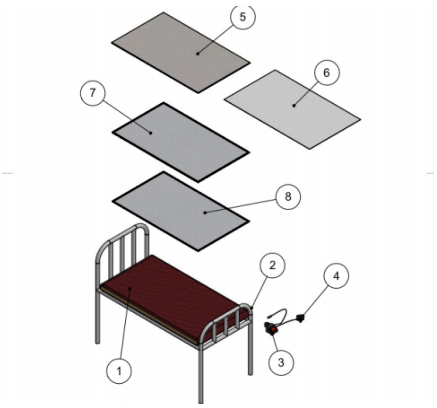
Pamela Whiley | whileypamela@gmail.com

Automated Adult Warming Blanket System

UI Design Studio



Health Issue Addressed:

This innovation addresses the issue of hypothermia in surgical theaters. Patients can get cold during surgery from a combination of factors including: uncovered skin, exposure to cold environment, the action of anaesthetic drugs and the administration of cold fluids during surgery. Perioperative hypothermia is a typical side effect of these factors and is associated with numerous complications, such as cardiac abnormalities, impaired wound healing, increased surgical site infections, shivering and delayed postoperative recovery, increased ICU admissions, longer hospital stays, etc. These complications prolong hospital stays and recovery times, exacerbating the economic burden for both the patient and the community as a whole.

Innovation Overview:

The Automated Adult Warming Blanket System monitors the core temperature of a patient undergoing surgery and regulates the patient's temperature. If their temperature is lower than required (36°C), the system automatically warms up the patient until they reach the desired temperature range of 36.5–37.2°C. The warming blanket has a dimension of 150cm by 90cm and contains embedded heater pads that are controlled externally by a control unit. It also has temperature sensors that measure the temperature of the heater pads and the patient.

Automated Adult Warming Blanket System

Team member(s)	**Goodnews Akindele** **Charles Adeoye**
Engineering advisor(s)	**Professor Akinwale Coker**
Clinical mentor(s)	**Dr. Olusola Idowu**
Technology name	**Automated Adult Warming Blanket System**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Hypothermia, temperature regulation**
Healthcare system level	**Tertiary**

Contact Information:

UI Design Studio

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Charles Adeoye | challycharlie@gmail.com

Design and Production of Gait Measuring Device

UI Design Studio

Health Issue Addressed:

This innovation will address the problems of affordability, availability, accessibility and mobility of a gait measuring device.

Innovation Overview:

The concept includes the insertion of customized insoles (with light-producing sensors) into a pair of shoes to measure the user's gait parameters; such as gait speed, step length, stride length, stride width and acceleration.

Design and Production of Gait Measuring Device

Team member(s)	**Alo Isaac Olusegun** **Faola Adeyemi James**
Engineering advisor(s)	**Dr. Adedoyin A. Adeleye**
Clinical mentor(s)	**Dr. Olumide Olasunkanmi Dada**
Technology name	**Design and Production of Gait Measuring Device**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Gait measurement**
Healthcare system level	**Tertiary**

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UI Design Studio

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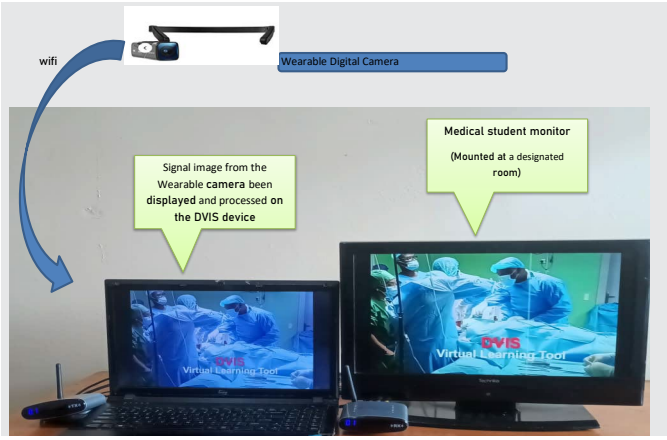
Digital Video Integrated System (DVIS)

UI Design Studio



Digital Video Integrated System (DVIS)

Team member(s)	**Olubode, Gabriel** **Oguntade, Michael**
Engineering advisor(s)	**Professor Osita Anyaeche**
Clinical mentor(s)	**Dr. Afieharo Michael**
Technology name	**Digital Video Integrated System (DVIS)**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Beta prototype**
Health care issue innovation addresses	**Surgery software**
Healthcare system level	**Secondary**

Health Issue Addressed:

The innovation is aimed at solving the problems of;

1. Lack of line of sight by the medical students and trainees during surgical procedures in the operating theatre at University College Hospital, Ibadan
2. Inability of the surgeon to review and recast the surgical procedures to hone their skills.
3. Overcrowding the operating theatre during surgical procedures with medical students.
4. Restriction of international collaboration/tutorials on complex surgical procedures to physical presence in the operating theatre.

Innovation Overview:

The innovation is a multimedia system for real-time, remote transmission of surgical procedures to enhance the educational experience for medical and other students. Once the live video stream is captured, it can be edited or deployed for offline use and review. The system incorporates digital technology into medical education by the medical students and trainees of the University College Hospital - Ibadan surgical operating theatre.

Components of the system include a wearable camera, a microphone, a computer, a transmitter, a receiver, a display, and additional software.

This remote access can be shared with the senior consultant who may wish to monitor the procedure from the comfort of his office using a hand-held device.

This innovation is scalable, incremental, modular, and made using standardized components. A unique feature in development is enabling real-time, remote participation (feedback and talk-back system) for remote colleagues to virtually join surgeries.

Contact Information:

UI Design Studio

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Infant Oxygen Saturation Monitor

UI Design Studio

Artist's rendering

Health Issue Addressed:

Our innovation addresses a pressing challenge of monitoring oxygen saturation in patients in Nigeria. It will allow the clinical practitioners and other healthcare providers to determine accurate pulse rate and oxygen saturation level in the blood. This device will help to prevent some clinical complications associated with hypoxia such as anemia, hypoxia, pneumonia, heart diseases etc, that can occur during diagnosis especially when the oxygen level in the blood is unknown.

The accurate determination of oxygen level in the blood and pulse rate is needful for proper diagnosis, prevention and treatment of diseases by health practitioners. Hence, the innovation of improved oxygen saturation monitoring in medical settings, including pediatric clinics, is highly needed.

Innovation Overview:

Our innovation is an Infant Oxygen Saturation Monitor, a device that measures pulse rate and oxygen saturation level in the blood. Oxygen saturation measurement is a vital physiological sign, and its deficiency may be associated with pneumonia or any respiratory disease that requires adequate clinician attention for proper and timely treatment.

Our design will measure oxygen saturation through the fingertips of the infants and children and will be powered by a rechargeable battery to ensure availability at all times amidst irregular power supply in Nigeria.

Infant Oxygen Saturation Monitor

Team member(s)	**Dr. Abu Rahaman** **Dr. Mojisola Bolarinwa** **Dr. Taiwo Lawal** **Kayode Oludayo** **Emmanuel Joy**
Engineering advisor(s)	**Dr. Abu Rahaman** **Dr. Mojisola Bolarinwa**
Clinical mentor(s)	**Dr. Taiwo Lawal**
Technology name	**Infant Oxygen Saturation Monitor**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Insufficient oxygen concentration in blood**
Healthcare system level	**Primary** **Secondary**

Contact Information:

UI Design Studio

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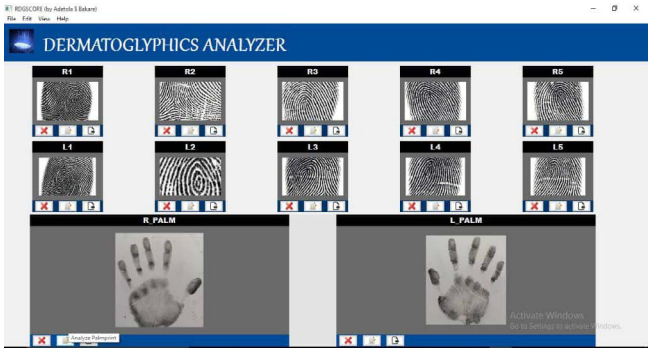
RDGCORE (Dermatoglyphic Analyzer)

UI Design Studio

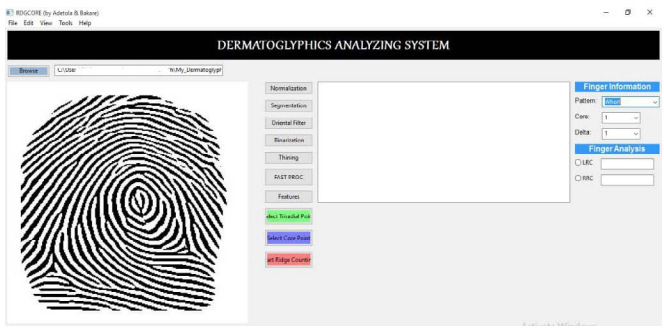


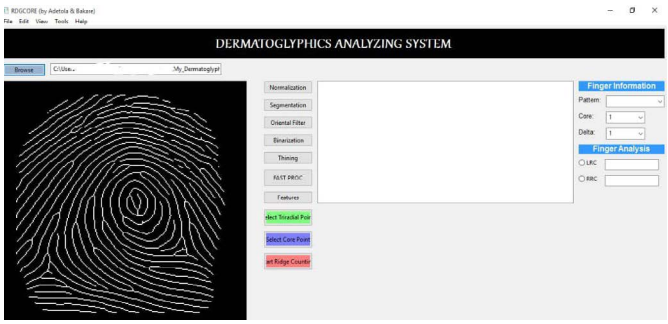
Health Issue Addressed:

RDGCORE addresses the impact of hypertension through early detection of patients predisposed to develop hypertension and are thus advised on better ways of preventing the disease.

Innovation Overview:

RDGCORE is a software that analyses fingerprints quantitatively and qualitatively to determine whether or not a patient is predisposed to developing hypertension.





RDGCORE (Dermatoglyphic Analyzer)

Team member(s)	**Jeleel A. Bakare** **Adetola B. Akinbiola**
Engineering advisor(s)	**Dr. M. O. Petinrin**
Clinical mentor(s)	**Dr. M. O. Adetona**
Technology name	**RDGCORE (Dermatoglyphic Analyzer)**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Hypertension detection**
Healthcare system level	**Primary** **Tertiary**

Contact Information:

UI Design Studio

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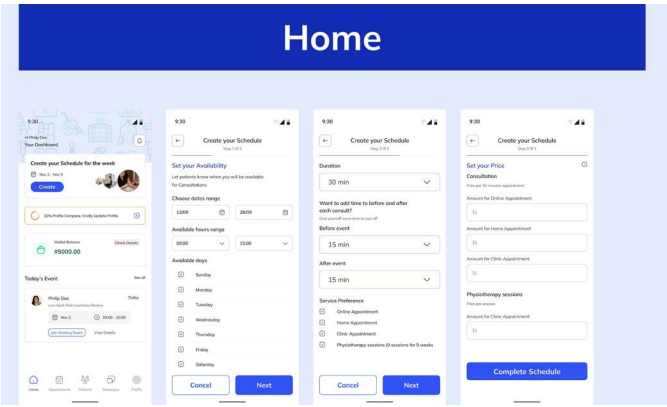
Remote Progress Monitoring for Physical Therapy

UI Design Studio



Health Issue Addressed:

The innovation addresses the following challenges:

1. The innovation will address the difficulty in remote monitoring of Home Exercise Programs (HEPs) by enabling real-time audio-visual monitoring.
2. It will solve the problem of poor execution of home exercise programs by providing animated sample videos of prescribed exercises.
3. It will create seamless interaction and communication flow between the physiotherapists and the patients, preventing the challenge of poor/inadequate communication.
4. It will allow adherence through reminder functions and smart scheduling thereby eliminating the problem of non-compliance to scheduled HEPs.
5. The application and demonstration videos will be adapted to various local languages to enable its wide useability amidst populations that speak diverse languages.
6. It will aid ease of treatment of patients.

Innovation Overview:

This innovation is a mobile software application that enables physiotherapists to monitor patients with lower back pain virtually. It is a dynamic, intuitive, and interactive platform for at-home patient monitoring. The app ensures compliance of patients with prescribed home exercise to treat their lower back pain.

Remote Progress Monitoring for Physical Therapy

Team member(s)	**Victor Olowoniwa** **Gideon Alejo** **Hilda Okafor**
Engineering advisor(s)	**Dr. Olufemi Adefisan**
Clinical mentor(s)	**Dr. Adesola Odole**
Technology name	**Remote Progress Monitoring for Physical Therapy**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Beta prototype**
Health care issue innovation addresses	**Physical therapy monitoring**
Healthcare system level	**Secondary** **Tertiary**

Contact Information:

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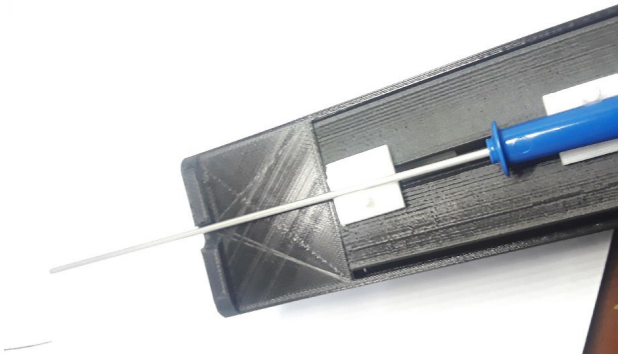
SLIM-RE (Slim Reusable CNB)

UI Design Studio



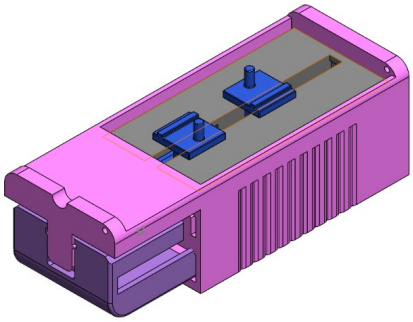
3D Print

Health Issue Addressed:

This innovation aims to address barriers in diagnosis of breast cancer due to high cost and poor quality breast biopsies through the invention of a new breast biopsy device.

Innovation Overview:

The team is designing a reusable core needle breast biopsy (CNB) device which will work with a disposable coaxial needle. The novelty aspects of the work are: (i) the simplicity of our design, which will be lower cost; (ii) the inclusion of a collapsible-expansive blood-trapping mechanism.



CAD Design

SLIM-RE (Slim Reusable CNB)

Team member(s)	**Osifuwa Adegboyega Daniel**
Engineering advisor(s)	**Dr. S. K. Fasogbon**
Clinical mentor(s)	**Dr. Adenike T. Adeniji-Sofoluwe** **Dr. E. AyoOluwa Idowu**
Technology name	**Breast Biopsy Device (Reusable Core Needle Biopsy device)** **Product name: SLIM-RE (Slim Reusable CNB)**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Beta prototype**
Health care issue innovation addresses	**Breast cancer biopsy**
Healthcare system level	**Tertiary**

Contact Information:

UI Design Studio

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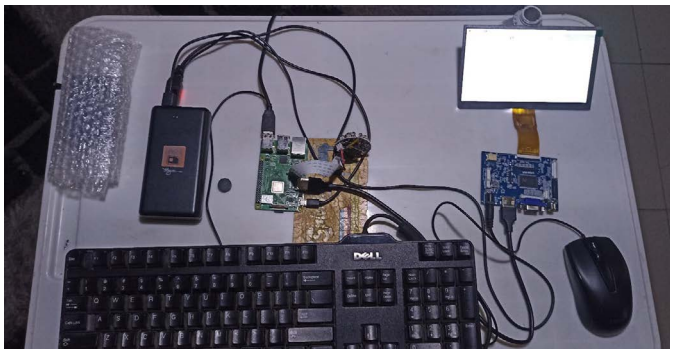
Vein Finder Technology

UI Design Studio

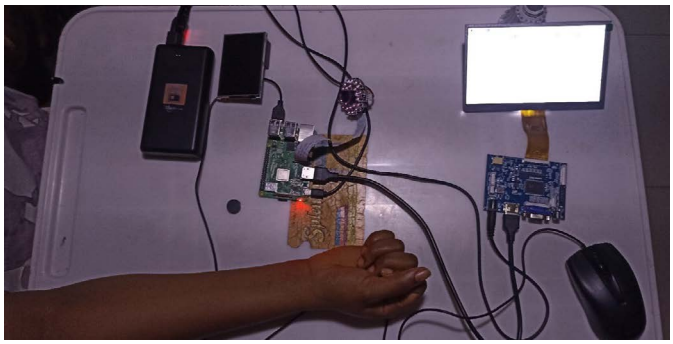


Health Issue Addressed:

The vein finder device seeks to improve the accuracy of cannula placement and address the difficulty associated with venous access using Near Infrared (NIR) imaging for improved blood vessel contrast.

Innovation Overview:

Our innovation is a hand-held device that performs vein illumination using infrared technology consisting of three major subsystems, a hand-held vein image acquisition, image processing, and vein image display for clinical intravenous access.



Vein Finder Technology

Team member(s)	**Mr. Lolomari Sepribo** **Mr. Henry Ogunmodede**
Engineering advisor(s)	**Prof. Michael A Odeniyi**
Clinical mentor(s)	**Dr. John Chuks**
Technology name	**Vein Finder Technology**
University / design lab	**University of Ibadan (Ibadan, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Cannula placement accuracy**
Healthcare system level	**Primary** **Secondary** **Tertiary**

Contact Information:

UI Design Studio

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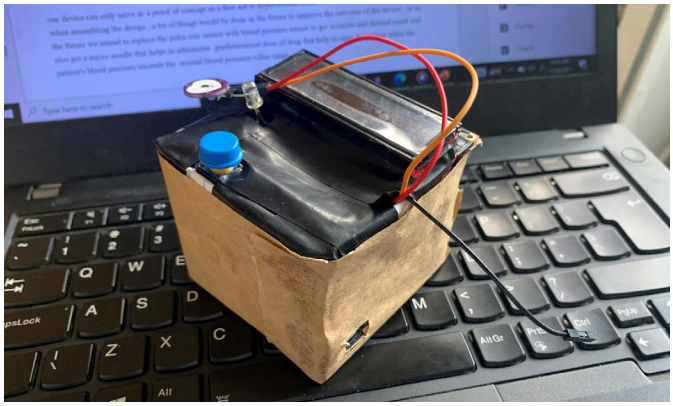
5. UNILAG DESIGN STUDIO

Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

Smart Blood Glucose Monitoring and Control System

UNILAG Design Studio



Health Issue Addressed:

Most glucose monitoring devices in the market today which allow continuous self-monitoring of glucose do not proffer therapeutic intervention during an emergency scenario as they only alert the patient or user about possible hypertensive crisis. Our innovation is aimed to provide both monitoring and control by the incorporation of the automated drug administration system.

Innovation Overview:

The device developed for this project works by non-invasively measuring the blood glucose of the patient. With the help of a programmable microcontroller, the device triggers when to administer drug/insulin to the patient by sending a control signal to a motor mechanism. The administration of the drug/ insulin is achieved with the help of a servo motor that pushes a microneedle into the skin of the patient when needed.

Smart Blood Glucose Monitoring and Control System	
Team member(s)	Onowenoni Moses Nyerhovwo[1] Muftaudeen, Rahamat Wumi[3] Lawal Ayobami Salim[1] Williams K. Baah[1,2] Adeosun Samson Oluropo[1] 1 University of Lagos, Nigeria. 2 Rice University, USA 3 First Technical University, Nigeria
Technology name	Smart Blood Glucose Monitoring and Control System
University / design lab	UNILAG Design Studio (Lagos, Nigeria)
Development status	Alpha prototype
Health care issue innovation addresses	monitor and control of drug delivery
Healthcare system level	Primary

Contact Information:

UNILAG Design Studio

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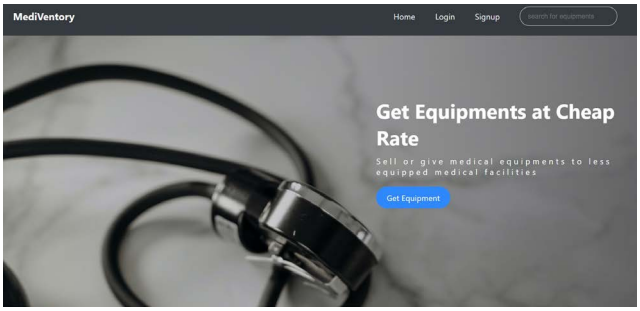
MediVentory

UNILAG Design Studio

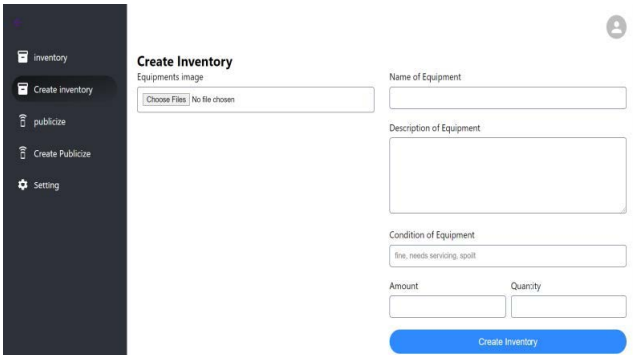


Health Issue Addressed:

This innovation is designated to ensure that medical equipment or devices are made available at facilities and sites where they are needed to provide healthcare delivery. In addition, low-resource medical facilities can have access to redundant equipment which could be purchased at affordable rates as compared to acquiring new units of such equipment. The platform can also be used to donate equipment to facilities in need as well.

Innovation Overview:

Mediventory is an electronic auctioning platform where resource-limited medical facilities in low-income countries have access to solicit or procure redundant medical equipment at an affordable cost from other healthcare facilities willing to sell or donate medical devices and accessories from local and international communities.



MediVentory

Team member(s)	Onowenoni Moses Nyerhovwo[1] Muftaudeen, Rahamat Wumi[3] Lawal Ayobami Salim[1] Williams K. Baah[1,2] Adeosun Samson Oluropo[1] 1 University of Lagos, Nigeria. 2 Rice University, USA 3 First Technical University, Nigeria
Technology name	MediVentory
University / design lab	UNILAG Design Studio (Lagos, Nigeria)
Development status	Alpha prototype
Health care issue innovation addresses	Medical device accessibility
Healthcare system level	Primary

Contact Information:

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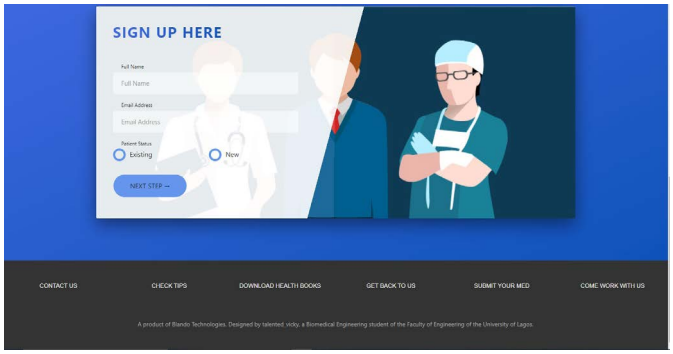
MyCliniQ

UNILAG Design Studio



Health Issue Addressed:

Over 90% of low income countries still use paper-based medical record systems which are time-consuming, prone to errors, and can be detrimental to the health in emergency situations. The use of the paper-based system leads to data loss and also incurs high cost of operation. Healthcare data is very sensitive and can be linked to life and death decisions about patient.

Innovation Overview:

MyCliniQ is a robust healthcare management system that offers telemedicine and medical record-keeping with the following key features:

- A mobile application module for patient-doctor interaction
- A USSD module for patients without internet access
- An enhanced interactive user experience
- Intelligent appointment management system
- Patient-access to medical handouts for general health issues
- A cloud-based database to store medical records
- Improved drug monitoring system

MyCliniQ

Team member(s)	**Zainab Ashimiyu-Abdusalam[1]** **Victor Otubure Onotevunrine[1]** **Jonah Uka Chukwuebuka[1]** **Williams K. Baah[1,2]** **Akiniyi Osuntoki[1]** **[1] University of Lagos, Nigeria** **[2] Rice University, USA**
Technology name	**MyCliniQ (A Healthcare Management System)**
University / design lab	**UNILAG Design Studio (Lagos, Nigeria)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**Healthcare management**
Healthcare system level	**Primary**

Contact Information:

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NURSease

UNILAG Design Studio

Health Issue Addressed:

This project was motivated by a complaint received directly from a nurse in a local healthcare facility in Lagos, Nigeria. The nurse often needs to squat or bend to the ground before she could administer care to the foot of a patient. An existing device in the facility was found to be nonadjustable and heavy to lift if there was need to relocate the device. The design of the NURSease primarily sought to overcome the challenges narrated by the caregivers in the healthcare facility.

Innovation Overview:

The NURSease is a pneumatically operated adjustable support device to support clinicians in providing care for patients with foot related issues. The device elevates the patient's leg, providing a lever for the care-giver to adjust the height as preferred. Our design utilized lightweight materials to ensure easy mobility from one place to the other within a healthcare facility.

NURSease

Team member(s)	Zainab Ashimiyu-Abdusalam[1] Victor Otubure Onotevunrine[1] Jonah Uka Chukwuebuka[1] Williams K. Baah[1,2] Akiniyi Osuntoki[1] [1] University of Lagos, Nigeria [2] Rice University, USA
Technology name	NURSease (An adjustable Leg support for foot-care)
University / design lab	UNILAG Design Studio (Lagos, Nigeria)
Development status	Alpha prototype
Health care issue innovation addresses	Foot care
Healthcare system level	Primary

Contact Information:

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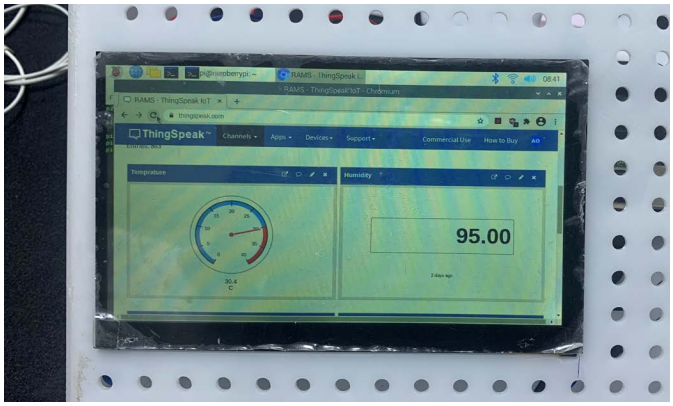
Room Atmosphere Monitoring & Alert System (RAMAS)

UNILAG Design Studio



Health Issue Addressed:

Air is one of the most essential shared resources on Earth. Sadly, air quality has undoubtedly deteriorated over the past years, especially for metropolitan cities in low-resource settings. Among the various dimensions of air quality, particulate matter (PM) with diameters less than 2.5 micron, or PM2.5, has gained a lot of attention recently, partly because of its significant impact on our respiratory systems. Medical studies have revealed that PM2.5 can be easily absorbed by the lung, and high concentrations of PM2.5 can lead to respiratory disease or even blood diseases.

According to epidemiological studies, long-term exposure to pollutants may result in the damage to respiratory systems, nervous systems and cardiovascular systems that cannot be ignored. This solution provides a better way to monitor the quality of air in our immediate environment in order to take health precautions such as wearing masks or staying at home.

Innovation Overview:

The aim of this innovation is to develop a smart device that continuously monitors the atmospheric parameters in an enclosed space and alerts occupants when these parameters exceeds preset threshold values. The prototype monitors temperature, humidity, particulate matter, liquid petroluem gas, and carbon monoxide in a confined space.

RAMAS

Team member(s)	Oyelakin A. Ayodeji[1] Akinremi Samuel[1] Fakayode G. Faruq[3] Williams K. Baah[1,2] Theophilus Fashanu[1] [1] University of Lagos, Nigeria [2] Rice University, USA [3] First Technical University, Nigeria
Technology name	Room Atmosphere Monitoring & Alert System (RAMAS)
University / design lab	UNILAG Design Studio (Lagos, Nigeria)
Development status	Alpha prototype
Health care issue innovation addresses	Air quality monitoring
Healthcare system level	Primary

Contact Information:

UNILAG Design Studio

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Smart Billiwrapper

UNILAG Design Studio

Health Issue Addressed:

Our innovation aims to provide a low-cost technology for treating neonatal hemolytic jaundice in low-income countries. Pathologic jaundice occurs when a newborn's bilirubin levels exceed expected norms in the first weeks of life. Phototherapy is the use of visible light to treat neonatal hyperbilirubinemia, often known as jaundice. Many newborns with neonatal jaundice are from low-income countries where there is limited access to expensive phototherapy treatment. If not appropriately deployed, phototherapy can lead to fatal consequences.

Innovation Overview:

We have designed and fabricated a locally made smart Biliblanket which is capable of monitoring the temperature of a neonate and reporting it in real time. The device, called Smart Biliwrapper, also has the ability to alert a caregiver of an impending danger when the temperature of the baby exceeds a set threshold value.

The Smart Biliwrapper is comprised of three parts: a source of blue light, a temperature regulation system, and a detachable neonate cover.

The illuminator/light-source produces blue-light directed to the neonate's skin through the transparent cover. The illuminator is an LED strip arranged in a 63 x 21 waterproof enclosure.

The detachable wrapper cover has a transparent and opaque part that allows easy installation. The calculated irradiance of the Biliwrapper is 39μW/cm2/nm in compliance to the American Association of Pediatricsrequirement.

The design continually reads and displays the temperature of the newborn in the blanket. Above a preset threshold temperature, the blanket automatically switches off the LED and alerts a caregiver with a buzzer alarm.

Smart Biliwrapper

Team member(s)	Eniola Alex Oladele[1] Okey-Ihedi Chiamaka Deborah[1] Emmanuel Oluwapelumi Arowesan[1] Williams K. Baah[1,2] Olawale Ajibola[1] [1] University of Lagos, Nigeria [2] Rice University, USA
Technology name	Smart Biliwrapper
University / design lab	UNILAG Design Studio (Lagos, Nigeria)
Development status	Alpha prototype
Health care issue innovation addresses	Neonatal hemolytic jaundice
Healthcare system level	Primary

Contact Information:

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Innovations from Tanzania

6. DIT DESIGN STUDIO

Country	Design Studio	No. of Innovations
1. Ethiopia	AAiT	2
2. Malawi	MUBAS	2
	MUST	2
3. Nigeria	UI	9
	UNILAG	6
4. Tanzania	DIT	1

Cardiopulmonary Resuscitation Training Model

DIT Design Studio

Health Issue Addressed:

- Shortage of training model for student's clinicians
- Limited accessibility of locally produced training models
- Lack of hands on training

Innovation Overview:

The innovation is a locally manufuctured training model to enable effective training of the CPR procedure in Tanzania. This training model will improve the individual basic life support skills of health care providers and the general public at large, and hence reduce the mortality due to cardiac arrest.

RAMAS

Team member(s)	**Napendaeli T. Msangi**
Technology name	**Cardiopulmonary Resuscitation Training Model**
University / design lab	**DIT Design Studio (Dar es Salaam, Tanzania)**
Development status	**Alpha prototype**
Health care issue innovation addresses	**CPR training**
Healthcare system level	**Primary**

Contact Information:

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