10th - 14th FEB 2025

# VIRTUAL
# MECHATRONICS LABS
# WEEKLY MAGAZINE

VIRTUAL MECHATRONICS LAB
REVOLUTIONIZING EDUCATION IN AFRICA

+254 716 150 627

vr.africa@dkut.ac.ke

Nyeri, Kenya

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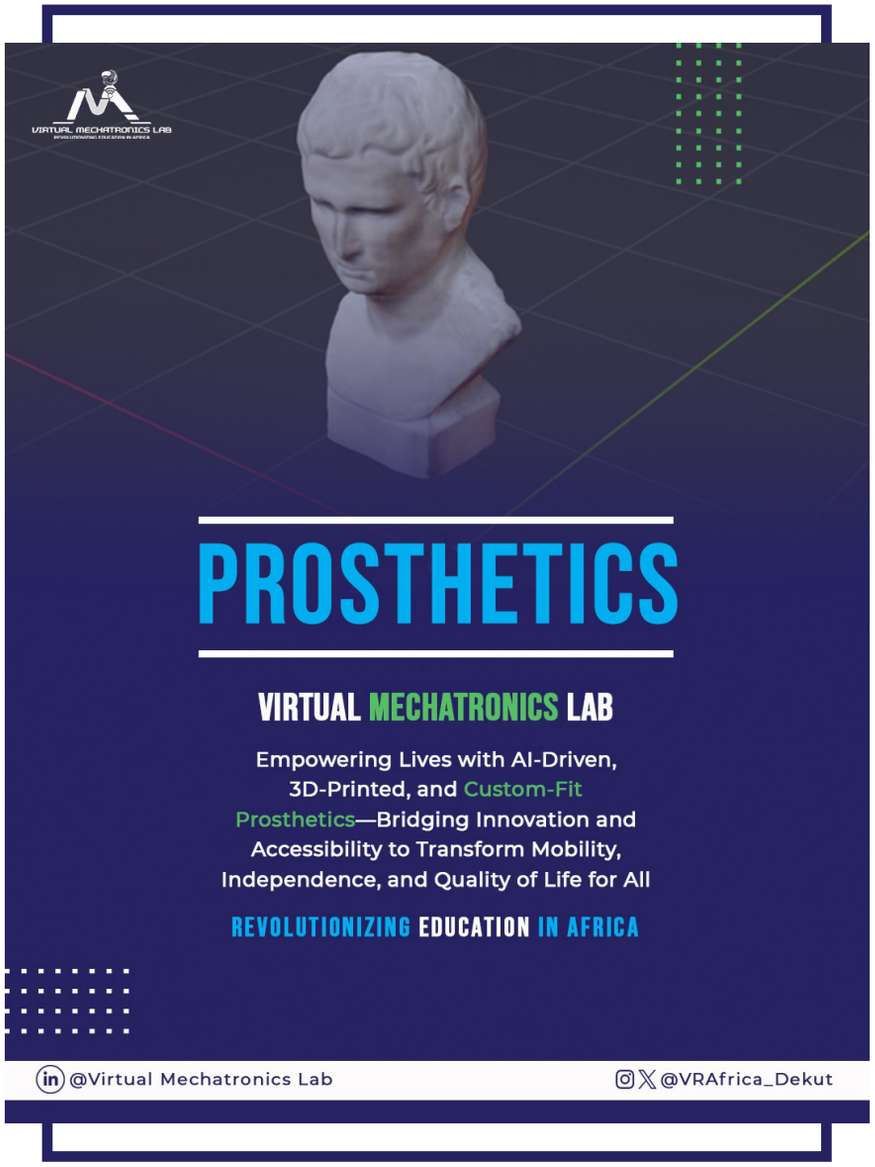
# Introduction to the Virtual Mechatronics Labs

The Virtual Mechatronics Labs (VML) at Dedan Kimathi University of Technology (DeKUT) is an advanced research hub focused on cutting-edge innovations in robotics, automation, and digital manufacturing. Founded and led by Prof. Jean Bosco Byiringiro, the Director of the Siemens Centre at DeKUT, the lab plays a crucial role in fostering technological advancements in Africa.

Prof. Byiringiro is a Professor of Mechatronics Engineering and a recognized leader in Industry 4.0 technologies. He is also the Co-Founder Expert of the Alliance for Industry 4.0 and Smart Manufacturing in Africa (AISMA) with the United Nations Industrial Development Organization (UNIDO). His extensive experience in mechatronics, artificial intelligence, and digital manufacturing has positioned the Virtual Mechatronics Lab as a key driver of innovation in Africa.



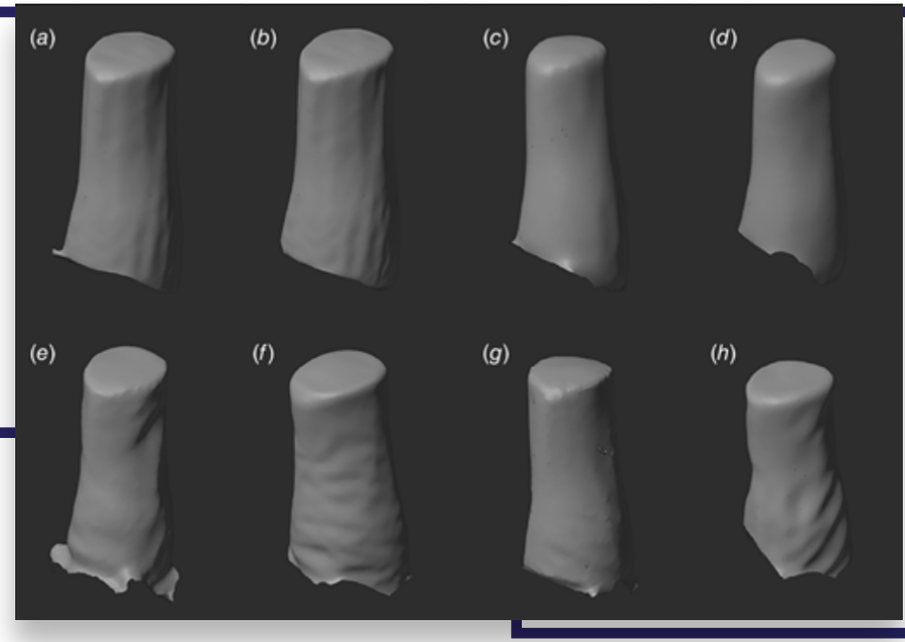

# Revolutionizing Prosthetic Care

## How AI and 3D Printing Are Changing Lives in Africa

One of the lab's most impactful initiatives is the prosthetics project, which seeks to provide accessible, affordable, and high-quality prosthetic care using modern technological advancements. In a pioneering move, Dedan Kimathi University of Technology (DeKUT) in Kenya has teamed up with Carnegie Mellon University (CMU) in Rwanda, Carnegie Mellon University (CMU) Pittsburgh and University of Nairobi (UON) to revolutionize prosthetic manufacturing across Africa. This ambitious interuniversity collaboration aims to make prosthetic services more accessible, particularly for underserved communities, by integrating artificial intelligence (AI), advanced manufacturing, and smartphone-based 3D imaging.

A team of engineers, medical experts, and researchers is developing advanced prosthetics by combining mechatronics, AI, biomechanics, and material science. The project also involves healthcare professionals to ensure real-world usability and supports student training to boost Africa's healthcare and engineering sectors.

# REVOLUTIONIZING PROSTHETICS THROUGH DIGITAL TECHNOLOGY




## The Problem

Traditional prosthetic fabrication methods, such as plaster molding and thermoforming, require multiple hospital visits, rely heavily on specialized labor, and are often time-consuming and costly. In many regions, the scarcity of trained professionals and specialized materials makes it difficult for individuals to obtain a functional prosthesis. This significantly affects their mobility, independence, and overall quality of life.

## The Innovative Solution

To address these challenges, the VML-led project incorporates digital tools like 3D scanning, computer-aided design (CAD), and 3D printing to streamline prosthetic fabrication. This approach reduces production time, lowers costs, and enables a scalable solution that can be implemented in low-resource settings.

This eliminates the need for traditional molding techniques, making prosthetic production faster, more affordable, and widely accessible.

# Technological Advancements and Achievements

The research team has successfully developed a pipeline for 3D reconstruction using video capture and image processing. By refining these processes, the project has managed to produce high-quality digital prosthetic models.

## key developments include:

### 1 Post-Processing Techniques

The team created methods to clean and smooth 3D meshes, addressing common issues such as incomplete slices in the final model.

### 2 Factors Affecting Reconstruction

The team identified critical elements impacting 3D modeling quality, including video quality, lighting conditions, object properties, and camera distance.

### 3 Factors Affecting Reconstruction

Leveraging knowledge from recent research, the team is exploring the incorporation of functional lattice structures into prosthetic design to improve comfort and performance.

# Future Prospects: Toward Automated Prosthetic Production

By integrating AI, machine learning, and 3D printing, this initiative has the potential to transform prosthetic care for amputees in Africa. The ability to create customized, affordable prosthetics with readily available technology marks a major step forward in medical accessibility. With advancements in 3D-printed functional materials and energy-responsive lattice structures, the future of prosthetic design is evolving toward higher efficiency, durability, and enhanced mobility for users.

As DeKUT and CMU Rwanda continue their groundbreaking work, they are not only improving the quality of life for amputees but also setting a precedent for technological innovation in healthcare worldwide.

- **Automatic Socket Generation:** The project aims to develop a fully automated system for generating prosthetic sockets from scanned data.
- **Testing 3D-Printed Prosthetics:** The mechanical properties of the 3D-printed sockets will undergo extensive evalution.
- **Clinical Trials:** Pending ethical approval, trials with real patients will be conducted to assess the effectiveness of the prostheics.
- **Paper Proposal:** Research teams plan to publish their findings to further the discourse on accessible prosthetic care.

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## WHY CHOOSE US?

- **Unmatched expertise in virtual mechatronics education**
- **Immersive learning experiences through innovative integration**
- **Streamlined processes for enhanced educational efficiency**

African Union

AUDA-NEPAD
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Co-funded by the European Union

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DEUTSCHE ZUSAMMENARBEIT

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