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NEWS RELEASE

UP graduate's research aims to restore mobility for paraplegics

Dian Meintjes during his 2025 UP autumn graduation ceremony.

PRETORIA - A breakthrough in rehabilitation for paraplegics may be just around the corner, thanks to Dian Meintjes (22), a University of Pretoria (UP) graduate of the Faculty of Engineering, Built Environment and Information Technology.

For his final-year research project, Meintjes – who graduated with a Bachelor of Engineering in Computer Engineering during UP's recent autumn graduation session – focused on improving the quality of life for individuals who have lower-limb mobility difficulties, specifically paraplegics.

"My motivation for my research stemmed from my desire to use engineering to improve the quality of life for individuals with spinal cord injuries," Meintjes says. "My undergraduate journey was eventful; I learnt all about electronics and software. All the bits and pieces contributed to my final-year project."

His project involved the development of a functional electrical stimulation (FES) system.

“This system has feedback control to assist paraplegic individuals to stand and walk,” Meintjes explains. “This project required learning about Kalman filtering and biomedical signal processing.”

The Kalman filter is an algorithm that can take noisy measurements and use them to create accurate estimates of unknown variables. The research also required Meintjes to design and manufacture unique parts so that the system could perform optimally.

“The Kalman filter significantly improved the system’s joint angle estimation accuracy when compared to raw sensor data,” he says.

Meintjes also found a reliable, low-voltage method to deliver stable electric currents through electrodes attached to the surface of the skin.

“This, in turn, contributed to the system being able to generate sit-to-stand gait patterns that could be tracked and modified in real-time.”

He hopes his research will contribute to the development of affordable, safe and effective FES systems that can restore partial mobility in paraplegic patients.

“Ideally, my research could support future clinical implementations and form the foundation for advanced rehabilitation devices that use real-time feedback for personalised therapy,” Meintjes adds.

The importance of his research became apparent to him during the research and development phase of the project.

“I observed the accuracy of the gait controller and stimulation circuits, and saw how it could mimic natural movement. Another important finding was my observation of how the use of human movement modelling can assist surgeons prior to surgery. Ultimately, my project aims to address limitations in existing FES systems by improving their adaptability and reducing their complexity, which will make them more accessible and available for broader use for rehabilitation purposes.”

Meintjes is pursuing a career as a junior embedded software engineer, and is considering doing a master’s degree in Biomedical Engineering.

“I would like to explore advanced rehabilitation technologies or AI-assisted movement prediction and control,” he says. “I am also considering the possibility of taking courses that will expand my knowledge of biomedical, electronic and embedded software engineering.”

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ABOUT THE UNIVERSITY OF PRETORIA

The University of Pretoria (UP) is one of the largest contact and residential universities in South Africa, with its

administration offices located on its Hatfield Campus in Pretoria. This 115-year-old institution is also one of the largest producers of research in South Africa.

Spread over seven campuses, it has nine faculties and a business school, the Gordon Institute of Business Science (GIBS). It is the only university in the country with a Faculty of Veterinary Science, which is ranked the best in Africa. UP has 120 academic departments and 92 centres and institutes, accommodating more than 56 000 students and offering about 1 100 study programmes. It has the most academic staff with PhDs (70%), NRF-rated researchers (613).

The 2025 Times Higher Education subject rankings placed UP first in South Africa in the fields of Accounting and Finance; Architecture; Electrical and Electronic Engineering; Law; Sport Science; and Veterinary Science. UP's Faculty of Law has been ranked as the top law school in Africa for a remarkable eighth consecutive year.

Quacquarelli Symonds (QS) ranked the University among the top five in Africa, as part of their 2024 World University Rankings (WUR). UP was the only South African university featured in the 2023 World University Rankings for Innovation (WURI), falling within in the 101-200 range of innovative universities.

For more information, please go to www.up.ac.za