# Daniel A. Udekwe

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I am a Civil Engineering Ph.D. candidate at Florida State University specializing in Human–Machine Interaction (HMI). With a multidisciplinary background in control engineering and electrical engineering, my research integrates virtual reality, deep reinforcement learning, and advanced computational methods to develop intuitive, human-centered interaction frameworks for autonomous systems. I have experience in both academic research and applied system development, creating solutions that strengthen collaboration between humans and machines in complex, real-world environments.

## Education

- **Doctor of Philosophy (PhD) Civil Engineering:** –
  *Florida State Univerisity (FSU)* *Florida, USA*
  **GPA:** 4.0/4.0
  **Advisor:** Dr. Qianwen (Vivian) Guo

  **Doctor of Philosophy (PhD) - Transfered to Florida State University (2024)**
  Virginia Polytechnic Institute and State University (Virginia Tech), VA-USA

- **Master of Science (MSc) Control Engineering** 2022
  *Ahmadu Bello University* *Kaduna, Nigeria*
  **GPA:** 4.58/5.0
  ***Thesis:*** *Development of a Deep Reinforcement Learning Controller for Trajectory Tracking of Classical Control Systems*
  **Advisor:** Engr (Dr.) Emmanuel Okafor

- **Bachelor of Engineering (B.Eng) Electrical Engineering** 2017
  *Ahmadu Bello University* *Kaduna, Nigeria*
  **GPA:** 4.31/5.0
  ***Project:*** *Implementation of Timing and Synchronization in Digital Clocks: A Wireless Communication Design*
  **Advisor:** Engr (Dr.) Basira Yahaya

## Fellowships and Awards

FAMU-FSU College of Engineering Dean's Fellowship

FSU Research and Creative Activity Grant

FSU Congress of Graduate Students Award

## Research Interests

Human-Machine Interaction, Virtual/Augmented/Mixed/Extended Reality, Computational Intelligence, Human-Robot Interaction, Control/Autonomous Systems, Optimization,

## Skills Summary

- **Virtual Reality**: Unity3D, Unreal Engine
- **Languages**: Matlab, Python, PHP, C++, JavaScript, SQL, Bash
- **Frameworks**: Scikit, TensorFlow, Keras, Django, Flask, NodeJS
- **Tools**: Docker, GIT, PostgreSQL, MySQL, SQLite
- **Robotics**: ROS, MoveIt, Gazebo, RViz
- **CAD**: SOLIDWORKS, CATIAv5, Shapr3D
- **PCB Design**: EAGLE, Proteus Design Suite, Genmistsu CNC 3018-PRO Router
- **Platforms**: Linux, Web, Windows, Arduino, Raspberry,
- **Soft Skills**: Leadership, Event Management, Writing, Public Speaking, Time Management

## Experience

- **Graduate Research Assistant - Civil Engineering Department** Full time
  *Florida State University, Tallahassee* *May 2024 - Present*
  - : Conducting research on the application of quantum computing, virtual reality (VR), and deep learning methods to solve complex problems in civil engineering and transit systems.
  - : Developing quantum-inspired optimization models for transportation network restoration and transit route design, leveraging algorithms such as the Quantum Approximate Optimization Algorithm (QAOA).
  - : Implementing VR-based simulation environments to study human-in-the-loop interactions for civil engineering education and transit system analysis.
  - : Designing and training deep learning models to analyze large-scale transportation and mobility data, focusing on demand prediction, accessibility improvement, and equity assessment.
  - : Collaborating with faculty and research teams to publish findings in peer-reviewed journals and present work at national and international conferences.

- **Graduate Research Assistant - intelligent Automation and Connected Tech. Lab** Full time
  *Virginia Polytechnic Institute and State University, Virginia* *August 2022 - May 2024*
  - : Collaborated with professors and senior researchers on projects involving virtual reality (VR) and human-robot interaction (HRI), focusing on teleoperation and immersive control of robotic systems.
  - : Developed and tested VR-based tele-operation interfaces for controlling robotic manipulators in real-time, enhancing human-robot collaboration.
  - : Provided guidance to undergraduate students on VR software tools and robotic system integration for tele-operation experiments.
  - : Assisted in documenting experimental results, preparing technical reports, and contributing to research publications on VR and HRI.
  - : Conducted experiments evaluating user performance and interaction efficiency in VR-based robotic tele-operation tasks.

- **Graduate Assistant - Aerospace Engineering Department** Full time
  *Air Force Institute of Technology, Nigeria* *April 2020 - August 2022*
  - : Assisted professors and senior researchers in conducting aerospace engineering research projects.
  - : Assisted in the preparation and submission of research proposals and grant applications.
  - : Presented research findings at conferences and assisted in the preparation of research papers for publication
  - : Assisted in teaching undergraduate courses, grading assignments, and providing feedback to student
  - : Mentored undergraduate students, providing guidance and support in their research projects.

- **Trainee - Concept to Product Lab** part time
  *Ahmadu Bello University, Nigeria* *November 2016 - September 2017*
  - : Collaborate with fellow trainees on projects related to computer engineering concepts and product development
  - : Assisted in the design, development, and testing of hardware and software prototypes.
  - : Participate in brainstorming sessions and contributed creative ideas for improving existing products or developing new solutions.

- **Intern - Cisco Networking Academy** full time
  *Ahmadu Bello University, Nigeria* *July 2016 - November 2016*
  - **Course Completion - CCNA 2**: CCNA Routing and Switching: Routing and Switching Essentials
  - **Course Completion - CCNA 1**: CCNA Routing and Switching: Introduction to Networks

## Projects

- **Development of A Virtual Reality Platfrom for Immersive and Interactive Surveying Education**: I designed and developed a virtual reality (VR) application to simulate surveying practices for civil engineering education. The system allows students to interact with virtual total stations and levels, enabling immersive hands-on training and enhancing understanding of surveying concepts in a controlled environment.
- **Human-Robot Interaction for Robotic Teleoperation Using Virtual Reality**: I developed and tested a virtual reality (VR)-based teleoperation system for controlling a robotic manipulator, enabling immersive human-robot interaction. The system was designed to improve task precision and operator efficiency in remote manipulation, with applications in automated harvesting and other field robotics tasks.
- **Methane Management from Cattle**: I designed and fabricated custom methane-capturing masks using CAD modeling and 3D printing to measure enteric methane emissions from cattle. Integrated gas sensors, PCB circuitry, and an ATMEGA328 microcontroller to collect real-time methane concentration data in parts per million (PPM). Analyzed collected data to investigate and recommend effective methane mitigation strategies, including dietary modifications and manure management practices, contributing to sustainable livestock production and greenhouse gas reduction efforts.

- **Design and Production of an Electric Utility Vehicle Integrated with Onboard Synchronized Charging Systems**: I developed the charging systems of an electric ambulance developed for the Air Force Institute of Technology, Nigeria. These charging systems were based on regenerative braking as well as solar power.
- **Design of Onboard Power Generation and Autostart Systems for the "AH-25" UAV**: I developed the power generation system for a hybrid wing UAV using a BLDC motor. This power generation system had the advantage of serving as an autostart mechanism for the UAV's engine

## Relevant Coursework

- **Urban Transit Systems and Technologies**: Studied design, operation, and evaluation of urban transit modes, focusing on service reliability, capacity planning, and integration with emerging mobility solutions.
- **Transportation System Analysis**: Applied quantitative and analytical methods to model travel demand, optimize network performance, and evaluate transportation policies.
- **Machine Learning**: Explored supervised and unsupervised learning algorithms, feature engineering, and model evaluation for predictive analytics and pattern recognition.
- **Introduction to Artificial Intelligence**: Covered search algorithms, knowledge representation, probabilistic reasoning, and decision-making under uncertainty for intelligent systems.
- **Guidance, Navigation, and Control**: Analyzed control algorithms and sensor fusion techniques for navigation and trajectory tracking in autonomous vehicles and aerospace systems.
- **Flight Dynamics**: Examined aircraft stability, control response, and aerodynamic forces to model and predict flight performance.
- **Robotics and Autonomous Systems**: Studied kinematics, dynamics, perception, and motion planning for autonomous robotic platforms and manipulators.
- **Optimal Control**: Learned optimization techniques for dynamic systems, including Pontryagin's Maximum Principle and linear-quadratic regulators, to achieve energy-efficient and stable control.
- **Electromagnetic (EM) Fields and Waves**: Investigated electromagnetic wave propagation, transmission lines, and antenna fundamentals, with applications in communication and sensing systems.
- **Circuit Theory**: Analyzed electrical circuits using Kirchhoff's laws, network theorems, and frequency-domain techniques for power and signal processing applications.

## Selected Publications

- **Preprint**: Udekwe, D., Bolkas, D., Ozguven, E. E., Moses, R., & Guo, Q. (2025). VRISE: A Virtual Reality Platfrom for Immersive and Interactive Surveying Education. arXiv preprint arXiv:2507.22810.
- **Preprint**: Donatus, R., Ter, K., Ajayi, O. O., & Udekwe, D. (2025). Multi-agent reinforcement learning in intelligent transportation systems: A comprehensive survey. arXiv preprint arXiv:2508.20315.
- **Preprint**: Udekwe, D., Ke, R., Lu, J., & Guo, Q. W. (2025). Q-restore: quantum-driven framework for resilient and equitable transportation network restoration. arXiv preprint arXiv:2501.11197.
- **Preprint**: Guo, Q., Moses, R., & Ozguven, E. E. (2025). Crash Patterns and Severity Analysis on Rural Highways: Insights from Explainable Machine Learning and Correlation Analysis.
- **Preprint**: Seyyedhasani, H., Udekwe, D., & Qadri, M. A. (2025). Comparative Evaluation of VR-Enabled Robots and Human Operators for Targeted Disease Management in Vineyards. arXiv preprint arXiv:2507.04167.
- **Journal Article**: Udekwe, D. (2025). Evaluating a ddpg reinforcement learning agent on a ball-and-plate system: A comparative study of intelligent control approaches. Nigerian Journal of Technology, 44(2), 338-346.
- **Journal Article**: Udekwe, D., & Seyyedhasani, H. (2025). Human robot interaction for agricultural Tele-Operation, using virtual Reality: A feasibility study. Computers and Electronics in Agriculture, 228, 109702.
- **Journal Article**: Udekwe, D., & Seyyedhasani, H. (2025). Virtual Reality-Enabled remote Human-Robot interaction for strawberry cultivation in greenhouses. Computers and Electronics in Agriculture, 237, 110567.
- **Journal Article**: Udekwe, D., Ore-ofe, A., Ubadike, O., Ter, K., & Okafor, E. (2023). Comparing actor-critic deep reinforcement learning controllers for enhanced performance on a ball-and-plate system. Expert Systems with Applications, 123055.
- **Journal Article**: Adetifa, A., Okonkwo, P., Muhammed, B. B. & Udekwe, D (2023) Deep Reinforcement Learning for Aircraft Longitudinal Control Augmentation System. Nigerian Journal of Technology
- **Journal Article**: Udekwe, D. (2024). Embedded Residual Neural Networks for Real-World Plant Disease Identification in Digital Agriculture. International Journal of Software Engineering and Computer Systems, 10(2), 149-158.
- **Journal Article**: Okafor, E., Udekwe, D., Ibrahim, Y., Bashir Mu'azu, M., & Okafor, E. G. (2021). Heuristic and deep reinforcement learning-based PID control of trajectory tracking in a ball-and-plate system. Journal of Information and Telecommunication, 5(2), 179-196.

- **Journal Article**: Okafor, E. G., Udekwe, D., Ubadike, O. C., Okafor, E., Jemitola, P. O., & Abba, M. T. (2021). Photovoltaic System MPPT Evaluation Using Classical, Meta-Heuristics, and Reinforcement Learning-Based Controllers: A Comparative Study. Journal of Southwest Jiaotong University, 56(3).
- **Journal Article**: Okafor, E. G., Okafor, E., Ubadike, O. C., Abba, M. T., Jemitola, P. O., Shinkafi, A. A., ... & Udekwe, D. (2021). Electric Vehicle Integrated with PMSM and Regenerative Braking System Speed Evaluation based on Diverse Control Strategies. Journal of Southwest Jiaotong University, 56(6)
- **Conference**: Okafor, E.G., Udekwe, D., Muhammad H., Ubadike, O., & Okafor, E.C. (2021). Solar System Maximum Power Point Tracking Evaluation Using Reinforcement Learning. In 2021 Sustainable Engineering and Industrial Technology Conference
- **Conference**: Garba, S., Yahaya, B., Sadiq, B. O., Udekwe, D. A., & Abubakar, Z. M. (2019, October). Implementation of Timing and Synchronization in Digital Clocks: A Wireless Communication Design. In 2019 2nd International Conference of the IEEE Nigeria Computer Chapter (NigeriaComputConf) (pp. 1-4). IEEE.

## Conferences Attended

- Bridging Transportation Researchers Conference – August 2025
- Transportation Research Board Annual Meeting – January 2025
- Transpo 2024 - Florida Puerto Rico District ITE – August 2024
- Sustainable Engineering and Industrial Technology Conference – July, 2021
- Second International Conference of the IEEE Nigeria – May 2019

## Professional Service and Memberships

**Professional Society Memberships**

- Institute of Transportation Engineers (ITE)
- Honor Society of Phi Kappa Phi ($\Phi\kappa\Phi$)
- Institute of Electrical and Electronics Engineers (IEEE)
- American Society of Civil Engineers (ASCE)
- National Society of Black Engineers (NSBE)
- American Society of Agricultural and Biological Engineers (ASABE)
- Black in Roboticcs (BiR)
- Nigerian Society of Engineers (NSE)

**Reviewer for Professional Journals**

- IEEE Internet of Things Journal
- The Journal of Supercomputing
- Discover Computing
- International Journal of Intelligent Robotics and Applications
- Scientific Reports
- International Journal of Machine learning and Cybernetics
- Computers and Electronics in Agriculture
- Expert Systems with Applications
- Information Processing in Agriculture
- Nuclear Engineering and Design
- Engineering Applications of Artifical Intelligence
- Discover Artificial Intelligence
- Results in Control and Optimization

## Volunteer & Community Outreach

- **[2025] Engineering Research Open House:** Presented interactive demonstrations on the use of virtual reality and driving simulators to enhance transportation research, engaging with attendees to explain the implications of immersive technology for traffic safety analysis and infrastructure planning. Answered technical questions and inspired interest in transportation engineering among students and community members.
- **[2023] Undergraduate Research Competition:** Served as a Poster Judge, evaluating undergraduate research presentations based on clarity, methodology, and innovation. Provided constructive feedback to help students refine their research communication skills and encouraged them to pursue further research opportunities.
- **[2019] Community Development Service:** Participated in a community health and welfare initiative focused on improving living standards in underserved neighborhoods. Organized educational sessions on sanitation, distributed basic health supplies, and collaborated with local leaders to raise awareness about preventive healthcare practices.
- **[2018] Mathematics Subject Teacher:** Taught secondary school students fundamental and advanced mathematical principles, fostering problem-solving and analytical thinking skills. Designed lesson plans, provided one-on-one tutoring for struggling students, and improved their performance in national examinations.
- **[2016–2017] General Tutor:** Tutored undergraduate students in core electrical engineering courses, including circuit analysis, control systems, and electromagnetics. Simplified complex concepts through practical examples, conducted revision sessions before examinations, and contributed to improved academic performance among mentees.